



HORTICULTURE ENGINE FOR AGRI GROWTH AND RURAL PROSPERITY

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From the Editor's Desk

Horticulture - Hoisting Farm Incomes



ndia is endowed with a remarkably heterogeneous area characterized by a great diversity of agro climatic zones, allowing for production of a variety of horticultural crops such as fruits, vegetables, flowers, spices, plantation crops, root and tuber crops, and medicinal and aromatic crops. India is the second largest producer of fruits and vegetables in the world. Horticulture accounts for 30% of India's agricultural GDP from 8.5% of the cropped area.Fruit and vegetable farmers reaped a bumper harvest in 2014 and are set to surpass foodgrain production for the third straight year. Vast supply of production base, increase in population and potential export market will remain the key drivers of the growth in this sector.

Government has also lent massive care to this sector. From the establishment of the Horticulture Division to the latest policy of Mission for Integrated Development of Horticulture (MIDH), the horticulture sector has been the recipient of government's support during the different stages of its growth.

With the development of this sector, many new technologies have been espoused by the farmers in furthering the benefits acquired from practicing horticulture. A 'Hi tech Horticulture' has thus emerged which has increasingly started to replace the low input home based vegetable/fruit farming.

Micro irrigation which stresses on more crop per drop has become the most widely accepted technology in the horti sector, given the high value nature of its produce. 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 fertilizer upto 30%; increase in yield upto 100%; saving of water upto 70%; prevention of weed growth; saving of energy; improving in guality of produce. Despite the many advantages, micro irrigation hasn't extended its utility to most parts of India. Inadequate awareness about the advantages of micro irrigation; sufficient availability of surface and ground water in some of the states, particularly in northern and eastern India; lack of trained manpower; inadequate credit facilities for the farmer; non uniform availability of the system and its spares throughout the country are some of the factors limiting the expansion of this system if irrigation. The distribution networks at rural areas have inadequate facilities in terms of material availability and technical knowhow. Compared to the available potential and in view of the growing concern over the decreased availability of water, much more needs to be done to promote micro irrigation in the country.

Besides micro irrigation, biotechnology, tissue culture techniques, bio fertilizers and green house technology are other improved technologies that have steadily been aligning with horticulture.

India in the years to come will be confronted with the increased domestic demand for horticultural products. Diversification of cropped area with high-value horticultural crops in the hills, arid and coastal agriecosystems can benefit India greatly. Enhancement of small-holder competitiveness and increase of labour intensity both through on-farm and non-farm activities are possible by promoting horticulture. The marketing disadvantages are severe in perishable horticultural crops and strong infrastructure support and investment are, therefore, needed. Institutional reforms

such as strengthening of market, credit and pricing, accelerated goal-oriented research and technology transfer for horticultural development need greater focus.

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Dr. MJ Khan



Cover Feature

Horticulture

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Engine for Agri Growth and Rural Prosperity



EXTENDING THE GREEN REVOLUTION TO EASTERN INDIA



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Know Your Leader Harsimrat Kaur Badal



Water Management for Prosperity

Drip & Sprinkler Irrigation





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Farmer Schemes Galore

uly was particularly a farmer oriented month. Two much awaited farmer oriented schemes were cleared by the Cabinet Committee on Economic Affairs (CCEA). The highly anticipated schemes – Pradhan Mantri Krishi Sinchai Yojana (PMKSY) and Promotion of National Agriculture Market (PNAM) - to improve farm productivity and to increase farmers' get good money for their crop, will now be a part of India's agriculture polices.

While PMKSY is a major irrigation initiative worth Rs. 50,000 5crore to be spent over five years to help expand cultivable area, the Agricultural Market aims to provide better price to farmers, improve supply chain, reduce wastage and create a unified national market through common e-platform.

'Har khet ko paani' (water for every field) was one of the slogans that echoed the sentiments of Modi when the ambitious PMKSY was unveiled. The scheme has an outlay of Rs. 50,000 crore over a period of five years (2015-16 to 2019-20). The programme architecture of PMKSY aims at a 'decentralized State level planning and execution' structure, in order to allow States to draw up a District Irrigation Plan (DIP) and a State Irrigation Plan (SIP). DIP will have holistic developmental perspective of the district outlining medium to long term developmental plans integrating three components namely, water sources, distribution network and water use application of the district to be prepared at two levels - the block and the district. All structures created under the schemes will be geotagged. The programme will be supervised and monitored at the national level by an Inter-Ministerial National Steering Committee (NSC) headed by Prime Minister.

The spending this year is expected to bring an additional 6 lakh hectares under irrigation while 5 lakh hectares will benefit from drip irrigation. Apart from this 1,300 watershed projects have been marked for completion. Currently, 142 million hectares are used for cultivation, of which only 45% farm land is under irrigation. The major objective of the PMKSY is to achieve convergence of investments in irrigation at the field level, expand cultivable area under assured irrigation (har khet ko pani), improve on-farm water use efficiency to reduce wastage of water, enhance adoption of precision-irrigation and other water-saving technologies (more crop per drop), enhance recharge of aquifers and introduce sustainable water conservation practices by exploring the feasibility of reusing treated municipal based water for peri-urban agriculture and attract greater private investment in precision irrigation system.

The scheme also aims at bringing concerned ministries, departments, agencies, research and financial institutions engaged in recycling of water under a common platform, so that proper water budgeting can be done for various sectors like household, agriculture and industries.

The National Agricultural Market will be promoted through Agri-Tech Infrastructure Fund (ATIF). The Department of Agriculture & Cooperation (DAC) will set it up through the Small Farmers Agribusiness Consortium (SFAC) by creating a common electronic platform in selected regulated markets across the country. An amount of Rs.200 crore has been earmarked for the scheme from 2015-16 to 2017-18. This includes provision for supplying software free of cost by DAC to the States and Union Territories (UTs) and for cost of related hardware/infrastructure to be subsidised by the Government of India up to Rs. 30 lakh per Mandi (other than for private mandis).

In all, 585 regulated markets across the country will be integrated with the common eplatform to provide farmers and traders with access to opportunities for purchase-sale of agricommodities at optimal prices in a transparent manner across the country. Besides, private markets will also be allowed access to the e-platform thereby enhancing its outreach. What it means is that there will be one licence for the entire state, there will be single point levy. There will be electronic auctions for price discovery. The impact will be that the entire state will become a market and the fragmented markets within the states would be abolished.

Modi government has displayed a sense of urgency in clearing many agri related schemes. Over an year of assuming the power, the government has already introduced Soil Health Card, Pramparagat Krishi Vikas Yojana, Kisan Channel etc. which were part of their promises before election. With PMKSY and the National Market, two more significant schemes get added to the list.

Fertilizer DBT Comes to a Halt

irect benefit transfer (DBT) of fertiliser subsidy to farmers, on the lines of LPG was another illuminated scheme that could have been added to the long list of schemes that were changing the face of Indian agriculture. But apparently, the scheme may have to wait as the review committee bumped on to many possible road blocks that could hamper the execution of the scheme. The nature of the impediments, in fact, suggests a temporary suspension of the implementation and the hiatus could be too long.

The plan according to the scheme was to transfer the fertilizer subsidy directly to the beneficiaries' accounts, which in this case are farmers. There are many advantages over the preexisting system of paying the subsidy to the producers. The scheme would bring in transparency and avoid corruption. The DBT in fertilizer subsidy transfer will not only yield considerable saving in subsidy by plugging leakages but also end distortions in resource allocation and inefficiencies in supply chain that is central to the existing route of subsidizing fertilizers through lower selling prices.

The exercise although looks simple requires a lot of ground work. An appropriate system must be developed that can conjure up a conduit for the hassle free transfer of subsidies. The beneficiaries should be identified based on an appropriate identification strategy so unique that the benefit reaches the intended beneficiary and not anyone else. The route of transfer should end in an institutional structure, most possibly a bank from where the beneficiary can withdraw the subsidy and use it for the intended purpose. This brings forth the mammoth task of creating an Unique Identification Number (UID) which are linked to bank accounts. Considerable progress has been achieved on this front. Aadhaar, a 12-digit individual identification number issued by the Unique Identification Authority of India [UDAI] has already been issued to many citizens. The biometric and demographic data of residents stored in a centralised database are used to generate this UID number. The number is also linked to the person's bank account. As on 8 July 2015, over 87.9 crore (879 million) Aadhaar numbers have been issued in the project. The DBT uses JAM- Jan Dhan Yojna (JDY), Aadhaar and mobile numbers platform. So for DBT to work, the beneficiary i.e., the farmers have to have a bank account, Aadhar number and mobile numbers. DBT via the JAM route has been working well in the case of subsidy transfers on LPG. As Aadhar hadn't fully penetrated the Indian subcontinent, in 2013, Supreme Court via an interim order ruled that "no person should suffer for not getting Aadhaar" as the government cannot deny a service to a resident if s/he does not possess Aadhaar, as it is voluntary and not mandatory.

The dilemma is still the same. Aadhar card hasn't penetrated many districts in the hinterlands making the implementation of the scheme difficult for the government.So is also the case with organized banking. Besides this, the creation of a financial and IT (information technology) architecture for direct transfer of subsidy to beneficiaries is a pre-requisite. Many rural districts are assailed by the unavailability of proper I-T and Internet infrastructure and irregular power supply. Also very few districts have 100 per cent Aadhaar-based bank account holders. This means that a majority of states are not yet ready to launch the programme.

Another unique problem encountered during the review meeting was that people in rural areas are prone to frequently changing their mobile numbers, so tracking them in order to make them beneficiaries for the scheme becomes a problem. Also it was found that anybody can purchase fertilisers and the state governments don't insist on production of any kind of an identification proof while selling it. With such ambiguities popping up during the review, it was felt that the matter should be taken up with the Prime Minister's Office before the scheme can be implemented. As for now, the scheme will take time to materialize. The inhibiting factors are crucial and has to be properly dealt with before implementing the scheme.

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Ragi Returns

hanks to the growing population of discerning consumers in India, millets are going to see a rise in acreage in coming years. Cue to this fantastic development comes from the southern state of Karnataka, where ragi (finger millet) is a staple, and the continuous policy push from the state government is improving the acreage under this nutritious crop.

Karnataka accounts for over two-thirds of the country's total produce, followed by Uttarakhand, Maharashtra and Tamil Nadu. The Karnataka government has procured over one lakh tonnes of ragi at Rs 2,000 a quintal last year (includes a bonus of Rs 450 over the MSP of Rs 1,550 announced by Centre for 2014-15) for public distribution under the Annabhagya Scheme in southern districts, the main growing regions of the cereal.For the kharif 2015-16, the Centre has announced Rs 100 increase in MSP at Rs 1,650, while Karnataka is yet to spell out its procurement target and the support price. However, the expectation is that procurement and the support price would be higher than last year.

Harvesting is a laborious and hence cost consuming process in ragi. So the proposed initiative for introducing mechanisation, especially the harvest reapers, could provide a fillip to the cultivation. With the development of ragi reapers, it is expected that the cost of cultivation is set to come down.

Surprisingly, R&D in ragi is also suggesting a total makeover for this unassuming millet. The UAS-Bengaluru recently released a ragi variety that's white in colour. The white variety is targeted at bakers and makers of biscuits, vermicelli, pasta and cereal-based snacks and could help in attracting new set of consumers.

Ragi has also become the favourite of the health conscious breed of consumers as they prefer the protein and fiber rich millet over the carb centric cereals. With its high calcium, protein and fibre content, compared to other cereals such as wheat and rice, ragi has found a favour even among biscuit makers including companies such as Britannia, breakfast cereal makers Kottaram Agro Foods Pvt Ltd and manufacturers of ready to eat mixes such as MTR Foods and Maiyas. The rising awareness of the nutritional benefits of ragi and development of value added products – be it in the form of biscuits or cakes, malt and even porridge mix is driving the consumption of such small millets.

Ragi is also a solution for the curse of malnutrition that has been prevailing in India. Ragi has an important protein component, amino acid methionine, which makes it an important low-cost ingredient for fulfilling the protein intake requirements of millions of poor who generally live on starchy staples e.g. plantain, polished rice, or maize. Apart from important protein components, ragi also has a substantial amount of carbohydrate, minerals, calcium and fibre. Also 328 KCal of energy can be provided by 100 g of ragi. Most of these benefits peg ragi with a potential to improve nutrition, food security, as well as to foster rural development and support sustainable land use.

Ragi is also a low maintenance crop. Being a rainfed crop, it does not need elaborate networks of irrigation channel or expensive fertilizers or management practices. It can withstand severe drought conditions and can even be grown throughout the year, thereby, proving its suitability and thus, aiding its long-term sustainability. Its adaptability to the higher elevations makes it suitable to grow even at a height of more than 2,000 meters.

A versatile crop like ragi has a huge potential in India not only in securing rural prosperity but also in ameliorating the problem of malnutrition in India. Schemes like 'Mid-day meal' scheme offers a good medium of transferring this wonder millet to the plates of the children. Bodies such as the ICRISAT (International Crops Research Institute for the Semi-Arid Tropics), ICAR (the Indian Council for Agricultural Research), CBOs (community-based organisation), farmer associations, the Ministry of Health as well as private companies need to build a strong ragi-based cropping system that promotes intercropping of ragi, developing ragi-based food products as much as nutraceuticals that in turn will acts as enablers in multiplying the overall efficiencies of this crop. mmem

The Wheat Threat

mporting good quality wheat is soon going to be a pricier affair for Indian Flour millers and private traders. The ten per cent import duty that will be slapped on them comes in the wake of the millers' desire to use good quality wheat in manufacturing their products. The policy will thus ensure that inferior quality wheat is purchased and distributed by the traders to the citizens of the country. A strange phenomenon, since on one side, when government has started to crack down on products unfit for consumption in the market, on the other side the same machinery is promoting the sale of poor quality products.

The year 2014-15 saw bumper wheat production and surplus stocks with the Food Corporation of India (FCI), the nodal agency for procurement and distribution of foodgrains. The cause of jubilation has now turned into a nightmare for the wheat millers. FCI has procured 27.6 million tonnes of wheat so far in the current marketing year that started from April. FCI has huge stock of 40 million tonnes of wheat despite drop in production to 90.78 million tonnes in 2014-15 from record 95.85 million tonnes in the 2013-14 crop year. 20-30 per cent of the grain procured latest as officials themselves admit, is of poor quality. The corporation had to procure poor quality wheat "under relaxed norms (URN)" for procurement of the grain this year to protect farmers, whose crop got damaged due to hailstorms and unseasonal rains in February-April.

The non availability of good quality wheat has forced the private flour millers to import wheat from Australia for the first time in a decade. So far about 5,00,000 tonnes of wheat have been contracted for supply from Australia and yet another 5,00,000 tonnes from France and Russia are being considered. It is cheaper to import as landed cost of wheat is about Rs 16/kg as against Rs 17-18/kg for wheat that is purchased and transported from Madhya Pradesh to Tamil Nadu.

It is the millers in the South India that this move is going to affect the most. Not many northern millers opt for the import of wheat since wheat is grown there and the ports are not nearer whereas the Southern Millers has the viability to import wheat since the ports are nearer. Also, the millers are importing only about 15 per cent of their requirement. Poor quality of the locally acquired wheat affects the nutrients in wheat and those with lower protein content cannot be used for bakery products as their quality will be affected. The imported wheat, which contains higher protein content, is only blended with local wheat variety to get the required mix. In the event of import duty materializing, the resulting products will be pricier or the products will be inferior in quality. The policy is pushing the wheat traders to raise the prices or reduce the quality. Either way, it is the common man who is going to suffer.

Alternatively, rather than thrusting lustre less and damaged wheat on to the common man, the government can look for other options that is way more convincing and conscientious. In 2002-03, lustre loss wheat was classified of lower category and was offered as feed wheat, the category which has got abundant demand in India and abroad. About 4 million tonnes were exported at discounted values of 20-25 per cent from the normal values. So why not do the same than putting the consumers' health and government's integrity at stake.

It was a laudable move by the government to procure wheat from producers, the quality of which was compromised by unruly weather. But instead of maintaining the good will, the government wants to distribute the unwanted dividends of that gesture to the unsuspecting consumers. Not only the move is undemocratic but highly unbecoming of an elected responsible body.

M&M to enter edible oil, pulses segment under NuPro brand

• Mahindra & Mahindra is set to enter the branded oils and pulses category with NuPro. Adopting a farm-to-fork approach, it will source these commodities from farmers across Maharashtra, Rajasthan and Madhya Pradesh. "We will enter the branded edible oil and pulses category with NuPro within a month. Coming from the house of Mahindra, these products will have stringent quality standards as we intend becoming a premium and niche player in this segment with the agri-business division targeting revenues of Rs. 1,000 crore this year," said Ashok Sharma, Chief Executive, Agri and Allied Businesses, Mahindra & Mahindra. Building a distribution network across the metro markets, to begin with, it would reach out to 500-800 outlets with its NuPro brand, and compete with established edible oil brands such as AdaniWilmar's Fortune and Marico's Saffola. However, in terms of pricing, it would peg itself between Fortune and Saffola. "Our pricing would be less than that of Saffola but higher than mass edible oil brand of Ruchi Soya and AdaniWilmar," said Sharma. Being the largest brand



in farm tractors, the \$19.9-billion Mahindra Group entered the agri business in 2010 and has been in the B2B space selling grapes, potato, pulses, oilseeds, and dairy products besides providing services to farmers with its 200-odd Samriddhi centres. "All this time we have mostly been in the input side of agri-businesses like seeds and chemicals but now we are looking at the B2C segment with branded products. Having launched a fresh fruit brand Saboro, we are now launching NuPro and this may be followed by a new brand for milk soon." However its rivals said the going will not be easy for M&M. Angshu Mallik, COO, AdaniWilmar, said, "Despite being a large player with deep pockets, Mahindra will face the same set of challenges in terms of building infrastructure, processing and supply-chain and competing with national and strong regional brands."

Andrew Yule to set up green tea factories

• Public sector Andrew Yule & Company Ltd. is planning to set up two green tea processing factories at its tea gardens in West Bengal. The first factory at Darjeeling is likely to be launched this week. The company, which has 15 tea gardens in Assam and West Bengal (Dooars and Darjeeling), has decided to get into green tea production in view of its increasing demand. "Initially we plan two such units — the Darjeeling factory will be commissioned by this week, while the Dooars unit in North Bengal unit will be rolled off by early August," Director-in-Charge-Tea, Andrew Yule, Sunil Munshi. Although the use of green teas is dates several centuries back, it is only recently that its health benefits came to the known widely. While both black and green tea comes from the same bush, the quality of the leaves and the manufacturing process decide which tea is green and which is black. Green tea is not fermented, allowing the leaves to retain their natural benefits.

