

Agriculture & Industry Survey

India's Leading Business Magazine for Agriculture



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Clean Green Biosystems, Chennai



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Managing Director
Urban Growers LLP, New Delhi



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Not forget Agriculture issues!

Towards sustainable agriculture!

Not pursuing an unsustainable rural development strategy!

Our conception of agriculture and rural development as things stand is so out of date and not in accordance with how the Indian rural realities are shaping up with rapid urbanization and employment opportunities are opening up with education spreading on a vast scale.

Agriculture is a serious subject. It needs a more open mind and a very different socio-cultural outlook. Agriculture is all about farming. And land ownership. This is a sector where too many inequities and inequalities and injustice and much suffering are accumulated over the years. More because of our urban-elite desires reforms can't take place. Farm, rural issues are also very complex and complicated too!

They are basic and critical for our peoples' well-being, social harmony, and also for health and living standards. The rural social hierarchies need to be addressed in some depth.

Our universities also must study the many social and sociological issues of rural society. There are many social classes and there will always be a feudal class and a workers' class to make farming a paying activity.

We as a people are too much preoccupied with politics of a very superfine layer. After Independence, some seventy years have passed and yet some colonial hang ups persist. One is the food ration shops! They are surviving the war years and they are a reminder of the long history of poverty, successions of famines, and re-born deaths. In 1860 alone, there were three major famines in Punjab in 1860, 1868, 1865 in Orissa in Rajputana states in 1865 and later also in the same century in 1876-78.

The point I want to make here is that the Indian economy suffered a great deal under the British rule and there were periodic famines and record deaths of people took place. Now the one big lesson we, the rulers, have to learn is that agriculture and food production are so intrinsically linked that there is always the danger of doom shortage which now, in our own time, there is the new politics of free distortion of food articles under the democratic governance.

Now, the more populist governments are winning elections with so many wrong policies like distribution of cash to the voters, there is every possibility that poverty is unlikely to go away at the time, even now there is an 11 odd percentage of people living under the poverty line. Democratic government is also becoming more and more corruption-driven regimes and there is never the situation likely to become debt-free regimes.

There is a reported 5 lakh crore debt for the Tamil Nadu government alone. There is also the likelihood of unsustainable economic management, the 100-day poor worker's employment scheme, and how long the governments can sustain this unsustainable rural employment scheme possible?

Surely, agriculture in India would be always a small farmers economic capital and ownership is likely to down further. With one or two hectares per capita would always be an unsustainable rural economy reality. Sow seeds to discuss further in some depth, the future of Indian agriculture. For this purpose, we need first to meet the farmers face to face and seek their sympathetic response. The current imbroglio over the nearly 8-month old agitation in the Capital needs to be called off.

One suggestion is that we accept the farmer's demands in to and as the Supreme Court itself had suspended the laws indefinitely there is no loss of face for the government and also the farmers. All that is needed is to have an open mind and also shed any egos and seek reconciliation.

If there is a will, there are always ways!

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How does agriculture matter to all sections of society?

YET HOW AGRI ISSUES ARE RELEGATED TO LOWER PRIORITY!

Yes, agriculture doesn't rank high in any of our day-to-day concerns except in our meals times! Yes, agriculture has evolved over time in such a way that when we think of agriculture, we think of villagers and rural India and rural India is what it is and so too agriculture and that is why even now we had ignored the farmers that they continue to agitate, maybe not so in a rational way that the three laws that are at the heart of the controversy and Delhi borders are uttered by the farmer's protests for such a long time.

We talk of democracy, we have Parliament function right now, and yet no one, the very bulk of the body politic is assembled in Delhi, the capital and we never heard a word that on the opening day of Parliament the Prime Minister is shouted down and the subjects talked about are also not remotely connected with any issues of such urgency, the MPs in both houses didn't allow the PM to make his statements and the talks were about some foreign spy agency trying to interfere in India's security issues with a foreign spy agency trying to probe into Indian affairs.

We are not sure how many Indian readers would have read through the morning newspapers or scanning through such remote issues. What remained in one's memory, we imagine the unruly demands to ask for Home Minister's change or the least of the courtesies extended to the country chief executive, the Hon'ble Prime Minister.

The monsoons have been plenty and the kharif season is in full swing yet the news reports are such that the kharif sowing lags the targets and as in mid-July that the area covered by this time was below target, it is only 6.1 million hectares instead of the expected 6.9 million hectares! Thank God only one mainstream daily reported on the front page when the whole nation is not worried about how democracy is functioning in the country. Even when we are imagining the rainfall was more than in excess, seeing the rainstorm was so threatening and almost flooded the city so completely.

Now, turning to the main issue that we have to take agriculture sector always very seriously only. Someone or others keep reminding the indifferent and also corrupt politicians all the time about how we look at the sector that had shaped and kept India and the Indians. At the mercy of the elements, we like to draw the attention of all Indians to the pictures of the Indian people at various historic times after at least the art of photography came into use.

There are even now many such albums that are featured in such devices as You-

tube. There is one such large picture of the years in the 1870s where one large family stands in such one photo that must devastate you, if not simply shake you out of your very bearings.

In fact, we need a separate department of the sociology of Indian agriculture and Indian villages in some select universities and socialist research institutes. After all, our agriculture is such a very high priority area and so there is a new perspective to our agriculture. And we have to create such a new perspective and it is the demand of the times, we feel even our agri universities need to imagine such a new perspective, the time for which has come and the government must turn its attention to such an approach.

There are very many issues for debate and discussion in any agricultural reform topic. One is new innovations in agriculture. Of course, there is no other agri institute than the famed Netherlands's own Wageningen University and Research (WUR), located 50 miles South East of Amsterdam.

Why this university is not studied in some depth by the Indian agriculture policymakers?

This university has some of the most daring innovations and slogans, goals, and targets. Agri study centers must warmly adopt the WUR has made a slogan: Twice as much food using half as many resources! They have demonstrated this target already in many of their crops. The Dutch have also shown that water for some of the crops can be reduced as much as 90 percent. The campus is dotted with a sea of greenhouses surrounding farmers' homes. Climate-controlled farms such as these have enabled farmers to produce record outputs. Some of the greenhouses are so large that in all, the greenhouses area cover an unprecedented 175 acres. Day and night have merged and the Dutch are the world leaders in vegetable seed exporters and also the fair-weather fruit, tomatoes!

More than a third of the world's vegetable seed exports originate from the university's high-tech broiler households up to 150,000 birds, from hatching to harvesting.

Horticulture output reaches all-time high of 330 MT, acreage and production growing consistently



India's horticulture production in the pandemic-hit 2020-21 is estimated to be an all-time high of around 330 million tonnes which is nearly 3% higher than the output in 2019-20, keeping pace with the consistently growing preference of consumers for fruits and vegetables.

Analysis of past data shows a trend where farmers keep on increasing acreage of horticulture crops, resulting in higher outputs backed by use of high-yielding varieties of seeds and better farming techniques.

The latest data, released on Thursday as part of agriculture ministry's sec-

ond estimate of horticulture output for the crop year 2020-21 (July-June cycle), shows that the country has registered increase in production over previous year in all categories of horticulture crops – fruits, vegetables, spices, plantation (such as coconut, cocoa, areca-nut and cashew nut), and aromatics & medicinal plants – except flowers. Among vegetables, all three most popular kitchen staples – tomato, onion and potato (TOP) – have registered an increase in 2020-21 compared to 2019-20.

While Andhra Pradesh, Uttar Pradesh and Maharashtra turned out to be the top three states in producing fruits in 2020-21, the credit of producing vegetables went to West Bengal, Uttar Pradesh and Madhya Pradesh as the top three states. Uttar Pradesh, however, emerged as the top producer with 13% of total production of all horticulture crops put together.

Sharing the highest horticulture output estimate data, agriculture minister Narendra Singh Tomar attributed the increase in production to the “government’s farmer-friendly policies, tireless efforts of farmers and research of scientists”.

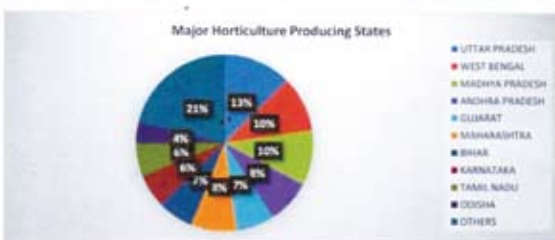
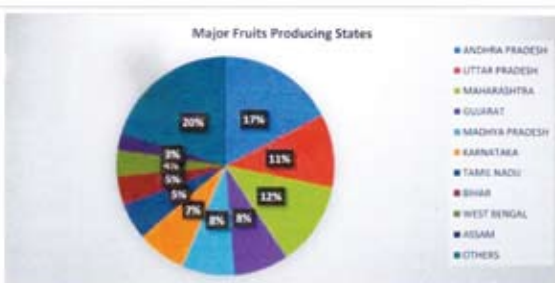
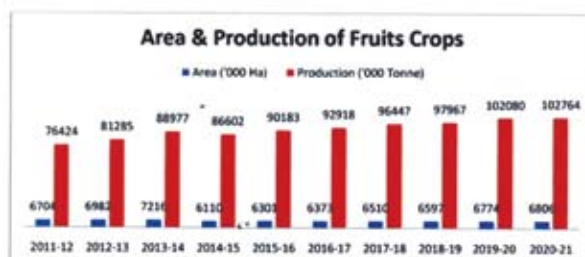
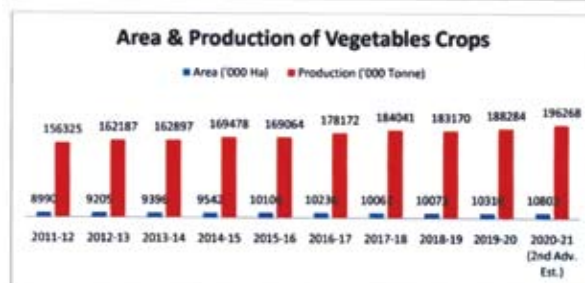
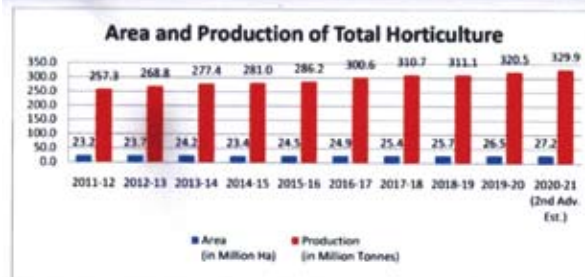
Earlier in May, the ministry had pegged the estimated output at around 327 million tonnes (MT). It has now, however, revised it to 330 MT by factoring in updated production data from states and other government agencies.

According to the updated output data, production of fruits is esti-

mated to be 102.76 MT this year as compared to 102.08 MT in 2019-20 whereas the production of vegetables is estimated to be 196.27 MT (growth of over 4%) as compared to 188.28 MT tonnes in the previous year.

The production of onion, which invariably faces high price fluctuation leading to major concerns among consumers, is, however, reported a minor increase -- from 26.09 MT in 2019-20 to 26.92 MT in 2020-21. Potato production, on the other hand, is increased by over 10% -- from 48.56 MT in 2019-20 to 53.69 MT in 2020-21.

Source : timesofindia.indiatimes.com



INDIA

is now in the category of world's top agricultural exporters

Backed by the stupendous streak of reforms, India has entered the top 10 list of the countries exporting agricultural produce in the year 2019 with a sizable share in the export of rice, cotton, soya beans and meat.

As per a report by World Trade Organization (WTO) on the trends in world agricultural trade in the past 25 years, India and Mexico with 3.1% and 3.4% share in global Agri exports, respectively, replaced New Zealand (9th) and Malaysia (7th) as the largest exporters across the globe.

The United States of America (USA), which topped the list in 1995 with 22.2% share of world Agri export, was overtaken by the European Union (EU) in 2019 with 16.1% global Agri share. The USA's exports reduced to 13.8% in 2019 while Brazil maintained its ranking as the third-largest exporter by increasing its share from 4.8% in 1995 to 7.8% in 2019.

Applauding the achievement, former Union Health Minister Dr. Harsh Vardhan took to Twitter and said, "Despite the pandemic, India stepped in to meet increased demand & emerged as a significant global supplier of food & other essential agricultural products."

Notably, the top exporting nations of rice in 1995 were Thailand (38%), India (26%), and the US (19%). In 2019, India



with a lead of 33% overtook Thailand (20%) to top the list, while Vietnam (12%) overtook the US and climbed to the third spot. The top 10 exporters accounted for more than 96% of exports in both 1995 and 2019.

Further, India is also the third-largest cotton exporter (7.6%), and the fourth-largest importer (10%) in 2019. In the largest traded Agri product, soya beans, India (0.1%) has a meagre share, but was ranked ninth in the world. In the "meat and edible meat offal" category, India secured 8th rank in the world with a global share of 4%.

India's share of foreign value-added content in its Agri exports clocked 3.8% share primarily due to high tariffs on

Agri imports to boost the domestic markets and local farmers.

According to a report, "Reforms to promote Agri exports" released in the first half of this year, the commerce ministry of India had mentioned that the government's consistent and concerted endeavors to bring in reforms to boost agricultural exports have been highly fruitful.

"Despite COVID-19, India has been able to step in to meet the increased global demand, emerging as a significant global supplier of food and other essential agricultural products," the report added.

Source : newsonair.com



Tractorisation in India high, but agriculture mechanisation low



The tractor industry in India registered an increase in sales by more than 40 percent in 2020 as compared to 2019. And to all of our surprises, this was recorded when we were hit by a global pandemic and all the other segments were performing poorly. In fact, 2020-21 has been dynamic for this sector as the tractor industry witnessed the highest ever sale of about 9 lakh units. Now while these numbers are a good sign of tractor penetration in India, only 'tractorisation' is not agriculture mechanisation. In fact, mechanisation in agriculture is very low in our country.

While tractors are an integral part of farm mechanisation, they are not the only machinery that can assist in agricultural operations. Many Indian farmers, however, are solely dependent on tractors and perform other farm activities such as spraying and harvesting manually or with the help of farm labour. On top of that, micro surveys reveal that tractors are not even being used very efficiently. Their use in many parts of the country ranges between 500-600 hours per year as compared to a benchmark figure of 800-1000 hours for better utilisation.

Farm machinery such as laser levelers, field cultivators, mowers, combine harvesters, sprayers, backhoes, etc. should also be made available to the farmers to increase farm productivity. Farmers in India have limited access to modern machinery. Many farmers still rely on traditional farming techniques. Technological interventions in farming can usher massive changes. According to a report by the Indian Council of Agricultural Research, climate change could reduce agricultural yields by up to 9 percent. If that were to be true, farmers would be harshly affected by it. However, with climate-resilient technologies, farmers can make informed

Farmers in India have limited access to modern machinery. Many farmers still rely on traditional farming techniques. Technological interventions in farming can usher massive changes.

choices with respect to their farming practices and thereby avoiding climate-change shocks. India has approximately 13 crore farmers of all kinds - small, medium, marginal, large. However, only a very less percentage of this big number is aware of the vast possibilities that they can tap on with the help of digitalisation. Digital transformation in this sector is bound to make the farmers more resilient against the major possible challenges in terms of access to information, weather predictions, soil fertility, and better cropping patterns, etc.

The need of the hour is to provide farm equipment on pay per use basis. Since most of the farmers cannot afford to buy expensive machinery on their own and usually end up getting trapped in debts as a result of buying/loaning costly equipment, there should be a means by which they do not suffer from such extreme losses. 'Uberising the farm services' can help in solving India's farm crisis as more and more equipment are made affordable and accessible to the farmers on pay per use model. By allowing farmers to rent out their assets, farmers can pay off the purchase cost and even generate more revenue. Providing farmers with such lucrative choices is all the more important now due to the uncertain pandemic shocks

that may affect them.

When COVID-19 hit us last year, agriculture was the only sector to have reported a positive growth of 3.4 percent at constant prices in 2020-21. While the Indian economy contracted by 6.5 percent, on the whole, the farm sector expanded. Recent data suggests that India's agriculture exports also jumped from

17.34 percent to \$41.25 billion in FY21. What proved beneficial for this sector was the exemption from the nationwide lockdown and good monsoon. This also proves the massive potential of this sector. However, as the rural areas are affected due to the second COVID wave this time, the situation has changed and farm-related activities may not go unhindered.

In perspective, while our agricultural exports soared to a six-year high of over \$19 billion in 2020-21, we still have challenges that need to be addressed. The pandemic has opened opportunities in agriculture in India, which, if recognized early can help in doubling the farmers' income. Many experts believe that India's economic recovery would be V-shaped and agriculture would play a prominent role.

In order to double farmers' income and increase productivity, farmers need cost-effective technologies available to them. A tractor is one of the many farming machinery that can be deployed. The use of sensors, drones, GPS technology, robots, etc. can make the lives of farmers easy. Since India has now improved remarkably in its digital connectivity, farmers can also use this high-end equipment with the help of private players, government, or farmer producer organizations. Only when at least a considerable percentage of farmers begin putting in service various kinds of farming equipment other than a tractor on their farmland, can we successfully declare that there is high agriculture mechanisation in India.

Source : www.cnbtv18.com

Online Meetings



www.agricultureinformation.com

Upcoming events

AUGUST 9, 2021

3:00 pm

Dr. Pankaj Sharma on "Constraints for sunflower production in India"

05.00 PM

Dr. Virendra Pratap Singh on "Integrated weed management in major kharif crops"

AUGUST 10, 2021

3.00 PM

Mr. Lucky Agrawal & Mr. Mayur Chumbalkar on "Cashew nuts processing in detail"

5.00 PM

Mr. Rahul Paharia on "How to setup mango processing plant"

AUGUST 11, 2021

3:00 pm

Mr. Tejas Joshi on "Selection of different product processing machinery"

05.00 PM

Dr. Neeharika Kanth on "In Vitro grafting in fruit crops"

AUGUST 12, 2021

3:00 pm

Mr. Yogesh Rajkumar on "Importance of international marketing in agriculture sector"

05.00 PM

Mr. Sushil Kumar Choudhury on "How to set-up rice mill and its economics"

AUGUST 13, 2021

3:00 pm

Mr. Rajender Kumar on "Sweet pepper – A profitable greenhouse crop"

05.00 PM

Dr. P. Venkataravana on "Modern cultivation practices in groundnut"

AUGUST 16, 2021

3:00 pm

Dr. Sharanakumar A Biradar on "What is Agroecology ? (Forage and Pasture) and Integrated Farming Systems"

05.00 PM

Mr. Kulkarni HB on "Organic Food FPO's challenges and opportunities in Madhya Pradesh"

AUGUST 17, 2021

3:00 pm

Ms. Monika Shukla on "Management of Saline Vertisols – for better crop production"

5:00 pm

Mr. Pavan Muddanna on "Zero Budget Natural Farming Methods (ZBNF)"

AUGUST 18, 2021

3:00 pm

Dr. Devarajareddy NJ on "How to rejuvenate bore wells in agricultural farms / bore well recharge in simple way"

05.00 PM

Mr. Shivakumar Swamy on "My 20 years experience : How to do organic agriculture/horticulture with too little water"

AUGUST 19, 2021

3:00 pm

Dr. Venkata Sameer Kumar on "How to make a higher yield in pulses?"

AUGUST 20, 2021

3:00 pm

Mr. Palaniswamy on "About rice mill industry: Rice processing methods"

05.00 PM

Mr. Nintin Singhal on "Value added products of neem"

AUGUST 23, 2021

3:00 pm

Dr. A. Amarendra Reddy on "Schemes for value addition and food processing industry development"

05.00 PM

Ms. Simmi Ranjan Kumar on "Value addition of underutilized crops such as millets and legumes"

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Online Meetings



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Recently Completed Meetings

Dr. Priya P. on "Methods of composting"

Dr. Priya P. is an Assistant Professor (Agronomy) at College of Agriculture (University of Agricultural Sciences, Dharwad) in Haveri District, Karnataka. Her interests are Nutrient Management, Organic Farming, Precision Farming & Nanotechnology and Integrated Farming Systems.

Dr. Sushant Shekhar on "Mushroom value added products"

Dr. Sushant Shekhar is the Founder & Director of Jayaa Agro Foods in Deoghar, Jharkhand. His interests are mushroom cultivation, manufacturing and value addition. To know more view <https://bit.ly/39wZtiQ>

Mr. R S Venkatraman on "Value addition of sugarcane jaggery"

Mr. R S Venkatraman is the Proprietor of Natura Food Products in Bengaluru, Karnataka. He says majority of the sugarcane jaggery production units are following the traditional production process only. It is mainly because this industry is run by traditional people only and hence there are no new entrants who could think differently.

Dr. V. Vani on "Processing and value addition of jack fruit"

Dr. V. Vani is the Assistant Professor at Horticultural College and Research Institute in Periyakulam, Tamilnadu. Her interests are Food processing and preservation; Nutrition; Post harvest technology of fruit & vegetables and Quality control of processed products.

Mr. V. P. Senthil Kumar on "Nutrient, pest & disease management in banana"

Mr. V. P. Senthil Kumar is the Director – Marketing & Technical of Jayaree Biotech in Hosur, Tamilnadu. His interest is tissue culture banana. To know more view <https://bit.ly/3AS4grU>

Dr. Bikash Ghosh on "Improved methods of cultivation of li-tchi"

Dr. Bikash Ghosh is a Retired Professor at Bidan Chandra Krishi Viswavidyalaya in Mohanpur, Nadia District in Bidan, West Bengal.

Mr. Gorityala Vidyasagar on "Climate Smart Agriculture – How to solve the challenges arise from the climate changes"

Mr. Gorityala Vidyasagar is the Assistant Director of Agriculture at Department of Agriculture, Govt. of Telangana, Hyderabad, Telangana. To know more view <https://bit.ly/3yt9Cba>

Prof.(Dr) R P Singh Ratan on "Support and value chain management for sustainable food systems"

Prof.(Dr) R P Singh Ratan is the Dean (Agriculture) at Jharkhand Rai University in Ranchi, Jharkhand. His interest is Agricultural Extension Services.

