

**CENTRE OF EXCELLENCE
MORINGA**

HOSTED BY: SMDIS

**20
18**



**INTERNATIONAL
CONFERENCE ON
MORINGA
ENTREPRENEURSHIP**

Organised by



STELLA MARIS
INSTITUTE OF DEVELOPMENT STUDIES (SMIDS)

Post Conference Publication

DEC 20-22, 2018 • • KANYAKUMARI

Kovalam Road, Kanyakumari, Tamil Nadu, India 629702

FOREWORD



Mis en forme : Gauche

I am pleased to have this opportunity to share about this Post Report publication of the “International Conference on Moringa Entrepreneurship” which was held from 20-22nd Dec 2018 at Kanyakumari, Tamilnadu.

Moring tree which is called ‘Moringa Oliefera’, tree of life or miracle tree in English, is indeed God’s gift to mankind, serving as green gold. Moringa, a native to India, is widely cultivated across the world because of its power to with stand both severe drought and mild frost conditions. With its high nutritive value, every part of the tree is suitable for either nutritional or pharmalogical purpose. The products stemming from moringa leaves, seeds

and bark and roots are being increasingly proven to be sustainable source of livelihoods and wealth creation.

Moringa is truly a miracle plant, and a divine gift for the nourishing and healing of mankind. This magic plant has so many uses and special features, and it is really difficult to know where to start, sharing about their benefits, which I have learned about this wonderful plant. Although few people have ever heard of it today Moringa could soon become one of the world's most valuable plants, at least in broad humanitarian terms. In the words of Andrew Young (UN Ambassador) Moringa shows great promise as a tool to help overcome some of the most severe problems in the developing world – malnutrition, deforestation, impure water and poverty.

This international conference is clearly a first step to scientifically validate the traditional and widely practiced evidence-based medical benefits of moringa and further explore the future potentials and possibilities of the use of moringa not only as a nutritional supplement but also to make use of its multifarious benefits in medical, health care and cosmetic applications. This platform was an opportunity to disseminate about the multiple health and medical applications of this miracle tree to the World Scientific and Medical Community and to promote and popularize its extensive use for the wellness and welfare of Human race.

This Conference also opened avenues for inspiring entrepreneurship development based on Moringa products and promoting the networking opportunities in the field.

Various audiences were present during the conference, like experts who shared their rich knowledge and experience especially in specialized moringa based product development and Students who participated with the vision of becoming dynamic entrepreneurs in Moringa cultivation, along with traders and people who were already in the moringa farming were benefitted through networking possibilities and also refreshing their knowledge on the latest advancements in Moringa products development.

“Begin with the end in mind” is an old saying. I am happy to share that “The International Conference on Moringa Entrepreneurship” has achieved its purpose of disseminating knowledge and practical experiences of delegates in cultivating, processing and marketing the moringa based products and also further encouraged the participants towards exploring methods of efficient farm management, identifying technologies, products, funding opportunities, business avenues and to develop their business networks.



We are thankful to all the dignitaries who were present for the conference from various field sharing their valuable insights and for their valuable support in making this program a grand success. Also special mention and thanks to the researchers and moringa product developers who presented their papers and did poster presentations at the conference.

This publication is presented in a way that the reader’s will find it easy to get a snapshot of all the proceedings happened during the Conference and the book will give you the key information’s in a concise way so that it will be easy to read and share its content with others.



I wish you a lot of fun as you acquire new knowledge through this publication and spread the word about this God given miracle plant to others and join the army of bearing the torch to create a pain free world.

Sr. Dr. Archana Das DM

Secretary

Stella Maris Institute of Development Studies (SMIDS)

Message from the Director of Stella Maris Institute of Development Studies (SMIDS)



Jebamalai Vinanchiarachi, Former Principal Adviser to the Director General, UNIDO, Vienna, Austria

Principal Adviser, Knowledge Management Associates, Austria

Moringa tree is God's gift to humanity. The tree is now called "green gold" by virtue of its proven utilities. The products of the tree are increasingly being used by pharmaceutical, cosmetic and food processing firms, leading to a dramatic increase in the global demand for moringa-based products. The global market value of value added products is to the tune of over \$10 billion, growing at an average annual rate of over 13 per cent. This promising product area makes an indelible impact on the livelihoods of millions of poor across countries and continents and serve as potential source of wealth creation.

SMIDS captures this "niche" product area for the cause of making a breakthrough in the quality of the poor living in rural areas. The ideas that transpired during the international conference organized by SMIDS in Kanyakumari unveiled unlimited avenues of making an array of value added products with direct and indirect impact on the welfare of the people engaged in farming and processing activities.

The impact of the Conference lends credence to the fact that knowledge is wealth. Knowledge disseminated during the Conference created awareness among the participants about the potential of moringa tree serving as an infinite source of wealth creation. The internationally

tradable products sourced from different parts of moringa tree could serve as sustainable sources of livelihoods and wealth creation.

I am extremely happy that SMIDS is coming out with the Conference report comprising all the research papers presented during Conference. I am sure, the ideas contained therein will rekindle new and dynamic avenues of making optimal use of green gold – moringa.

I sincerely believe that the report will serve as a good source of knowledge and research pertinent to farming and processing activities.

Jebamalai

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Introduction

ABOUT STELLA MARIS INSTITUTE OF DEVELOPMENT STUDIES (SMIDS):

SMIDS is a not for profit organization, founded in the year 1997 and being managed by the Sisters of the Congregation, the Daughters of Mary. SMIDS works in the areas of Animal Husbandry, Dairying & Fisheries, Animal Welfare, Children, Disaster Management, Environment and natural resource management, Food and Agriculture, HIV/AIDS, Legal Awareness & Aid, Micro Finance (SHGs), Panchayati Raj, Women's Development & Empowerment, etc. As part of the sustainable livelihood mission SMIDS involved in various research activities to find alternate livelihood creation for the poor and marginalized farmers.

CENTRE OF EXCELLENCE FOR MORINGA:

SMIDS realized the high potential and value of Moringa products and also understood the gap in the area of cultivation, processing and trading. By understanding the need, SMIDS has set up the Centre of Excellence for Moringa at SMIDS campus, Kanyakumari. Centre of Excellence for Moringa is the first such Centre in South India, which closely works with the farmers and integrates traders, financial institutions, researchers and equipment suppliers. It incorporates many different methods of protected cultivation and improved modern methods of processing. It will provide Moringa farmers a wide spectrum of new technologies and possibilities to learn and later adopt and use in their own fields to raise their produce and resource efficiency. Also it aims at increasing farmers' yield and productivity using innovative method and technology to add value for their produce material.

Centre of Excellence for Moringa is intent to set up a high tech lab facility to execute world class research activities in the area of Moringa production. Also this centre will facilitate the farmers to set up a Moringa producers' company in South Tamilnadu.

HISTORY OF MORINGA:

Moringa is the vernacular Tamil name for the small tree. Moringa Oleifera is also called the drumstick tree, very popular in the home stead of South India especially Tamilnadu and Kerala, much valued for its leaf and fruits. The leaf, flower, fruit are used as a vegetable and also used in a variety of Siddha and Ayurvedhic- Medical formulations. The oil from Moringa seed is also used in a variety of medical preparations both in Siddha and Ayurvedha. It is mentioned in the Siddha scriptures that there are more than 500 important bio chemical compounds in moringa of which more than 300 are essential for human body.

The leaf contains almost all the essential vitamins including Vitamin K, almost all the essential minerals including calcium phosphorous Magnesium and Zinc and almost all the essential Amino acids, hence considered to be the single source of essential nutrients for human. Moringa Leaves also contain very rare regulatory compounds and antioxidants like Flavanodes Zeatin and Beta Carotene for regulating enzymes and also function as antioxidants suppressing inflammation and pseudo immunity.

Moringa oleifera has been used for generations in India and neighboring countries to treat and prevent diseases such as diabetics, heart diseases, anemia, arthritis, diseases of liver and respiratory skin and digestive disorders. Moringa is also used in recent years to alleviate anemia (tired blood) Rheumatism, arthritis and other joint pain, asthma, cancer, constipations, diabetics, diarrhea, epilepsy stomach pain, stomach and intestinal, ulcers, intestinal spasms, head ache, heart problems, high blood pressure, kidney stones, fluid retention, thyroid disorders and a variety of medical and health care applications.

So Moringa leaf powder is now used globally as a nutritional supplement and also sickness healing magic powder and infact is fast emerging as a “Global Super Food”. So Moringa tree is now popularly called as a Miracle Tree and also as the “Tree of Life”.

INTERNATIONAL CONFERENCE ON MORINGA ENTREPRENEURSHIP:

The International Conference on Moringa Entrepreneurship was held in Kanyakumari, the southernmost part of India, at the Hotel Singaar International from 20-22 December 2019. This International seminar is the first step to scientifically validate the traditional and widely practiced evidence based medical benefits of Moringa and further explore the future potentials and possibilities of the use of Moringa not only as a nutritional supplement but also to make use of its multifarious benefits in medical and health care applications. This platform will also be utilized to announce the multiple health and medical applications of this miracle tree to the world scientific and medical community and to promote and popularize the extensive use for the wellness and welfare of human race.

The scope of “Moringa” conference aimed to bring the advancements in the field of cultivation, value addition, and marketing through exchange of ideas, sharing latest developments & current technologies, and identify future trends. The conference will enable participants the opportunity to develop social networks among a group of international participants.

PARTICIPANTS:

Two Hundred and twenty participants attended the conference from different parts of the globe with thought provoking keynote lectures, oral and poster presentations. The purpose of this 3 DAY CONFERENCE is to bring together high profiled researchers, scholars, producers, traders, decision makers, eminent personalities and students around the world under a single roof.

OUTPUT:

It was an opportunity for the participants to Learn & Explore about technologies and product. Many found this opportunity as Business potential. Excellent speakers and researchers got an online visibility to their work and products. Many cultivators and traders found solution for their problems in Moringa production, processing and marketing.

Plenary Session

A). INAUGURAL ADDRESS:

DR. N. KUMAR, VICE CHANCELLOR, TAMIL NADU AGRICULTURAL UNIVERSITY

Two reasons compelled me to attend this conference. One is affinity to my native district. Second reason is affinity to the native tree moringa, a common man's vegetable which has assumed a status of home vegetable garden to the commercial status. Now it has also become an export oriented crop. So our intervention from University side, government side needs to see that the produce is knocking at the doors of needy people in other countries with quality assurance. As everyone knows Moringa a 'miracle tree' its uniqueness is every part is useful right from flowers, leaf, bark, fruit, and seed. No part in the tree is waste. It is a very potential tree. We use to call coconut tree as Kalpakaviruksha, at least we should also attach some prominent name to Moringa which is becoming more popular now a days. As far as India is concerned we are the leader and have already used 38,000 hectares of land for cultivation and producing nearly 2.2 million tons of Moringa leaves alone. The trend has already spread to states like Tamil Nadu, Karnataka, Andhra Pradesh and some parts of Maharashtra and Gujarat. Though even North India wanted to take up the Moringa cultivation, because of adverse climate it is not possible, as Moringa remains the crop of Tropical region. Fortunately some of the districts in Tamil Nadu like Dindugal, Thoothukudi, Theni, Karur, Erode etc. are fast enough to grab the opportunity as the places are highly suitable for commercial cultivation of Moringa.

From our University side we have released two types of varieties PKN1 & PKN2. I am happy to inform you that PKN1 has revolutionized in a way it has become synonymous to Moringa crop, because of its exceptional performance, which was introduced 25 years back, and the University has also identified ways of addressing the genetic contamination, and taken up a project which has purified the original variety and maintain the seed availability, because for

any industry to flourish the seed availability should be ensured for those who seek.

The Nutritional property of Moringa is unmatched. People say carrot is rich in Vitamin A, but Moringa has 7 times more nutritional value than carrots and has 7-8 times more calcium value than present in milk. Moringa is a multi-vitamin plant and has essential nutrients like potassium which needs to be highly exploited crop, and take it up at a big scale. Earlier we heard from the speaker that our products are not up to the expected standard of the importing countries, so my request to the scientists that we have a very good process technology lab and other related facilities in TNAU, if the division team of Export brings to the notice of the University scientist we would take up in a meticulous way and provide right solutions. Because India is considered leader in many crops, like cashew we are the leader. Intea, and vegetable we are number two in production. So it is not a big task. The problem is some people do not reveal the facts to the scientist and keep it a secret. So if your requirements are well indicated to the University, I assure that we would be able to develop the protocol for exports. The reason why I am saying this is, though we are leader in Banana production, only 1% is being exported. Whereas in country like Peru and some of the African countries, where the food is produced less about 90% are exported. The real problem is export protocols are not being successfully followed in India.

Recently for your information, from Theni, we have sent one container load of banana successfully to the Italy port and now undergoing post import quality assessments. If one city accepts it, then we are not going to compete with other countries or organizations who are dealing multiple varieties of Banana. We have our own varieties of banana, like Kanyakumari is leader in the production of Nendram, Kathali these products can be easily exported. Once the proper requirement is there, I am sure that TNAU will take it in a positive way and help the farmers. And also my request to the entrepreneurs who are related to Moringa processing that you should not exploit the growers, and due share should be given to them, as they are the ultimate producers of this Moringa.

So with these few words I am happy to inaugurate the International Conference on Moringa Entrepreneurship and once again thank you for the opportunity.

B). PRESIDENTIAL ADDRESS:

DR. JEBAMALAI VINANCHIARACHI, DIRECTOR, SMIDS

Former Principal Advisor to the Director General of UNIDO Vienna Austria

We are living in a world of Technological marvel, we are talking about the 4th Industrial revolution, which is nothing but underlined by so many varieties of destructive technologies, every day inventions happen but it becomes obsolete the next day as new things come up. It is called creative destruction.

In this process something is running parallel, Traditional knowledge is flourishing as a source of wealth creation, everywhere across the countries. And traditional products used by our great parents, is now penetrating coveted markets. And in the last three years, the global demand for Moringa and Moringa based products, is growing at an average rate of 10% per year. It is a very high rate of growth actually. A friend of mine who had good position in US, an distinguished student IIT , he abandoned everything and has already converted 200 acres for Moringa cultivation and planning for 400 to 600 acres in future.

Moringa is a gift of God given to mankind, which we only recently we discovered. I also found that many cosmetic and pharmaceutical companies using Moringa for their high nutrition content. I also realized that the secret of me looking young is mainly due to daily intake of Moringa based curries in my young age, prepared daily by my sister in law from one Moringa tree in our back yard. Three years also discovered that when you combine Moringa oil with aloe Vera gel that is the best cream to apply on face, that is reason for the glow in my face even when I am 74 years old.

With all these technological marvels, Countries are enhancing global competitiveness, without the resource based comparative advantages, using human ingenuity at the infinite source of wealth creation. The Japan is one example. But at the same time it is being increasingly proved that the resource based comparative advantage is the pre requisite for achieving rapid economic transformation. And with Moringa we have huge resource based comparative advantage; unfortunately we are not converting it in to competitiveness, because we rarely

apply the science and technology in to that situation. Take for example, Palm oil plant was originally transplanted from West Africa to Malaysia. Today Malaysia is top performer in producing 87 varieties of Pal oil based products. But in Africa the tree is still standing. What is the difference here is, Malaysians applied the Science and technology, which is just a simple efficient farm management which dramatically increased the production.

In the case of Moringa what is happening is everything is sold, Moringa leaves, seed, stem and roots. We use to say waste is not a waste until it is wasted. This is applicable to Moringa, that's why everybody is venturing in production of Moringa.

A person from Sudan who is 94 years old has become a Billionaire just by planting the Moringa seed which he brought from Tamilnadu some 20 years back. Twenty years ago he came to Tamilnadu as an ordinary farmer and a tourist, he read somewhere about the value of Moringa took some seeds and plated in just a 35 acres and believe me in the global market he is the best performer. Everybody wants to buy from him. I met him and asked him how he made it. He says everything he does manually. He plucks the good leaves, get rid of the spoiled ones, expose it to sun, and the preserve it and pack it to international standards and quality control norms, he provides intensive training to the totally illiterate farmers who are working there. This product has transformed their lives; their children are going to Universities. Same I saw in the life of farmers living in Zanzibar, china. Within 5 years their life was completely transformed because of one promising product.

It is said that Indiato struggle to achieve ratification of its transformation, it has to be one or last in the country side. We believe in that, as the rural area is the nerve center. The SMIDS is very keen to disseminate knowledge pertaining to value addition, semi processing and then processing for final product. We have actually brought so many experts who are involved in this. All the ideas which are going to be transpired during this conference are under pinned by practical insight and nothing less than that. The SMIDS will certainly attend to follow up and conceptualize, formulate & implement big project making an long lasting impact on rural poverty reduction.

C). GOVERNMENT SCHEMES AVAILABLE FOR MORINGA CULTIVATION:

**MR. ASHOK – DEPUTY DIRECTOR,
DIRECTORATE OF HORTICULTURE AND PLANTATION CROPS**

Happy to be part of this International Conference on Moringa Entrepreneurship and share about few Government schemes available on behalf of the Directorate of Horticulture and plantation crops Kanyakumari District. Though in India 38,000 hectares have been used for Moringa cultivation it is to our surprise that only 3 hectares have been used in Kanyakumari district. Initially I was amazed at the confidence of the SMID – Dr. Kamalhasan Pillai & Sis Archana, who met me with this idea of conducting such program in Kanyakumari district. I was wondering given the situation how they chose Kanyakumari for that purpose. I thought Thoothukudi would have been a better place. But now I could see how true their instinct is. Only after they met me with the idea, I believed that there is possibility of doing Moringa cultivation in Kanyakumari in a large scale manner. I knew round 12 people are exporting moringa products from here to Gulf countries and Maldives daily.

Here I would like to talk about the feasibility of moringa cultivation and also the schemes available for the support of the same. Two places of cultivation is possible – the places where windmill is lying vacant, dry area, around 1000 acres available for moringa cultivation. We need to influence the wind mill owners for that matter. Secondly, the rubber plantations place, where in the beginning 2 years of the rubber plantation they also plant the banana trees, and also tapioca. We could also try to plant moringa in these places. Around 28,000 hectare place is available, so in these two places we can promote moringa cultivation.

There are about two types of schemes available, one is scheme based and another is project based (www.migh.gov.in). The scheme based has four divisions based on the subsidy we provide you the support. Project based means if you prepare the project based on the guidelines given, you can receive the fund. If you submit project for moringa we will consider it. Even you can find some details here in www.nhp.gov.in, also under NHP we have project based funding. If we want to do moringa farm in 1000 or 2000 hectares we will send it for approval. And there is provision for Rs 20,000 to 25,000 fund support per hectare under this scheme.

We also have plan for area extension also. Another one is GAP – Good Advisory Practice, where we can get around Rs.10,000 as subsidy for one hectare.

Other than this through NHRDF, value chain process in moringa was proposed in 2 places in Tamil nadu, (Dindugal & Theni), but it has not started yet. I think if you take steps proactively you could bring that program to Kanyakumari itself before anyone could do. So there are already many plans available but we need to ask and get them. If you propose such programs for our Kanyakumari district which benefits the people, then Horticulture Department will be surely supporting such initiatives and extend our help towards it.

D). FELICITATION:

SHRI. AUSTIN, MEMBER OF LEGISLATIVE ASSEMBLY, KANYAKUMARI.

Greetings to everyone. People before me spoke about the medicinal values of moringa and the different parts of moringa which is very useful. But this awareness is not present among the common man today. This is the reason why only 3 acres have been used for moringa cultivation in Kanyakumari district. My request to the Deputy Director of Horticulture is that they should take this message to people and explain about the benefits of moringa and the profitability of this moringa cultivation. I remember 24 years back, I sold 4 acre land to a landlord. He removed the coconut trees in the land and planted the Jaffna moringa trees (The drumstick would be from 3 to 4 feet actually). And within first cultivation time he earned the money, which he has paid as land rate, through the moringa business. That's how there was demand even in those days. In Sathankulam, Udankudi, & Thoothukudi we could see plenty of moringa farms now a days. But in Kanyakumari the awareness is very less therefore moringa is only planted as a home plant. The horticulture department should bring more awareness on the medical health benefits of the moringa to people. With this I would like to thank everyone for coming to our constituency and believe that good things will happen here and extend your support for the development of this Kanyakumari district.

