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The Indo-Israel Agricultural Cooperation: Ushering Second Green Revolution

SPECIAL PUBLICATION

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Workshops, National Expo & Conference

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Shri Nitin Gadkari

Chief Patron, Agrovision Honable Union Minister for Road, Transport, Highways & Shipping - GoI

"Agrovision aims at increasing farmers income through education and exposing them to the new and innovative farm technologies. Agrovision will change the agrarian scenario in the water-parched Vidarbha by building confidence of the farmers in technology. Agrovision informative workshops and innovative exhibition is attracting lakhs of farmers from all over the country. It is also providing right networking platform for the manufactures, consumers and the distribution chain elements. It is motivating youths to take up agriculture as career."

Devendra Fadnavis
Chief Minister
Maharashtra

Mantralaya
Mumbai 400 032
2nd November 2017

MESSAGE

I am happy to know that Maharashtra Economic Development Council is bringing out its special publication on Agriculture Industry & its Allied Sectors to mark the organisation of Agro Vision which is going to be held in Nagpur.

MEDC is a unique, apolitical and autonomous research organisation working proactively with State Government, Business and Industry, Educationists, Professionals, Bankers, Economists and other leading stakeholders on vital issues of economic development.

It is praiseworthy that since its inception MEDC contributes actively to promote and provoke 'reasoned thinking' on matters of socio-economic policy both at the National and State level.

I hope that the special issue on Agriculture and Allied Sector will serve a great purpose of dissipating knowledge. I extend my best wishes to the members of Maharashtra Economic Development Council.

(Devendra Fadnavis)

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पांडुरंग फुंडकर

सत्यमेव जयते

मंत्री
कृषी व फलोत्पादन
महाराष्ट्र राज्य

24.10.2017

I am happy to state that Maharashtra Economic Development Council is bringing best of its service by publishing a special issue on Agriculture & its allied sector.

I believe this book will help to showcase the various dynamics of Agriculture. I hope this digest would be useful to various department of state and to all the readers who look forward to gain knowledge.

I congratulate MEDC and wish them good luck.

(Pandurang Fundkar)

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Eknath Shinde

MINISTER, PUBLIC WORKS (Public Undertaking)
Government of Maharashtra, Mantralaya, Mumbai.

I am happy to know that 'Maharashtra Economic Development Council' is publishing a special issue on Agriculture and the related sectors.

I would like to congratulate Maharashtra Economic Development Council for the special issue. This issue has discussed very important topics like sustainable Agriculture, management, White Revolution, Blue Revolution etc.

Even It includes other aspects of Agriculture. This issue throws a new light on the different aspect of Agriculture industry.

This issue will definitely benefit all readers of this digest.

India is the agriculture country. Agriculture Industry is the backbone of India. Because large number of population is dependent on this sector. That's why the special issue on Agriculture will really benefit its readers.

Ones again I wish to congratulate Maharashtra Economic Development Council for their valuable effort.

I hope this issue will help in exchanging the ideas and come out with better actions to achieve the national goals.

Regards!

Yours,

(Eknath Shinde)

No MoS./Agri & Horti &
Marketing & Water Sup. & Sanitation/Gen./1226/2017
Dated – 2 – 11 – 17

MINISTER OF STATE FOR
AGRICULTURE AND
HORTICULTURE, MARKETING

GOVERNMENT OF MAHARASHTRA
Mantralaya, Mumbai 400 032
www.maharashtra.gov.in

Date :

02/11/2017

BEST WISHES !

I Congratulate Maharashtra Economic Development Council on its special issue on **"Agriculture & Allied Activities"**.

It is remarkable that the Maharashtra Economic Development Council acts as an Economic Think-Tank for Business, Agro Industry as well as for the State Government of Maharashtra.

MEDC's publications seems to be great value to Governments, Business, Industry and Students for study & research.

My very best wishes to the MEDC's future endeavours research in socioeconomic aspects.

(Sadashiv Khot)

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President's Page.....

The most sought after event for the farmers of central India in general and Maharashtra in particular is the 'AGRO VISION'. This is the 9th Agro vision at Nagpur. A careful examination and research shows that this event is the single largest positive impact on making a difference in the pace of adopting new technology in food production, animal husbandry, dairy and food processing.
We in MEDC salute the vision and execution of such a major game changer in the domain of 'essentials of life.'

An introspective look at our past will be in order. Let us not look at the turbulent era of the world wars, great recession and the struggle for independence. In 1950 India became a republic and the share of agriculture and allied sectors in the GDP was a thumping 51.81%; which declined to 23.02% at the turn of the millennium. Regrettably the share of agriculture and allied sectors has further declined steadily and stands at a mere 21.02% in 2015-16.

Clearly our growth was so much focused on industry, manufacturing and services, that the essentials of life were ignored. We shifted from growing along the path of stable ever needed food products to volatile products and services dependent on ever changing demands of the world markets and disruptive technologies. It is not our case that growth in manufacturing, industry and services was not warranted. It is our considered opinion that we in India, along the path of growth ignored the most important and most reliable of our trusted growth sector; Agriculture. This error is sought to be corrected by the AGROVISION.

We in India need to manage the convergence of technology, innovation, energy efficient eco-friendly practices with the cultivation technologies and enhanced production without contaminating our soil with harmful chemical substances. We need to combine ancient indigenous knowledge and wisdom of food production with present day science and technology for food processing. We need to move away from 'Agri-Culture' and teach our next generations be in 'Agri-Business'.

We can then be the food bowl for the entire world and consequently a lasting, stable and strong economy.

India has enormous potential in the sphere of food production. Our vast arable land mass, our oceans, lakes and rivers coupled with sunshine and a very large work force already engaged in the agricultural activities is a potent mix that can potentially make India the food provider to the world.

We in MEDC are proud to be associated with the 'Agro-vison' year after year.This year we are bringing out a special issue of the MEDC Economic Digest. This issue starts with the vision of the man behind this event 'Shri Nitinji Gadkari', Hon Minister for Surface Transport, Water Resources, River development and Ganga rejuvenation. This is followed bymessages from The Chief Minister of Maharashtra Shri Devendraji Phadnavis, The Minister for Agriculture, Shri PandurangjiPhundkar; The Minister for Public Works, Shri Eknathji Shinde, and The Minister of State for Agriculture, Horticulture and Marketing Shri. Sadashiv Khot. Another noteworthy contribution is by the Consulate General of Israel on the Indo- Israel Agricultural Co-operation: on sharing second green revolution.

This special publication has many readable articles clubbed together under the headings of 'Sustainable Agriculture,' 'Animal Husbandry', 'Food Processing,' 'Agri- Businesses' and 'Technology & Management. In each section the research articles are followed by the present day statistical data and more importantly the details of schemes and incentives being provided by the government. We are certain that our readers will find this special publication as a useful reference book.

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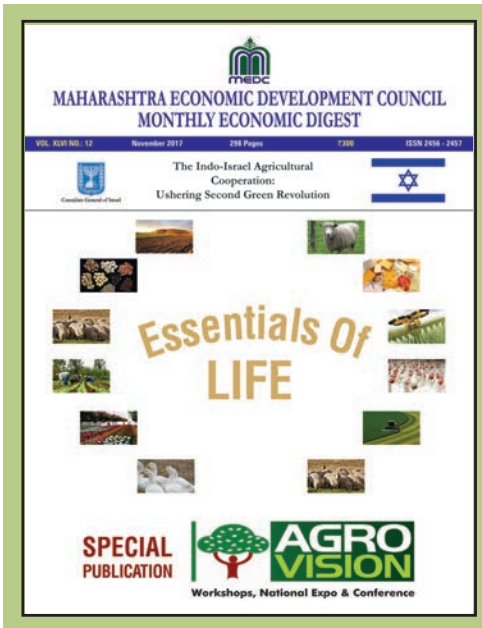

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VISION

Shri Nitin Gadkari

Words from Shri Nitin Gadkari

Shri Nitin Gadkari

Minister for Road Transport & Highways, Shipping and Water Resources, River Development & Ganga Rejuvenation in the Government of India.

1 Agro vision was your concept. We can see that every year the footfall is increasing. What are the new initiatives, benefits and schemes in Agro Vision 2017?

When we saw the farmers crises growing we introduced the concept of AGROVISION for dry land farmers of central India with the objectives of exposing the farmers to new technologies, innovation and entrepreneurship development .Over the years the response has been increasing because many farmers find the utility of the Agrovision for improving their farming sustainability. 2017 is the 9th edition. The concept of Agrovision is different than just an exhibition model of educating the farmers. From the very beginning we have introduced thematic workshops on topics of relevance to dryland agriculture such as; dairy, poultry, fisheries, sericulture, fruit and flower cultivation etc along with the entrepreneurship development in these areas. These workshops are now major attractions as they impart practical aspects covered by one specialist and one successful farmer/entrepreneur. To supplement these areas we have also introduced one day conference on again a topical issue where business men and entrepreneurs are invited to promote the agri-based industry in Vidarbha and around. For example over the last few years we have had conferences on Dairy, food processing, Development of cotton hubs, etc. Simultaneously an expert panel discussion on one day is organized for specialists to cover some burning issues before the sector like GM technology and its implications, surplus management of agri-produce, Bamboo plantation as a scope of income and likewise. Therefore the mega event of exhibition is linked to all such free workshops, conferences, brainstorming which makes the event of Agrovision an unique one.

2. What are the best means to encourage the growth of regional livestock markets?

One of the objectives of this program is encourage diversification of Agriculture in Vidarbha .The crop pattern is dominated by 15 lakh ha cotton and nearly 12 lakh ha soybean occupying nearly 69% of the total cultivable area in Kharif, Erratic rainfall, uncertain weather and climate change has time and again failed the crops every alternate year thus increasing the liabilities of the farmers and no alternative system to fall back in the event of crop failure. Agrovision has attracted the attention of farmers towards the livestock situation in Vidarbha. We conducted series of workshops and special classes through AGROVISION FOUNDATION on topics of animal husbandry. The impact is dramatic. Farmers are now going back for raring cows ,sheep's, goats ,poultry birds, and in Eastern Vidarbha districts like Gondia ,Gadchiroli ,Chandrapur, Bhandara going extensively for fisheries, sericulture and alternate allied agriculture .To support the sector of livestock Govt of Maharashtra has taken a major initiative through our constant persuasion to invite NDDB for milk processing .One can see a total transformation in live stock management as farmers have realized that this could be a wonderful source of livelihood in climate situation.

3. What is your vision for irrigated agriculture in India.. What percentage of irrigation intensity can we achieve in the long run?

Currently only 18% irrigation is available in Vidarbha region we have several projects of irrigation under construction for a long

time but due to one or the other reason they have been incomplete. Our approach is based on all the water conservation techniques to be adopted because what we find that rainfall in the entire region varies from 600mm to 1200 mm but distribution has not been as per crop requirement. Thus, all measures of conservations have been initiated and farmers are being trained through Agrovision for such techniques.Sugarcane, one of the most water consuming crops ,we insisted in all sugar factory areas that they adopt to drip and other micro irrigation techniques. As a result of teaching there is substantial surge in adoption of micro irrigation practices in several crops including oranges pomegranate mango etc. We expect that in another 5 years the irrigated area shall rise to minimum 32% of the total with all the measures including the support of Govt for completion of major and minor projects.

4.Do you think loan wavier can alleviate farmer's problems?

Loan waiver per se may not be the ultimate solution to alleviate the farmers woes, but then when they are currently on critical stages where they have no finances to put in to farming or even for survival one time dose of loan waiving may be acceptable. Agrovision attempts to educate encourage and ask farmers to develop abilities to innovate, diversify, make them confident in farming which shall be the real solution to any loan related issues. The vision we envisaged is basically to create the entire value chain from production, marketing processing to consumers involving the farmers and hence we at Agrovision support development of strong Farmers Group farming as the larger solution to individuals going in for ending life .

5. Can we have a brief note about new interventions to improve farmer's sustainability?

New interventions like processing, group farming alternate farming diversification and education are the key words if sustainability has to improve .With enhance sustainability our aim is to enhance profitability of farming which will attract the youth towards the farming. We are very positive that the initiatives taken by us will be replicated many folds in the areas of distress and the farmers in dryings agriculture shall be back with confidence.

6. What steps need to be taken to encourage young urban to engage in agricultural?

Major steps to attract youth in to this business is make the farming remunerative and that can happen by selecting such crops or allied sectors that will give income to them For example Agrovision introduced the cultivation of pomegranate which was restricted to western MH but those who are encouraged have realized the potential and in just 5 years the cultivation has increased from 100acres to 5000 acres in many districts. Simultaneously we encouraged cultivation for exotic vegetables and flowers .The young ones are attracted towards this as it looks like a small industry. Value chain development is the crux of the issue and modern technologies will certainly attract the youth in this profession which is tax-free.

7. Message to Nation….

Aim at education,, encouragement and innovation so that income of farmers is increased and he/she will retain interest in agri profession .production must be coupled or linked to markets to achieve the desire profitability and sustainability of agriculture .

It is never a one man show or one agrovision but we need several of such events and manpower to the cause of farmers which will help turn the tables

Mr. Ravi Boratkar

AGROVISION - Central India's Largest Summit

Mr. Ravi Boratkar
Organizing Secretary, Agrovision
Jt. Managing Director, MM ActivSci-Tech Communications
Vice President, MEDC

Despite the country making significant progress in key economic sectors, it is disheartening to see the socio economic condition of Indianfarmers in general and Vidarbha in particular. The revival of agriculture is not an option but an imperative — after all, about 50 per cent of our population is dependent on it.

We are aware that, Vidarbha with its 8 districts and its surrounding region have been blessed with the fertile soil, ample rains and many favourable factors however agriculture yield compared to other regions is very less.

Considering these facts, 8 years ago we started an initiative "Agrovision"tosupport faster agricultural development, accelerate the growth of agri-business and ensure a decent & fair standard of living for the farmers and their families. Under the able guidance and leadership of **Hon'ble Shri Nitin Gadkari**, Chief Patron, Agrovision; Minister of Road Transport, Highways & Shipping; Water Resources, Ganga RejuvenationGoIand **Dr. C. D. Mayee**, Chairman - Advisory Council, Agrovision; Former Chairman, Agricultural Recruitment Scientists Board (ARSB) ICAR, we have been organizing Agrovision.

Agrovisionhas been meticulously working to bring the latest practices,technologies, products and services not only from India but other parts of the world at one place.Through Agrovision, we are taking special efforts to educate farmers about the modern farm practices and new technologies. Here farmers, researchers, entrepreneurs, policy makers & other stake holders connected with agriculture come face to face to deliberate & discuss about various developments as well as current challenges in agriculture.

Agrovision is a unique combination of Exhibition, Workshops, Conference, Expert Panel Discussions etc. and it has become an annual feature. Through informative and interactive Workshops, an extensive Exhibition and a thought provoking Conference, Agrovision wants to enlighten and empower the farmers in particular and agriculture sector in general. Agrovision serves as a comprehensive platform to meet lakhs of farmers from the districts of Vidarbha and adjoining states and districts of Maharashtra.

With a roaring response from the farmers during the last eight editions, the Agrovision has beensuccessful in establishing itself as a major agricultural summit of the Central India. We are sure that growth of thissector will create a new class of young entrepreneurs, new satisfied farmers and possibly evenfarmers turned entrepreneurs, creating a win win situation for all.

Educate, Encourage and Empower is our motto and we continue to do that for the farmers so thatthey not only increase their income, but also contribute significantly in the nation's economy to callit in true sense the agro-based economy.

The participation of farmers has been increasing year after year and previous edition was visited by over Lakhsof farmers and more than 30,000 farmers attended the workshops, from the adjoining districts of Maharashtra and states like Andhra Pradesh, Telangana,Chhattisgarh and even from the states like UP, Bihar, Haryana.

Agrovision is one such genuine initiative, which is providing an integrative framework and a platform to bring all the stake holders consisting of farmers,

Government, NGOs, Scientists, Industry under single umbrella to deliberate and debate at different levels for all around growth of agriculture.

It is a great victory to see that Vidarbha once was known for the crops of Cotton, Soybean and Oranges but in recent years other crops like Sugarcane, Rice, Pulses, Pomegranate, Turmeric, Ginger have seen a remarkable production in Vidarbha.

In Central India, farmers now await for the arrival of Agrovision to learnnew innovations in agriculture. It has achieved its goal in creating the awareness in diversification of farming from cotton-soyabean, millet and making a shift to Dairy, Horticulture, Sericulture, Bee Keeping, Floriculture, Polyhousefarming, Processing etc.

Just few examples are that after learning about Pomegranate cultivation many farmers from Vidarbharegion have turned to Pomegranate. On the other hand Farmers have understood the importance of livestock management and have started looking at Poultry, Dairy, Goat Keeping and Fisheries for their additional income.

In the journey of last 8 years our observation is that the farming community is ready to adopt new technologies and alternate cropping for sustainability.

SPECIAL FEATURE

Mr. Pandurang Phundkar

Development of Agricultural Sector and Farmers in Maharashtra

Mr. Pandurang Phundkar
Minister for Agriculture, Government of Maharashtra.

The State Government has started to implement several important schemes in the last three years to ensure assured development of agriculture sector in Maharashtra while ascertaining the competency of the farmers who are the significant factor of this agrarian Country. Minister for Agriculture, Pandurang Phundkar, is throwing more light on the drastic changes that are effected in the agriculture sector….

The State Government, under the guidance of Hon. Chief Minister-Devendra Fadanvis, has implemented several innovative schemes in the last three years for the development of agricultural sector and farmers in the State. Several important decisions have been taken in the last three years to provide helping hand to our farmers who confronted drought for four consecutive years. Our State Government accorded approval to the Farmer's Loan Waiver Scheme called as "Chattrapati Shivaji Maharaj Shetkari Sanman Yojana" which is believed to be the biggest loan waiver scheme in the history of Maharashtra to bail out the badly indebted farmers who resorted to suicide on large scale. Loan to the tune of Rs.1.5 lakhs of each farmers family is waived under this Scheme. This has proved to be a historic step.

Moreover, "Unnat Sheti, Samrudha Shetkari" drive was implemented across the State in order to ensure substantive increase in the income of the farmers. Under this drive, orientation sessions were held for the farmers to ensure increase in agricultural production with the help of advanced technology in farming as well as with the use of good quality bio-fertilizers and pesticides. The concept of group farming was encouraged in Maharashtra by forming 1000 groups of farmers in Maharashtra wherein one group consists of 10 farmers each having 20 hectares of agricultural land. The State Government recently gave its nod to undertake review of the schemes meant for the Tribal farmers and make significant amendments therein in order to increase the income of these farmers and raise their standard of living. As per the new amendments, the Tribal farmers shall be given 100% grant upto a specific limit on factors namely construction of new well, repair of old wells, In well Bore well, electricity connection charges, micro irrigation etc. This revised scheme shall definitely provide solace to the tribal farmers.

Project "Maha-Vedh" has been started to ensure availability of real time weather information to the farmers in the State. Under this project, automatic weather stations are installed in all 2065 Revenue circles across Maharashtra. These stations provide correct and real time information of weather, mainly-temperature, rainfall, humidity, speed of wind, and its direction after every 10 minutes. This information is proving to be useful for Weather-based Crop Insurance Scheme, Agriculture weather advice and guidance, and Agriculture Research and Disaster Management. Presently, these units are installed at 1400 places in the State and remaining are in progress.

Prices of BT Cotton seeds were cut by Rs.100/ packet in order to curb profiteering by the Seeds manufacturing companies. Near about 50 lakhs farmers enjoyed the benefits this price cut. Our Government undertook the project of manufacturing seeds through 4 Agricultural Universities in the State in order to desist the farmers from using the costly foreign cotton seeds. As per MOU between the Dapoli University and Israel, a pilot project for manufacturing seeds of different fruits is taking place at Aurangabad, Dapoli,

Parbhani, and Nagpur. Our Government has undertaken "seed park" project in Jalna District in Marathwada. This Project will ensure considerable help in raising the rate of production of domestic seeds from 12% to 18%. This step of the Government to ensure the State to be self-reliant in the field of B-Seeds is very promising.

The Chief Minister Agriculture and Food Processing Scheme is being implemented across the State with a view to provide momentum to the food processing industry along with value addition of agricultural produce. A favorable atmosphere is being created for food processing business across the State due to this Scheme. Due to the Production of Agricultural Processing Industries, market arena is coming closure to the farmers and they are getting benefited from this. 25% of the Project Cost or Rs.50 lakhs is allotted as grants by the Government for starting Agriculture Processing Industry. Government had also sanctioned the Agro -Processing policy Our Government has always attempted to ensure development of each and every citizen of the State and also to ensure that benefits of Government Schemes are enjoyed by every element of the Society. As part of this, "Dr. Ambedkar Agriculture Self Reliance Scheme" is being implemented by the State Government for the Agriculture Development of farmers belonging to Backward Community. Under this Scheme, the Government provides financial assistance of Rs.2 lakhs 35 thousand to the farmers belonging to Scheduled Caste for Construction of wells, purchase of irrigation tools, motor pumps etc., as well as for construction of farm ponds. Our Government is also paying special attention towards the draught affected regions of Marathwada and Vidarbha. "Nanaji Deshmukh Krushi Sanjeevani Scheme" has been started by our Government under the aegis of World Bank for the villages in these regions. Efforts are being made to increase agricultural income of saline land holding farmers from 5000 villages in Marathwada region and 1000 villages in Vidarbha region and efforts are also being made for soil conservation in these villages. Our Government has made a provision of Rs.4000 crores for this purpose. "Motiramji Lahane Krushi Samruddhi Yojna" has been started by the Government for Suicide affected districts of Yavatmal and Usmanabad. Under this Scheme, efforts are being made to ensure that the benefits of all government schemes are availed by the financially stricken farmers from these two districts. Similarly efforts are also being made to ensure agricultural development of these villages through group farming by forming groups of small villages. Our government will always stand by the farmers to arrest the instances of their suicides and to help them.

Provision of substantial amount of funds for the agricultural sector in the Budget reflects the commitment of Government towards the well-being of the farmers in the State. In view of the statement of Hon. Prime Minister, Shri Modiji, our Government shall endeavor to increase the income of the farmers by two folds during our term. Utmost care is being taken to ensure that the agricultural sector never faces a paucity of funds. Expenditure is being incurred on a large scale on factors like drip irrigation, Onion Stacks, Shed Net, flattening of farm lands etc. During the period of the last three years, our Government has done an incomparable job to consolidate the agricultural sector in the State and has endeavored to provide solace to the farmers in the State.

Consulate General of Israel

The Indo-Israel Agricultural Cooperation: Ushering Second Green Revolution

Mr. Ya'akov Finkelstein

The writer is the Consul General of Israel in Mumbai.

(Contributed to this article Mr. Anay Joglekar, Political Affairs & Special Projects Officer at the Consulate General of Israel)

"Recognizing its centrality for development, India and Israel agreed to establish a Strategic Partnership in Water and Agriculture".

[India-Israel Joint Statement during the visit of PM Modi to Israel, July 5, 2017]

Israel is commonly known around the world as 'the Holy-Land'. Travelling in the pastoral rural areas of India - as Israeli diplomats in New Delhi, Mumbai and Bengaluruoften do –we find this term has here a particular meaning: Indian farmers refer to Israel as the'Holy Land for agriculture'. We're humbled to receive this recognition. As much as Israel is a global innovation centre and the 'start-up nation', agriculture is an integral part of our over 5,000 years old Jewish culture. Many of our festivals are linked to the agriculture calendar. However, the modern Israeli agriculture has a history of little over 100 years. The geographical and demographical differences between India and Israel make it hard to imagine how can the agricultural methods and technologies of a small country like Israel, with less than 30,000 farmers, be relevant to a huge country like India? And yet we can.The total area of Israel is 22,145 sq.km. nearlythe size of two districts in Maharashtra put together. More than half of its landmass is arid or semi-arid, where the annual precipitation is less than 10 cm. There are no major rivers in my country. Out of the fresh water reserves, 80% are in the North, while 65% of land available for agriculture is in the South. Israel's population has increased 15 folds in the last 70 years and has reached close to 9 million people. Today, only 1.1% workforce is engaged in agriculture production for livelihood and yet Israel exports more than 1.1 billion USD of agricultural produce. Israel's remarkable success in agriculture is a result of supplementing the traditional knowledge with science, R&D, experimentation and unorthodox thinking. It was not an easy task. This article will present an overview of the important components of the Israeli agriculture sector and how is it shared with our Indian partners to implement the Indian-Israeli strategic partnership in the field.

Water :

To address thedisproportionate availability of land and water, Israel started building a national water carrier in the 1950s. It brings water from the Sea of Galilee, which is the only major sweet water reservoir in Israel, to the Central Israel using

a complex system of giant pipes, open canals, tunnels, reservoirs and large scale pumping stations. The National Water Carrier is considered a marvel of hydraulic engineering. To supplement the Carrier, Israel created strong legal and institutional framework governing the usage of water. Water is a national asset in Israel. Nobody is allowed to use stored surface water or extracted ground water with an unmetered connection. Israel invented the famous "Drip Irrigation" technology that has revolutionized the agriculture sectorworldwide. Drip irrigation savesup to 70% water and improves productivity by at least 30%. Today, the water guzzling crops such as rice, cotton and sugar cane cultivated in many countries using Israeli drip irrigation technology. For the last few decades, Israel has been recycling its urban sewage on a large scale, most of which goes to agriculture.With 86% of its sewage water recycled, Israel is a world leader in this field, with Spain in the second place, recycling less than 20% of its sewage water. Israel has also invented varieties of crops that grow on saline water. Since the 1950s, the productivity has grown 4.5 fold per unit of land and 4 times per cubic meter of water.

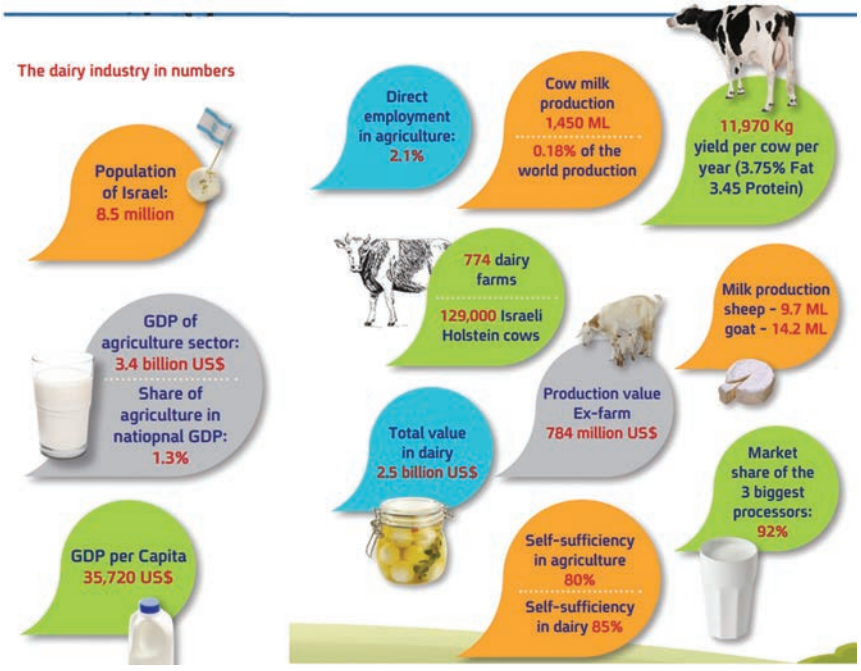
Crops& Horticulture :

Israel was famous for its Jaffa oranges. Today, countries like Spain produce more Jaffa oranges than Israel. The reason behind this shift is growing awareness among farmers about growing water-efficient crops. Improved geopolitical and economic stability has allowed Israel to switch over from growing

water guzzling field crops to high quality fruits and vegetables. Israel's vegetablesexport includes tomatoes, cherry tomatoes (another Israeli invention), green-herbs and pepper, while fruits export includes apples, dates, strawberries, olives, pomegranates, melons and watermelons. New and improved varieties are introduced on a regular basis, which are quickly adopted by farmers. In recent decades, many Israeli farmers have turned to floriculture. Israel exports 70% of its floriculture, which includes cut flowers, ornamental flowers, potted plants and propagation material. Many of you would remember that as a special gesture to mark the visit of Prime Minister Narendra Modi to Israel, a new fast-growing Israeli Crysanthumun flower was named as 'MODI'.