Ms. Anjali Choudhary on "Growing own food in urban homes"

Ms. Anjali Choudhary is an Research Assistant at Indian Institute of Management in Ahmedabad, Gujarat. To know more view <https://bit.ly/367ZGYy>

Ms. Sapna Nigam on "Artificial Intelligence in Agriculture – To solve number of challenges and optimize production"

Ms. Sapna Nigam is a Scientist at ICAR-Indian Agricultural Statistics Research Institute in New Delhi. To know more view <https://bit.ly/2UhuNHM>

Shri. Mahendra M Manivaasan on "Why Organic farming is not successful?"

Shri. Mahendra M Manivaasan is the Founder Chairman and Managing Director of WEESA Farmers Producer Company Ltd., Perambalur, Tamil Nadu. To know more view <https://bit.ly/3qWcytj>

Mr. R.R.Baskaran on "Agricultural products, consumable products: Differences among them"

Mr. R.R.Baskaran is the Managing Director of Nerkkalanjiam Collective Farming Farmer Producer's Company Limited in Kumbakonam, Tamilnadu. His interest is making agriculture ecological and poison free in a sustainable way.

Dr. S Varadharaj on "Profitable Moringa and its value added products: A case study"

Dr. S Varadharaj is an Associate Professor, Dept of Social Sciences at Tamilnadu Agricultural University, Horticultural College and Research Institute in Theni, Tamilnadu. His interest is moringa crop.

Ms. Kshitiz Srivastava on "Vegetable farming - Management of root knot nematodes"

Ms. Kshitiz Srivastava is a Research Scholar at Odisha University of Agriculture and Technology in Patna, Bihar. Her interest is plant production. To know more view <https://bit.ly/3d8Vlbv>

Mr. P.K.Unnikrishnan Nair on "Innovative technology for coir pith processing"

Mr. P. K. Unnikrishnan Nair is an Engineering Scientist at Truman Enterprises in Coimbatore, Tamilnadu. He says coir pith is the by product obtained after the extraction of fiber from coconut husk. Four years of research with the collaboration of Tamil Nadu Agricultural University, Coimbatore, has gone into inventing innovative technology to process coir pith and husk along with the design and fabrication of suitable machines. This technology is first time in India may be probably globally has multiple benefits and beneficiaries and solution to a lot of problems faced by the industry for the past more than two decades.

Dr. Mam Singh on “Plug plant production in ornamental and flower crops”

Dr. Mam Singh is the Principal Scientist at ICAR- Indian Agricultural Research Institute in New Delhi. Plug plants are seedlings which have been germinated and grown in trays of small cells. When the roots have grown sufficiently they can be easily pushed out of the trays and either transplanted into larger pots or planted outside in the ground.

Mr. Lakshmikanth on “Growing tissue culture banana plants”

Mr. Lakshmikanth is the Proprietor of Vigneshwara Biotech in Bengaluru, Karnataka. His interest is growing tissue culture banana G-9 & yelakki plants. To know more view <https://bit.ly/3wQ2y8b>

Mr. N.Narasimha Reddy on “My experience in tomato cultivation including sorting, grading, packing, transporting and marketing”

Mr. N. Narasimha Reddy is the CEO of Shri Amaranarayana Horticulture Farmer Producer Company Limited in Chintamani, Karnataka. To know more view <https://bit.ly/2SSi9oY>

Dr. Chandra Kiran Sant on “Opportunities and Challenges in Indian Dairy Sector”

Dr. Chandra Kiran Sant is the Dairy Advisor at Livestock Management Centre in Mumbai, Maharashtra. He is also associated with 1) Gomati Cooperative Milk Producers Union, Tripura as Expert Dairy Development for improving the milk quality & quantity as well as oversee installation of 40000 LPD Dairy Processing Plant.....

Dr. Rajeshnallaiah on “How to increase soil fertility and reduce input cost”

Dr. Rajeshnallaiah is the Director & CEO at RNR Agri Developers in Madurai, Tamilnadu. To know more view <https://bit.ly/3vvPKCc>

Mr. Thillaikannan Veeraragavan on “Sugarcane development with mechanization to overcome labour problems”

Mr. Thillaikannan Veeraragavan is the Manager, Agriculture at Kiryandongo Sugars Ltd., in Kigumba, Kiryandongo District, Uganda. His interest is farm mechanization.

Dr. Geetha P.N. on “What is sustainable agriculture? What are the different types of sustainable farming methods?”

Dr. Geetha P.N. is the Director(India Operation) at World Alliance for Planetary Health – USA in Cochin, Kerala. Her interest is sustainable agriculture. To know more view <https://bit.ly/3wtkTYn>

Mr. Samiran Patra on “Business opportunities in seed production of pabda and koi”

Mr. Samiran Patra is the Subject Matter Specialist, Fishery Science at Murshidabad KVK, West Bengal University of Animal and Fishery Sciences in Jiaganj, Murshidabad District, West Bengal. To know more view <https://bit.ly/2SyrD8A>

Dr. PK Shrivastava on “How to establish a dairy business successfully”

Dr. PK Shrivastava is a Dairy Business Consultant at M/s. Dairy Consultancy India in Bengaluru, Karnataka. To know more view <https://bit.ly/2Sj19bn>

Ms. Joanna Kane-Potaka on “Opportunities for millets cultivation and value addition”

Ms. Joanna Kane-Potaka is the Assistant Director General (External Relations) & Executive Director, Smart Food at International Crops Research Center of the Semi-Arid Tropics (ICRISAT) in Hyderabad, Telangana. To know more <https://bit.ly/3iery2F> <https://bit.ly/2SchEpA>

Dr. Lachhman Das Singla on “Early and accurate diagnosis of parasites in proper management of dairy ”

Dr. Lachhman Das Singla is the Director, Human Resource Management cum Professor and Head Veterinary Parasitology in Guru Angad Dev Veterinary and Animal Sciences University in Ludhiana, Punjab. To know more view <https://bit.ly/3z91tdt>

Dr. Rajiv Kumar Agrawal on “Hydroponic fodder production”

Dr. Rajiv Kumar Agrawal is the Principal Scientist at ICAR- Indian Grassland and Fodder Research Institute in Jhansi, Uttar Pradesh. His interest is hydroponics. Low productivity of livestock is a matter of concern which is usually attributed to poor fodder and feed resources over the seasons and regions as well as unproductive animal breeds.

Dr H.C. Gena on “Wasteland development through afforestation ”

Dr H.C. Gena is the Chief Project Manager at Indian Farm Forestry Development Co-operative Limited (IFFDC) in Gurgaon, Haryana. Indian Farm Forestry Development Cooperative (IFFDC) is a Multi-state Cooperative working in the field of Natural resources management particularly developing wastelands & marginalized lands through afforestation by promoting Primary Farm Forestry Cooperative Societies in Uttar Pradesh, Madhya Pradesh, Rajasthan and Uttarakhand States.

Dr. Veerangouda M on “Farm mechanization & advanced technology for achieving success in farming”

Dr. Veerangouda M is the Dean(Ag.Engg.) at College of Agricultural Engineering, UAS in Raichur, Karnataka. To know more view <https://bit.ly/3iwrNrX>

Dr. Kanchan Nainwal on “Organic farming: Opportunities and challenges”

Dr. Kanchan Nainwal is the Associate Director, Agronomy at Govind Ballabh Pant University of Agriculture & Technology (GBPUAT) in Pantnagar, Uttarakhand. To know more view <https://bit.ly/2Rz3f6t>

Dr. Udai Bhan Singh on “How to establish new orchard & high tech nursery”

Dr. Udai Bhan Singh is the Dean at College of Agriculture, Bharatpur, Rajasthan. His interest is establishment of orchard and high-tech nursery. To know more view <https://bit.ly/3gjFxDn>

Dr. Basavaprabhu L. Patil on “Cutting edge technologies for the management of viral diseases in crops”

Dr. Basavaprabhu L. Patil is the Principal Scientist at ICAR-Indian Institute of Horticultural Research, Bengaluru, Karnataka. His interest are viral diseases of plants and their management. He says plant viral diseases cause serious crop damages and yield losses across the world and hence posing a huge risk to the food security. Almost every economically important crop plants are affected by viral diseases, against which there are no formulations for treating these viral diseases, unlike the fungicides against fungi and the bactericides against bacteria. To know more view <https://bit.ly/3wQ2y8b>

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TALKING TO



Arnab Vohra

Managing Director

Urban Growers LLP, New Delhi

are being supplied to these states on a monthly basis. We soon expanded our product line by including fresh fruits and vegetables for export purpose and decided to explore that vertical.

Exports: Currently we are handling about 15 SKUs in our product portfolio. We procure our produce directly from the farmers. We have tie-ups with cold storage and packing facilities where produce is packed and loaded in the containers. We are purchasing from farmers and FPOs in the country. We provide farm to container stuffing services to the exporters, that is right from farm procurement to domestic transportation to pack houses, where the company does packing, sorting, grading, strapping, and container stuffing. This service is availed by existing and new exporters.

The established exporters have the advantage of just managing the process and exporting as they have a strong buying network with the exporting countries. For the new exporters, we make it easy by doing all the ground work required. The execution time to stuff the container by sea is 3 days and 24 hours by air, which is the lowest in the country.

So far, we have successfully executed 200 tons of export orders within 18 months of starting this service. We have tie-ups with domestic cold storages in Maharashtra, and we are actively looking for such tie-ups in Gujarat, South India, and Northeast India. It is important to localise cold storage to curtail transit time and avoid quality deterioration.

We have innovated the redundant process of exporting perishables by packing the produce on the farm itself, stuffing in the container, transporting by railways to the port, and then shipping it off. It has helped us to avoid doubling

of logistics, labour and resulted in significant reduction of time and improved the quality of product as there is no pilferage and lags in supply.

Wholesale: We are working with distributors, wholesalers, and institutional buyers, and are on the look out for new alliances and customers. The produce that lands in Mandis does not have source of origin certificate or date of harvesting certificate. Nobody knows when it was harvested, how transportation took place, its shelf life and this results in quality degradation. Consumer awareness has increased, especially after this pandemic, people have become more health conscious and particular regarding the fruits and vegetables they consume.

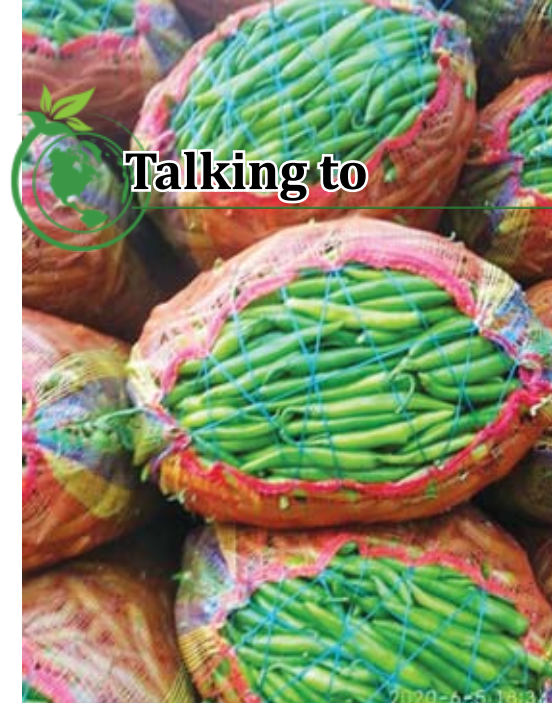
The third vertical is retail. We were supplying certified organic products to companies like Big Bazaar in New Delhi. The pilot project was started last year. We felt a robust supply chain is needed to supply certified organic products to our clients. We are supplying 20 SQA certified organic products and high quality non-organic products directly procured from the farms. We have very attractive packaging made of biodegradable material which is shelf-friendly, and presentable. We are willing to share the details with anyone who is interested in buying.

The fourth vertical is processing. When the lockdown came into force, the entire system was shaken up. Traditional movement of fruits and vegetables was disrupted. During that time we tied up with farmers in UP and supplied 150 tons of green chillies to processing units. In processing, we buy straight from farmers, and with the help of district horticulture officers and our team, we were able to identify surplus production clusters. This helped us keep the price in check. When there is surplus

Mr Arnab Vohra is the Managing Director of Urban Growers LLP, New Delhi. The company was established in 2017 and provides expert turnkey solution for fresh Fruits & Vegetables. They are further expanding into various allied verticals such as retail, wholesale, processing, and exports. They have tie-ups with farmers and FPOs throughout the country.

We had our own indoor mushroom growing facility in Okhla in New Delhi where we were growing 3 varieties of mushrooms in an area of 1800 sq ft under controlled environment. We soon started our second facility near Rohini to grow fresh oyster mushrooms. We soon began outsourcing production of button mushroom and started working with farmers through mandis. We observed that the farmers were charged commission and labour handling as a result the product was costly and of low quality.

We started purchasing button mushrooms from suppliers from Sonipat belt, and started supplying to Chennai and Odisha in particular. These two states in particular showed good demand for button mushrooms. We deliver by railways in ice box packing of 18 kgs each containing 9kg ice. About 50 tons



production, the farmer is forced to sell his produce to local commission agents. But now with APMC laws in place, he can go to private companies without paying the APMC fees. The advantage the farmer will have with us is we offer on field assistance during harvest process, this keeps the parameters in check, and helps them sell their entire lot without running to different agents.

We also offer rudimentary process of farming, such as air drying and removal of stem for green chillies, and in order to avoid labour and time, we offer this service on the field itself. Air drying is done by the farmers. We offer customised delivery schedule to processors to match their production cycle. We have zeroed down on clusters around the country where we have tie-ups with farmers. We are actively looking for farmer producer organizations, agripreneurs, farmers, and local agents to tie up with us and aggregate the agriculture produce at the local level. We also invite farmers who want to sell their produce at the national level. We assist our clients right from on-farm procuring, packaging, financing and arranging of certification according to different countries requirements.

We feel that farmers should explore an alternate to the traditional mandi system in order to gain fair price for their produce. We want to help the farmers by advising them with what variety of seed to sow, what mode of transport to use and whether to go via APEDA ter-

minal or not. We are also looking for new packhouses and cold storage facilities in South India. We are also interested in certified and non-certified organic products for export especially Okra, green chilli, and drumsticks since these products that have tremendous scope in the European market.

Can you provide a roadmap for the standard procedures to adopt for new ventures to market produce?

In the agriculture exports sphere payment terms have to be checked thoroughly, especially when dealing in UAE markets who are the worst payment markets. UAE markets function exactly like the local mandis. Produce is sold at the market rate prevailing by the commission agent who deducts his share and passes the rest to the exporter. There is no fixed rate for the produce. I would seriously urge all exporters not to fall for this. We understand there is some sense of coordination among importers in UAE. So an exporter sends the produce at an ongoing market price and once the produce lands, the rate falls leading to a loss for the exporter. Anyone entering the agriculture exports business in his initial orders should get fixed rates, get diligent terms of payment, go through government organisations such as ECGC that covers 95% of payment for any exporter, which is like an insurance cover for the payment.

About mandis, I have never been to a mandi to sell my produce. They have to bypass the mandis and the companies to buyback. They have to wait for somebody to pick their product and they are at the mercy of somebody else. With organic produce, a few may be doing it. But do you feel to aggregate and do meaningful business is not possible?

At the end, every production is at the mercy of marketers and distributors. Even huge companies operate this way to sell their products. The manufacturer cannot reach the buyers directly. The marketers and distributors do the aggregating of produce. Being at the mercy of someone, it has a lot to do with the kind of aggregator the farmer is working with. There are lots of aggregators who are greedy, catering more to buyers than farmers' interests. But I don't think there is any other option than del-

egating the responsibility to market.

Certified organic farmers are less, and round the year availability is difficult. We stopped supplying to Big Bazaar because we were unable to meet the demand. At that time, we were working with a group of farmers in UP, who had seasonal produce with them. Once it was over, crop rotation time came in. So we found alternative belts from where we can substitute the produce in the off season when the local farms are not producing. This is how we manage the year-round supply. You need to think locally and pan India network and have farmers from other states ready to supply in the off season when the local farmers are not able to supply.

Apart from vegetables and fruits, do you deal with jaggery? Is there scope for powder or lump form?

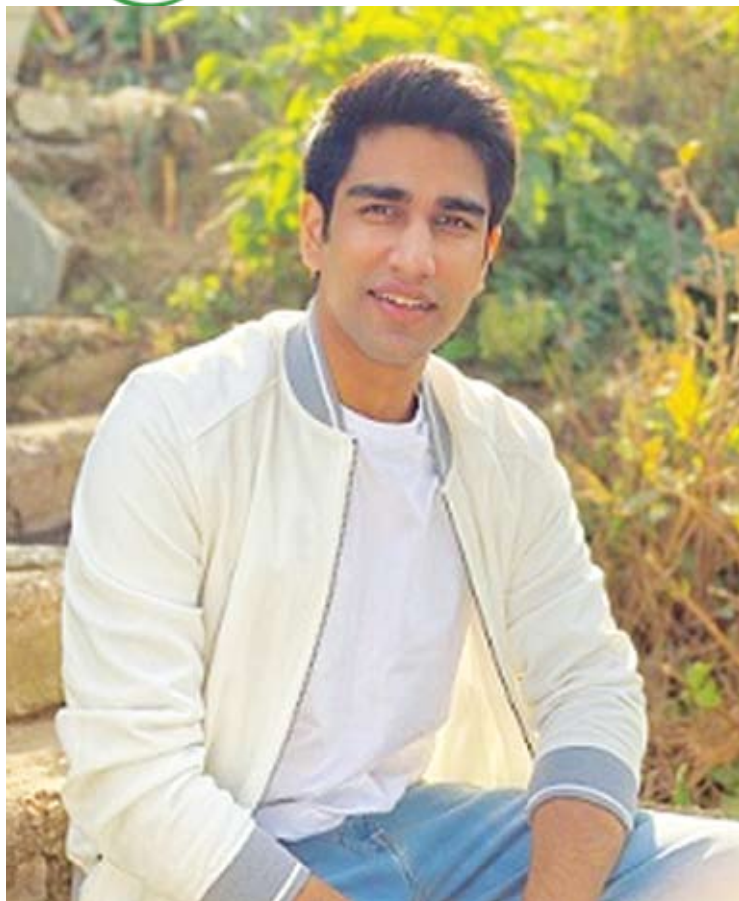
Currently we are not handling jaggery. We are constantly expanding our portfolio. You can shoot us an email with your product and packaging, and we can look into marketing it. We see lot of demand in international market for jaggery powder as the world is moving away from sugar. Younger generation is not taking sugar. It is all about making sugar free products and jaggery powder which acts as a substitute to sugar in beverages. The only downer with jaggery is the difference in taste when used in beverages. Jaggery powder in retail packages has immense market potential at the international level if marketed in the right way.

We have a facility in Kolhapur, border of Maharashtra and Karnataka. The facility is in the highway, but no-





Talking to



body has come up with a cold storage yet. Can you take advantage of the facility here which has all back-up and infrastructure? Do you have requirement of jaggery which we are making in the coastal areas?

The facility we use is in Vashi, Navi Mumbai. Kolhapur is a very attractive place. You can send us an email with all details, and we will look into it. You can also write to us about jaggery, and we will try to take it forward.

For someone who is at a zero platform, how best can we make a project report, or can you make a project report and guide us on how we can collaborate with you? Are you ready to have a contract farming with farmers?

We are doing contract farming in a

couple of areas. We have a lot of institutional buyers with regular demand. We have a regular demand calendar plan already. If we have a supply calendar also, it is a big win for us. In our contract farming, we focus on excess and viable production cluster. We inform the farmers the variety we want, the harvest time, and the volume we need. We predetermine all this on day zero of harvest and pick up all the produce. Since you have 4 acres of farm, we can get you tie up with one of our institutional buyers and arrange to pick up your produce year-round. You can plan 3 crop cycles a year. You can

tell us which crop is grown comfortably in Hyderabad depending on the climate and soil condition. If your farm is organic, and soil levels are permissible, we can pick your produce for export purpose which can fetch you higher price.

We are from Bangalore and grow exotic mushrooms in hilly areas. Is there any value addition that we can do with a self-help group in hilly areas? Do you have any buyback arrangement or agreement on exotic mushroom?

We are not into retailing in Bangalore. If you want to promote self-help groups, the easiest is to cultivate oyster mushroom. The growing medium is paddy straw that is thrown away or

burnt by the farmers, so there is no input cost. Temperature requirement is not great unlike button mushroom which requires 14 to 18 degrees after pinning starts. You can have temporary makeshift sheds for oyster mushrooms as done in Sonipatt belt. Oyster mushroom can be a better choice to promote self-help groups, and they should be supplied to metropolitan cities which are within 4 to 5 hours of travel, otherwise the quality of mushroom starts deteriorating. In terms of value addition products, you can look for oyster mushroom powder and dehydrated ones. Patanjali and lots of pharmaceutical firms require them.

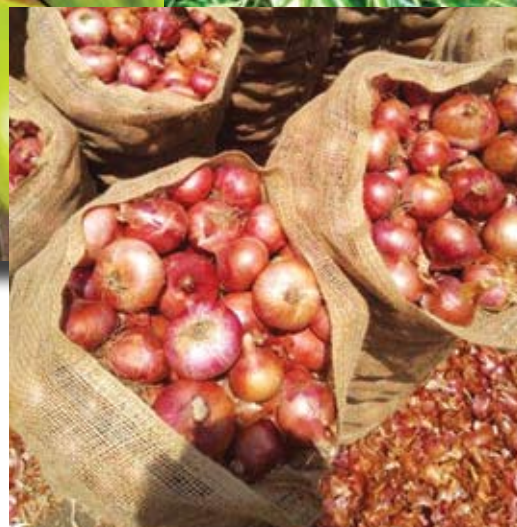
What is the investment to start in a small way?