Black tea: McLeod Russel to gain from Kenya dry spell

• A drought in Kenya is set to benefit McLeod Russel India Ltd, the world's biggest tea grower. Hot, dry weather in the African nation, the No. 1 exporter of black tea, is threatening to cut output, and a dip in global supply may help boost auction prices for McLeod Russel this year by as much as eight per cent, Chief Financial Officer Kamal Baheti said in an interview. "Since there's been a shortage of crop in the overseas markets, exports from India will increase and that will have a positive impact on the prices," Baheti said from his office in the eastern Indian city of Kolkata, formerly known as Calcutta. Prospects of better prices spurred a rally in tea stocks. McLeod Russel was



poised for the biggest gain since February 13, while Jayshree Tea & Industries Ltd. surged the most in more than two decades. Higher auction prices may provide a shot in the arm to McLeod, which has sought to reverse a decline in profit amid a forecast for stagnant leaf production for the next five years. Average auction prices may rise to Rs 180-185 per kilogram by end of March 2016 from Rs 172 last year, Baheti said.



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Farm sector needs more capital from banks: V S Vyas

• The agriculture sector needs more financial support from banks in order to promote sustainable and equitable farming and rural prosperity which will also help in tackling food security issue in future, according to noted economist V S Vyas. Speaking at 34th National Bank for Agriculture and Rural Development (Nabard) Foundation Day Lecture at Jaipur's regional office, Vyas said the areas that have good potential like dairy along with the farming should also be focused prominently. "Banks should be encouraged to create more capital for agriculture sector for consistent economic growth. This would also increase productivity in the sector and it would ensure food security in future," Vyas said. Sunanda Batra, General Manager at Reserve Bank of India, said that Nabard has played a vital role in development in the desert state and its contribution has enhanced productivity and crop yield. She said that innovation in financing by Nabard has also shown positive results. R K Gupta, state level bankers committees convener, said the banks in the state have not only achieved but surpassed the mandatory targets in lending and loan disbursement. He said that there was a need to create financial literacy in rural areas and banks were making their efforts. Earlier, Chief General Manager - Nabard – Sarita Arora highlighted the achievements of the bank and said the bank would make all efforts to achieve its targets. The apex development, which came into being on July 12, 1982 after the Parliament through an act in 1981 approved the setting up of Nabard, promotes sustainable and equitable agriculture and rural prosperity through effective credit support, related services, institution development and other innovative initiatives.

Maha co-op bank lowers valuations for sugar

• At a time when sugar mills in Maharashtra find themselves hard-pressed to make FRP payments to farmers, Maharashtra State Cooperative Bank (MSCB) has lowered valuations on sugar pledged by mills yet again. Valuations now stand at R1,950 per quintal, leaving R910 for cane payments and R1,660 as the pledge amount, Pramod Karnad, MD, MSCB said. Valuations stood at R2,100 per quintal till June 6. Since the start of the season in October 2014, this is the ninth time that MSCB has lowered valuations for mills in the state, Karnad said. This gives a clear indication of the volatility of the



market, he pointed out. Millers have been given time till July 15 to make up for the short margins, Karnad said. They could make up for this through the sale of sugar. According to him, around 32 mills find themselves facing short margins and have to recoup their balance sheets before July 15. Ex-mill sugar prices are currently at R1,900 per quintal. At the start of the season, prices were between R2,500 to R2,700 per quintal. According to analysts, there has been a gradual process of slowdown in the market and since the decontrol mechanism, mills are now in a rush to sell sugar in a period of 6-7 months, something that usually takes 14-15 months. Sanjeev Babar, MD, Maharashtra State Cooperative Sugar Factories Federation (MSCSFF) expressed the fear that atleast

50 mills may not be able to crush cane next year. "Mills do not have the funds to pay farmers and when they sought assistance from the government, they have been given interest free loans adding to their liabilities. Lower valuations will mean short margins causing more problems for mills," he said.

Centre working on new farm income insurance scheme, says Rajnath

• The Centre is working on a new farm income insurance scheme which will help increase earnings of farmers and lessen their plight, Home Minister Rajnath Singh said. Addressing a farmers' rally in Modha village here, Singh said the Central government was committed to improving infrastructure in villages and initiate development programmes. He also listed out social security schemes and programmes of the NDA government for the benefit of the poor. The Union Home Minister said the State government was yet to provide relief to hailstorm-hit farmers though the Centre had released funds for the purpose. Singh said steps also need to be taken to improve law and order situation in the state and offered to deploy additional central security personnel, if required.





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Policy NOTES



\$20 billion food welfare plan to be rolled out by December

● India will roll out its multi-billion dollar food welfare plan by December, the food minister said, allowing 67% of its 1.2 billion people access to cheap rice and wheat. The previous Congress-led United Progressive Alliance (UPA) government approved the National Food Security Act (NFSA) in August 2013. All 29 states and seven union territories had to implement it within a year. After missing several deadlines, only 11 states could introduce the plan and the rest sought more time. "Finally, most states have agreed to implement the NFSA by December, after the latest deadline ends in September," Ram Vilas Paswan told. In his 28 February budget, Union finance minister Arun Jaitley earmarked Rs. 1.24 trillion for food subsidies. Although Prime

Minister Narendra Modi is implementing the expensive food welfare plan approved by his predecessor Manmohan Singh, the government is now trying to rein in overall subsidies to focus on investment in manufacturing and infrastructure.

MMTC to import 5,000 tonnes of urad to curb pulse prices

• The government has asked state-run trading company MMTC to import 5,000 tonnes of urad dal immediately to check prices of pulses in the retail market that have crossed Rs 100 per kilo. This will be in addition to 5,000 tonnes tur dal that is being imported for which the MMTC has already floated bids. Apart from resorting to imports following a cabinet decision, the government has also banned export of pulses barring kabuli chana, organic pulses and lentils beyond 10,000 tonnes. The central government



has already hiked export price of onions to \$ 425 per tonne to rein in the prices spurt in the domestic market. Apart from these measures, the centre has also imposed stock holding limits for traders to ensure they do not resort to hoarding of pulses. Meanwhile, the centre and states have evolved a consensus on giving a boost to supply of pulses, given the localised shortages owing to supply constraints and hoarding of the commodity. State food ministers who met here with food minister Ram Vilas Paswan in chair, also thrashed out an action plan to make essential commodities including pulses, edible oils, rice, onions, potatoes and tomatoes available to people across the country. At a day-long meeting of state food ministers chaired by Paswan, the centre has also asked states to take stringent steps against hoarding and black marketing of pulses.

550 FCI depots to go online in FY16

• The Food Corporation of India (FCI) will put all its 550odd grain depots under an online system where the movement of grains from the surplus states to the consuming states could be tracked on a real time basis. The software and hardware requirement for an online tracking system for all the depots would be entrusted to a private party for execution.

The tender for depot modernisation work would be opened on July 10 and the project for putting the operation of depots online would be completed by March 31, 2016 with an esti-



mated budget of R81 crore. However, the depot online system work will be completed in the rest of the 1,288 godowns hired by FCI from Central Warehousing Corporation, state warehousing corporations, etc later part of the next fiscal. The total cost of putting all the 1,842 depots online would be around R200 crore. According to an FCI official, the depot online system would facilitate process automation, standardisation and efficiency of the management of foodgrain distribution and would enable real time monitoring of operations and timely reporting on grain stocks in each of the depot. "The existing system of manual upgradation of grain stocks data in the various depots and on the transit would be done away with and through online tracking of stocks at the various depots, the movement of transport trucks would be also monitored," the official told. A software for linking depot through an online network has already been developed and tested in one-two depots in Andhra Pradesh. This will be scaled up and rolled out across the country. A senior official said that automation of the entire process from entry and exit of foodgrains at FCI depots would curb theft and diversion. This will improve efficiency in operations of depots.

Policy NOTES

Centre to Scale Up Karnataka's e-Mandi Model

An e-market for farm products in Karnataka has been so successful that the NDA government is setting aside politics and holding up the Congress-ruled state's programme as a model for all others. In fact, the Modi government is going to scale up Karnataka's eMandi model to the national level. Agriculture Minister Radha Mohan Singh said that he is so happy with the model that he is taking a delegation from 21 states to Hubli in Karnataka to "see, learn and replicate "the Karnataka system in their states. "Karnataka ne bahut achcha kiya hai. Others states are also trying things, but I want them to see the Karnataka model and replicate it all across the country," he said. Karnataka's Minister of State for Agriculture Krishna Byre Gowda said arrangements were being made to demonstrate to the dele gation the e-Mandi system, which has generated a revenue of Rs 8,521 crore in the last 16 months, trading commodities like copra, tur, paddy, ragi, groundnut, til, maize and so on. "The delegation, including ministers from all political parties, is coming on Thursday and Friday. We are very happy that the Union government has taken this project beyond politics and is sharing the benefits of the programme to all states," he said. Andhra Pradesh's Chandrababu Naidu has already visited Karnataka for a live demonstration, while Odisha and Rajasthan have asked for the e-Mandi platform. The Centre also has big plans to connect farmers and traders from across the country within six months on the National Agriculture Market, an e-platform based on the Karnataka model.

PMKSY to subsume three irrigation programmes

The newly launched Pradhan Mantri Krishi Sinchai Yojana (PMKSY), with an allocation of Rs 50,000 crore spread over a period of five years, will amalgamate three major ongoing irrigation programmes of the Centre to achieve a holistic development of irrigation potential, Agriculture Minister Radha Mohan Singh said. The programmes, which would be brought under one roof, are the accelerated irrigation benefit programme of the ministry of water resources, integrated watershed management programme of the ministry of rural development and land resources, and the farm water management component of the national mission on sustainable agriculture of the department of agriculture. "The scheme also aims at bringing the ministries, departments, agencies, financial institutions - engaged in creation, use and recycling of water - under a common platform so that a comprehensive and holistic view of the entire 'water cycle' is taken into account and proper water budgeting is done for all sectors households, agriculture and industries," Singh said.





farm market for online Move platform gamechanger

In China, economic reforms started with agriculture, industry came later, while financial sector liberalisation is still a work in progress. It's been quite the opposite in India, where the best proof of reforms completely bypassing the farm sector is the agricultural produce marketing committees or APMCs. Most crops produced by farmers today, barring milk and sugarcane, can be sold only in market yards (mandis) controlled by these institutions. The Narendra Modi government has taken a significant step towards ending the monopoly of APMCs through the proposed creation of an online National Agriculture Market (NAM) platform. This would be a virtual marketplace allowing farmers to offer their crop to buyers anywhere in the country, as opposed to only traders and arhatiyas at the local mandi. The NAM trading portal thus expands the universe of buyers for farmers, while giving processors the option of sourcing produce directly, rather than going through licensed traders in the particular APMC jurisdictions. Yet, the very move to create an alternative, pan- Indian electronic trading portal for primary agricultural produce can be a potential gamechanger. As farmers and producers organisations start to realise the benefits of supplying directly to large processors or retailers - including new- age online grocers - state governments are bound to come under political pressure to dismantle the monopoly enjoyed by APMCs. The latter will then have to shape up to survive - by offering superior infrastructure and services that will attract farmers and buyers. And that's what competition is all about.

Rajasthan exempts WDRA warehouses from stock limit on pulses

• In a major relief to commodity futures market players, the Rajasthan government has decided to exempt all the warehouses registered with Warehouse Development and Regulatory Authority from the stock limit recently imposed on pulses. "The Government has decided to exempt commodities kept in regulated warehouses (registered with WDRA) from stock holding limits under the Essential Commodity Act, 1955, subject to the condition that these warehouses will publish information of stock available with them on real time basis," said a notification issued by the Rajasthan government. Earlier, the State government has extended the deadline for abiding by the stock limit to July 15 and increased the stock limit to 400 tonnes against the earlier 250 tonnes. Of the 400 tonnes, a stockist may hold up to 200 tonnes of any one of the pulses - chana, tur and urad. On June 22, the State issued a notification levying a stock limit of 250 tonnes on pulses. It was supposed to be effective from July 7 till September 30. However, the notification did not exempt warehouses regulated by WDRA from the stock limit. The agriculture-focused commodity futures exchange, NCDEX, has 26 accredited warehouses at Bikaner and Sri Ganganagar, the largest pulses trading hub. Of these warehouses, 25 are registered with WDRA. Currently, chana is the only pulse traded on commodity exchange platforms.

Punjab to promote organic basmati

• Punjab government said it will now start promoting cultivation of organic basmati rice in the state. "After the tremendous success of organic wheat, Punjab Agro is all set for organic basmati in the state," KS Pannu, Managing Director, Punjab Agro Industrial Corporation said. After a favourable response from farmers, now basmati will be cultivated in Organic farms of various districts, he said. The state government is committed to encouraging farmers for organic farming. And for this purpose, the government is going to establish an 'Organic Farming Board.'



• Gujarat has recorded a negative growth of 3.89 per cent in 2012-13 -the lowest in the country -according to a Government of India study called `Agriculture Statistics 2014'. The study also cites neighbouring Madhya Pradesh as having recorded highest growth in agriculture and allied sectors in 2012-13 and 2013-14. However, officials are yet to finalize their conclusions as Gujarat is yet to submit its data for the year ending 201314. According to the report, Gujarat (3.89 per cent) and Tamil Nadu (2.2 per cent) are the only two states to have registered negative growth in 2012-13 compared to the previous year. Statistics show that the state recorded negative growth in four years between 2004-05 and 2012-13. The data on the state agriculture and allied sector released since 2004-05 also shows that the gross state domestic product (GSDP) has not remained constant. The years 2006-07, 2008-09, 2009-10 and 2012-13 saw a drop in the GSDP. Officials of the state agriculture department blame a deficient monsoon for the negative growth, however neighbouring states seem to have done better despite deficient rainfall. The registrar and professor of economics at Junagadh Agriculture University, R L Siyani says the negative growth at the current price is directly related to industrial output -if the industrial output increases, the share of agriculture and allied sector in GSDP will also decrease. A president of the Produce Market in North Gujarat says agricultural production had fallen during the 2012-13 period due to low sowing activity compared to the previous year, adding that the per hectare yield with the exception of the cotton crop is decreasing, resulting in low output. According to the state's director of agriculture, Bharat Shah, 2012-13 was a bad year for the state as deficient rains decreased the output leading to negative growth. "However, the data for the year 2013-14 is encouraging and the report shows growth to be in double digits," he says. Minister of agriculture BabubhaiBokhiriya, when contacted said he would get the report checked as the total income of farmers from agriculture was running into 1,42,000 crore and therefore it was not possible for the state to show negative growth. Officials say that the share of agriculture in the total GSDP of the state is only 16.16 per cent. Data shows that Madhya Pradesh has shown a growth of 31.17 per cent while that of Rajasthan is 11.16 per cent and growth in Maharashtra was at four per cent adding that the GSDP of MP has constantly been increasing since 2004-05 with the exception of 2007-08.

State **ROUNDUP**

Kerala Adds a Rs 300-cr Bounce to Rubber

• State government gives subsidy to get small-scale farmers to increase production. The new Rs 300-crore subsidy scheme currently being implemented by the Kerala government to provide succour to the smallscale rubber farmers may encourage them to increase the production. Rubber production has been dropping for nearly a year as the low level of prices discouraged many farmers to continue tapping.Under the new scheme, the govern ment will buy a maximum of 150 kg per hectare per month at a price of 25 higher than Rs 50 per kg, which is current prices, from a grower. The difference is paid as the subsidy. Unlike earlier schemes, the payment is made online directly to the farmers. The benefit is available to farmers having up to two hectares. At present, the farmers who are eligible for the subsidy are getting their names



registered through rubber production societies which will certify the facts. The scheme is expected to spur the farmers to raise the level of tapping to increase production. Last year, the natural rubber production slumped 15% to 6.55 lakh tonnes. This fiscal the April-May months saw 9-11% drop in production. As a result the tyre companies, who are the principal consumers, are still depending more on imports to bridge the supply-demand gap. Last year, the total natural rubber imports touched a record of over 4 lakh tonnes.

Nod for privatisation of 4 Uttar Pradesh sugar mills

• In a significant development, the UP government on Tuesday decided to hand over four closed sugar mills of UP State Sugar Corporation on long lease to the private sector to develop them into integrated complexes under the PPP model. The four mills, some of which have been closed for almost 15 years now, are Maholi, in Sitapur, which was closed in 1998-99; Nandganj, in Ghazipur, which was closed in 1998-99; Burhwal in Barabanki that was closed in 2008; and Chatta in Mathura, which has been non-operational since 2009-10. The state cabinet, headed by chief minister Akhilesh Yadav, approved the decision to invite the private sector to develop the closed mills as integrated complexes on a long lease of 30 years. "The selected players would need to set up new mills with a minimum crushing capacity of 2,500 TCD (tonnes of cane a day) which should also have a minimum 10 MW cogen and 30 kilolitre distillery facilities in it," said a senior official of the state government.

Madhya Pradesh to release georeferencing database of land records

In a move that is going to be of immense help to the state's farmers in designing cropping patterns and planning fertiliser usage, Madhya Pradesh will release comprehensive georeferencing database of its land records soon. It will be the second state after Gujarat to do so. Policymakers would also find the facility handy, with digitised cadastral maps of the state to be superimposed with satellite images procured from Indian Space Research Organisation (Isro). With the database in place, the state government, sources said, would be carrying out region-specific comprehensive planning and designing for various projects, covering sectors such as agriculture, roads, irrigation, water supply, etc. without having to visit the actual sites. Cadastral map would include details of ownership, tenure, location, dimensions and at some time, even the value of land. According to Hari Ranjan Rao, secretary, Department of Information Technology, Madhya Pradesh, various government departments, including revenue, forest and agriculture, had collectively worked to put together available individual maps and digitised land records and merged them with actual satellite images for creating the georeferencing database.

Farm varsity develops more crop boosters

• Following the success of TNAU Coconut Tonic, a growth regulator for coconut, the farm varsity here has developed more crop boosters to improve the yield and quality of pulses, sugarcane, cotton, maize and groundnut. The Department of Crop Physiology at TNAU says coconut growers have benefited from the application of the Coconut Tonic both in yield and size of the nut. The university is said to have been distributing the coconut tonic across the State and Kerala, Karnataka and Andhra Pradesh for over eight years. The Pulse Wonder is a booster with nutrients and growth regulators for pulses, while TNAU Groundnut Rich is for groundnuts. The varsity has rolled out TNAU Cotton Plus, which researchers claim increases seed cotton yield up to 18 per cent. The Sugarcane booster improves cane yield up to 20 per cent.