E). KEY NOTE ADDRESS:

MR. AMALOPAVANATHAN, DEPUTY MANAGING DIRECTOR, NABARD

We are in a very critical stage as far as the Farm development is concerned. The reason for that is we have started the systems and institutions in early 50's when we started the plan for the development. The agricultural situation at that time was very different. There was severe food shortage, and an urgent need for increasing the food supply was there. So host of institutions were started including the ICR, Universities, Research stations, Extension services, Societies, Co-operative Banks many such institutions were started during that time. 75 year down the line we are continuing with the same, even the demographic situations have changed, the purchase system has changed, the supply chains have improved, purchasing power of the people have improved but the systems that were created during 1950s remain the same.

The problems of dealing the deficit are different from the problem of supply. Today we have lots of surplus created but we are trying to manage the surplus with the institutions that is meant for dealing with deficit. This is one big problem we are facing. Therefore we need to re-look the entire strategy of agriculture and rural development.

We started with almost 100% of the silk labor, today almost 100% of the farm inputs are purchased from the field, right from seeds to everything. Earlier it was entirely organic because people were using the farm manure etc but even though now we are using, but almost we are done away with the old systems. Therefore so much change has taken place. The purchasing power and the customerpattern have changed. Therefore we need to re-orient the agriculture towards that and all the strategies.

The Department of Extension earlier used to visit the field but it has changed, we hardly see it now. The sales system continuesthe same now and the people are given subsidies and fees etc rather than going and educating the farmers about what they should do. Now they are doing in radios' and FMs. And I don't know how many of us are actually seeing the farmers program in the Television's. Now there is other competing element that has come that is being relegated to back. According to our National Survey only 3% are taking advice from scientific institutions'.

Rests of them are relying on other channels to get the advices on Agricultural farming. And we need to think why this is so. And be alike that scientific knowledge should be going from the farming universities and also from Krishi Nigam Kendras etc. We have serious concern about this. And what we are doing now we don't know. All the scientists are here, we need to think about it.

The second thing is going from the sustenance agriculture, to the commercial agriculture domestically and going for trade with agriculture and then International markets it requires different kinds of changes that are required. In terms of standard, practices etc. And from an Individual farmer oriented agriculture we are going towards agricultural enterprises. Now we are talking about 100 acres of moringa etc these are enterprises. It is not just a farming for an own purpose. So people are moving towards enterprises but our systems are not moving.

Benefits of exporting moringa has not reached our own population in India, and today we are facing lot of Nutritional insecurity, though we have achieved some food security but the Nutritional security is very bad. We have achieved public health, but still we could see lots of people are retarded in many parts of country. And malnutrition is present even now. Inclusive development should also include every factors of development. Now we have also developed organic farming and natural farming. There is a difference of opinion that organic is better than natural farming vice versa. And that organic is not nature, but natural farming is different. There are some scientific debates which I am not interested. The thing is that we need to reach the people the way nutritional security is achieved not only in India but globally.

We don't need to export; we have huge market here with purchasing power. But the issue is do we provide quality products to our own country. You know the answer better. Universities are or Research stations are increasingly moving to production oriented. The commercial orientations are also important. How many enterprises we are creating? How many are participating at the universities. We could rarely see companies joining them. We should research, commercialize, and take it forward to the people and enterprises. They should move forward in terms of technology and that is very crucial for our Universities to move forward in future.

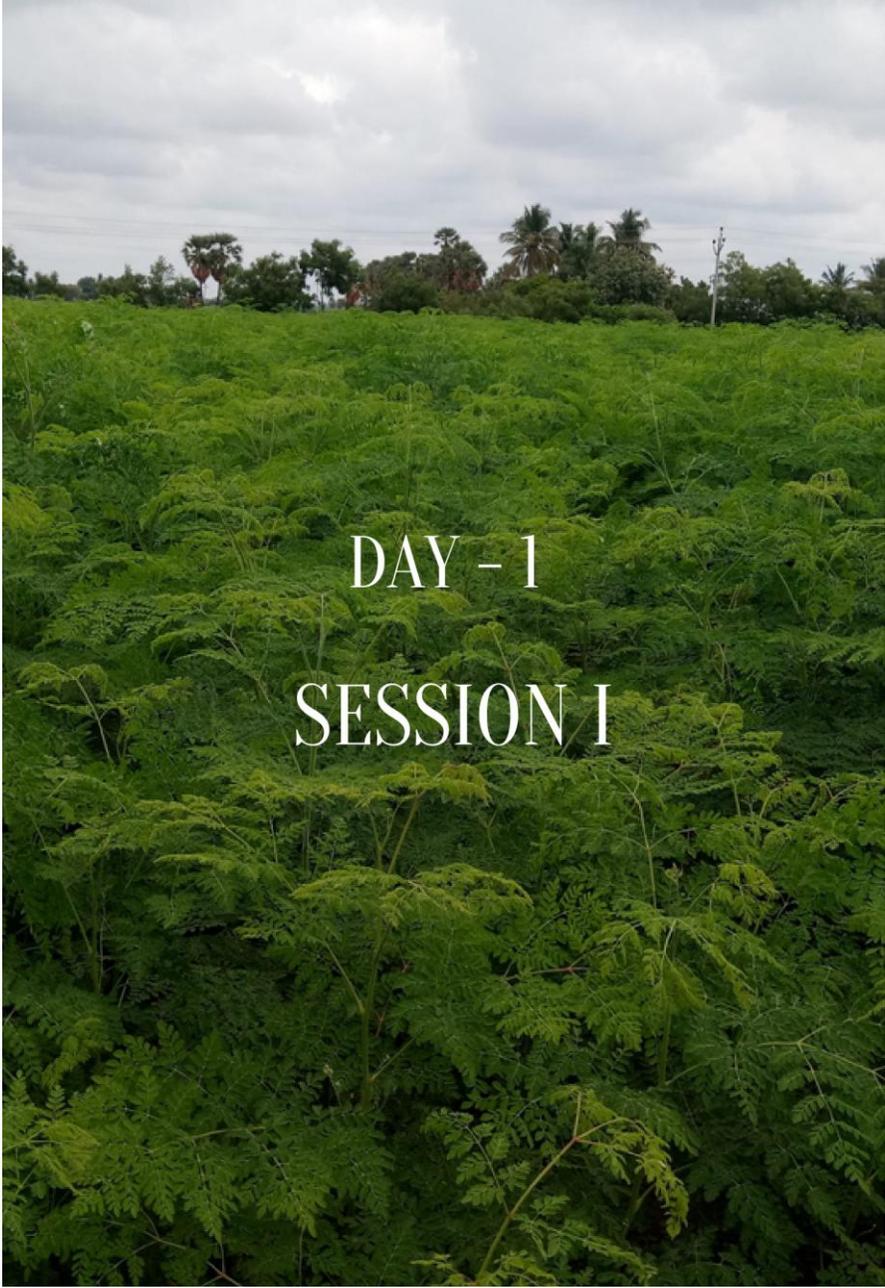
We need to create a lot of awareness on moringa, and only way is through network. There is no dearth of cooperation from NABARD but in terms of networking I need to comment. We are very successful individually but when we join together we are not that much successful. We are the land of small & marginal farmers. We need to evolve some systems. As you know that NABARD has started farmer producer organizations, which is three years old, and it has started more than 3000 Farmer producer organization. It starts from awareness building and slowly takes it into company format, so that they will be able to manage themselves, in terms of production, purchase, marketing processing etc. So this model is the key for success of all farmers. And here where the scientist's entire role is important, you need to hand hold them and give those practices and then see that they practice the right methods so that the markets can accept that. The farmer producer organization is the center of this so that in production and supply side they can manage in collaboration with universities and on the demand side they can manage it with the enterprises export councils.

And whatever the financial needs are there NABARD is able to supply this by giving them up to 21 lakhs as grant up to formation of the company and come out with the business model. We have recently started the venture fund, because initially they will not be able to take loans, so we started a month ago. Also Nav Kisan a subsidy created by NABARD for retaining these loan to the Farmers producers' organizations for financial support and I happen to be the chairman of it and we have done a quite a bit. In last 4 years 58,000 crores it was in 2014 and today it is 620 crores. I am planning to take it forward to 2200 crores in another 6months' time. The need for collaboration and networking with Government is very important. We are going to sign agreements with Orissa and Haryana govt. And Tamilnadu govt. in principal agreed but there is no movement on that unfortunately. So many govts are joining hands to promote the FPOs. Different organizations of the Govt. like horticulture etc should join and network together.

We need to develop enterprises capable of delivering in the field. We need to develop inclusively. Farmers club promoted by NABARD, a person from Maharashtra, chief volunteer, 2 and half lakhs farmers are under him. We have more than 7 lakhs farmers club. Farmers club are there propagating the technology, bringing the scientists to the farmers.

Expenditure is met by us. And we have further 500 crores for FPO promotion. We have the promoting and resource supporting agencies of NABARD for every state which you can make use of. To help them to register a society or company there are manuals and guidelines'. Small farmers can unite together; it will be a huge success. Enterprise development is very important and we have sanctioned the first one from NABARD to Madurai campus of TNAU to take care of the south operations. All the entrepreneurs will go there and get their product tested; we have also covered the areas like vendor capital front, NGO front, Bankers and also the Scientists, who can all meet at one place. So please make use of the especially people in southern states.

Finally, I would like to thank the Stella Maris Institution for having invited me. For every product based you can form clusters like moringa clusters, cashew clusters, rubber clusters etc. as the cluster based approach will help us to unite the farmers and invite lot technologies and market oriented production and then NABARD will be with you all the way. You can contact us for any support in this regard; I am available 24/7. Thanks again. All the Best.



DAY - 1
SESSION I

Public Private Partnership Development in Moringa Production (A Case study)

MR. PADMANAND. V.,
EXECUTIVE DIRECTOR, GRANT THORNTON INDIA IIP

Mr. Padmanand with his profound knowledge and experience has made the participants to dream and aspire more in their domain of agriculture based production, preservation and value addition through various programs and schemes available throughout India. In his session he mentioned about the following schemes, benefits, eligibility and process:



MoFPI Scheme for Creation /Expansion of Food Processing & Preservation Capacities

Mega Food Parks Scheme- MoFPI

Scheme for Cold Chain Infrastructure Development

Micro Small Enterprises- Cluster Development Program

Project Profile- MSE-CDP

Project Profile- MIIUS

SFURTI Scheme: With a view to make the traditional industries more productive, competitive and facilitate their sustainable growth, the Government of India has launched a Scheme in the year 2005 called SFURTI (Scheme of Fund for Regeneration of Traditional Industries). The Union Ministry of Micro, Small and Medium Enterprises and its organizations and institutions, in collaboration with State Governments, their organizations concerned, non-Governmental organizations, etc., are implementing the Scheme. Grant Thornton has been appointed as Technical Agency for Implementation of Projects.

Along with this he shared his own experience of working for SRUTHI scheme. Mr. Padmanand answered all the queries raised by the participants. His session was more helpful for the business startups and expansion of the Moringa product based business.



DAY - 1
SESSION 2

a) Recent Trends in crop improvement and production of Moringa

DR. R. BALAKUMBAHAN,
ASSISTANT PROFESSOR (HORTICULTURE), DEPARTMENT OF VEGETABLE CROPS
HORTICULTURAL COLLEGE AND RESEARCH INSTITUTE, PERIYAKULAM.

Moringa Oleifera, a deciduous, fast growing plants, Widely distributed along tropical and sub-tropical climates is known as Horse raddish tree, Raddish tree, West indian bean and Miracle tree which originated from North West India.

Different varieties and crop improvement:

- a) **Moringa arborea**, a very beautiful tree, because it's covered with its large sprays of pale pink & wine red flowers. Young fruits resemble like a yard long string bean. Root is used for medicine (root).
- b) **Moringa borziana**, Occurs from southern kenya to kisimayu in southern somalia. Produce tuber more than 1m. Flowers are greenish cream to yellow with brown smudges on petal tips.
- c) **Moringa pygmaea**,Tiniest member of moringa, delicate tuberous herb with very tiny leaflets.
- d) **Moringa longituba**, grows in northeastern Kenya, southeastern Ethiopia, and much of Somalia. It is broadly used medicinally for intestinal disorders of camels & goats. It has bright red flowers and has large tuber with one small shoot reaching knee high above soil.
- e) **Moringa stenopetala**, most research be applied and focuses in this species, other than M.oleifera. It is an important food plant in southwestern Ethiopia.
- f) **Moringa ruspoliana**,Occurs from northern somalia to southeastern Ethiopia. It is the only species having simply pinnate leaves, large leaflets (15cm dia) and flowers – are pink with green bases.
- g) **Moringa ovalifolia**,found from central Namibia to southwestern Angola, usually grows on rocky ground.

- h) **Moringa drouhardi**, conspicuous element of southern malagasy dry forest, which grows extremely fast, surpassing 3m in its first year.
- i) **Moringa hildebrandtii** is a beautiful tree with a massive water storing trunk can grow to 20 m tall, leaf rachis and stem tip of young plants is often a distinctive deep red.
- j) **Moringa peregrine**, Use as imporant oils in ancient times. In southern Arabian Peninsula, Tubers of saplings are roasted and eaten.
- k) **Moringa oleiferaa** fast growing, small tree adapted to arid sandy condition and every part of leaves is beneficial.
- l) **Moringa concanensis**, very strong central trunk that is covered with an extremely distinctive layer of furrowed bark. It has bipinnate leaves, petals with red streaks or reddish at base. It occurs in tropical dry forest from southeastern pakistan to south tip of India.

Crop Improvement:

- **KM 1**- Improved type designated as seed moringa (Bushy variety), Selection from a seed type, Pods are short (32-37 cm lendht), 226-328 pods/ tree.
- **PKM 1**- Pureline selection from a selfing population, Harvest:- 8-9 MAP, 200-350 pods/tree, propagated through seeds
- **PKM 2** - Hybrid derivative (MP 31 x MP 28), Medium tall tree, Pod length: 123 cm, Pod girth: 8.5 cm, Pod weight: 280 g, Less seed content and more flesh content, Propagated through seeds
- **GKVK 1, 2, 3** - UAS Bangalore, Small stemmed varieties with 2-2.5 m height, 120-200 pods/tree/year.
- **Dhanaraj** - UAS, Dharwad (UHS), starts bearing 9-10 MAP, 150-200 pods/tree/year, Pod length- 35-40 cm, propgated through seeds.
- **Bhagya** - UHS, Bagalkot, and Open pollinated seedling selection from Dhanaraj, 2-4 m height, Flowering- 100-110 DAP, Pod length- 60-70 cm, 350-400 pods/tree/year.
- **Rohit 1** - Superior quality, two crops/ year, yields 400-600 pods/ tree/year
- **Konkan Ruchira** - BSKV, Dapoli, Selection from Vasai Local, Annual bushy tree, Flowering- 90-100 DAP, 275 pods/tree/year
- **Anupama** - KAU, Early, regular, protracted flowering and high yield, Yield/ tree: 300 kg, Pod length: 55.5 cm, Fruit colour: green
- **AD 4** – KAU, Early, regular, protracted flowering and high yield, Yield/ tree: 285 kg, Pod length: 55 cm, Fruit color: reddish green turn dark green at harvest stage, Annual seed drumstick.

b) Origin, evolution and geographical distribution of Moringa

DR. L. PUGALENDHI, PH.D., PDF (ISRAEL),

PROFESSOR AND HEAD (HORT.) HORTICULTURAL RESEARCH STATION, TAMIL NADU AGRICULTURAL UNIVERSITY, COIMBATORE

Mis en forme : Espagnol
(International)

Tree of “Miracle” Moringa, Olifera *Moringa oleifera*– Moringaceae, an incredible plant to the mankind. It has got immense potential to end malnutrition and starvation. Different parts of this plant contain a profile of important proteins and minerals like iron, calcium, vitamin B and C, β – carotene, amino acids and various phenolics. It provides rare combination of zeatin, quercetin, β - sitosterol, caffeoyl quininc acid and kaempferol. It is known as a balanced diet for human. Drumstick is mostly cultivated in **home gardens and courtyards**. *Moringa oleifera* is adapted to a wide range of soil types but best in well drained loam to clay loam. It does not withstand prolonged water logging. It prefers a neutral to slightly acidic soil reaction. Pacific atolls, where pH is >8.5 . **Best suitable temperature range between 26 to 40° C**, Annual rainfall required 500mm. Moringa is **quite drought tolerant**, but it yields much less foliage under continuous water stress.

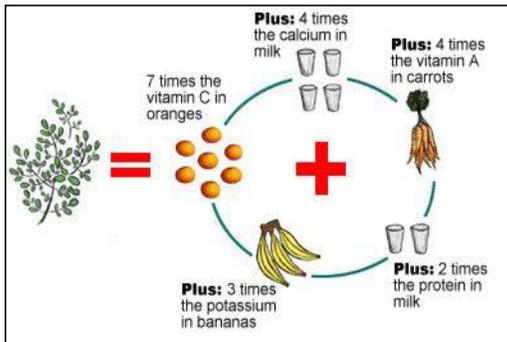
Potential uses of Moringa:

Leaves are used as high Nutrition food and Medicine; trees are used as Alley Cropping, and planted to control soil erosion. Flowers are used for medicinal purpose, pods are used as nutritional food and medicine. Root are used for medicine preparation, seeds used as water purifier, medicine and for oil extraction. Gum and barks are used for medicine. Such a way the entire parts of the tree is been used by human being.

Origin Evolution & Other names for Moringa tree: Drumstick tree, never die tree, West Indian Ben tree, Radish tree, harsh radish tree and Miracle tree are the other known names for moringa in different parts of the world. Moringa tree is indigenous to North West India; south of the Himalayan Mountains It is found growing wild in the Sub-Himalayan regions of Northern

India and now grown worldwide in the tropics and sub-tropics. The moringaceae is a single genus family with 13 known species. *Moringa oleifera* is the most widely known species and is planted in the whole tropical belt. Common name of *Moringa oleifera* in Malabar is Moringo and this is the origin of the generic name Moringa. It is also called as Morunga in Dravidian language of India means “generic root”

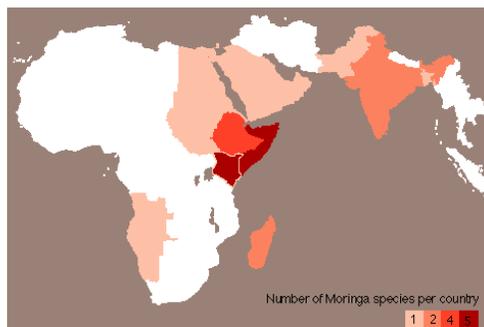
The moringa roots are pungent and commonly used as a condiment or garnish



by Europeans in India as a substitute for horse radish. Hence the tree is commonly known as ‘Horse radish tree’. The other widely used common name is ‘Drumstick tree’ (shape of the pods, resembling the slender and curved stick used for beating the drum)

Distribution:

Moringa was cultivated in India and distributed to other areas of Tropical Asia in prehistoric times. The British carried it from India to Africa as an ornamental tree. An Englishman named Hinton East introduced it into Jamaica in 1784.