It depends on the kind of input. You can tap the farmer network and get straw for free. So the investment is needed for shed preparation and seeds. If you have 1500 sq ft, since mushrooms grow vertically, you can make 3 layers of 1000 sq ft, which will be 3000 sq ft for growing. So the investment will not exceed more than a lakh including the cropping materials for the first cycle.

What do you think of residue free products in organic farming?

We found that whatever bulk volume we got are not residue free. Certified organic products are difficult to get in India. Organic certification is tedious and a long process, and conversion from nonorganic to organic takes 3 to 6 years for any farm depending on the residue levels. Since ground water is common, if your neighbouring land uses urea and chemical fertilizer, even if you keep your soil clean and organic, ground water from the neighbouring soil will contaminate your land too. The future of organic farming is going to be predominantly residue free produce. So I think residue free products has lot of opportunities as importing countries like UK and Singapore are strict and have started demanding for residue free products.





What are your thoughts on exotic vegetable market in India and Delhi?

The market is huge as HORECA industry grows, people travel, and the culinary experiences are getting better. Exotic vegetable market will grow exponentially. But they will not see the bulk movement as the traditional vegetables are used in processing sector too. Exotic vegetable market is a promising sector and method to market to get good synergies with retail and culinary experience outlets because that is where the real demand is.

We have a robust chain of 5-star hotels, restaurants and we supply locally. We currently procure capsicum, avocado, iceberg lettuce, zucchini from Maharashtra belt and south India as well.

For exotic produce like elephant yam from Andhra, MNK1 golden custard apple variety from Maharashtra, do you think you can get international market for us?

We picked 2 tons of elephant yam from Andhra and did 2 containers during lockdown to UAE. Fresh elephant yam and dried ones have different markets. Vietnam and UAE are the major exports for elephant yam from India. For Custard apples, European and American belts are conducive and get better prices. We will be interested in marketing them.

If you talk about mandis, we have been selling lots to Azadpur in Delhi and Sholapur in Maharashtra. Do

you think they will become imperative at a given time?

Both need to exist side by side. Mandis set rates for markets. Market is largely unorganized. They work on demand and supply forces. Rates have to be dictated by mandis and the small, fragmented demand cannot be catered to by private players. Small restaurants or small shop owners cannot tie up with us, and we also cannot serve their orders.

Here come mandis. But for institutional buyers who have regular demand and those who purchase for exports, mandis are big minus points. People have incurred heavy losses because the traceability factor does not exist in mandis. They are imperative, they exist, and there are instances they are not imperative in all verticals.

We have a group of farmer from Kolhapur who grow exotic vegetables but have no market due to pandemic. Can you help us to market the

produce such as red cabbage, zucchini, etc?

Yes, we can look into it. We have good market for exotic vegetables in Delhi. But the exotics from Maharashtra have shorter shelf life. We have to look at the surrounding markets to sell the produce.

Can you please tell us how many employees are there, and what is your turnover?

We cannot disclose our financial details. We have a strong team of 20 on field procuring agents who work on order basis and 5 to 7 employees on our payroll who are working in our corporate office in New Delhi.

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Talking to

Hari Mohan

Cocoa Agriculturist
West Godavari District, Andhra Pradesh

Mr Hari Mohan is a lawyer turned agriculturist, who does not regret his decision one bit. Although his fore fathers were into agriculture, he admits having nothing to do with agriculture until he decided to venture into it.

Mr Hari Mohan explains, "I came into the world of farming in the year 1998, when I was practicing as a lawyer. At that time, I came in contact with a few people through whom I came to know that cocoa creates very good alternative income for farmers. I inquired extensively about this after which I decided to purchase a piece of land.

I was extremely new to the farming field back then. Earlier to that I had no experience even going to fields and watching how things were done. Upon purchasing the land, I enquired about coconut trees and planted those. Around that time, Cadburys' started their agriculture sector here and began giving away their cocoa saplings which was sold back then at 50p per sapling. I had my coconut at 27ft spacing. Since cocoa is a shade-loving plant it could be planted after 3-4 years of planting your coconuts. So, in 1991 I got in touch with Cadburys who had by then, started their sales and marketing sector here. They were excellent guides. They told me how to plant cocoa etc. I bought their saplings.

On a one acre plot, you can plant about 180 plants when you are inter cropping with coconut. After that I was stuck about how to care for the plant. I then did a lot of reading and I got a lot of information. I put to use all the information I gathered. As a result, I was able to and am still able to generate good income from cocoa. I took time because during those days it was extremely hard to source information. Today it is available at your finger tips. Even the horticulture departments today are very much friendly and knowledgeable."

How do you cultivate cocoa?

First you have to get the saplings. It is best to plant them as an inter-crop between coconut. If your coconut is placed at a distance of 27ft, you can plant about 5 cocoa plants in between two coconut trees. After 24 months of plantation you will begin getting returns. Before planting of course you have to treat the soil with organic matter and manure. You can plant these cocoa plants in between palm trees as well.

After a year, these plants grow up to 5-6ft. It will develop 5 branches similar to an umbrella. After that you have to do regular pruning in the months of June - July. The plants should not grow more than 10 ft. October to June is when you get peak yield from cocoa. The duration of the plant is about 25 years. With good care, they can go up to 30 years as well. You have to regularly watch and replace the diseased plants, if any.

Irrigation

If you have surplus water, flood irrigation is the best for cocoa. Having said that we all know about drip irrigation. Drip can also be employed. The water requirement is, for every 7 days, in summer season, the fields must be irrigated. In monsoons, of course, this is not required. During monsoons, irrigation can be provided depending only on the ground moisture.

Manuring

Provide 5-10 kgs of cow dung every year. The complex manure like urea, ammonia, neem powder etc, can be used 200 grams in the first year in 2 regular intervals. Then, depending on the growth and requirement of the plant this must be increased.

Harvesting

You can expect a standard yield from the 36th month of planting your crop. Cut the pod when it turns from green to yellowish color. Extract the wet bean from the fruit. Keep it then in heaps and leave it for fermentation for at least 5-6 days. Post that, it has to be dried in sunlight for more than 5-6 days until it dries fully. Ensure that it is left to dry on a clean and flat cement surface. If you get 21 pieces which amounts to 100 grams it can be considered a good yield.

What are the advantages of cultivating the cocoa?

Cocoa is a tropical plant which is inherently a wild plant and so it is highly resistant to natural calamities. With good support, it is an amazing plant to grow. Just ensure correct managerial procedures. Prune the plant regularly such that it is shaped like an umbrella and the maximum height is not more than 15ft no matter what the age of the plant is. With proper care at all stages from sowing the sapling to drying the bean you can make Rs.30,000 to Rs.40,000 every year. The market is very good. All the chocolate industry has a good demand for cocoa and the payment system is pretty prompt. People come to your doorstep and take the produce. With the booming chocolate industry the demand is very high.

Statistics show that even if the cocoa cultivated land is doubled, it is not sufficient to satisfy the basic demand of the industry. With respect to marketing, the demand is very high compared to the production. You





can get your revenue based on the international market and dollar value. These days it is Rs.120 owing to all the calamities. But you can expect peak amounts of Rs.210. On an average you can get Rs.160. This is the assured amount you can get every year. If you follow good agricultural procedures, you will get 350 - 400 kgs per acre every year. 30-40% of your revenue will go back into the field and the rest is your profit. Just keep in mind that the quality of the bean is superior.

What are the main pests and diseases that can attack the cocoa?

There are two types of diseases that I have come across so far:

1. Fungus attack: Post pruning, the plant is sensitive to fungal attack at its branch ends. This can be avoided by using blue copper or biotech.
2. Caterpillars: Use chlorophyrophos to keep caterpillars at bay. Don't use it in huge amounts because whenever you use it, cross pollination also decreases as this chemical affects honey bees as well. Hence, use only a mild dose of chlorophyrophos. Spray it only once in 10 days. Also, do not use the chlorophyrophos in its concentrated form.

Apart from these, stagnant water is not good for cocoa. The soil should have good drainage properties.

After I plant coconuts, when is a good time to plant cocoa?

You can plant cocoa after 30-40 months after coconut planting. That will ensure enough shade for the cocoa plants. You will begin getting yield from coconut trees from the 4th year onward. You get hybrid varieties of cocoa also now. This ensures quicker yields. You generally get cocoa yield from the 24th month but your standard yield begins from the 36th month. Coconut yield begins from the 4th year onwards. You can start making a regular income from the 7th year onwards. Before that also you will make money but it will be only just enough to support your farming practices.

How much income can I make per acre considering coconut and cocoa?

This depends on the area you are at as well. Here, we are selling coconut for Rs.800-900. A good yield is about 350 - 400 kgs after you have achieved stability. Per acre, after 6-7 years, you can get about Rs.800-Rs 1000 per plant and cocoa can fetch you a minimum of Rs.160 per plant. In terms of expenses, the max, on an average, you will incur is 40% of the revenue per acre. This is based on my practical experience, not based on any bloated marketing figure.

For how many years would a cocoa plant yield effectively?

The lifespan of a cocoa plant is projected as 25 years on an average. My plants have completed 25 years but my trees are still doing well. One



best practice I have done is I have always replaced diseased plants immediately. I keep my eyes open to ensure that this is caught and done regularly.

Which variety of coconut should be planted along with cocoa - the tall or the dwarf variety?

I would recommend, the dwarf variety. If you want longer coconut tree life, you will have to go for the tall variety.

Please tell us if you do any kind of value addition?

I do not do any other value added product. I sell it directly to Cadbury.

How long does it take to get paid from companies like Cadbury?

They take only one day. The payments are very prompt. I haven't had a difficulty on that front till date.

Where are these companies located?

They come and take the product from your farm and they remit money into your account. They even come and pick up one quintal. It is fairly easy to deal with them.

Has Cadbury ever refused to purchase from you? Do you have a Plan B?

Cadbury is a very good company to associate with. We have not had any issues with them till date. There are other local chocolate companies that are in the game. They also come and pick the product from you.

Is there any contract period agreement you get into with companies?

No, I do not have anything in writing from the company.

Have you sold to other private parties besides Cadbury?

Yes, I have. I have not faced any problem from them as well. The industry in general is doing well.

Would you be open to sharing Cadbury's details with others?

Yes, please get in touch with me for details.

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S. Ramakrishnan

Proprietor

Rynco Orchids, Trivandrum, Kerala



Mr S. Ramakrishnan is the proprietor of Rynco Orchids in Trivandrum, Kerala. He evinces keen interest in orchid farming, organic farming, and pest control predator and parasitoides. His firm, Rynco Orchids is the largest pot plants orchid farm in South India. His sister concern, Cryptox BioSolutions is into producing Macrobials like Predators and Parasitoides for the pest management on farming. In a recent interview, Mr Ramakrishnan elaborates on growing orchid plants in India which is a highly profitable business currently.

Mr Ramakrishnan points out that orchid farming has been booming since the last few years in India. He started his firm about 8 to 10 years ago when there were very few growers, but now the industry has grown up in a big way. Active farming of orchids is taken up in states like Kerala, Karnataka, Maharashtra, and Odisha, and many commercial farmers are also entering the sector and speeding up the business.

Orchid business falls under two categories – cut flowers and pot plants. Mr Ramakrishnan says that one has to decide which one to go for before venturing into orchid cultivation. Cut flowers business is easy, more so if one is keen on doing offline business. For undertaking pot plants, one has to be active, get good plants, take care of business, customer care etc. Cut flowers plants will last for 6 to 10 years. All that it requires is to take care of replanting, and they are alive for many years. Once the flower buyers are finalized, it will be a smooth affair.

One can take up Dendrobium, Vanda, Cattleya, Mokara,

In Konkan area, Maharashtra, there is good amount of rainfall only in 4 months of the year. Remaining period is dry. Will shade net help in growing Dendrobium orchids or is there any other solution?

During the rainfall, the growth of orchid plants is high and the same time Disease incidence also more and it can be overcome by adjusting the shade net to lower percentage of shade if possible. Yes, you can go for shade net cultivation. Shade net increases the microclimate like humidity and the dry period can be managed.

In my area, rainfall is for a shorter period and not evenly distributed. Since extra rainfall will spoil the plants, do you suggest shade net or poly tunnel system?

You can grow Dendrobium under shade net. There is no need for poly house.

I am a new grower of orchids in Chennai where the humidity level is more than 70%. I use blue metal and charcoal with 50% shade in my terrace. Can you guide me regarding shade net, humidity, and the potting mix I should use?

For Chennai, shade net is ideal. Since the place is close to seashore, orchids grow well. You can go for 100% coconut husk media. Before using the husk, soak them in water for few days to remove the lignin content from the husk and then use.

Can you explain the economics of the orchid cultivation?

You can go for large scale cultivation of cut flowers if you are sound in capital. Or go for pot plants cultivation and needs less capital with pot plants, breakeven is achieved usually within 2 to 3 months based on your investment. For cut flowers, it will take 3 years. The cost of Dendrobium cut flower is Rs. 15 to 25. For the local cut flowers, the market is different. The ones from Thailand are sold at a low price. The flowers grown in India are used for flower arrangements and fetch high price. They are sold at Rs. 15 to 30 which is higher than the imported ones. You must cultivate in one or two acres for cut flowers. You can tie up with contract growers and expand slowly to have your own market.

I have been growing orchids for the last 4 years. I find that Phalaenopsis variety gets very less flowers. What could be the reason?

Phalaenopsis initiate flower when the night temperature drops to between 18 to 20 degree for 2 weeks continuously. So this happens only during winter time or monsoon time in tropical area. So you will get flower buds only during these periods. This climate can be artificially created by using Air conditioner to induce the flower spike that's what





all the Orchid growing countries are doing.

How do you use desi cow dung and urine?

We prepare panchagavya using desi cow dung, urine, curd, Milk and other materials. It is highly helpful in growing orchids. It has very good beneficial microbes like pseudomonas and growth hormones to induce flowers and resist diseases.

Apart from Dendrobium, what other varieties can be grown in Konkan, Maharashtra?

You can go for cut flowers variety like Aranda and Mokara. High demand for these cut flower varieties in Mumbai market and other markets. You will get whatever price you demand.

Can you provide the basic sourcing material?

We are supplying sourcing material to all cut flower and pot flower growers.

I have a land near Coimbatore. I am planning to plant trees. Can orchids be grown in the shade below the trees? Which variety will you suggest?

If you are going for commercial farming, it should be done in open areas only.

Shady places are ok for hobby growers. Too much shade under the trees will reduce flowering.

Where can we get saplings from?

There are lots of suppliers in Kerala and Karnataka. You can approach them.

I am using two kinds of pots, plastic, and mud pots. I find healthier plants in mud pot. Is it due to the ventilation?

In a mud pot, humidity is high, and growth is better. Though getting mud pots is tough, plants grow well in them. Dendrobium can be grown in mud pots without holes too.

More than tabletop position, plants bloom better in hanging position. Why is it so?

The plants need breeze. The root system absorbs all the nutrients from the air. There is no need for fertilizers. Dry breeze however is not good for plants.

Due to the pandemic, have the import rules changed? Why do we find less import of plants?

There is no change in the import rules. It is because the flights are cancelled the cargo flight freight charges has jumped 100 to 200%

Is there any special variety to import to grow as a hobby? We get plants from South Asian countries. But from South America, Brazil, and other countries we do not get. Can we directly import from these countries?

If it is not a wild species, we can bring. There is no restriction about importing. We can help in importing such varieties.



Phalaenopsis, Cymbidium and Oncidium varieties. We can do cut and pot flowers with these varieties. Mokara and Aranda type orchids are good for Kerala climatic condition. Good quality planting materials are imported from Malaysia. The cultivation of this orchid is highly remunerative. Traders are willing to accept any price that is quoted. Within 2 to 3 years one can achieve breakeven, and the profit is quite high. Many people in Kerala have started cultivating orchids and are doing extremely well. They are even expanding the cultivation area.

Mr Ramakrishnan points out that there are a few vital areas that need constant attention and concentration of the cultivators. Some of them are selection of planting material, cultivating techniques, contract farming, flower marketing network, tissue culture and hardening and breeding. The cut flowers are going to be in the farm for many years, and so they need working on these aspects. One should make sure that he has selected the healthy plants, tolerant to local climate like rainfall and are regular bloomers. Any mistake in this will make the whole lifecycle of plants go wrong. One should have strong knowledge in this regard. Cultivation techniques are different for cut flowers and pot plants.

When selecting the plant, one should ensure that the plants are healthy and regular bloomers. Dendrobium Sonia yield flowers 10 to 12 flowers a year. The pot varieties may look beautiful, but their flowering will be less only. In Kerala there is heavy rainfall, which is ideal for Aranda, and some varieties of mokara that are tolerant to such rainfall, and they do not get much disease. Since these flowers are for decoration purposes, the vase life of the flowers should be long, and they should remain fresh for 10 to 15 days. Otherwise, traders will not accept them. In India, the preferred colours are dark red, yellow, purple, and blue, while in Japan they prefer light colours like light pink and white. Traders may also prefer white flowers. The good arrangement of flowers in a spike is important for packing and transportation. Haphazard arrangement will make it difficult to pack and damage the flowers.

Cultivation techniques for each variety is different and again





Floriculture

based on topography. It includes shade net selection based on the topography and availability of sunlight. The middle of Tamil Nadu has more sunlight, and in Central India it is very high. So one should adjust the shade net accordingly. With the help of the shade nets, one can adjust the microclimate too. Then comes selection of good fertilizer. Mr Ramakrishnan says that he buys the quality fertilizers imported from



Israel and other countries. Only specific companies' fertilizers are preferred specially fertilizer like Gaviota and Peters which is very good for orchids but it's not available in India. One should also have broad knowledge about protecting the plant, control of pests, diagnosis, and prevention.

Resorting to contract farming can be considered when one wants to expand the cultivation area for cut flowers. He may have to invest huge sums for the land. Instead, he can go for contract farming. Small growers can take over the cultivation, and the products can be bought back. In countries like Singapore, Thailand, Malaysia, Taiwan, and other places, people go for contract farming only. They give all the technical details to these small farmers to get better yield.

Mr Ramakrishnan points out that demand for orchid flowers is growing every day. People are looking for new varieties, and new products are needed. Orchid flowers are new to Indian market, and the demand is high. The growers are unable to meet the demand. Lots of varieties are available in India, and they can be further bred to create new hybrids. Already many breeders are working on getting new ones.

Tissue culture and hardening has huge potential in India. Due to the pandemic, importing has not been easy. Cut flowers planting material is quite expensive, and tissue culture reduces the price.

Mr Ramakrishnan points out that Rynco Orchids is not into cut flowers. The farm is located near the western ghat in Tamil Nadu and Nedumangad region of Kerala. They cultivate Dendrobium pot plants, Vanda, Cattleya, Mokara, Oncidium, Paphiopedilum etc. The whole system has been



copied from the farms in Thailand. The farm has post pillars made of concrete and shade nets on top which is working out very well in India.

Elaborating on how to take care of the plants, Mr Ramakrishnan insists that orchid cultivation is not like cultivating other plants. If there is any problem, one should be knowledgeable enough to understand the nature of the same. The orchid plants are epiphytic, meaning they cling on to the trees for support, but they do not take the nutrients away from the trees.

They will absorb nutrient from the air and do not cause any harm to the host plant. Nurserymen mix orchids with other ornamental plants, but he feels that orchids should be exclusive. Even while growing one can grow one variety of orchid like dendrobium and not mix with other varieties of orchids like mokara or Oncidium, and once he has gained full knowledge about the particular variety then he can try the other variety of the orchids, because each variety need different care.

Requirement of light and shade is different for each variety at different stages of growth. Orchids require more shade when compared to other flowering plants. And again, orchid Seedlings need more shade compared to flowering orchids. For flowering sun light has to be increased. Dendrobium and Vanda do well in 50% shades under Kerala climate. In Tamil Nadu it has to be increased to 75%. Depending on the availability of sunlight, shade net has to be provided to reduce the sunlight. For leaf growth, more shade is needed. Phalaenopsis need 8000 to 10,000 lux for seedlings and 15,000 to 20,000 lux for blooming stage. Shade nets have to be changed every five to seven years as their degradation process will affect the plants, and it will not filter the UV radiation.

Humidity where orchids are grown should be 60% and above and should be maintained at that. Occasionally drops below 60% is bearable. During summer minimum 60% should be maintained normally this will be maintained due to microclimate created by the shade nets and sprinkler irrigation system

Potting media include charcoal, coconut husk, broken pot pieces, blue metal, sphagnum moss, peat moss, etc. While



Floriculture

sistant variety when he is opting for cut flowers business. He can apply microbials like *Trichoderma* and *pseudomonas* to control the disease. Panchagavya can also be applied. There will not be any problem when organic fertilizers are used. Desi cow dung and urine are very useful. Dithane M-45 and Carbendazim can be used for emergency to control the diseases. If sunlight and humidity are adjusted, fungicides will not be needed.

For pest management, Mr Ramakrishna suggests predators and parasitoids. He is doing with *Trichogramma* at 5 cards per acre. This will kill pests at the egg stage. He also uses green lace wing 5000 eggs/ acre, reduvid bug 2000 grubs/ acre and no pesticides and fungicides are used. It gives lots of immunity to the plants. The sister concern, Cryptox BioSolutions produces these things and supplying to all the farmers.

