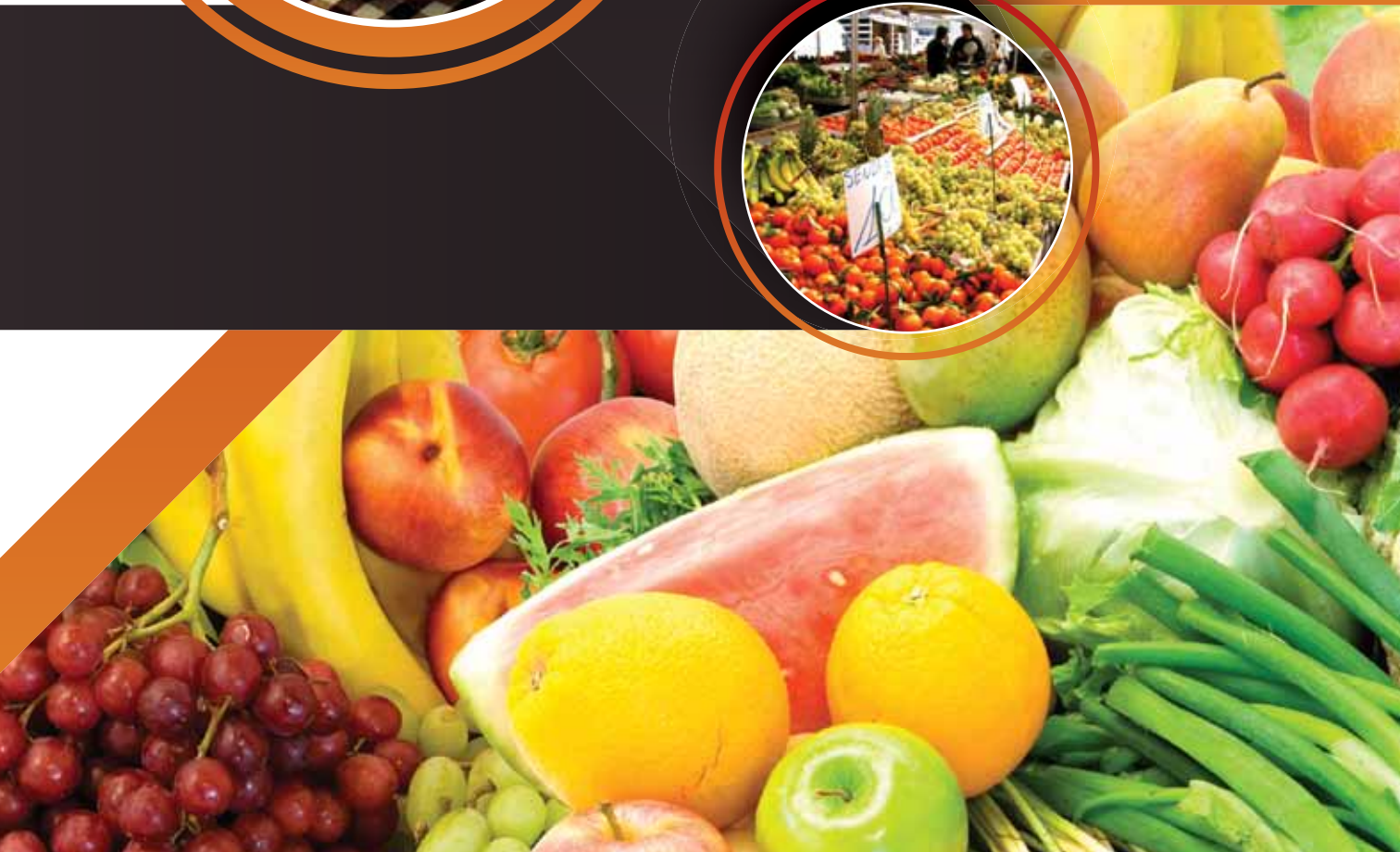


# HORTICULTURE

## ADDING NUTRITION AND INCOME





**F**ood grain production was the top agenda of the Indian government soon after independence.

While that mission was accomplished rather spectacularly owing to various conducive policies and green revolution, India has endeavoured upon another journey where astounding results have been observed. India has started to witness voluminous increase in horticulture production over the last few years. The better incomes and the increasing demand from the sizeable financially stable population have spurred this transformation.

### RISE OF HORTICULTURE

Horticulture has emerged as one of the potential agricultural enterprises and has played a significant role in accelerating the growth of Indian economy. It has also played a stellar role in ensuring nutritional security, poverty alleviation and employment generation. Besides being a major avenue of diversification, they feed many agro industries that are modes of agri-entrepreneurship, rural employment and income generation.

India's horticulture production has grown at a phenomenal pace - Indian farmers now produce more than double the quantity of fruits and vegetables compared to what they did in early 2000. Data shows that between 2001-02 and 2016-

17, horticulture production rose from a mere 146 million tonnes to 295 million tonnes. During this period, production of foodgrains grew from 213 million tonnes to 273 million tonnes, showing the growing importance of short duration horticulture crops for Indian farmers. Production of horticulture

**India's horticulture production has grown at a phenomenal pace - Indian farmers now produce more than double the quantity of fruits and vegetables compared to what they did in early 2000**

crops such as fruits, vegetables and spices hit a record breaking 300 million tonnes in the growth year of 2016-2017, massively overtaking production of food grains for the fifth consecutive year.

The horticulture crops were grown in less than 5 per cent of India's gross cropped area,

compared to 63 per cent used to grow foodgrains. Maharashtra is the largest producer of fruits in India, while West Bengal is the second largest producer of vegetables. While Gujarat grows most amount of spices, Tamil Nadu tops the list of states in the production of flowers.

At present, horticulture contributes 24.5% of GDP from 8% land area. India's diverse climate has ensured cultivation of all varieties of horticulture crops. Fruits and vegetables account for nearly 90% of total horticulture production in the country. India ranks second in fruits and vegetables production in the world, after China. As per National Horticulture Database published by National Horticulture Board, during 2015-16, India produced 90.2 million metric tonnes of fruits and 169.1 million metric tonnes of vegetables. The area under cultivation of fruits stood at 6.3 million hectares while vegetables were cultivated at 10.1 million hectares.