Now, an e-nose to rate jasmine fragrance

♦ The Department of Floriculture at TNAU is set to transform fragrance testing of the jasmine flower using electronic nose technology. Developed jointly by C-DAC (Centre for Development of Advanced Computing), Kolkata and the Department of Floriculture, Tamil Nadu Agricultural University, this handheld electronic device, will help assess quality of the fresh flower, determine harvesting time for extraction, assess industrial quality and identify ideal concrete extraction stage. The extract of jasmine flower, called concrete, is highly valuable for



perfume, confectionery cosmetics and toiletry industries. "The fragrance assessment has more or less been subjective until now. The analysis was (and is still being) done using GCMS (Gas Chromatography and Mass Spectrography) instruments. This not only requires technically trained hands to operate the instrument, but is time consuming and expensive. The instrument costs around Rs 40 lakh and it takes about 5 hours to complete assessment of a sample," M Kannan, Professor and Head of the Department, explains. E-Nose, therefore, is expected to be a breakthrough. It is a sensor-aided handheld device with five sensors each – to assess the quality of fresh flowers and for identifying the compounds in concrete. The sampling time is less than a minute (40 seconds), said Xavier Alex Isac, a research scholar. The Varsity has installed the new assessment tool at NC Aeromatics, Mettupalayam and at the Flower Market in Sathyamangalam. The three-year project is nearing completion and we are waiting to get the feedback from the users, said KR Rajadurai, Assistant Professor, Department of Floriculture, TNAU.

Manual paddy transplanting device developed

In yet another development, Dr Uddhab Kumar Bharali, who has already designed many manual devices, has now come up with a manual paddy transplanting device for farmers. Speaking about his new machine, DrBharali said that this device is designed to help the farmer in transplanting seedlings in the absence of women who due to the waist pain they suffer while transplanting seedlings while bending downward, are most reluctant to do the work. "A transplanting machine is also beyond their reach, both due to costs and technique. Again, the methane gas emission in the paddy field is very harmful to the women,' he said adding that with the use of this



device, they can plant the seedlings in a standing position. Absolutely no skill is required and it maintains the geometry of transplantation also very accurately. He also said that doing other works like weeding, harvesting etc., is much easier with this mechanism. "Two persons are required. Hardly five hours is required for two persons. The weight of the gadget is just 8 kg. They can insert at least 50 seedlings at a time. The cost of the gadget is less than Rs 5000." He said that this is just the beginning of a mission to make paddy cultivation easier. He said that the VC, Assam Agricultural University is providing all the logistic support towards this venture on behalf of the AAU.

What's NEW

Icrisat's \$300 phablet to offer timely tips for farmers

Sarmers in the country can now have customised tips on their phablet on the agricultural inputs they might require for their field. Based on the specific soil health of their small land holdings, scientists at the International Crops Research Institute for Semi-Arid Tropics (Icrisat) and Government of Telangana would send timely messages to the farmers through the phablet. The Hyderabad-headquartered Icrisat launched the Green Phablet, priced at \$300 (about Rs 18,600), for farmers in Telangana. The institute would maintain servers to safe keep the information. And even if the users lose their device, they could get back the information in no time. "We are in touch with telecom provider Airtel to help us in this initiative. We however would like this open to other players as well," Icrisat Director-General David Bergvinson said. He signed



a tripartite agreement with the Telangana Departments of Agriculture and Information Technology to collaborate in transforming agriculture using digital technologies. Addressing a gathering later, Telangana IT Minister KT Rama Rao said that there was a need to bring down the cost of the device to Rs 10,000 to make it affordable for farmers.

Agri Ministry launches 3 portals

• The Centre launched three new websites for farmers aimed at making organic farming certification, fertiliser quality checks and disbursal of soil health cards easier. The portals, developed by National Informatics Centre, are part of the existing schemes. The 'Participatory Guarantee System' portal will help small and marginal farmers engaged in organic farming to secure certification after checks for compliance to standards are carried out. The 'Soil Health Card' portal has been developed to register soil samples and record tests results along with fertiliser recommendations to create a national database on soil health for future use in research. The 'Fertiliser Quality Control System' portal will collate results of drawn samples of imported fertilisers helping both consumers and importers with analysis reports. "The three agricultural portals will bring transparency and accountability and help the farming community," said Radha Mohan Singh, Union Agriculture Minister, at the unveiling ceremony.

Indigenous 'rice chips' to revolutionize rice breeding

Scientists from the Indian Council of Agricultural Research (ICAR) have developed a high-density microarray chip with more than 50,000 DNA markers that could speed up the development of new varieties of rice by at least five years. Among its many applications, the chip can be used to quickly identify rice types, how they can affect yield and how disease-resistant they are. These single-nucleotide polymorphism (SNP) chips can scan all DNA from a rice variety and analyse the genetic variation in that particular variety, speeding up the breeding process. SNP is the most abundant form of DNA sequence variation present in plant genomes and has revolutionized plant breeding recently. With the ICAR rice chip, researchers can carry out evolutionary and genetic diversity studies of cultivated and wild rice seeds and tissues. Indian scientists designed their own DNA chip as the only other such chip, developed at the Cornell University in the US, was not



available for research in India. While the Cornell chip has 44,000 SNP markers, the ICAR chip has 50,051 SNPs from 18,980 genes spanning all the 12 rice chromosomes.

Global UPDATE

Agricultural use of drones to take off as US eases restrictions

Agricultural use of drones is about to take off in the US after being grounded for years by the lack of federal guidelines. The small, relatively inexpensive vehicles could replace humans in a variety of ways: transmitting detailed information about crops to combines and sprayers, directing them to problem spots and cutting down on the amount of water and chemicals that a farmer needs to use in those areas. The Association for Unmanned Vehicle Systems International, a trade group, says agriculture could account for 80 per cent of all commercial drone use. The Federal Aviation Administration has approved more than 50 exemptions for farm-related operations since January. Companies with



those exemptions say business has grown, helped by quick advances in the technology. Bret Chilcott of AgEagle, which sells unmanned aerial vehicles and the software to help

operate them, says his company took its first orders last year. Now it has a backlog of several hundred orders. "Last year, users had to land their aircraft and then take the data to the computer," he says. "Now the data appears on your iPad or handheld device." That data could be pictures, 3-D images of plants, thermal readings of crops or animals or other observations. In some cases, it can be integrated with data collected from other high-tech farm machinery. "In five years, we won't have to blanket a field with chemicals," Chilcott says. Most farmers cannot legally fly the vehicles yet. The FAA is working on rules that would allow the drones to be used regularly for business.

Global agri prices at 6-yr low in June

Olobal agricultural commodities' prices declined to a sixyear low last month, with bumper output of all products in the value chain. Data compiled by the Food and Agricultural Organization (FAO) of the United Nations showed prices of global agri commodities fell by 0.9 per cent in June. Weighed in terms of the FAO's Food Price Index (FPI), prices of agri commodities stood at 165.1 points, a decline of 21 per cent from a year before and its lowest level since September 2009. Price movements diverged across markets, with sugar and milk products incurring pronounced falls, while cereals and oils firmed somewhat. Meat prices were stable. Except for a lull in October 2014, the overall food price index has declined every month since April 2014."The decline in the FPI mainly came as a result of a drop of 6.6 per cent in the price of sugar and of 4.1 per cent in dairy products, which more than offset a rebound in palm oil and wheat guotations. Increasing worldwide demand for livestock feed, especially in Brazil, China and the United States, is supporting prices for coarse grains, including maize," FAO said in a report.



Basmati exports could rise by 10%: APEDA

After initial concerns arising out of reduced Kharif sowing, rice acreage increased by about one per cent, as per data released by the Agriculture Ministry. While it's still early in the season, it is expected that last year's output of 102.5 million tonnes (mt) will be matched if rainfall continues to steady, particularly across eastern India. The Central Rice Research Institute expected transplantation of rice saplings to pick up over the first half of July Basmati rice exports, as a result, are likely to register an increase of about 10 per cent over the 3.7 mt recorded during the previous fiscal, according to the Agricultural and Processed Food Products Export Development Authority (APEDA). "For the 2015-16 fiscal, we are projecting exports of at least 4 mt. It's the expected growth of the product for which there is steady demand. So, one can expect around 10 per cent growth," said AK Gupta, Director, Basmati Export Development Foundation, APEDA. As of April, there was a shortfall in exports primarily because of Iran scaling back its imports due to surplus domestic availability, a situation that Gupta said "has stabilised now". The country had imported 0.9 mt in 2014-15, as compared to 1.44 mt in the earlier fiscal. Saudi Arabia became the top basmati export destination last fiscal, importing 966,931 tonnes, worth \$1,188 million. "There was a shortfall of about 10,000 tonnes as of April, but we expect this to pick up in the next round of data that will be published by the Centre this month. Some of the Iran shortfall was compensated by Saudi Arabia," said Rajen Sundaresan, Executive Director, All India Rice Exporters Association.

Global **UPDATE**

Centre bans import of rice from Myanmar

The central government has instructed the governments of Manipur and Mizoram to drop the plan to import rice from Myanmar. Myanmar produces high quality rice and there is untrammeled smuggling of rice and other consumer items to the NE states. The governments of these two border states have been noticing the free sale of the smuggled consumer items which do not appear in the approved list of the border trade. India and Myanmar had legalised the border trade in 1995. Since time immemorial there have been under world trade between the two countries at the border areas. Attempts to legalise these thriving under world business were spiked by those who stood to gain pigeonholing the multi million dollar business as "traditional trade among the tribes on the either side of the international border". It was agreed in principle that each state would import 10,000 metrictons



of rice every month for the buffer stock. The Manipur plan was that 10,000 metric tons of the high quality and nutritious rice would be bought and stocked at Moreh. Govindas Konthoujam, the Minister of Consumer Affairs, Food and Public Distribution had supervised the construction of godown, opening of a food safety laboratory to control the rice to be imported. The state government had even initiated the process of hiring transporters.

Mango exports to touch 45k tonne as new markets emerge worldwide

• As the mango season is coming to an end, mango exports have stopped from Maharashtra and Gujarat, but a few tonnes are being exported from Uttar Pradesh. Government statistics reveals that some 9,000 tonne of mango have been exported from Maharashtra to Europe this season as against 7,000 tonne the previous year. Since Europe lifted the ban on Indian mangoes, the produce has gone through hot-water treatment and has been sent to the EU,



senior officials with the state horticulture department said. The officials estimated the total mango exports from the country to touch some 45,000 tonne and said collating data would take time. Statistics available with Agricultural & Processed Food Products Export Development Authority (Apeda) reveal that mango export from Maharashra touched 32,962 tonne for the year ended March 2015 and was valued at Rs 256 crore, while the country's export for the same period touched 42,998 tonne, valued at R302.66 crore. Mango pulp export from Maharashtra touched 20,814 tonnes valued at Rs 170 crore for the period ended March 2015, while nationally mango pulp export touched 1,54,820 tonne valued at Rs 841 crore.

Indian onion loses second rank in global exports

Onions from India have gained fame worldwide for their pungency and good quality. In the last five years, however, erratic weather and shifting policies on export have left the country behind others. Countries such as China and Pakistan are fast catching up with India both in terms of quality and increase in cultivation. India ranked second among the top 10 onion exporting countries for several years. However, this position has taken a hit. According to officials from APMC, Nashik, India now ranks fourth in onion export in the world. Earlier China ranked first followed by India. Now China ranks first and countries such as the Netherlands, Mexico, Spain and Pakistan have joined the race. Moreover, region that India has been traditionally exporting to such as Southeast Asia has also begun to grow onion in addition to exporting the vegetable. According to sources from National Horticultural Research and Development Foundation (NHRDF), India had topped in export in 2009-10 with 18 lakh tonne. Average export also hovered around 14 lakh tonne. However, in the last five years, onion export from the country has taken a downward turn. In 2014-15, only 10.86 lakh tonne of onions have been exported. The decline has been as much as 20% compared to the previous year.









Horticulture Engine for Agri Growth and Rural Prosperity

Horticulture has developed into a major enterprise in India. The numerous auxillary markets linked to it have generated an industry outlook to this farming sector. Horticulture holds immense prospects for the future not only in terms of production but also in generating a respectable income to its practitioners. India's burgeoning population and the rise in income level have led to an increase in the demand for high value agriculture (HVA) and its produce (fruits, vegetables, meat, eggs, milk, fish) and value-added food products. The associated industries will also ensure employment and assured market returns. Horticulture in years to come will emerge into a major enterprise spurring economic development of the country.





ndia has steadfastly enhanced its agriculture production in the recent decade and much of its success can be owed to the increasing technology, better communication and moreover to the market dynamics. India's success with food grains is no less a secret. Considering the massive push given to this sector by the various government supported policies, it is no wonder that India has been able to swing its production positively from being a net importer to an exporter. The government's policies to support food grain producers such as MSP, subsidies and procurement made sure that most of the vast expanses of farm lands in India were devoted to food grains rather than to any other plant species.

Although, it was a success on its own right, India could not shy away from the huge market potential of horticulture which lay ahead with the numerous free trade pacts and world itself turning into a huge market place. India's own biodiversity and agro ecology supporting diverse horticultural crops, it didn't come as a surprise when India went ahead with its horticultural journey turning into an ace producer. Today horticulture presents an opportunity and scope to the Indian farmers to turn around their fortunes.

Indian Horticulture – A Success Story

India is endowed with a remarkably heterogeneous area characterized by a great diversity of agro climatic zones, allowing for production of a variety of horticultural crops such as fruits, vegetables, flowers, spices, plantation crops, root and tuber crops, and medicinal and aromatic crops. India is the second largest producer of fruits and vegetables in the world. Horticulture exports have helped the country to earn Rs 14,000 crore in 2011-12.

Horticulture accounts for 30% of India's agricultural GDP from 8.5% of the cropped area. India's major exports include onion, mango pulp, fresh mangoes, dried walnuts, fresh grapes.India's biggest export markets are South Asian & Middle east Countries. India's share in the global market is insignificant – it accounts for 1.7% of the global trade in vegetables and 0.5% in fruits.

The horticulture sector is spread across cultivation, propagation, processing and marketing of vegetables, fruits, nuts, ornamental plants, flowers, spices and turf. On the global map, India is one of the







leading exporters of fruits & vegetables with an export of approximate INR 38.56 billion, comprising of INR 26.35 billion worth of fruits and INR 12.21 billion of vegetables. India accounts for about 10% of the 500 MMT of total global production of fruits (excluding melons) and in 2010-11, it produced 75.8 MMT of fruits and 137.7 MMT of vegetables. India accounts for about 15.5% of the 890 MMT of total global vegetable production. The nation is the largest producer of okra amongst vegetables and ranks second in production of potatoes (10%), onions, cauliflowers, brinjal, cabbages, etc. It is also the largest producer and consumer of cashew nuts and is the third largest producer of coconut and leads 90 coconut-producing countries of the world, producing 11 MMT (2010-11). India produces a wide variety of spices like black pepper, cardamom, ginger, garlic, turmeric, chilly and a large variety of tree and seed spices. The total production of spices was 4.0 MMT and the area covered was 2.5 million hectares. With regard to floriculture, the flower production in India is spread across 0.18 million hectares witnessed a production (2010-11) of 1 MMT of loose flowers and 69 million tonnes of cut flowers with USA, Germany, Netherland, United Kingdom and UAE as major importers. Vast supply of production base, increase in population and potential export market will

remain the key drivers of the growth in this sector.

The year 2014 was not a different one. Fruit and vegetable farmers reaped a bumper harvest in 2014 and are set to surpass foodgrain production for the third straight year as deficient rain hit grain output in North India, considered the nation's bread basket.

Horticulture production likely grew to 280.4 million tonnes (mt) in 2014-15 from 277.4 mt the previous year, according to early estimates by the agriculture ministry. Horticulture production (268.9 mt) surpassed foodgrain output (257 mt) for the first time in 2012-13. The trend has sustained even in the bumper crop year of 2013-14, with horticulture production (277.4 mt) surpassing foodgrain output (265 mt). Current estimates show the trend is likely to continue and

that, unlike foodgrain production, horticulture output won't be hit by poor rain.

The area under horticulture farming increased from 12.8 million hectares (ha) in 1991-92 to 23.7 million ha during 2012-13, according to data from the ministry of agriculture. Total production during this period increased by almost threefold and pro-

ductivity increased by 1.5 times. India is now only second to China in the production of fruits and vegetables.

During 2013-14, India exported horticulture products worth Rs.14,365 crore, nearly double the value



of exports in 2010-11, according to data from the ministry of agriculture.

Government Support

In a country like India government support to farming sector is inevitable. Our endeavours in cereal production have very well demonstrated the immense importance that we attach to government incentives and packages. Realizing the importance of horticulture in ushering in a new revolution, government has over the years supported this sector with a slew of programmes and policies.

As early as 1980, the Horticulture Division was created by reorganization and redeployment of existing staff in the Crops Division. Policy planning for horticulture development is being done by the Horticulture Division in the Department of Agriculture & Cooperation (DAC) of Ministry of Agriculture (MOA) headed by a Horticulture Commissioner. Horticulture division Supports and formulates policies aimed for accelerated growth of horticulture: Co-ordinate activities for the promotion of Horticulture; Implement programmes for improving production, productivity and utilisation of horticultural crops; Facilitate the availability of disease free planting material and seeds of horticultural crops; facilitates transfer of technology to farmers and promotes the use of information technology; Promotes better utilisation and increased consumption of horticultural produce to ensure higher returns t o farmers and nutritional security to people; Develops strong

base for the supply of inputs, transfer of technology and human resource developmental activities and Promotes horticulture in NE region, hills, tribal & backward areas for improving economic status of people.

There are two Boards namely National Horticulture Board and Coconut Development Board and two Directorates namely Directorate of Arecanut & Spices Development and Directorate of Cashew and Cocoa Development supporting horticultural development activities in the Ministry of Agriculture.

A National Horticulture Mission was launched in 2005-06 as a Centrally Sponsored Scheme to promote holistic growth of the horticulture sector through an area differentiated based regionally strategies. The objectives of National Horticulture Mission include establish convergence and synergy among various on-going and planned programme in the field of horticultural development; and promote the development and dissemination of technologies by blending traditional wisdom and frontier knowledge. The priority areas under the mission include horticultural research and development, improving post harvest management and promoting processing and marketing of horticultural crops. The special attention is devoted to the promotion of

The area under horticulture farming increased from 12.8 million hectares (ha) in 1991-92 to 23.7 million ha during 2012-13



National Mission on Micro Irrigation (NMMI), a centrally sponsored scheme implemented by the Ministry of **Agriculture (MoA)**, **GoI since 2005-06** to promote use of **Drip / Sprinkler Irrigation Systems** in the country had also helped in the development of horticulture in a big way in India.

horticultural export through establishment of focal Agricultural Export Zones (AEZs).