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watering the media should be completely wet and it should dry before evening also. So one should select media based on their local climate. More water will rotten the root system. There should be balancing. When there is high rain fall and humidity, one should select charcoal and pot pieces, as practiced in Kerala. In dry places like Tamil Nadu and other areas, husk and moss are ideal. The media should be dry in the evening. Watering should be done only when the media is 80% dry. If it is dry for a long time, plants will die. Research has shown that orchids prefer to grow in wet media like coconut husk and sphagnum moss, but make sure that it will be watered only after the media is 80% dry

Orchids prefer wet and dry cycle. When you see the orchids in the forest there will not be any water or rain for few months in the summer, but they are able to survive because it spreads its root system to the whole tree and absorb moisture from air So a good root system can able to survive adverse condition. Hence commercial growers give more importance to the root system for a healthy growth.

It is ideal to water the plants in the morning. Monopodial like Vanda and Mokara are not having basal pseudobulbs, so they need watering at frequent intervals. Sympodial orchids have pseudo bulbs to store water hence comparatively they thrive more dry conditions and less water. Rainwater is always good for orchids.

Fertilizers can be given to the orchids in the evenings if the climate is hot. Otherwise, mornings are good to apply fertilizers. Before applying the fertilizers, plants should be wet with water which is always good. For better growth, one can go for 20:20:20 balanced fertilizer at 1 to 2 gm per litre of water. To induce flowers one can apply high phosphorus fertilizer like 13:40:13, 10:30:20. This can be given consequently 3 weeks and then followed by high potash fertilizers to improve the flower size like potassium nitrate (13:0:45).

Disease management can be done by keeping the plants dry. Under wet and high humidity conditions, disease incidence is quite high. There should be increased sunlight and reduced humidity. Reducing humidity is not always easy as Orchid plants need more shade and high humidity. Then they grow fast and flower fast. One should go for disease re-



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Organic Farming

Sanjay Aggarwal

CEO, Clover Organic



Mr Sanjay Aggarwal is the CEO of Clover Organic Pvt Ltd., Dehradun, Uttarakhand, and his company is providing sustainable organic products & solutions in agriculture, aquaculture and waste management. In a recent interview, he expresses his views on “Organic farming as a sustainable model”.

Clover was set up in 2008 and has a pan India presence. Apart from organic agriculture, they are also into organic aqua culture, solid waste management in terms of composting, foul odour removal, etc and Wastewater treatment, where they help large establishments in wastewater treatment like P&G, Ion Exchange etc. more efficiently. They also help in rejuvenating lakes and water bodies. Their modern factory is at Dehradun, which manufactures organic certified probiotic products with

a professional team of people. In Agriculture, they are working with State Governments of Mizoram, Manipur & Meghalaya to implement organic farming in about 50,000 acres. They are responsible for organic production, certification, processing, and marketing of produce on both B2B & B2C basis. They bring in innovation in terms of using radio to reach out to farmers, promoting settled agriculture, mass SMS, sharing cultivation practices in regional languages, setting up Farmer Driven Markets where farmers come and sell their produce.

According to him, Organic Farming is a production system that sustains the health of the soil, ecosystems, and people. It combines tradition, innovation, and science to benefit the shared environment and promote fair relationship and good quality of life for all involved. The whole world was more or less or-

ganic before the great wars. World wars created demand for weapons where the main ingredient was Ammonium Nitrate. Once the demand slowed down after the war, idle factories used this raw material to make chemical fertilizers. In the 2nd World War, there was a requirement for rapid food production to feed the soldiers. This led to the use of chemical fertilizers to keep up with the pace of demand. Large stockpiles of Sarin Gas (or Mustard gas) were found. It later found use as an insecticide. This helped chemicals enter agriculture and to some extent pave the way for Green Revolution.

The US invented Genetically Modified (GM) foods, led by Monsanto and others. EU created a trade barrier of organics, as they did not want US GM food to enter Europe and prosper. One of the principles in organic farming is that you cannot use any genetically



Organic Farming



modified seeds in the farming.

The key point in the definition of organic farming, according to IFOAM – International Federation of Organic Agriculture Movements, is the phrase “adapted to local conditions”. This resonates very well with “Vocal for Local” or even our PMs “Atmanirbhar” scheme. According to him it is time to re-invent organics in our Country.

He says that we have a wrong idea that West is the best. We try to emulate them though we gained freedom many decades ago! This does not suit us. Most of the mountain states still practice traditional or ‘non-chemical farming’. Our Organic Standards should allow their certification in short time instead of the traditional 3 years. Now the Ministry of Agriculture has come up with a new PGS (Participatory guarantee system) of certification, which is a good break away from tradition. According to him many more changes have to be made. He was happy to note that the Ministry is working on these slowly but surely.

Local varieties are being neglected for HYVs (High Yielding Varieties). This is leading to extinction of certain traditional foods, that could be extremely beneficial for us. There used to be > 5 lakh varieties of paddy before the Britishers colonized India. Now we have a few thousand varieties left in our Country. Thus, preservation of traditional seed is very important through seed banks.

Organic food is positioned as “food for the

elite” but not for the masses, with unreasonable rates. Organic or chemical free food can be made mainstream if several measures are applied without reducing the yield.

Today, when one says organic, the farmer says, “I am going to get a premium”. This is not true. No one can build a business on ‘Premiums’. Just like any other product it depends on demand and supply. When the organic movement in India started, the organic tea demanded 400% premium. Nigeria, Sri Lanka, and Vietnam joined in this race. Thus, today the premium for organic tea is less than 20%. This is because the supply of organics actually went up. There is a good demand for organics, but the supply outstripped the demand.

PRODUCTION RELATED CONSTRAINTS

Quantity of Nitrogen and minerals:

It is said that compost cannot supply required quantity of nutrients. The calculation is based on quantum of nitrogen required to grow a particular crop. Compost is for the soil but not for the crop. Compost is not a fertilizer! It is food or substrate for the soil borne microbes that in turn produce all the nutrients required by the crop.

Yield Drops: There is a misconception that the yield drops when compared to conventional chemicals. Initially it will be. But once you progress with the organic cultivation, by providing other organic technology, like crop rotation, mix farming, mulching etc., the yield does not drop. You can effectively reduce the chemicals anywhere between 20-30% in every crop cycle and eventually in about 2-3 years, you can

be fully organic.

No cure for pest and diseases: This is not true. There are hundreds of different cures for pests and disease. Starting from our traditional times, even in scriptures like Veda, written in 5000 years ago, they talk about pests and diseases. One can say that the farmers are the best scientists. They have come up with their own cures, and some of them are superior to the conventional chemical cures.

Focus on crop and not on soil:

Organic farming is being seen through a conventional lens. Once you change your view, you will see and realize the benefits. But be aware that one should understand that the focus should be given to the soil than the crop itself.

MARKET TRENDS

During these covid times, Ginger, lemon, turmeric, and millets have regained their superfood status. This has created opportunity to grow these and exploit the situation. Organic is now synonymous with “Immunity Booster” during these times. The consumption of organic produce has estimated to have increased by >600%. Also due to the pandemic situation, people are not spending money on other things, so they can afford to buy organic products, and this is creating increased demand.



These are some of the market trends that attribute to erating demand and creating - portunity for organic farming. e constraints discussed earlier be turned into opportunities, and e opportunities can be turned :obusiness models.



Organic Farming

SOME OF THE BUSINESS MODELS ARE:

Precision Agriculture or digitization in Agriculture: Brining in technology into agriculture is important and results in a high ROI. This is gaining ground. The use satellites, drones, sensors are extremely exiting avenues to realize growth. There are several ERP solutions available. Since this is still an emerging sector, there are avenues to build custom applications and implement them. This could be a high revenue generator. The agriculture value chain offers multiple opportunities for everyone. One has to find out what fits best as per your strengths and create a business.

Inputs (Biologicals, Mechanical, Herbal): There are close to 3,000 inputs in organic farming like growth promoters, pest controlling agents, and agents for post-harvest process. There is a huge opportunity to manufacturing and trading in them. Along with that there is always a scope for further R&D to create new products. The Government has created a mechanism of accepting new innovations by including them as part of FCO (Fertilizer Control Order) guidelines.

Training Programs: In Clover also we are developing several training programs. Recently we did a training on innovative ways to carry out >10 different ways to carry out composting. Also, there are lots of training materials available, and Mr. Aggarwal will be happy to share them. The farmers are eager to spend money in upskilling them.

POST-HARVEST MANAGEMENT

Training: As mentioned earlier, there are several training programs available on several aspects of Post-Harvest Management like Precooling, Cleaning and Disinfecting, Sorting and Grading, Packaging, and storage.

Cooling Chamber: This is a system to increase the shelf life of fruits and vegetables. As the production increases, the produce needs to be stored, till they reach the consumers. There is an unexplored potential to start business and succeed. There are new technologies like Vacuum and Nitrogen filling technology to increase the shelf life and to ward off pests from the produce.

Packaging: Ecofriendly packaging is in high demand. One can innovate to add value for his brand. There are lots of opportunities one can look into.

ORGANIC PROCESSING

Processing: Initial process involved in this is preparation of the product to the desired state to be further processed. For example, if we take turmeric, after the harvest, the primary process is to dry it to a certain humidity level and later also convert into powder or oils.

There are also opportunities in creating wellness products from organic ingredients. There are thousands of recipes available to make such products.

ORGANIC MARKETING

There are several avenues in reaching the masses with the current boom in organics due to the pandemic. Local stores, home deliveries of organics and

farmer driven markets are flourishing across the Country. There are many large businesses that are interested in organic produces but have limited idea of how to procure them. Organic Produce are high in demand abroad, so one can package and export them. One can play the role of an aggregator and supply into this demand.

Clover has helped FPOs directly sell produce worth about INR 2 crores by bringing in buyers. They have helped set up local stores in Mizoram, where organic products are brought in by the farmers and sold by the farmers. Training programs, setting up compost units, information through media, help in marketing, helping entrepreneurs in preparing face packs and other products are some of the features of Clovers.

To summarize organic farming has tremendous growth opportunity and is good for the environment.

Where does India stand on the exports of Biofertilizers?

According to me, there are 2 types of biofertilizers one is under FCO which are mainly single strain microbes and other are a cocktail or consortium of microbes that we are manufacturing. These products contain > 15 microbes put together. There are two main factors that favour exports from India - economic cost of production and good quality. There is a huge growth potential and we need to tap into it.

What are the pre-requisites to venture into Organic farm? What needs to be done to open an organic produce store? In both cases how can Clover, as an institution help?

Clover can help in conversion of any farm into organic. They can give you guidelines via a call or an email. But one needs to realize that organic farming will not suit all. First you, as a person have to make sure that you have the passion to go organic and the stamina! Just by growing seasonal vegetables and supplying them to households, you can make Rs. 5 to 6 lakhs on a 2-3-acre farm. For setting up a store, first you need to make a market survey before you decide to invest. Identify the demand and then you directly procure organic products from the farmers. Buy it, wash it, clean it, and then sell it. You



Organic Farming

can do home deliveries also.

Can you elaborate on the statement "Organic Farming will not suit everyone"?

Organic farming is a personal choice. For example, whether one will be okay working with cow dung, cow urine, and if he will be OK to being physically present on the farm. It is very difficult to run a farm on remote control. It is effort intensive. It is more of a personal choice.



If a farmer does not have good quality, will it be helpful for the farmer to go organic in a short span of time?

The answer is both yes and no. The bottom line is "you treat your soil", whether you go the chemical way or organic way is a personal choice again. Ideally adequate compost is needed for the soil as food for the microbes. Add green manuring, do crop rotation, mixed farming and mulching. These practices will help in improving the soil fertility.

In India there is a farmer crisis, can Organic farming help the farmers in getting over this crisis?

Crisis in farming is due to variety of factors. One of the main reasons is a drop in soil fertility. Organic farming coupled with a good supply and marketing chain can really help the farmer

to tide over this crisis. There are different kinds of organic farming, zero tillage, microbial farming (that Clover practices and advocates), bio dynamic agriculture, and then there is integrated farming.

Farmers are confused. Most of the farmers look at subsidy as an income but not as an investment. They have to realize that the subsidy is a starter for a new way of earning more income. We cannot build an economy with subsidies. The cost of going organic does not differ much from conventional farming. You can even create your own inputs, and become self-reliant

Do you allow visitors in your farm at Dehradun?

Any one at any time can come. There is no farm now. You can come to our production facilities. Please reach out separately.

Clover website shows several products, pineapple, ginger, turmeric, Mizo chili. Do you still produce all these products?

We are farming in about 50,000 acres in the Northeast. The main organic produces are ginger, chilis, pineapple, turmeric, avocados, and black rice. Depending on the requirement, this produces can be made available to you. We have a good SOP (Standard Operating Procedure) in place to help source best quality produce for our clients at reasonable rates.

Off late we see the demand for Indian exports are in the rise especially in Middle east and our neighboring countries. However, there is some resistance in the EU sector. What can be done to change this?

Every country tries to limit its imports, and they want a favorable trade surplus. There are 2 types of trade barriers, non-tariff barriers and tariff barriers, like import duty. You can do

a market survey on the requirements/challenges and then come up with a sound market strategy. The EU has something called "Food Mile". The greater the food mile, the lower the demand.

As longer the distance, it creates carbon footprint that is not received well. These are all hurdles posed by Countries to limit imports. However, if one develops very high quality products with distinct USPs, then there is a good market for the same in EU as well.

Clover is exporting to chilies for example from the North East as they have high levels of pungency (SHU). While normal chilis have a pungency of about 5-6,000 SHU (Scoville Heat Unit), Bird Eye Chilies from Mizoram start with an SHU of 70,000 and higher! These are thus in very high demand in many Countries.

India is number one producer and exporter of many spices and agro-commodities. During this pandemic, the exports for the spices have increased by 60-70%. The demand for spices like turmeric, ginger is enormous. Curcumin found in our turmeric is upwards of 5-6%, which is very high.

Technology in Organic Farming – I am looking for specific technology to dry drumstick leaves and grind them into powder and then to be exported. How do we go about it?

Not the right person to talk about! One will have to do research on this topic. However, you could sun dry these leaves and grind them manually or mechanically depending on the quantum of produce being targeted.

Do you have planting material for Black turmeric?

We might have the same. We will have to check with our people in Manipur or Meghalaya to find out.

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Aditya Patidar

**Proprietor - KRD Musli Farm
Indore, Madhya Pradesh**



Mr Aditya Patidar is the proprietor of KRD Musli Farm in Indore, Madhya Pradesh. They are the leading producer and supplier of quality safed musli planting material and dry musli which they get by using high-tech organic agriculture techniques. Mr Aditya Patidar says that he has been in this business for 20 years. The profit averages between Rs. 2.5 to Rs. 4 lakhs after all the expenses.

Mr Patidar says that Safed musli is a national plant used in every kind of ayurvedic preparations like Chyawanaprash and allopathic medicines. Earlier it was found more in the forests of Madhya Pradesh, Maharashtra, and Gujarat, and later was introduced into cultivation. There are about 256 varieties of Safed Musli in the world, of which

17 are found in India. It has different names in each state, and it is a traditional crop.

Mr Patidar lists the use of Safed Musli as a good hair tonic, used a lot in ayurvedic and allopathic medicine preparations. It also cures physical weakness and other related illnesses.

Women after childbirth use this to boost their general health. It is also said to be a aphrodisiac agent and vitalizer, immunity improving drug, and a good remedy for diabetes and arthritis.

The land has to be prepared for the sowing of the saplings that are readied by March. In May and June, when the monsoon starts, they have to be sown in the farm. There are 2 kinds of beds prepared for the sowing. One is the bed with 4.5 ft and the other one is the ridge of 2 ft. Farmers can do the harvesting in

November. The plants can be watered using the flood water, drip irrigation, and sprinklers.

Mr. Aditya points out that USA and UK are cold in climate. Here the usage of Safed Musli is high. The product is exported to countries like France, Germany, Italy, and USA. Pharmaceutical companies can extract from the Safed Musli and the same can be exported. The demand for the product is too high and it is also easy to sell the product. The markets in Delhi and Mumbai and dry fruit markets have huge demand for the product.

According to Mr. Patidar, one can easily generate a profit of Rs. 4 lakhs from an acre of Safed Musli. When the farmers plant this, the planting material for the next year is also taken from these plants itself. One can sow on bed which is 4.5 ft and 54 inches. The price varies each year and month. Depending on the market, one can sow and produce the materials. The price would depend on market conditions, and the price this year for the planting material was Rs. 300 per kg. The actual expenditure for growing in an acre is Rs 1.5 lakhs, and with other expenditure it works out to Rs. 2.5 lakhs per acre. Under normal circumstances, one can ear about Rs. 1000 per kg, which was Rs. 2600 per kg a few years back. The farmers can cut the other expenses to get more profit. On an average, he can earn Rs. 4 lakhs when he sows on beds.

Mr Patidar's farm provides the best quality Safed Musli planting material. They tried growing it using organic



method but with lack of response, they stopped it. They grow the plants using high tech implements such as tractor. They do not use ox. The company provides all market related information and guidance to the person who wants to plant Safed Musli. The farmers have to start planning by November and December, and the planting materials will be supplied to them by March. Since growers dry the plants and do not sell easily, there is a great demand for the product. Mr Patidar's farm is currently growing Safed Musli in 50 acres, and their relatives are growing in 200 to 300 acres in and around Indore.

On precautions to be taken to avoid diseases and pests affecting the plant, Mr Patidar says that the plants are affected by some disease only when there is excessive or very less rain. Fungicides and pesticides can be used to control pests, and it is easy to control the same in these plants. Weeds can be removed using herbicides. The production involves very less labour.

What is the cultivation methodology and what is the duration for harvesting?

When the monsoon arrives in June and July, upon getting the first showers, cultivation will start. When you sow on a bed, you have to dig it and create 4 rows in one bed. Each plant should have about 6 inches of gap. You can provide water supply through drip irrigation. You can also infuse manures and fertilizers through the drip irrigation. You cannot decide on the amount of water needed which depends on the rainfall. The plants can be harvested in November.

If we want to grow Safed Musli in a cof-

fee plantation, mango or lemon plantations, can you provide planting materials?

You must understand that coffee plantations are dense, and Safed Musli needs sunlight. You cannot grow them in coffee plantations. If you plan in any other land, I can provide the materials. The same is the case with mango and lemon plantations. The Safed Musli will not grow well.

Will wild animals such as wild boars affect these plants if they are grown in hilly regions?

They will not be. Since the plant can be grown in hilly regions, animals will not affect this crop. Mainly the crops are affected by small worms from cow dung.

Under contract farming, what is the minimum area of land required for growing this plant? We would want tribals in our area to benefit out of this.

Minimum area of land to be cultivated would be 1 acre. If you need any consultancy over phone also, we can provide. It is not difficult to grow this crop. We can supply the planting materials from MP.

We also have a buyback policy if you cannot sell in your area. But we need dried Safed Musli and not the fresh one. The white musli has to be dried to be sold in the market.

You must be aware that the prices will change according to the demand and natural calamity if any. Too much rainfall will affect the production and profit will also be less. It takes about 2 to 3 days of bright sunlight to dry up.

When can the plants be harvested? Can we do it mechanically?

If you plant in June, you can harvest in November. You will get the planting materials by March. Yes, we can use tractor to harvest the musli.

What are the main challenges in marketing the product?

There are not much challenges in selling the dried musli as the demand is quite high. In Delhi and Mumbai, you can easily sell the product. People will come to your house and buy. As such we are not facing any problem in selling Safed Musli.

How much do you pay for buyback?

Based on the quality of the dried musli,



we buy, and depending on the market rate, we can pay for the buyback product.

After 6 months, can we grow Safed Musli from the same planting material?

Yes. If you get the planting material by March, you can sow the same by June and July. You can also postpone your harvest by a month or two if you are unable to do so in 6 months. There will not be any problem.

For 10 acres of land how many labourers do we require?

We may need 30 labourers per acre at the time of harvest and cultivation. They can do the planting in the farm and do the weeding too. We also take their help for spraying pesticides and herbicides in the farm.

Can we grow Safed Musli in Telangana?

Yes. In any kind of region, you can grow. At the time of monsoon, temperature all over India is almost the same. So, it can be easily cultivated. We have people cultivating the same in Hyderabad too.

Are you into exporting Safed Musli?

At present no. A few years back, we were doing it. But we found that the cultivation process is more profitable than exporting and so we stopped. We sell our products locally only. The persons come home and take the product.

Can you please clarify on Safed Musli buying in the country? We faced issues with many companies while selling aromatic and medicinal plants. They were not coming forward to buy which proved a major drawback for the farmers.

While I agree upon this, I also wish to inform you that I am a farmer only and not a company. I am doing cultivation of Safed Musli for 20 years as there is a great demand in India. You can go to any





Medicinal Plants



dry fruit market and find their requirements. Based on that you can grow the plants. Even in Delhi and Mumbai there is a great demand, and I have found it to be a profitable product.

Can we grow Safed musli along with sugarcane? How is the Safed Musli used in our food? Can we take advantage of the time gap between sugarcane harvesting and Safed musli growing?

No. Sugarcane is also a dense crop and allows no sunlight to come in. The powder is dissolved into milk for consumption, or in roti atta. You cannot make use of it for preparing any vegetables. You can plant Safed Musli which will take 2 months to grow.

Within 3 to 4 days, the plants will start coming out. You can easily grow in the gap between sugarcane harvesting. You can plant them in ridges. The plant requires black soil. There should be no water logging.

Is there any scope for value addition to Safed Musli? Can we make it a powder and sell?

Yes, you can sell through markets like Amazon.

Can you provide consultancy in making quality powder and can we use machinery for harvesting?

We in our farm use only labourers for harvesting and peeling the plants. You should have to dry the plants, and there should be no skin on it. Then you can powder the same and sell. Peeling has to be done on the same day.

On an average, we can peel 8 quintals of Safed Musli. We will easily get 25 quintals per acre. You have to check that it is fully dry, remove the skin and powder. It is the time that we harvest that is important.