India is the largest producer of ginger and okra amongst vegetables, and ranks second in production of potatoes, onions, cauliflowers, brinjal, Cabbages, etc. Amongst fruits, the country ranks first in production of Bananas (25.7%), Papayas (43.6%) and Mangoes (including mangosteens and guavas) (40.4%).



Besides the conventional fruits, India has also experimented with others. The arid zones of the country are potential areas for fruits like aonla, ber, pomegranate, annona etc. There has been a steady increase in the area and production of these fruits particularly aonla, ber and pomegranate in the country as a result of identification and development of suitable varieties and production technologies. In addition to these, date palm and fig cultivation is also finding favour in suitable areas. There are a large number of indigenous fruits such as jackfruit (*Artocarpusheterophyllus*), jamun (*Syzigiumcumini*), bael (*Aeglemarmelose*), kamrakh (*Averrhoacarambola*), phalsa (*Grewiasubinaequalis*), wood apple (*Limoniaacidissria*) mulberry (*Morusalba*) and Lasooda (*Cordiamixa*). These fruits have diverse uses, besides being hardy and well adapted to different agro-climatic conditions and stress situations. In recent years, olive and kiwi fruits have been successfully introduced in the temperate areas of Jammu and Kashmir, H.P. and U.P. Other useful introductions have been kinnow mandarin and low chilling varieties of pear, peach and plum, which have become very popular in the sub-tropical zone of northern plains. A number of tropical, sub-tropical fruits like avocado, macademia nut, mangosteen and rambutan though introduced in the country have yet to be commercially exploited. There is also need to give priority to nut fruit production, e.g. almond, walnut, pecan nut and pistachio nut in suitable areas in temperate regions of the country. Being low volume, high value crops having a long shelf life, these nuts will find favour with farmers in Jammu and Kashmir, Himachal Pradesh and Uttaranchal particularly in far flung areas.



The country's total horticulture production is estimated to rise marginally to 314.87 million tonnes in the 2018-19 crop year, according to the Second Advanced Estimate (2018-19) of area and production of various horticulture crops released by the agriculture ministry, as compiled from information received from different state/UTs and source agencies. Horticulture production stood at 311.71 million tonnes in the previous year. The area under horticulture crop also rose to 25.6 million hectare from 25.43 million hectare. Under the horticulture crops, production of fruits is estimated to be around 97.38 million tonnes in 2018-19 compared to 97.36 million tonnes in the previous year. Vegetables production is estimated to rise 1.6 per cent at around 187.36 million tonnes. Among vegetables, onion Production is estimated to be around 23.28 million tonnes, slightly higher than production in 2017-18. Potato production is estimated to be around 52.96 million tonnes, which is 3.2 per cent higher than 2017-18. Tomato production is estimated to be around 19.66 million tonnes, which is 0.5 per cent lower than 2017-18. As per the data, spices Production is estimated to be around 8.61 million tonnes, which is 6.01 per cent higher than 2017-18.

### HI TECH HORTICULTURE

With relevance of horticulture increasing in Indian economy, the sector has seen many sweeping changes. Though cost intensive, many Hi-Tech technologies have become indispensable for horticulture development in recent years. 'Hi-tech Horticulture' involves the deployment of



technology, which is modern, less environment dependent, capital intensive and has the capacity to improve the productivity and quality of horticultural crops.

Genetic Modification can be adjudged as a very promising technology that can fulfil the existing challenges of yield stagnation, biotic and abiotic stress. World over, existing advancements have been made. India too had embraced this technology, albeit gingerly. So far, commercially only Bt cotton is cultivated in India. Research in other crops are being pursued. However, currently the policy and political environment are unfavorable for the acceptance of GM technology.

Micro-propagation is perhaps the most popular and widely commercialized global application of Plant Biotechnology in horticulture. Micropropagation is well-known as a means of producing millions of identical plants ('clones') under aseptic conditions, in a relatively short period of time, independent of seasonal constraints. An added advantage is production of pathogen-free planting materials. Propagation of plants through tissue culture, including sophisticated techniques of meristem culture and molecular indexing of diseases,

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**The annual demand of tissue cultured products constitutes nearly 10% of the total, amounting to 15 176 million US dollars. The estimated annual growth rate is about 15%. Among the developing countries, India is in an advantageous position to exploit this market**

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are of immense use in making available healthy propagules. The global biotech business is estimated at around 150 billion US dollars. Around 50-60% of this constitutes Agribusiness. The annual demand of tissue cultured products constitute nearly 10% of the total, amounting to 15 million US dollars. The estimated annual growth rate is about 15%. Among

the developing countries, India is in an advantageous position to exploit this market. There are about 130 small, medium and large tissue culture units in India. Their combined installed capacity is around 300 million plantlets per annum. However, not all units are functioning at their full production potential, with a combined capacity utilization of 25-30% only. As a result, many of the units have become non-viable. Some of the problems encountered by the Indian micropropagation industry are long gestation period; non-availability of skilled operators; high overhead costs; systems development needed for each new cultivar; problems of scaling up; genetic instability; greenhouse design and management expertise scarce; overproduction of a number of classical crops; difficulties in penetrating new markets; poor market intelligence and expertise; export bottlenecks and poor domestic base.

Protected cultivation is emerging as a significant method of cultivation among horticulturists. Their detachment from the environment and independence from climatic variables have rendered them stability. Considering the advantages of green house, there is



ample scope for encouraging area under protected cultivation of high value flowers and vegetables out of season, both in the temperate and tropical climate. However, profitability in green house cultivation will depend upon the choice of green house structure, selection of crops and varieties and production technologies adopted. States like Maharashtra, Madhya Pradesh, Karnataka, Kerala and the North Eastern States have also brought significant area under green houses. The constraints in adoption of green houses are high investments and nonavailability of cost-effective technology for many crops. The package of practices for green house cultivation is yet to be standardized. There is need to take up studies for perfecting the agro-techniques for cultivating inside green house.