National Committee on Plasticulture Applications in Horticulture (NCPAH) was constituted in the Ministry of Agriculture (MOA), Govt. of India to focus in a coordinated manner to popularize adoption of various plasticulture applications in horticulture and over all development of plasticulture applications in the country. Plasticulture applications offer a multitude of benefits and are considered most important indirect agricultural inputs which results in moisture conservation, water saving, reduction in fertilizer consumption, precise application of water & nutrients, controlled environment agriculture, plant protection through the use of nets and use of innovative packaging solutions for increasing shelf-life and during collection, storage & transportation of fruits and vegetables. In horticulture plastics are used in broad areas- Drip & Sprinkler Irrigation, PVC & HDPE pipes used for water conveyance, Nursery bags, Pro-



trays, Plastic plugs, Coco-pits, Hanging baskets, Trays, Soil Solarisation, Plastics Mulching, Greenhouses, Shade net houses, Plant Protection nets, Plastics crates, bins, boxes, leno bags, unit packaging products, CAP Covers, Controlled Atmospheric Packaging(CAP) & Modified Atmospheric Packaging (MAP).

National Mission on Micro Irrigation (NMMI), a centrally sponsored scheme implemented by the Ministry of Agriculture (MoA), Gol since 2005-06 to promote use of Drip / Sprinkler Irrigation Systems in the country had also helped in the development of horticulture in a big way in India.

A Centrally Sponsored Scheme of MIDH has been launched for the holistic development of horticulture in the country during XII plan. The scheme, which has taken take off from 2014-15, integrates the ongoing schemes of National Horticulture Mission, Horticulture Mission for North East & Himalayan States, National Bamboo Mission, National Horticulture Board, Coconut Development Board and Central Institute for Horticulture, Nagaland.

Horticulture – A Conduit for New Technology

The recent years have seen a number of farmers keen on practising better and newer technologies in their farm lands. As a result a number of believers in Hitech Horticulture have risen. 'Hi-tech Horticulture' may be defined as the deployment of any technology, which is modern, less environment dependent, capital intensive and has the capacity to improve the productivity and



quality of horticultural crops. In the present day context, adoption of hi-tech horticulture has become inevitable to ensure nutritional security of a population of one billion, besides attaining self-sufficiency and generating surplus for exports.

Micro-propagation

Micro-propagation is perhaps the most popular and widely commercialized global application of Plant Biotechnology in horticulture. A large number of plants are being cloned and exploited commercially worldwide.

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 pathogenfree planting material. Propagation of plants through tissue culture, including sophisticated techniques of meristem culture and molecular indexing of diseases, 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 constitutes nearly 10% of the total, amounting to 15million US dollars. The estimated annual growth rate is about 15%. Among the developing countries, India is in an advantageous position to exploit this market.

The Govt. of India identified micro-propagation of plants as an industrial activity under the I (D&R) Act of 1951, made effective in 1991 and several subsidies and incentives were offered. Large scale promotion of this technology was taken up during the VIII plan under the Centrally Sponsored Scheme on Integrated Development of Horticulture.



As per a recent study, 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 the Indian micropropagation by industry are long gestation period; nonavailability of skilled operators; high overhead costs; problems associated with scaling up; genetic instability; greenhouse design and management expertise; overproduction of а number of classical crops; difficulties in penetrating new markets; poor market intelligence and expertise and export bottlenecks and poor domestic base.

A major handicap in the Indian scenario is the unorganized nature of the Indian farming community, followed by regional regional preferences in crops. However, elite planting material in horticultural, plantation and agroforestry crops like the banana, cardamom, vanilla, bamboo, etc., enjoys a good domestic market.

Today, virus-free clones of cardamom and microtubers of potato, obtained through meristem culture, are a reality. A PCR-based technique for indexing micropropagated banana for the Banana Bunchy Top Virus (BBTV) has also been developed. Potato microtuber production has been scaled-up using the bioreactor technology. The BARC, Mumbai, and Center for Plant Molecular Biology





As per the estimates, the total cropped area suitable for micro irrigation in the country is to the tune of 27 million ha. (CPMB), Hyderabad have developed the synthetic seed (synseed) technology for Banana. This technology involves the use of shoot apex, nodal microcuttings or somatic embryos encapsulated in an alginate-based gel matrix, serving as 'synthetic seeds'. The advantage of these 'synseeds' is that they can be stored and used when needed, and, are more easily transportable. Unfortunately, tree crops like cashew, mango, walnut and dates which would immensely benefit from micropropagation are still intractable.

Micro-Irrigation

Micro irrigation represents an economic and sustainable system of irrigation which ensures more crop per drop. Horticulture in particular has derived immense benefits from utilizing this mode of irrigation.

Micro-irrigation system is irrigation system with high frequency application of water focussed in and around the root zone of plant system. The micro irrigation system consists of a network of pipes along with a suitable emitting device. In drip irrigation system, water is applied at a low rate for a longer period at frequent intervals near the plant root zone and through a lower pressure delivery system (0.5-2.0-kg/ cm2) to a plant. 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 fertilizer 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. Drip irrigation however has had a chequered fortune in India. Despite the many advantages, micro irrigation hasn't extended its reach to many parts of India. Inadequate awareness about the advantages of micro irrigation; sufficient availability of surface and ground water in some of the states, particularly in northern and eastern India; lack of trained manpower; inadequate credit facilities for the farmer; non -uniform availability of the system and its spares. The distribution networks at rural areas have inadequate facilities in terms of material availability and technical knowhow.

The government has done its share of work by including micro irrigation as part of promotional scheme. Drip irrigation



was promoted under the Centrally Sponsored Scheme on Use of Plastics in Agriculture since the VIII Five Year Plan. The programme was continued during the IX Plan under the Centrally Sponsored Scheme on Development of Horticulture through Plasticulture Interventions with an outlay of Rs.3750 million. However, with effect from the year 2000-01, the programme has been amalgamated the Centrally under Sponsored Scheme on macro management in agriculture.

In the last 20 years, the area under micro- irrigation increased from around 1500 ha in 1985 to around 0.3 million ha. Compared to the available potential and in view of the growing concern over the decreased availability of water, much more needs to be done to promote micro irrigation in the country.



Green houses are framed or inflated structures covered with plastic material or glass in which crops could be grown under partially controlled environment which is large enough to permit normal cultural operation manually. 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.

Though beneficial and apt for horticultural production, the high investments and non availability of cost-effective technology for many crops can act as a deterrant. 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.

States like Maharashtra, Madhya Pradesh, Karnataka, Kerala and the North Eastern States have brought significant area under green houses. Under Indian conditions, naturally ventilated greenhouses are most suitable due to low initial cost and operating costs. The cultivation under greenhouses is economical under climates of southern peninsula. The naturally ventilated greenhouses are also economical for cultivation in northern hilly regions during summer.

Bio-Fertilizers

Biofertilizers are staging a perfect comeback in the horticulture domain of India. With so much of animosity to inorganic fertilizers and chemical pesticides, biofertilizers fits in a

Protected Cultivation / Green House Technology

Although India is endowed with all natural resources, climatic vagaries have been a nightmare for the Indian farmers. To protect the valued horticultural crops from the natural disasters, green house technology can be utilized. Not only these technologies shield the produce from uneven climatic variables, but also protect it against pests thus imparting the harvest with optimum quality attributes.







seemingly appropriate addition to the schedule of horti care.

The decline in crop vield due to continuous use of inorganic fertilisers has been observed throughout the world. Therefore increasing need is being felt to integrate nutrient supply with organic sources to restore the health of soil. 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 are inputs containing microorganisms, which are capable of mobilizing nutritive elements from non-usable form to usable form through biological processes. They are less expensive, eco-friendly and sustainable. The beneficial microbes in the soil. which are of greater significance to horticultural situations, are the biological nitrogen fixers, phosphate solubilisers and the mycorrhiza fungi.

The nitrogen fixing organisms associated with horticultural crops are the Rhizobium species which live in symbiotic relationship with the leguminous plants and the free living fixers belonging to the Azotobacter family and the Azospirillum Sps. which live in association with the root system of crop plants. All these species make nitrogen available to the host crop thereby increasing the yield sustainably. Azospirillum inoculation helps the plants in better vegetative growth and also in saving inputs of nitrogenous fertilizers by 25-30%. Several soil bacteria, particularly those belonging to the genera Pseudomonas and Bacillus and fungi belonging to the genera Penicillium and Aspergillus possess the ability to bring insoluble phosphates in soil into soluble forms by secreting organic acids such as acetic, formic, propionic, lactic, glycolic, fumaric and succinic acids. Mycorrhizal fungi are another group of microorganisms which make more nutrients available to the plant, improve soil texture, water holding capacity, improve disease resistance and help in better plant growth. Besides, mycorrhizae are also helpful in the biological control of root pathogen. Another biofertilizer that has been a common ingredient of some highly successful farms is vermicompost which is the

byproduct obtained as a result of earthworms' interaction with organic wastes.

Thrust areas

India in the years to come will be confronted with the increased domestic demand for horticultural products. It will be a good thought to bring more land under horticultural coverage. Diversification of cropped area with high-value horticultural crops in the hills, arid and coastal agri ecosystems can benefit India greatly.

Horticulture is increasingly being associated with processing industry. The surpluses and better price realization has made processing an important aspect of horticulture industry. Recently, the processing industry has started growing rapidly, aiming to process





7-8% of horticultural commodities. The estimated market potential of processed food in 2015 is reported to be 11 times in fruits and vegetables. compared to the figures for 2003-04, and 4.5 times in spices. Some established agro-processing players have shown interest in sourcing raw materials directly from the farmers through contract farming arrangements.For example, apple trade in Himachal Pradesh corporate houses like Reliance Fresh, Adani Exports and ITC picked up the best quality apples for their own retail outlets. Similarly, in Andhra Pradesh, Coca-Cola, Reliance and others have been involved in procuring mangoes directly from growers for processing.

The next best thing that can happen to horticulture sector is development and strengthening of better markets and marketing structure. Although marketing of horticulture produce has improved after amendment of the APMC Act and certain other market intervention schemes, modern markets are still unrealized in many parts of the country. The recent launch of National Agriculture Market aims at creation of a common electronic platform which will allow farmers and traders to sell their produce to buyers anywhere in the country, is a glimmer of hope that can transform the marketing system of the country. More such initiatives can expand the scope of future horticulture production that is bound to expand.

Climate change is another area of concern. The various physiological processes and growth stages of the crops especially the horticulture crops are tightly linked to the climatic variables. A slight change in them can cascade into a poor production or produce. So, future research priority should be to develop varieties or technologies that can offset the after effects of an errant climate.

HORTICULTURE & MICRO IRRIGATION

Enhancement of small-holder competitiveness and increase of labour intensity both through on-farm and non-farm activities are possible promoting horticulture. by The marketing disadvantages are severe in perishable horticultural crops and strong infrastructure support and investment are, therefore, needed. Output per hectare of land from fruits and vegetables is reported to be Rs 135,000 against that of Rs 18,000 in the case of fine cereals. Therefore, institutional reforms such as strengthening of market, credit and pricing, accelerated goal-oriented research and technology transfer for horticultural development need areater focus.

Horticulture has thus come a long way in India's agricultural scene. Today it commands a good market share and in years to come will become more crucial for India.





Indian Horticulture- Current Status

Importance of horticulture for a country like India is needless to sayimmense. It is indispensable for the country as a source of variability in produce, source of nutrients, vitamins, minerals, flavour, aroma, alkaloids, oleoresins, fibre and a host of other essential food constituents and as a source of medicine. Horticulture is an important source of income for the farmers and growers and as an economic proposition as they give higher returns per unit area in terms of energy, money, job, etc. Horticulture is also important for the economy of a country like India from the point of view of employment generation. Fruit crops on an average need 860 man days of engagement in a year which is guite higher than for example, 143 man days required per year for cereal crops. In some cases for crops like grapes, banana and pineapple, there is requirement of 1000- 2500 man days per annum. Apart from substituting family income of poor and marginal farmers of our country, it also serves as an important source of family nutrition for nutritionally sensitive members of the family like pregnant women and children. Indian horticulture for a long time now has been an important source of foreign exchange for the country. Fig 1 below provides an overview of the importance of horticulture as a sector to the country.

The production of fruits and vegetables in India has increased consistently in past several years. Between 2009-10 and 2013-14, the country witnessed an increase of 14% in total area under fruit crops. In 2009-10, the total area

under fruits in the country was 6.3 million hectares which increased to 7.2 million hectares in 2013-14 (Fig 2).On the other hand, the production of fruits in India in 2009-10 was 71.5 million metric tonnes which has increased significantly to 89 million metric tonnes in 2013-14. This signifies an increase of 24.4% in total fruit production between the years 2009-10 and 2013-14. It is clear that the rate of increase in total production under fruits in the country



Fig 1: Scope and Importance of Horticulture Sector in India

Incentive for the farmer (Higher returns, value addition, export potential, more money for farmers) Adaptability (great variety of climatic and edaphic and soil conditions in India, scope for growing a wide variety of horticultural crops)

Necessity (nutrition security, decreasing arable area, employment generation, scope in food processing) International trade(export value and importance, spices, tea, coffee, processed products, flowers etc.)





has outpaced the growth in area under cultivation of fruits. The country has been witnessing a substantial increase in the growth in area under vegetable cultivation, which is a healthy sign in terms of nutrition security and increase in income of farmers when compared to lesser earnings from cereals, though in some cases, rates of some vegetables have seen great fluctuations. The total area under vegetable cultivation in 2009-10 was 8 million hectares which increased to 9.4 million hectares in 2013-14. This is an increase of 17% in total area under vegetable cultivation in the country between 2009-10 and 2013-14. The production of vegetables in the country has witnessed a significant increase of 21.6% between the years 2009-10 and 2013-14. In 2009-10, the total production of vegetables in the country was 134 million metric tonnes that increased to 163 million metric tonnes in 2013-14.

Medicinal and aromatic plants along with various plantation crops form important segments of horticultural crops other than vegetables and fruits. These categories assume further significance when one considers the export potential and capacity to earn foreign exchange. Aromatic and medicinal plants have important and crucial application in various products related to herbal medicines, cosmetics industry and as food additives. It is interesting to note that in India, the area under aromatic and medicinal plants has marginally declined from 0.5 million hectares in 2009-10 to 0.49 million hectares in 2013-14. However, the production of aromatic and medical plants has significantly increased by almost 58% in the same period. In 2009-10, the total production of aromatic and medicinal plants was 0.57 million metric tonnes which increased to 0.9 million metric tonnes in 2013-14 (Fig 3). Talking about plantation crops in India, the total area under

the same has increased by 15.6% between 2009-10 and 2013-14. The production during the same period has increased by 33%, from 12 million metric tonnes in 2009-10 to 16 million metric tonnes in 2013-14.

In India, Maharashtra, Andhra Pradesh. Guiarat. Tamil Nadu. Uttar Pradesh and Karnataka are the leading states in terms of fruit production. Maharashtra has the largest area under fruit cultivation in the country with a total area of 1565 thousand hectares in 2013-14 (Fig 4). It is worthy to note that the area has not registered significant growth over the years, remaining more or less stagnant. Andhra Pradesh including the newly formed state of Telengana, has been witnessing increasing trend in terms of area under fruits cultivation. In 2011-12, the total area under fruits cultivation was 671.7 thousand hectares which increased by almost 50% to 1004 thousand hectares in 2013-14.Similar to Maharashtra, Gujarat as a state has also not witnessed any significant growth in area under fruits in the recent past, though it stands out as one of the leading fruit producing states in terms of area. In 2011-12, the total area under fruit cultivation in Gujarat was 353.7 thousand hectares which increased marginally by about 5% to 371 thousand hectares in 2013-14. States like Tamil Nadu has witnessed a marginal decline in









UP

MP

Bihar

Karnataka

14

area under fruits between 2011-12 (332 thousand hectares and 2013-14 (328.6 thousand hectares). Area under fruits in Uttar Pradesh has increased by more than 12% from 337 thousand hectares in 2011-12 to 379 thousand hectares in 2013-14. Karnataka, another leading state in terms of fruit cultivation saw a small growth in area from 371.8 thousand hectares in 2011-12 to 396 thousand hectares in 2013-14.

Production figures of fruits in the leading fruit producing states in India witnessed growth in the recent years, except Tamil Nadu. Andhra Pradesh including Telangana that attained statehood recently has registered the highest increase in production when considered between the period of 2011-12 to 2013-14, followed by Maharashtra and Uttar Pradesh. Fruit production in Andhra Pradesh including Telangana increased by 66.6%, from 9.8 million metric tonnes in 2011-12 to 15 million metric tonnes in 2013-14. Production in Maharashtra increased from 10.5 million MT in 2011-12 to 13.4 million MT in 2013-14, registering an increase by 26% (Fig 5). Gujarat as a state could not register any significant growth in production of fruits between 2011-12 and 2013-14. In 2011-12, the total production of fruits in the state was 7.5 million MT which marginally increased to 8 million MT in 2013-14, an increase of just 6.6% over the period of 3 years. In Uttar Pradesh, the total production of fruits in 2011-12 was 5.8 million metric tonnes. This increased by 20.6% to 7 million metric tonnes in 2013-14. Karnataka on the other hand, though a leading producer of fruits in the country, could not register any significant growth in production in the recent years. In 2011-12, the total production of fruits in the state was 6.4 million MT which increased marginally by 3% to 6.6 million MT in 2013-14.

In terms of percentage of the national production of fruits, Maharashtra shares 15% of the total production. Share of Andhra Pradesh including Telangana is the highest





with 17%. Gujarat shares 9% of the production whereas states like Tamil Nadu, Uttar Pradesh and Karnataka respectively shares 8% of the total production of fruits in the country. Madhya Pradesh, Bihar and West Bengal respectively shares 6, 5 and 3% of the fruit production. However, even though these states are the major or leading states in terms of fruit production, the North Eastern region needs a special mention even though currently the region as a whole is not featuring in the national production scenario. The region of North East is home to a large number of fruits like banana, mango, along with a large number citrus species. Among the states of the NER, in terms of fruit production and area, Assam occupies the prime position followed by Arunachal Pradesh and Tripura. Further, this region is naturally organic and has a tremendous potential for growing organic horticultural crops.