Milk & Honey

The Holy Land is also known since Biblical times as 'the land of milk and honey'. The modern Israel



has turned this metaphor into a reality, with milk productivity per cow being the highest in the world. Israeli cows, which are hybrid of Holstein and Syrian cows, give approximately 40 liters of milk every day, exceeding the productivity in countries like Switzerland, Netherlands and Australia. India produces the highest quantity of milk in the world, but with an average productivity of less than 10 liters per cow a day. The fully automated Israeli dairy farms are based on the zero grazing model. They use sophisticated technologies such as sensors and big data. High quality milk production enables Israeli companies to offer a large variety of cheese, chocolates and ice creams. Israeli company has set up the largest dairy farm in the world in Vietnam with 36,000 cows. To end this chapter on a sweet note- there are more than one lakh beehives in Israel, which produce 3,500 metric tons of honey. The economic contribution of bee-keeping is 30 times more in value than the value of honey.

Other Components:

The limits of this article do not allow us to elaborate, but it should be mentioned briefly that Israel is also among leading countries in the areas of wine making, caged aqua-culture, goat raring, poultries, organic agriculture and agro-tourism. Israel has world-class universities and research centers for agriculture. They work very closely with the Government, Extension Centers and the Farmers. There's a large number of agriculture start-ups, which are bringing out of the box solutions to the field.

Growing India - Israel cooperation

This year marks the 25th anniversary of India & Israel's diplomatic relations. The two countries signed the first agreement for Cooperation in the Field of Agriculture back in December 1993. Since then the cooperation is ever growing. Thousands of Indian farmers, agronomists and political leaders visit the Agri Tech Conference. In 2006, India's Agriculture Minister, Mr. Sharad Pawar led a delegation to Agritechalong with the then Guajarat Chief Minister, Mr. Narendra Modi. Based on Israel's unique expertise in Agriculture, India and Israel have signed another Agreement for Agricultural Cooperation in 2006. This evolved into Indo-Israel Agriculture Project (IIAP), which is a partnership between MIDH (Mission for Integrated Development of Horticulture, Government of India), Indian States and MASHAV -Israel's Agency for International Development Cooperation under the Ministry of Foreign Affairs. The main goals of IIAP are as follows:

- Increasing crop diversity
- Increasing productivity
- Increasing resources use efficiency

Within this framework, the State of Israel is contributing its best-practices and knowhow, and providing capacity building through professional training programmes by MASHAV conducted both in Israel and in India.To achieve the goals of the agreement, it was decided to establish "Agricultural Centers of Excellence" (CoE), in various states in India, dedicated to different crops, fruits and vegetables. The project covers 26 Centers in 9Indian states, out of which, 4 are in Maharashtra: A center for citrus in Nagpur, two centers for mangoes in Dapoli (Alphonso) and Aurangabad (Kesar) and one center for pomegranates in Rahuri. In upcoming phase of the IIAP, seven more states are invited to participate in the project, which will take the number of centers to 34. Due to its success, the project is extended every three years.

The first Indo-Israel center started at Gharaunda in Haryana. At this center, production of cucumber increased by 12 times, while production of tomatoes and capsicum increased by up to 6 times vis-a-vis conventional methods. Most importantly, the use of fertilizers was reduced by 50% and the usage of pesticides was reduced by almost 75%. Today, this center produces the best quality vegetables on a commercial scale. They cost just 10%-15% more in the market and have a huge demand. Within 3 years, this center has recovered the costs incurred and is set to become self-sufficient.

Israel's contribution of its know-how, technology, guidance of its experts, innovative thinking and entrepreneurial approach is the reason for its success and popularity in the agriculture sector.in our partnership with India – as well as with other countries- we understand the importance ofadaption to the local climatic conditions and take into

consideration the socioeconomic situation of the farmers in that region. Technologies that are easily accessible to farmers, such as pruning at regular intervals, high-density cultivation, protected cultivation, drip irrigation and fertigation are blended with innovative approach on these centers. Preference is given to high-yielding local varieties of plants in addition to suitable Israeli varieties.

Innovative and deeply committed Indian agriculture officers ably lead these centers. We organize a number of training programmes for them in Israel and in India. We learn quite a lot from these programmes. The knowledge is taken to the farmers through Field Extension Officers and Progressive Farmers. These centers are open for visits and training for farmers throughout the year. The fact that tens of thousands of farmers from all over India visit each of these centers every year speaks volumes about the CoEs relevancy and success.

Israel's Agriculture Ministers have participated in the two consecutive Vibrant Gujarat conferences in 2015 and 2017. They met PM Narendra Modi and other senior government ministers and officials. Israel was a partner country in the India Water Week in year 2016. Recently a high level delegation of NABARD, led by Chairman Shri Harsh Kumar Bhanwala visited Israel to explore other fields of cooperation. Today, both sides are discussing the possibilities of involving the private sector companies in India and Israel under a Government-to-Government framework.Baring the scope of our cooperastion, it's only natural that the joint statement issued by India and Israel during the historic visit by PM Modi to Israel has a special reference to agriculture. It states that "Recognizing its centrality for development, India and Israel agreed to establish a "Strategic Partnership in Water and Agriculture". This will focus on water conservation, waste-water treatment and its reuse for agriculture, desalination, water utility reforms, and the cleaning of the Ganges and other rivers using advanced water technologies. It will also include the reinforcement and expansion of the existing Centres of Excellence (COE) under the stewardship of the Israeli Ministry of Foreign Affairs (MASHAV) and the Ministry of Agriculture of India to promote commercially viable business models involving Farmer Producer Organizations (FPOs); the provision of quality planting material; and the transfer of post-harvest technical know-how and market linkages involving the private sector through PPP, B2B & other models. The two leaders also agreed on the establishment of a Joint Working Group to steer this Partnership."

Agriculture and Regional Development Models

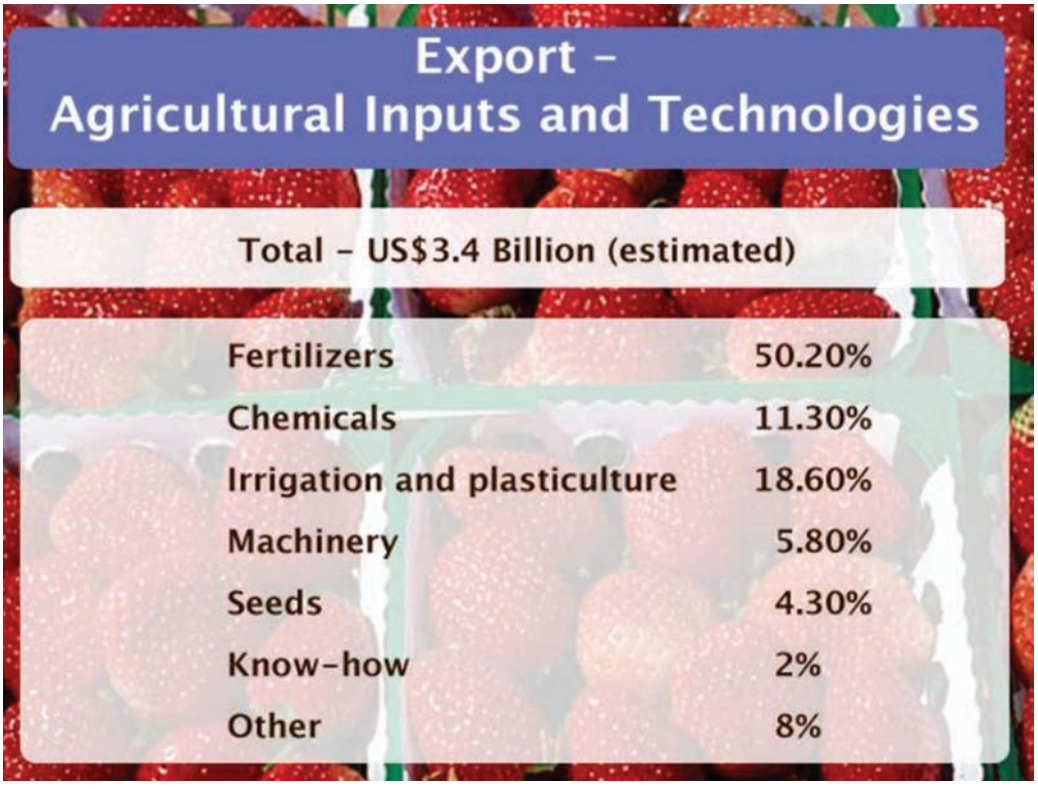
Two unique Israeli models played a huge role in the development of Israel's agriculture sector: Kibbutz- a cooperative model under which the land and all other resources are owned collectively by the community and the Moshav- where the land ownership remains with the individual farmers, but the decisions like crop planning and variation, purchase of seeds, fertilizers and other inputs, post-harvest and marketing of produce are done collectively with the help of professional management. The Government plays an important role by making investments in rural infrastructure and by forming a policy framework enabling cooperative farming. After transforming Israel's agriculture, several Israeli Moshav-based companies started replicating this model on a very large scale in Africa and South American countries. Cooperative movement

has played a major role in the Indian agriculture and rural sectors. The new models of collective farming in India such as farmer producer companies have many similarities with the Israeli Moshav model. We are hopeful therefore that Israel's experience in this field will take the India-Israel agriculture cooperation to new heights.

Maharashtra-Israel Cooperation

The state of Maharashtra has a major share in the growing Indo-Israel agricultural ties. For many decades, farmers and socio-political leaders from Maharashtra are visiting Israel to participate in the MASHAV training programmes and agricultural conferences. The Chief Minister of Maharashtra, Mr. DevendraFadnavis& Water Resources Minister, Mr. Girish Mahajan participated in the Agritech conference in 2015 along with a large number of farmers and companies based in Maharashtra. During this visit, the Hon. Chief Minister was exposed to the Moshav model of regional development. As a follow-up to this visit, the Government of Maharashtra has requested the Government of Israel's help in building a Center of Excellence for Family Farming and Irrigation in the Yavatmal district.

In the last 3 months, since my posting in Mumbai, I have visited the India-Israel Center of Excellence for Citrus in Nagpur and was impressed by the positive impact it has had on the farmers in the Vidarbha region. I had an opportunity to meet and the Chief Minister aon a few occasions. It was fascinating to listen to his analysis of the complexity of the problems faced by the agriculture sector and his vision for making it sustainable and prosperous. The CM suggested a number of measures such as massive investments in the infrastructure, emphasis on decentralized water conservation, rain water harvesting (Jal YuktShivar) and digitization in the areas of agriculture marketing and finance. I am confident that these measures will boost agricultural growth and improve standard of living of farmers in Maharashtra. There'sa huge scope for cooperationwith Maharashtra and other Indian Statesin the areas of post-harvesting technics, processing, packaging branding and other. I'm humbled and excited to part of thios growing cooperation, contributing to the realization of The Indian-Israeli strategic partnership, as visioned by the leaders of our two great nations.



Dr. Deepak Mhaisekar

NAGPUR METROPOLITAN REGION GROWTH THROUGH SATELLITE

Dr. Deepak Mhaisekar
IAS, Metropolitan Commissioner
NMRDA, Nagpur

Since the globalisation and liberalisation of the Indian economy in the 90s, Indian cities have seen accelerated economic and social growth, which has attracted more and more people to cities from rural parts of the country. The time has come for India to leverage the existing technological tools to develop new smart cities and transform existing ones, and unleash their true potential as centres of opportunity.

It is an established fact that periurban or fringe areas around the city which are not included in urban local body tend to have haphazard and unplanned growth and by the time these areas are included in the urban local body, the areas have already developed characteristics of urban slums mainly showing unplanned growth, without basic services and urban infrastructure.

In view of this fact, having proper plan in the metropolitan region becomes the essence for developing a well planned urban area with features of smart city. In fact this area being undeveloped offers opportunity for green field planned Smart City or Satellite township. In the planning process having a regional plan for the district and Development Plan for metropolitan region / lays foundation for planned metropolitan region having potential for green field planned smart satellite

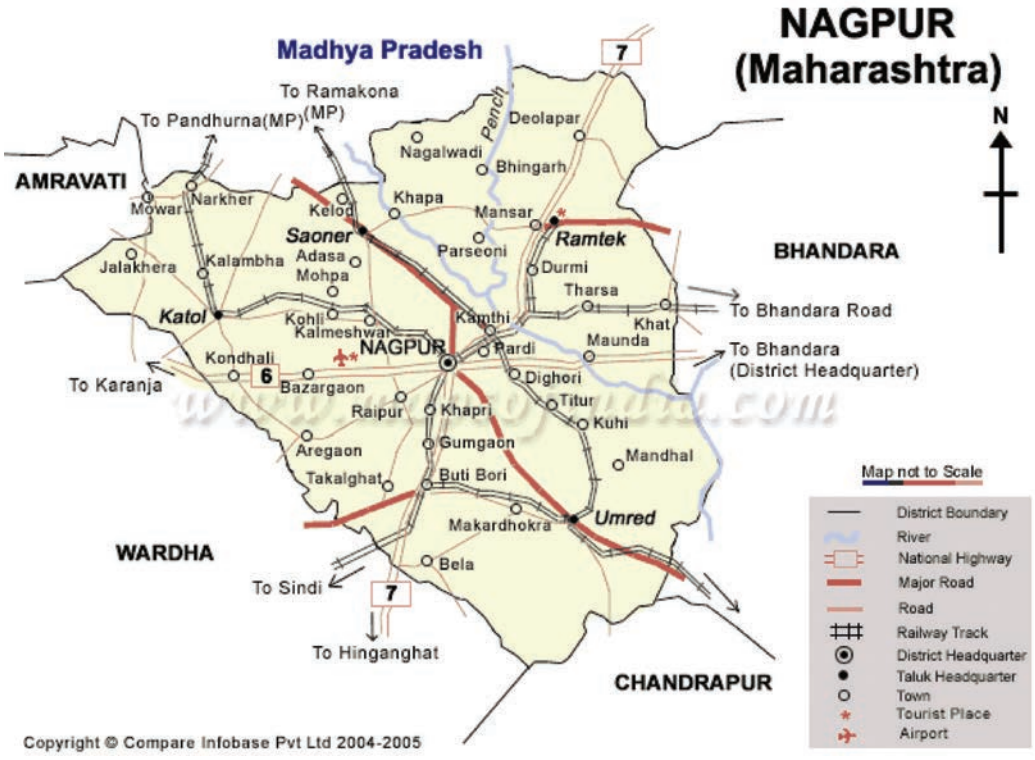
Nagpur Metropolitan Region :

The rapid growth of Nagpur City and spread of urban agglomeration beyond municipal limits has presented challenges for the future growth of the city. In view to have proper plan in this area Nagpur Metropolitan Region was notified in the year 1999. The region comprises of 9 tahsils, 719 villages and it is spread over area of 3567 Sq. Kms. The actual planning of the Metropolitan area which was notified in 1999 started in 2010. Development / perspective plan for the Metropolitan Region is on the verge of finalisation.

Nagpur an emerging Metropolis of India is the main centre of commerce in Vidarbha region and also Divisional Head Quarter.

Nagpur is a major industrial city of Maharashtra that plays a key role in providing economic stability both to the city and region. Butibori Industrial area, which is considered as the largest industrial area in entire Asia in terms of area is a home for units of several big industries such as synthetics, power transmission, Woolen Yarn, Industrial Dryers etc. Moreover Hingna industrial estate which homes around 900 small and medium industrial units including large scale industries. As the region is rich in natural resources, mining is a major activity here. There are many government organisations related to mining industry in Nagpur. The City has the head office of Western Coalfields Limited (WCL), one of the eight fully owned subsidiaries of Coal India Limited. Govt. takes special care in the industrial, agricultural and commercial development of Nagpur that will result in the economic stability and growth of the city.

Such population growth and development, needs to be planned in a systematic manner. Apart from the land use and infrastructure planning proposed within this plan, NMRDA (Nagpur Metropolitan Region Development Authority) is also planning to execute improvement schemes. These schemes can be considered as catalystic projects in which NMRDA plans to invest resources to speed up the development of infrastructure and promote private sector development and investment.



Satellite Township :

Nagpur is about to have one of the best Metro Rail connectivity and two metro lines / tracks are proposed i.e. North - South, 19 kms, East - West 18 kms. developing a network of 37kms. And it may be extended further. This satellite township / city will help to take away the burden of the Metropolis and at the same time would give commuters / riders for the metro rail. The most important factor is that this area is totally without development and hence there is a scope for green field development. The NMRDA plans to develop this satellite township into a smart satellite township.

The satellite township is being developed on the land pulling model so that the land owners / farmers of the region would also share the fruits and benefits of the development.

The proposed satellite townships are very close to MIHAN, Airport and also are in the vicinity of proposed National Law University, IIIT, Sanskrit University, Cancer Hospital & MIHAN.

Logistic Hub :

Inview of GST coming in India, there is going to be uniform tax structure through out India, suddenly Nagpur becomes a centre of attraction because it being geographical centre of India. In addition, the connectivity of Nagpur to all the directions of India i.e. North-South, East-West by road, by rail and Air gives it advantage over any other city in India and therefore it becomes the first choice in terms of industrial / logistic development and investment. Considering these factor NMRDA proposes to develop various logistic parks in the metro region. In the beginning, it is proposed to start two logistic parks / hub in the region.

NMRDA also has plans of development of 11 potential urban growth centres and 12 rural growth centres. The NMRDA is also exploiting possibility of foreign collaboration for development of this region.

SUSTAINABLE AGRICULTURE

Strengthening Collective Action: Learning from Field Experiments in India

Experimental games prove to be a respectful, creative way to engage with communities, shape behavior change, and gain insights into desirable outcomes

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Introduction

Anantapur is a particularly water-distressed district in Andhra Pradesh. In 2010-12, 76% of the total area irrigated was serviced by tube wells, which is an increase from 44% in the period1998-2001. During the same period, the area irrigated by dug wells declined from 27% to 4% and that by tanks fell from 22% to 15%. Today, more than 80% of the irrigated needs and more than 90% of household needs, including drinking, are met by groundwater alone. The increasing dependence on groundwater and the corresponding decline of tanks and other forms of communal assets are related.

Further, groundwater is the most important source of drinking water in Anantapur; the rural population here is almost entirely dependent on groundwater for drinking and other domestic uses. Groundwater governance is thus important to ensure more equitable distribution of groundwater for essential purposes like drinking.

It is within this context that the interventions on groundwater are significant. The project described here aimed to understand how participation in economic field experiments can influence the knowledge, attitudes, and behaviour of the participants and their communities with respect to the management of common pool resources, especially groundwater.

The project was conducted over two phases; the first phase was between April-August 2013 and the second phase was between December 2013 and August 2014. It encompassed 28 habitations spread across the mandals of NP Kunta, Gandlapenta and Tanakallu mandals of Anantapur district, Andhra Pradesh (AP).

Role of partners

- Farmers of Anantapur: They were the principal stakeholders of this project. Care was taken to involve both irrigated and un-irrigated farmers from both forward caste and Dalit communities, as well as small or marginal farmers.
- Women : No community mental model of groundwater is complete without the perspectives of women, who bear the brunt of the groundwater crisis in Anantapur.
- Small and Marginal Farmers : As was mentioned above, a majority of farmers do not have tube wells in this region.
- Dalits: The price of groundwater depletion is often paid by marginalized communities, including Dalits; we found it important to engage with Dalits separately.
- Village institutions : Institutions like the Village Development Committees and Watershed Management Committees were involved in identifying the people who would play the games and for mobilizing people to take part in the discussions that followed the games.
- Tube-well owners : Engaging with this group helped us understand the difficulties that exist in sharing groundwater.

- IFPRI and ASU : The International Food Policy Research Institute (IFPRI) and Arizona State University (ASU) were instrumental in designing the games, analyzing the findings and coming out with academic reports and papers.

- FES: The Foundation for Ecological Security administered the games in the field and the various concomitant surveys; they ensured the quality of the data collected and provided context to understand the findings of the exercise.

Interventions and approaches

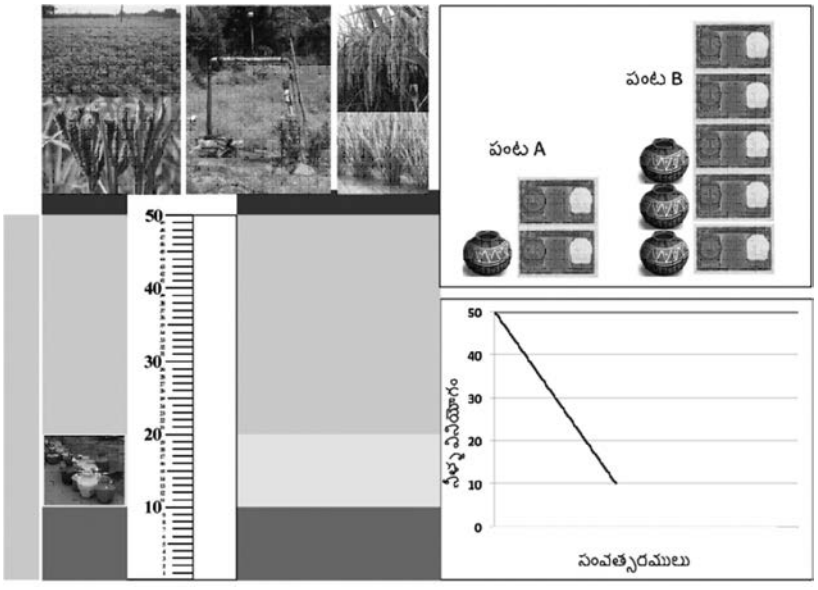
The game was played in each village with two groups – one of men and one of women –of 5 participants each. Each group got to play two games comprising of 10 rounds each (a total of 20 rounds); each round stands for one cropping season. Since Kharif season in Anantapur is largely driven by rainfall, the focus was largely on the behaviour of the farmer during the Rabi season when the dependence on groundwater or other alternative forms of irrigation is high.

In the first game, participants make decisions individually; in the second game, participants can discuss and arrive at collective decisions on what crops to plant.

If the water level touched 20 units, each farmer would be penalized one unit of money to indicate purchase of water. If the water levels touched 10 units, the game would end as it is assumed that at this point, the water in the aquifer cannot be replenished. At the beginning of each round, the common groundwater resource would be recharged by a fixed quantity of five units.

Each game starts with 50 units of water in the common bore well and continues till the water reaches 10 units; the farmers have two crops to choose from; Crop A and Crop B. The former consumes one unit of water and gives two units of remuneration, while the latter consumes three units of water and gives five units of remuneration. Thus, if all the five farmers grew only Crop A, they could maintain water levels for perpetuity and if they chose Crop B, they would exhaust water in four rounds.

At the end of the game, players are paid five times the amount of virtual money earned (50 units of virtual money translates to Rs.250 in reality). If every farmer chose Crop B to maximize individual earnings, collective water levels would collapse in no time. If they only chose Crop A, to try and conserve water, earnings would be low. The challenge was to find the ideal mean (in this case, three people sowing Crop A and two sowing Crop B);and to persuade each other to adopt this ideal mean in a way that the earnings were distributed more evenly and water levels were sustained for a longer duration. This process was followed for both men and women.



Innovativeness of the intervention

We have found that groundwater experiments are a unique way to engage with communities in order to better understand their perceptions and mental models regarding ground water. The reasons why experimental games are considered to be effective tools.

a) Games are a powerful tool: Experimental games are powerful tool to understand the mental models of rural communities vis-à-vis natural resources. The tool is an effective way to engage with

rural communities on the issue of groundwater.

b) Surfacing Commons Dilemmas: Games are useful in bringing to surface commons dilemmas. We get an insight of how communities comes into terms with reconciling long term ecological considerations with short term livelihood concerns, and to try and find an ideal middle ground. Many such dilemmas were articulated by the communities themselves.

c) Gives Valuable Insights: With the help of games, we are able to place the players in situations that somewhat resemble their lived reality; in doing so, we prompt them to take decisions regarding the use of groundwater.

d) Helps in Challenging Community Narratives: Games are a tool to challenge dominant narratives within communities. A case in point is the classic understanding that groundwater levels are only dependent on rainfall, and that with rainfall, the groundwater situation would suddenly and dramatically change.

Impact and outcome

In all, we engaged with about 600 men and women spread across three mandals of Anantapur. The representation of various groups among the total number of players was approximately as follows:

- Other Backward Castes (OBCs): 47%
- General category: 37%
- Scheduled castes: 10%
- Small land holders (less than 2 hectares of land) comprised the largest land holding category among the players (45%), largely in keeping with the demographic trend of the study area.

The general feedback that we got from the players was that the game was useful in helping them understand the linkages among crops, water levels and income. They felt that that the rounds played with communication helped them in better gauging each other's concerns, which in turn helped them in conserving scarce water resources better. Thus, many farmers felt that some institutional platform where ground water concerns could be discussed would be ideal for long-term conservation of this precious resource.

The specific impacts of the intervention are below.

- *Underscoring the need for judicious use of groundwater.* The experimental games underscored the relationship between judicious use of ground water and improved household income. In most habitations, players realized that they would earn more, both individually and collectively, by using the available groundwater smartly.
- Highlighting the role of communication: Groundwater consumption was higher in those rounds which were played without communication, in comparison to those where the players communicated with each other. Participants acknowledged this through comments to the effect that when they played the game without communication, each person planted the crop as per their will, but when they played with communication, they were able to talk to each other and plant low water crops.
- Highlighting the role of institutional mechanisms: An important spin-off of the game was that it helped in underscoring the importance of institutional mechanisms for better governing groundwater. Several players and observers felt that the availability of some institutional platform that permitted discussions on groundwater and had the authority to pass resolutions regarding access to and sharing of groundwater could be effective in ensuring more equitable distribution of the same. They felt that such a platform could enable those who had access to tube wells and those that did not to regularly interact to find mutually agreeable solutions regarding groundwater.

Sustainability and scaling up

- Within the organization, we are now planning to integrate the games with the on-going water commons initiative in order to engage with the communities both in terms of what can be done and in terms of what will be done. In doing so we plan to make the games more unpredictable – for instance, by introducing dice to simulate the inherent unpredictability of rainfall.

- Further, we plan to engage with communities with a package of activities; comprising of experimental games, crop water budgeting and meetings wherein we discuss possible agronomic interventions that can help meet the twin-objectives of water conservation and income maximization.
- We plan to train youth from rural communities in conducting the games; thereby creating a pool of people within the villages where we work, who are in a position to map the mental models and explain the same to the rest of the members in the local idiom.

Snapshots—Experimental Games in Pictures

Introduction about the game

Score sheet explained

Participants explained about the game rules

Participants playing game

OPERATIONAL GUIDELINES OF PRADHAN MANTRI KRISHI SINCHAYEE YOJANA (PMKSY)

1.0 Introduction:

Hon'ble President in his address to the joint Session of the Parliament of 16thLok Sabha indicated that "Each drop of water is precious. Government is committed to giving high priority to water security. It will complete the long pending irrigation projects on priority and launch the 'Pradhan Mantri Krishi Sinchayee Yojana' with the motto of 'Har Khet Ko Paani'. There is a need for seriously considering all options including linking of rivers, where feasible; for ensuring optimal use of our water resources to prevent the recurrence of floods and drought. By harnessing rain water through 'Jal Sanchay' and 'Jal Sinchan', we will nurture water conservation and ground water recharge. Micro irrigation will be popularised to ensure 'Per drop-More crop' .

Out of about 141 m.Ha of net area sown in the country, about 65 million hectare (or 45%) is presently covered under irrigation. Substantial dependency on rainfall makes cultivation in un-irrigated areas a high risk, less productive profession. Empirical evidences suggest that assured or protective irrigation encourages farmers to invest more in farming technology and inputs leading to productivity enhancement and increased farm income.

The overreaching vision of **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)** will be to ensure access to some means of protective irrigation to all agricultural farms in the country, to produce 'per drop more crop', thus bringing much desired rural prosperity.