Can you provide planting materials in bulk?

Yes. We can.

Can we grow Safed Musli in greenhouse or open field is needed?

We can also grow them in greenhouses. If we can do it in open land, it is better.

Is rain must for Safed musli?

Yes. If you do not get enough rain, you can use drip irrigation system for the purpose.

The government is having special

schemes for growing medicinal and aromatic plants and get subsidy. Can you please throw light on it?

Each state has its own schemes for the subsidy. In Madhya Pradesh, we got the help from the government. The Prime Minister has announced subsidy for growing medicinal and ayurvedic plants.

But I have no idea on the schemes. You have to contact the local offices for more details.

Is it possible to grow Safed Musli as intercrop for Moringa?

Yes. If Moringa is not a dense plant, you can try intercropping.

Even in hilly areas, with less soil, they can be grown.

All that the plant needs is sunlight, water, and pesticides.

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Dr. Uma Saini

Managing Director , Agricare Organic Farms
Ludhiana, Punjab



Ms. Uma Saini is the Managing Director of Agricare Organic Farms in Ludhiana, Punjab. The company

is a major producer of organic food and inputs like biocontrol agents, organic pesticides, vermicompost, organic liquid fertilizer, etc.,. In addition, Agricare Organic Farms provides consultancy services for all types of agricultural activities and are the largest producer of vermicompost in Northern India. It is a proprietary firm serving the farmers of Punjab, Haryana, and adjoining states.

Dr. Uma Saini, in a recent interview, talks at length about organic farming and vermicomposting that she is into. She says that organic farming has been in India since ancient days. It is a method that helps the soil to be healthy and full of life using organic methods. These methods are used with the help of animal manures and biodegradable wastes from farms and mandis, and these materials are absolutely environmental-friendly. There are no chemicals used in organic farming. Fertilizers, pesticides, chemicals, and hormones that people use to grow fruits and vegetables by injecting them are avoided. We may find shiny vegetables and fruits, but they are being injected with hormones in the night and get the shine in the morning. All the food products that we get are not organic but almost poison.

Agricare focuses on organic farming which is very easy. Dr. Saini attributes two points to why farmers are not going for organic cultivation. Farmers want more yield at a short time and thus earn more money. Otherwise they are monetarily at a loss. They always question

when they can get a bumper yield and thus get more income, why they should opt for organic cultivation. Organic cultivation brings health and wellbeing. She offers buyback from farmers and MSP for their products.

Dr. Uma says that some of the components of organic farming are vermicompost, green leaves, manure, animal husbandry, biological management, and crop rotation. She has been dealing mostly with vermicompost. For organic farming, her farm does biological control. They are able to reduce the cost of input with natural biological management. Biological control can be taken up, and the characteristic of organic farming is protecting long term fertility of the soil. She says that the soil should not be drenched in chemical fertilizer. Nitrogen self-sufficiency, recycling of organic materials, weeds, disease, and pest control depend on crop rotation and should not be by pesticides. The farmers should go for crop rotation, planting resistant variety etc, so that they are benefitted without any use of pesticides. When carbon-based pesticides and biological pest control are done, the organic output is nutritionally rich and free from harmful pesticides. Organic farming improves the taste and quality of food when compared to the regular products.

Dr. Uma elaborates on how to do organic farming. It is the system that is highly beneficial to one and all. With integrated farming system one can manage with the resources available freely. The by-product of one system is used as the input of another system. It is actually diversifying farming into sustainable agriculture. Reduction of cost and

increase of total income are integrated.

The types of organic farming include pure organic farming where use of organic manure is practised and biopesticide avoided. Integrated organic farming where whole organic farm management system produces sustainable agriculture products such as healthy milk products and organic cattle feed, professional vermicomposting, all done in small area of land. There are different processes, and there is no need to possess acres of land to do this.

Soil management in organic management aims at healthy soil that produces healthy crop. To maintain soil health, soil texture, soil pH, level of organic matter in the soil, plant nutrition, and nitrogen content in the soil are essential. She explains that biological control agent is the organism that helps in controlling other pest population. Agricare is doing biological control as it is the nature's way of maintaining the balance. The pure and integrated farming includes farming, fisheries, vermicompost, controlling pest, cattle feed, and soil management.

Dr. Saini goes on to elaborate on vermicomposting. Her company, Agricare converts biodegradable waste into vermicompost. They recycle the biodegradable waste from sabzi mandi and fruit vendors, and some food industries, and MNCs like Nestle, Cadburys, and Hindustan Unilever have huge food waste. She collects the waste from these places to convert the same into vermicompost by recycling the waste. Such biodegradable waste includes organic matter, waste broken into carbon-di-oxide, and other microorganisms. Some people use cow dung. Her company is adding all biodegradable waste from the food industries to increase the nutritional value of vermicompost.

Dr. Saini says the benefits from vermicompost are aplenty. The waste from the food industry fetches money as these industries pay to remove the waste from their premises. She sells the vermicompost at a good price, thus earning both ways. The big industries





Vermicompost

want zero landfills. Else they are forced to dig a big pit and fill it with wastes which results in evolution of methane gas and fire accidents. She collects such waste from Delhi and Punjab, and Haryana, as people have started realizing that pollution control is essential. She says that she picks the waste from Nestle at Rs. 4.00 per kg. She collects tons of waste and thus earns huge amount of money. Thus both the incoming waste and outgoing vermicompost fetch her money. She is willing to help anybody who is interested in start this business. She has demonstrated to many students how to grow in hydroponics, vermicomposting, and granulation of vermicompost. Many universities are sending their students to learn the technical knowhow. A student, after doing B.Sc agriculture, can get the certificate of Agrilclinic and Agribusiness and start his own business. NABARD also helps financially by offering Rs. 5 lakhs. National Institute of Agriculture Extension Management in Hyderabad and the unit's office in Amritsar, Punjab, also give certificate after a 3 months' course. Any person joining the institute in Amritsar, after undergoing 3 months course, can approach NABARD for re-finance up to Rs. 5 lakhs and start the vermicomposting unit.

If a farmer tries to sell his organic produce in market, he will not get a good value for his products. It is the organic certification that will help him to sell his products. For that he has to go for organic certification. It is a huge process for producers of organic agriculture products, certified seed suppliers, farmers, food processors, and retailers. There is an application process. The product must get certified by national organic program. There are many ac-

credited agents, such as Union Control Certification, Uttaranchal State Organic Certification Agency, Indocert, IMO, etc. The government is tying up with Agriculture University of Hisar to work on organic certification. The process takes about 3 years. The first year involves application, then the certifying agents will instruct and guide you to avoid leaching etc. After registration, they mark the land as under conversion. Totally after 3 years one can get organic certification. Within these 3 years, if one wants to sell the products, it will be considered as good product and not organic.

Dr. Uma talks about how to do the vermicomposting in the land. Earlier they used to dig pits, put cow dung and worms etc. Now there is no pit. It is the product of composting with red earth worms or *Eisenia fetida*. They feed on the food waste and cow dung apart from the biodegradable waste laid as bed. They digest these, and the excreta of these worms is the vermicompost. They prepare the beds on the level land with bricks to avoid contamination with other worms. On that 3 ft apart they prepare beds, put the materials and worms. Worms' excreta will go down, and heaps will crop up. They collect this excreta for use. These worms multiply in the bed to give vermicompost. The process is repeated. Dr. Saini is supplying this vermicompost to different states, apple orchards in Himachal Pradesh, Kashmir, and Leh and Ladakh are declared as organic states where her firm supplies. There is no wastage and no watering. After 45 days, one can see the product and sell it at a good price. She points out that our dependency on agriculture is 78% and requests people not to shy away from agriculture and organic farming. She suggests that if

there are no companies to offer waste, one can use leaves, cow dung, and farm-yard waste. Women can do this in the backyard of their house with the kitchen waste. She concludes that vermicomposting is easy, productive, and fetches huge money.

What is the capacity of vermicomposting of your company today?

There are many beds with different capacities. With about 100 beds, and 1200 mt waste, you can get 500 mt output of vermicompost.

We have about 100 mt waste available every day. I want to set up a big plant for doing this. Please advise.

The bed size should be 25 to 50 ft long and 3 ft width. 2.5 mt material should be given to each bed up to 5 mt maximum. The material should be put up to 3 ft. Try to put shade net, tunnel shade or under the trees as the pits need shade. Or you can cover the bed with straw.

Can we get technical and marketing support from you?

Yes. We give technical support. If you want to get technical knowhow, I can send my people. All these services are chargeable. You will have to arrange for their transport and lodging. The markets in Uttaranchal are good. You can market in horticultural plantations and other hilly areas.

What is the difference between vermicompost from the cow dung and the one made with biodegradable waste?

When you get biodegradable waste from food industries, there is additional nutritional value with hydrolyse plant protein coming from waste, which is not found in cow dung. There are so many nitrogenous ingredients in cow dung, and it is a natural farmyard manure. When you add hydrolyse plant proteins and the other nitrogenous materials it enhances the quality of vermicompost. The one made of biodegradable waste with cow dung is an enriched one.

When you buy the biodegradable waste from companies, do they also bear the transportation charges?

No. They pay only for the material and not the transportation charges. In fact, some of the companies charge us for taking their materials. Vermicomposting is a new venture. Not always you get good price. There are other companies that do not have the capacity. So they want

us to pay for taking their biodegradable waste, and we pay to pick the waste material so that air is not polluted.

How do you segregate the waste from mandi?

Segregation of the waste is done manually. Usually mandis do not have glass or plastic waste. From a sabzi mandi, we get mostly peels and rotten portion of the fruits and vegetables. So they are manually segregated. There is no need for any magnet or cranes to separate the nails or glass. We can handle the same manually.

How much is your investment and the income generated?

The process involves very less investment. For example, one normal size trolley of cow dung costs Rs. 1000/- when they bring it to your premises. The output from the same is Rs. 4000/- all inclusive. If you get the cow dung free, it is additional income for you.

Do you need to have your own vehicle to get the waste?

It depends on the quantity you need. You can use a tricycle tank or bring manually. We use electric motors to sieve the vermicompost and fill them in bags of 50 kg. 4 mm sieves are preferred, and these are electric. Some people do use manual sieves. They put it in a bucket and sieve. So everything depends on how big your unit is, if it is mechanical or manual, etc.

Do you have to make a concrete tank or a dig out tank is enough?

There is no deep digging involved. On a level ground, you put bricks, so that the red worms do not mix with the other worms. Then you need to put liquid cement to paste the bricks and make partition of 3 ft apart and make beds. It is an easy process.

How to solve the problems with rodents and rats when we make small pits?

In order to save your unit from rodents and birds, you can put a shade net. Then nothing will go inside. Since it is a proper floor, no rodents can come. When the sides are sealed, birds also cannot enter.

What is the area of land required?

If you go for 100 beds, you need 3 kanal and 2 more for storage. You can start with even 2 beds, but you need to have area for beds and storage. After sieving the vermicompost, you need place for

storing the bags. The space needed is according to your unit. With a measurement of 25 ft by 3 ft, you can calculate how many beds you can create.

What should be the height of the unit?

You should not heap the material for more than 3 ft, and the height is based on the height of the person to move in freely. You can make windrows and cover it. Pillars of 9 ft to have the net can be placed. You can check for details from my website.

Can you provide details regarding the demand for vermicompost in Southern India, especially Karnataka?

I have the details of the local market demands. But about the market in Karnataka, I can provide the number to my technical director who can give you more details. You can get the details over phone or email.

Can you tell me how to manage vermicompost pits in hot and dry zones?

If the dryness is more, you have to put some overhead sprinklers that will sprinkle water frequently, i.e., 4 or 5 times. It will reduce the temperature and help worms to grow comfortably.

Punjab is known to be one of the states doing highest level of chemical farming. How do you manage there?

I am trying my best to replace the pesticide with organic herbicide. Punjab is drenched with chemical farming. What I am doing is the pioneer venture. I am trying to get farmers into confidence and create self-help groups. I am doing contract farming too. And I offer buyback MSP to the farmers.

Is the vermicompost produced from Agri-care sufficient or can there be supply from South India?

We are producing lots of vermicompost. Getting from South India will involve very high transportation cost. If you want to sell from South India, you can plan to export the same through ports in South India. If there is no local market, you can go for international market. I will try to help you to market your products only if you want after considering the other factors.

Do you undertake analysis of NPK?

You can get licence from the depart-

ment of agriculture in your state. If you are a manufacturing unit with output of more than 50 mt, you have to get the licence, state directors, and go for manufacturing. Vermicompost that we give is high in nitrogen, helpful in nitrogen fixation. Sometimes the nitrogen level in NPK goes as high as 2.5:1:1. We have our own ISO lab to do the NPK testing and soil testing.

Can we go for 100% sabzi waste and not use cow dung?

You have to mix them. If cow dung is not mixed, worms cannot survive as some ingredients will be highly acidic. Red worms have a suicidal capacity. If one bed of worms dies, the whole bed of worms will die. pH of the material should be normal. If it is either acidic or alkaline, it is normalized by the cow dung. It should be 50 to 50 ratio. You cannot prepare vermicompost fully using cow dung.



Do we have to have special pack of worms?

Yes, we have to use red worms which are called *Eisenia fetida*. They are special for vermicomposting.

If we have a bed in an industrial shed with a height of 30 ft, can we make the unit?

You can, as long as it is under shade with a proper flooring. The site should be covered, and there should be aeration as well. Sometimes if you have concrete on top or sheets, you can put shade net on the sides to make it airy. It can also protect from birds and other worms.

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Food Processing

Dr. Prem Mathi Maran

Founder Director & CEO

Clean Green Biosystems, Chennai

Dr. Prem Mathi Maran is the Founder Director and CEO of Clean Green Biosystems in Chennai. He is having vast experience in fruits and vegetables processing systems which mainly focuses on extraction of Phytopharma compounds from fruits and vegetables, nutraceuticals and functional foods from fruits and vegetables. They follow certain unique procedures in agriculture consultancy too. He says his machinery is being exported to many countries such as USA, Malaysia, Canada, Nigeria, and Ghana. The cost of the machinery depends on the requirement of the customer and may vary from Rs. 25 lakhs to 15 crores.

In a recent interview, Dr. Prem Mathi Maran says that they have 18 years of experience in serving phytopharmaceutical, phytochemical extraction, fruit and vegetable processing, and active pharma ingredients, and drug delivery system. They have a few patents on various herbal extracts and fruit and vegetable related things. They have 5 companies, 3 in India, 1 in Malaysia and 1 in Canada. They have worldwide operations. They are operating globally with head office in Chennai. All their processes and projects are backed with Research and Development. On the basis of the R and D, they do the detailed engineering and supply the plant and machinery to customers. They have a good set of people with knowledge of extraction technologies and other related things. They also have a well-equipped fabrication unit in Ahmedabad and Indore supported by Autocad and process engineers. The company also holds 9001:2015 and GMP certification. All their turnkey supplies conform to USFDA's DQ, IQ, and OQ.

In his words, we offer pilot scale to commercial systems, both solid liquid, liquid liquid extraction, semi continu-

ous, batch process, and fully continuous plants, manual, semi-automatic and fully automatic plants and have patented hydrodynamic extraction technology and drug delivery system.

The speciality of our plant and equipment is that they are made with pharma grade SS material, conform to ASME standards, pharma grade, electrical systems conforming to CSA standards, integrated with efficient solvent recovery system, skid mounted plant and machinery, cGMP plants, process technology involving low temperature short contact distillation path, pre-processing equipment and post extraction equipment and technology. The systems are user friendly, safety compliant, versatile.

We have developed technologies that are commercialised internationally. The R and D centre does herbal, nutraceutical, pharmaceutical, fruit and vegetables processing, Phyto cannabinoids extraction, and botanical drug delivery system. Using our fabrication facility, we first supplied fruit juice concentration in 2000.

Why do we do fruit and vegetable processing? Fruits and vegetables are processed for their nutritional value. India is an agricultural country producing fruits and vegetables in a lot of localities. It is important to consume fruits and vegetables. But there are certain aspects wherein the produce which have been harvested cannot be sold immediately or distributed to the supply chain immediately. We need to preserve, store, or process them to get high nutritional value. We supply turnkey projects on processing fruits and vegetables. The process involves extraction, maceration, squeezing, pressing, clarification, evaporation, concentration, clarification, and ultra-filtration. The final products are frozen fruits, fruit juice, and juice powder, frozen vegetables, juices and concentrates, vegetable



purees, vegetable sauces, and canned vegetables.

The generalized processing integration includes receiving the produce, pre-washing to pre-grading, and conveying system to storage bins. CGBS recommend that the damaged fruits and vegetables should be sent to the feed mills to be included in the animal feed.

Extraction process involves squeezing or rearranging juice from whole or halved fruit by means of mechanical

DISCOVERIES OF THE COMPANY

- Catechins from fresh tea leaves (patented)
- Phyto cannabinoids from cannabis plant (patented)
- Lycopene from tomato (patented)
- Drug delivery system for phytochemicals (patented)
- Curcuminoids and glycosides from citrus pulp
- Artemisinin from artemisia leaf
- Combined antioxidants from crude rice bran oil
- Natural colour from annatto seeds
- Madder extract from roots
- Water soluble curcumin from turmeric
- Water soluble piperine from pepper
- Bromelain from pineapple
- Nausinin from egg plant
- Carotenoids from beetroot and carrot
- Fenugreek phytochemicals
- CBD based hand sanitizer
- Organic agricultural inputs.

FRUITS, VEGETABLES AND SPICES THAT CAN BE PROCESSED

- | | |
|----------------|---------------|
| • Turmeric | • Apple |
| • Green chilli | • Pineapple |
| • Mulberry | • Watermelon |
| • Garlic | • Lemon |
| • Ginger | • Pomegranate |
| • Tomato | • Banana |
| • Carrot | • Grape |
| • Beetroot | • Amla |
| • Eggplant | • Strawberry |
| • Lettuce | • Mulberry |
| • Oranges | |

pressure. We have extractors of different capacity with varied pressure.

Clarification: this process involves a suitable type of mechanical sieving to separate the pulp and juice. The juice is clarified in the centrifuge and a very clear fruit juice is obtained. This can be canned for direct consumption or packed. Or this can be sent to concentration centre where the excess water is removed, and a concentrated fruit juice is obtained. Multiple evaporation systems we adopt, such as a low temperature short contact concentration system where water is distilled or removed. The temperature is not taken to boiling level, but with low temperature short contact concentration method, we get a fully loaded phytonutrients. The non-concentrated juice is pasteurised and stored.

Concentration: we have obtained a patent for producing a highly bioavailable phytochemical from fresh herbs, fruits and vegetables. When a fruit or vegetable is harvested, it is sent to the supply chain to be stored in cold storage or marketed or processed. To avoid any wastage, we can process the vegetable available in excess quantity and convert it into a value-added product. Here this process comes into picture. You can convert a waste product, excessively produced product, or non-marketable product into a value-added product. This process enhances the bioavailability of the phytonutrients. It also helps in producing highly bioavailable phytochemicals and Phyto pharma ingredients from fresh herbs and phytonutrients from fruits and vegetable juices, and natural colours.

The list of We have done experiments and succeeded and patented on tomato, carrot, beetroot, green tea, cannabis, grape, mulberry, orange, apples, and pineapple, and many more.

The 8 principles of processing fruits and vegetables include:

- Fresh plant materials of fruits and vegetables cell fragmentation under intense hydrodynamic force release bioactive compounds from the plant cells due to breaking of epidermis,

cuticle disintegration, and membrane disintegration.

- The bioactive components in the plant cell are released and dissolved into an aqueous phase

- Cells disruption is a sensitive process and control of the cell disruption is required to avoid uncontrolled release of cell debris or product denaturation.

- Hydrodynamic force is a well controllable means for cell disintegration. It provides faster and more complete release of bioactive components into an aqueous media improves the mass transfer.

- Hydrodynamic shear waves disrupt cell walls and release a full spectrum matrix of compounds. All the fluid waves break the cell wall mechanically by the shear forces, it facilitates the transfer from the cell into the solvent.

- Particle size reduction also increases the surface area in contact between the solid and liquid. The solvent can enter the cell transporting essential oils and bioactive compounds from the cell interior into the surrounding solvent.

- This enables to produce high potent extracts with the highest content of flavonoids, non-flavonoids, carotenoids, terpenoids, phytosterols, and various other phytonutrients.

- In an engineering sense, hydrodynamic shear force can be manipulated as a controlled parameter to enhance the extraction process.

The problem statements addressed by CGBS technologies involve. The herbal

extracts or phytonutrients or the phytochemicals or fruit and vegetables in the market have less bioavailability. If you take a beta carotenoid extract from beetroot, the juice has 100 ml of beta carotene and your body can only assimilate 30 to 50%, and the rest can be excreted. To have a high pharmacological activity, we need to enhance the bioavailability of the active biomolecules in the fruit and vegetable juice. So bioavailability defines it as the degree and rate at which a substance is absorbed into a living system or made available at the site of physiological activity. To make a medicine work, it has to reach the destination. The bioavailability of many herbal extracts and fruits juices is 10 to 35%. This poor bioavailability results in poor pharmacological activity resulting in repeated dosages. This current process produces highly bioavailable phytochemicals or phytonutrients extraction will produce a full spectrum extract.

Using the hydrodynamic process we have trademarked the process that uses the fresh plant material to preserve all the unique phytochemicals and phytonutrients compounds in a full spectrum or broad-spectrum extract or juice.