Organic farming has also caught up with the new age farmers as customers have started to shun the conventional farm produce grown with inorganic inputs. This has opened up avenues for alternative inputs of biological origin. Bio-fertilisers offer an economically attractive and ecologically sound means of reducing external inputs and improving the quality and quantity of internal resources. Bio-fertilizers, containing microorganisms, are less expensive, eco-friendly and sustainable. Biological nitrogen fixers, phosphate solubilisers and the mycorrhiza fungi have proved to be useful in horticulture.

Precision Farming has evolved as a movement world wide. The technology involving application of inputs and use of resources for deriving maximum outputs by appropriately integrating different systems involving computers, Global Positioning System (GPS), GIS, Sensors and application

control, has immense prospects for improving production and productivity of horticultural crops. However, by adhering to the basic principles of precision farming, farmers in Tamil Nadu, Maharashtra, Kerala and Andhra Pradesh, among others, have more than doubled their yields. Between 2004 and 2007, the Tamil Nadu Agricultural University undertook a pilot project in Tamil Nadu's Dharmapuri and Krishnagiri districts with



about 400 farmers. Both districts suffered from water scarcity and farmers in the region followed traditional agricultural practices. The university helped the farmers adopt "precision farming". Within a short period, the farmers were enjoying yields that were three to 12 times higher than normal.

Soil-less Culture involving the usage of natural substrates like cocopeat, rock wool, gravel, sand, saw dust, groundnut and paddy husk, vermiculite, perlite etc., have been popularized in horticulture to overcome the variations arising from the non uniform soil compositions. Media constituents like cocopeat is successfully

used for better management in both vegetables and flowers. It is already proven that crop grown on cocopeat and rock wool have better growth and development compared to soil grown plants. Hydroponic techniques using deep flow technique, nutrient film technique are used to limited extent for commercial cultivation of vegetables and flowers.

High Density Plantation is a proven technology, commonly practiced for mango cultivation worldwide and combined with other sustainable agricultural techniques, has the potential to yield upwards of 200% more produce than that by the traditional method. Project Unnati is aimed at a large scale adoption of UHDP in the country and aims to scale up the project to cover end-to-end fruit supply chain and further optimize delivery. The project to be scaled up over a period of 10 years, is aimed at creating an ecosystem that delivers higher growth and income for farmers and 'Grove to Glass' fruit supply chain and optimizing delivery for Indian brands Maaza and Minute Maid Mango. Project Unnati alone is expected to deliver close to 240KMT fruit by the year 2023 - 24. Ultra High Density Plantation (UHDP) technique enables plantation of nearly 600 trees in an acre, against the conventional method of planting 40 to 70 trees. In traditional mango cultivation, trees are allowed to grow as high as possible; they are pruned minimally or not at all. In UHDP, canopy is maintained in such a way as to attain maximum light interception and canopy volume per unit area in early years of plantation. This leads to the orchard attaining full potential in 3-4 years. The gestation period in UHDP is less, and the farmer starts getting returns in the early years,

as UHDP orchards start commercial bearing from the 3rd to 4th year onwards against the 7 to 9 years required in traditional planting. This innovative technique has been standardized and commercialized by Jain Irrigation at its R&D farm at Udmalpet, Tamil Nadu where currently 100 acres is under Ultra-High Density Plantation. The technique further utilizes drip irrigation, offering twin benefits to the farmers by improving yield/acre and simultaneously decreasing the quantity of water used per kilo of mango produced.

### **MICRO IRRIGATION- MAXIMISING WATER USE**

Out of the total cultivated area of 172 million ha in the country, only 65 million hectare (37%) is irrigated. Of the 105 mha meters of utilisable water, only 70 mha meters is utilized for irrigation. Even if the entire water is harvested by 2025,

by present methods of irrigation, 45 percent of the cultivated area will still remain rainfed.

With dwindling water resources, it becomes pertinent to judiciously use water in agriculture. Enormous quantity of water is wasted with the present methods of irrigation, which are in vogue. It is becoming increasingly clear that with the advent of high yielding varieties, the next major advance in our agricultural production is expected to come through efficient soil and water management practices, like adoption of water saving methods such as drip irrigation. It has been very successful for irrigating horticultural crops like mango, banana, grapes, pomegranate, guava, citrus, brinjal, cucumber, okra, capsicum etc. Some of the advantages of micro irrigation are saving of fertilizers upto 30%; increase in yield upto 100%; saving of water upto 70%; prevention of weed growth; saving of energy;

improving in quality of produce. As per the estimates, the total cropped area suitable for micro irrigation in the country is to the tune of 27 million ha.

The benefits of micro irrigation and drip irrigation are not restricted to water saving. It increases the productivity and yields of crops due to better air : water ratio thus increasing farm incomes. It considerably reduces weed problems and soil erosion as the water is applied directly to the root zone in very small quantities. The technique also reduces atmospheric humidity which may reduce the occurrence of pests and diseases. It also reduces problems of water logging, salinity and ground water pollution. The continuous application of water in small quantities helps keep the salt concentration below the harmful levels. It reduces the cost of cultivation mainly due to savings in labour costs and energy savings. According to some estimates,







the system can save electricity of 278 kWhr/ha for wide spaced orchard crops and 100 kWhr/ha for closely grown crops. The continuous and uniform application of water across the field will also improve the quality of produce. Combining micro irrigation with water soluble fertilizers, fertigation is a recommended practice in horticultural crops. The fertilizer use efficiency can be increased up to 95% using this system when compared to conventional methods of water application. Moreover, micro irrigation is well suited to all soil types and undulating terrains as the water flow rate can be controlled.

At present, United States (1.64 million ha), China (1.67 million ha) and Spain (1.63 million ha) are some of the leading countries which have adopted drip irrigation. Considering the world's total irrigated area as 212 million ha, only 4.75% of it is currently irrigated under drip irrigation which shows the immense potential that still exists for this kind of irrigation.