Production of all the major and widely grown fruits witnessed a growth during the period between 2011-12 and 2013-14. Production of apple in the country increased from 2 million MT to 2.5 million MT during this period. Similarly, production of banana increased from 28.4 million MT to 30 million MT between 2011-12 and 2013-14. Citrus fruits witnessed a significant increase of 37.5% from 8 million MT in 2011-12 to 11 million MT in 2013-14. Production of guava



in the country during this same period also registered a significant increase of 44%, increasing from 2.5 million MT in 2011-12 to 3.6 million MT in 2013-14.

Fig 9 shows the scenario of vegetable production in the country. Vegetables like onion, potato, okra, tomato etc. showed either decreasing trend or a stagnant trend during the period between 2011-12 and 2013-14. Potato production in the country in 2011-12 was 41.4 million MT which increased to 45.3 million MT in the following year. However, in 2013-14, the production was down to 41.5 million MT. Onion production on the other hand decreased from 17.5 million MT in 2011-12 to 16.8 million MT in 2012-13. It registered

an increase in the following year of 2013-14 to 19.4 million MT.

HORTICULTURE & MICRO IRRIGATION

Micro Irrigation- The Mantra for "More Crop Per Drop"

Water is increasingly becoming scarce all across the world and India is no exception to this trend. According to reports, India is set to become water scarce country by 2025 due demand-supply mismatch. to As Indian society and the economy is developing leading to increasing household income and increasing consumptions from the service and industrial sectors, the demand for water in the domestic and industrial sectors are increasing substantially. As result, water supply for use in various sectors is surely going to be a challenge in the near future. In India, per capital water availability has been speedily declining from 5000 cubic metres per annum in 1950 to around 2000 cubic meters currently and is projected to decline to 1500 cubic meters annually by the end of 2025. This will lead to serious stress on the availability of water in the agriculture sector. Therefore a situation is arising where there is going to be increasing scarcity of water and at the same, requirement of water for irrigation which is necessary to grow crops and feed the nation. In this kind of a situation, technologies like Micro Irrigation (MI) is the only way forward for producing more crops utilizing

Irrigation and Livestock	688000
Municipalities	56000
Industry	17000
Total Surface and Ground water withdrawal	761000
Total withdrawal as % of actual renewable water resources	40%
Source: AOUASTAT (FAO)	

minimum water in a judicious way. Irrigation and livestock draws up significant amount of ground water, to the extent of 91% as shown in Fig 10.

During the last decade, the concept and use of micro irrigation has gained popularity in India and with focussed government support to spread the use of this technique, it is definitely becoming a vehicle for growth in agriculture. There is substantial promotional effort by the government and private organisations all across the country. States like Andhra Pradesh, Maharashtra, Gujarat etc are emerging as leading states in terms of adoption of MI. However. the spread is still below the expected level and several factors like high cost, complexity of the technology and other socio-economic issues such as a lack of access to credit facilities, fragmented landholdings, localised cropping pattern etc. are some of the important factors for this. The adoption of MI in the country has not been equitable and there are several states where MI is still to be adopted on a considerable scale. Several studies have revealed that MI technologies like drip and sprinkler crucial interventions in the pursuit towards water saving and improving crop productivity. Evidence shows that up to 40% to 80% of water can be saved and water use efficiency can be enhanced up to 100% in a properly designed and managed MI system which assumes great significance when water table is going down drastically due to overexploitation.

The significance of micro irrigation in agriculture is increasing with each passing year. Agriculture removes the largest amount of water. Micro irrigation discharges water in very less amount, in case of drip irrigation, drop by drop and that saves a lot of water from getting wasted. Micro irrigation helps in judicious and efficient use of water. Water is directly targeted to the roots of the crops. Further, minimum amount of water gets wasted as runoff, or by evaporation losses that generally happens with open irrigation channels.

Micro irrigation system in India has witnessed robust growth during the recent years. It is mainly driven by strong demand in states such as Andhra Pradesh, Maharashtra, Guiarat, Bihar etc. The state governments of Gujarat, Andhra Pradesh, Tamil Nadu, Chhattisgarh, Himachal Pradesh and Bihar have also conceived micro irrigation projects as part of the Micro Irrigation Scheme. Andhra Pradesh has currently the largest area under micro irrigation with over 91 thousand hectares. Maharashtra as a state has been

adopting micro irrigation significantly and it is estimated that over 70, 000 hectares of land under the coverage of micro irrigation. Guiarat has been adopting micro irrigation rapidly with over 60,000 hectares of land under of micro irrigation. States like Bihar, Madhya Pradesh etc. are featuring in the list of states with significant spread of micro irrigation. However, the spread of micro irrigation in India has not reached its desired potential and the adoption rate has been quite inequitable across the country. There are states where micro irrigation adoption has been zero or negligible.

Table 2 provides an overview of the status of irrigation potential across various states in India. Uttar Pradesh as a state has the largest area under irrigation with almost 15 million hectare of area under potential irrigation. This is about 25% of India's total area equipped for irrigation, almost 72% of the total irrigated area in Uttar Pradesh is ground water, while the rest is surface water. Andhra Pradesh has a total irrigated area of about 5.2 million hectares and almost 50% of it is irrigated with surface water. Maharashtra is another state where the total area equipped for irrigation with ground water is significantly more that the area equipped for irrigation with surface water. Almost 75% of the total area under irrigation is equipped with irrigation sources utilising ground water.

Among all the micro-irrigation methods, drip irrigation technology is the most efficient and widely used.

It can be applied to a large variety of crops, ranging from vegetables, orchard crops, flowers to plantation crops. Drip irrigation enables water to be applied near the plant root through emitters or drippers. It is done on or below the soil surface and water is discharged at a low rate varying from 2 - 20 litres per hour. This helps the soil to retain moisture at an optimum level with frequent irrigations, resulting in very high water application efficiency of up to 90-95 per cent. People in India were accustomed to the use of drip irrigation hundreds of years back when the tulsi plant in the courtyard of ancient Indian houses used a small pitcher with a minute hole hanging over the tulsi plant during summer months. This pitcher used to discharge water drop by drop keeping the soil around the plant wet. Even today, in some areas in the state of Arunachal Pradesh, the tribal farmers uses an indigenous technique of drip

irrigation using a slender bamboo as the conduit for water flow. Organised system of using drip irrigation in Indian agriculture started during the eighties

Table 2: Status of Irrigation Potential in India				
State (Union Territory)	Area equipped	Area actually irrigated (ha)		
	total	with ground- water	with surface water	
Andhra Pradesh	5 172 886	2 476 555	2 696 331	4 903 330
Bihar	3 454 567	2 147 035	1 307 532	3 454 567
Gujarat	3 580 371	3 047 419	532 952	3 197 196
Haryana	3 305 007	1 986 146	1 318 861	3 256 161
Karnataka	2 763 821	1 432 391	1 331 430	2 382 743
Madhya Pradesh	4 442 828	2 744 264	1 698 564	4 188 479
Maharashtra	4 154 227	3 119 987	1 034 240	3 361 506
Orissa	1 238 664	166 395	1 072 269	1 238 664
Punjab	3 995 004	3 059 792	935 212	3 956 837
Rajasthan	5 500 371	3 977 627	1 522 744	5 117 450
Tamil Nadu	3 033 555	1 606 371	1 427 184	2 660 603
Uttar Pradesh	14 846 319	10 641 176	4 205 143	14 491 181
West Bengal	3 306 093	2 087 003	1 219 090	2 975 070
India:	58 793 713	38 492 161	20 301 552	55 183 787

Source: Ministry of Agri, Govt. of India

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and slowly with government support and the entry of few companies in the drip irrigation technology, the use of drip irrigation picked up. In 2010, drip irrigation was applied to about 8 million hectares. In India, the state of Maharashtra has witnessed rapid adoption of micro irrigation in the recent years. The total irrigated area in the state varies between 35 and 40 lakh hectares out of the net cropped area of 175 lakh hectares. Out of this total irrigated area in the state of Maharashtra, nearly 12 lakh hectares is under the coverage of micro irrigation. It has been observed that since 2005-06, use of micro irrigation technology has picked up significantly, particularly in the horticulture belt of western Maharashtra and the cotton belt of Khandesh and Marathwada. The growth of micro irrigation in the state is particularly driven by the adoption of drip irrigation system, which accounts for about 8.5 lakh hectares during 2012. Important crops which are irrigated with micro irrigation system in Maharashtra are vegetables (1.8 lakh hectares), cotton (1.18 hectares), sugarcane (1.08 hectares) and fruits like banana, grapes, papaya, pomegranate and fruits of the citrus group.

India is however far away in terms of adoption of micro irrigation in agriculture when compared to countries like the USA, Russia, Brazil, Italy, France etc. In the USA, more than 57% of the total area equipped for irrigation in the country is through micro irrigation technique. Russia as a country has about 3.52 million hectare of land out of a total of 4.45 million hectare of area equipped with irrigation under micro irrigation. This accounts for almost 78% of the total area equipped for irrigation. Similarly, Italy, France and South Africa has 58%, 51% and 77% respectively of the total area equipped for irrigation under micro irrigation.

National Mission on Micro Irrigation-The Scheme Driving the Growth of MI in India

Recognizing the importance of use of modern irrigation methods like drip and sprinkler irrigation as the only alternative for efficient use of surface as well as ground water resources, government of India is running the National Mission on Micro Irrigation. This is aimed at popularising the use of MI among farmers. Under this Centrally Sponsored Scheme, 40% of the total cost of installing MI System borne by the Central Government and 10% by the respective State Government, Remaining 50% is borne by the beneficiary and this can be done either through own finance or through soft loan from various government financial institutions. The assistance is limited to five hectares per beneficiary family. The scheme covers all categories of farmers irrespective of the size of land holding. However, while selecting the beneficiaries, the

Table 5. Comparative data table of micro infigation across the world in different countries					
Country	Total area equipped for ir- rigation (million ha)	Sprinkler Irriga- tion (million ha)	Drip Irrigation (million ha)	Total Micro Irri- gation (million ha)	% of Total Ir- rigated Area
USA	24.7	12.3	1.64	13.99	57
India	60.9	3.04	1.9	4.94	8
China	59.3	2.93	1.67	4.6	8
Russia	4.5	3.5	0.02	3.52	78
Brazil	4.45	2.41	0.32	2.74	62
Italy	2.67	0.98	0.57	1.55	58
France	2.9	1.38	0.1	1.48	51
South Africa	1.67	0.92	0.36	1.28	77
Source: ICID					

Table 3: Comparative data table of micro irrigation across the world in different countries

respective state governments should take care that the interest of the small and marginal farmers are met and they are given due priority during implementation of the scheme. The scheme states that at least 25% of the beneficiaries should be small and marginal farmers and the beneficiaries are selected through the Panchayati Raj Institutions (PRIs). Further, the scheme has a provision where 75% of the cost of drip and sprinkler demonstration for a maximum area of 0.5 ha per demonstration is borne by the Central Government.

Challenges towards Adoption of Micro Irrigation in India

Despite various demonstrated advantages, the spread of micro irrigation has not been uniform and is restricted to only a few isolated pockets across India. There are several challenges to the wide adoption of the technology. Some of the important ones are:

- High initial cost: MI system needs high cost of installation. Even though there are government schemes and assistance, still a part of the cost has to be borne by the farmers. Considering the socio-economic conditions of Indian farmers, majority of whom are small and medium this initial cost has acted as a deterrent for installation of MI techniques.
- Technical issues: MI system, particularly the drip irrigation system is prone to issues like clogging of the emitter due to salinity and dust accumulation. The system needs proper and regular care such as proper filtration of the water used so that dust and other particles do not block the small emitter holes. Often, regular care and inspection is not carried out because of which the drip irrigation system becomes non-functional in the fields of the farmers.
- Unsuitable cropping patterns: Often, micro irrigation is not viable

or suitable for using in closely planted crops like various cereals which are actually grown on a vast area by Indian farmers. This is acting as a challenge towards use of MI on a large scale in the country.

- Need of technical and management skills: Successful implementation and use of MI systems need technical orientation and a minimum level of management skills of the users. Often, after installation of MI systems, the beneficiaries do not get adequate support in this area from either the government system or in many cases from the companies.
- Complicated process of documentation for subsidy: Farmers needs to do a lot of documentation and fill up forms that are complicated for availing subsidy. It also requires networking with multiple agencies which are often not possible for illiterate

small and marginal farmers. As a result, they depend on the officials of the companies or even in some cases, middlemen to facilitate the process.

- Stringent rules discouraging innovation within industry: Government scheme encouraging the use of MI systems in the country has a rigid set of predefined criteria for being able to be included under the scheme for the companies. This in turn is reducing flexibility and innovation in terms of the fact that only selected, pre-approved MI kits qualify for subsidy.
- Easy availability of irrigation water in some areas: Certain parts of the country, especially some of the states in Northern India have well developed traditional irrigation system and availability of irrigation water is not a big problem. This reduces the interest of the farmers to undertake the initial hassles of establishing MI system in their field.

THE PIONEERS IN WATER MANAGEMENT

What is the broad market scenario of micro irrigation in India?

Micro irrigation technology is gradually emerging as DEMAND driven technology these days in India. This stage has come about over a period of 25 years. The role of Private manufacturers, Government policies and Level of farmer awareness and role of media has helped to create the present situation. From a scantily respected "ForcedinTechnology" micro irrigation has grown to a "Sought After" technology. The coverage of micro irrigation is 7.5 million hectares (Drip 3.2 and Sprinkler 4.3 million hectares each) in India by 2014. More than 60% of this is provided by Jain Irrigation. An estimated over 3 million small farmers were provided with micro irrigation by Jain Irrigation.Over a period of 2 decades, the awareness level has grown tremendously in the country. The spread of technology has however; been restricted to states like Maharashtra, Andhra Pradesh, Guiarat, Tamil Nadu, Karnataka, Madhya Pradesh, present Telangana and Rajasthan. The North and North Eastern

states of India still have not come into the main picture yet. States like Haryana and Punjab are slowly getting into the groove. Apart from fruits and vegetables and plantation crops (horticulture crops) drip irrigation has spread to agricultural and commercial crops like, sugarcane, Cotton, Tobacco, oil seeds and few pluses and spice crops. The benefits from drip irrigation- increased yield, lower input (water, fertilizer, power and labour) use and higher production efficiencies have attracted the farmers and policy makers alike. The adaptation of a technology, that used to serve large farms in the developed countries, to the small farm holdings of the Indian farmer and supporting him with information and training is pioneering effort adopted by Jian Irrigation. The effort has paid off. India has become the largest adopter of micro irrigation.

What is the product profile of Jain Irrigation systems?

Jain Irrigation manufactures all components necessary to assemble a drip or sprinkler

Jain Irrigation Systems Ltd. (JISL) derives its name from the pioneering work in the field of Micro Irrigation in India. The Corporation has multi product industrial profile and are manufacturers of Drip and Sprinkler Irrigation Systems and Components: PVC Pipes, Polyethylene (HDPE, MDPE) & Polypropylene Piping Systems: Plastic Sheets (PVC & PC sheets): Agro Processed Products includes Dehvdrated Onions and Vegetables: Processed Fruits (Purees, Concentrates & Juices): Tissue Culture, Hybrid & Grafted Plants: Greenhouses. Poly and Shade Houses: **Bio-fertilizers: Green energy solutions includes Solar** Photovoltaic (Solar lighting and appliances, Solar pumping systems). Solar water heating systems. Bio-Energy sources: Financial Services and other agricultural inputs since last 27 years. We render consultancy for complete or partial project planning and implementation e.g. Watershed or Wasteland and / or Crop Selection and Rotation.Their tryst with micro irrigation began in when they pioneered watermanagement through Micro Irrigation in India. They have been successful in introducing some hi-tech, concepts to Indian agriculture such as `Integrated System Approach'. One-Stop-Shop for Farmer, `Infrastructure Status to Micro Irrigation & Farm as Industry.'In an interview with Agriculture Today, Mr. Ajit Jain, Jt. Managing Director, Jain Irrigation Systems Ltd. discusses the role played by Jain Irrigations in expanding the imprint of micro irrigation in the country.

> system. The manufacturing plants in India are located in Jalgaon (MS); Hyderabad, (TS);Udumalpet, (TN); Bhavnagar (Gujarat); and Alwar (Rajasthan).Globally the manufacturing is housed in Israel, Spain, Turkey, USA, Switzerland, Peru and Brazil.We manufacture PVC and PE pipes, emitters and emitting pipes and tapes, inline and online emitters, filters, fertilizer injectors and all other accessories for MIS. Jain also manufactures automatic control systems for Automation of drip or sprinkler systems. All products as manufactured under BIS. ISO certification or as per host country standard. Besides, Jain Irrigation also produce superior planting material for Banana, Pomegranate, Straw berry, Onion, Mango, and supply them Pan India with tested and standardized cultivation packages. Jain is also one of the large processors of fruits (Mango, Banana, Pomegranate, Amla (Indian Gooseberry), Papaya and Onion, Garlic and Tomato. These value added products are mostly exported.Our new product line includes solar PV based pumping systems and bio energy (energy from waste).

What is the market share of Jain irrigation in India and abroad?

In irrigation and agriculture supply and services, Jain Irrigationis placed at no. 1 position with in India, with 55% share in Drip market and around 40% of the share for sprinkler market. It is the more than 3 million or so farmers that we could reach out with this efficient technology that matters most. Drip irrigation has come to stay in India and Jain irrigation's contribution to this state of affairs is unique. Globally, for Drip Irrigation (excepting India) we have 20% market share.

Apart from the products, what are the services offered by the company?

Jain provides services along the complete agri. value chain. High value planting material. Water conveyance systems (PE and PVC pipes). Crop Advisory and agronomy support. Field level technical support and hand holding for small farmers. Training and capacity building of farmers. Integrated water/irrigation management projects-design, planning and execution and O&M for agreed period. Buy back and value addition of selected commodities (fruits and vegetables)Finance channels to farmers either thru its own NBFC or thru associated commercial or Co-op banks.Reach out half million farmers every year.

What is the scope of micro irrigation in India?How has been the industry performance in the last decade in the sector of micro irrigation?

There is an overall potential of 27.80 million ha area in India is suitable for providing drip irrigation, in horticulture sector alone. This includes fruits, vegetables, Sugarcane, Cotton, Tobacco, spices, Tea, Coffee, Rubber and Coconut and floriculture crops. Additional potential exists in the future by more crops getting adapted to drip or sprinkler method of irrigation with modified cultivation practices taking the potential to as high as the irrigated area in the country, 83 million ha. For example, framer field trials for 4 years have shown positive results in the case of pulses, especially pigeon pea. These irrigation methods are also getting acceptance for primary cereals like wheat and maize. And the last frontier, rice is also grown successfully with drip and fertigation technology for the last 8 years by Jain irrigation. Of the potential area for Drip irrigation only 58% comes under irrigation cover at present. The idea of rain water harvesting, and farm pond concept would have to be taken with high priority to bring in the presently rain fed areas also under drip irrigation. Similarly, 38.7 million ha area grows crops that can be suitably irrigated by Sprinkler systems. The performance of this technology has been remarkable and in the current program of the Central government (PMKSY) micro irrigation is uniquely placed as one and only technology for "creating" water and using it for irrigating more rain fed areas. The higher irrigation efficiency achieved thru drip (95%) and sprinkler (60%) offers a vast opportunity for India to share its meager water resource (1143 Billion Cubic Meter) to all purposes-agriculture, domestic, industrial and recreational. Because agriculture uses more than 82% of water, savings in this sector is most critical. Micro irrigation is the tool for this conservation exercise.