2.0 Objectives:

The broad objectives of PMKSY will be:-

a) Achieve convergence of investments in irrigation at the field level (preparation of district level and, if required, sub district level water use plans).

b) Enhance the physical access of water on the farm and expand cultivable area under assured irrigation (Har Khet ko pani),

c) Integration of water source, distribution and its efficient use, to make best use of water through appropriate technologies and practices.

d) Improve on-farm water use efficiency to reduce wastage and increase availability both in duration and extent,

e) Enhance the adoption of precision-irrigation and other water saving technologies (More crop per drop).

f) Enhance recharge of aquifers and introduce sustainable water conservation practices

g) Ensure the integrated development of rainfed areas using the watershed approach towards soil and water conservation, regeneration of ground water, arresting runoff, providing livelihood options and other NRM activities.

h) Promote extension activities relating to water harvesting, water management and crop alignment for farmers and grass root level field functionaries.

i) Explore the feasibility of reusing treated municipal waste water for peri-urban agriculture, and

j) Attract greater private investments in irrigation.

This will in turn increase agricultural production and productivity and enhance farm income.

3.0 Programme Components

PMKSY will have following programme components:

A. Accelerated Irrigation Benefit Programme(AIBP)

a) To focus on faster completion of ongoing Major and Medium Irrigation including National Projects.

B. PMKSY (Har Khet ko Pani)

a) Creation of new water sources through Minor Irrigation (both surface and ground water)

b) Repair, restoration and renovation of water bodies; strengthening carrying

capacity of traditional water sources, construction of rain water harvesting

structures (Jal Sanchay);

c) Command area development, strengthening and creation of distribution network from source to the farm;

d) Ground water development in the areas where it is abundant, so that sink is created to store runoff/ flood water during peak rainy season.

e) Improvement in water management and distribution system for water bodies to take advantage of the available source which is not tapped to its fullest capacity (deriving benefits from low hanging fruits). At least 10% of the command area to be covered under micro/ precision irrigation.

f) Diversion of water from source of different location where it is plenty to nearby water scarce areas, lift irrigation from water bodies/rivers at lower elevation to supplement requirements beyond IWMP and MGNREGS irrespective of irrigation command.

g) Creating and rejuvenating traditional water storage systems like Jal Mandir (Gujarat); Khatri, Kuhl (H.P.); Zabo (Nagaland); Eri, Ooranis (T.N.); Dongs (Assam); Katas, Bandhas (Odisha and M.P.) etc. at feasible locations.

C. PMKSY (Per Drop More Crop)

a) Programme management, preparation of State/District Irrigation Plan, approval of annual action plan, monitoring etc.

b) Promoting efficient water conveyance and precision water application devices like drips, sprinklers, pivots, rain-guns in the farm (Jal Sinchan);

c) Topping up of input cost particularly under civil construction beyond permissible limit (40%), under MGNREGS for activities like lining inlet, outlet, silt traps, distribution system etc.

d) Construction of micro irrigation structures to supplement source creation activities including tube wells and dug wells (in areas where ground water is available and not under semi critical / critical /over exploited category of development) which are not supported under AIBP, PMKSY (Har Khet ko Pani), PMKSY (Watershed) and MGNREGS as per block/district irrigation plan.

e) Secondary storage structures at tail end of canal system to store water when available in abundance (rainy season) or from perennial sources like streams for use during dry periods through effective on-farm water management;

f) Water lifting devices like diesel/ electric/ solar pumpsets including water carriage

pipes, underground piping system.

g) Extension activities for promotion of scientific moisture conservation and agronomic measures including cropping alignment to maximise use of available water including rainfall and minimise irrigation requirement (Jal sarankchan);

h) Capacity building, training and awareness campaign including low cost publications, use of pico projectors and low cost films for encouraging potential use water source through technological, agronomic and management practices including community irrigation.

i) The extension workers will be empowered to disseminate relevant technologies under PMKSY only after requisite training is provided to them especially in the area of promotion of scientific moisture conservation and agronomic measures, improved/ innovative distribution system like pipe and box outlet system, etc. Appropriate Domain Experts will act as Master Trainers.

j) Information Communication Technology (ICT) interventions through NeGP-A to be made use in the field of water use efficiency, precision irrigation technologies, on farm water

management, crop alignment etc. and also to do intensive monitoring of the Scheme.

D. PMKSY (Watershed Development)

a) Effective management of runoff water and improved soil & moisture conservation activities such as ridge area treatment, drainage line treatment, rain water harvesting, in-situ moisture conservation and other allied activities on watershed basis.

b) Converging with MGNREGS for creation of water source to full potential in identified backward rainfed blocks including renovation of traditional water bodies

4.0 Funding Pattern

PMKSY funds will be provided to the State Governments as per the pattern of assistance of Centrally Sponsored Schemes decided by Ministry of Finance and NITI Aayog. During 2015-16, existing pattern of assistance of ongoing schemes will be continued.

lIllustrative Activities under PMKSY (Refer to Para 4.0 of the Guidelines)

Sr. No.	Programme	Illustrative Activities
1	AIBP	• To focus on faster completion of ongoing Major and Medium Irrigation including National Projects
2	PMKSY (Har Khet ko Pani)	• Creation of new water sources through Minor Irrigation (both surface and ground water) • Repair, restoration and renovation of water bodies; strengthening carrying capacity of traditional water sources, construction rain water harvesting structures (Jal Sanchay); • Command area development, strengthening and creation of distribution network from source to the farm; • Improvement in water management and distribution system for water bodies to take advantage of the available source which is not tapped to its fullest capacity (deriving benefits from low hanging fruits). At least 10% of the command area to be covered under micro/precision irrigation. • Diversion of water from source of different location where it is plenty to nearby water scarce areas, lift irrigation from water bodies/rivers at lower elevation to supplement requirements beyond IWMP and MGNREGS irrespective of irrigation command. • Creation and rejuvenation of traditional water storage systems like Jal Mandir (Gujarat); Khatri, Kuhl (H.P.); Zabo (Nagaland); Eri, Ooranis (T.N.); Dongs (Assam); Katas, Bandhas (Odisha and M.P.) etc. at feasible locations.
3	PMKSY (Watershed)	• Water harvesting structures such as check dams, nala bund, farm ponds, tanks etc. • Capacity building, entry point activities, ridge area treatment, drainage line treatment, soil and moisture conservation, nursery raising, afforestation, horticulture, pasture development, livelihood activities for the asset-less persons and production system & micro enterprises for small and marginal farmers etc.

		• Effective rainfall management like field bunding, contour bunding/ trenching, staggered trenching, land levelling, mulching etc.
4	PMKSY (Per drop more crop)	• Programme management, preparation of State/District Irrigation Plan, approval of annualaction plan, Monitoring etc. • Promoting efficient water conveyance and precision water application devices like drips, sprinklers, pivots, rain-guns in the farm (Jal Sinchan); • Topping up of input cost particularly under civil construction beyond permissible limit (40%), under MGNREGS for activities like lining inlet, outlet, silt traps, distribution system etc. • Construction of micro irrigation structures to supplement source creation activities including tube wells and dug wells (in areas where ground water is available and not under semi critical /critical /over exploited category of development) which are not supported under PMKSY (WR), PMKSY (Watershed) and MGNREGS. • Secondary storage structures at tail end of canal system to store water when available in abundance (rainy season) or from perennial sources like streams for use during dry periods through effective on-farm water management; • Water lifting devices like diesel/ electric/ solar pumpsets including water carriage pipes. • Extension activities for promotion of scientific moisture conservation and agronomic measures including cropping alignment to maximise use of available water including rainfall and minimise irrigation requirement (Jal sarankchan); • Capacity building, training for encouraging potential use water source through technological, agronomic and management practices including community irrigation. • Awareness campaign on water saving technologies, practices, programmes etc., organisation of workshops, conferences, publication of booklets, pamphlets, success stories, documentary, advertisements etc. • Improved/innovative distribution system like pipe and box outlet system with controlled outlet and other activities of enhancing water use efficiency
5	MGNREGA	• Water harvesting structures on individual lands of vulnerable sections, creation of new Irrigation sources, upgradation/desilting of traditional water bodies, water conservation works etc. • Supplementating soil and water conservation works in the identified back ward rainfed blocks by overlaying of the plans with that of watershed projects for development to full potential • Desiltation of canal & distribution system, Deepening and desiltation of existing water bodies, strengthening of bunds/embankments etc. • Restoring the potential of traditional water storage systems like Jal Mandir; Khatri, Kuhl, Zabo, Ooranis, Dongs, Katas, Bandhas etc. through disltation and deepening activities.

INDIAN SEED INDUSTRY ; OVERVIEW AND ITS REGULATORY FRAMEWORK

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If one says that Seeds are the backbone of Indian Agrarian economy, then it would not be untrue. It is after all that good quality Seeds, harbinger of productivity and income in a farmer's life. Indian agriculture has undergone sea change over the past few decades. India's overdependence on agriculture as source of employment has been reducing. In the year 1950-51 the share of agriculture in GDP was 55.1 % which reduced to 17 % in 2008-09 and currently in it is 16.5%. Subsequently we have witnessed growth in other key sectors of Indian economy like industry (29.8%) and services (45.4%). Though share of agriculture in GDP has drastically reduced however its importance remains high for Indian economy. It is of prime importance as it is the largest employer about 49% of the total workforce but contributes to a declining share of its GDP (17% in 2013-14). Numerous lakhs of household depend on agriculture as their primary source of livelihood. Seed sector has vital role to play in the lives of such households. Good quality of seeds can provide them higher return on their expenses done for cultivation.

Journey of Seed Industry over the Years

A major re-structuring of the seed industry by Government of India through the National seed Project Phase-I (1977-78), Phase-II (1978-79) and Phase-III (1990-1991), was carried out, which strengthened the seed infrastructure that was most needed and relevant around those times. This could be termed as a first turning point in shaping of an organized seed industry. Introduction of New Seed Development Policy (1988 – 1989) was yet another significant mile stone in the Indian Seed Industry, which transformed the very character of the seed industry. These changes have led to faster growth of Indian Seed sector.

India constitutes the fifth largest seed market measured in value terms in the world. The share of Indian seed industry in the global seed production is 4.7 percent preceded by the US (28.1 percent), China (21.2 percent), France (8.4 percent), and Brazil (6.2 percent). In terms of overall demand-supply scenario, the Indian seed industry appears to be self-sufficient in a number of seeds categories such as flower, fruits, vegetables and field crop. The future scenario also seems well.

Key Stakeholders in Seed Industry

The various stakeholders in Seed Sector are Central and State Governments, Cultivators, National Seed Corporation, State

Seed Corporations, National Seed Association of India, Indian Council of Agricultural Research, State Agriculture Universities, Private Companies, International Seed Testing Agency and Dealers and Distributors, Cooperatives and Ancillary industry partners (Seed Coating, machinery etc.). For seed quality certification, there are State Seed Certification Agencies (SSCAs) and State Seed Testing Laboratories (SSTLs).

Regulations governing Indian Seed Industry

From growing into the farmer's field as a grain or a product of crop to the marketable product i.e., Seed, it goes through various post harvesting treatments / procedures and quality testing, and becomes fit to enter into the market. Seed quality is the major factor to be maintained by seed industry in this process, so that it would perform better in the farmer's field and yields profusely. During the whole process to make seed fit for the market there are several regulations enacted by the government to regulate the seed quality and industry.

Seeds Acts, 1966, Seeds Rule, 1968 and Seeds (Control) Order, 1983 are the major statuary enactments in the Seed Sector. These enactments control the entire progression from seed production to marketing to control the quality of seeds and to offer good quality seeds to famers. Apart from that to protect the variety and hybrids developed by the researchers, India has developed a separate enactment called **Protection of Plant Variety and Farmers' Rights Act** in 2001. India is one of the mega biodiversity centers in the world and has two of the world's 18 biodiversity hotspots' located in the Western Ghats and in the Eastern Himalayas. There are several wild forms of commercial crops in the biodiversity of India, which are being used to develop improved variety or hybrids. To protect the biodiversity of India from the foreign players, India has enacted the Biodiversity Act in 2002. Indian Seed Industry can use the Indian germplasm to develop new varieties or hybrids after prior intimation to Biodiversity Authority, whereas, foreign companies or researchers have to take the permission for using Indian germplasm.

- **Seed Quality Assurance**

In India, Seed quality assurance relies on four important parameters namely genetic (variety) purity, physical purity, germination and moisture. Further, seed vigour and seed health assurances are also being accomplished in several countries. The seed quality is mainly ensured through seed certification, seed labeling, seed law enforcement and seed testing. Within these broad parameters, there are several types of formal, quasi-official and voluntary seed quality assurance systems are operative globally.

Seed quality as envisaged in the Seeds Act is to be achieved through pre- and post-marketing control where, **Seed Certification is voluntary and Labeling is compulsory** of notified kind/ varieties. The **notification of the varieties** is done under **Section 5 of the Seeds** Act in consultation with the Central Seed Committee. Under the Seeds Act, 1966 (Section 6(a) of the Seeds Act) Central Government has specified the Minimum Limits of Seed Germination and other Seeds and Field Standard to maintain the quality of different classes of Seeds. Size, color and content of the label of Seed packets are also notified under Section 6(b) of Seeds Act.

The Seeds (Control) Order, 1983 regulates the quality of seeds of non-notified varieties and also provides licensing of dealers, display of seed stock etc. As per the Seed Control Order, 1983, Seed Companies has to take the compulsory Seed license from the state licencing authority. However, no separate seed dealer license is required if the company do not have their sales/storage office in the particular state and selling their seeds through their dealer/distributor having a valid Seed license issued by local State Government.

- **Seed Certification**

Seed Certification is also regulated under the Seeds Act, 1966 in India. Seed Certification is a legally sanctioned system under the Seeds Act to make available good quality seeds to the farming community with certain prescribed standards of genetic purity, physical purity, physiological quality and seed health. The seed certification system is designed to prevent the passage of substandard seed material into the distribution channel which should have been otherwise left unchecked. Seed Certification Agencies are

established under Section 8 of the Seeds Act, 1966. Seed Certification is voluntary and only those varieties which are notified under Section 5 of the Seeds Act are eligible for seed certification.

Three classes of Seed comes under the Certification system viz.; Breeder Seed (100 % genetic purity), Foundation seed (99.99 % genetic purity) and Certified Seed (99% genetic purity). A class of Truthful label seed is also available in the system, which is not certified by the certification agency but self-certified by the Seed Company or Seed producer. These Truthful label seed also confirm the Minimum Limits for Germination and Purity as per the Seeds Act, 1966 and the standards are also printed on the label as specified by the Central Government.

- **Seed Testing**

In India, there are 125 notified Seed Testing Laboratories in States, which are established under the section 4(1) and 4(2) of the Seed Act 1966. Besides this Central Seed Testing Laboratory at NSRTC, Varanasi is functioning as referral laboratory for seeds of all crops and CICR Laboratory at Nagpur as referral laboratory for Bt. Cotton seed.

The Ministry of Agriculture & Farmers Welfare, Government of India established National Seed Research and Training Centre (NSRTC) in 2005 as a nodal agency and premier Institute for imparting National and International Trainings on seed related aspects. The important functions of Central Seed testing Laboratory include analyzing the litigation seed samples (seed samples referred by the court of law) as indicated in the Seed Act and Rules.

- **Intellectual Property rights for Plants**

India is member country of World Trade Organization (WTO), and therefore India is under the obligation to provide optimum IP protection in the country. In 1994, India became signatory to the TRIPs Agreement and under the Article 27 3(b) of TRIPs Agreement India has is under the obligation to provide IP protection to Plants either through the Patents Law or through developing a Sui generis system in the country.

In this context, India has enacted a sui generis IPR law viz., the **Protection of Plant Varieties & Farmers' Rights Act, 2001** to grant intellectual property rights to the breeders of plant varieties including farmers. India is the only country where, farmers do also have the rights to use and market their farm produced seeds of the protected plant variety without a brand name.

Conclusion

The Seed industries contribution to agriculture can be understood in terms of creation of an ecosystem where each part is functioning to optimal capacity. Today the private seed sector has matured to a level where its presence is there across India in form of registered seed producers and dealers. India is the only country, where for the first time price control order has been released for controlling the price of seeds in Bt Cotton. Though the importance of seed quality and product integrity has been recognized by the Seed Industry since its inception, despite of that and a robust system in place there is also the presence of spurious seed into the market. Stopping the sale of spurious, fake and substantial seeds to the farmers is a big challenge before the seed industry and this could be achieved through effective implementation of regulatory measures for seed quality control. A multi-dimensional approach would also be required at different levels by both Government and Private organization for effective checking of seed quality at different stages of seed production, processing stages, testing and marketing of seeds.

Seed Industry in India

Introduction

Seed is a vehicle for delivery of improved technologies and is a mirror for portrayal of inherent genetic potential of variety. Seed offers to integrate production, protection and quality enhancement technologies in a single entity, in a cost-effective way. Farmers are moving towards branded seed instead of using seed saved from the previous harvest and upgrading to better quality seeds to improve their yield leading to growth in the seed industry. Further, the advent of genetically modified (GM) cotton changed the landscape of the Indian seed industry. As per ICRA, the Indian Seed Industry is the sixth largest in the world in value terms accounting for about 4.5% of global industry preceded by the US (27%), China (22%), France (6%), Brazil (6%) and Canada (4.8%). Despite being a leading agricultural producer (only behind USA and China), the relatively small-scale of seed industry in India can be attributed to poor SRR. Multiple forecasts advocate that the Indian seed industry will grow twice the average for the rest of the world for the years to come.

The Indian seed industry is the fifth largest seed market in the world, accounting for 4.4% of global seed market after the U.S. (27%), China (20%), France (8%) and Brazil (6%). In terms of global trade, India is almost self-sufficient in flower, fruits and vegetables and field crops seeds. According to NSAI, the market size of Indian seed is expected to grow at a healthy rate on account of favourable global grain demand supply fundamentals, grain productivity well below world's major grain producing regions and government's continued focus on improving seed replacement rate.

Rising income levels owing to increase in minimum support price (MSP) for almost all the crops off-late and increased availability of high quality seeds has fuelled growth for orgnaised market during last 4-5 years. Further introduction of more stringent Seeds Bill which has been tabled in the Parliament, stresses on controlling the market of spurious seeds, which will aid the growth of organised players who provide high quality seeds.

Seeds have been highly instrumental in supporting agricultural growth over the past 40-50 years, with productivity gains and the expansion of the domestic seed industry moving in tandem. Though seed constitutes a small proportion of the total input costs of crop production, it is a basic and critical input in increasing productivity. Given the importance of seed in the livelihood of millions of farming families, the quality in terms of yield and consistency in performance is paramount. Further, as the cost of seed is not considerable to the total cost of cultivation, the farmer would be willing to pay a premium for the right product.

Policy Initiatives in Seed Sector: The following policy initiatives have been taken by the Government of India in seed sector:-

- Enactment of the Seeds Act, 1966
- Seed Review Team-SRT (1968)
- National Commission on Agriculture's Seed Group (1972)
- Launching of the World Bank aided National Seeds Programme (1975-85) in three phases leading to the creation of State Seeds Corporations, State Seed Certification Agencies, State Seed Testing Laboratories, Breeder Seed Programmes etc .
- Seed Control Order (1983)
- Creation of the Technology Mission on Oilseeds & Pulses (TMOP) in 1986 now called The Integrated Scheme of Oilseeds, Pulses, Oil Palm and Maize (ISOPOM).
- Production and Distribution Subsidy
- Distribution of Seed Mini-kits
- Seed Transport Subsidy Scheme (1987)
- New Policy on Seed Development (1988)
- Seed Bank Scheme (2000)
- National Seeds Policy (2002)

- The Seeds Bill (2004)
- Formulation of National Seed Plan (2005)
- National Food Security Mission (2007)
- Rashtriya Krishi Vikas Yojna (2007)

National Seeds Policy, 2002: Thrust Areas

- Variety development
- Plant variety protection
- Seed production
- Quality assurance
- Seed distribution and marketing
- Infrastructure facilities
- Transgenic plant varieties
- Import of seeds and planting materials
- Seed exports
- Promotion of domestic private sector seed industry
- Strengthening of the monitoring system

Seeds Bill, 2004 : Salient Features

- Registration of kinds and varieties of Seeds etc.
  - – Evaluation of performance
  - – Compensation to Framers
  - – Registration of Seed Producers and Processing Units
  - – Seed dealers to be Registered
- Regulation of Sale of Seed and Seed Certification
- Seed Analysis and Seed Testing
- Export and Import of Seeds and Planting Material
- Offences and Punishment.

Outlook

The seed industry is expected to register double-digit growth in FY 2016-17 owing to predicition of above-normal monsoon and higher commodity prices. Improvement in seed replacement rate (SRR) and farmers opting for hybrid seeds are further expected to fuel the growth. The favourable policy environment aimed at supporting the usage of seeds through National Seeds Plan (NSP) and boosting agricultural productivity through National Food Security Mission (NFSM) augurs well for the industry. A transparent and unambiguous regulatory environment would be critical to aid the growth of the industry.

Moreover, with demand for crops rising and arable land available in India remaining limited, increased productivity is the natural path forward making quality of seeds an indispensable component of all agricultural production in the coming decades.

Opportunities in Seed Industries

- **The surge for food**

  The demand for agricultural raw materials is set to rise manifold given the increase in the world population. With increasing disposable income, demand will increase for better quality food like protein, fruits and vegetables. According to United Nations Food and Agriculture Organization, by the year 2050, food production will consequently have to be increased by 70% to meet the demands of 9 billion and growing world population.

- **Seed Replacement Rate (SRR)**

  Seed Replacement Rate is the percentage of area sown out of total area of crop planted in the season using certified/quality seeds as against the farm saved seed. The need for higher SRR emerges from the fact that the quality of a seed deteriorates in successive generations in case of farm saved seed. Hybrid seed, however, needs to be replaced every year whereas inbred variety non-hybrids every three to four years. In India, there is sufficient scope for improvement as far as SRR is concerned. Increasingly, farmers and vegetable producers are using branded seed due to their proven efficiency and higher yields over farm saved. The importance of producing more, while using less inputs is gaining prominence in the Indian context.

- **Prospects for increased cotton market share**

  The performance of Jaadoo has been relatively much better than competition and hence it is expected to gain market share in the established markets. ATM will be the next growth hybrid especially in the states of Maharashtra and Gujarat.

- **High Density Planting (HDP)**

  High Density Planting (HDP) is a system in which higher number of cotton plants are accommodated in per unit area. We have designed and delivered a cotton hybrid 3X1 to suit under HDP with a spacing of 3 feet row-to-row and 1 feet plant-to-plant to accommodate more number of plants to obtain high yields. Our R&D cotton is also concentrating their efforts to change the plant ideotype concept for determinate type to suit for mechanical harvesting.

- **Price regulation of cotton seeds**

  In December 2015, the Agriculture Ministry issued a Cotton Seeds Price (Control) Order to fix a uniform maximum retail price (MRP) for all cotton seeds including the genetically modified versions from March 2016. It also decided to fix and regulate the seed value and licensee fee including royalty or trait value. We welcome this order, as it reduces uncertainty and improves business viability for all seed companies.

- **Paddy**

  Paddy occupies the largest area under any crop in India and is the staple food for large population. Farmers traditionally use their own seed for planting but there is rapid shift towards using packed seeds. Farmers are moving to hybrid seeds in few markets and in other markets upgrading to packed selection variety seeds which are made available by private players. Government programme to promote hybrid usage and effort by industry to educate the farmer on the benefit of hybrid paddy has helped to increase the usage of hybrid rice but current hybrid rice penetration percentage is still in single-digit. Current paddy hybrid products available in the market does not address the needs of all the markets. The market for selection variety rice is growing rapidly.

- **Corn (Maize): Increasing demand**

  Maize is the widely grown crop worldwide. Maize is an important raw material in food processing, poultry, dairy, meat and ethanol industry and along with its traditional uses makes it one of the fastest-growing crops in the world. India is the world's sixth largest producer and fifth largest consumer of maize. Over the last several years, maize production in India has leaped forward as farmers increasingly adopted maize hybrids and upgraded to better hybrids. Maize acreage has grown in India over years as it is highly adaptable to different season, requires less water, easy to grow with good commodity price.

- **Vegetables**

  Hybrid vegetable seed is one of the fastest-growing segments in India estimated to be around `2,000 crores. This makes India the second-largest producer of vegetables in the world, after China. The market for hybrid vegetable seeds is rapidly expanding in the country. Tomato, chillies and Okra are the key crops in hybrid vegetables and we have identified these crops as our primary crops for product development. We will also be participating in gourds, egg plant and watermelon market. Vegetables market is characterised by many segments due to varied customer needs and we have identified the priority segments in each crop to focus upon.

Seed Production System In India :

The Indian seed programme largely adheres to the limited generations' system for seed multiplication in a phased manner. The system recognizes three generations namely breeder, foundation and certified seeds and provides adequate safeguards for quality assurance in the seed multiplication chain to maintain the purity of the variety as it flows from the breeder to the farmer.

Breeder Seed

Breeder seed is the progeny of nucleus seed of a variety and is produced by the originating breeder or by a sponsored breeder. Breeder seed production is the mandate of the Indian Council of Agricultural Research (ICAR) and is being undertaken with the help of;

i) ICAR Research Institutions, National Research Centres and All India Coordinated Research Project of different crops;

ii) State Agricultural Universities

(SAUs) with 14 centres established in different States;

iii) Sponsored breeders recognized by selected State Seed Corporations, and

iv) Non - Governmental Organizations.

ICAR also promotes sponsored breeder seed production programme through the National Seeds Corporation (NSC) / State Farms Corporation of India (SFCI), State Seeds Corporation (SSCs), Krishi Vigyan Kendras (KVKs) etc. There has been a steady increase in the production of breeder seed over the years.

The indents from various seeds producing agencies are collected by the State Departments of Agriculture and submitted to the Department of Agriculture and Cooperation (DAC), Ministry of Agriculture, Government of India, which is turn compiles the whole information crop wise and sends it to the Project Coordinator/ Project Director of the respective crops in ICAR for final allocation of production responsibility to different SAUs/ICAR institutions.

The actual production of breeder seed by different centres is intimated to DAC by ICAR. In the case of varieties which are relevant only to a particular State, the indents for breeder seed are placed by the concerned Director of Agriculture with the SAUs/ICAR institutions located in the State. The breeder seed produced is lifted directly by the Director of Agriculture or foundation seed producing agencies authorized by him.

Foundation Seed

Foundation seed is the progeny of breeder seed and is required to be produced from breeder seed or from foundation seed which can be clearly traced to breeder seed. The responsibility for production of foundation seed has been entrusted to the NSC, SFCI, State Seeds Corporation, State Departments of Agriculture and private seed producers, who have the necessary infrastructure facilities. Foundation seed is required to meet the standards of seed certification prescribed in the Indian Minimum Seeds Certification Standards, both at the field and laboratory testing.

Certified Seed

Certified seed is the progeny of foundation seed and must meet the standards of seed certification prescribed in the Indian Minimum Seeds Certification Standards, 1988. In case of self pollinated crops, certified seeds can also be produced from certified seeds provided it does not go beyond three generations from foundation seed stage-I.

The production and distribution of quality/certified seeds is primarily the responsibility of the State Governments. Certified seed production is organized through State Seed Corporation, Departmental Agricultural Farms, and Cooperatives etc. The distribution of seeds is undertaken through a number of channels i.e. departmental outlets at block and village level, cooperatives, outlets of seed corporations, private dealers etc. The efforts of the State Governments are being supplemented by NSC and SFCI which produce varieties of national importance. NSC markets its seeds through its own marketing network and also through its dealer network. SFCI markets its seeds mainly through the State Departments of Agriculture and the State Seed Corporations. The production of certified seed by NSC and State Seed Corporations is mainly organized through contract growing arrangements with progressive farmers. SFCI undertakes seed production on its own farms. The private sector has also started to play an important role in the supply of quality seeds of vegetables and crops like hybrid maize, sorghum, Bajra, cotton, castor, sunflower, paddy etc.

Conclusion :

The Indian Seed Improvement Programme is backed up by a strong crop improvement programme in both the public and private sectors. At the moment, the industry is highly vibrant and energetic and is well recognized in the international seed arena. Several developing and neighbouring countries have benefited from quality seed imports from India. India's Seed Programme has a strong seed production base in terms of diverse and ideal agro-climates spread throughout the country for producing high quality seeds of several tropical, temperate and sub-tropical plant varieties in enough quantities at competitive prices. Over the years, several seed crop zones have evolved with extreme levels of specialization.