India, with a total arable area of 140 million ha with almost 42% of arable land irrigated, too has a huge potential for micro – irrigation which is still underutilized. Task Force on

Micro – Irrigation (2004) estimated a potential of 27 million ha for drip irrigation based on the area under crops most suitable for that form of irrigation, the Indian Committee on Irrigation and Drainage (INCID) estimates a potential of 10.5 million ha.

In India, Maharashtra (0.48 million ha), Andhra Pradesh (0.36 million ha) and Karnataka (0.17 million ha) account for more than 70% of the total area under drip irrigation. However, the total area covered under drip irrigation (1.42 million ha) is still quite low as compared to the potential area of

11.6 million hectare. While Andhra Pradesh (50% of Potential) and Maharashtra (43% of Potential) have been able to bring substantial area under drip irrigation, other states lag far behind.

Micro Irrigation systems have also seen several upgrades, one among which is the Automated Irrigation System which requires just a minimum of manual intervention besides the surveillance. Automated with the help of timers, sensors or computers or mechanical appliances, it makes the irrigation process more efficient besides considerably reducing the





labour charges. However, under the current context, such systems can be expensive and the complexity of the designs may warrant experts to plan and implement. Also, solar energy has replaced electricity which comes in useful in remote locations beyond the reach of electric power lines. According to experts, Solar Photovoltaic (PV) panel is one of the simplest possible ways to generate electricity beyond the reach of power lines. It has no moving parts and lasts for decades with virtually no maintenance. Solar power is no longer an expensive, experimental energy source.

Despite these apparent benefits, farmers across the country have been reluctant to adopt this on a wide scale. High initial costs make the technology unfeasible for small and marginal farmers. Installation of a drip irrigation system requires an initial investment of up to Rs. 1,25,000

per hectare according to some estimates. The system requires proper filtration so that dust and other particles do not block the small emitter holes and sometimes it entails high emitter clogging rates. Drip Irrigation has been used for irrigating only a few selected crops in India. It is adopted mostly for coconut (19% penetration), banana (11%), grapes (10%), mango (9.4%), citrus fruits (7.9%) and pomegranate (6.2%). It may not be suitable for closely planted crops like cereal grains which are grown across large areas in the country. Lack of technical support and follow up by the government, private companies and NGOs may be a hindrance for adoption. Only selected, pre-approved drip kits qualify for the subsidy which stifles creative marketing strategies on the part of manufacturers as well as efforts to bring down the cost of drip systems through innovative

technology or product designs.

Horticulture has emerged as a successful agri enterprise in India. With the demand for horticultural products increasing both locally and globally, many farmers have been motivated to take up horticulture. The high value attached to the horticulture products has also increased the sector's desirability among farmers. However, recurring gluts coupled with lack of suitable infrastructure for prolonging the shelf life of the produce have recently marred the profitability of the sector. Investments need to be made to strengthen the infrastructure and logistics. Good Agriculture Practices and Precision technologies can not only guarantee assured markets, but also ensure judicious use of resources. We have to look for directions to increase the income of the farmers without compromising the integrity of natural resources.



# IMPEDIMENTS TO EXPLORE THE POTENTIAL OF HORTICULTURAL PRODUCTS

**T**he state procurement of wheat and paddy drifted the cropping pattern of an entire nation towards two crops, Wheat and Paddy at the cost of the cultivated area in other equally important crops. Albeit, India is at number two in respect to horticultural products after China. But where China is at number one in the export of processed fruits and vegetables, India is far behind at number 19. In 2017, when China exported processed fruits and vegetables worth 8805 million dollars, India's export were only 1085 million dollars. Similarly, with respect to the export of fresh fruits and vegetables, where China is at number 6th, India is at number 28th. In the same period, China exported these products worth 5837 million dollars where India exported only of 1166 million dollars.

Apart from their low export, these products are not within the reach of every Indian. Particularly, the fruits, which should have been a regular part of the diet of every individual, are beyond the reach of

90 percent of Indians because of the high prices. If it may be assumed that there is no potential to enhance the production of these products, the cropping pattern and depleting area under these crops negates that conception. Positive co-relation between farm holding and the area under these crops was observed in number of studies. As the size of the holding is increasing, the area under these crops was also found to be increasing.

While analyzing the volatility in the prices of vegetables and fruits and often repeated circle of fluctuations, the lack of assured marketing was observed as the main impediment. As 93 percent of the Land holdings are below 5 acres, those are reluctant to grow such crops, because of the involved risk, either of price or of output. While assured marketing of wheat and paddy is the main reason for escalation of area under those crops, lack of assured marketing is the main impediment for depletion of the area, even with the high profitability. The small farmers are unable to bear the risk and they are prepared to forgo the high profits if it involves risk.

Fruits and vegetable crops are yielding more income as indicated by the fact that with 13 percent area under these crops, their contribution in the agricultural G.D.P is 30 percent. Where there is underemployment in agriculture, horticulture has the capacity to absorb more labour. When central and state governments are stressing





on diversification of cropping pattern as a measure to enhance the farm income, and where there is high potential of income and employment in horticulture products, the measure of assured marketing becomes the only issue that needs to be addressed by a prudent policy.

It is being reported that 18 percent of horticultural products goes wasted every year because of the lack of appropriate preservation facilities. Hardly 0.4 percent of these products reach cold stores. The farmers have least involvement in the cold storage services. About 96 percent of the cold stores are owned by the private entrepreneurs, and 4 percent belongs to co operative societies and government. The distribution of cold stores is also uneven. 60 percent of the cold stores are located in 4 states of Punjab, UP, West Bengal and Gujarat. The co operative movement could not involve the farmers to build their own stores and that proved as a hurdle.

Four percent of fruits and two percent of vegetables are processed whereas in developed countries, 85 percent of the horticulture products are processed to preserve

and prolong their shelf life. Even in Thailand, 35 percent of products are processed and the China is far ahead in the area of processing. Role of processing is most imperative for their exports. While analyzing the slow progress of agro-processing, particularly of fruits and vegetables, inadequate supply of these products to avail the full capacity of the unit is assigned as the major factor. There is volatility in production as well as in prices. The instances to throw away the potatoes on roads in one year and to depend on their imports in the other are instances pointing at the unpredictable scenario.