Global Distribution of Moringa (Fahey 2005)

c) Ultra High density planting in Moringa for leaf and fruit production

DR.T.N.BALAMOCHAN, PH.D., PDF.
PROFESSOR AND HEAD (HORTICULTURE),
AGRL. COLLEGE & RES. INSTITUTE, TNAU, MADURAI



There are three systems of Moringa cultivation methods prevail in Tamilnadu. They are Homestead single tree system, border system of cultivation, and commercial cultivation (PMK 1 annual Moringa cultivation)

High Density planting for leaf production is a method followed by many farmers for commercial purpose. The following specification is followed and advocated in the high density planting of Moringa by TNAU

Spacing between the plant is 1x 1m, 4000/ ac. Plant are being planted per acre. Micro irrigation inline system is recomended. Total Cost of cultivation would be Rs. 1.52 lakh and the Yield would be 22 t/ac fresh wt. and 3.5 t/ac dry wt. B: C ratio is 1.61 (first year)

Cost Economics on Ultra High density Farming is mentioned below

Particulars	Cost (Rs.)	Yield	Gross return (Rs.in lakhs)	Net return (Rs.in lakhs)
Expenditure I year	152400.00	Dry – 3.5 t/ac @ Rs. 70 /kg	2.45	0.93
Expenditure II year	53500.00	Dry – 3.5 t/ac @ Rs. 70 /kg	2.45	1.92

Mis en forme : Français (France)

Mis en forme : Police :+Corps, Français (France)

Mis en forme : Français (France)

Mis en forme : Police :+Corps, Français (France)

Production parameter of Moringa at first cutting on Ultra High density planting

Spacing	Plant density (Plants / ha)	Fresh Matter (tonnes /ha/ cutting)	Dry Matter (tonnes /ha)	Protein (kg/ha)
45 x 25 cm	95,000	19.6	3.33	566
25 X 10 cm	3,50,000	29.7	5.05	859
15 x 10 cm	9,00,000	52.6	8.94	1,520
10 X 10 cm	10,00,000	78.0	13.26	2,254

10 x 10 cm = 10 lakhs plants /ha

Moringa Shoots cut at 20 cm height:

650 t/ha/year, Harvest 50cm (every 35-40 days) and up to nine harvests can be obtained annually.

Neutraceutical properties of moringa

- 46 Antioxidants & 36 Anti-Inflammatory compounds
- Fresh leaves boiled in water can be used in curing malaria, hypertension and stomach pain
- Aqueous extract of the mature flowers contained the free neutral sugars
- Moringa seed oiled cake increases number of flowers and flower size in jasmines, rose and tuberose

d) Export Potential of Moringa

**MR. PLATOSEN SAMARASAM,
ZUWA ORGANIC FARMS PVT LTD**

A Management professional currently pursuing his passion - Sustainable Agriculture and has started an organic farm and export company to produce market and promote certified organic products. He is working to establish a model farm with a farm school that would educate farmers on best practices in agriculture.



At ZUWA aims to lead the farmers for a net income of 2 to 5 lakh per acre per year, by choosing the right crop, adopting ultra dense cultivation, best organic practices, establishing market buy back even before the first seed is sown and adding value to the produce.

Moringa market potential:

Current Market size of Moringa trades (2015) – 4 Billion USD. Market size of Moringa trade by 2020 – 9 Billion USD and India’s share of Moringa trade is approximately 50 %. Annual growth rate globally is 10 % till 2022. Major buyers are from WEST – USA, Europe (UK, Germany, France) China (Seeds – largest buyer) and Taiwan, S.E Asia – Malaysia, Singapore. Major Sellers are India, Philippines, Mexico, Africa and Vietnam.

Moringa price an idea:

Moringa leaves -Conventional – 75 to 95 INR / Kilo and Organic – 100 to 150 INR

Moringa leaf powder-Conventional – 150 to 175 INR / Kilo, Organic – 250 to 450 INR / Kilo

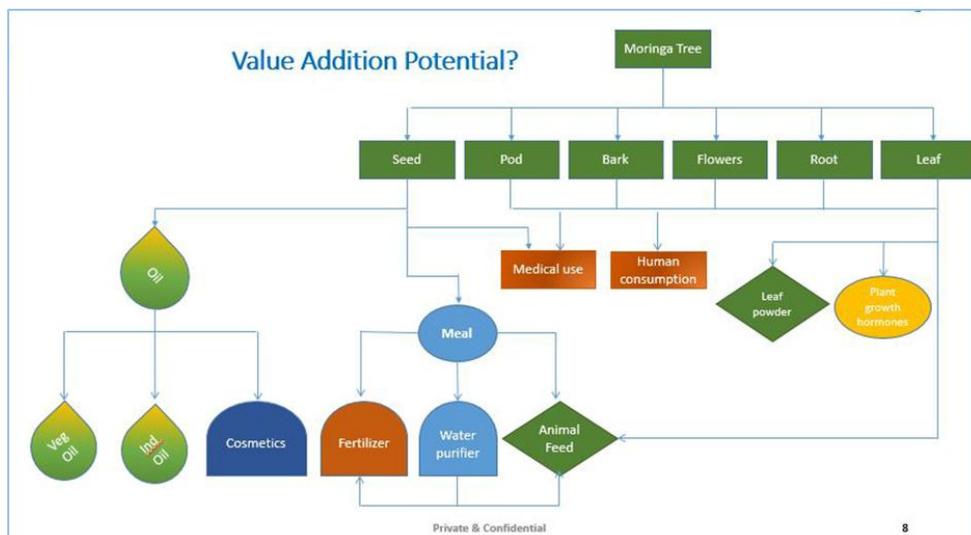
Moringa T-Cut leaves -Organic – 175 to 250 INR / Kilo

Moringa Seed- Germination Organic– 2500 to 3000 INR / Kilo, Seeds – 450 to 800 INR / Kilo

Moringa Oil - India – 2000 to 5000 INR / litre, Abroad – 5000 – 10000 INR / Litre

Minimising cost and standardizing process:

Following methods are being followed to reduce cost of Agri Inputs (₹ 1200 / Acre to ₹ 350 per Acre): Simplifying the Agri Inputs preparation, standardizing the Inputs, minimizing the number of application, skilling Labour (trial and error – learning curve), optimizing drying technique for Quality, from Sun drying – local traders, solar dryers – Indian buyers (pharma and Agri processing), advanced Solar – Export (Pharma Grade).



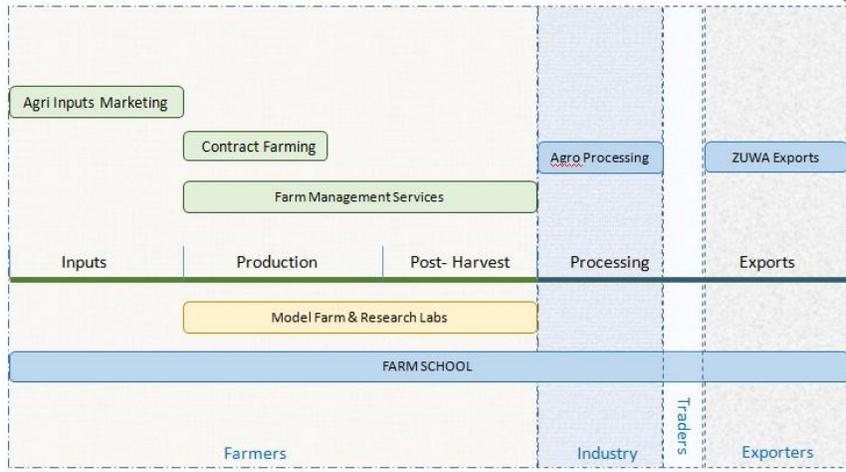
Land preparation with farm compost (6-10 tons per acre) is been followed by ZUA and the Drip irrigation system (4 ft between laterals) is very effective.

Market potential of Moringa products:

Current Market size of Moringa trade (2015) – **4 Billion USD**

- Market size of Moringa trade by 2020 – **9 Billion USD**
- India's share of Moringa trade – Approx 50 %
- Annual growth rate globally is 10 % till 2022
- Major buyers:
 - WEST – USA, Europe (UK, Germany, France)
 - China (Seeds – largest buyer) and Taiwan
 - S.E Asia – Malaysia, Singapore
- Major Sellers: India, Philippines, Mexico, Africa, Vietnam.

Business Model Schema



ZUWA Organic Farms Pvt Ltd

Private & Confidential

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Productivity Issues and Enhancement

Parameters	Traditional Farm	Our Farms
Density	200 to 700 Trees Per Acre	10,000 Trees / Acre – 2015 & 35,000 Trees / Acre – 2018
Productivity	750 kilos / Acre / Year	2200 to 3500 Kilos / Acre / Year
Irrigation	Flood irrigation or Drip system	Drip or Sprinkler systems
Fertilizers	Chemical or Traditional organic preparation	Standardised Organic Nano fertilisers
Fertilizer application	Manual , Spray or Drip	Primarily through Drip
Pest Control	Chemical or traditional Organic inputs	Standardised organic inputs
Postharvest processing	Sun Drying	2015 – Sun drying / Solar Dryer 2018 – Automated Solar dryer (IoT)

Maximizing yield and minimizing area is the motto of ZUA in moringa cultivation.

e) Economic Analysis of Moringa Cultivation and Marketing

DR.X.ALEX ISSAC, PH.D (HORT.),

PRESENTING A STUDY ON MORINGA CULTIVATION AT DINDIGUL DISTRICT OF TAMILNADU:

Dr. Alex Issac presented a study report conducted by his team at Dindigul District of Tamilnadu.

Objectives of his study was

- To study the cost and returns structure of moringa cultivation for small and large farmers in Tamil Nadu.
- To identify the determinants of yield and factors causing yield gap with regard to small and large farmers in study area.
- To analyze the existing channels of distribution of Moringa and to evaluate the marketing cost, marketing margin, price-spread and marketing efficiency of different channels in study area.
- To offer suitable suggestions for improving the Moringa cultivation and marketing of Moringa in Tamil Nadu

3076.34 Ha of area covered by moringa cultivation in 13 Blocks of Dindigul District

Collection:

When harvesting pods for human consumption, farmers collect them while they are still young and immature, are less than ½ inch in diameter and easy to snap. When producing seed for planting or for oil extraction, farmers harvest dried and brown pods and store them in well-ventilated sacks in dry, shady places. For either use, family members take on harvest practices themselves

Traders:

A common sight in Moringa growing areas is the proliferation of petty traders who trade Moringa pods to wholesalers or small retailers in the nearest markets. It was unclear how many

petty traders there are or how much they trade but one thing is certain- they greatly outnumber wage workers as well as licensed traders.

Whole sellers and distributors:

Petty traders sell their produce to middle man (wholesaler) at markets such as Oddanchatram and Dindigul. Moringa also have a large demand in metro cities like Chennai, Hyderabad, Bengaluru, Mumbai, Pune etc. Shop owners scattered across India often offer Moringa pods for consumption throughout the year, given the importance of Moringa pods in the local diet. Shop owners have different options to get their supply throughout the year; agreements with traders on a commission basis, direct agreement with farmers or supply through wholesalers, just to name a few mechanisms.

Processor and exporters:

The domestic sector represents the largest market for drumsticks. On the other hand, if we look at the potential for export, over the last two years and remains on an upward trend. To meet the demand for the export market, processors/exporters pack 20-22 inch drumsticks on 10 kg carton boxes.

Benefit – Cost ratio of Moringa:

S.No	Particulars	Cost per acre [Rs.]
1	Seeds	1000
2	Field preparation	5000
3	Labours	7000
4	Fertilizers & Pesticides	15000
5	Weeding and Inter cultural operation	6000

6	Irrigation , Harvesting & Marketing	9000
7	Total cost of the production	43,000
8	Yield : 9 tonnes / acre x Rs. 12/- kg of price	1,08,000
9	Benefit - Cost Ratio	1: 2.51

Findings:

- As per the findings, 58 per cent of the farmers attended training conducted by Horticulture Department, KVK's and University.
- 68 per cent of the respondents are earning more than Rs. 6,000 per month on average.
- This research reveals that 58 per cent of the respondents are illiterates and 42 per cent of them are literates, but they are completed up to higher secondary education level.
- In our study area, 90 per cent of the respondents received loan from money lenders to farming needs.
- All the farmers are facing the problems of environmental affects, pest and disease outbreak and reduction to crop yielding.

Suggestion:

- The outbreak of pests and diseases played a major role in reducing the yield of Moringa and the profit margin. The Government should establish disease forecasting centre in major Moringa cultivations areas.
- Exploitation of farmers by village merchants who take more profit constitutes another major problem. This could be eliminated by producers who would sell their produce in the regulated market through a co-operative marketing society.
- Lack of technical knowledge in moringa cultivation is an important lacuna. Therefore, the Government should intervene and arrange for periodical training program for Moringa cultivators.
- The government has to give support to the Moringa cultivators by providing proper price norms, storage and market facilities.

f) High quality organic Moringa and fruit production leaf

**MR. PADMANAND. V., EXECUTIVE DIRECTOR,
GRANT THORNTON INDIA IIP**

**Modern Integrated Fruit and Vegetable including Moringa Processing Facility.
By Jaycee Organics LLP, Tirunelveli**

The main objective of the scheme is Creation of Processing and Preservations capacities and modernization/ expansion of existing food processing units which will help in increasing the level of processing value addition and thereby lead to reduction of wastage and enhancement of farmer's Income.

Background:

M/s Jaycee Organics LLP is a Limited Liability Partnership Firm formed under the section 12(1) of the Limited Liability Partnership Act 2008. Mr. K. Jayachandran is Director of the firm. He is 71 years old, hailing from agrarian family. He is Graduate in Chemistry and Post Graduate in sugar technology. Served in the sugar industry which is a agro based continuous process manufacturing of sugar. Started the career as quality control officer and Served in various capacities like manufacturing chemist, Chief of the processing department and rose up to the President of sugar mill complex namely Kothari Sugar & Chemical Ltd. Served in the industry for 49 years and taken up organic farming as the passion. Currently for the past 9 years managing and cultivating organic products of all horticulture grains, dairy products, edible cold press oils.

Mr. K. Chandrasekaran is hailing from agroian family and have 39 years of experience in his professional life. He is a Graduate in Economics and later obtained Degree in Law from Madras Law College. He is also a Fellow Member of Institute of Company Secretaries of India, New Delhi. After practising for 4 years in Madras High Court, he moved into a Heavy Engineering Industry in Government Sector and worked there in various capacities for 12 years. Later, he

moved to Hotel and Resorts Company as Director handling various management portfolios including Law, Secretarial, Corporate Finance and Administration.

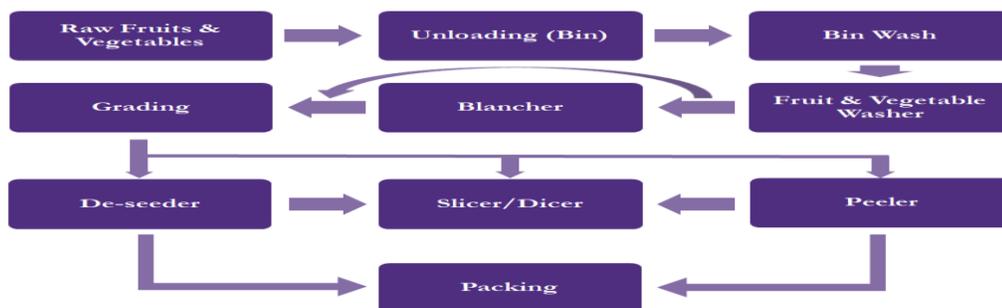
Mr. K. Jayachandran and K. Chandrasekaran are directly involved in the farming activities in their own integrated farm of 200 acres and contract farming of 225 acres to produce vegetables, fruits, paddy, pulse, coconut and oil seeds etc. through organic route.

Fruit and vegetable processing unit:

The Project entails setting up of Fruits and Vegetable including Moringa Processing Unit with a capacity of 12TPD. The project will be comprising of primary fruit & vegetable processing, Moringa processing, dehydration section, coated fruits section, juice/Jam/Jelly processing line, preserve line, packaging line etc.

Raw material required for the project are dried amla, dried lemon slices, dehydrated pineapple, dehydrated jackfruit, dried bitter gourd pieces, honey coated pine apple and jackfruit, amla and lemon concentrate, Moringa powder, oil etc.

Process description – Fruits and vegetables:



Means of finance:

S. No	Particulars	Amount in Rs. Lakh	Percentage
1	Promoters Contribution	223.84	24.94
2	Term Loan	450.00	50.14
3	Grant from MoFPI	223.71	24.92
	Total	897.55	100.00

g) Pest and Disease Management



MR. JAISON J JEROME

**B.SC. (BOT), B. SC AGRI, M. SC AGRI, PGDBA, DST,
DEMETER INTERNATIONAL ADVISOR.**

Cultivators should understand the basic information on insect and non-insect pests of drumstick, [Maringa oleifera](#) Lam at different stages of crop growth as well as their nature of damage. This session would be more helpful for the

producers to know more about the control mechanism available for the crop.

This miracle tree is susceptible to many insects' pests. There are few **aphids** feeding on the terminal end of the fruit causing tip drying has been recorded. **Termites** and other pests are also associated with drumstick. In the recent years, damage by the **fruit fly** is increasing especially during rainy season. Infestation of these pest starts from fruit initiation and persists till harvesting stage.

Pod fly has attained a major pest status in Southern India. Among the piercing and sucking insects were numerous **green and brown/black aphids, whiteflies and mealy bugs**. This pest is reported to cause 70 per cent loss under poor management conditions. Butani and Verma gave a list of 28 species of insects and two species of mite pests are also attacking drumstick. Such of the insect and non-insect pests on drumstick, as reported by different workers, have been enlisted in the Table. Accordingly, 49 insect pests and four mite pests have been found to infest drumstick.

“The pest and disease attacks are the true reflection of unbalanced growth due to the poor fertility status of the soil in which the crop is growing and the quality of the seeds/ seedlings used”

Indiscriminate use of chemical pesticides has resulted in resistance in pests, resurgence of minor pest and high level of residual level in the food materials. ***High pesticide residues in the food chain*** cause deaths due malfunctioning of organs, immune suppression, neurotoxicity,

impairment or reproductive functions carcinogen city, paralysis, etc and harmful to beneficial flora and fauna. Hence, primarily steps have to be taken **to increase the soil fertility in long run**. With the increase in the **soil fertility status of the soil** the crop grown will get a balanced nutrition for its growth, so there will be a balanced growth with vigor and resistance power to resist the insect infestation and disease incidences. Then it is very important to get **good quality seeds** by growing or buying it from a reliable source.

Alternate approaches: Health of a plant is determined by its environment which includes physical factors such as soil wind rain and Sunshine Service and biological factors that is pest diseases and weeds. All these factors can play a role in the balance which exists between Herbivorous insects and their natural enemies. Understanding the intricate Intel interactions in and Ecology can play a critical role in pest management. Agro ecosystem analysis is needed to understand the field situation with regards to pest defenders, soil conditions, plant health and the influence of climatic factor and their relationship for growing a healthy crop.

Ecological engineering for pest management: (below ground)

Crop rotation with leguminous plants which enhance nitrogen content, keeping soils covered ground with living vegetation and crop Residue, Adding organic matter in the form of farmyard manure vermin compost crop residue which enhance below ground biodiversity of microorganisms, reducing tillage intensity so that hibernating natural Enemies can be saved. Applying balanced dose of nutrients using bio fertilizers, Applying Trichoderma and Pseudomonas fluorescens seed treatment and soil application, The major predators or a wide range variety of spiders Ladybird beetle, long horned grasshopper, chrysoperla, earwig, etc., due to **enhancement of biodiversity** by the flowering **plants parasitoids and predators natural Enemies** number also will increase due to availability of Nectar Pollen fruits insects, etc are the ecological engineering ways used for the pest management system below ground at Moringa plantations.

Principles of agro-ecosystem analysis based IPM:

Cultivators can grow a healthy crop by selecting a variety resistant tolerant to major pest; treating the seed with recommended bio pesticides, selecting healthy seeds and seedlings, following proper spacing. eg - 2 feet x 4 feet, soil health improvement by mulching and green manuring, nutrient management especially organic manures and biofertilizers, if the dosage of nitrogenous fertilizers is too high the proper become too succulent and therefore susceptible to insects and diseases are controlled, proper irrigation, crop rotation, monitoring the field situation at least once a week, taking direct action when needed for example collecting egg masses, removal of infested plants etc.

Better to know the defenders or natural enemies to understand their role by regular observations of the agroecosystem methodically. Natural enemies may require Food in the form of Pollan and nectar for adult natural enemies. Shelters such as over wintering sites moderate microclimate are needed. Natural Enemies may also require alternative host when primary host are not present.

Biological control measures

Most of the insect pest can be controlled by the use of Beauvariabassiana and Verticilliumlecanii. Most of the commercial formulations - the fungal entomophagous fungus mentioned above will be in the sleeping or hibernation mode. we need to do the following as well as to adapt certain spraying procedures.