There are six stages in the process we are using:

- Harvested fresh plant material is frozen to fix the phytonutrient intact once it is harvested. The size reduce can be done by shredders or cutters





Food Processing

ADVANTAGES

- The first of its kind
- Freezing the plant material before processing retains their aromatic compounds and have stronger phytochemicals, phytonutrients, flavour
- Utilises the intrinsic heat generated during the process for the extraction of phytochemicals
- Proprietary technologies and procedures are designed to optimise the extraction of active phytochemicals and phytonutrients maximising the yield and creating higher bioavailability.
- Converting the plant materials into nano-emulsions thereby producing highly bioavailable full spectrum phytonutrients
- Almost 50% less solvent requirement
- Technology used are hydrodynamic method, nano-emulsion method, and low temperature processing.

The various sections of integrated fruits and vegetable processing system are:

- Size reduction freezing in the pre-processing
- Higher shear cell rupture, ultrasonication, nano-emulsion, filtration under hydrodynamic system
- Liquid liquid extraction, phase separation under extraction
- Forced circulation, evaporation, molecular distillation, drying under concentration
- High shearing, ultrasonication, reaction, drying under formulation

and after that we freeze it to preserve the phytonutrients.

- Real hydrodynamic process where we convert the plant material into a nano emulsion. In the nano emulsion, phytonutrients are released in aqueous form.
- We separate the dissolved solids and suspended solids, and we dry the dissolved solids to animal feeds or to be reused in agriculture as manure.
- Liquid liquid extraction and separation is done wherein we use the active phytonutrients of the fruits and vegetable juices, isolate them using liquid-liquid extraction system.
- Either that can be pasteurised or packed for direct selling, or we can go

for concentrated fruit and vegetable juice. We use low temperature short contact distillation system to get concentrated juice.

- If it is for fruit and vegetable juice powder, we use the Vacuum Tray Drying to dry the juices under low temperature. If we spray dry it has to be done at 120 degrees with some possibility of degradation of phytonutrients.

The difference between conventional method and various pre-processing method are the typical homogenization methods, or disruption of tissues into powder, extraction by solid and liquid extraction method, simpler distillation methods and extract with low bioavailability. But Hydryne MC uses whole freshly harvested fruits and vegetables and gentler and well controlled hydrodynamic forces, liquid liquid extraction method, low temperature short contact solvent evaporation, and a molecular distillation unit, highly bioavailable phytonutrients.

This is hydrodynamic system that uses nano-emulsion system release intrinsic heat during the process, converts inactive phytonutrients into active phytonutrients. Ultrasonication disturbs the cells and aids the release of active phytonutrients into the aqueous medium.

The various stages in the process include the hydrodynamic system that converts the fresh material into nano-emulsion, goes for liquid liquid extraction, low temperature and short contact distillation and then drying concept.

Our proprietary distillation path wherein the integration of forced circulation evaporation and molecular separation. If the juice volume is high we can go for 2 or 3 stages, if less, if the producer wants less production, we opt for single stage evaporation. If it is higher we can go for 2 or 3 stages. The purpose of molecular distillation setup is to keep the phytochemicals, phytonutrients intact in the juice to get full spectrum phytonutrients. We have produced the phytochemical and phytonutrient extracts from juices. This process of fruits and vegetables can be taken into 2 angles. At a nutraceutical angle, a manufacturer can produce fruit and vegetable juice directly for consumption, and the

next one is converting the juices into a variable nutraceutical or phytonutrient or healthy supplement that goes to pharmaceutical area which has higher profitability and marketability. It is mandatory for the time wherein the produces in excess can be converted into a phytonutrient in the field itself. We recommend this system can be integrated or can be fixed on wheels on a truck that can go to the fields when the fruits and vegetables harvested can be segregated. Some can go to the market and the rest can be processed to produce high value components. The profit of the farmer and agriculture can go up. This system we are discussing with NABARD to promote the system on wheels to enhance the economy of the farmer by 3 or 4 times.

We have supplied the PLC/SCADA machines to various places and are in operation there. We can note that the agriculture is always profitable provided we give a technologically innovative insight to the farmer. It is economically viable.

Please let us know what work you have done on supercritical extraction.

We can do supercritical extraction, but for fruits and vegetables, it is not advisable. It is better to process them in fresh conditions. It addresses only the dry material. So there are chances you can dry the fruits and vegetables like tomato or pineapple, and you can dry and process in supercritical method. But you have to generate process data by various experiments. It will be very specific. When you do with fresh fruits and vegetables, you do not need to optimise for everything. It is only changing some SOPs.

How will it be helpful for farmers who are growing fruits and vegetables? Do you pick the products from the gate? How do we contact you for that?

These equipment can be fixed on a truck. Farmers cannot do the operation. We recommend at a later stage, there are some cooperative companies, or NGOs, especially in the government site, and horticulture department who can take the equipment to the gates of





Can you tell us about application of phytonutrients?

It is now everywhere. The field is coming up now in a big way. It is not only phytonutrients, but also nutraceuticals and health supplements. They are available in fruit juice, vegetable juice, fruit and vegetable juice powder or capsule form. The application has become very hot nowadays. Yes, we can produce in powder form and fill in capsules to be consumed.

Do you supply equipment for extraction of curcumin from turmeric and moringa for the phytonutrients right from drawing, powdering, and capsuling? What is the cost of one complete unit?

Yes. The price depends on the volume you want to produce and the type of material you want to produce.

Can we visit your plant and see the machinery?

Yes. We have demonstration machinery. If you want, you can bring your raw material, and we can show you the whole process.

Can you throw light on the investment and any capacity of the plant?

It depends on the capacity. It can be from 250 kg per batch or per day up to 20 mt. The smaller system can process about 250 kg and will cost Rs. 25 to 30 lakhs. If there are specific requirement from the clients, we can share the price details. If you need only liquid clarification, pasteurisation, and packing the cost differs. If you want concentrate, the cost is different, and if you want powder or highly concentrated product, the price is different.

Do the machinery to get powder form and capsule from cost Rs. 25 to 30 lakhs?

Yes. Capsule form is ideal, but the cost goes up. If you go for Lycopene from Tomato, the yield is 2%, curcumin from turmeric is 8%. So there are some differ-

ences. As the equipment and plant and machinery are versatile, you can process any fruit and vegetable. Accordingly we have to adjust by changing SOPs. The price will be worked on based on the specific requirement.

What will be the cost of the smallest plant to get moringa powder?

With regard to moringa, it is better to have it sundried than extraction. I will not recommend extraction of the moringa leaves. The powder that is sundried and pulverised to the maximum level will get more pharmacological effect.

What is the cost of minimum capacity small machine?

These equipment are customised. If you want to process 100 kg, the system is designed accordingly. You need to specify what you want to process, fruits or vegetables, and what finished product you want. The price varies accordingly. The minimum viable investment is Rs. 25 to 30 lakhs.

What is the space required? Do you help to set up the plant? What is the power required?

1200 to 1500 sq ft for plant and machinery is needed. There should be some space for utility outside. If you want to go for full-fledged system, you need to have space for lab also. Yes, it is a turn-key supply we do help in setting up. The power requirement depends on the volume you want to process. It can be addressed if you mention your requirements.

Have you supplied to customers in the market and under what brand name are they giving phytonutrients?

I have supplied 7 systems to USA, Nigeria, Canada, and South Africa. None in India. These are the systems supplied based on my technology. The first 4 plants were supplied to Baba Ramdev for Patanjali for phytonutrient extracts from various plants, and not for fruit and vegetables.

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the farmers, collect, process, and make it a valuable product. They can share whatever the benefit is. There should be some arrangement between the farmers and the processor so that the cost agreed between the two can be passed on to the farmer. Since farmer himself cannot do or afford this, the technical cooperations can take up this activity.

As of now are you buying the fruits and vegetables from the farmer directly?

No. We are not the processor. We are suppliers of fruit and vegetable processing equipment.

While some fruits like apples can be stored and preserved for 1 year, the shelf life of vegetables and fruits are in general very short, not more than a week or fortnight. Do you have any economic model of preservation method?

Yes, preservation of fruits and vegetables can be done economically to support the farmers. If you come here I will take you around and explain.

Which fruits and vegetables can be used for phytonutrients and phytochemicals?

All fruits can be used. If you want to be specific, you can get Lycopene extraction from tomatoes. That is full of antioxidants. Since different fruits and vegetables have different nutrient content, you need not be specific.

Mr Rajeev Khurana is the partner of Khurana dairy farm, Rohtak, Haryana. He is involved in breeding of cattle breeds like Hariana, Sahiwal, Tharparkar, and Murrah breed of buffaloes for 4 decades and has established good rapport and network of farmers in different states for marketing. He also provides consultation about animal management and selection and procurement with regular interactions with his clients to make the projects successful. In a recent interview, he explains the benefits and problems faced by farmers when breeding Murrah buffaloes and indigenous cattle due to various factors prevailing in India.

Mr Rajeev says that he has been in the line of livestock breeding for 7 decades. His firm helps in breeding elite Murrah buffaloes and elite indigenous cattle such as Sahiwal, Hariana, and Tharparkar. He feels sad that the farmers have strayed off to follow lax and false breeding policies in our country since 1950. It has been an established fact that Murrah buffalo is the best dairy buffalo breed in the world and yields highest quantity of milk. During the '50s indigenous cattle such as Sahiwal, Red Sindhi, and Tharparkar were also yielding about 4 thousand litres of milk. But it

Rajeev Khurana

Partner, Khurana Dairy Farm, Haryana

is unfortunate that the policy makers at that point of time introduced wrong and shorter way to increase milk production by opting for exotic bloodline in our country. He feels that the policy makers could have introduced these varieties in areas where not much good milking breeds were available in the country. Selective breeding should have been done within our own milch cattle breed and by today we would have been getting more than 8 thousand litres from our Indian cows, but we failed because of wrong policies. Our indigenous cattle breed has already vanished from the country. In Gir, the number of these animals is more because the veterinary team could not do artificial insemination. The farmers could save the breed and bloodline because they were doing natural service with their own bulls.

Murrah buffalo is our country's breed and has high milk yielding potential. But it has not been spread within our country in the way it should have been. Karnataka or Tamil Nadu does not worry about buffalo improvement. The engineering people started the dairy in Ootacamund initially and started crossbreeding from that area. Not only exotic crossbred cattle came into our country but also came in the diseases unlike earlier days.

We continue to witness the disease in such exotic cattle even now, but our own breed of cattle is resistant to the disease.

The exotic cross breed cattle are not meant for our country. In other countries they are just milking machines for those countries where once the lactation is over, they are consumed which is not the case in our country. The longevity of the hybrid cattle is short. It is impossible for the farmers to maintain the cattle. In states such as Karnataka, Tamil Nadu, and Maharashtra, exotic cattle produce the milk yield from them is quite low. The average milk production for a prospect cow is 8 to 10 litres while a few yields about 20 litres. But in Punjab, the crossbred cattle give 20 to 60 litres with a minimum of 15 litres. Punjab is importing semen from USA since a long time. In Karnataka and Tamil Nadu, new bloodline is not introduced. Halikar and Kangeyam cows are low yielding ones. The new bloodline must be introduced but is not happening because of the policymakers. It must be imported every year.

In many states, the Head of the Departments may be good administrators, but they are not practical, says Mr Rajeev. They do not have any feel of the production of the cattle, and they would not have worked in the field to understand what a farmer wants, about the cows and buffaloes, and the problems of the farmers.

After independence, it was only when Shri Modiji came to power, that a meeting was called for in Delhi where he invited retired scientists, Vice Chancellors of Universities, farmers from dairy, fishery, sheep and goat rearing, and other delegates and took their view on how to increase the income of farmers by 2022. He listened to all the speakers and said that he has noted down the valuable suggestions from the experts and farmers concerned and would include them in the government policies to double the income of farmers by 2022. Mr Rajeev also had given his suggestions out of which a few of them have already been included. These suggestions should be included in the policies of the states also



while making breeding policies.

There are many national institutions that spend lots of money on research of embryo transfer. Unfortunately, till today, the scientists have not been able to provide a single embryo transfer technology to the farmers, laments Mr. Rajeev. Also, there is no genetic potential embryo being produced which will be too expensive for the farmers to bear. Scientists and government should ensure that quality semen is produced from high genetic and high potential bulls and sex semen is produced. Research work should be done on this. Mr. Rajeev is disappointed that though the country's money is being spent apart from time on research, but nothing fruitful has been delivered to the farmers till today.

Mr Rajeev says that Karnataka, Tamil Nadu, and Orissa are known for known for cows but wonders why they do not go for buffalos which have longer lifespan. Murrah buffalos have more milk production and more fat percentage, but they are not preferred. Farmers, when they go for cows, are given loan and subsidy. Buffalos can live up to 15 years give up to 20 calves. They are less expensive to maintain, medicines are cheaper, and no distokia in buffalos and indigenous cattle, but exotic cows contract distokia. Such things are not shared with the policymakers. There are plenty of drawbacks in the breeding policies.

There were hardly 2 or 3 companies that come up with medicine like penicillin injections earlier, but now everyday many companies are coming up with products that are very costly. About Rs. 5 lakhs are needed for the treatment. Very few laboratories are testing which medicine is suitable for cattle. Farmers are in great problem as they do not get any right help from the policymakers. It is a sad fact that milk is sold at a price less than water. While there is minimum selling price for agricultural produce, there is no such provision for cattle. Why should they sell at a throwaway price? Farmers should also get the good price as feed ingredient is quite expensive, green, and dry fodder and labour are also incurring expenditure. Commercial farmers are unable to survive. In India, commercially dairy



farming is a loss proposition. If a person starts with 20 or 100 animals, unless he can market the products under his brand name, and if he depends on some other brand, he cannot survive in the field.

It is quite strange that in India with all its potential for milk production, dairy farmers are unable to make money. The Haryana government has come up with a few policies to encourage farmers to produce high milk yielding indigenous cattle. For Haryana and Sahiwal varieties, the farmers are given incentive of Rs. 25 thousand for one year if they get more than 15 litres a day from Sahiwal cows. Free insurance is given by the government to the farmers. Male calves are bought at a good price. In exotic cattle breed, there is no value for male calves. But in buffalos, male or female has value. Farmers can get rearing cost back at the end of the year.



Mr Rajeev also talks about the breeding practices of Murrah buffalo. Till 5 years back each village panchayat had own high potential Murrah bull which was genetically superior. They changed the bull in every 3 to 5 years or had 2 bulls and mate the cows with different bulls. If the farmers have better and healthy bull, there is no need to go for artificial insemination. The farmers were opting for natural services till 5 years when the government started having high potential bulls in Haryana semen station. So, people have started to accept artificial insemination process. Till 5 years before they were depending on natural breeding only.

It is said that farmers growing cattle for milk production are not benefited. Can we have value addition to the milk like manufacturing ghee or butter? Also there seems to be demand for A2 milk and A2 ghee. Can we breed Indian cows that give A2 milk like Gir or Sahiwal?

Yes. Farmers are doing it to get good price. Only very few farmers can market directly but commercial farmers are doing it. The cost of production is Rs. 1300 per kg for desi cow ghee. Poor farmers are trying to sell desi ghee but are not getting the cost price also.

Which is the best breed of grass for buffalos?

When compared to the exotic cow breeds, buffalos can survive very well without green grass. Green grass from maize and jowar is good. Buffalos can adjust to any kind of food and condi-



tions. They need only a little quantity of green grass. In our farm, we are not feeding grass to buffalos but only dry fodder as it is very costly.

How do you manage when it becomes difficult to get green fodder?

We can take them for grazing. The grass available in the market can be given. Maize and jowar grasses are available in our state in rainy season also.

Is it a good business to grow green fodder and supply to buffalo growers?

No, it is not a good business. In North India, green fodder is available throughout the year at a cheap rate, Rs. 2 or 3 per kg. There is no need to produce green grass yourself. Intercropping farmers grow green fodder and sell it at the market price. But there is a slight dependency for green fodder in South India. Green fodder has good market in Tamil Nadu and Karnataka.

Are Murrah buffalos available in Hyderabad for buying and what is the approximate cost?

Yes, it is available in Hyderabad. The cost approximately will be between Rs. 80 thousand to 1.5 lakhs.

What is the cost of maintenance of 1 buffalo per month?

It depends on the milking capacity of the animal, lactating or dry. While milking it needs 50% of fodder in 1:2 ratio of production, about 8 kg of fodder or 10 kg is needed for a day.

We are importing Whey protein. With no domestic production is it difficult to manufacture whey protein in India? What are the pitfalls in this?

In private market there are very few institutions manufacture whey protein. I thought about it in 1988 and then I went ahead with milk production and semen production. It was the first semen bank in India with 10 lakh doses per year supplied to states governments all over India. Due to unavoidable circumstances, I closed it in 2000.

Can we get sex semen of Murrah buffalo?

No. ABS people are producing a little bit, but not in our state.

What is the success rate of Artificial Insemination?

There are four factors to it: timely detection of heat, frozen semen quality, maintaining quality of frozen semen, and the person who is inseminating.

In terms of number, what is the capacity of Khurana farm and how many numbers you have in various categories?

We have been having 100 to 200 animals breeding stock till now, which is limited to that only. We get national farmers' institutional requirements through network with farmers and then procure and supply to the clients according to their requirement. About 50 thousand dairy animals are supplied per annum all over India.

Do you help in marketing and offer advice to them? Are you into any agreement with them?

No, we market only dairy animals and no value addition products. We offer advice and consultation to them. We explain the management practices. When we supply to state governments under various programs, we must enter into agreements with them.

Do you encourage breeding indigenous cattle and is it viable?

I feel indigenous cattle are not viable for commercial purpose. It may be viable for farmers for their personal consumption because good quality indigenous cattle are less in number and quite expensive too. Even if you market their milk at Rs. 80 per litre, it will not be profitable for you. Marketing system for milk in India is not suitable for commercial farmers, be it normal milk or A2 milk. It is not profitable as it is expensive to produce.

Do you think the government should encourage breeding Murrah buffalo and indigenous cattle? Is there any

policy for this? Does the government come into picture here?

The state governments should frame the policies. They should include the breed in their cattle breeding policies. They should always make semen available. If the government does not help, what can the farmers do and what is the point of having hybrid cow?

Do the universities for veterinary sciences or state governments help in breeding cattle at various levels?

In Haryana, the government has brought in policies to help farmers improve Murrah buffalos and are implementing the same at various levels. They encourage farmers by offering incentives for the milk producing cows and buffalos. No other state has come up with such policies.

Wherever artificial insemination is followed, do you encourage twins or multiple pregnancies to get more calves?

No. We do not get twins or multiple calves. Since the government is not able to get the semen, it is not possible to get embryos. For a farmer, the success rate, cost of embryos, genetic potential, and the other issues are too huge to handle. It is a sad situation that no government gets embryos for the farmers.

Would you advise developing desi cows to help people in the society to get original milk?

My advice would be, if you are doing it as a social service, do it. If you want to make money, please do not do. I discourage 99% of the people who talk to me for setting up dairy units. I do not encourage them as they will lose their hard-earned money.

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Raju. S.V.

Director, Varsha Associates



Mr S.V. Raju is the Director of Varsha Associates in Chitradurga, Karnataka. The firm is promoted by a group of young agricultural graduates who have experience of more than 28 years in the field of manufacturing implements, agricultural machinery, equipment, marketing, and consultancy services. Mr. Raju is a graduate in Agri Science and trained in IIM, Ahmedabad in contract farming. The company's team has Mr. Raju, Mr. Mallikarjun, Mr. Ramesh, and Ms. Bindu Raj to help in the smooth functioning of the firm.

Mr. Raju says that there are numerous types of agricultural machineries that have usage value at various stages of crop cultivation. Agriculture activity is at crossroads now, especially with scientific progress in seeds, fertilizers, and crop cultivation methodology to control insects and pests. Agriculture has been facing acute labour shortages in India at various stages. In this scenario, farm mechanisation is the need of the hours.

Today in India, the level of farm mechanisation in various aspects of cultivation is as under:

- Soil working and land preparation: 60%
- Seeding and Planting: 45%
- Plant Protection: 45%
- Irrigation: 45%
- Harvesting and threshing in rice and wheat: 70 to 80%
- Others: 25%

Mr. Raju points out that today in India agricultural mechanisation is quite low compared to other countries. There is a huge scope for farm machines. The present challenges are choosing the right ma-

chine for the right activity, requirement of skills to operate and repair, capital investment, government support not up to the expected level, and standardisation in usage and spares utility. Farmers can get about 40% subsidy from central government schemes such as RKVY and SMAM, and about 50% subsidy from state government schemes. There is a huge prospect through FPO as Agriculture Infrastructure Funds which offer 75% subsidy and support for capital investment.

About his companies, Varsha Associates, ABC4D, and Vau Technovations, they have branches in many states like Andhra Pradesh, Telangana, Tamil Nadu, etc. Mr. Raju says that they provide equipment for land preparation, inter-cultivation, irrigation, crop care, harvesting, post-harvest processing, and other general usage. He talks about the various agricultural machinery that his company offers:

- Land preparation: Ploughs, different types of cultivators, disc harrow, rotavators, and land levellers
- Equipment for sowing: Various models of seed and fertilizer drills, rice planters. These are very successful and adjustable in various land conditions and crops.
- Inter-planter: Power weeders to adjust the row space, weed cutter, and roto slashers
- Equipment for irrigation: Electrical pump sets, submersible and above the ground centrifugal pumps, petrol and diesel driven pumps, and highly fuel-efficient, need-based pump sets
- Crop Care: Equipment for spray, based

on various requirements, battery operated sprayers, engine operated sprayers

- Harvesting: Depending on the crops, the farmer can select combine harvest equipment to get the harvesting activity in a single go. As per the area of operation, he can select the equipment, battery, handheld, or tractor reapers.

- Threshers: The company has multi-crop threshers and area-based threshers. People go for threshers based on their crop and change the sieve and use it for multipurpose operations. For dairy and agricultural waste shredding, the company has many varieties of shredders and chaff cutters, such as hand-operated, motor operated, engine operated, and tractor operated shredders. Combine harvester is the latest equipment being used for harvesting various crops like paddy and wheat and has proved to be very successful. In other crops it is not that much adapted. Combine harvester can be adapted to manage the harvesting situations well.