This volatility of prices either of fruits or of vegetables never affects its traders. No risk is involved in their business. It is a daily affair and not seasonal. They may purchase from the market or from cold store, it is irrelevant for them. Even in the period when the potatoes were thrown out on road, traders were enjoying comfortable profit. Often the consumer price is double or three times from the prices obtained by farmers, in most of the vegetable and fruit products. But what is the share of the farmer in that price?

This share can be created through the co operative model similar to the model of dairy co operatives in India, that have never been tried.

Now the Government of India has announced a new procurement policy in which some new crops would be added for state procurement with the collaboration of state governments. It is imperative to add some of the fruits and vegetables crops those are most suited to that areas. Even in the same state, the zone system can be adopted on the basis of more yielding crops of the zone. The contract farming system of developed countries like Canada, Australia, U.S.A etc., must be emulated in which the contracts are made for quantity and price with the farmers. The horizontal constraint of space in our country can be compensated by vertical expansion of space by growing fruit trees. The prudent policy assuring the marketing of horticultural crops can be much helpful to extricate the farmers from their web of deficit farming.

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# VALUE ADDITION FOR BETTER INCOME

## SUCCESS STORY OF MADHUR FRUITS

**D**oubling farmers' income has been a long standing objective of the government. The perishability and the inability to convert fresh perishable produce into value added products with a longer shelf life has most often deterred farmers from not only realizing profits but also forcing them to live in penury.

Thottiam Banana Producer Group, a young and dynamic farmers group founded in 2014 by 13 like minded agriculturist in a town called Thottiam in Trichy district, Tamil Nadu, tells a different story. MADHUR FRUITS a unique value added product developed by the farmer group has become a success story that could be emulated across the country. The Moniker derived from the presiding deity of Thottiam, 'Shri MADHURAKALI AMMAN' has become a common name for quality and taste. Launched by the then Minister for Agriculture Shri. Radha Mohan Singh and Minister of State Dr. Sanjeev Kumar Balyan in 2014,



Madhur Fruits has even made a name in the global market.

The Farmers group is one of the sub groups functioning under the Tamil Nadu Banana Producer Company Ltd formed with the guidance of SFAC (Small Farmers Agri-Business Consortium, Dept. of Commerce, Govt. of India, New Delhi) and Tamil Nadu Agricultural Marketing & Agri-Business Department to effectively cater to the business needs of the Banana growers in Tamil Nadu. " Tamil Nadu Banana Producer Company has 1000 banana growers as shareholders which has been formed

with Banana Producer Societies and Groups covering from 13 banana growing districts of our state. The company was incorporated in the 25th of July 2014," says Director, Mr. G. Ajeethan, Thottiam Banana Producer Group. Mr. Ajeethan, a post graduate in sugar technology redesigned his career to be a full time agriculturist with an on farm experience of 26 years. He was the first farmer to introduce Tissue culture banana seedling in Tamil Nadu in association with Spic Bio-tech Ltd, Coimbatore in the year 1989. He cultivated tissue culture variety of native Poovan variety of





banana which doubled the yield to 21 M.T per acre for which he was awarded Best Banana Grower 2003 by the National Research Centre for Banana, Trichirappalli. He is also a recipient of Best Farmer Award 2005 from Rastriya Chemicals and Fertilizers(RCF)Ltd Mumbai, for judicious utilization of fertilizers combined with organic inputs for better yield in ground nut.

His pioneering work with a group of farmers from the neighbouring village to put up a solar dehydration facility for banana, first of its kind in India to add value and convert the traditional banana varieties in to value added products successfully was the beginning of the journey of Madhur fruits. The project that cost Rs.10 lakhs was donated by Bayer Material science and German Development Bank as a part of social upliftment initiative.

"Traditionally grown matured banana varieties like Poovan, Karpooravalli, Neypoovan and Rasthali are chosen to scientifically ripen in climate controlled ripening chambers. Farmers are paid Rs.1.50 per fruit or the prevailing market rate whichever is higher. This has enthused the banana growers to offer even the farm ripened bunches

for solar dehydration. The fruits are processed by the technical protocol advised by National Research Centre for Banana, Trichirappalli. The project met with tremendous success. The government of Tamil Nadu realizing potential of this value added activity has now announced 100 solar driers at 50 percent subsidy to growers to improve their farm revenue and livelihood," says Mr. Ajeethan.

Fully matured Farm fresh bananas selected from the orchards grown on the confluence of river Cauvery in Thottiam Taluk forms the raw material. Quality fruits of traditional banana varieties are ripened in a scientific method using climate controlled ripening chambers. Ripened fruits are dehydrated in the state of the art "GREEN HOUSE SOLAR DRIER" hygienically. Honey, a natural preservative sourced from KOLLI Hills, are impregnated on bananas for sweetness and softness and rolled out into a Nutritive honey laced solar dried Banana, an instant energy booster. The shelf life of the product is six months.

"We have 3 PV ventilated Polycarbonate glazed Greenhouse Solar Dryer which uses German

technology for Drying vegetables, fruits, herbal products, etc. Polycarbonate green house (PGH) drying is a natural ultraviolet filter, meaning that it protects the fruit from excessive exposure to harmful radiation. PGH drying provide better light diffusion than standard glass, meaning light will spread much more evenly throughout the greenhouse. All the fruits, vegetables, herbal leaves, etc are evenly dried. PGH drying reduces only the moisture content of the fruit without reducing the nutrition content of the fruit. PGH results in a hygienic dried fruit fulfilling microbiological norms, residues free from extraneous matter, better sensory attributes and Quality,' explains Mr. Ajeethan.