Similarly, for post harvest handing, the Indian seed processing/

conditioning industry has perfected the techniques of quality up-gradation and maintenance to ensure high standards of physical condition and quality. By virtue of the diverse agro-climates several geographical zones in the country have emerged as ideal seed storage locations under ambient conditions. In terms of seed marketing and distribution, more than about 20000 seed dealers and distributors are in the business.

Over the years, seed quality specifications comparable to international standards have been evolved and are adopted by the Indian Seed Programme in both the public and private sectors. The country has a strong rigorous mechanism for seed quality control through voluntary seed certificate and compulsory labelling monitored by provincial level Seed Law Enforcement Agencies. For seed technology research, India has a national level Directorate under the Indian Council of Agricultural Research as well as Status level research set up in the State Agricultural Universities. In seed education, 4-5 prominent State Agricultural Universities offer post graduation in Seed Technology leading to M.Sc./Ph.D Degree. The seed industry has three well reputed national level associations apart from several provincial level groups to take care of the interests of the industry.

Thus, the Indian Seed Programme is now occupying a pivotal place in Indian agriculture and is well poised for continued growth in the years to come. National Seeds Corporation, which is the largest single seed organization in the country with such a wide product range, pioneered the growth and development of a sound industry in India. NSC, SFCI, States Seeds Corporations and other seed producing agencies are continuously and gradually expanding all its activities especially in terms of its product range, volume and value of seed handled, level of seed distribution to the un-reached areas, etc. Over the past four decades, these seed producing agencies have built up a hard core of competent and experienced seed producers and seed dealers in various parts of the country and have adequate level of specialization and competence in handling and managing various segments of seed improvement on scientifically sound and commercially viable terms.

Bibliography

"The Indian Seed Industry" by Credit Analysis & Research Ltd., January 2014

"MANAGEMENT DISCUSSION & ANALYSIS", by Kaveri Seed Company, Robust Fundamentals. Rapid Consolidation, 2016.

Indian Seed Sector

"INDIA SEED INDUSTRY OUTLOOK TO FY'2018 - RAPID HYBRIDIZATION IN VEGETABLES, CORN AND RICE TO IMPEL GROWTH", by Ken Research, April 2013

"Understanding the Seed Industry: Contemporary Trends and Analytical Issues", Bharat Ramaswami, Indian Statistical Institute, August 2002.

"Role of Biotechnology in Crop Improvement", National Seed Association of India - Vol 10 No. 1 Jan-April 2017

OPERATIONAL GUIDELINES ON SUB-MISSION ON SEEDS AND PLANTING MATERIAL (SMSP) UNDER NATIONAL MISSION ON AGRICULTURAL EXTENSION AND TECHNOLOGY (NMAET)

1. INTRODUCTION :

Agriculture and allied sector accounts for 14% of the country's GDP, 13% of overall exports and provides employment to over 50% of the work force in the country. Being both a source of livelihood and food security for a vast majority of the population, its performance assumes great significance for poverty reduction and gender equality. In order to achieve this objective, various schemes & programmes have been launched by the government with emphasis on improving farm productivity, enhancing agricultural research, education and extension enabling development, infusion of appropriate technologies and improving the conditions of farming community on sustainable basis.

The production of foodgrains during 2012-13 was at 255.36 million tonnes, comprising of 128.20 million tonnes during Kharif season and 127.16 million tonnes during the Rabi season. Of the total foodgrains production, production of cereals was 236.92 million tonnes and pulses 18.45 million tonnes.

A Central Sector Scheme 'Development and Strengthening of Infrastructure Facilities for Production and Distribution of Quality Seeds' is being implemented on all India basis from the year 2005-06 aiming at ensuring production and multiplication of high yielding certified/quality seeds of all crops and making them available to the farmers. Although the existing scheme has contributed in doubling the availability of quality seeds in the country during the last 5 years, a need has been felt to upgrade and expand the existing scheme into a Mission mode in order to include new/emerging technologies in production of quality/certified seeds, improve seed testing laboratories, support seed producing agencies in adopting new seed producing technologies etc. It will improve the availability of quality seeds to the farmers and at a reasonable price in a time bound manner.

Accordingly, during the XII Plan, a Sub-Mission for Seed and Planting Material (SMSP) under National Mission on Agricultural Extension and Technology (NMAET) will be implemented. SMSP will cover the entire gamut of seed production chain, from production of nucleus seed to supply of certified seeds to the farmers, to provide support for creation of infrastructure conducive for development of the seed sector, support to the public seed producing organisations for improving their capacity and quality of seed production, create dedicated seed bank to meet unforeseen circumstances of natural calamities, etc. The other Central Sector Scheme implemented by Seed Division, viz., Implementation of PVP Legislation has also been subsumed under the SMSP.

2. MISSION TARGETS

- Increasing production of certified/ quality seed
- Increasing SRR more particularly to achieve higher SRR in crops like paddy, gram, groundnut, cotton etc. As follow-up of the recommendations of Consultative Group of the Ministry of Agriculture, the increase in SRR is proposed below:-
- Upgrading the quality of farm saved seeds with specific objective to cover 10% villages and produce 100 lakh quintals of seed each year through farmers participatory seed production.
- Encouraging seed treatment particularly for farm saved seed.

(Quantity in lakh quintal)

No.	Type	Existing SRR	Proposed SRR
1	Self-pollinated crops	25%	33%
2	Cross-pollinated crops	33%	50%
3	Hybrids	100%	100%

- Strengthening the seed multiplication chain through assistance to public and private sector.
- Popularizing new varieties to encourage varietal replacement.
- Promoting new technologies and methodologies in seed production, processing, testing etc.
- Strengthening and modernizing infrastructure for seed production, storage, certification and quality control particularly to ensure compliance with the provisions of the Seeds Bill 2004/ISTA standards, OECD certification.
- Facilitating movement of seed from India in international trade and increase its share to 10% by 2020 as envisaged in the new policy on seed development.
- Assisting and supporting public and private seed producing organizations in seed sector and encourage partnerships.
- Ensuring availability of seed in contingent situations.
- Facilitating dissemination of seed related information through information, education and communication.
- To provide an effective system for protection of plant varieties, the rights of farmers as well as plant breeders and to encourage the development of new varieties of plants, through PPV&FRA.

3. MISSION INTERVENTIONS:

3.1 Strengthening of Seed Law Enforcement:

Department of Agriculture of State / UT are eligible for Financial Assistance for re-imbursement of cost of seed sample @ Rs. 10.00 lakh, Travelling Allowance for notified seed inspectors of Seed Law Enforcement Authority (as per the admissible rate) for Rs.3.00 lakh per State and for creation of awareness through printing and distributing the books and pamphlets on seed quality @ Rs.2.00 lakh per State per year. Financial Assistance will be available up to 75% from Central share and 25% from the state share.

3.2 Strengthening of Central Seed Committee (CSC) and Central Seed Certification Board (CSCB).

An amount of Rs.10.00 lakh per year may be provided for TA / DA for non-official members of CSC & CSCB and its sub-committees, Rs.5.00 lakh per year for Purchase of books, computers etc. for the technical staff, Rs.30.00 lakh per year for Payment of consultancy service for OECD consultant, Printing and publication of Compendium on seed Rs.25.00 lakh per year for Membership of International Organizations /

Associations like OECD, ITPGFRA etc. and Rs.25.00 lakh per year for participation in international meetings, foreign travels etc. for attending meetings, trainings, seminars, conferences etc.

3.3 Office Automation & Communication facility

Financial assistance will be available to each seed certification agency for supporting Office automation & Communication facility up to Rs.50.00 lakh per SCA for the entire Mission period. The financial assistance will be considered on case to case basis for the following component as per requirement:

- Office automation;
- Computerization;
- Purchase of equipment including cameras; machines for printing of tag;
- Information systems;
- Communication systems;

3.4 Seed Treatment (Share 75% GOI and 25% State)

State Government, Seed Corporations, and Cooperative shall be eligible for financial assistance under this. Assistance will be available up to 75% of the cost as subsidy for cost of seed treatment @ Rs.100.00 per Qntl. of seeds. The maximum central assistance permissible for one agency per year will be Rs.20 lakh. The costs are suggestive and can be revised by the Department of Agriculture & Cooperation,

Government of India as per requirement to retain dynamism and flexibility.

3.5 Promotion of seed export (Share 100% GOI)

Agri-business institution/enterprise with international trade expertise will be eligible for assistance under the project. Modalities for selection

of the firm will be decided by the ECS. However, rate of assistance would be as under:

3.5.1 Assistance of freight charges from seed store/ware house to port of exit @30% of the actual cost subject to maximum of Rs.3.00 lakh per beneficiary (20 units).

3.5.2 Assistance to exporter/ producer/growers for set up of seed conditioning unit for conditioning the seeds for export including controlled storage unit @40% of the actual cost subject to maximum of Rs.10.00 lakh per beneficiary (19 units).

3.5.3 Up-gradation of Seed Testing Laboratory upto the ISTA Standard to issue the orange certificate for international seed trade @25% of the actual cost subject to maximum of Rs.5.00 lakh per beneficiary (10 laboratories).

3.6 Seed Processing Plant (Share 100 % GOI)

3.6.1 Establishment of Seed Processing Plants : Grants-in-aid will be provided according to modular design of 1000 MT, 2000MT, 3000 MT, 4000MT and 5000MT annual capacity of seed processing. The grant shall be available at the following rates:

(Costs Rs. In lakh)

Annual Capacity (in Ton)	Cost of Main Equipment	Cost of Supporting Equipment	Total Cost
1000	27.9	9.90	37.80
2000	32.90	10.10	43.00
3000	47.10	13.90	61.00
4000	56.20	20.70	76.90
5000	62.80	21.30	84.10

3.6.2 Construction of building, receiving shed, drying platform, etc: Financial assistance for construction of building required for Seed processing plant and other supporting structure will be provided as under:

Annual Capacity of plant (Ton)	Plant building and receiving shed			Drying Platform			Grand total (Rs. In lakh)
	Size (sqm)	Rate (Rs/ Sqm)	Total cost (Rs in lakh)	Size (sqm)	Rate (Rs/ Sqm)	Total cost (Rs in lakh)	
1000	450	7000	31.50	100	1200	1.20	32.70
2000	525	7000	36.75	200	1200	2.40	39.15
3000	700	7000	49.00	300	1200	3.60	52.60
4000	800	7000	56.00	400	1200	4.80	60.80
5000	1000	7000	70.00	500	1200	6.00	76.00

The implementing agency will have the flexibility to establish / seed processing unit of desired capacity as assessed by them and financial assistance will be provided on prorata basis

3.7 Seed Storage (Share 100% GOI)

3.7.1 Seed Storage : The financial assistance towards cost of construction for various type of seed storage godowns including pallet/ racks, cover, sprays, dusters etc. required for safe storage of seeds will be provided as under.

Particulars	Capacity (MT)	Size sqm	Rate (Rs/ Sqm)	Total cost (Rs. in lakh)
Store with AC/ GI sheets	1000	700	7000	49.00
Ventilated Flat roof stores	1000	700	7500	52.50
Dehumidified store	100	100	14000	14.00
Air conditioned & dehumidified store	100	100	18000	18.00

3.7.2. Modernization / Strengthening of existing Seed Storage

Financial assistance for modernization of existing Asbestos Sheet stores / ventilated flat roof stores, to dehumidified or to air conditioned & dehumidified stores will be provided at a

differential cost @ Rs. 6500 per sqm. and Rs. 10500 per sqm. respectively.

The grants-in-aid @ Rs. 4000/- sqm. will also be provided for modernization of dehumidified storage to the level of air conditioned and dehumidified stores. The implementing agency will have the flexibility to establish /strengthen/modernize seed stores of desired capacities / capacity as assessed by them as per given modular pattern and financial assistance will be provided on pro-rata basis

3.8 Transport Subsidy (Share 100% GOI)

The topographic and the climatic conditions in North Eastern States including Sikkim, J&K, Himachal Pradesh, Uttarakhand and hilly areas of West Bengal are not conducive for seed production. Therefore, to ensure availability of certified/quality seeds to the farmers of identified States at affordable price, this component has been initiated. Only certified/ quality seeds of cereals, oilseeds, pulses, fibres, vegetable seeds and fodder crops shall be eligible for subsidy under the scheme. Potato seed tuber and spices are excluded from the purview of this scheme.

3.8.1 Movement of Seeds from outside the States :

100% difference between road and Rail transportation charges will be reimbursed to the implementing States/ Agencies for Movement of Seeds produced outside the

States and moved to these identified States Capital / district head quarter.

3.8.2 Movement of Seeds with in the States : Actual cost restricted to maximum limit of Rs.120 per qtls. whichever is less for movement of seeds transported within the State from States Capitals / District Head Quarters to sales outlets / sale counters will be reimbursed to the identified States.

3.9 Assistance for purchase of Machinery, plant building, receiving shed and drying platform : The maximum assistance to the implementing agencies will be given for purchase of machinery upto the capacity of 3000 tonnes per annum at the place where NSR has been maintained. The financial assistance will be provided in the enlarged proportion based on the criteria fixed/specified and shall be available at the following rates:-

Items	Capacity (in MT)		
	1000	**2000**	**3000**
Equipment & Machinery cost (Rs. in Lakhs)	37.80	43.00	61.00
Size in sqm. @ Rs. 7000/sqm.	450	525	700
Plant building cost (Rs. in lakh)	31.50	36.75	49.00
Size in sqm. @ Rs. 1200/sqm.	100	200	300
Drying platform cost (Rs. in lakh)	1.20	2.40	3.60
Total	**70.50**	**82.15**	**113.60**

The equipment/machinery can be added/modifications made as per requirement and certified by the Department from time to time. Modernization and strengthening may require replacement of machinery as per the life span of the machines.

4 Summary of pattern of Assistance : The component-wise pattern of assistance for SMSP under NMAET during XII Plan is summarised as under:

Sr. no	Intervention	Pattern of funding		Rate of Assistance
1	Strengthening for Seed Quality Control	100% GOI share, except a new sub-component with 75: 25 Centre : State share	(i)	Seed Testing Laboratories: Equipments for Seed Testing Laboratories: Assistance for Rs.60 lakh per laboratory will be available for laboratory equipments . Details of equipments and estimated cost for handling approximately 10,000 samples per year in a laboratory is given at Annexure–II. Renovation of Seed Testing Laboratory: Rs. 20.00 lakh available for renovation of a seed testing laboratory with capacity of 10,000 seed samples with area of 250 Sqm. Equipments for DNA Finger Printing / Varietal Purity- Testing Laboratory: Assistance for Rs.70 lakh will be available for DNA finger-printing facility at one notified seed testing laboratories Specialised seed health testing units: Assistance for Rs. 55.00 lakh will be available to establish/strengthen one specialized seed health testing laboratory. Payment of ISTA fee : Financial assistance of Rs.15 lakh will be available to the maximum 5 Seed Testing Laboratories functioning under NSRTC, State Government/Union Territories, Seeds Corporations, and Seed Certification Agencies to obtain / running the membership of International Seed Testing Association (ISTA).
			(ii)	Strengthening of Seed Law Enforcement: Assistance for re-imbursement of seed sample cost @ Rs. 10.00 lakh is available. (75% centre :25 % State)
			(iii)	Support to the National Seed Research and Training Center: Financial assistance of Rs. 12.00 crore will be provided to NSRTC for salary wages, maintenance of facilities and other routine activities and administrative expenditures for 3 years. Development of Centralized Seed Certification Portal at NSRTC : Financial Assistance will be provided for development of software and hardware @Rs. 20.00 lakh per State Seed Certification Agency Centralized Seed Certification Portal at NSRTC for giving linkage to the 25 SSC.
			(iv)	Training and workshop : Financial assistance of Rs.2.00 lakh will be available for training on seed related activities viz. training of 25 persons for 5 days training course.

			(v)	Strengthening of Central Seed Committee and Central Seed Certification Board: Financial assistance of Rs..10.00 lakh per year is available for TA / DA for non-official members of CSC & CSCB and its sub-committees.
2	Strengthening of Grow Out Test(GOT) Facilities	100% GOI	(i) (ii)	Grow-out Test Farm: Financial assistance of Rs.50.00 lakh for strengthening of 5 hectare of GOT farm. Green House facility: An assistance of Rs.10 lakh will be available for establishment of Green House facility to the eligible organizations.
3	Support to Seed Certification Agencies	25 % GOI : 75% State	(i) (ii)	Salary for the Staff: Rs.50.00 lakh, per agency, per year. will be available for staff which are involved in seed management; field inspection; sampling; analysis; monitoring; evaluation, certification and pre and post harvesting supervision etc. Travelling allowance: 25% of the total cost of travelling allowance subject to maximum limit of Rs. 10.00 lakh per agency to conduct of inspection, analysis and certification activities, the mobility of staff through jeep and motor cycle is proposed based as one for every 800 hectare and 400 hectare respectively.
			(iii)	Office Automation & Communication facility : Financial assistance will be available to each seed certification agency for supporting Office automation & Communication facility up to Rs.50.00 lakh per SCA.
4	Seed Treatment	75 % GOI : 25% State		Financial assistance will be available up to 75% of the cost as subsidy for cost of seed treatment @ Rs.100.00 per qntl. of seeds with maximum central assistance for one agency per year will be Rs.20 lakh.
5	Promotion of Seed Export	100% GOI	(i) (ii) (iii)	Assistance freight charges from seed store/ware house to port of exit @30% of the actual cost subject to maximum of Rs.3.00 lakh per beneficiary (20 units). Assistance to exporter/producer/growers for set up of seed conditioning unit for conditioning the seeds for export including controlled storage unit @40% of the actual cost subject to maximum of Rs.10.00 lakh per beneficiary (19 units). Up-gradation of Seed Testing Laboratory upto the ISTA Standard to issue the orange certificate for international seed trade @25% of the actual cost subject to maximum of Rs.5.00 lakh per beneficiary (10 laboratories).

6	Support for R&D, contract Research and Acquisition of New Varietal Products.	60 % GOI : 40% State		Assistance of 60% subject to maximum of Rs.1.15 crore will be provided to prepare a project for acquisition of new varietal project, technology Contract Research, setting up of R&D Unit, etc. The beneficiary institute has to provide the detail financial backup of remaining 40% of the project.
7	Strengthening of Seed Farms	75 % GOI : 25% State	(i)	75% financial assistance restricted to approved project cost to maximum limit of Rs.80.21 lakh including State share will be provided to by GOI to implementing agencies for each farm which comprises -.
			(ii)	Financial assistance of Rs.5.00 lakh will be provided for renovation of Staff Quarters including office building etc. for each farm Financial assistance of Rs.3.00 lakh will be provided for repairing of internal road etc. for each farm.
			(iii)	Financial assistance of total Rs.11.00 lakh will be provided for repair, purchase of farm machinery & equipments etc. as per cost norms for each farm
			(iv)	Financial assistance of total Rs.3.00 lakh will be provided for construction of farm machinery & equipments etc. sheds each farm
			(v)	Financial assistance of total Rs.3.65 lakh will be provided for construction /repairing of threshing floor @ Rs.730/sq. meter to a maximum of 500 sqm. for each farm
			(vi)	Financial assistance of total Rs.14.00 lakh will be provided for establishment of Seed Processing Plant 200 MT capacity including Building (Rs.9.80 lakh), approach road (Rs. 2.20 lakh), Drainage (Rs.2.20 lakh),
			(vii)	Financial assistance of total Rs.7.56 lakh will be provided for Seed Processing Machinery/supporting equipments etc. for each Farm
			(viii)	Financial assistance of total Rs.10.50 lakh will be provided for Pre-fabricated /or other type of Seed Storage Godown of 200 MT capacity for each Farm.
			(ix)	Financial assistance of Rs.5.00 lakh for development of irrigation facilities will be provided as under– (a) Shallow tube well (70-80 feet) Rs.1.50 lakh (b) Medium tube well (40 meter) Rs.3.00 lakh (c) Deep tube well (75 meter) Rs.3.90 lakh

			(x)	Assistance of total Rs.7.50 lakh maximum will be provided for Irrigation underground HDPs Pipeline etc. for each farm.
			(xi)	Financial assistance for Drip & Sprinkler Irrigation facilities will be provided as per NMMI or actual, whichever is less upto a maximum of Rs.10.00 lakhs.
8	Seed Village	100% GOI	(i)	Distribution of Seeds : 50% assistance will be provided for distribution of foundation / certified seeds required for 1 acre area per farmer for cereal crops.
			(ii)	Financial assistance @ 60% cost of foundation/ certified seeds of pulses, oilseeds, Green Manure & Fodder crops etc. required for 1 acre area per farmer will be provided.
			(iii)	Financial assistance of Rs.15000 per groups (50-150 farmers each groups) will be provided for farmers training on seed production and post-harvest seed technology (Rs.0.15 lakh)
			(iv)	Financial assistance for treating seeds produced in the Seed Village will be available @ 3500 per seed treating drum of 20Kg capacity and Rs. 5000 per drum of 40Kg capacity.
			(v)	To encourage farmers to develop storage capacity of appropriate quality, financial assistance will be given to farmers for purchasing Seed Storage bins. The rate of assistance will be as under. @33% for SC/ST farmers for 10 qtls. capacity Rs.1500 @33% for SC/ST farmers for 20 qtls. capacity Rs.3000 @25% for General farmers for 10 qtls. capacity Rs.1000 @25% for General farmers for 20 qtls. capacity Rs.2000
9	Certified seed production through seed villages	75 % GOI : 25% State	I.	75% financial assistance will be providing for foundation/certified seeds required for 1 acre per farmers for pulses, oilseeds, fodder and green manure crops.
			II.	Financial assistance @50% of seed certification charges actual or maximum of Rs.600/ha whichever is less. (Rs.0.60 lakh for 100ha. area)
			III.	Financial assistance @ Rs.15000 per groups (of 50-150 farmers each groups) will be provided for farmers training on seed production and post harvest seed technology will be provided.
			IV.	Assistance to establish seed processing and prefabricated or other type of seed storage godowns 150 sqm. @ Rs.10000 per sqm. to process and store 200 Mt capacity will be available for each seed village
			V.	Financial assistance of Rs.7.56 lakh will be provided for seed processing machinery and supporting equipments.

10	Seed Processing Plant	100%GOI	(i) (ii)	Financial assistance will be provided to modular design of 1000 MT and higher annual capacity seed processing capacity plants (wheat basis) @ Rs. 37.80 lakh and so on. Financial assistance for construction of building required for Seed processing plant and other supporting structure @ Rs. 32.70 lakh and so on.
11	Seed Storage	100% GOI	(i) (ii)	Financial assistance towards cost of construction for various type of seed storage godowns including pallet/ racks, cover, sprays, dusters etc. required for safe storage of seeds will be provided as per details annexed. Financial assistance for modernization of existing Asbestos Sheet stores / ventilated flat roof stores dehumidified or air conditioned and dehumidified stores will be provided at a differential cost @ Rs. 6500 per sqm. and Rs. 10500 per sqm. respectively. Financial Assistance @ Rs. 4000/- sqm. will also be provided for modernization of dehumidified storage to the level of air conditioned and dehumidified stores.
12	Transport Subsidy	100% GOI	(i) (ii)	100% difference between road and Rail transportation charges will be reimbursed to the implementing States/ Agencies for Movement of Seeds produced outside the States and moved to these identified States Capital / district head quarter. Actual cost restricted to maximum limit of Rs.120 per qtls. whichever is less for movement of seeds transported within the State from States Capitals / District Head Quarters to sales outlets /sale counters will be reimbursed to the identified States.
13	Assistance for maintenance of Breeder Seed	75 % GOI : 25% State		Financial assistance @ Rs. 99.98 lakh (Recurring and Non recurring) will be provided for maintenance breeding of nucleus seeds for further multiplication of breeder seeds of various agricultural crops.
14	National Seed Reserve	100% GOI	(i) (ii) (iii)	**Cost of Seeds (Revolving Fund) :** Financial assistance @ 100% of total procurement value of foundation and certified seeds will be given to the participating organizations in the form of revolving fund. **Maintenance Cost** : Maintenance cost pertaining to Processing charges, cost of packing material, labour costs involved in the packing, cost of certification will be provided to the implementing agency up to Rs.300 per qtls. and handling cost up to Rs.200 per qtls. subject to actual cost incurred by implementing agencies. **Cost of Seed Storage Infrastructure:-** Financial assistance will be provided in the enlarged proportion based on the criteria fixed/ specified in the guidelines as under:-

Particulars	Capacity M.T.	Size Sqm	Rate Rs./sq m	Total cost In Lac
Ventilated Flat roof stores	1000	700	7500	52

• **Electrification-** incurred on seed location = Rs. 2.62 @ 5% of cost of Rs. 52.50 lakh storage infrastructure for one lakh

• **Compound wall & internal roads** - @ 5% of cost of Seed Storage infrastructure for one location i.e., = Rs. 2.62 lakh

(iv) Cost of material handling equipment: Financial assistance will be provided @ Rs. 50 per qtls to the implementing agency for purchasing of material handling equipment.

(v) **Assistance for purchase of Machinery, plant building, receiving shed and drying platform:** The maximum assistance to the implementing agencies will be given for purchase of machinery upto the capacity of 3000 tonnes per annum at the place where NSR has been maintained.

Items	1000	2000	3000
Equipment & Machinery cost (Rs. in Lakhs)	37.80	43.00	61.00
Size in sqm. @ Rs. 7000/sqm.	450	525	700
Plant building cost (Rs. in lakh)	31.50	36.75	49.00
Size in sqm. @ Rs. 1200/sqm.	100	200	300
Drying platform cost (Rs. in lakh)	1.20	2.40	3.60
Total	**70.50**	**82.15**	**113.6**

(vi) **Cost of services outsourced for fumigation, spraying, maintenance of dust free environment staking, de-staking and other operations involving labour**:- Maximum assistance upto Rs. 10 per qtl or actual amount incurred (whichever is less) would be provided to the implementing agencies every year on the qty of seeds maintained by the implementing agency.

			(vii)	**Cost of condemnation /unfit seeds**: 10% qty of targeted qty for the National Seed Reserve may be allowed under cost of condemnation. **"The procurement value of the seeds of 10% of reserved qty or maintained qty (x)-value of seeds sold as commercial grain after condemnation (Y)= Reimbursable amount would be x-y".**
			(viii)	**Cost of computerization**: The lump sum financial assistance on the basis of requirement of Implementing agency would be provided to maintain the information on crop wise, variety wise qty maintained by the implementing agencies under NSR against the qty allotted by GOI.
15	Application of Bio-technology in Agriculture	100% GOI		Financial Assistance up to Rs. 2.50 crores for establishment of new Tissue Culture Unit and financial assistance up to Rs. 20 lakh for rehabilitation /strengthening of old tissue culture lab as per the item given in the details in the Scheme
16	Public Private Partnership in Seed Sector	50 % GOI : 50% State		The credit linked @ 50% of the cost of the project subject to maximum of Rs.50.00 lakh per beneficiary will be provided.
17	Assistance for Boosting Seed Production in Private Sector	100% GOI	a) b) c) d) e)	Credit linked back ended subsidy is enhanced @40% of the capital cost of the project in general areas and 50% in case of hilly and scheduled areas subject to an upper limit of Rs 150 lakhs per project Assistance will also be available for R&D. With subsidy as proposed, a Committee will be set up by the Department to recommend cases and monitor progress under the Scheme. An agency will be selected and designated by the Mission as the nodal agency subject to overall control of the Committee. 2% of the total fund utilized under the component will be allowed as administrative charges for the agency. Efforts will be made to popularize the Scheme and the 2% of the annual allocation will be allowed as cost for the same.
18	Support to Sub-Mission Director and Survey / Studies	100% GOI		Hiring of consultants @ Rs. 70,000/- (max) alongwith supporting staff and surveys/studies conducted for smooth/ effective implementation of the SMSP.
19	PPV&FRA	100% GOI		Funds have been allocated for the PPV&FRA for undertake day-to-day activities and mandated works under PPVFR Act.