Groundnut digger can cover one acre of land in 2 hours and runs well in moisture conditions in the soil. Laser land leveller has been accepted among North Indian farmers because they can save good amount of water and resources like fertilizer. Silage is the new method of utilization of maize. With that one can cut the crop when grains are in the filling stage, and a nutritious feed can be given to the cattle. Especially in drought and floods, this helps as food security for animals apart from other feed supplements. This machine uses pressurized hydraulic press. Bales can be created and wrapped for 30-45 days so that it will be in anaerobic condition. Bacterial activity will be inside the bale. It will be a nutritious feed for the cattle, and milk yield is also high.



What is the cost of groundnut digger and also the multi-purpose machine for seed? What about the subsidy?

Groundnut digger costs Rs. 1.30 lakhs. You need a 35 hp tractor. If the soil is sandy, 24 hp Kubota tractor can be used. If you want a demo, I will ask my Tamilnadu team to give a demo so that you can decide to use higher hp tractor or your own tractor.

As it is a power weeder, seed drill can be attached to that. Seed drill costs Rs. 9 thousand. All the arrangements including sprayer, seed drill, power weeder and cultivator will cost Rs. 70 thousand.

In Karnataka, subsidy is available, so also in Tamil Nadu. But about Pondicherry I am not quite sure. You can try to get the facilities using the central government certificate.

Is there any power weeder that can work as the reaper? Can it help in rice weeder?

Paddy weeder is a single row or double row are available. Rs. 30 thousand is the cost of the paddy weeder and Walk Behind reapers about Rs. 90 thousand to Rs. 1 lakh, and many models are available. For paddy transplanters, different models are available, Walk behind and ride on versions. Walk behind 4 rows transplanters are available at a cost Rs. of 3 to 4 lakhs. Regular versions are costly at Rs. 12 lakhs, and it can do transplanting of 6 rows.

Machinen driven Multiple rows transplanters available.. Only 2 rows available Walk behind and Hand Driven specially for paddy cultivation developed by Tamil Nadu university mostly hand driven and pull unit is there.

Do you have rental of power tillers in Kanakapura?

Yes. We are able to establish around Kanakapura. Currently we have tractors available on rental. Power tillers are available in Mandya and Mysore. In Ramnagar, it is in the establishment stage.

Do you have plans to establish near Kanakapura?

Yes, we will be shortly starting.

Do you have rentals in Sholapur, Maharashtra?

It is available in Karnataka only. Customer Service Centre is a concept developed by Central Government across India, and all state governments are being instructed to start one. So in near future, each block will have such a centre. Any entrepreneur can establish that and claim 40% subsidy. He can run it as an enterprise. We have office in Bangalore. With the call centre number, anybody can connect to us for any enquiry about machinery for rental.

Do you have Customer Service Centre in Hyderabad?

We do not have Customer service centre in Hyderabad. We have started the concept in Andhra Pradesh and Telangana.

It was started for paddy and groundnut. In Telangana Agriculture department called for expression of interest, but no further development has happened.

Central Government is insisting all state governments to take up this, and in future you will see more such centres. We can support crop specific queries.

Do you have tractor service in Hyderabad?

No, we have equipment sales centre.

How much do you charge for renting tractor for one hour?

Rotavator of 5 feet is being charged at Rs 800 per hour, and for a 40 hp tractor is Rs. 700 per hour for ploughing.

How do we get to see your product list?

You can visit our website, or you can contact our call centre. We will send the brochure and details.

Do you have branches in West Bengal?

No, we do not have branches in West Bengal.

Can you give franchise for Vidharbh for rental and sales? What are the terms?

Yes, we can give. We will get in touch with the concerned person so that we can explain in detail. We have one dealer for power weeders in Vidharbh area. I will revert to you in this regard.

Can you give consultancy for setting rental government scheme in Akola?

Yes sir. We have been working in this sector for 3 years. They can come over to Chitradurga and have one to one interaction. They can see for themselves how our centres work to get first-hand information. Then with his available resources, he can plan further. We will definitely support him in all aspects.

In the rental model, what about the driver availability? Or should the farmer go to the centre and get it?

We will have drivers for the tractors. They will come with the required equipment. If you have opted for tractor with rotavator, our driver will come and work for you. Some machinery will be given to the farmers themselves to work on their own, such as sprayer and power weeders. For this, we will not provide labour.

We can hire some eminent labourers who have knowledge about operating the machinery. Only machines are given for rental. You can hire labours who have skills to operate them.

How do we take the tillers to the farm?

Our tillers are a challenge. We have identified some local skilled guys who can operate them. We have been associated with these labours, but the farmers will have to pay them.

Mr. Raju concludes saying that agriculture mechanization which was totally disorganized for a long time is slowly improving now with the help of different associations. With the government help, the sector is improving to serve farming community in India.

Each state has its own schemes and subsidy percentage. In the coming days, more crop and area-specific machinery and precision agricultural technology will be the order of the day.



Power weeder has multiple applications for weeding between rows and bases of plants, and to create ridges. This can be used as a sprayer. It can take liquid and can be used as a sprayer. Wherever water resources are there, it can pump up to 1000 ft. There are different models. Drone spraying is the latest technology available in various capacities such as 5, 10, and 20 litres. It can cover around one acre in 15 minutes with precision. It comes with GPS and can find out locations. Multispectral drones can be used to get images and survey fields to identify the problems.

Mr Raju talks about introducing multi-purpose versatile machines. People can use sprayers for 5 to 10 days and use the pump set for the same time. If one machine can do many functions, it is good for small farmers as it reduces the investment. They can use power weeder for many purposes, though the main purpose is weeding. The same unit can be fixed for a seed drill to sow seeds. He can connect it to a pump set or a sprayer unit at various levels of cultivation.

Crop specific machinery for paddy is adapted in the course of agriculture. Mr Raju says that his company has mechanisation solution from land preparation to harvesting. Rotavator for land preparation, laser land leveller, rice transplanter, sprayers, paddy weeder, combine harvester, and baler. Laser land leveller is a useful equipment to save good amount of water and fertilizer application. On an uneven soil, water will be stagnant and fertilizer usage uneven. In the case of oil seeds such as groundnut, machinery such as rotavator, seed drill, sprayer, power weeder, and ground nut harvester are of great help. Groundnut harvester is picking up market, and it can do harvesting in a short time.

Seed drill is a useful equipment and has been accepted in South Indian areas for groundnut sowing. One can go for this based on the number of plants in one area and use for harvesting as well. Rotavator and seed drill and combine



harvester can be used to do harvest in a short time. In contract farming and silage, farmer can harvest in 70 to 80 days and go for second crop in rainfed area. His income can increase almost double.

In silage activity, it is cutting of the grown-up maize crop at the seed filling stage, and it will be harvested and baled. It will be with hydraulic power, compressed and made into bales. This can be used after 30 days and stored from 9 months to 1 year. The green nutrient rich fodder can be used as animal feed throughout the year.

In precision agriculture laser land leveller and drone are introduced by the other company of Mr. Raju, Vau Technologies. This is for spraying and imaging the land, and it is a precision agriculture and technology by using GPS, IOT, and AI products in agriculture, R and D, and expertise in commercial drone operations. Our drones have different capabilities, especially imaging. With the available images or survey, we can analyse the crop condition and stress in the crops and find suitable solutions. Drone working at the field level has been very much appreciated and welcomed by the farmers but more support is needed for such new technologies.

Mr Raju says that their Custom Hiring Service Centres are ones with a bank of agricultural machinery available to small and medium farmers. It will be helpful for the timely operations, and equipment are available for different applications in different stages of the plant growth. Mr Raju owns yet another company, Varsha ABC4D, which is a rural based social enterprise to provide wide varieties of agricultural machinery on rent under one roof. It can carry out activities by supporting farming community.

Objectives of Custom Hiring Service Centres:

- To provide machinery on rent for all agricultural activities
- To provide solution for crop specific machinery, and end to end solutions
- To give knowledge on crop cultivation and to support contract farming by providing machinery and information for

backend operations. Mr Raju points out that they provide warehousing facilities at selected places so that farmers can avoid distress sales. They also provide information on new technologies, such as exotic fruits farming, silage etc.

The key stakeholders of Varsha ABC4D are Department of Agriculture Karnataka, Agri machinery manufacturers, banking institutions, agriculture universities, research companies, and progressive farmers.

Mr Raju claims that about 700 customer service centres are operating in Karnataka. In each Hobli, there is a customer service centre is planned. There will soon be 324 centres working in 144 taluks in 26 districts. The company has served more than 1 lakh farmers in the last one year, and the number is increasing. Farmers living within 15 kms of each Hobli centre can be helped.

He says that the government CHSC app is used for the control of government, drivers app is to help farmers find drivers for ordering from the next centre, and the farmers app is to express their needs. Facilities of equipment and booking facilities are tied up with one bank, and this facility is introduced for microfinancing by holding their stocks. The company has 100 combine harvesters, 1000 tractors of 35 to 60 hp, 6000 modern equipment, balers, reapers etc, and other high-tech machineries.

The company undertakes promotional activities to promote and create awareness of different types of machineries to farmers, training courses for rural youth to operate the machines, and help them use their services to other fellow farmers on repairing and using the machinery by themselves.

Mr Raju claims that they have their establishment in Sindhanur and other equipment showroom in Tumkur. There is also an academy to train farmers. The company's headquarters is at Chitradurga, Karnataka.

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Cold Chain

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Mr Harshal Surange is the CEO and Director of ACR Project Consultants Pvt Ltd, Pune, Maharashtra. He is a consultant in cold chain with an experience of more than 20 years. Mr Harshal has handled many of their prestigious projects such as KAPPEC Kushtagi, Auto Cluster Development and Research Centre, National Film Archives of India, MSAMB at various locations, Savla Foods and Cold Storage, Boxco Logistics, Farmico Industries, etc . He's empaneled as Cold Chain expert with World Food Logistics Organization & Asian Development Bank.

He is an ASHRAE Trainer for the Dubai Global training Center, member of the ASHRAE USA Refrigeration Committee and Chair of ASHRAE RAL Refrigeration Committee & Past Chair of ISHRAE Refrigeration Committee. Founder President of IIAR Western India Chapter and member of International Committee of IIAR. He's won multiple national & international awards for Excellence in Cold Chain Design

During his talk, Mr Harshal talks at length about cold storage and cold chain that are essential for storing perishables.

What would be the cost for a medium size cold storage, for the Route B (Pack House), using solar energy?

Currently there are very small units say for about 5-10-ton unit can completely run is full solar power. But big units like 2000/5000 tons, can run assisted by Solar power, but not completely on solar power, due to poor cost viability. Typical cost of a pack house for this size depends on an export-oriented pack house or a domestic-oriented markets. A high-end facility, with 20 tons per day output, need Rs. 5-7 crores of investment without land cost. Your pack house should do food processing as per the guidelines to avail the government benefits.

What would you recommend for jaggery storing with 1000 ton with existing shed?

NHB gives subsidies to projects that store horticulture products like fruits, vegetables, pulses come under this category. Not sure whether jaggery is defined as a horticulture product. You can look into the earlier Cold Chain Schemes from Ministry of Food Processing, but you have to establish that how the product is coming in, how it is processed, and how it goes out of the facility using cold chain. People have tried powder of spices, but ministry has not accepted. Further, the new scheme from Ministry will be announced and the guidelines given there need to be followed

Irradiation – Does it damage cells and create mutation? Is irradiation safe? If yes, then why some countries are not allowing irradiated foods?

There are countries that mandates only irradiated products like USA, and there are countries that do not allow irradiated products. Here in our country, the irradiation

process is in the complete control of BARC. One centre in Navi Mumbai has the facility to irradiate food products. The right amount of irradiation depends on the product. If you are looking for setting up an irradiation facility, it is going to take Rs. 30-40 crs.

How do we influence hesitant farmers to uptake cold storage?

There is an input cost that goes into this process. But the biggest advantage of precooling and sorting is the product value increase. Sorting process can actually give the farmers fair price for the products according the quality grading. Farmers need to understand that Cold Storage increases the product life, and so they can reach more customers and in turn they get more returns on their products.

Can you brief about the schemes that the Government is coming up with?

You can look into Ministry of Food processing Industries, (mofpi.nic.in), National Horticulture Board (nhb.gov.in) or National Horticulture Mission for the relevant State. MoFPI have previously had an upper limit on the grant Rs. 10 crores for the Cold Chain scheme, for a project range of Rs. 30-35 crores, in non-scheduled areas. If the project was in for scheduled areas, you could avail the subsidy of Rs. 10 crores for a project around Rs. 25 crores. We will have to wait for the latest information as schemes are further announced.

How do you tackle rodent infestation?

You can protect the unit from rodents entering from outside. In India, rodents can come with the products. Current-

He discusses about cold chain and its components, cold chain scenario in India, and the relevance how cold chain can help in today's scenario in the long run too. This article is an adaptation of the talk he gave on a web based forum and hence, certain portions are relevant to the given time frame when the talk was made. Queries on the same may be directed to Mr Harshal Surange directly.

The key areas of focus of his company are:

- Integrated Cold chain Projects
- Multipurpose cold storages
- Pack houses
- Food Processing units
- Distribution Centres
- Ice Plants and Industrial refrigeration systems
- Air Conditioning
- Evaporative cooling systems

- Heat recovery systems
- Energy Saving Studies
- Ventilation systems
- Preparation of DPRs

They have completed more than 700 projects all over India. They are empanelled members of several associations like NHB, SBI, MSAMB and CDC-Consultancy Development Centre. And member of:

- National Cold Chain Development (NCCD)
- Global Cold Chain Alliance (GCCA Including partners IARW, WFLO, IRTA and IACSC)
- ISHRAE India
- ASHRAE USA
- International Institute of Ammonia Refrigeration (IIR)
- Indo German Chamber of Commerce (IGCC)



Their strengths are across all aspects of Project Consultancy Services like Architecture, Structure, Refrigeration, Electrical, Insulation, Material Handling, Processing and DPR & Allied services.

Mr Harshal says that cold chain is a safe refrigeration assisted path of food from the farm to consumer. Not a new area in our country. We have well established systems to milk and milk products and to some extent for fish, meat and poultry products. This is emerging section for fruits and vegetables and has tremendous potential.

The Fresh product contains the following processes Starting from the farm till

ly there is no fool proof process to screen that. Maybe you can use conventional methods of install rat traps, fumigation, but you should not use rat poison inside a cold storage. But one has to acknowledge that this is a challenge and question of hygiene.

Do you help customers set up a pack house?

Yes! As consultants, we can help in all every area, starting from designing the project, structure design, architectural requirements, insulation requirements, refrigeration and electrical requirements etc.

How much land is required for a multipurpose cold storage unit? What will be the cost to maintain the unit?

Usually for a rental facility of 2000 ton capacity, you need a minimum of $\frac{3}{4}$ of an acre. They usually recommend allocating 2-3 acres, it is easy for subsequent expansion. Maintenance cost depends on the unit and its operation. While there is a thumb rule for setting up cost, there is no thumb rule for maintenance cost.

What are the opportunities for individual entrepreneurs in Cold Storage/Cold Chain that are there with an investment of Rs. 50 lakh -1 Cr?

For a personal fund of Rs. 1 cr, you can get 75% of the project cost as bank loan. With subsidy, the capital is around Rs. 4 cr. With that, you can set up a facility with 2500-3000 tons. One has to identify the correct size of the facility where the recurring fixed costs are covered in your returns. If not, you will run more costs, that will make the project unviable.

What will be cost of cold storage for vegetable for a 2-ton

capacity? What will be the vehicle cost with 1 ton capacity and what will be the per km running cost?

2-ton facility seems like a walk-in type. You can get this information directly from the market as there are standard walk-in type facilities available with dealers. Regarding vehicle costs and running also, you will be able to get information directly from vehicle manufacturers.

Is it better to set up a facility for domestic needs, due to the cost involved? What is the percentage effect of Fruits and vegetables exported from India?

Local markets in India are wide open, and we have high production capacity. Once setup, with exports in mind, that can cater to local need also. Many people in India still prefer local vendors, shops to bargain and buy.

You need to be aware you need several certifications to comply when you set up for export. It is important to have a trusted partner in the exporting region to manage the process locally and make sure that you have all your risks covered.

What is your advice to small farmers to set up more accessible irradiation facility?

It will be highly difficult for a small farmer to set up such a facility. However, a bunch of farmers (say a group of 50) can get together and create a common cold chain facility. They can avail subsidies/grants from government for the setup. There are such groups that have successfully set these kinds of facilities and share the profits with the farmers. But there should be a person who is capable of handling such situations. Ideally an irradiation facility setup should be created and managed at Government level.



reaches the consumers.

- Sorting
- Packaging
- Storage
- Transport
- Marketing

He also cites there are leakages in almost all the steps involved. As Cold Chain Consultants, it is their main goal to stop all these leakages. There are different Routes in Cold Store Systems.

1. Route A: Cold Storage

Multipurpose Cold Storage: MIDH (Mission for Integrated Development Horticulture) guidelines states that any Cold Storage project which has 7 chambers or more, with a capacity less than 250 tons are considered as Multipurpose Cold Storage. However, they cost more around INR 13K-17K/tons. Smaller the chamber, the pricier it becomes. You can store commodities like fruits and Vegetables, spices, milk products, beans, pulses, turmeric and to some extent onions etc.

Bulk Storage: All other projects which have bigger chambers are classified as Bulk Storage. They usually store single huge volumes of commodity like potatoes, Apples, Pear, Raisins. The cost is around INR 10-12K/ tone. They overcame some of existing problems in stor-

ing onions, by using new technology and now even store turmeric and carrots. With proper design and recommendation on chambers and processes, setup cost and energy costs can be reduced and saved. 2 common models of a cold storage business setup are Trading Model and Rental model. In the Renting model, the ROI is typically between 5-7 years, where as in Trading model ROI is faster.

2.Route B: Pack house

Pack house is where fresh produce comes in and is graded, sorted, cleaned, packed and “precooled”. Precooling is a process of rapidly bringing down the temperature of the commodity to a certain temperature within 5-6 hrs. The pre-cool temperature varies from product to product. Once the commodities are precooled, they need to be maintained and stored in that same temperature and is one of the critical process in the cold storage for certain fresh fruits and vegetables.

This is where India has growth potential, as requirements outnumber the existing facilities. Asian Development Bank and Government of Maharashtra are coming up with high value projects to setup pack houses. World Bank is also coming up with projects in various states of India. Flowers, grapes, pome-

granates, and strawberries follow precooling route. Several states like Maharashtra, Karnataka, Andhra Pradesh, Punjab, Haryana, etc have

setup pack houses. Precooling facilities have a separate area for receiving the commodity, Grading /Sorting, Packaging, Precooling, cold storage, and despatch.

3. Route C: Controlled atmosphere storage

In the CA storage, commodities are stored in specific temperature. Other than reducing the temperature and humidity in the storage, they also reduce the amount of atmospheric Oxygen from 21% to 1.5-3% and increase the amount of Carbon-di-oxide.

Because of this, the commodities are put into a hibernating state, maintaining their freshness for a longer period of time. For utilizing maximum benefit of CA storage, the product needs to be in the facility within 24-48 hours of harvest. That is why these facilities need to be set up very near the harvesting area. They have such facilities in Kashmir and Himachal Pradesh. Currently in India CA facilities are being used to store apples and pears. They have tried storing Lemons; however, it does not seem feasible as the cost of setting up a CA store is 3 to 4 times of the regular cold storage set up.

4. Route D: Frozen section

In this route activities like blanching, pre-processing, IQF (Individual Quick Freezing) occur. The process is principally similar to precooling route, and the temperature of the products is brought down rapidly, to (-)18 deg C. Unlike to precooling route, the target temperature is (-)18 degrees C for all the products. Some of the popular items in this route are green peas, okra, mixed vegetables, tomato puree, fish, meat, poultry products, cooked food etc.,

5. Route E: Pre frozen section

In this route, the products reach the facility pre frozen from the factories. Examples are cheese, butter, ice-cream etc. Once they reach the facility they are just stored. Only transportation and storage need to be addressed. They are trans-





Cold Chain

ducers of milk, fruits, and vegetables in the world. It is estimated that the milk production is 130 million M.T and fruits and vegetables production is 280 million M.T. We

have the largest cattle and poultry in the world. There is a rapid growth in the "Ready to eat" segment also. Currently we contribute around 5-6% in the Food processing sector.

ASHRAE's (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Guide on Sustainable Refrigerated Facilities and Refrigeration Systems and 'Cold Storage basics' (published by ISHRAE) authored by Mr. Arvind Surange are good sources of information. About the relevance of cold chain presently, he says it is a major upcoming sector and provide good opportunity for employment in future. With the growth in food production and Food processing, Packhouses play a major element in getting the fruits and vegetables industry into cold chain. Current COVID situation creates more opportunity in low-cost Reefer transport to get supplies to reach. For example, to transport of vaccines, they may not need huge storage, but the requirement of logistics is heavy. Transparent policies are needed to ensure effective functioning. Multiple Govt agencies (MOFPI, APEDA, NHB, NHM etc) and financial institutions like ADB, WB are promoting growth in this sector.

In the future it is imperative that we need more refrigeration and cold storage facilities. Proper designing is extremely important for the facility to be less harmful to the environment. Designing should be put in place way before the start of the execution of the project and cannot be changed once it is executed. Efficiency in terms of power, reducing the environmental foot print, re-use of water, natural ventilation and lighting, environment friendly material etc., are to be considered for sustainability. This sector is rapidly growing and have an excellent returns and benefits.

CONTACT :
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ported in reefer vans and these facilities are usually located at consumer centres and are a part of multi-purpose cold stores.