The company has also obtained license from Food safety standard association of India FFSAI No.22414317000614 with GS1 international Barcodes labelled on the product. The Farmers Group under the trademark "MADHUR FRUITS" distributes Solar Dried Bananas through various farmers' organic retail stores which operate under Brick and Mortar model such as: Unnathi (Retail outlet dedicated for farmer products) and Organic and curated outlets. Online stores such as Amazon and Qtrove are also used for marketing.

The farmers' group has evolved with a common objective of improving the livelihood of the banana farmers in and around Thottiam. Being a first of its kind in India, TBPG is the pioneer in solar drying of all type of fruits, vegetables and herbs. TBPG provides members with economic benefits in terms of access to dynamic markets. "Our collective action remains an important potential strategy to increase small-scale producer participation in emerging modern markets and to generate sustained commercial flows of high-quality products," avers Mr. Ajeethan.



# LITCHI – SWEET YET BITTER



Mr. BP Singh, Secretary, Litchi Grower Association

Litchi has over the years become a prominent fruit in India, with production mostly centered around Bihar and West Bengal. Litchi production in Bihar, that grows 60 percent of the country's litchi production, has gone up by 50 percent to 60 percent over the previous year. However, the alleged connection of Litchi with the Acute Encephalitis Syndrome in Bihar has affected the market prospects of this fruit. In an interview with Agriculture Today, Mr. BP Singh, Secretary, Litchi Grower Association enumerates the challenges and opportunities of Litchi cultivation in India.

## What is the total production of Litchi in India?

The total production of Litchi in India is 750000 Mt annually. The crop covers an area of 80000 hectares. India is the second largest producer of litchi in the World after China. Among fruit crops, litchi ranks seventh in area and ninth in production but is sixth in terms of value in India. The national average productivity of litchi is 6.1 t/ha, which is much lower than the realizable yield of the crop under well managed condition.

## What is the export potential of Litchi?

Litchi is most delicious and costly fruit. But due to lack of cool chain system and adequate infrastructure currently the export prospects are very limited. However, "Shahi litchi of Bihar has earned GI tag and I believe that it offers tremendous export possibilities with right infrastructure support.

## Which states in India are the largest producers of Litchi?

Bihar is the largest producer of litchi in India. Bihar produces 300000 Mt litchi and covering 32000 hectares.

## How did the recent association of Litchi with Acute Encephalitis Syndrome in Bihar affect the market of the fruit?

It affected the market heavily. The rumour linking all Acute Encephalitis Syndrome cases in Bihar state to consumption of Litchi has affected the market. About Rs. 100 crore worth of Litchi could not be sold.

## What are the activities taken up by Litchi growers' association to improve the market of Litchi?

Litchi Growers Association has petitioned the state and union government to help us recover from the losses incurred due to the half truth information about litchi

spread during the peak business season following the AES death every year. Association is also considering to knock the door of high court for protecting Litchi from rumours.

## How economical is Litchi in doubling farmers' income?

Annual sales of Litchi in India is about Rs 2000 crore. If the government promotes organic farming and provide irrigation system in orchard and adequate infrastructure to develop market points, then litchi cultivation has the potential to double farmers' income.

## What is the level of value addition happening in Litchi in India?

Mostly litchi growers of India are not doing any value addition. In fact, only one percent of total production is processed. We can double farmers' income by promoting and increasing value addition.

## What are the challenges associated with Litchi cultivation in India? What are your suggestions in improving the same?

Research institutions should be encouraged for developing capacity building activities like providing pure commercial proposition of business which can be emulated by clusters. Awareness about Risk management against natural climates should be covered by "Restructured weather based insurance scheme" of govt. Litchi has very short shelf life, so research center should take it on priority to increase shelf life of Litchi. In remote areas, livestock rearing, antelope and wild pig are also a new big challenge for growers because they are unable to fence their orchard. Quick and smooth transport system to south Indian cities is also needed.

# 'INDIA NOW OCCUPIES A PLACE OF PRIDE IN THE WORLD OF HORTICULTURE'



**Padma Shri. Krishna Lal Chadha has brought horticulture to a national focus raising India's esteem in the sector at international level. Today the growth of India's horticulture is recognized as phenomenal globally and India is the second largest producer of fruits and vegetables. Being the doyen of horticulture, Dr. Chadha is aptly referred to as the 'Father of Modern Horticulture'. In the words of Dr. M.S. Swaminathan "Dr K.L. Chadha has provided outstanding leadership to horticultural renaissance of India - he has rendered invaluable service for which we are all very grateful" a phenomena which has led to the Horticulture (Golden) Revolution in India. He has been recognized by various R&D organizations, Food Processing industry and Farmers Organizations through 20 awards, including Borluag Award, Om Prakash Bhasin Award,**

**B.P. Pal Memorial Award, H.S.I.-Shiv Shakti Life Time Achievement Award. In an interview with Agriculture Today, Dr. KL Chadha discusses the journey of Indian Horticulture so far.**

## How has Indian Horticulture grown over the years?

India now occupies a place of pride in the world for production of different horticulture crops. Its role in crop diversification, food, nutrition and employment generation was realised only in mid 1980s. Thereafter, development of horticulture in the country has been planned systematically through higher financial allocation to the sector from a meagre sum of Rs 3.5 crores and Rs 25 Crores in VII Plan to 31.9 and 789 crores in VIII Plan to Rs 1,050 and Rs 15,946 Crores in the XII Plan for research and development respectively. The increase in budget was 300 times for research and 638 times for development between VII to XII plans. The increased allocation resulted in establishment of a sound R&D infrastructure and launching of several flagship programmes. As a result, this sector has witnessed tremendous growth in area,

production and productivity from VIII Plan onwards. The area under horticulture crops has increased from 12.8 million ha in 1991-92 to 25.87 million ha in 2017-18 resulting in cumulative increase of 99 % during the last 28 years. During the same period, total production increased from 96.6 million MT to 314.67 million MT registering a cumulative increase of 223 %. The average productivity also witnessed a significant increase from 7.5 to 12.3 MT/ha in the same period with cumulative increase of 62%. As a result, India is now the second largest producer of fruits and vegetables in the world after China with a share of 12.2 and 10.7 per cent of total global production, though the Indian fruit productivity is higher than China. Among fruits, India is the largest producer of banana (26.2%), mango & guava (41.9%), lemon & lime (16.4%), papaya (44.4%), pomegranate, sapota and aonla. India also produces 21.04% of grape, 10.4% of citrus fruits and 14.96%





pineapple. Among vegetables, India is the largest producer of okra (73.6%) and pea in the world, while second largest producer of potato (12%), dry onion (22.1%), brinjal (27.1%), tomato (11.1%), cauliflower (36.4%) and cabbage (11.9%). In plantation crops, India tops in coconut and arecanut production and is the second largest producer of cashewnut after Vietnam. In spice crops, India ranks first in the production of chilli (dry), coriander, fennel, aniseed, cumin, while in turmeric, garlic, ginger and small cardamom, India ranks second. In pepper, it occupies the third position.