Preparation Of Fertile Soil

-Mr. Pradeep Nikam

Preparation of fertile soil With Biomass:-

Collect available dry biomass like leaves, stubbles, twigs, weeds etc, soak it overnight and spread by layer on nursery bed of 3'x3'x10'. Every layer of biomass should follow a sprinkle of water a mixture of 1kg dung + 12 to 15 lit urine +1/2 lit urine + 2 kg soil. So the mixture of cereals, pulses and oilseed crop seeds of cereals, pulses and oilseed crop seeds.

The germinated 20days old plants are cut at ground level. Second sprouted crops of 40 days is also cut against to increase biomass in the bed and prepare most fertile soil bed. This bed can be used as nursery bed of paddy crops

- Green Maturing with agreen mixture of cereals, pluses or saunhaung/ dhaincha which is cut at ground level after 40 days of sowing.

- **Seed treatment :-**

  soak the desired verity of paddy seed material @22 to 22 kg/acre in solution of 2 %common salt (2kg salt in 100liters water).floating seed is discarded. Prepare a solution of 1 kg soil from road side + 2.3 kg cow, buffalo, bullock dung or urine. Treat the seed property to have uniform coating of the solution. The seed material is dried under shed. For one acre of paddy cultivation, 20kg seed material and 8 raised beds of 20'x3' are required. Paddy husk ash 30kg,karanj cake 40 kg is mixed well uniformly in the bed and seed is sown in line on the bed 10% urine is sprayed on 10days old seedlings.

- **Seedling treatment:-**

  212 days old seedling are taken out and only roots are dipped in the solution of 10kg dung ,20kg urine, 10kg goat litter ash/wood ash and 100 gm jiggery for 5-10 minutes. The same solution can be sprayed in the fired 10 days after transplantation. It helps in profuse growth of white roots.

- **Transplanting:-**

  Seedlings are transplanted in such a way that only root part of the seedling goes in the soil and not the white portion above the roods as while portion controls tilling material. This should be critically followed. seedlings are transplanted at 6'x6' spring with 3 seedlings /hill theses should be 12-14

  Seedling/sq. area to get 40-45 fruiting plants.

- **Organic manure balls:-**

  600kg cow /bullock/buffalo dung, 60 kg karanj/neem cake,15 kg paddy husk ash,120 lit urine and 1kg jiggery is mixed well with sufficient quality of water to prepare manure balls.

- 100 balls /guntha plot. One ball is placed at the centre of 4 seedling. Organic balls can either be applied to puddle field or placed in the centre of 3-4 seedlings at the time of transplanting.

- Jeevamrut solution of 10 kg dung +10 liters urine +1kg pulse flour green gram or soybean +1 kg jaggarey is tormented for not more than 4 days. It is diluted in 200 lit of water /acre and applied to soil 3 times at an interval of 20days.

New Opportunities in the field of Soil

Central Soil Salinity Research Institute

(Haryana)

The opportunities for salinity researches are enormous due to the size and diversity of the country, where all kinds of salt affected soils and waters of varying quality are encountered and require specific solutions. Newer technologies being unveiled in different areas of science like biotechnology, nano-technology, genomics, phenomics, space science, ICT etc. can be integrated into the existing approaches for the improved management of salt affected soils and poor quality waters. Such integration would lead to higher economic returns to resource poor farmers.

Remote sensing and GIS technology : In this technology sensors placed on the ground, in the air or in satellites catch the multi-spectral images, which are used to interpret for the following:

- To detect salt affected soils, which are yet to be reclaimed as well as areas undergoing secondary salinization. The precise identification of new salt affected areas would provide opportunities to extend the technologies in these areas.
- Identification of areas under resodification after reclamation.
- To enhance our capabilities to forecast the seriousness of soil degradation.
- To prepare accurate national inventories of salt and nutrient load in soils, vegetation, rivers etc.
- Early forecasting of areas prone to water logging and soil salinization.
- Proper distribution of water of canal systems leading to improved decision making.
- To identify types and health of crops as affected by water logging and soil salinity.

The existing technology is being upgraded for applications in agriculture in terms of resolution and precision.

Probabilistic modelling : Modelling can be of benefit in understanding risks related to salinity build-up, secondary salinization, resodification, water availability on regional and basin scale, deterioration of water quality, use and reuse of poor quality ground and drainage waters and agriculture production. The opportunities provided by technologies based on remote sensing and modelling is constrained by the ability to have ground truth and validation of the generated information.

Indian Council of Agricultural Research

Biotechnological approaches: The power of biotechnology as atool to address issues hitherto unresolved for harsh saline environments is evident from the following issues and strategies for the development of salt tolerant high yielding varieties.

- Introgression of salt tolerant quantitative trait loci (QTLs) like Saltol into popular rice varieties of the region enhancing their salt tolerance potential following backcrossing approach and identifying plants with desired genes in every generation to minimize the duration for the development of new salt tolerant varieties.
- Introgression of submergence tolerance QTL Sub 1A into popular rice varieties especially for coastal region following marker assisted backcross breeding to enhance the submergence tolerance of rice varieties besides significantly enhancing their economic yield.
- Tolerance to pests and disease can be enhanced by incorporating bacterial blight resistance genes (xa 5, xa13 and xa21) and blast resistance genes (Pi-2t and Pi-9t) into high yielding rice varieties through molecular breeding approach
- Development of recombinant inbred lines and near inbred lines from salt tolerant and sensitive lines of different crops

for the identification of QTLs for salt tolerance

- Development of transgenic lines by transferring different genes conferring salinity tolerance into desired crops to enhance salt tolerance potential of different crops.

Bioremediation products : Development of bioremediation products like microbial formulations through identified microbes to reclaim saline/ sodic soils and remediate poor quality waters laden with heavy metals. While application of such microbial formulations to degraded soil would enhance crop growth, poor quality waters contaminated with heavy metals can be remediated for safe use in irrigation once passed through a medium containing such microbes.

Nanotechnology : Nano-filtration, nano-materials and nano-particles have the potential to enhance efficiency of chemical amendments for reclamation of alkali soils and alkali waters and/ or develop effective alternative amendments for their reclamation. Nano-particles could also be used to enhance efficiency of fertilizers and other chemicals, water purification and waste water treatment. These could also be used to develop nano-sensors for non-destructive monitoring.

Water conservation technologies : Increasing rainwater use efficiency, irrigation through alternate wetting and drying, developing low water requiring crops, recycling and reuse of good and poor quality waters, reclamation techniques to increase the usage of reclaimed water from ground, industrial and municipal sources and identifying low water and salt tolerant growth stages in life cycle of different crops can have significant impact on crop's ability to tolerate water and salt stresses and/or ability to conserve water. These could also help to bring more areas under irrigation besides reducing impacts of climate change on the deterioration of water resources. These technologies have the potential to save water in agriculture and as a result are becoming more relevant.

Precision farming : By using satellite data to monitor soil conditionand plant growth, precision farming can help fine tune the placement of seeds, fertilizers and chemicals and application of water use at the right place and at the right time. It can potentially increase production and reduce production costs. Real-time kinematic global positioning system allows a tractor to position itself within an accuracy of 2 cm, thus reducing inefficiencies stemming from overlapping of input application or deep percolation losses.

Utilization of municipal and industrial waste : Due to increased urbanization and industrialization the generation of municipal/ industrial waste is increasing rapidly and its disposal has become a challenge. Research efforts are needed to use them in salt affected soils as reclamation agents as the sources of gypsum or pyrite are limited. The use of municipal/industrial waste will also contribute to 'Swachh Bharat Abhiyan' especially near cities, where heaps of municipal wastes are occupying good agricultural lands besides giving the area a filthy look and creating pollution.

Post-harvest and value addition : Food saved is food produced. With the concept of global village in place, surplus food needs to be processed for value addition for domestic consumption and export. The institute in association with its collaborators would initiate measures in this regard especially with respect to halophytes and seaweeds etc.

Marketing innovations : Agricultural marketing is now getting liberated and private players are participating actively in the process. Several innovative and alternate marketing systems are in place. This ongoing liberalization process and entry of private players in agricultural marketing have assumed an important dimension. A strong supply chain of inputs and sale of produce needs to be developed through multi stake holder partnership.

Management of energy and agricultural wastes : Energy requirement in agriculture is growing rapidly due to mechanization and intensification. To meet the future energy demand as well as to reduce the dependence on conventional (non-renewable) energy resources, there is a need to explore the alternative (un-conventional or renewable) energy sources from biological or natural resources. Bio-fuel from potential crops (e.g. sugar beet, Jatropha etc.) suited to coastal regions need to

be explored. Coastal regions are highly suited to generate energy from natural sources such as wind, waves and tides etc. These alternative energy sources can be harnessed for agriculture in the coastal regions.

Bio-risk management : Bio-risk is increasing in agriculture due to climate change and increase in trans-boundary movements of insect-pests and diseases. It adds to the cost, reduces food production and adversely affects farm income. To overcome the problem of bio-risks, efforts would be made to develop effective and integrated risk-and-disaster management production systems and institutional mechanisms, which would bear risk. Bio-risk intelligent system (such as early warning systems for heavy rainfall, climatic disaster, drought indicators, migratory movement of bio -risk agents, etc.) would be developed for taking informed decision at the local, regional and national levels.

Information and communications technology: This can be an effective tool to manage salt affected soils and poor quality waters as farmers can be exposed to newer technologies and improved practices through these techniques in a faster and cost-effective manner.

Emerging Issues in Agricultural Sustainability : An Indian Perspective

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Indian agriculture has under gone many structural transformations since independence with the onset of a green revolution, a white revolution, a yellow revolution and a blue revolution. Notwithstanding the declining share of agriculture in GDP, the higher share in employment, increased demand for protein with change in income profile, higher potential for exports have made agriculture an important sector .Thus, the development in this sector is high on the agenda of the government. It is widely recognized that any adverse development in this sector has a multiplier effect on the entire economy. The famous quote by Samuel Johnson thus was *"Agriculture not only gives riches to a nation, but the only riches she can call her own"* However, the agriculture sector is characterised by instability in incomes owing to various types of risks related to production, markets and prices

It is therefore necessary to achieve sustainability in agriculture in terms of food security to the changing human needs with improved quality food, rural employment, and environmentally sustainable technologies such as soil conservation, sustainable natural resource management and biodiversity protection. In many senses, sustainable agriculture is critical for sustainable industrial and overall economic development. Apart from the economic growth dimension of agriculture the recent past episodes of high food inflation has added a new dimension to agriculture sustainability in terms of price stability and credible monetary policy.

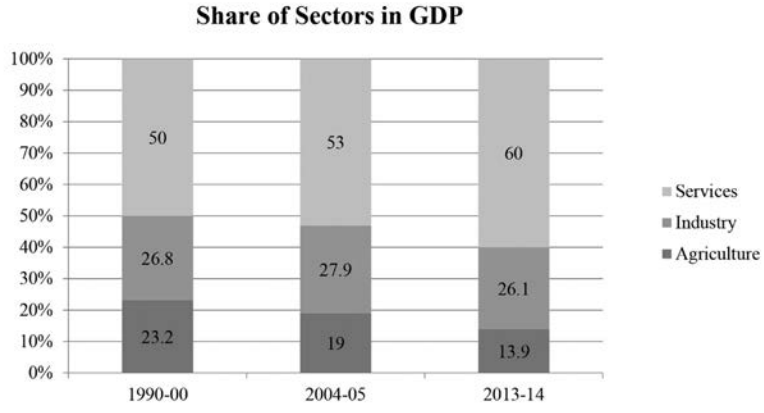
Against the above drop back the present article discusses the emerging issues in agricultural sustainability in terms of economic growth, employment, food inflation and risks in agriculture highlighting some aspects of food management.

1. Growth in Agriculture in India

Agriculture sector is an important constituent of the Indian economy with around 54.6 % of the population engaged in *Agriculture and allied activities* (census 2011) and it contributes 17 % to the country's Gross Value Added (current price 2015-16, 2011-12 series). The share of agriculture in India's GDP has been declining, yet agriculture and

its allied sectors like forestry and fishing contributes nearly 14% to India's GDP and accounts for about 11% of our exports, besides being the source of raw material for a large number of industries (Table 1).

Table 1: Sector-wise share in GDP



Source: Planning Commission, FICCI Research

Agricultural GDP growth saw an increase of 5 per cent every in 2005-06 and 2007-08. Due to good monsoons, there was an increase of agricultural GDP growth in 2010-11 and 2011-12. The average growth rate in the agricultural sector in the five years till 2013-14 was 4.1 per cent. According to the advanced estimates of Central Statistical Organisation, Agriculture and allied sectors recorded a growth of 8.3 per cent in FY15.

1.1 Agriculture Gross Value Added (GVA)

Agriculture and allied sector contributed approximately 17 per cent of India's GVA at current prices during 2015-16. There has been a continuous decline in the share of Agriculture and allied sector in the GVA from 18.2 per cent in 2012-13 to 17 per cent percent in 2015-16 at current prices. Falling share of Agriculture and Allied sector in GVA is an expected outcome in a fast growing and structurally changing economy (Table 3).

Table 3 : GVA of agriculture

Items	Year			
	2012-13	2013-14	2014-15	2015-16
A of Agriculture and allied sectors (Rs. crore)	1680797	1902452	1995251	2093081
per cent to total GVA	18.2	18.3	17.4	17

Source : Central Statistics Office, Ministry of Statistics and Programme Implementation, Govt. of India.

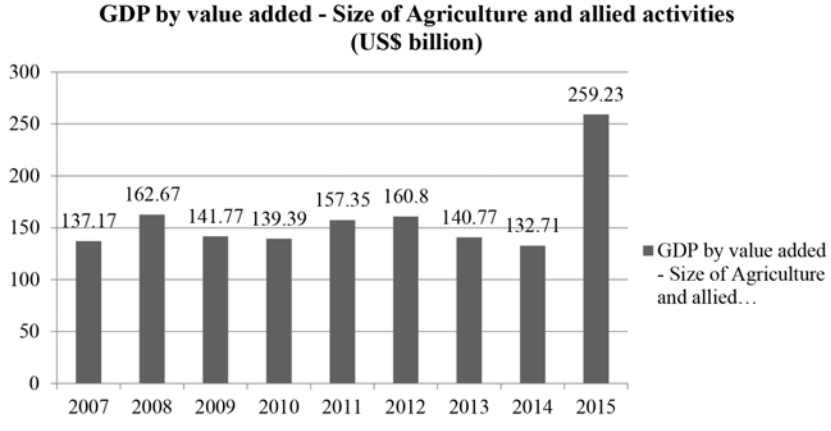
Growth in the total GVA of the economy and that in the GVA of Agriculture and allied sector at 2011-12 basic prices is depicted in Table 4 and chart 1.

Table 4 : Total GVA and agriculture and allied sector GVA growth

Period	Total GVA (in per cent)	Agriculture and allied sector GVA (in per cent)
2012-13	5.4	1.5
2013-14	6.3	4.2
2014-15	7.1	-0.2
2015-16	7.2	1.2

Source : Central Statistics Office.

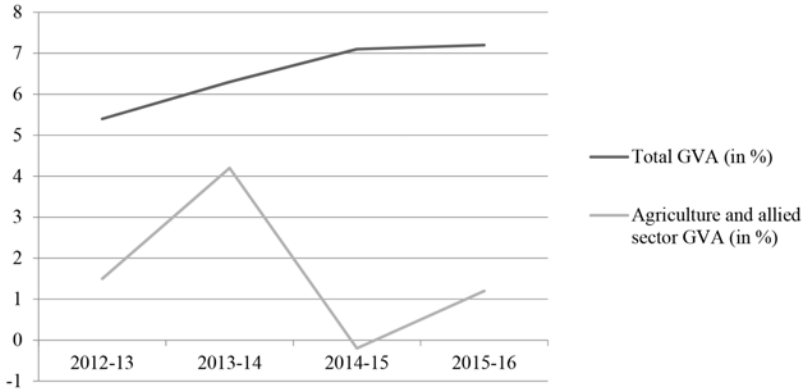
Table 2 below presents the GDP by value added.



Source: Ministry of Agriculture, Print Release, RBI, TechSci Research

Agriculture and allied sector witnessed a growth of 1.5 per cent in 2012-13, 4.2 per cent in 2013-14, -0.2 per cent in 2014-15 and 1.2 per cent in 2015-16 (at 2011-12 basic prices).

Chart 1: Recent Trends in total GVA and agriculture and allied sector GVA



The agriculture sector in India is expected to generate better momentum in the next few years due to increased investments in agricultural infrastructure such as irrigation facilities, warehousing and cold storage. Factors such as reduced transaction costs and time, improved port gate management, and better fiscal incentives would contribute to the sector's growth. Furthermore, the growing use of genetically modified crops will likely improve the yield for Indian farmers.

2. Employment in Agriculture

Agriculture is the primary source of livelihood for about 58 per cent of India's population. Agriculture provides employment to not only the adult males of the households but also to the household's women. Women work extensively in production of major grains and millets, in land preparation, sowing, applying manure, weeding, winnowing and harvesting.

India's overall employment growth since 2004-05 has been poor. On an average, 2 million people were added to the workforce since 2004-05 compared to an average of 12 million people that were added to the workforce every year between 1999-00 and 2004-05. However, the addition to non-agricultural employment has been increasing, whereas the size of the workforce in agriculture declined by around 30.57 million between 2004-05 and 2011-12.

The percentage of people employed in agriculture and allied sector has been consistently declining, from around 60 per cent in 1999-00 to 49 per cent in 2011-12.(Table 5)

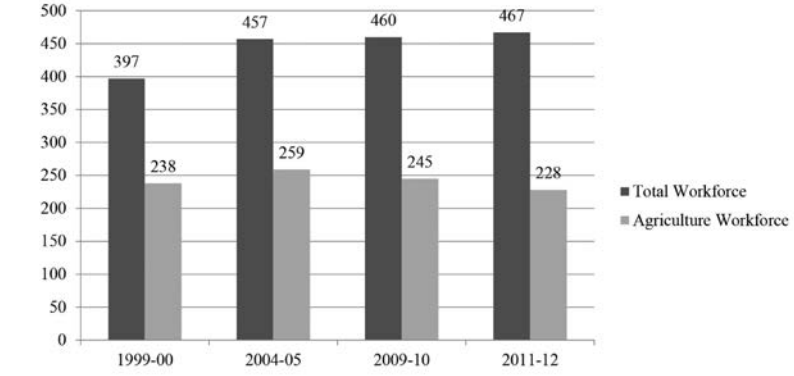
3. Food Inflation

In any competitive, developing economy, fluctuations in prices are necessary for its efficient functioning. But when these fluctuations become extremely uncertain and volatile over a considerable period of time, that's when issues arise. Historically, such instances have been infrequent the world over. The probability of occurrence of such instances is low but when they do take place, high socioeconomic costs and risks are involved.

When it comes to agricultural output, India is one of largest countries in the world. About 60 % of the total land area in India is used for agriculture. The agriculture sector employs more than 50 % of the workforce but contributes only 14 % to the GDP.

According to a 2016 study by the International Monetary Fund (IMF), as India continues to grow economically, with increasing incomes, a shift can be expected

Table 5 : Total work force and agricultural sector work force

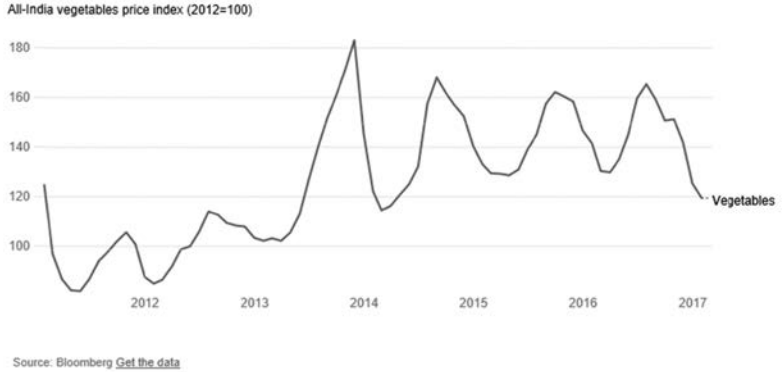


Source: NSSO, FICCI Research

from simple, plant dominated diet towards such high value products as dairy products, fruits, vegetables, proteins, etc. Overall the Indian economy has been growing phenomenally since the past few years but the growth in agriculture has remained stagnant. Increasing demand for food especially dairy products and proteins and excessive buffer stocks have only contributed to food price volatility.

Volatility in the prices of food is primarily responsible for volatility in the overall prices in India since the past few years. Volatility in pulse prices has been contributing to the overall food price volatility. In a country like India, where pulses form one of the most important part of our diet, this is highly undesirable. The area for growing pulses in the country has not increased over the years whereas the demand for pulses is ever-increasing. To meet the domestic demand, India has been importing pulses. Further, farmers also prefer to cultivate cash crops due to unpredictable monsoons and farm prices. With rising global prices and the need for importing to bridge the demand-supply gaps, domestic prices have not been under control.

Chart 2: All India vegetable prices



However, more recently, food inflation is witnessing a downward trend. For the past three years the contribution of food inflation to overall inflation has been declining significantly. It can be said that India is shifting towards low inflation (Chart 2).

The above graph shows that vegetable prices are quite volatile. Sharp declines have often been followed by an upward spike.

The trends in general headline inflation and food inflation are set out in chart 3. The trends in food inflation, vegetable inflation and pulses inflation are in chart 4.

Chart 3 : Trends in General Inflation and Food Inflation

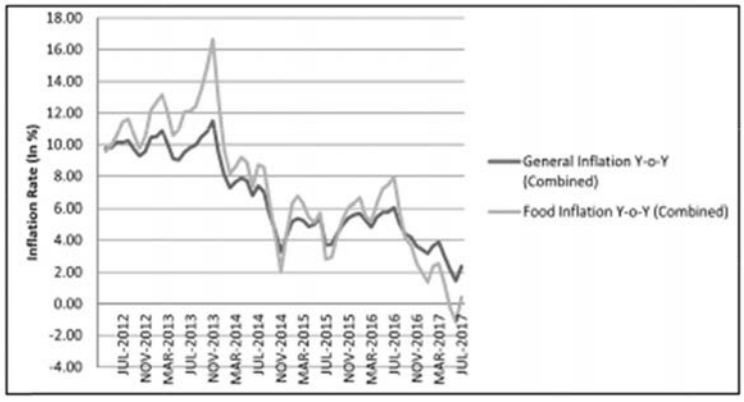
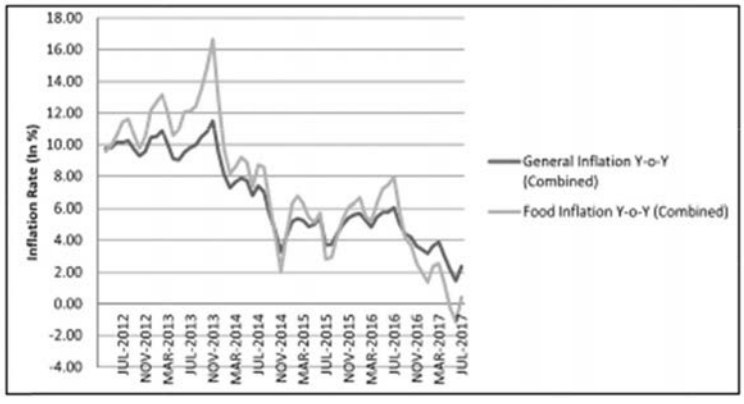


Chart 4 : Trends in food , vegetable and pulses inflation



During 1980s-1990s, "Green Revolution" included a set of policy interventions along with subsidies, incentives, technological advancements, limited food inflation and increased cereal productivity. During the 1990s and 2000s, agriculture supply growth fell and so did cereal production. But buffer stocks helped to limit the inflation.

Global food prices began to surge during 2007-08. There was a decline in buffer stocks as well. The government increased the subsidies, minimum support prices which prolonged inflationary pressures. 2009 saw insufficient rainfall affecting key crops that elevated inflation even in 2010. Food inflation exceeded non-food inflation by almost 7.5 percentage points

Between 2005-06 and 2011-12, private consumption was increasing but declined between 2012-13 and 2013-14. While agricultural GDP growth saw an increase of 5 per cent every year between 2005-06 and 2007-08, private consumption grew by 9 per cent. These pressures on the demand side coupled with the global financial crisis, led to significant increases in the relative food prices in India. 2010-11 and 2011-12 witnessed a good monsoon, leading to recovery of agricultural GDP growth. Further, private consumption also grew in moderation given the general economic slowdown, which ensured that the relative food prices remained stable during this period. It can be observed that food inflation was at its highest in November 2013. Also, recent figures show that food inflation has been witnessing a deflationary trend primarily in vegetables and pulses leading to low food inflation levels. The nature and composition of food inflation as well as dietary habits have changed dramatically over the years. Bridging the gap between demand and supply has been challenging. The recent trends of low inflation rate have been a welcome change but we need to ensure its sustainability.

4. Risks in agriculture and food management

Agriculture, like other economic activity entails risks. Risks are categorized as production risks, credit risks, market risks and price risks The Indian farmer faces price uncertainties, for his produce in seasons during a year, across years owing to supply and demand fluctuations, speculation and hoarding by traders. The price risks emanating from an inefficient APMC market are severe for farmers in India since they have very low resilience owing to the perishable nature of produce, inability to hold produce, hedge in surplus/shortage scenarios or to insure against losses.

The main objectives of food management is procurement of foodgrains from farmers at remunerative prices, distribution of foodgrains to consumers, particularly the vulnerable sections of society at affordable prices and maintenance of food buffers for food security and price stability. The instruments used are Minimum Support Price (MSP) and Central Issue Price (CIP). The nodal agency which under takes procurement, distribution and storage of foodgrains is the Food Corporation of India (FCI). Procurement at MSP is open-ended, while distribution is governed by the scale of allocation and it's off take by the beneficiaries. The off take of food grains is primarily under the Targeted Public Distribution System (TPDS) and other welfare schemes of the Government of India. Foodgrains, pulses and minor crops are procured at the Minimum Support Price (MSP) fixed by the Government.

The Decentralised Procurement Scheme (DCP) which was introduced in 1997-98 has the objectives to ensure that MSP is passed on to the farmers, to enhance the efficiency of procurement of PDS and to encourage procurement in non-traditional States. The system enables extending the benefits of MSP to local farmers, to save on transit losses and costs and enables procurement of foodgrains more suited to local taste for distribution under the TPDS. The National Food Security Act, 2013(NFSA) is an important initiative for food security of the people. With a view to make receipt of foodgrains under TPDS a legal right, Government of India has enacted NFSA which came into force w.e.f. 5-7-2013.The Act provides for coverage of up to 75 % of the rural population and up to 50 % of the urban population for receiving subsidized foodgrains under Targeted Public Distribution System (TPDS), at Rs.1/2/3 per kg for coarse grains/wheat/rice respectively at 35 kg per family per month to households covered under Antyodaya Anna Yojana(AAY) and at 5 kg per person per month to priority households.

The provision of minimum nutritional support to the poor through subsidized foodgrains and ensuring price stability indifferent states are the twin objectives of the food security system. In fulfilling its obligation towards distributive justice, the Government incurs food

subsidy. While the economic cost of wheat and rice has continuously gone up, the issue price has been kept unchanged since 1st July, 2002. Due to implementation of NFSA, CIP has further gone down for APL and BPL categories. The Government, therefore, continues to provide large and increasing amounts of subsidy on food grains or distribution under the TPDS/ NFSA and other nutrition-based welfare schemes and open market operations..

5. Concluding observations

The response to agricultural sustainability in terms of higher economic growth, employment and food inflation needs to be addressed by increasing the productivity and addressing various risks in agriculture, particularly the price risks. In this context some of the observations made in the latest Economic Survey of government of India include: (a) increasing the coverage of water saving irrigation systems like micro irrigation systems. (b) routing inputs through direct benefit transfer mode in a crop neutral manner, (c) disseminating the scale neutral technology suited to small scale farming and use of IT is necessary to improve the productivity of small farm holdings which dominate the Indian agriculture sector, (d) resolving the controversies on the adoption of HYV and GM seeds, (e) allowing a greater role for market forces, (f) lifting all restrictions on permit/ licensing requirements, stock limits and movement restrictions alongwith the laws on which they are based and (g) Providing timely and affordable credit to the small and marginal farmers is the key to inclusive growth.