6.Route F: Air Conditioned and Ventilated storage

Some processed food and packed items need airconditioned storages and do not need extremely cold storages, they would need 15 deg. Products like chocolates, confectionary items, tobacco etc can be store in these routes. Another type of ventilated storage "Controlled Ventilated storage" is used to store Onions. However, one must realize that the weight loss in Onion storage is more this is type of storage, and the weight loss is significantly less in cold storage. According to the last guidelines provided by the Ministry of Food Processing, to be qualified as a cold chain facility, you need at least two components like Farm level facility, and a storage facility (like a Hub), a farm level facility and reefer vans or all the components including farm level facility, a store facility (like a Hub) and a reefer van. Latest technology of "Irradiation" is where you use radioactive waves to kill the microbes, to increase the life of your products. Irradiation Facility is considered as a stand-alone component of Cold Chain facility as per the last scheme of the Ministry of Food Processing Industries.

7. Distribution Centres

This area is relatively new concept in India. One of the earliest distribution centres was established in 2000 by Radha Krishna Foodland. The facility with all the components of Cold chain put together is a "distribution centre". A typical food distribution centre caters to the following requirements:

- Dry goods store to store non-perishable products with or without ventilated and air-conditioned areas.
- Raw material receipt and storage block.
- Processing, freezing and packing zone
- Cleaning, drying, grading, packing / precooling zone
- Ripening chambers
- Cold and frozen food storage
- Delivery dock
- Services for workmen, utility service block and administration

The distribution centres must have separate paths for processing, cooling / freezing and storage for handling both veg and non-veg foods. The temperature requirement varies from 20 deg C to (-)30 degC. Once the process and facility are set up properly, the leakages that we earlier discussed are mitigated and pipeline from the producer to the consumer is more efficient. About the current scenario of cold chain storages, he says that we (as India) are top pro-

Gap analysis in this sector (as per figures available from 2015)

Types of Infrastructure	Infrastructure requirement (A) (in numbers)	Infrastructure created (B) (in numbers)	All India Gap (A-B) (in numbers)	Gap % (B/A)
Pack House	70,080 nos.	249 nos.	69,831 nos.	99.60%
Reefer Vehicles	61,826 nos.	9,000 nos.	52,826 nos.	85%
Cold Storage (Bulk)	341,64,411 MT	3,28,67,458 MT	22,33,204 MT	6.30%
Cold Storage (Hub)	9,36,251 MT			
Ripening Chamber	9,131	812	8,319	91%



Underwater Farming

What are underwater farms? And how do they work?

Could underwater strawberries and deep-sea herbs provide a more sustainable alternative to land-based farming?

Industrial agriculture is struggling to meet the needs of a rapidly growing population. And decades of intensive farming has taken a heavy toll on the environment.

An over-reliance on pesticides, displacement of wildlife, the wasting of gallons of water and the generation of harmful emissions are damaging our world.

So, scientists and entrepreneurs are hoping underwater farming could address these issues by growing crops under the ocean, eliminating the need for pesticides, while also reducing water use and carbon emissions.

Indeed, the UN estimates the world could easily be fed if we used just 2% of the oceans for sustainable farming.

BOOSTING SUSTAINABILITY WITH UNDERWATER CROPS

Aquaculture has long been used to grow and harvest foodstuffs such as seafood, but several companies are now looking at ways of farming traditional crops such as strawberries and herbs under the sea.

- Industrialized farming was once seen as a solution for a rapidly-growing global population, but it is taking its toll on the environment.
- The UN estimates that the world could easily be fed if just 2% of oceans were used for sustainable farming.
- Underwater agriculture has the potential to eliminate the need for pesticides, reduce water use and cut carbon emissions.

Nemo's Garden is an underwater farming project consisting of six air-filled plastic pods, or biospheres, anchored at the bottom of the sea off the coast of Noli, Italy.

The plastic pods are suspended at different depths – from between 4.5 to 11 metres – below the water's surface, and each is equipped with sensors to measure carbon dioxide and oxygen levels; humidity, air temperature and illumination.

Created by diving company Ocean Reef Group in 2012, the project has already yielded everything from tomatoes, to courgettes, beans, mushrooms, lettuce, orchids and aloe vera plants using hydroponic techniques.

This means that plants are grown, without soil, in a nutrient-rich solution to deliver water and minerals to their roots, in a controlled environment.

UNDERWATER FARMING MEANS NO PESTICIDES ARE NEEDED

Each dome is equipped with seedbeds and a 10-metre spiral tube. Irrigation water and fertilizer are kept in a tank at the lowest part of the spiral,





Underwater Farming

An external water source is only required when initially growing the plants.

VERTICAL UNDERWATER FARMING OF KELP AND SHELLFISH

Meanwhile, a North America-based nonprofit organization called Green-Wave has developed a sustainable agricultural technique called vertical underwater farming or regenerative ocean farming.

The company grows a range of seaweed types like kelp and shellfish, including mussels and scallops, on a rope scaffolding system under the sea.

The model benefits the local environment by requiring zero inputs such as water, fertilizer or feed, while also rebuilding marine ecosystems.

At the same time, seaweed absorbs CO₂ from the ocean, making the water less acidic and helping wildlife thrive, while bivalves such as oysters actually improve water quality.

GreenWave's polyculture farming system also promises high yields with a small carbon footprint, and a low barrier to entry as anyone with 20 acres, a boat and \$20,000 to \$25,000 can start their own farm.

A SUSTAINABLE SEAWEED SOLUTION

In Namibia, Kelp Blue has been granted environmental clearance to start the underwater farming of seaweed crops that can be harvested for fertilizers, textiles and pharmaceuticals off the country's coast. Kelp is one of the fastest-growing organisms on the planet. It helps create habitats for many marine species and can be sustainably and repeatedly harvested for at least seven years.

The seaweed is also a very efficient carbon sink, with the company aiming to capture millions of tonnes of CO₂ a year by 2050. Also focusing on seaweed is Bangalore-based Sea6 Energy, which has designed a tractor-like vehicle called a 'SeaCombine' to seed and harvest tropical underwater plants.

The fully mechanized seeding and harvesting catamaran is currently being used for seaweed farming off the coast of both India and Indonesia. As well as providing a gelling agent for use in food production, Sea6 Energy's produce can be used as biofuel, in bioplastics and in agriculture, among other things.

By Natalie Marchant

Source : weforum.org

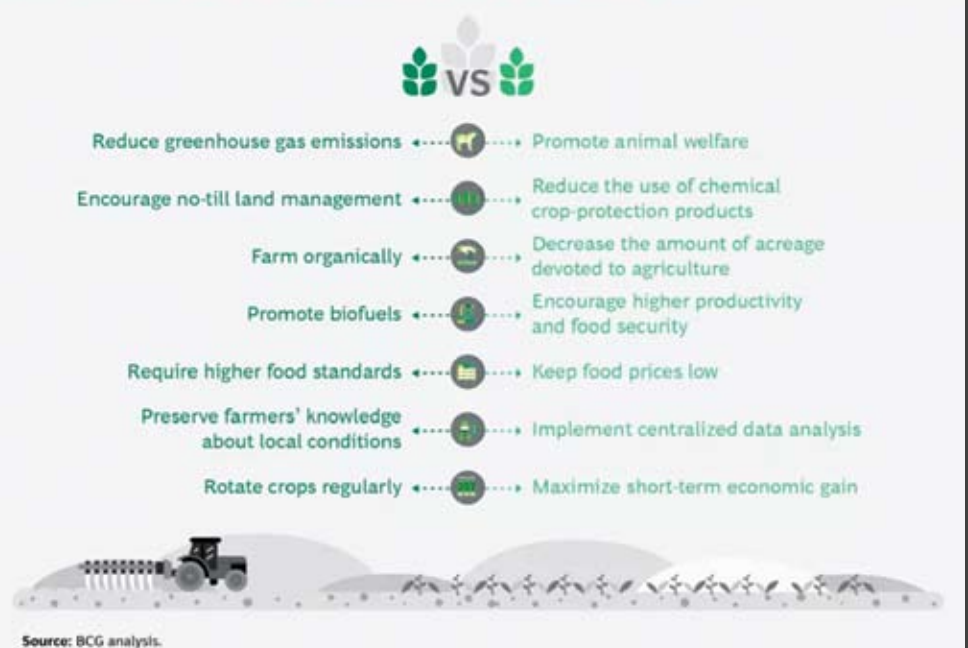
and are delivered to the plants using a pump.

All these functions can be controlled from an above-water control tower, which is also fitted with solar panels that control a fan in each biosphere to reduce humidity on the plants. Growing crops underwater also benefits the environment by eliminating the need for pesticides as no pests can enter the pods unless they are introduced.

In addition, the biospheres conserve water; seawater in the pods evaporates and then condenses back down to provide the plants with fresh water.



EXHIBIT 1 | Countries Must Balance Potentially Conflicting Sustainability Goals



Q&A

Answer

01

MAHOGANY

6677anna: I have 27 mahogany trees, Which was 8 years old .What should I do next ?

Answer 1 : shanmuga06 : Plz.wait for another eight years then only you are able cut the tree with timber added value.

02

TRAINING IN ORGANIC FARMING

yeskay : Hello all, Please suggest any in-person training available in organic farming around Bangalore area. Regards.

Answer 1 : shivc8a0: Contact us.

Answer 2 : pmpatil_1: Their are some institution provide training under ASCI (Agriculture Skil Council of India) for 21 days certificate course are carried out Krishi Vigyan Kendra (KVK) , University like GKV Bangalore and UAS Dharwad and research institute like IIHR Bangalore kind contact them join the training final assessment through exam and certificate are provided by Govt. Of India under ASCI

03

HOW TO GET RID OF PARTHENIUM?

nprabhs : Hi All, We have coconut farm with 1 year old trees. We take the weeds around the tree once in a month. But the area between trees are filled with parthenium and we are tired of removing it. We tried salt water and its only for couple of weeks. Again the Parthenium plants pop up. Please guide.

Answer 1 : garao56: Dear sri Nprabhs, Please follow the information on Parthenium

Scientific name: Parthenium hysterophorus

Common name: Carrot grass, congress grass

Family: Asteraceae

Biology and habitat: It is a noxious exotic weed which has spread to many parts for country covering 5 million ha. It is annual plant (thermo and photoinensitive). reaching 2m tall in good soils, usually 50 to 150cm, germinating after rain at any season, flowering in 6 to 8 weeks, and senescing with drought or frost. the stem is branched and covered with trichomes.

Leaves are pale green, lobed, hairy, initially forming a basal rosette of strongly dissected leaf that are up to 30 cm in length. Young rosettes with their radial leaves closely press to the ground, allow no other species to come up in their vicinity. The number of leaves per plant ranges from 6 to 55. Flower heads are creamy white, about 4 mm across, arising from the leaf forks

Reproduces by small seeds lasting up to 20 years in soil, induced dormancy on burial The plant is capable of flowering when one month old and remains in flower for 6 to 8 months It produces 5000-10000 seeds/plant. The toxin parthenin is responsible for allergic dermatitis and mental depressions in human beings. Plant prefer moist shady and organic rich habitat. They have remarkable adaptation to environment extremes which exerts allelopathic influence on the neighboring plant

species, the seed leachates inhibit germination of other weed seeds cause allergies and skin diseases. Seeds are light in weight and armed with pappus and disseminated by wind, water birds and animals. It is not only an agricultural weed but also a municipal weed.

Control:

Management

1. Mechanical and cultural: Manual uprooting of Parthenium before flowering and seed setting is the most effective method. A plant in flower will aid in the dispersal of pollen grains, resulting in allergic reactions.

2. Ploughing the weed in before the plants reach the flowering stage and establishing pastures or other plants may be effective

3. Competitive replacement of Parthenium can be achieved by planting species like Cassia sericea, C. sparsiflorus, Amaranthus spinosus, Sida acuta, Tephrosia purpurea, Stylosanthes scabra and Cassia auriculata, which will compete with the weed and reduce its population.

4. Similarly, planting Cassia tora will help to cover and suppress the growth of Parthenium. In certain parts of India, crop rotation using marigold (Tagetes spp.) during rainy season, instead of the usual crop, is found effective in reducing Parthenium infestation in cultivated areas.

5. 2,4-D, paraquat provide effective control of weed.

6. Pre-em application of atrazine, alachlor, butachlor prevent seedling emergence up to 2-5 months.

7. Chlorimuron @0.2-0.4kg/ha and metasulfuron @0.003-0.0045 kg/ha as pre-em.

8. Already established vegetation: in non cropped areas 2,4-D esters @2-5kg/ha or common salt @ 15-20% at actively growing stage.

9. Biological. The leaf-feeding beetle Zygogramma bicolorata and the stem-galling moth Epiblema strenuana are widely used in several countries to manage Parthenium. Z. bicolorata is now widely used in India to control Parthenium. The moth significantly reduces flower and seed production of the weed, especially at a young age.

Answer 2 :raashi: PARTHENIUM comes in dense as a weed. it has a high quality of Nitrogen and therefore, you must remove this parthenium before it flowers and bury it in one place together with cow manure. It can be used as a very good source of manure.

04

ORGANIC FARMING ON CULTIVABLE WASTE-LAND

vibhus: Dear Experts, I needed some advice on the feasibility of doing organic farming on cultivable wasteland.

Please find below my questions-

1. Is a cultivable wasteland in a village lying idle for 3-5 years a good option for organic farming?

2. What will be the steps required for land preparation?

How will they be different from the steps of regular agricultural land?

3. Since there has been no chemical farming on the cultivable wasteland for more than 3 years, will the organic certification



can be availed early after the restart?

4. What can be the prospective lease price for an acre of cultivable wasteland?

5. Will there be a big difference in the production cost on cultivable wasteland compared to regular agricultural land?

6. Any other relevant information you want to share.

Thanks for your help. Kind Regards!

Answer 1 : ecojobsin: I. Yes.

2. Depend on land/soil and atmospheric characteristics, and the crops planned.

3. Yes. It will be easier to get certification as there is no chemical history to be corrected.

4. Lease rate depends on location, infrastructure and other relevant factors applicable.

5. Cost depends on what you want to cultivate, the present conditions of land/soil and atmosphere, water sources and supply arrangements, and other infrastructure required etc.

We provide complete consultancy services for Organic Farming projects with High Value Crops, in all types of land and all climatic locations.

Answer 2 : garao56: Please contact us for guidance

Answer 3 : organic84: I.) Yes,

2.) You can start organic Farming on wasteland, But it also depends on your Soil Fertility and Atmosphere. If your Soil Quality is good then you can easily start farming on it. But if your soil quality is not up to the mark then you should go for some organic fertilizer for one month and repeat the process twice. This process will boost the Soil's nutrients naturally.

3.) It depends on your current soil Quality because an organic certification agent will approve your soil after its testing. If your soil has no chemical elements are left then you can get your organic certificate.

4.) Cost depends on your Area and you can also increase the cost if your soil has no chemical elements are left.

5.) In organic farming, your production will increase year by year. For organic products information please contact us.

ORGANIC FARMING PROJECT

jrtailor: Dear All, I am looking for the expert guidance for the setting up of the organic farming project.

We have a land of size 2.5 acre located in the near by of Vadodara area (Gujarat State).

Please do connect with me for the further discussion.

Answer 1 : vrikshaay: We provide complete consultancy services for organic farming projects, from farm designs to marketing of products. Please send request mail with your contact details and land details .

Answer 2 : jaisekhar: Hi sir I am experience in intigrated organic farming if you interested please reply.Thank you.

prabhupkk: Dear All, I am looking for the expert

guidance for the setting up the organic farming project.

We have a land of size 14 acre located in the near by of Kirushana-koil area Tamil Nadu State. Please do connect with me for the further discussion.

Answer 1 : rathnamkl: Hi, We are into providing natural farming consultancy services in Tamilnadu. Please contact for your requirement through .

GUAVA PROCESSING

vermaaditya : Dear Experts, Can you please suggest what are the options to preserve guava? what are possibilities? Jam/Spread/pulp? what's min capacity? Please share your experience. Best Regards

Answer 1 : maitys: There are several new brands using innovative culinary recipes to prepare bottled Guava juices -

Blending with vegetable juice , Sugar cane juice etc.

Blending of fruit with sugarcane juice is new entrant in the Indian juice space, not only enhances flavour but also elevates the nutritional profile of the juice and is a great source of vitamins and other essential micro nutrients.

Clarified guava juice powders were made using freeze-drying, spray drying and tunnel drying.

The freeze-dried product had superior quality; however the spray-dried product was stable and may be more economical.

Simple Guava sorbet (ice cream) with spicy combinations ..is also available in India ... one brand is doing roaring business in South India .

Guava commercially used in the production of juice, jams, jelly, beverages, canned slices, etc., which leaves behind huge amounts of guava wastes in the form of peels, eaves, bark, seeds, and pomace. Pectin can be extracted from Guava waste (peel, pulp, seeds , peels etc.)

Answer 2 : futurezen: Please connect to us for Guava Processing.

IS ORGANIC SOIL CONDITIONER A BETTER OPTION?

deepak47: Hello all, Nowadays farmers are excercising zero cultivation technique in the farms to maintain the soil structure. Is organic soil conditioner a better option in application on the farms to maintain healthy soil and improve aeration ?

garao56: Dear Sri Deepak, Soil is the base for crop plant growth and development. Soil structure and fertility management in a sustainable form is imperative for organic farming. Under organic farming, the soil fertility is maintained by adoption of appropriate crop rotations and application of organic manures and bio-fertilizers.

By adoption of the following practices improves better than the soil conditioner.

1. Crop rotation

2. Organic manures

3. Bio Fertilizers

Don't rely purely on soil conditioner which may not be cost effective.

Please consult us for further details



Question

Q&A

Answer

08

NEED SUGGESTIONS- PERMACULTURE?

kashwee: Hello, Happy Sunday! Hope you are keeping safe through these pandemic times. This is my first post here, requesting help with ideas and suggestions, I don't

know if I am posting it in the right topic section. we have a history of farming, traditionally paddy is grown. however want to experiment with permaculture kind of farming in a land of about 5000 sq ft to start with. The plots are separated by 30 ft road, a residential land in a village. Plan is to get returns all round the year, quarterly or twice a yr from interplantatation, and returns after 7-10 yrs for main plantation, to be noted, experimenting only. Please share your valuable suggestions.

Main factors-

Water isn't an issue, at any time of the year, hopefully we preserve it.

We need low maintenance kind of ideas, since we are on and off the village and an extended family member of ours could keep a watch on it.

Monkeys are frequent visitors

Red to black soil

finance isn't a concern at all

Main plantation : melia Dubia or sandal wood or bamboo

inter plantation; lemon, sweet lime, oranges what else can we opt considering monkeys

third plantation ideas please?

I would be very grateful to hear out all suggestions to take this project forward.

Answer 1 : rajurajan : Are you looking for commercial income? Or enjoyment?

If commercial income, ask what you can sell in small quantities in your area, and what the prices are.

Melia Dubia is a good idea. If you plant sandalwood, you would also have to factor in security -- otherwise, you will water it for 20 years and then find it gone one morning.

You could also look at some vines that can climb on the timber trees ... e.g., pepper or vanilla.

You could look at some shade tolerant species like nutmeg or cocoa for the understorey.

Also medicinal herbs or spices like turmeric.

They all work together well.

Answer 2 : garao56 : The following is a list of seven different functions that a Permaculture tries to include:

1. Food Staples, legumes, fruits, vegetables, and fats
2. Food for the soil Legumes and organic matter that provide nutrients to the soil
3. Climbers Important for making the most of vertical space
4. Supporters Plants that provide support to climbers
5. Miners or diggers Deep roots or tubers that open the soil and bring up nutrients from deep
6. Groundcovers Protects soil, provides shade, holds moisture, and suppresses weeds
7. Protectors Protection for others in the system (Repellents, attractors, live fencing, etc.)

09

HOW TO GET THE POTENTIAL YIELD OF TURMERIC IN ORGANIC FARMING?

infiniteg : How to get the potential yield of Turmeric in organic farming?

Can we use any biostimulant for increasing yield?

garao56: First of all convert your land into Organic farm by proper cultural practices, it will take atleast 3 years for getting standard yield. Get organic certification for quoting higher price for the produce.

Answer 1 : yogikm : Strictly increase the aeration and micro nutrients content of soil. Use only organic manure from your own land. Never uses chemical, use drip irrigation for soil to retain moisture content.

Answer 2 : garao56 : Abundant manuring (FYM - 10 tons per acre) and other organic growth stimulants and with timely irrigation yields can be maximized

10

NEED CAPSICUM SEEDS OF GREEN, RED AND YELLOW?

vsatya8 : Hello friends

I am looking for Capsicum seeds of Green, Red and Yellow variety as I am planning to cultivate in my farm near Rajamundry. First, would like to go for pilot project of 10 to 50 plants in order to look how it grows under our climatic conditions and also to know how far our soil supports. I want good quality seeds. In market there are many companies selling these, but they had not yielded any results. regards



Answer 1 : perumal99: I have capsicum crop experience in 5 years any information you need please contact.

11

OYSTER AND MILKY MUSHROOM FARMING

ravi41977: I want to start oyster and Milky mushroom farming. But core issue is about marketing of that.

My location is distt Ghazipur. It's 90 km far from holy City Varanasi on Patna route. I am looking for buyers of these mushrooms. Any suggestions/feedback/buying interest . Kindly contact me directly. Thanks

Answer 1 : garao56 : Generally mushrooms have to be marketed locally i.e., in near by cities and markets

Answer 3 : pra9626: Hi, We required huge quantity of milky mushroom in urgent. per day asking qty of 50kgs.

















Answer 4 : rohitej: Hi, We are cultivating Organic milky/oyster mushrooms in Chennai. Our mushrooms are made in extreme hygiene condition with no chemicals



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