In recent years, production of horticulture crops outperformed the production of food grains starting 2012-13 recording 269 million MT production against 257 million MT of food grains. It touched 312 million MT in 2017-18 against 285 million MT of food grains. The first estimates for 2018-19 also showed that production of horticultural crops will touch 315 million MT. This has resulted due to proactive government policies, increased infrastructural support, as well as farmers' interest due to growing market and a quicker cash flow. The impact of the above initiatives have become quite visible, and their role in development of this sector has been recognised in our country. Horticulture has emerged as the Growth Driver of Agriculture in India. Future of sustainable agriculture in the country lies in promoting technology led horticulture development. Highest annual growth of 9.5% has been recorded in fruit production as well as 7% in vegetable production during the period 1991-92 to 2018-19. There is now a shift from production of bulk/staple commodities to high value horticultural produce and products. Horticulture has emerged as a means for sustainable intensification and diversification globally to enable remunerative, viable, sustainable, alternate production system in agriculture and an economically viable option for small holders.

### How significant is the role of horticulture in doubling farmers' income?

I believe horticulture sector has been a key contributor in enhancing farmer's income in the country. The staple crops such as cereals, pulses and oilseeds while occupying 77 per cent of gross cropped area have been contributing only 41 per cent of total output to the crop sector, whereas horticultural crops have been contributing 33 per cent of total output from 15.08 per cent area which clearly shows the potential of horticulture in enhancing farmers' income.

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Diversification to horticulture has enabled the production of more energy resulting in high returns per unit area compared to field crops and earning more foreign exchange. These crops also have high potential for efficient utilization of wastelands, need comparatively less water than food crops and provide higher employment opportunities. These are also rich sources of vitamins, minerals and carbohydrates and have thus assumed a great importance both in food & nutritional security. Horticultural crops have a high potential for value addition for sustaining large number of agri and pharma industries generating huge employment opportunities besides

being environment friendly. The rapid change in demographic profile of the country is resulting in increased consumption of high value food items due to increased realization about their role in health and nutrition.

Horticultural crops are perishable and high value commodities that require immediate market access and market linkages. Onion, potato and tomato are three most important income generating cash crops for the farmers. Horticulture sector is also supporting many alternate sources of income to the farmers such as bee keeping, nursery management, mushroom production, value addition opportunities besides additional income through intercrop.

### What reasons would you attribute to the consistent performance of horticulture in India?

The performance of horticulture sector over the last two decades has been consistent and phenomenal. In fact I consider it virtually a repeat of the way green revolution took place in mid 60's in India. Starting with the VIII Five Year Plan, various initiatives taken for horticulture R&D by the Govt of India and farmers' interests in horticultural crops have contributed towards consistent performance of the sector. A sound horticulture Research and Education infrastructure in India is also available to develop technology and produce quality human resource.

After independence of the country, there were only 3 institutes, -related to Potato at Shimla, Tuber Crops at Thiruvananthapuram and Plantation Crops at Kasargod, Kerala. Subsequently, in 1967, the Indian Institute of Horticultural Research was established in Bangalore (now Bengaluru), Karnataka. However, major institutional development took place between 1985 and 1996 when a number of institutes, Project Directorates and NRCs were either established or upgraded. These include, institute on Subtropical

Horticulture (Lucknow), Temperate Horticulture (Srinagar), Arid Horticulture (Bikaner), Vegetable Crops (Varanasi), Citrus (Nagpur), Oilpalm (Pedavegi) and Spices (Kozhikode); Project Directorates on onion & garlic (Rajgurunagar, Pune), Floriculture (Pune), Cashew (Puttur), Medicinal & Aromatic Plants (Anand), Mushroom (Solan). In addition, there are National Research Centres on Banana (Trichi), Grape (Pune), Litchi (Muzaffarpur), Orchids (Sikkim) and Seed Spices (Ajmer). Subsequently, the Central Island Agriculture Research Institute (Andaman & Nicobar) was transferred to horticulture science division of ICAR and NRC on Pomegranate was also established at Solapur. As a result, the current infrastructure includes 12 Central Institutes with 25 regional stations, 5 Directorates & 6 National Research Centres. In addition, 13 All India Co-ordinated Research Programmes (AICRPs) with 215 centres are also operative at different research institutes & universities. A number of Central & State agricultural universities including 7 Horticultural Universities each in A.P., Haryana, H.P., Telangana and Uttarakhand and 2 in Karnataka, 39 SAUs, 2 deemed to be universities, 3 CAUs and 3 CUs with horticulture discipline, and 52 colleges of horticulture have also come up to meet the growing requirement of specialised manpower in horticulture sector. Besides ICAR, a number of institutions under the aegis of DST (CSIR), DBT, DoAE, DRDO, Ministry of Commerce, Ministry of Food Processing etc. have been working on different aspects of horticulture R&D.