Dr. S. D. Naik

SUSTAINABLE AGRICULTURE
Major Issues, Challenges and Priorities

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What is sustainable agriculture?

In simplest terms, sustainable agriculture is the production of food, fibre, or other plant or animal products using farming techniques that protect the environment, public health, human communities, and animal welfare. Sustainability rests on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. Therefore, the stewardship of both natural and human resources is of prime importance.

Making the transition to sustainable agriculture is a process. As demand for food increases and climate change ecosystem degradation imposes new constraints, sustainable agriculture has an important role to play in preserving natural resources, reducing greenhouse gas emissions, halting bio-diversity loss and caring for valued landscapes.

The Food and Agriculture Organization (FAO) of the United Nations defines sustainable agricultural development as "management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such development conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable."

According to the Ministry of Agriculture, Government of India, sustaining agricultural productivity depends on quality and availability of natural resources like soil and water. Agricultural growth can be sustained by promoting conservation and sustainable use of these scarce natural resources. Indian agriculture remains predominantly rain-fed covering about 60 per cent of the country's net sown area and accounting for 40 per cent of total food production. A National Mission for Sustainable Agriculture (NMSA) has been formulated for enhancing agricultural productivity, especially in rain-fed areas focussing on integrated farming, water-use efficiency, soil health management and synergizing resource conservation.

Need for new approaches

In the coming years, growth in food production will depend largely on finding ways to increase the productivity of existing agricultural land. Agricultural systems, in both developed and developing countries will need to use new approaches to increase food supplies while protecting the resources on which they depend. This can be achieved with the following practices:

* Fully exploit natural resources such as recycling nutrients, using plants that fix their own nitrogen and achieving a balance between pests and predators;
* Reduce reliance on inputs such as mineral fertilisers and chemical pesticides;
* Diversify farming systems, making greater use of biological and genetic potential of plants and animal species;
* Improve the management of natural resources;
* Rotate crops or develop agro - forestry systems that help maintain soil fertility.

Essential ingredients of sustainable farming

1) **Biological** : Continued conservation of genetic resources is essential for food supplies to be increased.

2) **Physical** : Conservation of soil and water to sustain plant productivity.

3) **Social :** Clear property rights and land tenure systems to provide incentives for owners and tenants to use their land in a sustainable way.

4) **Economic :** Farmers in developing countries need fair prices for their produce and better agricultural infrastructure, including adequate extension services and efficient transport for getting their produce to markets. They also need incentives to conserve soil and water resources.

Sustainable agriculture techniques enable higher resource efficiency – they help produce greater agricultural output while using lesser land, water and energy, ensuring better profitability for farmers. While sustainable agriculture through water and seed management can increase crop yields, an efficient warehousing and distribution system is also necessary to ensure that the output reaches the consumer without getting wasted. In fact, simply bringing down food wastage and increasing the efficiency in distribution alone can significantly improve food security.

Risk of climate change

Adverse climate change is also a risk to agricultural sustainability. It can lead to drop in yield and lower the quality of produce. According to Indian Council of Agricultural Research (ICAR), this could lead to a reduction of 4.5 to 9 per cent yield in agricultural production in the medium term and over 25 per cent in the long-term (2040 and beyond) if corrective measures are not taken. Sustainable agricultural growth must involve measures for soil conservation, water conservation and irrigation in order to mitigate the effects of climate change.

Measures like social forestry encompassing commercial forestry, including captive plantation as also community-based forest management practices will be of help. Other measures for water conservation include rain water harvesting, construction of check dams, farm ponds, and irrigation efficient technologies such as drip and sprinkler systems. In the long run, it is also necessary to revisit sustainable cropping pattern from water usage point of view.

The International Food Policy Research Institute in its recent report dated June 7, 2017 says that agriculture remains at the heart of efforts to achieve the UN goal of limiting temperature rise well below 2 degree centigrade above pre-industrial levels and ensuring the success of Sustainable Development Goals. With agriculture being both a source of greenhouse gas emissions and particularly sensitive to the impacts of climate change, it is critical that it remains a priority area for adaptation and mitigation action.

Climate change is the defining challenge of our times, but it is also a great opportunity to build a future that sees the planet and its people thrive in harmony. Resilient agricultural value chains will improve the livelihoods of millions of small holder farms across developing countries and benefit their broader economies. Continued investments across agricultural sector in areas such as irrigation, access to markets, seed development and technologies will help build resilience to extreme weather.

UNDP's climate resilient technologies

United Nations Development Programme (UNDP) supports its national partners to design, promote and implement innovative technologies for this purpose. By piloting adaptive technologies, UNDP projects directly support action at local level to facilitate adaptation to the impact of climate change. Innovative technologies and practices being supported by it include resilient agro-pastoral practices, water management, and rehabilitation of ecosystems.

By showcasing good practices, NGOs and local population are more likely to implement similar activities. Through these efforts, UNDP is also helping to ensure equitable, transparent and affordable access to energy and natural resources in productive sectors, with the highest potential for poverty eradication.

AGRICULTURAL SUSTAINABILITY IN INDIA

Agriculture in India is facing several challenges which together manifest into sustainability issues. The symptoms of agricultural instability are sub-optimal growth, absence of desirable profits, and poor financial conditions of majority of farmers. India has great diversity in agro-

climatic zones with as many as 127 zones under five agro-ecosystems such as rain-fed, arid, irrigated, coastal and hilly systems.

In the case of India, raising agricultural productivity has become much more difficult because of small and fragmented land holdings by farmers due to overpopulation in agriculture, for want of alternative job opportunities. This is actually disguised unemployment. Studies and surveys have revealed that about 40 per cent farmers in the country would quit agriculture if they have alternative employment opportunities.

According to NSSO 70th round findings, of India's 121 million land holdings, 91 million are with small and marginal farmers, with a land share of just 44 per cent and farmer population share of 87 per cent. Fragmented landholdings force the farmers to use only traditional methods of farming which limits productivity and makes agriculture an uneconomical and unsustainable endeavour. It is estimated that more than 50 per cent of the farm households in the country are in debt. Some 90 per cent of farm holdings in the country have shrunk to less than two hectares. Moreover, overdependence on traditional crops like rice and wheat makes the market skewed and farmers do not get remunerative prices.

To address some of these problems, following measures could be of some use:

1) Pooling of land at village level wherever possible for co-operative farming. This will induce banks to give farm loans. This will also enable application of better technologies to minimise crop losses.

2) Government can give attention to construction of canals through programmes like MGNREGA and provide subsidies on micro-irrigation. States like Tamil Nadu are giving 100 per cent subsidy for this purpose.

3) In areas with low rainfall, dry-land agriculture should be encouraged. Crop diversification will also help.

4) The problem of lack of investments in research needs to be addressed on a priority basis.

World Bank Report

In a report published on May 17, 2012, by the Word Bank relating to Issues and Priorities for Indian Agriculture, it had stated that to meet the country's growing needs, a productive, competitive, diversified and sustainable agriculture will need to emerge at an accelerated pace. It had suggested that three important challenges will be important to India's overall development and the improved welfare of its rural poor:

1) Raising agricultural productivity per unit of land. This is very important as virtually all cultivable land is farmed and water resources are also limited. Increasing productivity will need increasing yields, diversification to higher value crops, and developing value chains to reduce wastages and reduce marketing costs.

2) Reducing rural poverty through a socially inclusive strategy that comprises both agricultural as well as non-farm employment in rural areas.

3) Promoting new technologies and reforming agricultural research and extension services.

4) Improving water resources and irrigation / drainage management.

5) Sustaining the environment and future of agricultural productivity.

Agricultural sustainability through PPPs

According to experts, agriculture in India has the potential for major productivity and total output gains because at present crop yields in India are just 30 per cent to 60 per cent of the best sustainable crop yields in the farms of developed as well as other developing countries. Additionally, after harvest losses due to poor infrastructure and unorganised retail, India experiences some of the highest food losses in the world.

Clearly, there is a need for change to create an enabling environment for agriculture that needs to respond not only to longstanding issues and challenges, but also newer realities. A major game-changer for the agricultural sector in India can be the public-private partnership (PPP) model. PPPs, which bring together the collective power of all the stakeholders in the agricultural ecosystem – the government, private companies, and even research institutes- can transform the sector at multiple levels.

With the government providing and co-financing the backend of the value-chain, and the private sector and farmer contributions doing the rest, the sector still has the potential to become the primary engine of rural growth and poverty reduction in India. Food processing industry, supported by investments by government and the private sector, can now look at providing farm extension services, cut out intermediaries and improve supply chains through forward and backward linkages in order to enhance price realisations.

Need to encourage agricultural exports

India's agricultural prices were found to be fairly competitive in international markets. Hence it is not surprising that the country's new Commerce Minister, Mr. Suresh Prabhu is talking about his Ministry coming out with a policy for farm sector exports. His biggest problem, however, will be to get a favourable domestic policy framework approved by the Prime Minister and then adhered to.

Despite all talk of being concerned about the welfare of farmers, successive governments over the last 70 years have chosen the interest of consumers over those of farmers. So the moment local prices of food items start rising, most governments cutting across party lines have a template response – increase supply by reducing stocking limits for the wholesale trade and banning exports or imposing minimum export prices. It is hardly surprising therefore that the country's agriculture sector should be in the kind of crisis it is facing today.

It may be recalled that India's agricultural exports had increased at a brisk pace for more than two decades after the economy was opened up in 1991. Although imports also increased, they were more than compensated by exports. India's agricultural trade surplus had recorded more than ten-fold increase between 1991-92 and 2013-14. Three years later, the picture is vastly different. Between 2012-14 and 2016-17, agricultural exports fell by 22 per cent and imports jumped by 62 per cent.

A paper by agriculture experts Dr. Ashok Gulati and Shweta Saini argues that the government was unfair in putting export restrictions on important food items to prevent inflation pressure in the domestic economy. The policy deprived the farmers of higher prices in the international markets and also added an element of income uncertainty. If the government is going to impose export restrictions when the world prices of agricultural commodities peak, the farmers would lose part of the incentive to cultivate exportable crops. Earlier Economic Surveys have also made similar arguments.

Biswajit Dhar, a Professor of Economics at Jawaharlal Nehru University, sees other constraints as bigger impediments to growth in agriculture exports. "There is huge scope for exports of processed agricultural products, but for that we need to have effective cold chains. The government needs to put in money to push infrastructure if exports have to be increased," he said. Improvements in warehousing infrastructure will also counter inflation concerns due to seasonal factors such as poor monsoon rains, Dhar added.

Building resilience to environmental shocks

Climate change is a major challenge for agriculture, food security and livelihoods for millions of people, including the poor in India. India's farmers are constantly threatened by adverse weather and environmental conditions that spell disaster for their produce. Extreme situations such as flooding and droughts, constantly plague India's farming community. The public private partnership (PPP) models that can minimise their problems against the vagaries of nature can be lifesavers.

PPPs that can help the sector to deal with weather shocks through crop insurance etc. can provide great relief to poor farmers in the country, particularly the small and marginal farmers. Also the many technological and institutional innovations that have come up recently, can enable small and marginal farmers to raise productivity and increase incomes through diversification to high-value agriculture. These farmers will need help and guidance from the concerned government departments.

Dr. Sugeeta Upadhyay

Indian Agricultural System : Issues and Challenges

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Abstract

An assessment over longer spells of time (decades) asserts the fact that Indian agricultural performance has not been as expected. It has perennially been characterized by low investment, archaic irrigation practices, monsoon dependence, fragmentation of land holdings, and low level of technology. Lack of property rights and low initial net worth of farmers add to the constraints. It is in this context, this paper highlights that the significance of agriculture sector in India is not restricted to its contribution to GDP, but that on account of its complementarily with other sectors, it has far reaching ability to impact poverty alleviation and rural development. The Government has undertaken several measures in order to improve the profitability of crop production.

Introduction

As per official report, the Indian agrarian economy is the source of around 15 percent of Indian GDP, 11 per cent of our exports and it provides livelihood to about half of India's population. The importance of the sector from a macroeconomic perspective is also reflected in a significant flow of bank credit to finance agricultural and allied activities relative to other sectors of the economy (various GoI Reports).

According to recent RBI report outstanding bank advances to agriculture and allied activities have risen from about 13 per cent of GDP originating in agriculture and allied activities in 2000-01 to around 53 per cent in 2016-17. In real terms (adjusted for inflation measured by the GDP deflator), the growth of bank credit to agriculture and allied activities accelerated from 2.6 per cent in the 1990s to 15.4 per cent during 2000-01 to 2016-17(various RBI Reports).

Need & Importance of Agriculture

Though the Indian Economy has witnessed creditable growth in recent years, this growth has been fuelled by industry and the service sector. As far as agricultural growth is concerned ,during the 1970s and the 1980s it was widespread and pervasive. The growth scenario of agriculture completely changed in the nineties. The compound growth rates of area, production, and yield for the major crops were much lower compared to the earlier period. Employment in agriculture stagnated during the post reform period. Per worker productivity has not grown substantially to generate demand for boosting the growth of the secondary sector. But despite the fact that the contribution of agriculture

to GDP has declined drastically, it has been still an important sector of the Indian economy since a large proportion of the Indian workforce is engaged in agriculture and the growth of other sectors is affected by agricultural growth. Hence, a productive, competitive, diversified, and sustainable agricultural sector will need to emerge at an accelerated pace.

The Concern

Given the importance of this sector in an economy, it is obvious that there is no dearth of literature on the role of agriculture in the economic development of a country like India. Then why do we need

to discuss it again? Though the performance of Indian agricultural sector after Independence has not been the story of zero achievement, but the critics do argue that it could have achieved much

more, if proper policy measures were adopted. It is said that an assessment over longer spells of time (decades) asserts the fact that

Indian agricultural performance has not been as expected.

As far as policy measures and their impacts on the agrarian economy are concerned, it has been observed that despite the sizeable volume of subsidized and directed credit flows as well as the various fiscal incentives, Indian agriculture is beset with deep seated distortions that render it vulnerable to high volatility. It has perennially been characterized by low investment, archaic irrigation practices, monsoon dependence, fragmentation of land holdings, and low level of technology. Lack of property rights and low initial net worth of farmers add to the constraints.

Issues and challenges

Three agriculture sector challenges will be important to India's overall development and the improved welfare of its rural poor. One, raising agricultural productivity per unit of land, second, reducing rural poverty through a socially inclusive strategy that comprises both agriculture as well as non-farm employment, and third, ensuring that agricultural growth responds to food security needs.

Though different studies observed that the deceleration, which Indian agriculture has witnessed of late, is said to be the result of factors like adverse terms of trade for agriculture, impact of WTO, and small size of holdings, there are also other schools of thoughts who do believe that the main factors responsible are incongruence between Indian agrarian system and supportive institutions, too much reliance on output prices, deceleration in public investment in rural infrastructure, and improper Minimum Support Price policy.

Whatever may be the reason, policy makers will thus need to initiate and/or conclude policy actions and public programs in the right direction with an objective to build a solid foundation for a much more productive, internationally competitive, and diversified agricultural sector.

Farm Loan Waivers : Macro-Economic Impact

In the recent period, farm loan waivers have engaged intense attention among the farming community, policy makers, academics, analysts and researchers. On the one hand, there is a gamut of issues that have intensified the anguish of our farmers. In this context, farm loan waivers have brought forward the urgency of designing lasting solutions to the structural malaise that affects Indian agriculture. On the other, there are concerns about the macroeconomic and financial implications, how long they will persist in impacting the economy, the possible distortions that they could confront public policies with, and the ultimate incidence of the financial burden(Urjit Patel,2017).

The pros and cons of agricultural debt relief have been widely debated and a whole literature has evolved around the theme. Alongside beneficial effects in terms of clearing the debt overhang of farm households, negative side effects in the form of faulty targeting of beneficiaries and resulting discrimination, incentivizing willful defaulters, and erosion of credit discipline have been cited.

Role of GoI

The Government has undertaken several measures to compensate for the adverse terms of trade and the inert institutional architecture confronting agriculture in order to improve the profitability of crop production. The Interest Subvention Scheme has been running for a decade under which banks and cooperative institutions extend short term crop loans of up to ₹ 3 lakh to farmers at a concessional rate of 7 per cent. Timely repayment is incentivized by an additional subvention of 3 per cent. The scheme also encompasses other benefits, including post-harvest loans for storage in accredited warehouses against Negotiable Warehouse Receipts (NWRs) for up to six months for Kisan Credit Card (KCC) holding small and marginal farmers at a concessional rate of 7 per cent in order to avoid distress sales. On June 14, 2017 the Government earmarked a sum of ₹ 20,339 crore for this purpose for 2017-18 as against the provision of ₹ 15,000 crore originally made in the Union Budget. During 2016-17, the volume of short term crop loan lent stood at ₹ 6,22,685 crore, surpassing the target of ₹ 6,15,000 crore. Earlier, the Union Budget 2014-15 had put in place a scheme under which five lakh Joint Liability Groups of 'Bhoomi Heen Kisan' (landless farmers) will be financed through the NABARD in order to augment flow of credit to landless farmers

cultivating land as tenant farmers, oral lessees or share croppers and small/marginal farmers as well as other poor individuals taking up farm activities, off-farm activities and non-farm activities(Various, GoI & RBI Reports).

Way forward

According to the World Bank Report India is a global agricultural powerhouse. It is the world's largest producer of milk, pulses, and spices, and has the world's largest cattle herd (buffaloes), as well as the

largest area under wheat, rice and cotton. It is the second largest producer of rice, wheat, cotton, sugarcane, farmed fish, sheep & goat meat, fruit, vegetables and tea. The country has some 195 m ha under cultivation of which some 63 percent are rain fed (roughly 125m ha) while 37 percent are irrigated (70m ha). In addition, forests cover some 65m ha of India's land(The World Bank Report, 2012).

The Report also claims that some agricultural sub-sectors have a particularly high potential for expansion, notably dairy. The livestock sector, primarily due to dairy, contributes over a quarter of agricultural GDP and is a source of income for 70% of India's rural families, mostly those who are poor and headed by women. Growth in milk production, at about 4% per annum, has been brisk, but future domestic demand is expected to grow by at least 5% per annum. Milk production is constrained, however, by the poor genetic quality of cows, inadequate nutrients, inaccessible veterinary care, and other factors. A targeted program to tackle these constraints could boost production and have a good impact on poverty.

While progress has been made - the rural population classified as poor fell from nearly 40% in the early 1990s to below 30% by the mid-2000s (about a 1% fall per year) – there is a clear need for a faster reduction. There are several areas of importance for the agriculture sector growth. Major reform and strengthening of India's agricultural research and extension systems is one of the most important needs for agricultural growth.

References

1. Economic Survey, 2016-17,Vol 1, GoI.

2. Economic Survey,2016-17, Vol 2, GoI.

3. Mundra, S.S,27 june, 2017,Priority Sector Lending – Status, Issues and Future Agenda. Inaugural Address by Shri S S Mundra, Deputy Governor, Reserve Bank of India during the "Conference on Credit flow to Priority Sector – Policy and Implementation" held at College of Agricultural Banking, Reserve Bank of India, Pune.

4. Patel Urjit , 31ugust , 2017, Seminar on Agricultural Debt Waiver – Efficacy and Limitations

5. The World Bank,17 May,2012, India: Issues and Priorities for Agriculture.

SUSTAINABLE AGRICULTURE : THE KEY TO INDIA'S DELIVERANCE

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India's socio-economic and cultural development has been intrinsically linked to agriculture and agro-pastoralism since the dawn of the Neolithic Revolution. This long and rich history of our engagement with the world oldest profession has seen many ups and downs since the 1900s. The diverse agro-climatic regions coupled with unique soil and environmental niches spanning across the country have gifted us with unlimited potential to exponentially multiply our agricultural produce.

The pre-Independence Era (1901 – 1947) saw an increase in the Indian population by 38%. This was accompanied by an increase in land employed for agriculture of only 18%. A severe need to find corrective measures arose since the country could not meet its ever rising requirements for sustenance. The introduction of Economic Planning in 1951 brought about a steady rise in productivity per unit hectare as well as total area under cultivation in the country.

The Green Revolution marked the advent of extremely chemical dependant methods in agriculture with the sole aim of increasing crop productivity to meet the needs of the country's burgeoning population. It would be interesting to note that the Green resulted in a tremendous increase in the production of agricultural crops especially in food-grains. This not only drastically brought down the import of food but increased the per capita income and spurred the Indian farmer towards a more technology driven method of crop cultivation.

The production of rice and wheat increased by nearly four- fold since the advent of the Green Revolution in the seventies. The total food grain production rosen from 83 mt in 1960-61 to about 252.7 mt (fourth estimate) in 2014-15. With this stupendous rise, the country has not only been able to meet its own food requirement, but also generate business through export of the same.

The first post-Green Revolution phase (from late-1960s to mid-1980s) was marked by heightened productivity from otherwise poorly yielding land through the intensification of chemical and machinery inputs. Prior to this period, the Indian farmer relied on traditional methods of crop cultivation without an in-depth understanding of the requirements of maximising land productivity. However, all the inputs used were natural and by products of their agricultural and agro-pastoral activities. The second post-Green Revolution phase (beginning in the mid-1980s) was marked with high input-use and a contrasting reduction in productivity. Various committees and panels made up of scientists and economic policymakers have been set up over the years to address the issues that may have brought about this decrease in productivity despite of having high cost, high volume inputs.

Apart from this, a closer look at the facts and figures brings to light the fact that although we may be doing a lot better as compared to the pre-Independence era, we are still lagging behind the world despite having more favourable climate and much more fertile soils. A report published in 2014 stated that Egypt led the world in rice production with 6.63 tonnes/ hectare of productivity, while India stood behind Brazil and China with a meagre 2.4 tonnes/hectare. And this doesn't even seem to be crop specific. New Zealand leads the world in wheat productivity (8.08 tonnes/hectare) as compared to India's productivity of a meagre 3.15 tonnes/hectare.

The Green Revolution brought with it a number of unforeseen problem

that have snowballed into issues of grave concern today. First and foremost, incomplete knowledge of pest and nutrient management amongst farmers along with continuous cropping cycles has led to steady destruction of our otherwise inherently fertile soils.

Punjab, which has been at the epicentre of the Green Revolution, was back in the news for the wrong reasons in the recent past. Threateningly high concentrations of synthetic nitrates were found in the ground water and soil which were linked to spike in illnesses like cancer. In 2015, a parliamentary panel report brought to light horrific facts and figures concerning the nutrient availability in the soils of Punjab. It was found that the farmers of Punjab were using an alarming 39:9:1 NPK (nitrogen, phosphorous, potassium) ratio of fertilisers against the national average of 7:3:1 and ideal 4:2:1 ratio. Parallely, the crop yield per kg NPK in Punjab had dramatically dropped from 50 kgs to 10 kgs since 1970-71.

From the average Indian farmer's perspective, the key issue to be addressed in terms of sustainability is the rising input expenditure and resource required in order to be able to even maintain yields. This certainly poses a threat to the economic viability of this noble profession. However, each of the components of sustainable agriculture is complex and some quantifiable measures are needed to check whether a particular method being employed is sustainable or not.

The first and foremost step that needs to be taken in this direction is to educate the farming and agro-pastoralist community regarding the importance of maintaining the natural biodiversity of the arable soil in the farm as well the neighbouring areas. The importance of everything right from the microbial diversity naturally present in the soil, the insects that serve as pollinating vectors to the crop, the flora that lines the farms, the domesticated as well as non-domesticated fauna that inhabit the area, all play an intrinsic role in the maintainence of the biodiversity of the land. The callous and uninformed use of fertilisers, pesticides and weedicides catalyses a domino effect against the maintainence of the biodiversity of the land.

The realisation that utter disregard for these biotic factors ultimately is affecting the future of their livelihood will pave the road towards a more informed use of chemicals in every form. The very recent disaster in Yavatmal, where over 50 farmers and labourers have died with nearly 800 severely affected only highlights the urgency of the matter. The unregulated sale and use of pesticides/insecticides, uninformed use of mixed pesticides, failure of Bt cotton in reducing dependence on chemicals, and lack of guidance from the State Agricultural Department have been the main reasons highlighted.

Secondly, smart and informed choices need to be made about which crop would be most suited for the ever changing soil and weather patterns. Water-thirsty crops like sugar cane and crops requiring heavy chemical intervention like cotton need to be balanced with more hardy, less input heavy crops. Maharashtra again has been at the epicentre of an agrarian water crisis. The state's landlocked Marathwada region, has gradually veered from a traditional produce of millet, sorghum and other cereals, to sugar cane which is a relatively high profit crop. Sugarcane consumes about 22.5 million liters of water per hectare during its 14-month long growing cycle compared to just 4 million liters over four months for chickpeas. Despite this fact, the area under cultivation for Sugarcane has gone up nearly ten times since the seventies. Irrational subsidies for power and water, assured incomes for certain crops and political influence have created this recipe for catastrophe in the region. Focus on mono-cropping must be diverted to crop-rotations. Agricultural policies favouring certain crops need to be moulded in such a way that farmers do not feel challenged or pressurised to go after a certain crop, irrespective of the consequences.

Thirdly, the reduction in agro-pastoralism due to rising input costs has dramatically reduced the use of organic manure as part of the fertiliser regime. Labour and time involved in composting of agro-waste is another factor that has reduced usage of organic fertiliser. Today, technology has advanced to the point that milk production can be maximised through proper nutrition. This may make agro-pastoralism a viable profession once again. Tailor made bio-products that can spur the rate of compost generation as well as heighten its

nutritional quality are now available in the market. Rather the burning agro-waste and killing the soil microflora in the process, farmers must engage in these age old practices and develop sustainable solutions for increasing the nutritive value of the soil. Increase in agro-pastoralism will also ensure a parallel income thereby improving financial security. Recent advances in soil microbiology have made available a plethora of organic products that can equip the farmer with armour to fight the looming dangers of unsustainable agriculture.

Coming to the issue of resolving the world's impending food crisis, sustainable agriculture will need to encourage the technological advancements in terms of harnessing the power of microbes in transforming soil productivity without misbalancing the nutrient content of the soil. Realising the potential of this new frontier in science, the global giants of the agriculture industry have begun research in this area. Microbial products in agriculture serve two main purposes: enhancers of bio fertility as well as bio-control of phytopathogens.

Microbial bio-fertility enhancers assist crops by making available nutrients already present within the top soil but not readily available for plant uptake. This encourages maximal utilisation of already available nutrients, thus reducing the need to dump excessive nutrients in the soil. This also would help prevent loss of important micronutrients in the soil (which is a direct consequence of excessive fertiliser usage). Microbial bio-control agents act as protectants by creating direct defense mechanisms against pathogens or indirectly deter their colonisation by establishing themselves in the environment. Traditionally, single strain organisms have been available as products for the past decade. The drawback of this system is the need for the farmer to use multiple products for various sub-applications. This increases cost, time and labour, all three reducing the sustainability of using such products. The key to addressing this issue would be to design tailor made products which contain multiple strains that can play their roles as and when required. The so-designed products need to therefore be versatile, cost-effective, and tenacious in terms of survival in the environment. The transition from efficacy in the lab to the field is so far the greatest obstacle that the industry needs to address. The lack of regulatory framework to assist in the progress of these technologies in the country is one of the greatest obstacles today.

The Prime Minister's Council on Climate Change (PMCCC) in 2010, laid out the path to promoting sustainable agriculture through ten keys areas viz. Improved crop seeds, livestock and fish cultures, Water Use Efficiency, Pest Management, Improved Farm Practices, Nutrient Management, Agricultural insurance, Credit support, Markets, Access to Information and Livelihood diversification.

The need to promote organic farming in India is of utmost importance today because of the current unsustainable agricultural production methods and the damage they are doing to the environment. Not only this, the excessive inputs are not being justified by the kind of returns coming in from these practices. Veering towards organic farming will reduce the requirment of these inputs as well as equip the soil with managing stress related to agricultural production. It is also believed that reducing the dependancy on pesticides will equip crops with creating a heightened systemic resistance towards the onslaught of crop damaging diseases.