Improving efficiency of Biological Agents

Activation is carried out by utilising two or three grams of jaggery per litre. Jaggery mixed with the biocontrol formulation in the spray volume needed, It has to be activated for minimum 4 to 5 hours prior to the use. So in a day when we have to carry out the spray between 9:00 to 10:00 a.m. this activation procedures can be adopted and allow to activate till 2 or 3 p.m.

Type of spraying

The spray should be fine as possible in such a way that it is in the leaf and in the stem region. If we spray has big droplets the droplets will accumulate and Trickle down into the soil which will be of no use in controlling the insect pests.

Sticking agent

The sticking agent should be used. For this Maida at the rate of 3 grams per litre should be utilized. This can also serve as a food for the microbes especially the entomophagous fungus while the targeted insect's population is not adequate

Herbal extracts:

Herbal extracts should be used only as a final remedy only after utilizing & practicing all the above said methods. One should try to use only the locally available weeds or those that are grown as life fence for making herbal extracts. If enough materials are not available in and around the garden, then materials can be collected from other areas

Basic important procedures to be followed while preparing the herbal extracts are:

Macerate and grind the plant material to a pulp state. Soak the pulped material in at least **70-80% of the final volume of spray solution**. Soak the pulped material **only for 3-5 days**. After 3 – 5 days of fermentation, the whole solution should be **filtered and the final spray volume should be made** by adding the balance water. The filtered final solution has to be sprayed in such a way that the whole **plant is fully drenched** at least one or two times. Use at least **2-3 different materials** at a time to prepare the herbal extract.

Herbal extract -'Agnihasthirum'

An herbal concoction to combat the pest and diseases with the following combination. Materials needed are Ginger 1 kg, Green Chilly 500 gms, Garlic 200 gms, Neem leaves 1 kg, Adathoda leaves 1 kg .

Methods involved

Crush the materials to a pulp state separately. Then put the crushed materials in a 25 lts metal container. Add 10 lts of water boil it for 2 hrs, the concoction for two days, Add 5 lts of Cow urine, at the time of spraying, Use the concoction @ 15 ml/lit. Maitha @ 3 gm /lit can be used as a sticking agent.

Yellow pan water trap/sticky traps:

Set up yellow pan water trap/sticky traps 15 cm above the canopy for monitoring whitefly and blue sticky trap for thrips @ 4-5 traps/acre. Locally available empty tins can be painted yellow/coated with grease/Vaseline/castor oil on outer surface may also be used.

Light traps:

Set up light traps 1 trap/acre 15 cm above the crop canopy for monitoring and mass trapping insects. Light traps with exit option for natural enemies of smaller size should be installed and operate around the dusk time (6 pm to 10 pm).

Major/ common insect pests

Moringa hairy caterpillar, *Eupterote mollifera* Walker (Lepidoptera: Eupterotidae), Moringa budworm, *Noorda moringae* Walker (Lepidoptera: Pyraustidae), Leaf caterpillar, *Noorda blitealis* Walker (Lepidoptera: Pyraustidae), Pod fly, *Gitona distigma* Meigen (Diptera: Drosophilidae), Bark eating caterpillar, *Indarbela tetraonis* Moore (Lepidoptera: Cossidae) are the major common insects visible in moringa.

h) Additional income from Moringa through optimum fruit setting & honey production



DR. STEPHEN DEVANESAN,
FORMER DEAN, AGRICULTURAL UNIVERSITY, KERALA

Value addition of Moringa tender fruits, leaves and honey fetch high price in today's market. Exploiting culinary and medicinal aspects will increase the profitability. Producing organic natural and pure honey with organic certification will help the producers to stay in the market. Establishing long term cold storage facilities and to exporting to foreign countries the honey along with fruits and leaves ensuring better returns/profit to the moringa farmers. Finally establishing a board for moringa growers will help them to go to the next level.

Moringa honey constitutes
Moisture 19 %
Sugar 82 g/100 g
Calories 304
Sodium 4mg/100 g
Potassium 52 mg
Dietary fibre 0.2 g

Honey bee is rich in antioxidants, anti-bacterial&anti-inflammatory, boost your energy, and helps to retain body calcium, contain cancer-fighting flavonoids. It is an excellent cough medicine also helps improves Your Scalp to have a beautiful Glowing Skin

Honey bee colonies in Moringa garden:

Migrate honey bee colonies (*Apis cerana indica*) to moringa plantations at 5 per cent flowering after sunset (30 bee colonies /ha) resulting increased fruit set. The size and weight of individual fruit increased remarkably. (As per the observation of growers they got 30-35 fruits in the place

of one fruit from a single branch under the same drip irrigation and fertigation. The pest incidence was negligible).

Moringa growers were reluctant to permit to keep honey bee colonies in their orchards but they were surprised to see the enormous number of fruit set and weight of in their plantation. Now more growers welcomed to place the colonies in their garden. Later they were happy to keep the honey bees and each fruit, after bee visitation.

Considering the market price, an average of Rs.600 per Kg, an additional income of Rs.10,800/ hive/ year is possible. Thus for 30 hives the total income from the sale of honey alone will be Rs.3,24,000/ ha. If the honey is sold with organic certification there will be a hike in the price. The average productivity is 21 tonnes of tender fruits per ha in Tamil Nadu. The yield can be enhanced in multiples (30 times) as per the experience of the growers, in Korkai Manaloor, Eral, Tuticorin, and Tamilnadu.



i) Management of Bees Colonies in Moringa and honey products

MR. JEAN MARC SCOHY, FRANCE

As an exporter Mr. Jean shared his experience in adding more value to the moringa based products and earning extra revenue through honey bee keeping at Moringa garden. Selection of local / regional honey bees and setting up the colonies inside the Moringa plantation is a wise choice to increase the revenue. Apis Cerana is the Asian variety which always good for Moringa farms. Also he added that bees are the major contributors for the pollinations process which is very much essential for the Moringa tree.

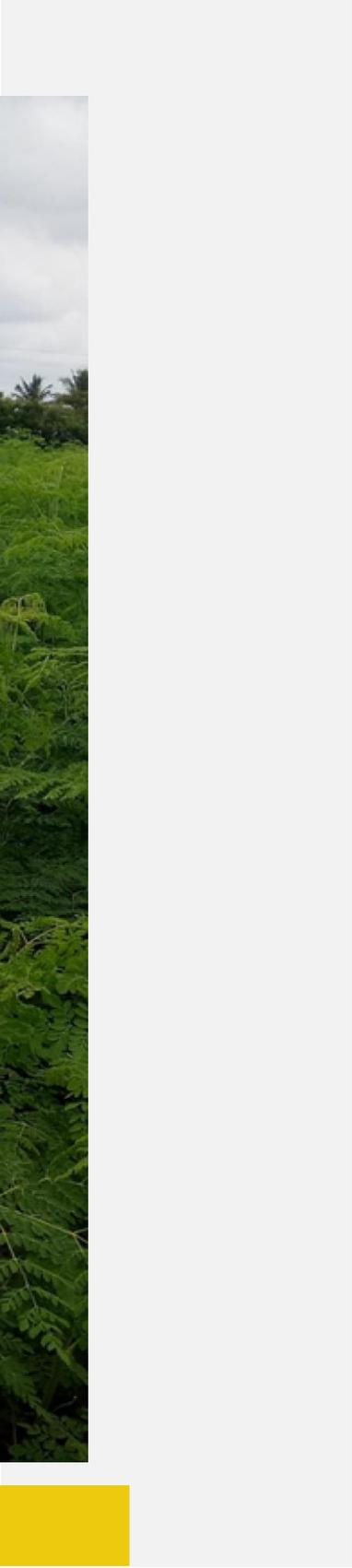
Just to land up in international market, the producers have to ensure the Controlled origin, Organic label, Guaranteed unheated, and laboratory certification.



Apis Cerana is the Asian variety Bee which is always good for Moringa farms.



DAY - 2
SESSION 3



a) Post harvest of Moringa (Part 1)

**DR S. ANANDAKUMAR, PHD, SCIENTIST,
INDIAN INSTITUTE OF FOOD PROCESSING TECHNOLOGY
MINISTRY OF FOOD PROCESSING INDUSTRIES
GOVERNMENT OF INDIA. (THANJAVUR - GUWAHATI –
BATHINDA)**



Importance of Processing startups:

1. Awareness around the nutritional value and market potential of Moringa products needs to be raised so farmers and households begin to maximise the returns of Moringa trees.
2. A detailed cost and benefit analysis around a Moringa production company should be conducted.
3. Upcoming suppliers need to get acquainted with the regulations and standards required when targeting the export market.

Effect of temperature on the quality of Moringa leaves

Drying temperature	Drying time (Hr)	Vit A (mg/100g)	Protein (%)	vit C
105°C	4	0.5448	9.83	22.02
60°C	8	0.7945	32.24	36.08
Room temperature (30°C)	96	0.7399	30.75	38.02
sun dried	varies	0.6365	15.48	32.06

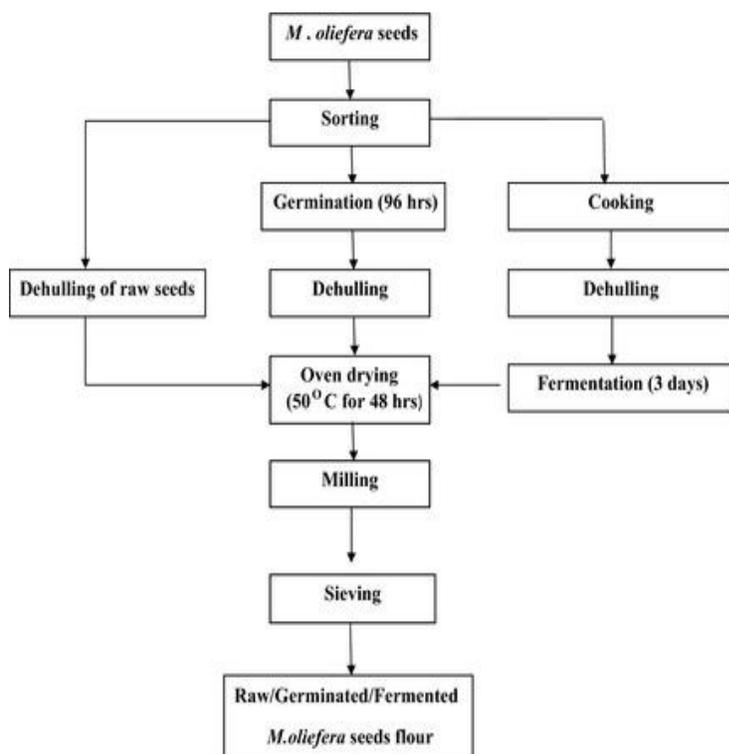
- Seven different drying treatments were used to dry Moringa leaves including shade, sunlight, oven 40C, oven 50 C, oven 60oC.
- microwave at 660 W (oC) and freeze drying.

- The leaves were spread uniformly in a thin layer with loading density of 100 g/m² (50 g fresh leaves) for all drying treatments.

Moringa seed Oil Extractions:

	Yield (%)	Quality	Solvent residue	Time (hr)
Screw press extraction	25	Middle	Not	1
Solvent extraction	38	Inferior	Yes	10
Supercritical fluid extraction	35	Superior	Not	3

Processing of Moringa seeds flour





M F P I
MINISTRY OF FOOD PROCESSING INDUSTRIES
GOVERNMENT OF INDIA

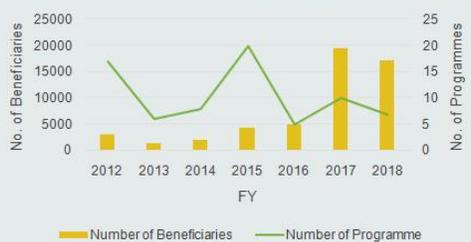
Mobile Processing Unit and Mobile Food Testing Laboratory



IIFPT

Mobile Processing Unit

Beneficiaries through demonstrations and awareness programmes



FY	Number of Beneficiaries	Number of Programme
2012	~3000	~18
2013	~1000	~8
2014	~2000	~10
2015	~4000	~20
2016	~5000	~10
2017	~19000	~10
2018	~17000	~8

Mobile Food Testing Laboratory

- About 70 adulteration tests covering 30 different product types can be tested
- 42 chemical parameters
- Last year conducted 27 programs and 14857 people got benefitted.










Plate 4 (a). Garlic extract pre-treated minimally processed drumstick pods packed in different packaging materials (at initial period of storage)



Plate 4 (b). Garlic extract pre-treated minimally processed drumstick pods packed in different packaging materials (at the end of storage)

T ₁ - High density poly ethylene	T ₄ - Poly propylene 100 gauze
T ₂ - Low density poly ethylene	T ₅ - Poly propylene 200 gauze
T ₃ - Poly propylene	T ₆ - Poly propylene 300 gauze

All packages with 0.5 per cent vents



Minimal processing of Moringa pods

a) Post harvest of Moringa (Part 2)

DR.P.KAMALASANAN PILLAI,
PRINCIPAL SCIENTIST, CENTRE OF EXCELLENCE FOR MORINGA
STELLA MARIS INSTITUTE OF DEVELOPMENT STUDIES (SMIDS), KANYAKUMARI.

HIGH QUALITY ORGANIC MORINGA LEAF, FRUIT & MORINGA HONEY PRODUCTION FOR LOCAL AND EXPORT MARKET

Appreciate the soil for Moringa Cultivation

- Test the soil and correct the EC & PH.
- Standardize the soil with suitable nutrient base, mineral base and organic matter.
- Regulate the soil organic content and inoculate microbial bio fertilizers to facilitate optimum mineralization in the soil.
- Correct the soil factors and environmental factors to suit organic Moringa cultivation.

Management for good quality Moringa leaf and fruits

- The quality of Moringa leaf root etc., will depend on quality of the soil, organic inputs and climate.
- So proper soil management, nutritional management and proper agronomic practices are the pre-requisites for quality products from Moringa so that the plants will not starve for nutrients.
- Moringa have to be grown only with organic inputs, use of chemical inputs is never allowed.
- Organic certification from reputed and accredited certifying agency is mandatory for export to most of the countries.

Special Management to get high quality leaf

- Optimize soil nutrient status of Macro and Micro nutrients with raw minerals like Zinc, Iron, and non-minerals like Nitrogen, Sulphur, and Phosphorous.
- Presence of Zinc, Potash, Iron and Selenium will enhance quality and quantity of Moringa leaf.
- Presence of phosphorous and sulphur will enhance the quality and quantity of Moringa oil.
- Presence of Calcium and Phosphorous will enhance the quality of drum stick.
- The presence of Phosphorous in the soil will enhance the quality of Moringa flower and Moringa Honey.
- Ensure microbial mineralization in the soil to ensure proper nutrient flow followed by physiological manipulation.
- Recently some buyers especially the pharmaceutical companies started testing the nutritional profile of Moringa leaf to ensure good nutritional profile in the end product.

Introduction of bee colonies in Moringa plantation

- Bees in Moringa plot not only provides Moringa honey but also ensure better fruit setting.
- The seeds from well pollinated farms will have higher percentage of germination.
- Percentage of oil from well pollinated farm are normally higher than the normal farm

Centre for excellence in Moringa

- An autonomous Institute for the promotion and Research on Moringa and Moringa related products.
- Organic farming and certification with R & D and Extension on Bio inputs and its application.
- R & D in post-harvest technology and value addition, product diversification and packing including industrial application.
- Domestic and international marketing, market promotion, market development and market diversification.

- Biodiversity conservation of Moringa, establishment of Biodiversity Park, breeding and seeds production center.
- Bio Chemistry and Pharmacology of Moringa, Clinical trials, scientific validation of tribal and traditional wisdom including Indian system of medicines.
- An advanced Research center having affiliations with United Nations Inter National University also having Research collaboration with National and International Research institutions.
- Conduct international conference every year. We will also organize Post conference workshops at State / District level as a logical continuation of the International conference.

Organic products from Moringa

- Bio Chemistry and Pharmacology of Moringa, Clinical trials, scientific validation of tribal and traditional wisdom including Indian system of medicines.
- An advanced Research Centre having affiliations with United Nations Inter National University also having Research collaboration with National and International Research institutions.
- Conduct international conference every year. We will also organize Post conference workshops at State / District level as a logical continuation of the International conference.



Organic Moringa Oil

Use of Moringa gum replacing gelatin extracted from bone

b) Mechanical processing of Moringa leaves

DAWN C.P. AMBROSE AND RAVINDRA NAIK

**CENTRAL INSTITUTE OF AGRICULTURAL ENGINEERING-REGIONAL CENTRE,
COIMBATORE**

Mechanical processing of *Moringa oleifera* leaves for commercial production in dried form

Moringa leaves is being exported from India in its dried form as Moringa leaf powder, capsules, tablet, Moringa tea leaf etc. The present method of processing the leaves is by manual means which incurs more labour, time and also results in poor quality product. An attempt has been made to mechanically process the Moringa leaves for better quality and hygiene. Fresh moringa leaves of PKM-I variety was stripped in a mechanical stripper developed at CIAE-RC, Coimbatore. The developed stripper comprises of main frame assembly, stripping assembly, drive assembly and vibrating sieve. The stripping assembly consists of four wooden rollers provided with nylon brushes. A vibratory sieve SS screen is provided below the stripping assembly. The machine is powered by 2 HP single phase motor. The capacity of the machine is 300 kg/h. The stripping efficiency was found to be 98%. The percentage damage to the leaves was found to be negligible. Savings in cost compared to manual stripping was found to be 93 %. About 50 kg of the stripped leaves were then washed and dried in a mechanical dryer (CIAE model) at 45°C and also in solar polyhouse dryer. The temperature and RH were recorded periodically in the solar polyhouse dryer. It took 6 hours for drying from an initial moisture content of 75% (w.b) to 5% (w.b) whereas the time taken for drying in CIAE-IEP dryer was 3 hours. The quality characteristics of the dried leaves in both the methods revealed that the Beta carotene was 954.82 µg/100g for solar dried and 1479.84 µg/100g for CIAE model dryer. The iron content was on nearly on par for both methods of drying i.e., 19.1 and 19.06 mg/100 g in CIAE and solar polyhouse driers. The colour values in terms of L, a, b were 39.3, -6.45, 19.71 and 37.26, -6.32, 18.84 for CIAE dryer and solar polyhouse dryer respectively.

1.0 Introduction

Moringa has long been considered a panacea for improving the nutrition of poor communities in the tropics and subtropics. Leaves can be eaten fresh, cooked, or stored as dried powder for many months without refrigeration, and reportedly without loss of **nutritional value**. Protein content of leaves is high (20-35% on a dry weight basis). Most important is that the protein is of high quality having significant quantities of all the essential **amino acids**. This **amino acid** balance is very unusual in plant foods. Moringa leaves also contain high quantities of nutrients (per 100 g fresh weight): **vitamin A** (7564 IU), **vitamin C** (51.7 mg), calcium (185 mg) and potassium (337 mg) ([Foidl and Paull, 2008](#)). The leaves of the *Moringa oleifera* tree are very nutritious. They can be consumed fresh, cooked or dried. Since dried Moringa leaves retain their nutrient content, it is possible to convert them into leaf powder. When there is an abundance of leaves, this leaf powder can be made and stored easily. Moringa Leaf Powder is an excellent nutritional supplement and can be added to any dish. It has a great export potential in Tamil Nadu. Moringa leaf processing is carried out in Tamil Nadu by small scale processors. The leaf is exported in its dried form as Moringa leaf powder, capsules, tablet, Moringa tea leaf etc. Processing of Moringa leaf into powder involves stripping of the leaves, washing, drying, powdering and packaging. The present method of processing the leaves is by manual means which incurs more labour, time and also results in poor quality product. Moringa leaf being compound in nature, the operation of stripping the leaflets is a major constraint faced by the processors. The leaves are sun dried without proper washing resulting in poor quality product. Due to improper storage of the dried leaves, the leaves are more prone to insect attack. Considering the above bottle necks in the processing of Moringa leaves, the present study was taken up to develop suitable equipment for mechanically processing Moringa leaves resulting in a hygienic and a better quality product.

2.0 Materials & Methods

2.1 Raw material

Freshly harvested branches of PKM-1 variety, which is exclusively grown for its foliage was used for the study.

2.2 Process

The following flow chart depicts the unit operations involved under the mechanical processing of moringa leaves.