What is the acceptance level of micro irrigation in India?Where does India stand with respect to adoption of Micro irrigation techniques?

Farmers in states like Maharashtra, AP, TS, Karnataka, Gujarat and TN have fully convinced of the value of this technology for crop production. The level of such awareness and conviction is yet to

improve in other states, especially the water rich states like WB, Bihar and UP.NE states and Punjab, Haryana, HP and UK are progressing at slow pace. Apart from water scarcity, in the Central and southern states, the crops grown there also is a reason for quicker adoption. Horticulture crops and sugarcane, and cotton are the major crops of these states onto which adapting drip irrigation was fruitful from the beginning. With efficient administration of Government subsidy assisting the farmers to invest in this technology, India would develop very high percentage of cultivation under micro irrigation. As for statistics, India has the largest area of micro irrigation in the world. And in the next five years the coverage for drip in India would take us not only to the highest drip covered country but the total area under drip would exceed the grand total of drip coverage in all other countries put together. India is going to become the world leader in application of the technology. Micro irrigation technology aims to enhance crop productivity and quality, besides reducing water and power used for crop production. It is applicable to all regions of the country irrespective of being irrigated (water sufficient) or dry (water deficit).

Being the veterans in this field, how do you see the government efforts in popularizing micro irrigation in India?

In the formative years of micro irrigation technology in India, government assistance to farmers played a very important role in the spread of the technology. Subsidy provision is a major driver of adoption. Recently announced Pradhan Mantri Krishi Sinchai Yojana (PMKSY) is expected to give good impetus to this sector. "Har Kheth Me Pani" (water for every farm) can become an actuality only by restraining water use in the current irrigated area. This restriction can effectively be brought out by micro irrigation technology.

What are the new products/systems that are available in this segment?

New products such as low cost diffuser systems, rubberized pipes, hydraulic and solenoid valves, automation systems, ondemand deliver outlets etc.are available in the segment

What are the challenges ahead of the industry?

Finding capital is the number one challenge for the industry.Providing right type of services to the far flung areas of the country is another challenge; trained man power requirement would be huge.The very low margins due to competitiveness are another major challenge faced by the industry.As the technology moves into more traditional agriculture areas, requirement for information and awareness building becomes a huge challenge. A lot of attention is required both from public institutions and private players.The curricula in various SAUs and ICAR institutions do not contain micro irrigation as a subject to be imparted to the graduates/post graduates. This certainly needs a change.There should be more involvement of Banks and financial institutions in extending the technology.

What are the future products/ developments that we can expect from the Jains?

- 1. Automation products: A complete range
- 2. Solar Pumping Systems and integration of the same with micro Irrigation
- 3. Jain Integrated irrigation Solutions From Resource to Root
- 4. Automatic on-line screen filters.

"MICRO IRRIGATION – MORE FOOD PER UNIT AREA"

EPC is a Mahindra group company, popularly known as EPC Irrigation which is a pioneer of micro-irrigation in India. Mahindra and Mahindra Ltd. (M&M) has acquired majority stake in EPC Industrié Ltd through preferential issuance of equity shares. This transaction has enabled M&M to enter Micro-Irrigation Sector. EPC provides complete solution for agriculture with a focus

on Micro-Irrigation, Pumps & inter-related requirements of fertigation & agronomic support.EPC has also launched first of its kind one stop shop for agro products & solutions (Agri Showroom) in Buldhana district of Maharashtra, wherein farmers can find all agri input products & services under a single roof. In an interview with Agriculture Today, Mr. Ashok Sharma, Executive Director & CEO EPC, A Mahindra Group Company, Chief Executive - AFS Strategy, Agri & Allied Businesses, M&M Itd discusses the relevance of micro irrigation technology and the services offered by EPC.

What is the relevance of micro irrigation in India?

India is currently on the verge of being water stressed (< 1500 Cu m / per capita). It is estimated that by the year 2050, owing to the growth in population and the pressure that it puts on agriculture. India will be on the brink of becoming a water scarce country (< 1000 Cu m / per capita). The agricultural productivity is currently half of what it is in many other countries. To fulfil the growing demand for food, fodder, feed, etc., India needs to produce more food per unit area. This makes farm productivity increase imperative. One of the major ways of solving this challenge is to make better use and management of water resources in agriculture, and micro irrigation is one of the best available solutions for the same with its ability to efficiently use water. Micro-irrigation such as Drip Irrigation and Sprinkler Irrigation are amongst these technologies in use over the last three decades. These irrigation systems are more efficient than conventional flood irrigation method, because they deliver low volumes of water directly to plants' roots, minimizing losses to wind, runoff, evaporation and these irrigation systems use 30 to 70 percent less water than conventional irrigation systems for different crops.

What is the broad scenario of micro irrigation in India? Where does India stand with respect to adoption of Micro irrigation techniques?

The potential for Micro Irrigation (MI) Systems in India is estimated to be around 45 million hectares with current penetration levels between 7 and 10%. A strong and stable government at the centre with the ruling party's background of pioneering Micro Irrigation work in key states where it is in power, augurs well for the industry all across the country. There is growing awareness among the farming community about the benefits of this technology and hence a greater pull from them is driving the adoption of Micro Irrigation systems forward. New breakthroughs in technology, the number of crops, and the types of farms that can be brought under Micro Irrigation is increasing.

New cost effective innovations like portable, gravity based drip irrigation systems, and systems that use alternative material are being introduced. Last, but not the least, with the evolution of the industry and growing use of information technology, the design, installation, customer service, and subsidy management process are becoming increasingly efficient leading to higher demand. Further the National Mission on Suatainable Agriculture is expected to be a major boost to the industry. NMSA has been formulated for enhancing agricultural productivity especially in rainfed areas focusing on integrated farming, water use efficiency, soil health management and synergizing resource conservation. NMSA derives its mandate from Sustainable Agriculture Mission which is one of the eight Missions outlined under National Action Plan on Climate Change (NAPCC). The micro irrigation industry in India is worth Rs. 4K to 5K Cr. with F15 being 4.5K Cr. This includes Drip Irrigation Systems, Sprinkler Irrigation Systems and associated elements of the irrigation systems. The Indian micro irrigation market is mainly contributed by drip irrigation system in terms of revenue. The drip and sprinkler irrigation technologies differ in terms of flow rate, pressure requirement, wetted area and mobility. India has mammoth potential for both the irrigation methods. It is a highly competitive market with the presence of large and small scale drip and sprinkler irrigation systems producers and marketers across numerous states across India. The major contributing states are Maharashtra, Gujarat and Andhra Pradesh + Telangana. Maharashtra contributes to roughly 18 - 20% of the industry.

Please brief us the company profile? What is the market share of EPC Industries Limited?

With a vision of delivering FarmTech Prosperity by enhancing the farm productivity, M&M LTD., Agri Business entered the micro irrigation business in 2011 by acquiring majority stake in EPC Industrié Ltd through preferential issue of equity shares. This started Mahindra's Drive to promote use of modern scientific

micro irrigation solutions for Farm productivity improvement. Started in 1986 with French technology support, EPC has developed capability to design and develop irrigation products, solutions of international standard, and satisfying needs of farmers.EPC provides complete solution for micro irrigation and other related products like pumps, landscape irrigation, poly house & inter-related requirements of agronomic support. EPC is one of the most trusted brands in Micro Irrigation Systems, and governs high brand equity among farmers. When EPC was acquired its market share was approximately 2.5%. Over these years, EPC has stabilised and consolidated its position while continuing to grow in volume as well as market share. The market share has doubled in a span of 4 years after acquisition and is at around 4-5%.With head office situated in Nashik, Maharashtra, EPC is also registered in 17 states under subsidy program in India with well-established dealer network of 550 dealers across these states.

What are the products marketed byEPC Industries Limited?

Drip irrigation is the targeted, intelligent application of water and fertilizer directly to root zone of plants. Our drip laterals are equipped with FINDRIP technology which helps proper distribution of water through the lateral line. Our sprinkler irrigation systems comes with patented QPC technology and are suitable for modern farming as they offer quality, high yield and cost efficiency. We also have a range of superior quality pumps for better quality crops & higher productivity which can operate in a wide voltage range hence overcoming the voltage fluctuation problems.i.

We have joined hands with Hunter Industries (USA) a market leader in landscape irrigation to provide world class landscape irrigation products.Landscape irrigation is a watering system that is used to create and maintain lawns, gardens, and custom landscapes etc. We also deal with poly houses that are structures utilized as microclimate environment to make plants grow well by maintaining the optimum temperature required by plant. Design of our poly house is best in class with robust and sturdy structure which aims at keeping maintenance costs lower and enables longer structural stability and life.

Apart from the products, what are the services offered by the company?

We regularly conduct farmer meetings for sharing Agronomy & Technology knowledge. We conduct various farmer meetings throughout Indian villages so as to keep farmers up to date with new methods of improving productivity of their farms. Keeping our vision of farm tech prosperity in mind we not only provide excellent product but also encourage farmers avail services of our toll free number where they can get solution for various crop related issues from our expert agronomists and that too free of cost. We have a team of talented designers who designs the layout of farm in such a way that we can provide cost effective irrigation solution for farming and improving farm output. We have also developed an in house matrix to measure the quality of designs made by sales executives & dealers and provide trainings to them for improvement in designs. We also have a dedicated team of customer care officers across India who takes care of all the after sales support. We have also developed an innovate matrix which measures the quality of installations done. We also measure the turnaround time for complaint resolution and aims to provide best services to farmers

Can you share with us any success story?

One of the biggest success stories has been the amount of water we have been able to save through this business. One of the key drivers for our business is our focus towards creating farming practices that promote efficient utilization of water. We are registered as the first CDM (Clean development mechanism) project in the industry by the UNFCC. We are saving more than 7 Billion Litres of water thereby making the entire Mahindra group water positive.

What are the challenges faced by the sector? Do you think micro irrigation as a viable option for the farmers?

There are quite a few challenges faced by the sector, the main one being the disbursal of subsidies. Being a subsidy driven industry, any delay in allocation of funds results in stress in the industry. Particularly during the election years, owing to constraints, most nodal agencies exhibit caution and this adversely affects the already tight working capital cycles of the industry. Also, the level of awareness is yet to spread across the country. While certain states like Maharashtra and Gujarat have done well, others still have a long way to go. The need of the hour is to educate the individual farmers about the benefits of micro irrigation. Studies by agronomists have shown that the real reason behind non adoption of micro irrigation is not that of affordability but a general lack of awareness about the benefits: both economic and agricultural. Micro Irrigation has the ability to increase productivity, reduce weeds and also result in significant savings on electricity apart from its ability to conserve water. Hence the viability of micro irrigation is not a challenge. The challenges mainly arise due to reasons such as - Perception of upfront high capital investment, Preference over other cheap sources of irrigation, Availability of free electricity and Lack of extension and awareness programmes.

The Pradhan Mantri Krishi Sinchayi Yojana was cleared by the cabinet recently. According to you, how can this project streamline the micro irrigation projects in the country?

We are very excited about the Pradhan Mantri Krishi Sinchayi Yojana. The theme of "more crop per drop" resonates strongly with micro irrigation practices. Further PMKSY would also enable convergence of the multiple schemes and initiatives that existed for improving irrigation in the country but were, at times, ineffective due to lack of clarity of scope and coordination amongst various implementing agencies. This makes for a great chance to create newer avenues for growth for the industry. Speaking in numbers, Dept. Of Agriculture & Cooperation (DAC) will receive Rs. 1800 crore for National Mission on Sustainable Agriculture (NMSA) under PMKSY scheme. In addition to this DAC has outcome budget of Rs. 835 crore under NMSA. With this total fund availability of Rs. 2635 crore under NMSA and assuming that this fund would be completely utilised in this fiscal, estimated micro irrigation industry should be around Rs. 10,000 crore in F16 against industry of Rs. 5,000 crore in F15.

MAXIMISING USER'S BENEFIT

Established in 1958, Finolex Group today has turnover in excess of Rs 4000 crores with 5 companies and 11 modern excellent manufacturing facilities located at Pune, Ratnagiri, Goa& Uttarakhand. Finolex Plasson Industries Pvt. Ltd. (FPIPL) is a Joint Venture between Finolex Group - India and Plasson Ltd. – Israel. Established in 1992 and based near Pune, FPIPL, an ISO 9001:2008 company, is today a leader in the field of Micro Irrigation in India. FPIPL offers a wide range of products and solutions in the field of precise Irrigation and Intensive agriculture cultivation. Along with its advanced systems, FPIPL also provides comprehensive Agronomic Guidance and Knowledge Transfer Programs on Irrigation, Fertigation and all parts of cultivation. In an interview with Agriculture Today, Mr. Vijay Chhabria, Managing Director,

Finolex Plasson Industries Pvt. Ltd. discusses the extent of micro irrigation in India and their relevance in today's agriculture.

What is the broad scenario of Micro Irrigation in India?

The growing need for food security and increased population has resulted in higher demand for irrigation water which could only be met by judicious use of available water resources. Micro Irrigation technologies are being promoted in India by providing different kinds of financial, institutional and technical support. These technologies are promoted primarily as a means to save water in irrigated agriculture, as a strategy to increase income and reduce poverty and to enhance the food and nutritional security of rural households. Despite the reported significant economic advantages, area under micro irrigation in India remains an insignificant proportion of its potential. Micro irrigation which involves the use of sprinkler and drip irrigation to optimize the usage of resources, (water, labour and fertilizer) in agriculture has been adopted round the globe to boost crop production. The percentage of area covered under Micro Irrigation with respect to total irrigated area, world over is 15% in comparison to less than 10% in India. Though India has largest irrigated area - 69 million hectares- it has only around 8 million hectares i.e. less than 11% under Micro Irrigation, which shows that there is a huge potential for adoption of Micro Irrigation. With the recent announcement of the 'Pradhan Mantra Krishi Sinchan Yojana', it is expected that there may be a boost in adoption of Micro Irrigation System.

What is the market share of Finolex?

Presently, Finolex Plasson's market share is around 7 percent.

What are the products offered by Finolex Plasson?

Finolex Plasson (FPIPL) offers a wide range of products and solutions in the field of precise Irrigation and Intensive agri-

culture cultivation. Our solutions include complete tailored Drip and Micro Sprinklers Systems and Turn-Key Projects for all agriculture sectors. We offer Drip & Sprinkler Irrigation Systems which includes Inline and Online Irrigation Systems, Micro Sprinklers, Fogging System, Fertigation Equipments, HDPE Sprinkler Pipes etc. In recent past, the company has introduced Pressure Compensated Non Drain Inline (PCND). PCND Inline is being used for precise irrigation in Greenhouses and subsurface applications for sugarcane, banana, grapes and horticulture crops.Recently, we have started manufacturing world class Plasson PVC Ball Valves in collaboration with Plasson Ltd., Israel at our manufacturing facility in Pune. Presently, we have introduced 50mm, 63mm & 75mm PVC Ball Valves.

Apart from the products, what are the services offered by the company?

Our services include Survey, Planning, Design and facilities for Drip, Mini& Micro Sprinklers, Foggers, Misters, Fertigation equipments, HDPE Sprinkler Pipe sets, etc. for various Field Crops, Horticulture Crops, Plantations, Landscape, Greenhouse and Poly-house Irrigation Systems, etc. Along with its advanced systems, FPIPL also provides comprehensive Agronomic Guidance and Knowledge Transfer Programs on Irrigation, Fertigation and all parts of cultivation.

How has been the industry's performance in the last decade?

Initially Government and Micro Irrigation Industry were promoting the concept of Micro Irrigation and the growth was very slow. Subsequently realizing the benefits and importance of Micro Irrigation System and formation of Micro Irrigation Mission by the Government of India, the growth accelerated fast. At present, the industry is growing by 25 to 30% every year. The last couple of years have been very difficult on the industry owing to unprecedented increase in polymer prices coupled with inadequate budget allocations for subsidy which resulted in substantial delay in releasing payments to farmers/ manufacturers.

How has been the acceptance of Greenhouses in India?

Farmer have now understood the benefits of micro irrigation in terms of increased yield, improving quality and saving of irrigation water. New trend of protected cultivation is being promoted by Central as well as State Governments. Good quantum of financial assistance is also being offered for con-

struction of greenhouses. The yield and quality of the produce in greenhouses are much more superior as compared to open field. Farmers can grow crops round the year. Due to this there has been substantial growth inadoption of greenhouse technology with automation.

Are Greenhouses a viable option under Indian conditions?

Yes, the produce from greenhouse is of superior quality which results in better prices to the grower. Moreover the yield obtained in the greenhouses, are more than double. This has been experienced by the floriculture and vegetable growers. As the crop can be cultivated under controlled micro climatic conditions throughout the year, farmer gets more returns

from the crops. Therefore greenhouse cultivation is preferred by progressive farmers and is increasing day by day.

Which are the crops in India that usually go under the greenhouse cover?

Floriculture industry is pioneer in cultivating various flowers in greenhouses for export as well as for indigenous market. Various crops like colored capsicum, cucumber, zucchini, cherry tomatoes, lettuce, broccoli, salad leaves and all exotic vegetables are being cultivated in greenhouses in India.

What are the advantages of micro irrigation in India?

Micro Irrigation is the process of scientific administration of water in required quantities to the crops. Its major outcome is a better remuneration for the farmer resulting from better quality and quantity of crop from the same land area. Increase water use efficiency; improved labour use efficiency; increased fertilizer use efficiency and lesser weed growth, therefore reduced use of weedicides. Micro irrigation is suitable for a wide range of agriculture and horticulture corps, row crops, mainly vegetables like Potato, Tomato, Onion, Cauliflower and Capsicum are the ones that have shown very good results, in addi-

At present, the industry is growing by 25 to 30% every year. The last couple of years have been very difficult on the industry owing to unprecedented increase in polymer prices coupled with inadequate budget allocations for subsidy which resulted in substantial delay in releasing payments to farmers/manufacturers

tion to this, cash crops like cotton and sugarcane, fruit crops like Banana, Orange, Mango and Grapes have also registered good results with Micro Irrigation, Field trials on Wheat and Paddy have also yielded positive results.