The key to making agriculture sustainable is to ask the right questions and have the courage to acknowledge the right answers. The right blend of crop selection, crop breeding, responsible methods of nutrient management and crop protection, water harvesting and management, technological advancements in agricultural microbiology and overall agronomic management coupled with sound policymaking will lead us to our deliverance.

References

http://censusindia.gov.in/2011-prov-results/data_files/india/Final_PPT_2011_chapter3.pdf

www.csa-india.gov.in

http://www.tribuneindia.com/news/nation/fertiliser-overuse-eating - away - punjab - soil-nutrients/123774.html

http://www.hindustantimes.com/india-news/yavatmal-pesticide-poisoning-battling-death- and-despair/

story-wEhrpAsEVd6RUVi309q3PK.html

http://www.livemint com/Opinion/nw9JKiPrDPpqCuWfmoibPN/Indias-agricultural-yield-suffers-from-low-productivity.html

Kumar P and Mittal S (2006) Agricultural Productivity Trends in India: Sustainability Issues (Praduman Kumar1 and Surabhi Mittal2) *Agricultural Economics Research Review* Vol. 19, pp 71-88

N Kim Guite (2016) The Economics of Organic Farming and Transition from Non-organic to Organic Farming. A joint publication of the Reserve Bank of India and Centre of Sustainable Agriculture.

ANIMAL HUSBANDRY

Women and small livestock economy : Leadership @ GRASS ROOTS

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Livestock farming has been mainstay of rural and peri urban livelihoods. In India. Small livestock like goats, sheep has been supporting over 8 million poor families through securing food, nutrition, income and fulfilling emergency cash needs. Livestock farming has also gone tremendous challenges over the years and rapid urbanization and market growth has forced to adoption of semi intensive and intensive livestock farming. This has further enhanced need to effective breeding, reproduction and production factor management. Mini commercial goat farm can be remunerative employment option for rural youth with low education and farming background. Livestock farming can also promote in situ sustainable family based business opportunities for trained youth, which can trigger further process through demonstration and more establishments of such enterprises.

Small livestock (Goat/sheep/ pig/poultry) is a critical source of livelihoods for rural poor especially women in developing and underdeveloped world including India. High mortality and morbidity of goats leads to economic, social and mental tragedy for rural households. This depletes most critical assets of poor families and exposes them to risks and vulnerabilities. Women are worst sufferers of such tragedies due to their high involvement with small livestock and have to take care of

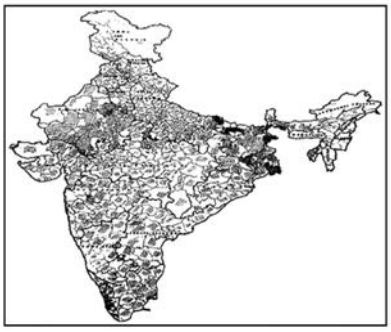


Figure 1 Distribution of goats in India -Each dot represents 10000 goats

ailing animals, which consumes significant time and energy. Such loss of livestock leads to cooping of families by selling food grains and even stopping child education and opt for long distance migration.

However small livestock farmers in spite of significant in number lacks, political voice and being poor, women centric , their economic contributions largely remain neglected and underrepresented due to prevailing biaseness and apathy. Livestock farmers with changing social and resource constraints had been suffering due to following major reasons –

- High mortality/morbidity
- Genetic degradation/ Low quality of goats
- Feed scarcity and seasonal stress
- Absence of transparent system of price estimation of goats .
- High cost of aggregation and trade due to informal and organized system and low adoption of information technology and inefficient trading

Access to on time, low cost, door step livestock health care, first aid and knowledge has been a key constraint in livestock production, which has adversely affecting poor people's livelihoods.

Present case study discusses an alternative community led livestock extension services delivery where women as beneficiary is empowered to take lead in generating demand and supply of services through technical training and hand holding support. As on date over 4712 Pashu Sakhi had been promoted in 16 Indian states reaching to over 2.5 lakh small livestock farmers daily and present case intends to share experiences of partnership between Maharashtra State Rural Livelihood Mission (MSRLM), Mahila Arthik Vikas Mahamandal (MAVIM) and The Goat Trust at Gondia.

Gondia is a tribal dominated district of Maharshtra and present case shares impact and challenges of such community based approach in livestock extension services in the country.

Uniqueness of approach

Alternative livestock extension services had been a felt need over last five decade and many

experiments around promoting and nurturing such service delivery mechanism had been tried with limited success at various points of time.

Major shortcomings of existing programs had been on three major points –

- Most often rural educated male youth was targeted for training and sustaining them through first aid service provision (large livestock mainly) for 8 to 15 villages in a radius of 10 to 15 Km. The program started fine but soon these youths aspire to earn more started focus on treatment rather than preventative practices and awareness building. Conflicting interest led to change in focus on program and exploitation of farmers and small livestock went out of sight for such service approach making poor farmers suffering and helpless.

- First aid requires close monitoring of first symptoms and first aid at first symptom. But such trained youth due to high travel cost and distance most often neglects such quick action. Besides first aid is not lucrative for such youth and farmers also delay action.

- Most often women involvement in goat shed cleaning enables them to observe first symptom and they have to bear pain and pangs of ailing animals but access for women to such trained rural youth was found low and costly. This delays first aid or proper & timely counseling. As women need proper counseling and access to knowledge for improved practices, rural youth had social and psychological barrier for counseling and sharing knowledge with women.

Based on learning from past limited success and some failure, an alternative process was conceptualized and implemented on scale to assess feasibility and impact of Pashu Sakhi model.

As per design a semi literate women is trained as Pashu Sakhi through periodic classroom training (total 15 days over a period of one year – 1+5+4+4 days) along with fortnightly meeting to review their work and field support by a trained professional. Quarterly grading of Pashu Sakhi based on objective and subjective assessment criteria is periodic monitoring tool to assess and provide support in weak areas. Selection by community and pre training briefing of roles and responsibility and involving family heads in orientation are new features added in promotion process to enhance ownership of community and family support for effective functioning of Pashu Sakhi .

Once nominated by local goat farmers, a systematic orientation and immersion program for potential Pashu Sakhi is organized, followed by local 5 days residential training. A participatory training process adjusted with pace of learner was evolved to have multiple training methodologies around key knowledge, skill and attitude required to function as Pashu Nurse.

Such Pashu Sakhi training module focuses more on management knowledge and best practices sharing rather than treatment. Pashu Sakhi essentially have to be small livherself stock farmer and adopter of best practices rather than just propagator. This enhances knowledge and creditability of Pashu Sakhi as a best practice propagator and local leadership.

A regular monitoring through data analysis is kept on diseases spread and decrease in frequency of morbidity (disease) and community based insurance is launched to make whole system accountable.

Most importantly Pashu Sakhi are sustained on entrepreneurial initiatives of input supply for goat farming (Which they promote through awareness and training under project) and self promoted business rather than treatment and first aid. So conflict of interest between decrease in morbidity is not become major hindrance and supply of input becomes a profitable venture as new improved practice adoption boost input demand.

In nut shell Pashu Sakhi works more like Anagawadi worker and ANM in human health management with only difference is that here she becomes input supplier and self business promoter by the side of service provider making system sustainable and more effective over a period of time.

Role & functions

Pashu Sakhi performs three kind of complimentary functions –

- Extension of improved practices and knowledge sharing,
- providing door step first aid and counseling services for disease prevention and management and
- Demonstration of best practices and enterprise management in her own house.

Besides she also works as monitoring and support service provider for the project as by visiting each goat house and assessing management condition, she provides critical feedback on adoption and required adjustment of technology or input and sometime feasibility and relevance of suggested practices.

Goat mortality has dropped from 22% to 6%, which saved nearly 8600 goats every year thus generating over 51 million INR. Besides reduced morbidity, reduced kidding interval and better growth of kids have collectively contributed Rs 25 million gain in profit of goat faming. This has been reflected in over 25% growth of goat population in last one year and farmers increased confidence motivated them to invest further in goat farming.

Pashu Sakhi had a positive social image as provider of critical service and knowledge disseminator.

Attitude of male especially from higher caste especially engaged in livestock farming has shown dramatic change towards such women Within family image of Pashu Sakhi including son and husband had shown positive change due to economic contribution and a knowledge which has respect in society.

Major changes through alternative approach

After Twelve to eighteen months of Pashu Sakhi Promotion, study findings has shown positive impacts on two fronts - Pashu Sakhi herself wherein they had enhanced social image due to a most sought after technical knowledge imparted and at goat Farming women level. Major & first tangible output of Pashu Sakhi promotion had been seen in significant decrease in mortality of goats and enhanced faith of community in managing risks. This in turn has also enabled goat farmers for enhanced price negotiation of their goats and bucks with traders where fear factor has

Field assessment study in Gondia in Maharshtra has provided strong evidences on improved knowledge, services and technology propagation & adoption by goat farming families.

Goat mortality has dropped from 22% to 6%, which saved nearly 8600 goats every year thus generating over 51 million INR. Besides reduced morbidity, reduced kidding interval and better growth of kids have collectively contributed Rs 25 million gain in profit of goat faming. This has been reflected in over 25% growth of goat population in last one year and farmers increased confidence motivated them to invest further in goat farming.

Sample based studies had shown that Pashu Sakhi had a positive social image as provider of critical service and knowledge disseminator.

Pashu Sakhi had been able to earn Rs 800 to Rs 2000 as an additional income through services and self improved goat farming.

Attitude of male especially from higher caste especially engaged in livestock farming has shown dramatic change towards such women as on need she had been requested to serve and provide basic care to their economic assets.

Within family image of Pashu Sakhi including son and husband had shown positive change due to economic contribution and a knowledge which has respect in society. Pashu Sakhi had her name now take more affectionately and sometimes called as "doctor didi" (The Goat Trust strictly opposes any such comparision) by villagers.

Limitation and way forward

This model only works in high small livestock density area, where knowledge and basic services are critical constraint. Diversification of Pashu Sakhi for other small livestock especially poultry had been tested successfully, however model is yet to be tested for large ruminants on scale.

The Goat Trust is also exploring now opportunities and capacitating these Pashu Sakhi for linking with market related role of Pashu Sakhi and is piloting now capacitating these nurses to estimate and assess live body weight pricing of small livestock and facilitate market linkages.

Activity data sheet from Gondia district in last 24 months

S.R	Discription	Salekasa	Tiroda	Total
1	No.Of Villages Coverd	74	70	144
3	No.Of Pashusakhi's Working	65	70	135
4	No.Of Goat Reares	5317	8542	13859
5	No.Of Goats	26039	28230	54269
6	No.Of Goat Clubs	168	118	286
7	No.Of Goat Sheds	1234	531	1765
8	No.OF Feeding manger adopted	1076	641	1717
9	No.OF Water Stands	855	459	1314
10	No.OF Green Fodder Stands	1051	524	1575
11	No.Of Devorming From Implementing	189950	55396	245346
12	No.Of Vaccines From Implementing	174398	39026	213424
13	First Aid	20944	3922	24866
14	Herbal Treatments	13779	2256	16035
15	No.Of Castreted Goats	2103	205	2308
16	Increase In Goat Numbers after Implementation	5453	6923	12376
17	Reducing In Mortility Rates	6.50%	8%	0.145

Training of Pashu Sakhies

National Project for Cattle and Buffalo Breeding

Genetic improvement in bovines is a long term activity and Government of India has initiated a major programme "National Project for Cattle and Buffalo Breeding" (NPCBB) from October 2000 over a period of ten years, in two phases each of five years, with an allocation of Rs 402 crore for Phase–I. In order to consolidate gains made during Phase-I, Phase-II has been initiated from Dec 2006 with an allocation of Rs 775.87 crore. The NPCBB envisages genetic up gradation on priority basis with a focus on development and conservation of important indigenous breeds. The project envisages 100% grant-in-aid to Implementing Agencies.

• The Objectives of the scheme is to:

1. Arrange delivery of vastly improved artificial insemination service at the farmers door-step.
2. Bring all breedable females among cattle and buffalo under organized breeding through artificial insemination or natural service by high quality bulls within a period of 10 years.
3. Undertake breed improvement programme for indigenous cattle and buffaloes so as to improve the genetic makeup as well as their availability.

• Components

1. streamlining storage and supply of Liquid Nitrogen by sourcing supply from industrial gas manufacturers and setting up bulk transport and storage systems for the same,
2. 3 photo introduction of quality bulls with high genetic merit,
3. promotion of private mobile AI service for doorstep delivery of AI,
4. conversion of existing stationary government A.I. centres into mobiles centres,
5. quality control and certification of bulls and services at sperm stations, semen banks and training institutions,
6. induction of breeding bulls for natural service in the areas not under AI coverage , and
7. institutional restructuring by way of entrusting the job of managing production and supply of genetic inputs as well as Liquid Nitrogen to a specialized autonomous and professional State Implementing Agency.

• Progress of the Scheme:

At present 28 States and one UT are participating under the project. Financial assistance to the tune of Rs 398.36 crore has been released to these States upto 2007-08. During current financial year RE of Rs 89.70 crore has been made available under the scheme and so far an expenditure of Rs 86.72 crore has been made.

• Constitution of State Implementing Agencies (SIAs)

Since inception of the project in October, 2000, 27 SIAs have been constituted under the project in 28 States. These agencies have professional approach in implementing the project. In case of small States, which are unable to constitute viable SIAs, funds have been released to the State Governments for implementation of the project.

• Increase in coverage of breedable animals:

Semen production in the country has increased from 22 million straws (1999-2000) to 44 million straws (2007-2008) and the number of inseminations has increased from

Table 1: Performance of AI centres

Agency	No. of AIC	AI in Million	No. of AI per centre/year
Government	47865	29.59	511
Private AI workers	9996	-	-
Co-operative	11842	10.00	844
NGO	1638	0.41	249
Total	**71341**	**40.00**	**560**

Table 2: Performance of semen stations

Agency	Semen stations	No. of Bulls	Semen production in lakh	Bulls per station	Doses produced per station in lakh
Government/ SIA	37	1608	224.30	43	6.06
NDDB, Dairy coop, NGO and private	12	1103	222.20	92	18.51
Total	**49**	**2711**	**446.50**	**46**	**9.11**

20 million to 41 million. As per the impact analysis report submitted by NABARD, overall conception rate has increased from 20% to 35%.

• Evaluation of semen stations:

In order to attain qualitative and quantitative improvement in semen production, Central Monitoring Unit (CMU) was constituted on 20.5.2004 by the Department for evaluation of semen stations once in two years. CMU has submitted its report for 2007-08. State wise distribution of semen station with grades awarded is given in table 3.

• Development of minimum standard protocol for semen production (MSP):

In order to produce frozen semen of the uniform quality, a Minimum Standard Protocol (MSP) for semen production has been developed in consultation with experts from BAIF, National Dairy Development Board (NDDB), NDRI (Karnal) and Central Frozen Semen Production and Training Institute (CFSP & TI) and the same has been made effective from 20th May, 2004.

• ISO Certification of semen stations:

The semen stations at Ooty (TCMPF), Bidaj (NDDB), ABC Saloon (NDDB), Amul Research & Development Association Anand (Amul Dairy), Jagudan (Mehsana Dairy), Urulikanchan Pune (BAIF), Hissar, Gurgoan, Jagadhari (HLDB) Haringhata, Salboni, Beldanga (West Bengal), Shyampur (Uttranchal), Nabha, Ropar (Punjab), Bhattain (Punjab Milk Fed), Nandani (KMF), SSCC Hessarghata, SLBTC Hessarghata, Dharwad (Karnataka) CFSP & TI Hessarghata (GOI Karnataka), Mattupatty, Dhoni, Kulathupuzha (Kerala), Vizag, Nandyal, Karimnagar, Banwasi (Andhra Pradesh), Bassi (Rajasthan), Bhadbhada (Madhya Pradesh), Cuttack (Orissa) and Chitale Bhilwadi (Private) are ISO certified. Semen station at Mattupatty, Dhoni, Kulathupuzha (Kerala), Haringhata (West Bengal), Salboni, Beldanga (West Bengal) and Bhadbhada (Madhya Pradesh) are also HACCP certified semen stations.

Table 3: State wise distribution of semen stations with the grades awarded

Sr. No.	State	Grade A	Grade B	Grade C	Not graded NG	Not evaluated NE	Total Stations
		80 and above	66 to 79	50 to 65	Below 49	NE	
1	Andhra Pradesh	1	2	1	-	-	4
2	Assam	-	-	1	-	-	1
3	Bihar	-	-	-	1	-	1
4	Chattisgarh	-	1	-	-	-	1
5	Gujarat	2	1	-	1	-	4
6	Haryana	-	-	-	3	-	3

7	Himachal Pradesh	-	1	-	-	-	1
8	J & K	-	-	-	2	-	2
9	Karnataka	1	1	3	-	-	5
10	Kerala	1	2	-	-	-	3
11	Madya Pradesh	-	-	-	1	-	1
12	Maharastra	1	1	-	1	2	5
13	Meghalaya	-	-	-	1	-	1
14	Orissa	-	1	-	-	-	1
15	Punjab	1	1	1	-	-	3
16	Rajasthan	-	1	-	-	-	1
17	Tamilnadu	1	2	-	1	-	4
18	Uttaranchal	-	1	-	-	-	1
19	Uttar Pradesh	1	-	1	2	-	4
20	West Bengal	2	1	-	-	-	3
	Total	**11**	**16**	**7**	**13**	**2**	**49**

INDIA EXPORT / IMPORT OF AGRO FOOD PRODUCTS

Value in Rs. Lacs

Qty In MT

Product: Sheep/Goat Meat Import

Country	2014-15		2015-16		2016-17	
	Qty	Value	Qty	Value	Qty	Value
New Zealand	36.32	394.30	40.68	360.92	55.32	526.84
Australia	47.05	449.05	16.68	118.76	45.29	263.17
Sri Lanka	0.00	0.00	0.00	0.00	9.47	34.96
Germany	0.00	0.00	0.00	0.00	12.85	25.23
United States	0.19	0.72	0.00	0.00	0.00	0.00
Total	**83.56**	**844.07**	**57.36**	**479.68**	**122.93**	**850.20**

Value in Rs. Lacs

Qty In MT

Product: Sheep/Goat Meat Export

Country	2014-15		2015-16		2016-17	
	Qty	Value	Qty	Value	Qty	Value
United Arab Emirates	11,439.11	40,849.05	12,449.84	47,259.24	13,003.17	50,025.45
Saudi Arabia	6,925.56	25,570.45	4,700.95	18,810.99	4,550.69	19,429.41
Qatar	2,003.65	7,048.91	2,173.64	8,416.98	2,102.87	8,243.83
Kuwait	1,741.99	6,350.44	1,680.44	6,638.02	1,612.95	6,510.96
Oman	480.69	1,516.03	318.29	1,113.70	363.87	1,309.14
Bahrain	178.96	660.61	211.53	852.69	274.91	1,160.14
Maldives	31.94	97.80	84.75	243.85	80.98	238.58
Seychelles	9.00	26.21	6.20	18.37	16.00	45.23
Vietnam Social Republic	0.00	0.00	0.00	0.00	2.00	8.24
Nepal	0.00	0.00	3.76	13.30	0.64	1.79
Unspecified	1.98	1.94	4.40	15.44	0.50	1.36
Angola	0.51	1.63	0.00	0.00	0.00	0.00
Australia	0.00	0.00	1.00	3.81	0.00	0.00
Bhutan	13.28	18.59	0.00	0.00	0.00	0.00
Bosnia-Hrzgovina	0.00	0.00	0.88	3.40	0.00	0.00
Lebanon	1.00	11.90	0.00	0.00	0.00	0.00
Pakistan	0.00	0.00	0.02	0.02	0.00	0.00
Turkmenistan	0.10	0.27	0.00	0.00	0.00	0.00
Total	22,827.77	82,153.83	21,635.70	83,389.81	22,008.58	86,974.13

Source: DGCIS Annual Export

Dr. Venkatesh N. Hubballi

DIRECTORATE OF CASHEWNUT & COCOA DEVELOPMENT

Dr. Venkatesh N. Hubballi
Director
Directorate of Cashewnut and Cocoa Development,
Ministry of Agriculture and Farmers Welfare

The Directorate of Cashewnut and Cocoa Development (DCCD) functioning at Cochin is the subordinate office of the Department of Agriculture, Cooperation & Farmers Welfare of the Union Ministry of Agriculture & Farmers Welfare. This was established in the year 1966 for the promotion of cashew cultivation in the country, bifurcating the erstwhile Indian Central Spices and Cashewnut Committee. The promotion of Cocoa also was entrusted to this Directorate in the year 1997. The objective and mandate of the Directorate of Cashewnut and Cocoa Development are as follows:-

1) Formulation and execution of development programmes of cashew and cocoa in the country and to monitor the implementation of development programmes formulated and executed by the State Governments under National Horticulture Mission.

2) Nodal agency to monitor production and distribution of planting materials of Cashew and Cocoa.

3) To coordinate the activities for the promotion of these crops between the Central and State Institutes with the Ministry of Agriculture.

4) To provide adequate exposure and dissemination of technologies in production, processing and export.

5) Function as a data bank on crop area, production, price trends, marketing and trade performance of export and import.

6) Advisory body to recommend, watch, and monitor the various aspects of crop development, marketing and by product-utilization.

7) Take up intensive publicity measures for dissemination of technologies among farmers by publishing journals, pamphlets, adoption of electronic media coverage, organizing national seminars, workshops and field days at regular intervals.

8) Render technical advice and suggestions to the entrepreneurs involved in the promotion of cashew and cocoa and farming community on various aspects of cultivation.

The DCCD is one of the national agencies under Mission for Integrated Development of Horticulture (MIDH) and will be responsible for implementing, coordinating and monitoring activities relating to Cashew and Cocoa. It will also be responsible for organizing national level training programmes, seminars and workshops on cashew and cocoa on regular basis. The DCCD will also act as a nodal agency for accreditation of existing cashew/ cocoa nurseries and issue certificate of recognition/registration.

Scheme of Directorate of Cashewnut and Cocoa development

1. Establishment of new plantations in farmer's field (Cashew & Cocoa)

The development of new plantations with clones of high yielding varieties of cashew and hybrid seedlings of Cocoa in the farmers field has been envisaged under this programme. The beneficiary will be assisted as per the MIDH guidelines i.e. 40% of the cost subject to the maximum of @ Rs.20, 000 per ha without integration with drip limited to a maximum of 4 ha per beneficiary in three installments of 60:20:20 subject to the survival rate of 75% in second year and 90% in third year. This will be done directly

by DCCD in association with state development departments, manufacturers association, corporations, tribal development agencies and local panchayats. The overseeing Institute will be provided with contingency charges of 5% of the total cost. The financial assistance will be paid to the individual beneficiary farmer in the form of e-transfer/ NEFT except planting material cost.

2. Cashew productivity improvement programme through High Density Planting

The objective of the programme is to improve the production and productivity of cashew in an unit area by high density planting technique. The programme is being implemented directly by DCCD with the association of corporations, manufacturers association, local panchayats and Departments. Financial assistance @ Rs.40, 000 per ha for meeting the expenditure on planting materials and cost of materials for INM/IPM in three installments in 60:20:20 subject to survival rate of 75% in 2nd year and 90% in 3rd year without integration with drip system. The pattern of assistance will be 100% Govt. of India share limited to a maximum of 4 ha per beneficiary is extended under the scheme for taking of new planting of Cashew. The planting density will be 400 nos cashew grafts per ha with a spacing of 5m×5m. The overseeing Institute will be provided with contingency charges of 5% of the total cost. The financial assistance will be paid to the individual beneficiary farmer in the form of e-transfer/ NEFT except planting material cost.

3. Establishment of new plantations by removal of senile plantations and replanting with high yielding varieties

The DCCD has been implementing the programme establishment of new plantations by removal of senile plantations and replanting with high yielding varieties under NHM since 2005-06. The objective of the scheme is to increase the production and productivity of the senile plantations owned by the forest departments and corporation on various states.

4. Rejuvenation of cashew plantation

The main objective of this programme is to improve the productivity of existing cashew plantations by adopting horticulture and agro technique practices such as mild pruning of branches, removal of unproductive shoots/branches, soil and water conservation techniques, application of recommended doses of organic and inorganic manures in two split doses, mulching life saving irrigation, intercropping and pesticide application etc.

5. Technology dissemination through demonstrations/front line demonstrations - Cashew & Cocoa

The DCCD has been implementing the technology demonstration programme for Cashew with the association of Research Institutes since 2005-06 under NHM. Several new production technologies of cashew viz: new varieties / hybrid for different agro-ecological requirements, high-density planting, integrated nutrient management, organic farming, integrated pest management and water management which are yet to be reached to the target group. Therefore, large scale demonstration of these technologies in the farmers field and research stations and Govt. farms with active participation of farmers, research and development agencies are needed for wider acceptance.

It is proposed to continue the technology demonstration under MIDH during 2017-18 at the farmer's field for Cashew & Cocoa directly by DCCD in association with Research Institute. The objective of this programme is to demonstrate and convince the farmers of the benefits of various scientific production technologies with financial assistance as per the norms of NHM.

Criteria for selection of technologies, farmers and site for demonstrations

1. Select only proven technologies which have higher potentialities in terms of yield, disease resistance, quality, and can fit in the existing farming systems and situations of the area/ farmers.

2. Avoid isolated farms: The demonstration plots may be established in cluster basis such a way that the size of demonstration plot should have a maximum area of 1 ha.

3. Demonstration site should be easily accessible for the farmers and extension workers. As far as possible, cluster of demonstration site should have a good number of farmers of all categories of land holding and status.

4. A group of farmers land holdings in the selected demonstration block and who are willing to cooperate in the conduct of demonstration should be selected by holding a meeting in the village where the purpose of demonstration should be clearly stated and suggestion sought from the farmers. They should not discontinue the practices for a minimum of three years after the financial support ceases.

The required planting materials in the form of high yielding clones of the recommended varieties of Cashew in the region /hybrid seedlings of Cocoa should be supplied to / obtained by / the beneficiary from the overseeing Research Institute. As a part of the demonstration, organize training programme on the technologies selected for demonstration. Besides, the beneficiary farmers should always avail the technical advice from the Scientists of the overseeing Research Institute / KVKs at various stages of demonstration. The inputs required for demonstration, planting material, manures and fertilizers, chemicals etc. should be arranged to be supplied to the farmers in time.

The scheme will be implemented on project basis. Each demonstration unit should not exceed 1ha and rate of financial assistance will be @75% and 100% of cost of the project for conducting the demonstration in the farmer's field and govt. farms respectively. The maximum assistance will not exceed Rs.40,000/- per unit of 1ha. The financial assistance will be released based on the schedule of activities envisaged in the project. On the recommendation of the concerned Research Institute, the assistance will be disbursed to the farmer directly by the DCCD through Cheque / Demand Draft/ NEFT and contingency charges to the implementing agency.

6. Production of planting materials

The objective of this programme is production and distribution of good quality planting material to meet the requirement of high yielding varieties for new planting and replanting of cashew/cocoa in the country. Registered/approved private and specified cashew nursery owners who own suitable land for raising cashew nursery can apply for availing assistance under this scheme. Modernization and expansion of existing cashew nursery by creating additional infrastructure facilities also can be considered for extending financial assistance under the scheme.

The private entrepreneur seeking assistance should have technical knowledge and enough skilled labour force, for raising cashew nursery and production of soft wood cashew grafts. Nursery should be located in area which is accessible to farmers. The nursery (big) shall be of 2.0 ha. with a capacity to produce 1.0 lakh grafts per year @ 50,000 grafts/ha, and the small nursery shall be of 1.0 ha with a capacity of 0.25 lakh grafts annually. Mother blocks are to be maintained at each nursery by obtaining mother plants from known sources recognized by research organizations. The nursery owners should ensure production of quality planting materials by following technical parameters such as:

a) The minimum age of the graft should be 6 months

b) The height of the graft should be 30-45 cm

c) The grafts should have 5-7 functional leaves

d) The graft joint should be a height of 15-20 cm from collar region

e) The graft should be healthy and vertical growing

f) The graft joint should be perfect without any girdling or constriction

g) The polythene bag should be intact and not torn

h) The graft should be free from side sprouts from rootstock.