Fresh Moringa branches



Stripping



Washing with chlorinated water



Surface water removal



Drying



Milling

2.3 Stripping of Moringa leaves using mechanical stripper

Moringa leaves were mechanically stripped with a Moringa Leaves Stripper developed by CIAE-RC Coimbatore. The Moringa leaf stripper consists of the stripper assembly, chassis, drive mechanism and vibrating sieve.

The stripper assembly is of four wooden rollers fitted with nylon brushes and mounted on flange mount bearing at the end on the frame. The unit is powered by two HP single phase electric motor attached to the chassis of the stripper. A variable speed control was used on the motor to vary the operating speed of the stripper.

2.4 Washing of Moringa leaves

The fresh and mechanically stripped Moringa leaves were washed in running water till the removal of dirt. This step plays a substantial role in removal of dust, pathogens as well as microbes present on the leaf surface.

2.5 Methods of bulk drying Moringa leaves (stripped)

Solar Polyhouse Dryer

A parabolic shape solar polyhouse dryer of 60'x12'x 3'dryer was used for drying Moringa leaves. The collector material is UV stabilized polyethylene sheet, which filters the infrared radiation from the sun to certain extent. The bottom surface of the dryer is laid with black kadappa stone to increase the absorptivity. As a result higher temperature is reached within a short span of time. Air inlet points have been provided at the bottom of the structure for entry of air. These ventilators help in more air circulation from all directions. The moisture laden air escape through the chimneys provided at different points by means of natural draft. An exhaust fan has been provided to adjust the temperature inside the dryer.

Forced flow dryer (CIAE-RC model)

The overall dimension of the dryer was 900x900x16500 mm. The dryer consists of a drying chamber, plenum chamber, heating chamber and a blower driven by 2HP motor. Loading and unloading of the material is done through the door provided at the drying chamber. An inspection door is provided at the front of the dryer. The ambient air entering through the blower gets heated up in the heating chamber having 6 kW electric heaters and enters into the plenum chamber. From the plenum chamber the hot enters into the drying chamber where the product is kept for drying. The hot air after absorbing moisture from the product is discharged into the atmosphere through the exhaust provided above the drying chamber. The temperature

inside the drying chamber was maintained at 45°C using a temperature controller. The air velocity was found to be 8.5 m/s.

2.6 Estimation of Quality Parameters during Drying

Moisture content

The moisture content of fresh Moringa leaves was estimated by drying in a hot air oven at 70° C till constant weight was achieved.

$$\text{Moisture content, \% (wb)} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

Biochemical constituents of dried Moringa leaves

The various chemical compositions like ascorbic acid, beta carotene, chlorophyll, iron and vitamin A was estimated based on the standard procedure.

Ascorbic acid

Ascorbic acid in the sample was estimated as per the method described by Srivastava (1998). About 10 g of sample was blended with 3% metaphosphoric acid, made up to 100 ml and filtered. 10 ml of sample was pipetted into a conical flask and titrated with a standard dye to a pink end- point. Quantity of Ascorbic acid (mg) present in 100 g was calculated as follows.

$$\text{Ascorbic acid (mg/100 g)} = \frac{\text{Titre value} \times \text{Dye Factor} \times \text{Volume made up} \times 100}{\text{Volume of filtrate taken} \times \text{Weight or volume of sample taken}}$$

Beta carotene

Beta carotene in the leaves sample was estimated according to the procedure by Srivastava (1998). About 5 g of sample was crushed in 10-15ml acetone with an addition of few crystals of anhydrous sodium sulphate in a pestle and mortar.

The supernatant was discarded into a beaker and the process was repeated twice to transfer the combined supernatant to a separatory funnel. 10-15ml of petroleum ether was added and mixed

thoroughly. On standing two layers separated. The lower layer was discarded and the upper layer was collected in a volumetric flask. The volume was made up to 100 ml with petroleum ether. The optical density was recorded at 452 nm using petroleum ether as blank. Quantity of Beta carotene (μg) present in 100 g of sample was determined as follows.

$$\text{Beta carotene } (\mu\text{g}/100\text{g}) = \frac{\text{O.D} \times 13.9 \times 10^4 \times 100}{\text{Weight of sample} \times 560 \times 1000}$$

Mis en forme : Espagnol (International)

Vitamin A

The procedure for the estimation of vitamin is as Beta carotene. Quantity of vitamin A in a sample can be estimated as follows. Srivastava, (1998).

$$\text{Vitamin A (IU)} = \frac{\text{beta carotene } (\mu\text{g}/100\text{g})}{0.6}$$

Chlorophyll

The chlorophyll content in Moringa leaves were estimated according to the procedure described by Srivastava (1998)

About 1 g of sample was cut into small pieces and homogenized in a blender. The homogenate was made up to 10 ml with water and centrifuged. 0.5 ml of aliquot was taken and 4.5 ml of 80% acetone was added to extract the pigment. The supernatant was recorded for optical density (O.D) at 480, 645 and 663 nm, using acetone as blank. Amount of chlorophyll in the sample was estimated as follows.

$$\text{Total chlorophyll (g/litre)} = (0.0202) (\text{O.D. at } 645) + (0.00802) (\text{O.D. at } 663).$$

Iron

Iron present in the sample was estimated according to the procedure described by (FSSAI, 2012). A known weight of sample was kept for ashing in muffle furnace at 450°C for 3 hours. It was cooled and 50 ml of dilute HCl was added, kept in a water bath for 30 minutes. Another 10 ml of HCl and water was added and filtered to a 100 ml volumetric flask and volume was made up with

HCl. To the ash solution, 1% ammonium citrate, 1% hydroquinone solution, 1% o-phenanthroline was added and diluted with distilled water. The solution was incubated for 1 hour and absorbance was measured at 510 nm. The quantity of iron (mg) present in 100 g of the sample was calculated as follows.

$$\text{Iron mg/100g} = \frac{\text{O.D. of sample} \times 0.1 \times \text{total volume of ash solution} \times 100}{\text{O.D. of standard} \times 5 \times \text{weight of sample taken for ashing}}$$

Colour

Colour value, L, and b of freshly processed and dry processed Moringa leaves was found using Colour Flex meter (Make: Hunter Lab, Model: 45^o/0^o). It works on the principal of collecting the light and measures energy from the sample reflected across the entire visible spectrum. The meter uses mathematical models called Hunter model which rely on “standard observer curves” that define the amount of red, green and blue (primary light) required to match a series of colours across the visible spectrum. It provides reading in terms of ‘L’, ‘a’, and ‘b’ where ‘L’ coordinate measures the luminance of colour and ranges from black at 0 and white at 100. Thus ‘L’ value measures lightness of colour and the chromatic portion of the solids is defined by: ‘a’ (red), ‘-a’ (green), ‘b’ (yellow), and ‘-b’ (blue). The parameters ‘L’, ‘a’ and ‘b’ generally give the total colour of the product. The instrument was calibrated each time by reading defined colours like white and black. After calibrating, the colour value for the Moringa leaves was measured. All experiments were conducted in triplicates.

Rehydration Ratio

Rehydration means refreshing the dehydrated or dried products in water. Two grams of dried sample was taken for rehydration under each time interval. 60 ml of water was taken in a beaker and kept for boiling at 5, 10, 15, 20 minutes interval. The dried samples were subjected to rehydration in the above time interval. The weight at each time after reconstitution was noted. At the end of each time interval, liquid portion was drained off and solid content were blotted with filter paper and weighed with an electronic

balance. The rehydration ratio and coefficient of reconstitution were determined based on the following formulae:

$$\text{Rehydration ratio} = \frac{\text{Weight of rehydrated material}}{\text{Weight of dehydrated material}}$$

$$\text{Coefficient of reconstitution} = \frac{\text{Rehydration ratio}}{\text{Dehydration ratio}}$$

$$\text{Dehydration ratio} = \frac{\text{Weight of prepared material before drying}}{\text{Weight of dried sample}}$$

3.0 Results & Discussion

3.1 Performance evaluation of prototype Moringa leaf stripper

In house trial and field trials were conducted on the Moringa leaf stripper developed at CIAE-RC, Coimbatore. The stripper could be operated by three people. The capacity of the machine was 300 kg/h. The stripping efficiency was found to be 98%. The percentage damage to the leaves was found to be negligible or nil.

3.2 Performance of dryers

About 50 kg of freshly harvested Moringa was stripped and washed. The washed leaves were then dried in the polyhouse dryer. The temperature and RH were recorded periodically (Table 1). It took 6 hours for drying from an initial moisture content of 75% (w.b) to 5% (w.b).

Table 1: Temperature and RH in Polyhouse drying

Time, hours	Temperature, °C		RH, %	
	Outside	Inside	Outside	Inside
0	40.5	44.9	38	54
1	40.3	43.9	37	44
2	41.1	45.5	41	36

3	36.3	41.2	46	45
4	38.9	44.0	42	44
5	40.5	40.0	43.3	39
6	38.9	43.0	40.5	42

Similarly 50 kg of stripped and washed Moringa leaves were loaded into the forced flow type dryer (CIAE-IEP model). The temperature inside the dryer was maintained at 45°C. Drying time was found to be 3 hours to dry from 75% (w.b) to 5% (w.b) moisture content.

3.3 Effect of drying on the colour and nutrient content of Moringa leaves

Table 2: Effect of drying methods on the colour scores of Moringa leaves

S.No.	Drying method	Colour values		
		L	a	b
1.	Solar polyhouse dryer	37.26	-6.32	18.84
2.	Sun drying	31.54	-2.32	11.54
3.	Forced flow dryer	39.30	-6.45	19.71
4.	Fresh leaves	40.82	-9.53	22.21

There was a change in colour of the leaves compared to the fresh leaves during drying. Leaves dried in forced flow dryer resulted in high value of 'a' which indicates greenness. However there was no much significant difference between solar polyhouse and forced flow dryers in terms of 'a' value.

The changes in the nutrient composition of Moringa leaves by different drying methods is presented in table 3

Table 3: Effect of drying on nutrient yield of Moringa leaves

Type of sample	Ascorbic acid (mg/100g)	Beta Carotene (µg/100g)	Vitamin A (IU)	Chlorophyll (mg/100g)	Iron mg/100g)
Fresh leaves	266.15	1652.95	2754.91	97.28	22.0
Sun dried	138.28	922.68	1537.8	57.21	18.33
Solar polyhouse dried	151.34	954.82	1591.3	73.21	19.06
Forced flow dried at 45°C	189.19	1479.84	2466.4	78.47	19.1
CD (0.05)%	1.1653	19.357	24.815	1.0107	0.2344

The initial ascorbic acid content of fresh leaves was found to be 266.15 mg/100g. During the entire drying process there was loss in ascorbic acid content. In traditional method of drying i.e., sun drying, more loss of ascorbic acid was found (138.28 mg/100g). Solar polyhouse drying resulted in a lesser loss of 151.34 mg/100g of vitamin C or ascorbic acid. The exposure of Moringa leaves to direct sunlight may also be the reason to the loss of ascorbic acid. This is associated with the high sensitivity of ascorbic acid to oxygen, light and temperature. In the case of forced flow dryer at 45°C drying recorded a value of 189.19 mg/100g compared to other methods. The maximum retention of vitamin C in cabinet drying may be due to controlled drying conditions and least exposure of vegetables to temperature and air (Goyal and Mathew., 1990). Beta carotene values for the fresh leaves are in the range of 1652 µg/100g. There was a decrease in the value during drying. In the non-mechanical method of drying, solar polyhouse dried method had the highest retention of Beta carotene of 1591 µg/100g. In mechanical drying, the

highest was recorded for forced flow drying at 45°C with the value of 1479 µg/100g. Statistical analysis showed significant difference among the treatments. The chlorophyll content of fresh Moringa leaves is 97.28 mg/100g which reduced significantly during drying. Sun drying had the least retention of chlorophyll of 57.21 mg/100g. This is due to the exposure of Moringa leaves to direct sunlight. Low pH of the vegetable is a factor responsible for conversion of chlorophyll to pheophytin by removal of magnesium from the porphyrin ring structure, as soon as the vegetable comes in contact with raised temperature (Shri Lakshmi, 2006). Iron content of fresh leaves was 22 mg/100g. Solar drying recorded the highest value of iron content with 19.01 mg/100g and in the case of mechanical drying, iron content was more or less the same. Iron content is not much destroyed while drying. This is in agreement with the results observed by Lakshmi and Vimala, (2000) and Raman *et al.*,(1988) for leafy vegetables.

3.4 Rehydration characteristics

The rehydration characteristic of dried Moringa leaves is presented in table 4.

Table 4: Rehydration ratio of dried Moringa leaves

Sample	Rehydration ratio		Maximum rehydration ratio	Dehydration ratio	Coefficient of reconstitution
	Time (min)	Weight of sample			
Sun dried	5	2.275			
	10	2.29			
	15	2.39	2.39	3.625	0.659
	20	2.39			
Solar polyhouse dried	5	2.90			
	10	2.92			
	15	2.95	2.95	3.389	0.863

	20	2.95			
Forced flow dryer 45 ^o C	5	2.32			
	10	2.34			
	15	2.35	2.35	3.2	0.734
	20	2.35			

Rehydration ratio of the samples differed significantly among the methods of drying. The rehydration ratio, dehydration ratio and coefficient of reconstitution ranged from 2.2-2.95, 3.2-3.6 and 0.6-0.86 irrespective of the drying method. In the traditional method of drying, the rehydration ratio was found to be 2.39. In mechanical method of drying, it was 2.35. The highest dehydration ratio and coefficient of reconstitution was observed for solar polyhouse drying with values of 3.38 and 0.863 respectively. The slight difference in moisture uptake can be attributed to variation in the drying conditions, initial moisture content, moisture removal and interactions between the components during dehydration.

4.0 Conclusion

Traditionally Moringa leaves are dried along with the stalks and branches in open yard. This results in inferior quality products. Mechanical processing of the leaves involving a leaf stripping equipment and drying either in electrical or closed (solar polyhouse) dryer results in better quality, hygienic and easier handling of the end product.

c) Drying methods and packing material for Moringa Powder

DR.CISSIE THEEBLYN DAVID,

**ASSISTANT PROFESSOR (FOOD SCIENCE AND NUTRITION),
ICAR-KVK, THIRUPATHISARAM**

Drying methods and packing material for Moringa Powder

- Standardization - suitable drying method and packing material
- Biochemical and shelf-life study
- Sorting, washing and drying are the major process followed before production of moringa powder

Drying methods: Shade, Vacuum, Fluidized bed

Methods:

Moisture: **Berwal et. al., (2004)**

Crude fiber and fat: **Sadasivam and Manikam (2003)**

Beta carotene and Vitamin C: **Ranganna, S (1997)**

Sensory Evaluation: **Sethi et al., (2001)**

Statistical Evaluation: **SPSS for Windows version 16.0.**

Expected Outcome:

- ✓ **Drying method – Shade, Vacuum and fluidized bed**
- ✓ **Packing material – LDPE, HDPE, PP and MPP**

Minimize PH loss, better nutrient retention, sensory score, shelf life, quality assurance, income generation, diversified product utilization and means of alleviating micronutrient malnutrition

Variety: PKM 1- orchards of Agriculture College and Research Institute, Madurai.

Packaging materials: LDPE, HDPE, PP and MPP bags

(13x10 cm) **Drumstick**

CHEMICALS: Analytical Grade and Laboratory Grade

EQUIPMENT: Muffle furnace, Digital Photo colorimeter, Hot air oven, atomic Absorption Spectrophotometer, Socs Plus and Fibro plus

Effect of drying methods on proximate principles in dehydrated Moringa leaves

Effects of drying methods

Proximate principles	Shade drying (%)	Vacuum drying (%)	Fluidized bed drying (%)
<i>Moisture (g)</i>	9.4.3 ± 0.03	7.3 ± 0.31	8.17.±0.03
<i>Crude Fat (g)</i>	0.32 ± 0.01	0.50 ±0.11	0.23 ± 0.04
<i>Crude Fiber (g)</i>	0.86 ± 0.03	1.02 ± 0.12	4.25 ± 0.08
<i>Ash (g)</i>	1.14 ± 0.02	1.72 ± 0.01	1.99 ±0.02
<i>Beta-carotene (Mcg)</i>	61.0 ± 0.01	79.5 ±0.02	71 .0 ±0.03
<i>Vitamin-C (mg/100g)</i>	13.0 ± 0.02	18.3 ± 0.02	14.4 ±0.01

SED	0.0772**	0.0091**	0.0084**	0.0749**	0.0091**	0.0165**
CD(0.05)	0.1746**	0.0207**	0.0190**	0.1694**	0.0207**	0.0372**
CD(0.01)	0.2508**	0.0297**	0.0274**	0.2433**	0.0297**	0.0535**

Effect of drying methods on mineral content of drum sticks leaves

Minerals		Shade drying (%)		Vacuum drying (%)		Fluidized bed drying (%)	
Calcium (mg)		12.89±0.01		17.28±0.00		28.14±0.02	
Iron (mg)		0.710±0.00		0.83±0.01		1.30±0.00	
SED	0.1042**	0.0994**	0.0320**	0.0451**	0.0378**	0.0185**	
CD(0.05)	0.2358**	0.2248**	0.0723**	0.1021**	0.0856**	0.0419**	
CD(0.01)	0.3387**	0.3230**	0.1038**	0.1467**	0.1229**	0.0602**	

d) Biological activities of glucosinolates derived from Moringa

Y. ERKINGS MICHAEL, ST. PAUL'S IAS ACADEMY

PREDICTION OF NOVEL BIOLOGICAL ACTIVITIES FOR GLUCOSINOLATES DERIVED FROM MORINGA OLEIFERA LAM

The glucosinolates are very common in cruciferous vegetables, which are associated with other phytochemicals have been performed the potential health benefits. Moringa oleifera leaf contains rich in glucosinolates. Most abundant glucosinolates are present in Moringa are glucomoringin and a novel glucosinolates named as glucosoonjnain. Glucosoonjnain was isolated from the Moringa leaves and its structure was characterized by Jed et al. (**may 2018**) But its Biological and in vitro activities was not characterized. Due to the directed way of testing chemical compounds in drug research and development, many projects fails because serious adverse effect and toxicity are discovered too late and many existing prospective activities are remains unstudied. Sometimes, new action of old compounds is found during clinical trials or practical use of medicine. Keeping these aspects in failure of drug research and development project is necessary. In the present study have investigated the possibilities of utilizing computer aided prediction to estimate the general biological potential of Glucosoonjnain and Glucomoringin and find out the suspected biological activity and relative potency.

Material and Methods used for the study:

- Glucomoringin.-4-(-L-Rhamanopyranosyloxy)benzyl GS (4RBGS),
- Glucosoonjnain.-4-(-L-glucopyranosyloxy)benzyl GS (4GBGS),

Here, computer based program called PASS used to predict the biological activities. PASS training set consists of about 46,000 of biologically active compounds. They include about 16,000 already launched drugs and 30,000 drug-candidates under clinical or advanced preclinical testing now. On the basis of structural formula of compounds PASS Predict the biological activities.

Result:

The glucomoringin were showed 282 biological activities, which include 44 activities shown Pa values greater than 0.5. Among them, 14 biological activities shows Pa values greater than 0.7

Pa Value	Pi Value	Biological Activities	Pa Value	Pi Value	Biological Activities
0.987	0.001	Chemopreventive	0.826	0.006	Apoptosis agonist
0.962	0.001	Anticarcinogenic	0.802	0.012	Anaphylatoxin receptor antagonist
0.950	0.003	Benzoate-CoA ligase inhibitor	0.786	0.004	Lactase inhibitor
0.903	0.009	CDP-glycerol glycerophosphotransferase inhibitor	0.780	0.004	Cyclomaltodextrinase inhibitor
0.887	0.002	Beta-mannosidase inhibitor	0.777	0.009	Exoribonuclease II inhibitor
0.880	0.006	Sugar-phosphatase inhibitor	0.776	0.021	CYP2H substrate
0.878	0.005	Antineoplastic	0.717	0.002	Mannosyl-glycoprotein endo-beta-N-acetylglucosaminidase inhibitor

Mis en forme : Espagnol (International)

Mis en forme : Police :+Corps, Espagnol (International)

Mis en forme : Espagnol (International)

Discussion:

The Pa and Pi values vary from 0.000 to 1.000. If $Pa > 0.7$, the compound is very likely to reveal its activity in experiments, but in this case, the chance of being the analogue of the known pharmaceutical agents for this compound is also high. If $0.5 < Pa < 0.7$, the compound is likely to reveal this activity in experiments, but this probability is less and the compound is not so

similar to the known pharmaceutical agents. Both glucomoringin and glucosoonjnain have potential chemoprotective activities (Pa Value 0.903 and 0.965 respectively) which may contribute for a green anti- cancer approach.