For systematic development of horticulture, a large number of organizations have been established to promote the horticulture development in the country by Govt. of India under four Ministries, namely, Agriculture and Farmer's Welfare, Food Processing, Commerce and Rural Development. Notable among them are the National Horticulture Board, Bee Board, Coconut Development



Board, NCDC, NAFED, NHRDF, SFAC under Ministry of Agriculture and Farmers' Welfare and Spice Board, Tea Board, Coffee Board, Rubber Board under the Ministry of Commerce, to name a few. Separate Departments of Horticulture have been established in most of the states. Even separate ministries dealing with horticulture have been carved out of agriculture departments in several of the horticulturally important states. Few Central and State funded institutions have also been established like Institute for Organic Farming, Ghaziabad, Central Institute of Horticulture, Medziphema, Nagaland, International Horticulture Innovation and Training Centre (IHITC), Jaipur etc to promote horticulture by Govt of India. India also has the world's largest network of 11 Agricultural Technology Application Research Institutes (ATARIs) and 706 Krishi Vigyan Kendras (KVKs) under the aegis of ICAR for technology assessment, demonstration, transfer and capacity building. The Horticultural R&D infrastructure in India is thus today one of the best in NARS compared to several of the advanced countries.

Various research universities and institutions are engaged in region and crop specific education and research related to improvement, production and post-harvest management

### **Which are the areas that need improvement in horticulture sector today?**

The requirement of horticultural produce and products are increasing in view of food and nutritional security, exports, food processing and pharma industry. Therefore, strategies need to be focused on achieving self-sufficiency in production of quality planting material and seeds, expanding existing area, improving productivity, quality, saving post-harvest losses, adoption of alternate horticulture systems, production of healthy pest free produce and products and improving the transfer of technology. There is a need to adopt hi tech horticultural technologies for improving productivity. It requires a holistic approach starting from production of high quality planting materials through establishment of model nurseries and their accreditation, increased adoption of hybrids, development and use of rootstocks, protected cultivation and precision input management, integrated pests and disease management to post harvest management and value addition.

### **Are you satisfied with the current level of research and development in the sector? Which areas in horticulture**



### need more R&D?

While a virtual revolution in horticulture has taken place in the Horticulture sector in the country through record production, improved productivity and increased exports, the demand of horticultural produce is increasing at a very fast rate due to demographic change, change in food habits resulting in increased consumption due to realization of nutritional and health properties, increasing exports and value addition. Diversification to Horticulture has been a fruitful proposition to farmers as it has brought substantial changes in the income particularly for small and marginal farmers. The requirement of horticultural crops particularly fruits and vegetables by 2030 would reach to 550 million MT. While significant development has taken place in food availability, a lot needs to be done to achieve high production levels in years to come. Though the conventional horticulture will continue to grow with small and marginal farmers, a shift to 'Hitech horticulture' with 'Alternative Horticulture' systems has become the need of the hour.

### What are your views on the various programmes and schemes launched by the Government for Horticulture Segment?

A large number of central sector schemes have been launched during the past few plans for development of horticulture. These include Technology Mission for North Eastern and Himalayan States (TMNE) (2001-02), National Horticultural Mission (NHM) (2005-06), National Bamboo Mission (NBM) (2006-07), National Mission on Saffron (2010), etc. All the on-going schemes however, now stand merged in the Mission for Integrated Development of Horticulture (MIDH), a centrally sponsored scheme launched for holistic growth of the horticulture sector covering all the horticulture crops. The schemes launched by the Government of India have yielded the desired results. However, some new programmes required to be initiated

are Creation of Horticultural Planting Material Development Authority to ensure large scale production and distribution of genuine quality planting material. I also feel the Creation of a Mission on Smart Horticulture is necessary to support adequate research and promotion of micro-irrigation and fertigation, smart nutrient management system, internet of things and Artificial intelligence, protected cultivation, hydroponics, aeroponics, peri-urban horticulture and use of precision tools in horticultural crops production

### What reorganisation would you expect in the current market structure that will help the farmers in realising more profit?

Marketing infrastructures particularly for perishable commodities in India is quite inadequate. Marketing system in mandies is non-transparent and marketing costs heavy due to intermediaries. This calls for innovations in marketing of perishables. The Govt. of India has taken many initiatives through amendments in APMC Act, which cleared the way for contract farming, direct purchase centres and provision of special markets for fruits & vegetables, besides setting up of a unified market. Contract farming has been in existence in several export oriented and other high value commodities like baby corn, sweet corn, chillies, onion, gherkins and papaya which has resulted in acceleration of technology transfer, capital flow and assured market. A number of initiatives in organised retailing have also been taken up. However, setting up of Farmers Producers Organisation (FPO) mandating primary producers as members resulting in formation of corporative entity (a hybrid between cooperative society and a private limited company) largely proven successful and needs to be promoted. It is estimated that about 3000 FPCs have been established so far, in the states of MP, Rajasthan, and Maharashtra & Bihar. I see a future in cluster based farming.

There is need to promote cluster based farming of horticultural crops enabling the agencies to create the desired infrastructure in the cluster locations

Horticultural trade is a potential area which requires more importance. Several issues are still affecting the horticultural exports need to be addressed such as pesticides residues, development of Sea Protocols for export of produce, imports of planting materials and patented varieties in fruits and vegetables etc.. There is need to improve exports through promotion of GAP, organic standards, pesticide residue standards. System wide interventions are needed to minimize food loss and to generate surplus for international markets. Flowers assume importance, particularly in tapping the international market. Spices are low volume high value crops which have the potential to provide better remuneration to farmers.

### What are the challenges existing in the horti-segment?

Although horticultural sector has made spectacular progress not only in area expansion but also in production, productivity and exports of horticultural produce but still there are many challenges before the sector. Inadequate availability of quality seeds and planting material, large scale prevalence of old and senile orchards, poor canopy management, high cost of inputs, low crop yield compared to potential yield, high post-harvest losses and low value addition, lack of trained outreach personnel, unorganised supply chain management etc. are a few of them. In view of introduction of high tech horticulture and precision horticulture, emphasis on skill development has become imperative. The transfer of technology in horticulture crops needs trained horticulturists in R&D instead of influx of trained agriculturists, not well versed in horticulture. The present atmosphere is highly conducive for increased investment in the sector to make it more vibrant in the coming years.