Are you satisfied with the Governments approach on Irrigation scenario in general and Micro Irrigation in particular? What are your suggestions to the Government?

Recently announced "The Pradhan Mantri Krishi Sinchan Yojana" is the most welcome step taken by the Government of India. In order to make the same more effective and easy for implementation, we suggestWorking Capital Funding for sub-

> sidv disbursement. It has been observed that the limiting factor in the growth of area coverage under Micro Irrigation in India is, working capital requirement to bridge financing until subsidy is received. There have been delays in the distribution of subsidy by the State Governments through their departments which in extreme cases even go upto two years but are normally three months. This results in huge funding requirement and Nationalised Banks do not finance due to RBI guidelines which do not permit lending against subsidy. If this issue is resolved and funding is made available, this can result into substantial increase in the coverage area under Micro Irrigation and thereby saving huge amount of water. Import Duties should be waived, if and when raw material is used for production of Micro

Irrigation System.Excise Duty wherever applicable should be waived for raw materials and components used for manufacturing Micro Irrigation system.Value Added Tax(VAT) should be exempted on micro irrigation systems to make it more affordable to the farmers. A System simplification of subsidy disbursement will also be beneficial. Agriculture being a state subject, all the states have their own set ups and procedures for the release of subsidy. This results in abnormal delays in some states. A proven and simple model should be followed by all the states so that funds are readily available at the offices, when orders are issued for supply of MI system.

What are the new trends in this segment? What are the future products that are in the pipeline?

Farmers are adopting more advanced techniques like use of PCND Dripline for subsurface drip irrigation for variety of crops which results in more saving of water and efficient use of nutrients through fertigation. By use of this technique Sugarcane Growing Farmers are getting higher yields to the tune of 100 to 140 tonnes/acre with increase in sugar content. Similar adoption is also being done in Banana, Pomegranate, Grape crops.

Crop Protection Scenario in India

he persistent increase in global population and negligible concurrent increase in available land for agriculture, effective crop protection is going to play a crucial role in safeguarding the world's future. The efforts put forth would essentially be on minimizing the crop losses due to ravages of insect pests, diseases, weeds, nematodes, rodents, vertebrate pests etc. amounting to the tune of 10-30%. Enforcement of Destructive Insects & Pests Act (1914) and Plant Quarantine Order (2003) for prevention of exotic pests, promotion of Integrated Pest Management (IPM) for economical, ecofriendly and sustainable management of the pests, Implementation of Insecticides Act, 1968 for regulating production and use of pesticides and Human Resource Development in Plant Protection through training are the major programmes in the gamut of plant protection.

The Directorate of Plant Protec-

tion Quarantine & Storage was established in the year 1946 on the recommendation of Woodhead Commission as an apex organization for advising the Government of India and state governments on all the matters related to Plant Protection. Apart from this, State Agricultural Universities, ICAR institutes, KVKs, State Ag-

riculture/Horticulture departments are also addressing different issues of plant protection in India.

In order to tackle the issues of plant protection in India, the Government of India has set forth three major schemes viz.,

A. Strengthening and modernization of pest management approach in India (SMPMA)

B. Strengthening and modernization of plant quarantine facilities in India (SMPQF)

C. Monitoring of Pesticides Residue at National Level (MPRNL)

Pests are one of the major constraints in production of different crops in all the agro-climatic zones. Reliance on chemical pesticides is in no way a complete solution for the pest vagaries. Injudicious use of these pesticides is not only posing a threat to the environment but also posing health hazard. Therefore, the concept of Integrated Pest Management (IPM) which is an eco-friendly approach to keep the pests population below Economic Threshold Level by employing all available alternate pest control strategies and techniques such as cultural, mechanical and biological with emphasis on the use of bio-pesticides and pesticides of plant origin like neem formulations need to be intensified. The concept of IPM does not preclude use of chemical pesticides, rather impresses upon need based judicious use of such pesticides. In order to minimize the use of hazardous chemical pesticides and to prevent/ manage the insect pests / diseases attack as well as to increase the crop productivity, IPM activities have been included under the scheme "Strengthening and Modernization of Pest Management Approach in India" since 1991-92. Under the ambit of IPM programme, the Govt. of India has established 31 Central IPM Centres in 28 States and one UT.

Farmers are being sensitized that the chemical pesticides are not the panacea therefore other inherent capabilities of the nature has to be exploited so that the natural balance can be maintained for sustainable agriculture. In this direction, efforts have already been initiated by the Ministry of Agriculture at the central level to "Grow Safe Food". The other agriculture related agencies like State Agricultural Universities, State Agricultural Departments, Indian Council of Agricultural Research Institutes, Krishi Vigyan Kendras, NGOs etc. of the country have to be roped into for this noble approach.

To avert any threat due to locust incursion, the Locust Warning Organization (LWO) is keeping constant vigil in the area of about 2 lakh sq km of Scheduled Desert Areas (SDA) in the States of Rajasthan, Gujarat and Haryana.

The Central Insecticide Board and Registration Committee (CIB&RC) is promoting registration of effective and safe bio-pesticides and botanicals. The virulence of strains of different microbial bio-agents at regional level should be given due

emphasis. There should be dynamic and frequent review of the registered pesticides for banning/ restricting them for use, based on the present knowledge base. New improved and strict legislation would be introduced for replacing existing Insecticides Act to have effective provision for safe disposal of used containers. safety issues for the operators, qualification for pesticides dealers, and heavy penalty for the rule violators. The Registration Committee (RC) has been constituted under Section 5 of the Insecticides Act, 1968. The Committee registers insecticides after scrutinizing formulae, verifying claims of efficacy and safety to human beings and animals specify the precautions against poisoning. To assess efficacy of the insecticides and their safety to human beings and animals, the Committee has evolved exhaustive guidelines/ data requirements which inter-alia includes residue in crops on which the insecticides are intended to be used.

Plant Quarantine regulatory measures in the country are operative through the 'Destructive Insects & Pests Act, 1914 (Act 2 of 1914)'. Under WTO, import/export of plants and plant materials are likely to go up manifolds thereby warranting fast track plant quarantine services. Due to the increased inflow of plant and plant materials, there is increased risk of introduction of exotic pests and diseases into the country and therefore Government of India has notified "Plant Quarantine (Regulation of Import into India) order 2003" replacing old Plants, Fruits & Seeds (Regulation of Import into India) order 1989. Issuance of Phytosanitary Certificate (PSC) in respect of exportable plants and plant materials, the Government of India has adopted international standards conforming to the requirements of the importing country in accordance with IPPC, WTO & SPS Agreements. Further, Govt. of India has developed and adopted various national standards for effective implementation of plant quarantine in India.

Dr. S.N. Sushil, Plant Protection Advisor to the Govt. of India

Green Revolution to Eastern India

n 28 June this year, while laying the foundation stone for the Indian Agriculture Research Institute in Hazaribagh district of Jharkhand, the Prime Minister reiterated the need for a Green Revolution (GR) in eastern India including Jharkhand, Bihar, eastern Uttar Pradesh, West Bengal, Odisha and Assam. The idea of "extending the Green Revolution to the eastern region" was first mooted in the Budget 2011-12, in recognition of the fact that in Punjab, Haryana and western Uttar Pradesh, the GR was now running out of steam. Newer areas with potential had to be identified for application of modern scientific technologies to ensure that growth in foodgrain

production continues to keep pace with the country's population.

It is now widely accepted that the earlier GR proved to be a double-edged sword. A cornucopia and a pandora's box. The intensification of agriculture through adoption of modern sciencebased technologies, tripled foodgrain production from about 90 million tonnes in the mid-1960s to over 264 million tonnes in 2013-14 thereby ensuring food security. In trebling foodgrain production, fertilizer application increased thirteen times.

Success of this GR, however, spawned a new and stickier set of environmental problems -- rapidly falling groundwater-tables, declining soil health, and dwindling biodiversity. Modern agricultural practices began to adversely affect soil fertility through erosion, s a l i n a t i o n , multiple nutrient d e f i c i e n c i e s , declining soil carbon, loss of organic

Dr. Rita Sharma

matter and reduction of biological activity. The indiscriminate use of agro-chemicals for pests, weeds and insect control was reflected in pesticide and insecticide residues in farm produce as well as in the widespread contamination of surface and groundwater with connected health hazards.

Current levels of water and fertilizer efficiency use are woefully low.

Irrigation efficiency is a mere 30%. Fertilizer-use efficiency ranges from 2 to 50%. The enormous wastage of resources not only increases cultivation costs but inflicts severe environmental damage. It is estimated that a 10% increase in water-use efficiency can give dividends of 50 million tonnes of additional foodgrain from the existing irrigated area. A 10% rise in nutrient use efficiency would result in a saving of almost 20 million hectares of land.

In extending the GR to eastern India, it is important to avoid the pitfalls of the earlier one. A second GR in India will need to be based on a new paradigm of sustainable intensification of agriculture as contrasted with the mere intensification of agriculture which characterized the GR of the 1970s and 1980s.

Sustainable Intensification of Agriculture (SIA) appears to he the pathway for convergence of production and ecological concerns. Embedded in the SIA is the recognition that technologies of the earlier Green Revolution cannot be done away with and will continue to be used in the foreseeable future. The second GR will use modern plant varieties but with much greater attention to sustainable use of natural resources and more efficient and judicious use of external inputs.

Productivity enhancing technologies and management practices have been developed that lead to resource conservation. Programme and schemes have been designed which have adaptation and mitigation to climate change as co-benefits in this new regime, which need to be aggressively promoted. Some of the initiatives are indicated here.

 Zero-tillage practices in wheat-rice farming systems reduce soil erosion and increase the soil's capacity to hold water and sequester carbon dioxide, sustain soil fertility, improve water management and reduce production costs through energy savings. Zero tillage leads to timely sowing and thereby to higher productivity. More crop per drop can be achieved through the use of watersaving technologies such as drip and sprinkler systems, innovative more efficient and waterpumping and water-conveyance structures.Water-saving practices in rice cultivation such as direct raised-bed seedina, planting, alternate wetting and drying can lead to increasing productivity, sustainably.

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- Systems of Rice Intensification (SRI) is a grassroots innovation which works by changing the management of rice cultivation. has demonstrated SRI vield advantage of 1.5 to 2 times together with savings in seed requirement of 65-70 percent, water savings of 35-40 percent and significantly less fertilizer use. SRI has been factored into the National Food Security Mission. States like Bihar, Tripura and Odisha have started taking up SRI practices. Other States need to follow suit.
- Climate-smart rice varieties. Drought, flood and salinity tolerant rice varieties developed by Indian Council of Agricultural Research and International Rice Research Institute are being promoted in eastern India. They are able to thrive in environments affected by flooding, drought and soils that are too salty.Inadequate quantity of requisite seed production and lack of capacity in farmers is a constraint in the more rapid adoption of these varieties.
- Improved nutrient management. The Integrated Nutrient Management Programme relies on conjunctive use of both inorganic and organic sources of plant nutrients like farmyard manure, compost, bio-fertilizers and green manuring. Suitable crop rotations and planting nitrogenous trees enriches the land. The emphasis on soil testing aims at greater precision in fertilizer application. The demand for soil testing among

farmers, however, continues to be very low.The soil health card scheme should provide some impetus.

Agroforestry is a potent tool for sustainability in agriculture. The addition of trees on farms offers multiple livelihood benefits to farmers, including sources of green fertilizer to build healthier soils and enhance crop production, providing livestock fodder, timber and fuelwood. There are environmental benefits too, in the form of shelter, erosion control, more effective water cycles and watershed protection, increased biodiversity, areater resilience to climate change, and carbon storage and accumulation. The National Policy on Agroforestry promotes tree-based farming systems and needs to be rigorously implemented.

Extending the GR to eastern India, through sustainable intensification of agriculture, will require multiple and delivery systems, extension supported information bv and communication technology to provide farmers with better access to knowledge and innovation, markets and weather forecasts as well as better tuned instruments of credit and insurance.

Necessity drives change. In an era of technological optimism with half a century of experience, a second GR can become a reality, leading to sustainable food security and transforming the lives of millions of small farming households who were by-passed by the earlier GR. It is time to adopt these higher aspirations.

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PROTECTING CROPS SUSTAINABLY

DuPont India markets a wide range of products in a variety of market segments including agriculture, food and nutrition; health care; home and construction; electronics; safety and protection; and transportation and infrastructure. Driven by the vision to empower farmers to turn their ideas into certainty, DuPont uses innovative ideas and cutting-edge technology to create solutions in insect, weed and disease control. These innovative ideas are put to work to protect crops such as rice, wheat, sugarcane, fruits and vegetables, pulses, and more.Mr. Ram Mudholkar, Business Director ASEAN & South Asia at DuPont, in a recent interview with Agriculture Today discusses the importance of crop protection industry in Indian agriculture and the role played by DuPont in the crop protection sector of India.

What is the market share of Dupont in India?

DuPont is one of the most prominent players in the global as well as Indian Crop Protection market. We have industry leading products in many major crops such as Rice, Sugarcane, Fruits & Vegetables, Pulses, Soya etc. In terms of market share, we have been amongst the top five players in India for a long time now, and are increasing our relative market share and competition steadily with new product launches.

Which are the products that Dupont has released in India?

DuPont offers a wide product range for insect, disease and weed control. DuPont[™] Ferterra[®] and Coragen[®] brands, powered by Rynaxypyr[®], are well established insec-

ticides for some of the most common pests. DuPont[™]Benevia[®] insecticide and Gallileo[®] fungicide, targeted at fruit and vegetable crops, have been recently launched with great response from the market. Apart from these, we have a wide spectrum of crop protection products. We continue to invest in R&D to realize better, safer and greener solutions to solve the needs of growers. DuPont's R&D and Crop Protection pipeline has been named by international bodies as the best in the industry for two consecutive years now. We believe many products in the research pipeline will also suit the requirements of Indian farmers.

What is the general scenario of Crop protection in India?

India is a very underpenetrated market for crop protection products. The pesticide usage in India is one sixth of some of the more developed agricultural economies. This results in sub-optimal productivity. The lower land holding combined with low awareness levels also result in farmers not being able to use the right crop protection measures. Having said that, the industry is moving in positive direction, with many suppliers introducing products suited to Indian needs and farmers adopting safer crop protection chemicals.

What are the challenges faced by the crop protection industry in India?

Fake & spurious pesticides, and low

levels of farmer awareness are the biggest challenges facing the crop protection industry in India. There are lots of spurious products available in the market, and many of them are passed off as bio products to circumvent the stringent registration requirements.Due to the fragmented land holding, there are many small farmers without adequate access to information on the right pesticides to use for their crops.

How does Dupont tackle the issue of spurious pesticides?

The issue of spurious pesticides is one of the most concerning issues facing the crop protection industry in India. There are

several suppliers of counterfeit pesticides.DuPont recognized the issue in all its severity, and is very active in educating farmers about the harms of using spurious products. We also run campaigns to tell farmers how to identify and report fake pesticides. Our channel partners have easy access to information on the techniques of identifying fakes, and are encouraged to report any suspicious case they come across. At the regulatory level, we extend our support to enforcement agencies for tracking fake products.For our products, we use the Izon[®] security feature, which is a very powerful visual anti-counterfeit technology. It is a fast, intuitive 3D hologram verification technology that makes identifying fake products easy. We also employ product tracking systems to reduce the risk of counterfeit products being sold by malicious agencies.

Pesticide residue has been overly criticised these days. Being a pesticide producer, how do you view this scenario?

Yes, I believe pesticides are overly criticized for various reasons including residues. However, the truth is that India consumes much less pesticides as compared to other countries, and over the years a number of low dose, safer chemistries have been introduced in the country. There are two key elements to ensure that pesticide residues in produce do not exceed legal limits. First is the choice of the pesticide itself. Registered products have been tested with regards to their toxicity and the decline of residues on plants. In contrast to that a grower does not know the ingredients of a counterfeit product and therefore runs the risk of unintentional residues on his produce which might lead to a rejection of his produce. There are various options available to farmers to address any major pest or disease, and the right choice of product, including ensuring that they are not buying counterfeit products is very important.Second, there is the issue of right use of pesticides as per the label. Improper dosage, spraying at the wrong time, not following the spraying and broadcasting procedures can result in pesticide residues beyond the allowed limits.We ensure that our product labels are very clear about the right usage, dosage, method of application and disposal.

What policy changes would you wish to see in this segment?

We have a robust regulatory system comparable to the best in the world. We could, however, do better with the speed of processing and simplification. It would be good to see government ramping up the enforcement measures against counterfeits. There is a lot of room for training across the value chain, and government intervention and support to farmers, retailers and local communities will go a long way in improving the overall farming practices, helping the farmers grow more and safer food.

Prevent **lumping** and **loss** of **fertilizer** during storage and bagging

Dehumidifier Removes moisture from storage

and bagging areas. Enables free flow of material

Innovative Learning Vistas for Agriculture in France

French model of he modern agriculture distinguishes itself with a focus on farmer centric growth within the cooperative framework and an insistence on agroecology which translates into producing and consuming in a sustainable manner. This was the fundamental message which was conveyed to Agriculture Today and the Indian Council of Agricultural Research (ICAR) in an informal meeting which was organised by Mr. Cédric Prévost, Counselor for Agricultural Affairs, at the French Embassy here in New Delhi on 19 June 2015. The meeting was attended by Dr. Mukhtar Alam, Executive Director, Centre for Agriculture and Rural Development (CARD), on behalf of Agriculture

Today, and Dr. Alok Jha, Assistant Director (International Relations), ICAR. It was organised on the occasion of the arrival of a French delegation comprising Mr. Jean-Christophe Ygrié and Mr. Christophe Groëll, both professors at French technical agricultural institutes as well as Indian Network Coordinators of the DEFIAA project – Developing Franco-Indian exchange in Agronomy and Agriculture. DEFIAA project is an initiative backed by the French Ministry of Agriculture, Agrifood and Forestry.

A presentation of the specificities of the French agricultural education system

The agriculture education model in France has been known over the years to provide a comprehensive professional and vocational education, integrating theory as well as both experimental and on-field practice. It is equally focused on promoting sustainability awareness, thereby playing a significant role in local communities, and finally capitalises on an active international cooperation to increase exposure to the best agrofood practices prevalent across the world.