How:

Chemotherapy is the use of any drug to treat any disease. Surgery and radiation therapy remove, kill, or damage cancer cells in a certain area, but chemo can work throughout the whole body that means chemo kill cancer cells along with normal cells. Cytotoxic drugs (chemo therapeutic drug) affect all dividing cells, including those of healthy tissue. But because cancer cells often divide markedly faster than normal cells, they are particularly sensitive to cytostatics. Chemotherapy is commonly given at regular intervals called cycles. A cycle may be a dose of one or more drugs followed by several days or weeks without treatment. This gives normal cells time to recover from drug side effects. The healthy cell's recover will be faster by the intake of Moringa leaves (Dry or Fresh) because its increase white blood cell (WBC) count and haemoglobin level and bone marrow cellularity due to its chemoprotective activities.

For above reason

Moringa leaves used to have anti- cancer approach. The cancer may even seem to have gone away for a while, but it's expected to come back. Overall survival rates don't specify whether cancer survivors are still undergoing treatment or if they've become cancer-free. If cure is not possible, Moringa can help the person with cancer feel better and live longer. Both glucosinolates have anti-carcinogenic and anti-neoplastic properties which are able to treat cancer cells. **But due to its chemo protective activity (prevent to cell death) and Angiogenesis stimulant nature (Formation of new blood vessels). Moringa may not used to treat the cancer cell.**Note: Cancer cell formation not only due to ageing

Age-related diseases are illnesses and conditions that occur more frequently in people as they get older which includes Arthritis, Heart Disease, Cancer, Alzheimer's Disease are postponed by Moringa because of its chemo protective activity (prevent to cell death) and its Angiogenesis stimulant nature(Pa Value.319)

Angiogenesis is the formation of new blood vessels. The process of angiogenesis is controlled by chemical signals in the body. Intake of Moringa leaves help to formation of new blood vessels.

Due to its Angiogenesis stimulant nature (Formation of new blood vessels) and Vasoprotective (Pa Value 0.523) used in the treatment of hemorrhoids and varicose veins. Note: For varicose Vein treatment, there is no successful drug available. Only surgery is remedy in now adays. If $0.5 < Pa > 0.7$, the compound is likely to reveal this activity in experiments. The study revealed that glucomoringin and glucosoonjnain have potential lactase inhibitor (Pa Value 0.786 and 0.698 respectively) which may cause indigestion of whole milk along with the consumption of Moringa leaf in both adults and children. Moringa used to increase breast milk production. Traditional knowledge suggests it might do this, But The present study revealed that best to avoid moringa if on breast-feeding because child cant digest whole milk due to lack of lactase . Glucosoonjnain compared to glucomoringin. Glucosoonjnain have potential for sweetener. (Pa Value 0.163 and pi Value 0.086) Taste difference of wild and domestic moringa may be sweetener nature of glucosoonjnain. Although this study was not powered to address whether responsible for differences in taste and Future research should compare the sweetener effects of both glucomoringin and glucosoonjn.

However it is necessary to keep in mind that PASS cannot predict whether compound become a drug, it only provided the food for thought for the medicinal chemists. The accuracy of prediction is about 90%. Anyway, serious negative effect and toxicity are discovered initial stage at proper interpretation.

e) Scientific processing of Moringa and its value addition

A COMPARATIVE STUDY ON THE ANTI - INFLAMMATORY EFFECT OF DECOCTION (KASHAYA) OF SIGRU (MORINGA OLEIFERA LAM.; FAMILY MORINGACEAE) LEAVES WITH ITS ALCOHOLIC EXTRACT

Herbs are nowadays used both in the form of extracts and in crude form. (eg: traditional dosage forms like kashaya).The conventional formulations of Ayurveda like kashayas, churnas, lehyas, etc are said to be non- palatable and having less patient compliance.So the pharmaceutical industry is trying to mould the Ayurvedic formulations into more patient friendly forms.The pure herb extract available in the market is one such modification. It is the necessity of time to scientifically validate the efficacy of herbal extracts and crude herbs, as the herbal extracts available in the market are claiming to have equal efficacy as that of crude herbs.Considering these facts, a study was carried out to assess the anti-inflammatory effect of kashaya and alcoholic extract of Sigru leaves experimentally in albino rats using carrageenan induced rat paw oedema method and to compare the results.

Preparation of medicine:

A. Preparation of Decoction of Sigru leaves 20 gm of shade dried and coarsely powdered leaves were taken with four times (80ml) water in a RB flask. It was boiled over low flame and was reduced to 1/4th (20ml). The reduced kashaya was then pressed and filtered through a cloth.

B. Preparation of Alcoholic Extract

Extraction was done by soxhlet extraction method using 99% dehydrated alcohol as the solvent.

Experimental study on acute inflammation

- Was performed using carrageenan induced rat paw oedema method.
- 40 animals were selected and grouped into 8, each group contains 5 animals.

- Group I (GI/NC) - Negative control
- Group II (GII/TK) - Therapeutic dose of sigru leaf kashaya
- Group III (GIII/HK) - Half dose of sigru leaf kashaya
- Group IV (GIV/DK) - Double dose of sigru leaf kashaya
- Group V (GV/TE) - Therapeutic dose of alcoholic extract
- Group VI (GVI/HE) - Half dose of alcoholic extract
- Group VII (GVII/DE) - Double dose of alcoholic extract
- Group VIII (GVIII/SC) - Solvent control

Dose of sigru leaf kashaya

- Therapeutic dose - 0.864 ml/100gm body weight
- Half dose - 0.432 ml/100gm body weight
- Double dose - 1.728 ml/100gm body weight

- Dose of alcoholic extract of sigru leaf
 - Therapeutic dose - 100 mg/100gm body weight
 - Half dose - 50 mg/100gm body weight
 - Double dose - 200mg/100gm body weight
- Route of administration : Oral
- Mode of administration
 - Kashaya was administered as such
 - Extract was administered by using 1 % alcohol solution as the vehicle.

Procedure

- After the acclimatisation period rats were starved overnight with free access to water.
- Next day the rats were restrained by hand and specified doses of medicine (drug) were administered.
- The tibio - tarsal junction of the right hind limb was marked so as to measure the volume up to this mark.
- The paw volume of the right hind limb was measured using a plethysmometer and was noted as initial paw volume.

- After 1 hour of drug administration, 0.1ml of 1% carrageenan suspended in 0.9% sterile saline solution was injected to the plantar tissue of the right hind paw using a tuberculin syringe.
- The paw volumes were measured using plethysmometer at hours 1, 3 and 5 after injection of carrageenan.

Result

- The mean paw volume readings of each group before administering carrageenan, 1 hour, 3 hour and 5 hour after administering carrageenan were used for calculation.
- The mean change in paw volume at different time intervals with respect to the initial paw volume was calculated and was compared with the control group using one way ANOVA method.
- Using two way ANOVA method a pair wise comparison was made between the kashaya, extract and control groups.

Comparison of change in mean paw volume 1 hour after injection

- There was no significant change in mean paw volume among any one of the group.
- On analysing the values of mean change in paw volume the double dose of Sigru leaf kashaya shows more effect.

On pairwise comparison 1 hr after injection

- No significant change was observed for the kashaya group and alcoholic extract with control group.
- No significant difference was found between the kashaya and alcoholic extract groups.

Comparison of change in mean paw volume 3hours after injection Double dose of Sigru leaf kashaya showed significant reduction in paw volume when compared with the control group.

- Compared to the control group, the order of effectiveness for different groups are;
Double dose of Sigru leaf **kashaya**>**half** dose alcoholic of **extract**>**half** dose of Sigru leaf **kashaya**≥**therapeutic** dose of alcoholic **extract**.

On pairwise comparison 3 hr after injection

- There was no significant change for the kashaya and alcoholic extract group when compared to the control group.
There was no significant difference between the kashaya and alcoholic extract group.

Comparison of change in mean paw volume 5hours after injection

- The following groups showed significant reduction in paw volume.
 - Double dose of sigru leaf kashaya group
 - therapeutic dose of sigru leaf kashaya group
 - therapeutic dose of alcoholic extract group
- The order effectiveness was double dose of Sigru leaf kashaya > therapeutic dose of Sigru leaf kashaya ≥ therapeutic dose of alcoholic extract > half dose of Sigru leaf kashaya > half dose of alcoholic extract.

On pairwise comparison 5 hr after injection

- Compared to control group only kashaya has significant change.
- On comparing the kashaya and alcoholic extract, the kashaya group was found to be more effective.

Conclusion:

- When compared to control group, only decoction of Sigru leaf has significant anti-inflammatory potential.
- Alcoholic extract of Sigru leaf possess anti-inflammatory potential (not statistically significant)
- Considering the 3 doses of Sigru leaf decoction (kashaya), double dose was more effective.

- Among the 3 doses of alcoholic extract, therapeutic dose was found to be more effective.
- Among the 6 drugs treated groups, double dose of Sigru leaf decoction (kashaya) is most effective.
- Double dose of Sigru leaf decoction (kashaya) totally cured inflammation within the study period.
- Double dose of alcoholic extract was found to increase inflammation.
- The vehicle used for administering the alcoholic extract didn't have any add on effect with the alcoholic extract.

f) Processing and value addition and Export of Moringa

MR. MATHEW SEBASTIN,
EXECUTIVE DIRECTOR INDOCERT, TRIVANDRUM, KERALA,
INDIA



Organic standards and organic certification for export with special emphasis for Moringa products:

Organic Certification of Crop production, Processing, Export

INDOCERT extends its services to the farmers and producers through various certification processes like Crop Production, Wild collection, Food Processing, Feed Processing and Trading.

INDOCERT Organic standard for non- EU country operators

“INDOCERT Organic standard for non- EU country operators” which is equivalent to EU organic regulation 834/2007 & 889/2008 Scope of the certifications are Crop Production, food Processing, feed Processing. Organic certification is being done in accordance with of the Swiss Ordinance of Organic Farming SR 910.18.

Crop Production Plan

The producer seeking certification need to develop an organic crop production plan which includes Documentation process, inputs usage in production, source of organic planting material, maintenance of buffer zone description of the record keeping system implemented to comply with the requirements.

Conversion requirement:

The process of changing agricultural farm from conventional land to organic land is essential for the process. The process starts from the day of signing contract. For annuals and biennials crops

the time line is 2 years. For perennial plants the duration is 3 full years. Plant products may sold as "produce of organic agriculture in process of conversion" or a similar description during the conversion period.

Planting material:

All seeds and planting material should be certified organic. When certified organic seed & plant material are not available, chemically untreated conventional materials shall be used. The use of genetically engineered seeds and plant material is not allowed

Diversity in crop production:

Aim is to maintain the fertility of the soil with minimum nutrient loss. Farms shall maintain sufficient diversity in a manner that takes into account pressure from insects, weeds, diseases and other pests. Maintaining or increasing soil organic matter, fertility, microbial activity and general soil health is essential.

Fertilization policy:

No synthetic inputs allowed – Only natural minerals used in Pest, Disease and Weed management. Products from local plants, animals and microorganisms prepared at the farm are allowed for pest, disease and weed management

Contamination control:

All the relevant measures should be taken to minimize contamination from outside and within the farm. Buffer zones should be maintained within the farm. Burning not allowed in the field. Soil and water resources should be handled in a sustainable method.

Organic processing and handling:

Specific requirements

Organic production and handling plan, includes description of practices and procedures to be performed, list of each inputs used during processing, storage and handling, description of the

record keeping system, description of separation measures established to prevent commingling of organic and non-organic products, etc.

Pest and disease control

A plan for pest prevention and pest control is essential. Mechanical, physical and biological methods need to be planned. Treatments are physical barriers, sound, ultra-sound, light and UV-light, traps (incl. pheromone traps and static bait traps), temperature control, controlled atmosphere.

Ingredients

100% of the ingredients used in processing shall be organic also the use of non-organic raw materials subject to periodic re-evaluation by CB.

Processing methods

Mechanical, Physical, Biological, Smoking, Extraction (water, ethanol, plant and animal oils, vinegar, carbon dioxide, nitrogen or carboxylic acids) , Precipitation and Filtration(not made of asbestos).

Packaging

Biodegradable, recyclable, reusable systems and eco-friendly packaging materials shall be used

Labeling

When the full standards requirements are fulfilled, products shall be sold as "produce of organic agriculture" or a similar description. The label for conversion products shall be clearly distinguishable from the label for organic products by mentioning the year of conversion.

Storage and Transport

The following special conditions of storage are permitted, controlled atmosphere, Cooling, Freezing, Drying, Humidity regulation.

g) Nutritional and therapeutic aspects of Moringa

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FLORICULTURE RESEARCH STATION, TNAU, THOVALAI

NUTRITIVE AND THERAPEUTIC PROPERTIES OF MORINGA

Moringa (*M. oleifera* Lamk.) a highly valued plant, since ancient times. Romans, Egyptians and Greeks - extracted edible oil from Moringa seeds and used as perfume and skin lotion. Cultivated species of Moringa- belongs to monogeneric family, MORINGACEAE. Moringa plant is Native to the sub-Himalayan tracts of India, Pakistan, and Bangladesh. Important crop of India, Ethiopia, the Philippines and the Sudan, and is being grown in West, East and South Africa, tropical Asia, Latin America. All parts of the tree are edible. Application - Alley cropping, animal forage, biogas, domestic cleaning agent, blue dye, fencing, fertilizer, foliar nutrient, green manure, gum, honey and sugarcane juice-clarifier, medicine, ornamental plantings, biopesticide, pulp, rope, tannin and water purification. It is an important source of major and micro nutrients, vitamins and minerals.

State wide production in India:

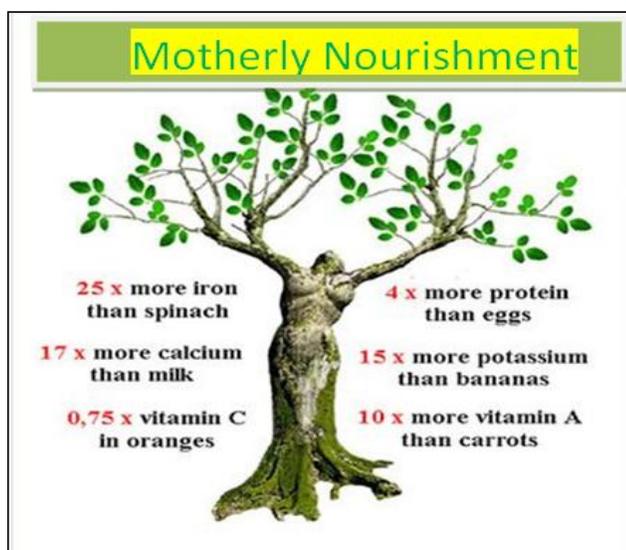
State	Area (ha)	Production (MT)	Productivity (T/ha)
Andhra Pradesh	18000	720000	40
Karnataka	12000	456000	38
Tamil Nadu	8000	280000	35
Maharashtra	7000	210000	30
Madhya Pradesh	2000	40000	20
West Bengal	1800	36000	20
Bihar	800	12000	15
Uttar Pradesh	1400	28000	20
Rajasthan	400	6400	16

Gujarat	200	3000	15
Other States	10000	270000	27
Total	61600	2061400	33.46

Numerous products from Moringa:

- Moringa seed gives a Pale yellow, non-drying oil, solvent extraction which is used as Hair oil, Lubricant, clock, oil paint, making soaps.
- Used as animal fodder during summer when green fodder is scarcity. Cows gave 30 % increased milk and meat when supplemented with 40% Moringa leaves.
- Soft and sponge gum gives little smoke or smell.Pulp is used for paper, wrapping, printing and writing. When wounded exudes polysaccharide light gum.
- In ornamental gardens, avenues Moringa Gives pleasing light shade in short span
- In agro forestry and mixed cropping, moringa helps to protect vegetables in hot sun
- It's downward rooting makes little competition with inter crop
- It works as a Water purification agent. Seed oil clarifies turbid water.

Moringa and its health benefits:



Nutritive value of fruits of drumstick (per 100 g of edible portion)

Composition	Amount
Edible portion	83%
Moisture	86.9 g
Protein	2.5g
Fat	0.1g
Minerals	2.0 g
Fiber	4.8 g
Carbohydrates	3.7 g
Energy	26 Kcal
Calcium	30 mg
Phosphorus	110 mg
Iron	0.18 mg
Carotene	110 mg
Carotene	110 mg
Thiamine	0.05 mg
Ribaflavin	0.07 mg
Niacin	0.2 mg
Vitamin C	120 mg

Nutritive value of drumstick leaves (per 100 g of edible portion)

Composition	Amount
Edible portion	75.0 %
Moisture	75.0 %
Protein	6.7 g
Fat	1.7 g
Minerals	2.3 g
Fiber	0.9 g
Carbohydrates	12.5 g
Energy	92 Kcal
Calcium	440 mg
Phosphorus	70 mg
Iron	0.85 mg
Carotene	6780 mg
Thiamine	0.06 mg
Ribaflavin	0.05 mg
Niacin	0.8 mg
Vitamin C	220 mg

Nutrient contents of mature leaves of different species of Moringa (per 100 g fresh weight)

S. No.	Species	DM	Protein	B Carotene (mg)	Ascorbate (mg)	Tocopherols (mg)	Iron (mg)	Calcium (mg)
1	<i>M.oleifera</i>	24	5.7	15	149	25	9.2	638
2.	<i>M.Stenope tala</i>	24	5.8	13	400	18	5.4	711
3.	<i>M. peregrina</i>	21	2.9	5	264	28	5.6	468
4.	<i>M.trouhar dii</i>	29	5	11	388	14	8.7	745

Y.ang et.al (2006)

Benefits of Moringa Leaf Powder

Moringa has many benefits and more medicinal values. It boosts stamina, controls diabetes, works as an anti oxidant, lowers cholesterol; controls blood pressure, it detoxifies, treats depression, it treats minor infections, improves immunity, heals wounds, aids in keratin formation, aids improved hair growth.

Medical uses of Moringa:

It strengthens the immune system, cleans the body from toxins and heavy metals, extermination of parasites in the intestines, supporting treating during radiation and chemotherapy, supporting treatment during lack of appetite in children and adults, helping with osteoporosis treatment, supporting with diabetes treatment, intestine infections, fume infections, prostate infection, various skin diseases, breathing disease, headaches and migraines, arthritis, gout, hair loss.

Nutritive composition of the drumstick flowers (per 100 g of edible portion)

Composition	Amount
Moisture	85.9 g
Protein	2.5 g
Fat	0.1 g
Minerals	1.3 g
Fibre	1.3 g
Carbohydrates	7.1 g
Energy	50 Kcal
Calcium	51 mg
Phosphorus	90 mg
Iron	-

Moisture, ash, organic matter and protein contents of Moringa seeds

Constituents	Amount
Moisture (%)	3.76 ± 1.73
Ash content (%)	3.60 ± 0.05
Organic matter (%)	9.64 ± 0.05
Protein content (%)	40.31 ± 1.63

Carotenoids in different morphological fraction of Moringa (mg kg⁻¹ DM)

Carotenoid	Morphological Fraction		
	Leaves	Stem	Seed
a-Carotene	6.5	ND	ND
b-Carotene	401	ND	3.8
Echinenon	ND	ND	ND
Fucoxanthin	ND	ND	ND
Lutein	702	21.8	4.0
Myxoxanthophyll	ND	ND	ND
Neoxanthin	219	5.9	ND

Drumstick based commercial health care products

Health care products	Product details
Moringa Zinga	Pure leaf power capsule without fillers used as energy and health supplements
Moringa Pharm	Organic Moringa leaf capsule with energy and health supplements
Moringa seeds	Seed cakes for water purification
Moringa tea	Nourishing beverages
Moringa capsule	Energy and health supplements
Moringa fruit power	Health supplement
Moringa dried leaves	Health supplement
Miracle Malunggay	100 % pure Moringa <i>oleifera</i> leaf Food supplementation
Pooga Monga Moringa tea	Nourishing beverages
Pooga Monga (Health Drink)	Health drink Mixture of Pomegranate – Moringa- Aloe
Ziga Smart Drink	Health Drink

Plant parts	Pharmacological activity
Leaves	Radio-protective, Anti-diabetic, Anti-anemic, Anti-hypertensive, Diuretic, Antioxidant, Lactation enhancer anti-septic
Flowers	Anti-athritic, Diuretic, Tonic, Improving reproductive health
Pods	Tonic, Anti-rheumatism, Antioxidant, Diuretic
Seeds	Immune-stimulant, Anti-spasmodic, Anti-anemic
Seed oil	Purgative, Tonic, Reproductive, Health promoter
Plant parts	Pharmacological activity
Gum	Diuretic, Anti-rheumatism, Rubefacient
Bark	Anti-oxidant
Roots	Cardio tonic, Abortifacient, Aphrodisiac, diuretic
Seed kernels	Anti-inflammatory

h) Moringa in Allopathic Medicine

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(MORINGA IN ALLOPATHIC MEDICINE - MEDICINAL APPLICATIONS OF MORINGA OLEIFERA)

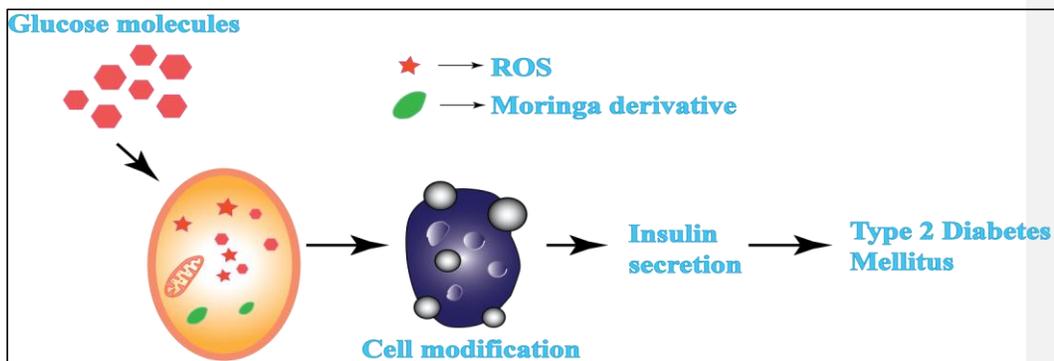
Moringa is commonly used as food in Sambhar, and Leaf curry and Avial. It has a huge medical value and is used as amorphous state stabilizers in pharmaceuticals, Reduction of NSAIDs related complications, Dexamethasone – Wound healing, In drug delivery systems, Recreational Leaf powders mixed with tea.

Following table explains the nutritional value of moringa:

Nutrients	Fresh leaves	Dry leaves	Leaf powder	Seed	Pods
Calories (cal)	92	329	205	–	26
Protein (g)	6.7	29.4	27.1	35.97 ± 0.19	2.5
Fat (g)	1.7	5.2	2.3	38.67 ± 0.03	0.1
Carbohydrate (g)	12.5	41.2	38.2	8.67 ± 0.12	3.7
Fibre (g)	0.9	12.5	19.2	2.87 ± 0.03	4.8
Vitamin B1 (mg)	0.06	2.02	2.64	0.05	0.05
Vitamin B2 (mg)	0.05	21.3	20.5	0.06	0.07
Vitamin B3 (mg)	0.8	7.6	8.2	0.2	0.2
Vitamin C (mg)	220	15.8	17.3	4.5 ± 0.17	120
Vitamin E (mg)	448	10.8	113	751.67 ± 4.41	-
Calcium (mg)	440	2185	2003	45	30

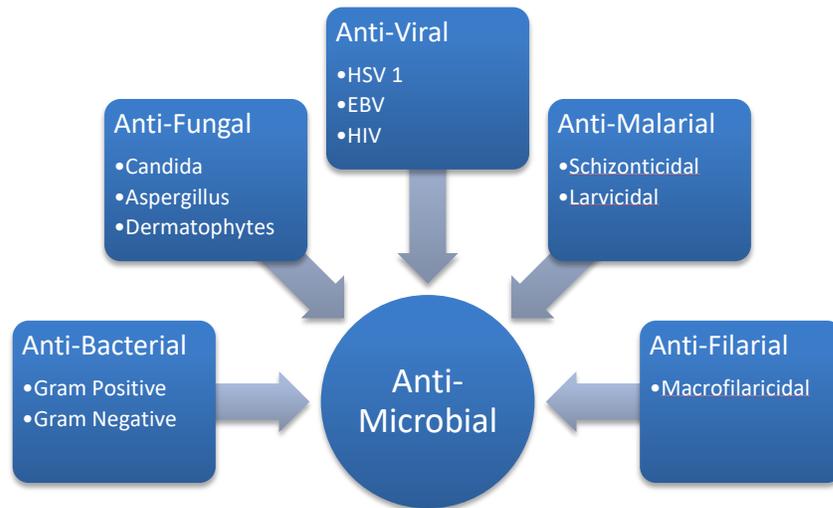
Magnesium (mg)	42	448	368	635 ± 8.66	24
Phosphorus (mg)	70	252	204	75	110
Potassium (mg)	259	1236	1324	–	259
Copper (mg)	0.07	0.49	0.57	5.2 ± 0.15	3.1
Iron (mg)	0.85	25.6	28.2	–	5.3
Sulphur (mg)	–	–	870	0.05	137

Moringa has Anti-oxidants properties which reduces the harmful effect of Reactive Oxygen Species (ROS) on cells. Moringa Oleifera – Rich in anti-oxidants



Moringa acts as anti-tumor agents – Reduce or even kill off tumors by apoptosis. Anti-Oxidant property was also found to aid in prevention. Anti-tumor agents are found to be present mainly in leaves, seeds and flowers.

Moringa is an Anti-microbial agent – Aid in eliminating microbial infections



Moringa is an anti-inflammatory agents– Reduce inflammation. MOA – Inhibition of inflammation signaling pathways. Applied aspects are Allergic rhinitis, Atopic dermatitis, Bronchial Asthma, Cancer, Rheumatoid arthritis, Reduces RA, TNF α , IL-1 in arthritic rats.

There is an effect in circulatory system as well. Also there is a direct effect on nervous system through Mono amine levels regulation, Electrical Activity regulation and Ache activity reduction. There is an effect on Metabolic disorders and GI system.

Effect in Renal system obvious, it decreases urea and creatinine in blood

Respiratory system is been supported through Bronchial relaxation, and treatment of respiratory infections. Moringine and moringinine Benzyl isothiocyanate, methyl benzyl carbamate, benzyl thiocarboxamide and benzyl glucosinolate with proanthocyanidins and glucomoringine. Moringa is also used for Immunomodulation and wound healing.

i) Moringa in Ayurveda

DR. SOUMYA.M.C,
RESEARCH OFFICER (AY)RARILSD, TRIVANDRUM

MORINGA IN AYURVEDA (MORINGA AN OVERVIEW)

In this presentation I would like to give you a gaze at different aspects of moringa through my research work in Moringa. Moringa is an exceptionally nutritious tree with a variety of potential uses. It is being considered as one of the world's most useful trees, as almost every part of the Moringa tree can be used for food or has some other beneficial property. It is known as miracle tree, tree of Life, Mother's Best Friend, God's Gift to Man, Savior of the Poor, etc. The *Moringa* tree is cultivated and used as a vegetable (leaves, green pods, flowers, roasted seeds), as a spice (mainly roots), and as a cooking and cosmetic oil (seeds). It is also used as a medicinal plant (all plant parts). *Moringa oleifera* silviculture is being promoted as a means to combat poverty and malnutrition.

Moringa is mentioned in Rigveda as a domestic plant. The Romans, Greeks and Egyptians extracted edible oil from the seeds and used it in perfumes and skin lotions. Moringa oil is used for skin protection by Ancient Egyptians. In ancient India, Maurian warriors were fed with Moringa leaf extract in the war front which was believed to have given the warriors extra stamina and strength. In 19th century, plantations of Moringa in the West Indies exported the oil to Europe for perfumes and lubricants for machinery.

Moolanur' is a popular variety of Kankayam tract of Tamilnadu. It yields 500 fruits per year. 'Kodikkal' has short fleshy and tasty fruits; it is grown in betelvine gardens.

'Yalpam' is a variety from Srilanka grown in the coastal regions of Tamilnadu. Its fruits are tasty and 1m long. It is ideal for growing in kitchen gardens.

The leaves are the most nutritious part of the plant. Leaves contain Vitamin B6, Vitamin C, Provitamin A as beta carotene, Magnesium, protein and calcium. The nutritious tender pods contains Vitamins, minerals, alpha linoleic acid. The seed contains high levels of vitamin C, moderate amounts of B vitamins and Dietary minerals. Mature seeds yield 38–40% edible oil called ben oil.

Pharmacological properties of Moringa

Rasa : Katu, kshara, madhura, thikta

Guna : Pichila

Veerya : Ushna

Vipaka : Katu

Karma : Vatasleshmahara

Flower – kaphapithaknam

Fruit – kaphavatakhnam

Mis en forme : Espagnol
(International)

- Acts as Analgesic Activity and Local Anaesthetic Activity, Antibacterial and Antifungal activity, Anti-cancer activity, Anti-fertility activity, Anti-inflammatory and antinociceptive activity, Anti-Oxidant Effect, Anti-spasmodic activity and hypoglycaemic activity.
- The seeds of *M. oleifera* Lam. possess marked analgesic activity and are equipotent to standard drug (Aspirin). Methanol extract of *M. oleifera* root bark has produced significant local anaesthetic activity
- The essential oil fraction of Moringa possesses antimicrobial activity and antifungal activities. Antifungal activity was also observed with the steam distillate of Moringa. More inhibition of *A. niger* was found followed by *A. oryzae*, *A. terreus* and *A. nidulans*
- The crude ethanolic extract of the seed of *M.oleifera* is known to have anti-tumour activity against Epstein – Barro virus. The root shows anti malignant activity against human epidermoid carcinoma of naso pharynx in tissue culture and P 388 lymphotic leukemia in mice.

- The root of *M. oleifera* is known to exhibit post – coital antifertility effect in rats. The aqueous and ethanolic extract shows abortifacient, anti-oestrogenic activity. The aqueous extract of root is known to induce anti implantation activity. The bark of *M. oleifera* does not exhibit any anti fertility, anti-implantation activity in rats, but is known to have anti implantation activity in hamsters.

The alcohol and water extract of root is known to have anti – inflammatory activity against the carrageenan induced paw oedema given in a dose 1gm intravenously. Water extract of bark and hot water extract of flowers does not exert anti – inflammatory activity.

The extracts of *Moringa oleifera* both mature and tender leaves have potent antioxidant activity against free radicals, prevent oxidative damage to major biomolecules and afford significant protection against oxidative damage.

Effects of cardio vascular system:

The alcoholic extract of leaves causes an initial rise in blood pressure then a steady and gradual fall, which lasts for a long period. Its action on blood pressure is considered to be due to potent adrenergic neurone blocking substances in the alcohol extract. *M. oleifera* lyophilized hydroalcoholic extract possesses significant cardioprotective effect, which may be attributed to its antioxidant, antiperoxidative, and myocardial preservative properties.

Ethanolic extract of dried leaves at a dose of 300 mg/Kg shows potent hepato protective activity against CCl₄ induced hepato toxicity. Methanol extract of dried flower buds exhibits anti – ulcer activity at a dose of 4 g/Kg. Aqueous extract of *M. Oleifera* leaves has significant wound healing property.

Therapeutic usages:

Juice of leaves mixed with salt and applied externally into a paste with garlic and turmeric is given in dog – bitecures swelling of joints. Internal use of 3 to 6 grams of moringa leaves and

avoiding salt in diet will reduce hypertension. Leaves ground and is applied externally to relieve febrile symptoms and heal the wounds.

Flowers are used to dispense swellings, as a tonic, diuretic and to increase the flow of the bile. Cure inflammation, muscular pain and enlargement of spleen.

Fruit used as a vegetable is preventive against intestinal worms. Have carminative action. Fruits are used in diseases of liver and spleen. Useful in articular pain, tetanus and paralysis

Dried seeds are used for nasal administration in headache and diseases related to head with kapha predominance. External use of seed oil is beneficial in rheumatic complaints. Internal administration of seed paste mixed with milk is beneficial in early ejaculation. Seed oil is useful in leprosy ulcers. Dried seeds rubbed in ghee are beneficial in dimness of vision. Seed oil with ground nut oil, applied externally will cure rheumatism.

Decoction of root is anthelmintic and will cure abdominal pain due to renal calculi. Root paste with rice soup will cure oedema. It is a rubefacient in palsy and chronic rheumatism.

Gargle with decoction of root is beneficial in hoarseness and throat sore. Juice of fresh root bark poured into the ears relieves otalgia.

j) Moringa” the Miraculous Green Herb as Food and medicine’.

DR. S. SANGHAMITHRA, BSMS,

**SANTHIGIRI AYURVEDA & SIDDHA
HEALTH CARE CENTRE**

According to Ayurveda & Siddha , health exists when there is a balance between three fundamental bodily humours ie, TRIDOSHAS-Vatha ,Pitha and kapha.The five elements ie , PANCHA BHOOTHAS–Water , Air, Earth, Space & Fire combine in specific pairs forms these dynamic forces.

VATHA is the air principle necessary to mobilize body; PITHA is the fire principle helps in digestion & metabolism; KAPHA is the water principle which nourishes the body.

Specifically,Vatha ,Pitha & kapha are respectively related to the body’s Kinematics, energy circulation & weight. This three humoural system controls the flow of energy acquired by the species from sun through photosynthesis in plants according to the food chain. Accordingly the functional system of human body has been set up in harmonious towards laws of nature. Whenever this balance is disturbed, disease occurs.

Moringa is one of the miraculous traditional herb familiar to mankind and seen commonly in most of the households. Itsmost unique anti-toxic property encouraged people to have it planted near fresh water resources and in their own courtyards.Moreover it has the capacity to neutralise the derrangement of three humours , it is prefered to be one of the best home remedy since time immemorial

Common names as Horse radish, Drum-stick tree, in Tamil Muringai and in Sanskrit it is Sigru.

Glucosinolates, Flavonoids, Phenolic acids, Carotenoids, Tocopherols, Polyunsaturated Fatty Acids, Folates, Anti-oxidants, Glucosinolates, Proteins, Vitamins, Minerals, etc are the chemical components of moringa.

ACTION:

Whole plant:1.Antispasmodic (relieve spasm of involuntary muscles)

2. Stimulant (increase alertness & energy)

3. Expectorant(promotes secretion of sputum)

4.Diuretic(increase production of urine)

Seed : 1.Aphrodisiac

Tender fruit:1.Demulcent (relieve inflammation/irritation)

2. Aphrodisiac(increases libido)

Fruit : 1.Expectorant

2.Aphrodisiac.

Flower : 1.Tonic (give feeling of well-being)

2.Emmenagogue(increase menstrual flow)

3.Aphrodisiac.

Leaf : 1.Emetic-in excess dose (induce vomitig)

2.Laxative-occasionally(increase bowel movements)

Leaf petiole: 1.Diuretic (increase urine formation)

Stem bark : 1.Abortifacient (induce abortion)

2. Febrifuge(effective against fever)

3.Antitoxic(neutralize action of poison/toxin)

4.Expectorant.

Root bark : 1.Acrid (unpleasantly pungent)

2.Vesicant(cause blistering)

3.Caustic(cause burns)

4.Antilithic(effective against calculi formation)

5.Carminative(relieves flatulence)

6.Diaphoretic(induce perspiration)

7.Sialogogue(promote secretion of saliva)

8.Rubefacient(produce redness of skin)

Gum : 1.Spasmodic
2.Aphrodisiac
3.Errhine(induce nasal discharge)

As Medicine:

SEED

Oil extracted from seed can be used externally for pain. Grinded mixture of moringa seed,mustard,hemp seeds & barley along with curd can be applied externally for scrofulous glands of neck. Moringa seeds are main constituent in medicines for increasing the quality of semen. Moringa seeds (20 nos) made into paste with rice washed water and kept in copper vessel and the prepared liquid can be poured on eyes for thickening,excessive lacrimation ,itching and swelling of eyes. Medicated oil from seeds along with some ingredients can be used as nasal drops for nasal polyp and other nasal infections. Medicated oil prepared from seeds and leaves can be used to cure oral and dental issues.

Moringa flowers are in curry form taken internally to reduce excessive body heat and improves spermatogenesis.

Leaf is used in multiple ways like Grinded mixture of the leaf along with garlic,turmeric,salt and pepper can be given internally for dog bite and same mixture applied on bite area for fast healing and antitoxic effect.

Leaf juice with small amount of purified vediyuppu(potassium nitrate) will act as diuretic. Leaf juice with induppu will act as diuretic and laxative. Mixture of leaf and pepper can be applied in forehead for head ache. Intake of leaf juice (equal amount to 36 g) induce vomiting. Leaf grinded with pepper and applied externally for head ache,throat pain,etc. Grinded leaf can be applied over swellings. Leaf juice mixed with small amount of slaked lime and honey can be applied on neck for cough,lymphadenitis,etc. For eyes: Fresh juice of tender leaves rubbed on a copper vessel and exposed to fumes of ghee and applied as collyrium will cure swelling,excessive tears(epiphora),friction and pain in eyes.

Leaf juice mixed with honey can be applied in eye lids for eye pain,conjunctivitis,etc .For ears- Juice of moringa,garlic and ginger can be used as liquid drop, medicine for ears to cure tinnitus,deafness ,ear infections, otitis media,etc. For nose: wicks made from its juice are used for fumigation in chronic sinusitis.Decoction prepared from moringa leaf petiole & curry leaf petiole can be given internally for stomach pain. Above decoction also have anthelmintic (kills intestinal worms) action. One fist of leaf petiole pound and boiled with water and reduced to the suggested amount .This can be taken at specific intervals will induce urination and control generalised oedema. Above prepration can be given as an antidote for toxicity of Semecarpus anacardium.

Stem bark is used in so many oils. Grinded stem bark can be tied over swellings & abscesses. Oil prepared from Moringa stem bark & Kuppaimeni(Acalypha indica) can be applied externally for eczema, dermatitis, scabies,etc. Grinded mixture of stem bark & mustard powder can be applied as paste over swellings. Stem bark juice is used for calcination of certain metals. NOTE:Stem bark juice acts as best thrombolytic agent and thus added as carrier for the medicines given for hemiplegia and post stroke conditions.

Root bark juice with milk can be given internally in specific dose cures swellings,bronchial asthma,joint pain,back pain,certain organomegalies,etc. Gum melted with oil can be applied as ear drops for ulcers in ear. Gum melted with milk can be applied externally on forehead for headache. Gum is applied externally for abscesses.

PREPRATORY MEDICINES-AYURVEDA:

Vendan Malar Kashayam – special medicine which cures varma injuries,deep wounds,septic wounds,cough,excessive phlegm ,diarrhoea,etc. Muringai Kizhangu Kudineer – Cures stomach pain and act as anthelmintic.Murivenna-Trauma,sprain,spasm,joint pain,wounds,spondylotic pain,etc.Dhanadanayanadi kashayam – Neuralgia,hemiplegia,paraplegia, neural disorders,etc

Nirgundyadi kashaym-Anti-toxic,Anthelmintic,intestinal problems,etc. Chinchadi thylam-Arthritis,pain,sprain,injuries,etc. Karpasthyadi thylam-Cervical & lumbar

spondylosis, hemiplegia, joint pain, etc. Prabhajanavimardanam kuzhambu-Neuralgia, numbness etc.