Describing agricultural education in France, the delegation explained it to be subdivided in five key areas, namely agricultural sciences (in the broad sense including animal sciences, plant sciences, rural economics, horticulture, etc), food sciences and nutrition, environment, veterinary medicine, and lastly land and landscape planning. In 845 institutes spread across the rural areas of France, the French vocational agricultural institutes offer 3 main diplomas: NTD (National Technical Diploma – CBSE/A level), HNTD (Higher National Technical Diploma – first 2 years of B.Sc.) and Professional B.Sc. (3 years), plus many other diplomas for young students and adults. These vocational institutes require their students to pursue 3 professional internships. They can be accomplished in France as well as abroad (both EU and non-EU nations), with the help of the international network supported by the French government.

As for the higher educational institutions, Professor Groëll said that France has 12 public institutions and 7 private institutions, with a network of partnerships with professional and vocational institutes offering engineering degrees/Master level and PhD in agronomy, agro-food industry, forestry, horticulture, landscaping, water management, environment and veterinary studies. The PhDs are obtained with close partnership with research institutes such as INRA (agronomy), IRSTEA (environment), CIRAD (agronomy for development), AFSSA (food hygiene and security) and IFREMER (oceans and seas).

Dr. Alam observed that India needs to emulate the French experience of learning given the high rate of employability which Mr. Christophe mentioned at a pleasant 90% for all who pass out of French technical agricultural institutes. This seems to be a result of the learning-by-doing approach which became possible since each institute has a professional teaching farm and/or a food processing unit, relationships with professional businesses and farmers, and close links with universities and partners from the research area, thereby increasing students' exposure to first-hand experience.

Towards a close bilateral cooperation

Describing the role of the DEFIAA delegation, which is a part of France's international agricultural education exchange programme, Mr. Ygrié and Mr. Groëll said that the role of the network was to promote and develop exchange with Indian universities, companies and selected NGOs. This year, DEFIAA-II Delegation of French Ministry of Agriculture, Agrifood and Forestry is celebrating 8 years of exchange with the College of Fisheries, G.B. Pant University, offering practical training to Indian students in France and agriculture work experience to French students in India.

At this turning point, there is a common will to extend this exchange to other agricultural fields. It is planned to propose more internships for French and Indian students and provide support to favour student and staff mobility in the thematic areas of organic agriculture, horticulture, food processing and water management among others. This programme is unique

in its way of assuring a warm welcome and assimilation of Indian students within the French cultural context and their subsequent 'gelling' with their French counterparts, and vice versa, ensuring a memorable personal experience combined with professional learning.

They cited the example of F2A network in the field of food processing which has 43 French public professional and vocational institutes delivering a wide range of training courses, meeting the local and national needs of the professional food sector in France. These institutes are willing to enter into cooperation with their Indian counterparts.

The Indian network coordinators informed that the next DEFIAA delegation would be visiting India in November 2015. They informed that French institutions are ready to host Indian students and staff in order to ensure a sustainable partnership. Dr. Alam, Executive Director, CARD, expressed solidarity with the vision of DEFIAA delegation and assured that such exemplary public private partnerships would contribute to agriculture sector-led economic growth with an abundance of food, water, nutrition and renewable energy security both in India and France.

FARMERS IN DISTRESS

rom 1995 to 2013 a total of 296,438 farmers have committed suicide in India, an average of 16,469 a year. This appalling figure does not even begin to shed light on the farmers' plight but definitely highlights the scale and gravity of the situation. What factors converge to compel a farmer to take his own life? Not surprisingly, the reasons for the high suicide rate stem from the hardships associated with agricultural production in India.

A certain bracket of farmers is largely impervious to these hardships. This section consists of the large and medium farmers as they do not experience an incessant threat to their livelihoods from factors which are largely beyond their control. These farmers have access to information, technology and services which help them withstand the vicissitudes of nature and vagaries of man.

It isn't a coincidence that the states with the highest suicide rates concur with those in which size of individual land holdings are rapidly diminishing. States in which land holdings have fallen by more than two fold are: Kerala, Andhra Pradesh, Karnataka, Madhya Pradesh and Maharashtra. States that together account for threefourth (75%) of total suicides: Kerala, Andhra Pradesh, Karnataka, Madhya Pradesh and Maharashtra. Thus the number of farmer suicides is largely impacted by the size of the average land holding. This is primarily due to a host of insurmountable obstacles inherently associated with farming on small plots of land which makes it impossible for small farmers to earn a sustainable living.

As our population continues to expand, the size of individual land holdings subsequently decreases. This is because land owned by a farmer is continuously divided with every successive generation. As a result, each new generation of farmers find themselves with less and less land to till as the land gets consistently fragmented. Invariably plots diminish to a point at which it is no longer feasible/profitable to continue production. However, due to the sheer lack of employment opportunities, cultivators have no choice but to continue farming. This becomes a huge problem because agriculture is one of the most capital intensive professions. On an average, the cost of inputs can account for nearly onethird of the revenue obtained from farming.

Now let's compare the average expenditure on capital to the average income per size of land holding.

As noted above, only the medium and large farmers are making adequate profits at the current cost of production. The small farmers barely make enough to cover their expenditure. Any business requires an initial investment to procure capital and carry out production. The primary source of such investments are financial institutions such as banks. Yet, most farmers do not have access to formal borrowings because they lack proper identification documents and collaterals. Furthermore, most rural areas are devoid of lending institutions. This leaves farmers largely dependent on government support and informal sources of finance such as money lenders.

Government finance is generally delivered through a cooperative society. But the formation of cooperative society has implications on its own such as lack of awareness, legal registration and coordination between farmers in matters such as the distribution of profits and losses.

So moneylenders and traders seem to be the most viable sources for loans as they demand no formalities and know the farmer on a personal basis. But these money lenders also charge high interest rates, manipulate the books and use unfair means and threats to recover their money. As a result, a farmer is almost entirely dependent on his own savings which are anyways quite negligible.

Let us explain this phenomenon by taking the example of the dearth of irrigation facilities in India. Irrigation supports crop growth in areas where water is not naturally available in adequate quantities. Yet, in India, about 60% of the total net sown area falls under the rainfed category. Farmers are quite literally at the mercy of the rainfall. Let's take a look at the two extreme scenarios.

A poor rainfall will result in a scarcity of water and a drastic fall in crop yield. The 2015 drought in Maharashtra has impacted nearly 90

lakh farmers. Sixty per cent of the villages recorded a crop yield which was less than 50% of the standard yield in the area. A heavy monsoon causes floods, and unseasonal showers can destroy crops. For example, the 2013 Uttarakhand Floods resulted in the loss of 753,711 hectares of cultivated farmland. The floods, which occurred in the month of June, resulted in the destruction of Kharif crop and left land unfit for further farming activities that year. An effective irrigation system is necessary but simply outside the financial scope of most farmers in India.

Another common problem is when farmers take loans for unproductive reasons such as social functions, religious ceremonies, marriages and even luxury goods like air conditioners. Since these purchases do not increase productivity or improve vield, it is impossible to pay back the loan. Over half of all agricultural households are indebted, and these are not small debts - the average loan amount outstanding for a farming household in India today is Rs. 47,000. For marginal farmers, who make under Rs 4,000 per month, loans of over Rs 30,000 are extremely difficult to repay.

The two important factors that contribute to agricultural growth and prosperity - inputs and technology - are not accessible to small farmers because of their low incomes and negligible savings. Hence credit, its availability and repayment, becomes a crucial factor in the future of small scale agriculture.

Modernization of agriculture refers to innovations and improvements in agriculture and related facilities. Modernization is the key to the growth and development of agriculture in a changing international scenario. Unfortunately, in terms of technology, agriculture has been largely stagnant since the Green Revolution in the 1960s. In 2001, nearly 40 years after the advent of the Green Revolution, 75% of Indian farmers were still dependent on bullock carts.

The usage of agricultural machinery

can increase the total output and reduce costs immensely. This cost can refer to both wages for hired labour or simply the minimum profit a small farmer makes by working on his own land. A bullock cart for instance, may take nearly five days to plough one hectare of land while a tractor can do the same job in five hours. Similarly, new varieties of seed will allow a farmer to amplify his total yield. Yet, once again, farmers simply cannot afford to procure such emends or be able to afford their maintenance but new initiatives such as the Mini Tractor by Mahindra are on the right track. The new organic farming movement has unfortunately been largely unsuccessful because this type of farming cuts productivity and is harder to sell despite its innate environmental and long term benefits.

of the most important One services still largely absent from Indian Agriculture is Crop Insurance. It provides farmers with the means to protect themselves against the variations in yield resulting from uncertainty from all natural factors beyond their control such as rainfall (drought or excess rainfall), flood, hail, and other weather variables. According to Census 2011, India had 95.8 million farmers. But in the six farming seasons covering 2011 to 2013, only an average of 12.7 million took crop insurance. This is primarily

the result of the lack of awareness and availability of loans. And despite high premium levels, Insurance companies are continuously making losses on crop insurance, further discouraging companies from providing such services.

Other services such as storage and transport too are grossly deficient. In most rural areas, warehouses are either inadequate or absent, so farmers are unable to store their produce. Private consulting firm Rabo India Finance had prepared a food wastage report for the government according to which the total losses incurred due to wastage of agricultural food items at various stages was worth Rs 30,000 crore (in 2010). As a result, farmers are desperate to sell their stock as soon as possible, leaving them in an exploitable position. A cheap and efficient form of transportation is necessary for farmers to make their goods available in any market. But unfortunately 40 percent of India's villages do not have access to allweather roads. As a consequence, about 30% of a farmer's harvest spoils every year. Thus, because a farmer's reach is limited to the local market and his produce is highly perishable, he has no option but to sell his grain to the middleman who can 'negotiate' prices in his favour. Even if a farmer manages to generate a good yield he will be unable to earn a just payback.

The small farmers of India are waging a losing battle. Debilitated circumstances bv bevond their control they have been thrown into what is called a vicious cycle. They take exorbitant loans for production, produce little yield and try to sell whatever crop they have to middlemen and subsequently struggle to meet both expenditure costs and interests on loans. But how long can they survive in this cycle? Their luck is bound to run out; even a small change in the rainfall patterns is enough to permanently to ruin the small farmer. For when they have lost their crop to rigours of nature, their land to the greed of the lender and their hope to the negligence of the government, the only recourse left is to take their lives.

To conclude, all of the problems mentioned above pose a major threat not only to small farmers but to the evolution of the Indian agricultural sector as a whole. We face a difficult road ahead, hampered by impediments

to which there are no easy solutions. But the first step towards change is to accept reality. Let's get down to earth. *Anantya Dube*

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Making Mechanization Affordable

mall and marginal farmers make up to about 80 per cent of country's farms. Out of the 121 million agricultural holdings, 99 million are with the small and marginal farmers though their share of land is only 44 per cent. Around 70 per cent of vegetables, 55 per cent of fruits, 52 per cent of cereals and 69 per cent of milk production come from small holdings, thus contributing to the both diversification and food security. In short, the country depends on this category of farmers for its food security.

Being smaller in nature, the productivity of their farms is lesser given the small size of the farms and the meagre resources that goes into its production. The rise in wages have made laboure intensive processes expensive. Given the initial capital investment in buying machines to ease the drudgery and reduce the labour involvement, farmers under this category dont even bother contemplating mechanization.

After 35 years of corporate experience across sectors including agri machinery, agriculture, telecom, automobile, and chemicals at firms like Escorts, Bharti Field Fresh and Bharti Airtel, Rohtash Mal decided to bring a change in this format by launching EM3 Agri Services, an agri-business startup last year. At Escorts, where he was the chief executive until 2012, Mal gained deep insights into India's agricultural landscape. He realized that to mechanize a majority of Indian farms, someone would have to come up with a business model that would convert capital expenditure into operational expenditure for farmers. That's precisely what he's done, pioneering the farming-as-a-service (FaaS) model that he launched commercially in Madhya Pradesh in Octo-

ber last year.

Aspada Investment Company, an early stage venture capital firm backed by Soros Economic Development Fund, Omidyar Network, and Google, has made a commitment of initially investing INR 20 crore (\$3.3 Million) to Delhi-based EM3 AgriServices Pvt Ltd. EM3 provides a full range of on-farm services using modern agricultural machines and technologies, delivered by the company's own trained personnel on a 'payfor-use' basis. Small farmers are universally unable to afford machines and equipment that can increase yields and productivity. EM3's goal is to eliminate the need for ownership by providing access to technologies that enhance yields per acre and that have heretofore been affordable to only the largest farmers and landowners.

Rohtash Mal, Chairman and Managing Director of EM3 AgriServices, says, "It is ironic that the farmer who feeds the nation is unable to feed himself. Most prominent among yield inhibiting factors is the small farmer's inability to afford modern machines and technology. Pay-for-use service models are, by far, the only solution to the enduring challenge of raising farm productivity without burdening the farmer with significant capital expenditure. So far, only adjacent opportunities in agriculture such as cold chains and warehouses have drawn serious interest from investors. EM3 is one of the few investments in 'core' Indian agriculture aimed at positively enhancing a small hold farmer's P&L account."

"In Aspada, we found the right DNA to work with on this path-breaking opportunity - a bright and energetic team that has an exceptionally mature approach to building sustainable, disruptive businesses that can become large and create real economic and societal value," continued Mr. Mal. Adwitiya Mal, Executive Director of EM3 AgriServices, adds; "Services are delivered under our brand 'Samadhan through EM3's farm service centres ('Samadhan Kendras). Each centre delivers a complete suite of basic and precision agri operations from soil to the farm gate. We have been operating in Madhva Pradesh for over a year, and with Aspada's investment will create a pan-India network of Kendras. Over the next 18-24 months, we intend to serve tens of thousands of farmers, thereby enhancing yields of numerous crops across multiple geographies. Simultaneously, we will continue investing in team building, bolstering our technology platform, enhancing soil and chemistry research, and augmenting our services and product portfolio - all with the intent of maximizing farm productivity and driving down farm operating costs."

"We are partnering with an exceptional team that brings significant experience in building large businesses and that comes with a deep understanding of Indian agriculture. We believe that EM3 can become India's first organized small-hold agricultural services platform at scale and will materially improve farm processes and productivity among small farmers in India," said Kartik Srivatsa, Managing Partner of Aspada Investment Advisors.

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PROCESSING INDIA'S FOOD FUTURE

Harsimrat Kaur Badal, a fairly unknown name in Indian Politics until six years ago, today heads the highly promising and crucial Ministry of Food Processing industries. Badal who hails from a prominent political family in Punjab, has created quite an impression in her political career within the six years she walked the corridors of the national politics. Her ascent into the ranks of Cabinet Minister in a short period of time is suggestive of the impact that she had created. Within a year into the new role she has made some real changes in the ministry and the sector.

> arsimrat Kaur Badal is the Union Cabinet Minister of Food Processing in the Government of India. Representing Bathinda in the Lok Sabha, Harsimrat is a member of Shiromani Akali Dal.

Born on 25 July 1966 to Satyajit and Sukhmanjus Majithia in Delhi, Harsimrat went to Delhi's Loreto Convent School. Later on she secured a diploma in textile design from Delhi University. Before swinging into politics, she worked as a merchandiser in a buying agency. She was also associated with the vast business empire set up by her husband in the fields of hotels, media and agriculture. She also ran a jewellery business in the upscale Trident Hotel in Gurgaon.

Her marriage to Sukhbir Singh Badal, the son of Parkash Singh Badal in 1991 was the stepping stone of this house wife onto the vast field of politics. She is thus allied with Punjab's most powerful political family, her father in law being the Chief Minister of Punjab and her husband the deputy Chief Minister. Her brother Bikram Singh Majithia is a Akali MLA from Majitha and a minister in the Punjab state government.

Badal started her political career with the Indian general election, 2009. She was elected to the 15th Lok Sabha from the Bhatinda constituency after defeating Congress candidate Raninder Singh by 120960 votes. At present she is the union minister for food processing in the Government of India. Even before foraying into politics her social work has kept her closer to the ground realities. Harsimrat Kaur Badal launched the highly successful campaign against female foeticide in 2008 called-"Nanhi Chhaan" ('innocent life' in Punjabi). The 'Nanhi Chhaan' Foundation worked for the rights of the girl child and women empowerment. Her other social activities included running a school for street children in Delhi's Vasant Kunj, supporting old age homes and sponsoring medical treatment for needy children. She was particularly committed to the causes of girls and quite notably as part of her election campaign, Harsimrat distributed bicycles to girls of Class XI and XII to ensure that their studies don't suffer and it becomes convenient for them to travel to school everyday.

Harsimrat Kaur Badal has emerged as a powerful leader of Punjab's ruling Shiromani Akali Dal in the last five years after she was first elected MP in 2009. Harsimrat won from Bathinda in 2014 by a considerably reduced margin of about 20,000 votes against her husband's estranged first cousin and former Punjab finance minister Manpreet Badal. She was also member of Committee on Estimates, Social Justice and Empowerment, Food & Public Distribution and Standing Committee on Health & Family Welfare. In May 2014, when she was re-elected to 16th Lok Sabha for the second term, a new role awaited her. She was inducted in to the Modi government as the Union Cabinet Minister, Food Processing Industries.

After assuming power as the minister of Food processing industries she openly declared that wastage as a major cause for inflation and said her target was to reduce this by at least 50 per cent in two years. "Statistics say wastage is 18 per cent, but I know that it is much more. It is because of food processing technologies are not reaching farmers," said Badal. Very much aware that food processing is the key to future successes in food production, she said, "Farmers are the future of Food Processing Industry and our ministry will ensure that food grown and produced reach consumers without wastage. This is what I call 'Khet to Thali' and we are committed to it". She had kick started many projects and proposals that have a direct bearing on the food processing scenario of India. Last year, Badal instituted a study to assess the cold chain requirements of the country.

Harsimrat Kaur Badal, a new face in the Indian politics brings with her a fresh approach to the highly demanding field of Food processing Industries. A year into the new role as a Union Minster, she has been able to push many food processing projects and proposals.

"Without reforming agricultural marketing practices we will not be able to deliver the true value of the farmer's produce to him, thus depriving him of incentives to invest in technologies for higher productivity and production"

RADHA MOHAN SINGH Union Agriculture Minister

"The government of India has accorded high priority to the issue of hunger and malnutrition in the country and is implementing several schemes to improve food security in the country,"

RAM VILAS PASWAN Minister of Consumer Affairs, Food and Public Distribution

"The farmers are in dire need of loan and banks are granting the loans to other entities. If the banks refuse loans to the farmers the government will initiate action against those banks"

> **DEVENDRA FADNAVIS** Chief Minister of Maharashtra

"A double digit growth is impossible if we ignore this sector. Agri-growth has multiplier effect on poverty reduction and rural prosperity. It has a high potential for creating 'Near Farm' jobs"

SANJEEV CHOPRA Joint Secretary, Ministry of Agriculture and Cooperation

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