According to the verse 'Prevention is better than cure', nature is gifted with suitable remedies for all diseases which is recorded and will come in future. Vegetation in specific localities are enriched with targeted constituents to alleviate all kind of health problems predominant in that area. So for every diseases there must be suitable unique remedy in nature in one or another form as the miraculous gift of God

But a major part of this fact is hidden somewhere in nature and still exists as unreachable to the human knowledge. Even though there are so many innovative programs are carrying out in different parts of the world to retrieve this knowledge which was once an inevitable part of our culture and the mode through which we lived long back ago. Briefly the greatest creation of God, humans can only unveil this knowledge from nature when we move with the rhythm of nature and live harmonious accordingly

k) Moringa in Sidha

PROF.P.PREMA M.SC.M.PHIL.M.SC(VARMAM)

**DEPARTMENT OF MEDICINAL BOTANY, ATSVS.SIDDHA MEDICAL COLLEGE &HOSPITAL,
MUNCHIRAI,KANNIYAKUMARI.DT, TAMILNADU**

Moringa plays a vital role in Sidha medicine. Botanical Name of the species is MORINGA OLIFERA. Tamil names are Murungai, Vedan, Venthan, Kizhavi., Eravil thoongan, Oor muthali etc.,

Systematic position of Moringa:

- **Class** : Dicotyledons
- **Sub-Class** : Polypetalae
- **Series** : Disciflorae
- **Order** : Sapindales
- **Family** : Moringaceae
- **Genus** : Moringa
- **Species** : olifera

Moringa leaf is a Decompounds, Green vegetable. Juice with coconut oil and salt is given for worms. Leaf with salt paste is good for anti-inflammatory. Decoction is a diuretic, anti –anemic, coolant.

Moringa Stem is having a soft wood the steel is discrete. The gum produced is medicine for syphilis. Young stem also is having lenti cells thereby eliminating dead cells periodically out. Pith is present, so there is no chance of storage of tannins suberins etc.

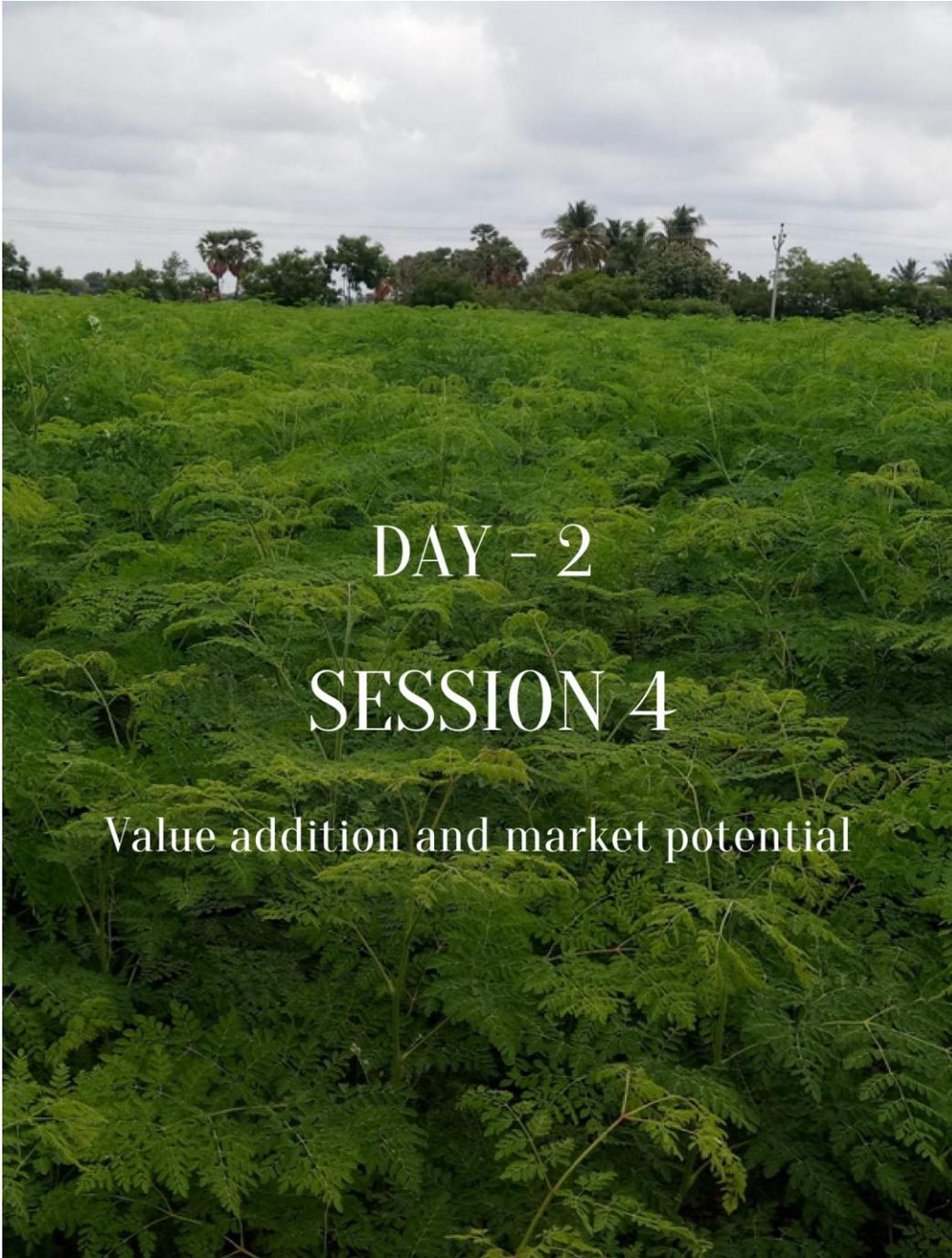
Each node is eliminating the toxins during the senescence. So we can say that Moringa is always juvenile. Every node is possessing flowers in the case of young branches. Because of the discrete steel repeated sprouts can be generated from the same node.

Moringa Flowers are auxiliary and anti- anemic.

Moringa Fruit is used as green vegetable. Especially in restricted food - while taking siddha drugs, this drum stick is used for Side dish, for all types of diseases. Tender fruits are good for Rheumatic bodies.

The bark is used for kapha diseases. It is anti – poisonous. For lymphatic swellings the bark with mustard seeds are used as a paste. Fresh bark is used along with some oily medicines for quick actions

Seeds are winged seeds There are three wings so that it can be used for vatha , pitha, andKapha patients. It enhances sperm formation. Moringa juice and decocotion are used as internal medicine. Moringa paste and oil are used as an external medicine in sidha.



DAY - 2

SESSION 4

Value addition and market potential

a) Moringa entrepreneurship and development video presentation

Ms. laana from Vienna shared a video on Moringa Entrepreneurship and development. Which was highly appreciated by the delegates and positive feedbacks on entrepreneurship development in the field of moringa farming was given.

b) Moringa entrepreneurship scope and business opportunities

K. JAYACHANDRAN,

**MANAGING DIRECTOR, JAYCEE ORGANICS LLP,
FARM & FACTORY: TIRUNELVELI**

**MORINGA ENTREPRENEURSHIP – SCOPE &
BUSINESS OPPORTUNITIES**



At the outset, thanks for the opportunity given to participate and present our experience, not only in cultivation of different Horticulture crops, but also our experience in processing the produce and business opportunities related to value added products in Food industry.

- Jaycee Organics is a self-sustained Organic certified Integrated Agro Farm situated at Udayampuli village, Alankulam Taluk, located at a distance of 23 Kms from the down south city of Thirunelveli, Tamil Nadu, India.

We grow multi horticulture crops, herbal and medicinal plants in our integrated organic farm in an extent of around 200 acres. As the demand and requirement for certified organic products in the international scenario, we have planned right from the beginning over a period of nine years and accordingly all required infrastructure have been gradually created.

Presently, out of 200 acres, nearly 170 acres are with different horticultural crops of short term, annual term and perennial.

Multi-crops Farming in Jaycee Organics:

- Short term crops - Vegetables, Paddy, Oil seeds, Millets
- Annual crops – Banana varieties
- Perennial crops – Amla, Mango, Coconut, Lemon, Chikku, Guava, Papaya
- Herbal & Medicinal – Moringa Oleifera, Curry leaf, Coriander, Mint, Holy basil, Indian borage, Spinach, Amaranth, Mudakathan, Vallarai, etc.
- Short term & long term trees cultivation with Timber value species like, Melia Dubia, Gmelina Arborium, Teak and Mahagoni.

However, for the given topic today, I will be sharing our knowledge and experience in food processing industry – Scope and business opportunities with respect to easily cultivable and processable, value added varieties like – Moringa oleifera, curry leaf, herbal and medicinal plants.

All organic, bio and bio dynamic manures, pesticides and bio dynamic compost are produced in-house. International Organic certifications are obtained in order to meet the Global Exports standards of various countries. The said certifications include, Lacon, Halal, Demeter in conversion, etc.

Scope: There is a huge scope in the international market for organic agrifood products. • India being a Tropical/ sub-tropical country with conducive agro climatic conditions for all agricultural crops in general and horticulture crops in particular.

Opportunities: Given the rising demand for the organic agri-products in domestic and international markets, India is very well positioned to meet the same. • India is one of the largest producer of food products but our share of processed food products in the global market is only 1.8%. Whereas, small countries like Thailand are much higher.

International Logistics infrastructure – Sea / Air / Road / Railways

India is blessed with natural resources- Sunlight, Soil and Water coupled with abundant human resources. We can utilize this rising opportunity of domestic and international Demand for organic agricultural processed food products. In our experience selection of crops are location specific. • Jaycee Organics focuses on easily cultivable and processable, value added varieties like – Moringa oleifera, curry leaf, herbal and medicinal plants.

Let us zoom in to Moringa Oleifera leaf production based on the data recorded in our farm:

- It is found that the indicative business value of Moringa Oleifera products in the international market is around US\$4 Billion, per year.
- One acre Moringa Oleifera cultivation to yield 20 to 30 tonnes of Green Mass.
- After Solar drying, it yields [10%] final product of 2 to 3 tonnes.
- International price for dried Organic certified Moringa oleifera is in the range of Rs.300 to Rs.400 per kg. Therefore, the annual revenue expected per acre is Rs. 6 to 8 lakhs

Story & history of Moringa Oleifera

1. Moringa History

2. Moringa Cultivation a. Site selection b. Land preparation c. Planting/ Sowing d. Maintenance of the crop

3. Agro climatic conditions a. Tropical/sub-tropical b. Temperature: 24 C – 42 C c. Rainfall: 400 mm – 1000 mm d. Soil type : Loam, sandy and sandy loam e. Soil Ph : 6 – 8 Ph

4. Plot condition a. Good drainage b. Avoid clay soil c. Avoid termite infested soil d. Open area to receive full sunlight e. Fenced and protected from roaming animals

5. Soil & land preparation a. Application of Basil manure b. Organic and Bio dynamic manures to be compulsory

6. Plant propagation a. Through seeds b. Through matured cuttings

7. Selection of seeds a. clean disease free seeds from reliable source b. should not be stored for long time c. Seeds count will be 2800 to 3000 nos. per KG. 8. Seed sowing a. Direct sowing b. Using grow bags

9. Planting pattern a. Plantation spacing: 20 X 20 cms or 30 X 30 cms or 2 mtrs X 1 mtr. The farmer can select the pattern based on experience.

10. Pest & disease a. Moringa plant will be easily affected with pest & disease b. Hence, regular preventive care to be given – c. Karpurakaraisal, Muligai poochi viratti, Agni asthram, etc.

11. Harvesting a. First harvest will be in 85 to 90 days b. Thereafter harvest will be every 40 to 45 days

12. Expected yield of Moringa – green mass [with leaves & stem] a. 20 MT to 30 MT per acre, per year
Based on individual farmer's involvement and care

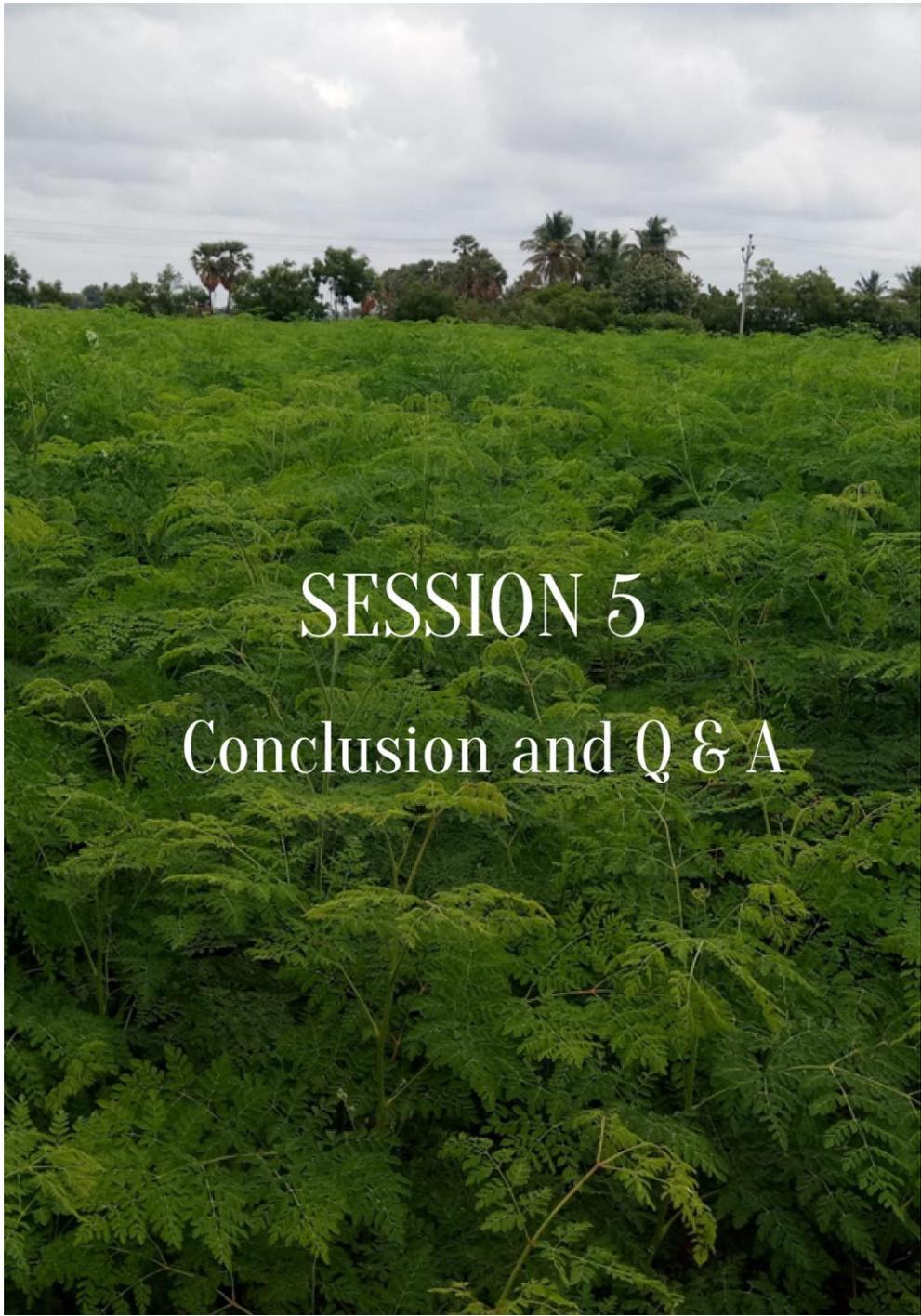
A brief on Moringa leaves processing after harvest:

1. Leaves are stripped
2. Washed in RO water
3. Dried in solar drier
4. Dried leaves are pulverized
5. Sieved
6. Packaged in bulk/ retail packets.



Finished Product - RETAIL Pack





SESSION 5

Conclusion and Q & A

Conclusion & Q & A

The 3 day International Conference on Moringa Entrepreneurship came to end on a good note from encouraging feedbacks from the delegates. Many shared their experience which was enlightening and about the thought provoking sessions and presentations by the resource persons. The delegates also shared that the conference has brought them good connections as well. And opined that the topics covered ranged from seed to moringa roots and stems, going beyond the processing of disaggregated value added products stemming from all parts of the miracle tree. Main aspects like Pharmaceutical benefits, Research findings, Siddha and Ayurveda medium of moringa treatment, and various other important topics were covered in detail. And to have covered almost all topics within two days' time is an achievement in itself. The purpose of the program has succeeded.

During Q & A time a participant unveiled viable avenues of penetrating local, national, regional and global markets with moringa-based value added products with practical insight and foresight. Many felt Organic moringa farming was very useful. And wanted to become a moringa entrepreneur as they have gained lots of motivation and knowledge through the sessions. The participants also shared about the scope of expanding the moringa market and also possibilities of networking and availing schemes and loans from institutions like NABARD and Horticulture departments.

One delegate shared with the organizers their experience in farming and processing activities, focusing largely on the indelible impact the tree can make on the livelihoods of the poor engaged in farming and processing activities. They congratulated the organizers, saying that "even though we are five thousand old in these (moringa farming) we have lost ground. We took everything for granted. Now organizing these kind of conference, is 100% sure we are all getting more aware of this magic plant, and we would venture successfully in to the 20 Billion market with confidence".

Sister Superior- Sis Rose Francis, Manager at the Stella Maris Stella Maris Institute of Development Studies and Sis. Archana, Executive Director SMIDS shared about their experience with the moringa farming and also reaching out to the marginalized farmers and creating awareness among different categories of people. Also about the setting up of processing unit and production of by products like moringa honey, moringa powder etc. Sis Rose Francis further shared about how they visited various farms for learning purposes. And decided to support the farmers at the grass root level. Also in future planning to organize a buyer seller meet along with a farmers meet for the benefit of the people who are looking for marketing opportunities. There was also discussion on the plan to set up a co-operative unit for farmers who will be engaged in the processing unit and work towards seeking export market.

In the end, awards were given to delegates for different categories: The following were the winners of the respective awards:

- The Facilitator award was given to Mr. S. Binu Pilot from Thiruvananthapuram.
- Dynamic Moringa Farmers award 2018, was received by Mr. Chandran Pramod
- Special award for collective moringa farming – was awarded to Thiruvananthapuram Agri Horticulture Development Cooperative society
- Dynamic Moringa Entrepreneur award 2018, was given to Mr. K. Jeya Chandran
- Business Analyst Award was given to Mr. Bliss Nainya.

The Participation certificate was also given to the delegates by Sis. Archana Das, SMIDS.

Finally the vote of thanks was delivered by Sis. Archana, Executive Director, Stella Maris Stella Maris Institute of Development Studies, Kanyakumari. She thanked delegates for their time and active participation in the conference. And also had special word of thanks to all the people who were the reason for the success of this conference. She extended her thanks to the following who made this possible.

DR. KAMAL HASSAN PILLAI
DR. JEBAMALAI VINANCHIARACHI, DIRECTOR, SMIDS
MR. JOHN STANLEY & JENNIFER STANLEY
MR. JAYACHANDRAN, JC GARDEN
MR. JAYAKUMAR, TACED
MR. PLATOSEN SAMARASAM, ZUWA ORGANICS



DAY - 3

SESSION 6

Field Visit

Field Visit

As part of the International Conference on Moringa Entrepreneurship, the delegates were given an opportunity to have a practical field exposure visit to JAYCEE AGRO FARM, which is located in Tirunelveli. The Jaycee Organics is a self-sustained Organic certified Integrated Agro Farm situated at Udayampuli village, Alankulam Taluk, located at a distance of 23 Kms from the down south city of Thirunelveli, Tamil Nadu, India.



The delegates on the 3rd day geared up for an exciting day, in order to witness the agro technology used and the types of Moringa farming being done in the Jaycee Agro Farm. And were truly blessed by the able environment in the agro farm and took away many learnings from the field visit.

Mr. K. Jayachandran- is the Director of the Jaycee Organics LLP, Farm & Factory. Having a 200 acre farm and have so far, planted about 65000 trees of varied species, which will provide a good green coverage. They have received organic certification for all the 200 acres and subsequently got another important certificate called the DEMETER certification. It is internationally recognized and DEMETER certified products will fetch at least 50% more prices in the international market than other products. They are also certified by LACON, a German subsidiary certifying company in India and they have also obtained the HALAL certificate.

The organizers of the Conference were thankful to the Jaycee Organics for hosting the field visit and giving an opportunity to the delegates for having a fruitful field visit.