Nursery should be self-sustaining with the initial grant and need to be continued for a minimum period of 10 years and MOU need to be signed with DCCD. The maximum financial assistance shall be limited to Rs.20.00 lakhs @ 40% of the total project cost for big Model

nursery and Rs.7.50 lakhs @ 50% of the total project cost for small nursery.

Procedure for sanction of project and release of subsidy

Application for availing assistance of the scheme shall be submitted in the prescribed form through the Nationalized Bank with following documents.

1. The project proposal along with sketch of area marked for the nursery
2. Copy of possession certificate of land
3. Loan sanction letter from the bank

On receipt of the application, officers of DCCD/SAU/CRS shall inspect the site and on the basis of report, DCCD shall issue administrative approval for establishment of nurseries including modernization/expansion. Eligible subsidy will be released to the loan account of the beneficiary as back ended capital subsidy in one installment based on completion of the project and report of the Joint Inspection Team. The subsidy released to the loan account of the beneficiary will be withdrawn, if the project is not being implemented as per guidelines or schedule of implementation. The project should have distinct identity with clear sign board.

Mode of Implementation

The DCCD will implement the programmes directly in association with State Developmental Departments, Agricultural Universities/Research Institutes, Cashew Dept / Plantation Corporations of the States concerned, KVK's, growers/ manufactures association and in coordination with State Development departments.

The address of this Directorate is as under:-

Directorate of Cashewnut & Cocoa Development,

Government of India, Ministry of Agriculture & Farmers Welfare,

Department of Agriculture, Cooperation & Farmers Welfare,

Kera Bhavan, Cochin-682011.

Ph.No. – 0484 2377151 (Office)

0484 2377239 (Director)

E-mail id – dccd @ nic.in

Web site: dccd.gov.in

7. Publicity on crop promotion - Cashew & Cocoa:

The dissemination of improved technology on cashew & Cocoa is essential to the farming community to make the crops a profitable enterprise. Many programmes have been implemented in the past and present plan periods and new technologies and practices have been developed by the Research institute for giving thrust to the production & productivity of the crops. However these technologies and programmes can achieve their objective in full only when the farmers and other beneficiaries have a complete knowledge about it and adopt if in their field and obtain higher returns per unit area.

As per the operational guidelines of the National Horticulture Mission, the DCCD is responsible for organizing District level and State level seminars and National seminars in all cashew and cocoa growing states for promotion on Cashew and Cocoa. In order to achieve this objective, "Publicity for Crop Promotion of Cashew & Cocoa through Technology Dissemination" has been envisaged to take up the intensive publicity measures by dissemination of modern scientific technology for the promotion of Cashew & Cocoa cultivation & industry in India during the year 2017-18.

a) District level seminar on Cashew & Cocoa:

The programme is envisaged to give intensive publicity measures for promotion of cashew and cocoa by dissemination of latest production technologies to the farming community and other target groups coming under the fold of cultivation, processing, marketing and export by organizing district level seminar in various states. The event is for one day and involving 150 participants consisting of farmers, extension workers, officials, manufacturers and other agencies involved with development of the crop. The programme will be organized by the DCCD through the Research Institutes, SAU's. KVK's.

In order to organize one day seminar for 150 farmers, an amount of Rs. 50,000 will be provided for the conduct of one district level seminar for meeting the following expenses.

b) National Seminar/Conference on Cashew/Cocoa :

The objective of the programme is to evolve strategies to augment domestic production of cashew by adopting feasible and viable technologies and by extending the crop to nontraditional areas of the country where potential is available for the prospects of this crop.

c). Cashew/Cocoa Fair/Field day:

The objective of the event is to expose to the public the importance, scope and development of the crops by organizing mela/field day in different States along with an exhibition arranged for the purpose and depicting various aspects of the crops by putting stalls from different organizations, research, development, inputs producing industries, and export consultation on specific issues.

d. Exhibitions, Advertisements, Printing of Literatures, development of video, campaign, documentation and publicity through AIR, Doordharsan etc. for the promotion of Cashew and Cocoa:-

Exhibitions, Field days and any other campaigns in the Cashew & Cocoa growing states on need basis with financial assistance from MIDH are proposed under the scheme. Besides, financial assistance is proposed for development of booklets, pamphlets, folders etc. in various regional languages. The implementing agencies will be provided grant-in aid in the preparation & printing of cashew and cocoa literatures on need basis in English and regional languages for distribution among farming communities and extension workers. Development of video on cultivation, processing aspects of cashew and cocoa for broadcast is also envisaged under the publicity programmes. Advertisements on important occasions will also be provided to institutions/societies & media engaged in horticulture development to create awareness about latest Technologies on Cashew & Cocoa among farming community of India.

Programme for 2017-18: During the year 2017-18, in addition to the above events envisaged under the scheme, the Directorate proposed to document the improved production and protection technologies, success stories of farmers and FLTD in cashew and cocoa farming and broadcasted through AIR and Doordharsan. Provision has also been earmarked for conducting training to field level workers and farmers at this Directorate. The Directorate also sponsors seminars, workshops and for conducting need based transfer of technology programmes. For each event provision of Rs. 30,000-Rs.1,00,000 as per the proposal is provided.

Under the transfer of technology programmes of cashew and cocoa development, farmers will be invited for attending seminars/ workshops/ trainings etc.. In order to enlighten them the activities related to the cultivation, management, processing on cashew and cocoa and to have a ready to adapt knowledge of the crop, a crop museum depicting posters, live materials of the crops, byproducts, data banners etc. needs to be established in the vicinity of the concerned research institute / organizing departments of ICAR/ KVK/SAU's during 2017-18.

8. Human Resource Development for Cashew & Cocoa:

The cultivation of cashew and cocoa is limited to few areas and categories due to inadequate extension activities by research and development departments. Ignorance of such technologies is a major constraint in large scale adoption of innovative technologies developed for cashew and cocoa sector. Hence H.R.D through training and demonstrations to the farming sector launched by the MIDH became an integral part for the development of these crops in the farmer's field. The component wise details of the scheme are as under.

i. Training programme on cashew and cocoa within the state

The objective of the scheme is to promote rapid growth of cashew and cocoa development by narrowing the gaps in knowledge and skill, both managerial and technical by giving training to all the people involved in the cashew and cocoa sector.

The programme provides appropriate training to the farmers in various aspects of cashew and cocoa farming consisting of production technology, varieties, high density planting, organic cultivation, pest management, processing, value addition, marketing etc.

The participants of the training will be the members from the farming community particularly self help groups, women and youth interested in agri business as a profession, agri business entrepreneurs and members of farmer interest groups coming under the field of cashew and cocoa.

Financial support: The training will be imparted by the respective research centers/SAU by submitting project based proposals to this Directorate. The duration of the training is for a period of 3 days and will be imparted in a batch of 50 participants per batch. The training carried out inside the state i.e. within the locality of the implementing agency, a financial assistance of 90,000 will be provided per batch of 50 farmers @ Rs. 400 per day per farmer for 3 days training and the transport cost of Rs. 600 per farmer considering shortest route by rail(II class)/bus.

ii. Exposure visit (Cashew):

The objective of the visit is to expose tribal and other farmers from non-traditional cashew growing districts of the States to the traditional growing districts of other States for familiarizing production and management practices being followed in the other states. A batch consisting of 50 farmers will be trained under the scheme and duration of the training will be 7 days. The assistance will be provided to the agencies involved in the training programme both in the government sector as well as private as per the MIDH norms, for which a project based proposal is to be submitted.

Financial assistance: For exposure visits which involves training-cum field visit, a financial assistance of 2,60,000 will be provided @ Rs. 600 per day per farmer for 7 days for 50 beneficiaries towards boarding & lodging and training kit, including traveling allowance of Rs. 1000 per farmer. The organizing agency can avail bus facility per batch of 50 Nos. for which above provision of Rs. 1000 per farmer has been provided.

For North Eastern States, Rs. 3.50 lakhs will be provided @ Rs. 1000 per day per farmer for 7 days for 50 beneficiaries towards boarding, lodging and training kit including travelling allowance of Rs. 1000 per farmer.

iii. Training of cashew apple utilization for unemployed women:

Cashew apple can be used for the preparation of various by products such as cashew apple Juice, Jam, candy, syrup etc. The utilisation of cashew apple at present taking place only in Goa and that too for fermented beverages. In all other States cashew apple is being wasted. The usage of cashew apple for manufacture of value added products will add to the income of the farmer. In order to popularize the usage of cashew apple, training on preparation of cashew apple syrup will be imparted to the unemployed women. The beneficiaries selected under the scheme will be trained in the respective research institute of SAU's where adequate infrastructure facilities for small scale processing units for cashew apple has been provided by this Directorate in earlier years.

iv. National level training programme:

The objective of the programme is to give training to the field level implementing officials of various development departments in implementing the developmental schemes of cashew and cocoa envisaged under MIDH in the farmers field and extend required farming techniques to the cultivators. The duration of the training will be 3 days. The training will be conducted at one of the research institutes at Directorate of Cashew Research, Puttur , ZARS, Brahmavar, RFRS, Vengurla and CPCRI, Vittal. The participants will be from all cashew growing states with special emphasis to North East region to build awareness and promote the cultivation in larger scale.

v. Skill Development Programme

The objective of the programme is to build capacity for skill development in nursery management and provide pathways for entrepreneurship. The duration of the programme will be minimum of 200 hours for 25 people per batch. The cost involvement for the conduct of the training will be provided to the research institutions/SAU. A maximum amount of Rs. 5.00 lakhs per programme based on the detailed project proposal will be provided to the institute for organizing training, training materials, food and refreshments, stay, honorarium to resource personnels and mobility charges etc.

Coffee Board

FLAVOUR

Scheme for granting Term loan up to Rs.100 Lakhs to Micro & Small Enterprises (MSE) to Establish Roasting, Grinding and Packaging industry of Coffee - Guidelines

Objective : To enhance quality of coffee product and achieve value addition through introduction of improved technologies in roasting, grinding and packaging which will result in boosting domestic coffee consumption and entrepreneurship in the coffee sector especially in the Non Traditional areas.

Market Development

Support to Small Growers' Collectives/ SHGS Cooperatives for coffee marketing

Objective: The objective of the scheme is to extend support to small and tiny growers, incentivizing them to form collectives/ Sell Help Groups/ Cooperatives thus encouraging them in the process for taking up marketing of coffee produced on community based approach through suitable financial incentives This way they will not only be able to improve the quality of coffee but also realize better value for their coffees. It is expected to provide a mechanism for better price realization for the group, arising out of both the improvement of quality as well as collective bargaining.

Modalities for implementation of

Component 8 : Export Promotion - Providing Export incentive

Objective : The objective of the scheme is to maximize export earnings by enhancing the market share of value added coffees and high value differentiated coffees in important high value international markets.

Export of value Added Coffee as 'India Brand' eligible for the export incentive

The following are the Value Added Coffees identified for the benefit of Export Incentive exported in a retail consumer packs' India Brand' up to a maximum quantity mentioned against each.

Value Added Coffee	Maximum Quantity in Grams
a) Roasted Coffee Seeds	1000
b) Roasted and Ground Coffee	1000
c) Instant/ Soluble Coffee	500

The retail consumer pack containing Value Added Coffees should clearly depict that coffee is from India by adopting either or both of the following 'Coffees of India' logos in every consumer pack and also depict the words 'Made in India, or 'Product of India' or 'Produce of India' etc.

INDIA EXPORT / IMPORT OF AGRO FOOD PRODUCTS

Value in Rs. Lacs

Qty In MT

Product: Cocoa Products Import

Country	2014-15		2015-16		2016-17	
	Qty	Value	Qty	Value	Qty	Value
Ecuador	3,752.29	7,703.75	4,853.53	10,274.50	14,860.70	30,270.61
Indonesia	9,966.80	20,239.47	10,164.27	27,115.26	10,421.13	26,698.17
Singapore	4,039.66	11,997.25	7,566.30	18,894.25	4,878.11	13,151.38
Ghana	6,454.10	14,988.49	2,077.10	5,353.97	4,152.18	10,255.10
Malaysia	7,116.79	17,488.64	3,990.29	7,829.61	3,694.09	7,776.32
Italy	2,419.61	8,835.62	1,921.41	6,845.01	1,698.93	7,346.05
Dominic Republic	907.20	1,786.79	4,435.20	9,546.73	3,024.00	6,568.05
Netherland	2,024.72	6,308.75	1,639.98	5,381.45	1,777.28	6,404.94
Nigeria	2,073.18	4,384.78	1,000.68	2,219.32	3,016.83	5,781.20
United Arab Emirates	2,423.42	6,283.85	2,807.54	8,170.85	1,793.66	5,203.98
Belgium	542.94	2,472.90	636.03	3,712.53	812.23	4,829.66
Cote D Ivoire	10,331.62	20,783.11	0.00	0.00	2,265.82	4,594.38
Turkey	2,082.15	2,065.07	2,511.02	3,704.39	2,375.48	3,759.02
Switzerland	603.67	4,970.01	309.68	3,120.68	309.16	3,522.83
Uganda	1,027.00	1,950.87	601.97	1,307.84	1,166.01	2,349.05
China P Rp	1,732.68	1,822.16	1,804.87	2,028.75	1,620.14	1,766.14
United States	805.35	1,687.96	895.17	1,461.64	936.64	1,739.93
Sri Lanka	316.61	596.84	467.46	750.36	1,043.00	1,723.17
United Kingdom	231.63	1,400.18	203.92	1,033.24	260.72	1,288.19
Egypt Arab Republic	540.88	1,899.24	572.25	2,458.59	201.00	944.20
Madagascar	215.24	408.36	329.40	681.79	454.90	895.30
Tanzania Republic	1,410.22	2,870.42	603.11	1,298.85	400.76	778.69
Germany	350.41	1,373.60	204.64	864.06	148.79	727.86
Saudi Arabia	312.11	1,589.03	222.79	1,288.47	107.49	629.66

Value in Rs. Lacs
Qty In MT

Product: Cocoa Products Export

Country	2014-15		2015-16		2016-17	
	Qty	Value	Qty	Value	Qty	Value
United States	4,565.65	19,171.33	6,185.51	24,141.55	5,978.43	23,965.77
United Arab Emirates	908.86	6,767.87	1,736.47	9,805.07	1,121.86	7,222.04
Saudi Arabia	749.92	3,951.92	1,641.90	7,382.89	1,282.19	6,926.24
Nepal	2,798.21	6,200.54	1,871.73	5,240.49	2,120.95	6,649.95
Hong Kong	557.31	3,922.79	723.94	6,070.57	537.94	6,428.25
Singapore	377.60	1,332.97	5,889.14	16,228.79	1,200.08	5,977.02
Germany	157.24	606.15	201.67	804.21	1,185.19	4,901.67
France	0.08	0.19	200.03	891.16	1,200.02	4,526.62
Netherland	2,074.08	8,752.78	1,785.85	7,139.83	1,074.40	4,358.36
Thailand	8.16	17.47	291.71	1,134.81	677.74	3,491.60
Indonesia	640.97	4,873.43	1,016.00	1,922.81	795.96	3,049.28
Turkey	0.20	0.56	0.00	0.00	523.77	2,992.11
Philippines	475.07	1,727.67	637.18	2,612.76	686.61	2,957.73
Malaysia	500.60	1,497.02	856.10	2,937.98	557.67	2,633.56
Bangladesh	382.45	587.29	840.21	1,196.69	1,124.08	2,595.08
Sri Lanka	223.02	1,274.74	294.33	1,448.79	284.24	2,148.51
Iraq	291.08	1,630.95	544.72	2,676.52	329.41	1,843.37
Vietnam Social Republic	9.17	64.08	68.25	472.15	281.79	1,808.96
Algeria	206.28	838.45	272.73	1,150.23	386.32	1,806.35
Kuwait	163.33	942.08	381.43	1,803.07	237.79	1,285.33
Taiwan	51.87	352.01	587.73	3,497.10	138.77	967.05
Egypt Arab Republic	121.34	617.44	300.01	1,736.80	192.57	909.68
Jordan	142.22	779.97	106.45	444.97	145.17	837.32

Management practices for enhancing productivity of piggery farm

Central Agricultural University, Imphal

Introduction

Pig farming constitutes the livelihood of rural poor belonging to the lowest socio-economic strata and they have no means to undertake scientific pig farming with improved foundation stock, proper housing, feeding and other management. In India pig rearing is very popular amongst the tribal backward and weaker section of the society, especially North Eastern region (NER). Moreover, pig farming fits very well with the integrated farming and also be complementary to intensive crop production programme. NER also has the tremendous potentiality of improvement of pig production through scientific management, as in NER the deficit is aggravated due to traditional ways of pig rearing like feeding of locally available feed stuff and scavenging, improper breeding, sizeable population of non - descript pigs and non-availability of good quality pig germplasm always remains matter of concern.

Different pig breeds are presently available in the region viz, non-descript, Hampshire and their cross breeds. The selection is based on consumer preference, growth rate and meat quality. For example black skin pig is more preferable than other pigs. However, ICAR Research complex for NEH region have developed upgraded pig having 50 per cent,75 per cent and 87.5 per cent Hampshire blood and were found to be very much suitable for the region due to faster growth rate, high meat quality and disease resistance capacity. Therefore, quality pigs should be procured from known Research and developmental agencies, State Veterinary Department, NGOs and other breeder farmers. Normally pigs that have acclimatized in the area need to be chosen.

Breeding management

Indigenous pigs normally reared by farmers are bred indiscriminately without much choice of male. Moreover, during the process of scavenging, there is no control over breeding. Reproduction is the main component limiting the productive efficiency of pig industry. Successful reproduction is the outcome of a series of closely linked events. The gilt must grow rapidly to attain sexual maturity, initiate estrous cycle, ovulate and be mated by a fertile boar or inseminated with fertile semen. The female pig becomes sexually mature between 8 - 10 months depending on the breed and nutrition level. But the local pig attains maturity at 5 - 6 months. The length of the estrous cycle averages approximately 21days (18 - 24 days). Signs of heat are restlessness, loss of appetite, increased vocalization, frequent urination, red swollen vulva, riding other females, elevation of tail, arched back etc. If the female is in heat she will remain stand still when pressure i s applied on the loin region with the palms of both hands (standing reflex). It is always better to leave one or two

Artificial Insemination and litter size in crossbred pigs

Hampshire

Khasi local

Ghungroo

estrous cycle in case of the gilt and breeding may be done during the third cycle depending on the physical condition of the gilt. The best time for AI of sow/gilt is 15 - 24 hours after the onset of estrus. She should be bred on the second day if she is still in standing heat. If the female does not conceive, it will repeat its heat symptoms after 21 days. Those who do not repeat are presumed to be pregnant which, however, needs to be confirmed/ diagnosed with the help of a veterinarian.

Care during pregnancy and farrowing

After breeding, the sow should be kept in dry clean and hygienic enclosure in comfortable place. It should be closely observed for estrus symptoms around 20 days after breeding to assure the non - return of estrus and expect the conception. Pregnant sow should be shifted to a clean farrowing house before 3 weeks of farrowing. Clean and dry bedding material preferably of dry paddy straw/ hay has to be provided in the pen. The pregnant animal should be fed individually . In most of the cases no assistance is required during farrowing. New born piglets are active and within two minutes each piglet reaches a teat and attempt to suck milk. Sometimes respiration is delayed in newborn piglets. To stimulate the respiratory activity of the piglet the mucous should be removed from nose and mouth. The weaker piglets should be assisted to the teat so that they can suckle the first milk (colostrums). The placenta may be expelled during the phase of delivery as single mass after the birth of last piglet. Care should be taken to avoid crushing of newborn piglets during and after farrowing.

Feeding management

The growth and mortality of pigs largely depend on their feeding regime. Pig is the most efficient animal in converting feed to meat. About 70 - 75 per cent of the total production cost of the pig farm is due to the feed cost. Generally farmers want to rear pigs with zero inputs like kitchen waste as well as vegetable waste mixed with rice polish/ wheat bran only. However, with this feed it is not possible to get desired body weight and other production norms. It is therefore, very much important to feed the animals with economical but balanced feed which will contain all the nutrient requirements for growth and to support the life. Generally two types of feeding are practiced. They are

1. Concentrated feed computed with different feed ingredients
2. Concentrated feed mixed with other locally available agro - industrial by - products, tuber crops like sweet potato, tapioca, colocasia, vegetables and kitchen waste etc .

The poor and marginal farmers in the villages who can not afford to provide the above feed, can feed their pigs with sweat potato (6 0%), protein source, vitamins and minerals. Besides the above the pigs can also be maintained with vegetables waste and kitchen waste consisting of cooked rice,

Feed formula for different categories of pigs

Ingredients	Weaner (18-20%) protein	Growers (15-17%) Protein		Gilt/sow/boar (14-16%) protein
		12th Weeks to Market age	9-12 Months	
Maize	55	58	60	15
Ground Nut Cake	17	15	8	30
Wheat Bran	20	20	25	20
Rice Polish	-	-	-	10
Fish Meal/soya Meal	6	5	5	5
Mineral Mixture	1.5	1.5	1.5	1.5
Salt	0.5	0.5	0.5	0.5
Total	100	100	100	100

Particulars	Body Weight				
	Below 10	10-20	20-30	30-60	Above 60
Growth Stage	Creep	Grower	Grower	Developer	Finisher
Required Protein level %	20	18	16	16	13
Conc.Feed required per day (Kg)	0.5	1	1.5	2	2.5

vegetables etc. and also with brewery waste and other feed waste. A good feed ration should contain the required nutrient in right proportion as per the need of body weight along with adequate drinking water.

Feeding of pregnant animal

The demands resulting from pregnancy and need for conserving nutrients for ensuing lactation are accelerated during the later stage of pregnancy. The increased needs are for proteins, vitamins and minerals. Mature sows gain 30 - 35 kg and gilts 40 - 45 kg during pregnancy. Feed should be so regulated that sows and gilts are never over fat or thin. Feed lightly with bulky laxative feed immediately before an d after farrowing. Bring the sow to full feeding in 10 days. Plenty of greens may be provided. Feed allowance may be calculated as 2.5 - 3 kg/100 kg body weight plus at the rate of 0.2 kg feed per piglet with the sow. Thus, a sow weighing 100 kg with 8 piglets should receive 4.6 kg feed per day. The piglets may be provided with special nourishing diet called creep feed separately.

Creep feeding

The practice of self - feeding concentrates to young piglets in a separate enclosure away from their mother is known a s creep feeding. Creep feed should be given when piglets are two weeks old. Each active and healthy piglet may consume about 10 kg feed before reaching the age of 8 weeks and two - third of this consumed between 6 - 8 weeks.

Orphan pigs

When a sow dies or fails to produce milk or does not claim her pigs, the piglings should be promptly shifted to a foster mother. Some sows may refuse to suckle alien piglings. Care should be taken to simulate the conditions including the odour and body size of piglings when admitted to a foster mother or another suckling sow. Cow's milk is the best substitute for sow's milk for hand feeding if a lactating mother is not available. Buttermilk or sweet skim milk can also be used. Each pigling may consume 300 - 500 ml milk per day. Best results may be secured by feeding 5 - 6 times a day for the first few weeks and thereafter the frequency may gradually be reduced to 2 - 3 times. Any standard vitamin preparation two or three times the quantity used for infants may be administered to the piglings until they start taking feed. Injectable iron preparation (e.g. Imferon) may be given as usual. A 60 - Watt electric bulb may provide enough warmth for the piglings during the early days of life.

Flushing

It is the method of increased feeding to sows and gilts before breeding to enhance litter size. A good grower ration fed to pigs for seven to ten days before breeding to increase ovulation rate in them. After breeding animals should be fed a limited but well balanced ration until the last six weeks of pregnancy and then full feeding should be resumed to avoid pregnancy complications.

Housing

While selecting the site for pig farm, it must be near to town/city to avoid transportation cost of feed or other requirements and to avail marketing facilities. Housing is required for the animals to protect them from rain, wind, storm, and sunlight, cold and extreme climate. The pigsty may be constructed with locally available materials like wooden plunks, jungle post, bamboo and thatch grasses or the houses may be of brick wall, RCC post and with Corrugated Galvanized Iron/asbestos sheet roofing. Floor should be cemented for easy cleaning and hygienic point of view. Pig can be kept under two systems and indoor system. A combination of both may be followed. It is easy to manage animals in indoor system compared to open air system. However in open air system more areas needed for animals, that is limitation particularly in NE Region. Further

The floor space for different categories of pigs

Category	Covered area/pig (Sq.ft)	Open space/pig(Sq.ft)
Weaner	10-15	15-20
Grower	12-20	20-30
Dry Sow	20-30	30-50
Lactating Sow	70-100	70-100
Boar	35-50	50-70

in open air system, possibilities of contamination of diseases a re more than indoor system. Each animal of different categories requires a minimum floor space for housing.

Important points for pig housing

1. Construct shed on dry and properly raised ground.
2. Avoid water - logging, marshy and heavy rainfall areas.
3. The side walls of the sheds should be 4 - 5 ft. high and remaining height should be fitted with GI pipes or wooden poles.
4. The walls should be plastered to make them damp proof.
5. The roof should be at least 8 - 10 ft. high.
6. The pig sty should be well ventilated.
7. The floor should be pakka/ hard , even, non - slippery, impervious, well sloped (3 cm per metre) and properly drained to remain dry and clean.
8. A feed trough space of 6 - 12 inches per pig should be provided. The corners of feed troughs, drains and walls should be rounded for easy cleaning.
9. Provide adequate open space for each animal which should be double of covered area
10. Provide proper shade and cool drinking water during summer season.

Deep litter housing

Deep litter housing is a type of pig housing where the floor is filled with sawdust 2 - 3 feet in the both open and covered are a, which is well suited for high rainfall and high altitude area. The floor of the pen remains clean and dry due to the sawdust. The pig house also provides better micro - environment in summer and winter as well as better physiological adaptation. This model provide 2 - 3 times higher manure than that conventional concrete floor pigpen.

Advantages of deep litter housing

- Deep litter housing is well suited for high rainfall and high altitude area.
- The floor of the pen remains clean and dry due to the sawdust.
- The pig house also provides better micro - environment both summer and winter, better physiological adaptation.
- This model provide 2 - 3 times higher manure than that conventional concrete floor pigpen

Diseases and health Care

Health care measure to be followed in a pig farm is one of the most important factors and if not followed properly, farmer may incur a heavy loss. The pigs can be infected with a number of internal parasites, skin infections and other bacterial and viral diseases, which in turn will result in poor growth and even death of pig. In general, illness in pig is characterized by dullness, 8 loss of appetite, declination to move or sluggish movement, rough body coat, constipation or diarrhea, dull eyes, dull skin and hair, separates itself from the rest etc. The piglet should be dewormed once in three months. Worms from pigs may infect human being also. Most commonly found parasitic disease in NEH region are Ascaries, Strongly infection, Coccidiosis and mange mite infection. Drugs like Piperzine@250 - 3 00mg/kg b.wt in feed and water, Fenbendazole @5mg/kg b.wt in feed (Single dose) or Ivermectin @0.3mg/kg b.wt (s/c) are useful against parasitic infection in pig. The pregnant sow should be treated before farrowing.

Another commonly occurring ailment in pig is the skin infection which may be caused by ticks , mites and lice. Mange caused by mites may occur around the head, ears, legs and tails which subsequently spread all over the body. Tick and lice feed on the skin and irritate the pigs which will scratch its body. The skin infection caused by the external parasites can be treated by spraying. Dipping or painting with Butox - 1% solution spray or dipping or painting or Deltamethrin @50 - 75ppm (two application at 1 0 days interval or Ivermectin @0.3mg/kg b.wt (s/c) should be done regularly. Other diseases like piglet diarrhoea, salmonellosis, mastitis etc can be treated when it occurs in consultation with the veterinarian.

The important infectious diseases of pigs

- Classical swine fever or Hog cholera is one of the most important and devastating viral

diseases of pigs. The disease affects both domesticated and wild pigs under natural conditions. It is characterized by fever, multiple generalized petechial and ecchymotic hemorrhages giving rise to visceral and skin lesion. Symptoms of tremor, in coordination and paralysis and occasionally peracute death without any signs may also be observed. Farmers should be advised to vaccinate the animals against swine fever about 20 - 30 days before breeding.

- Respiratory disorder/ Pneumonia: it is frequently caused by Pasteurella, it is considered to be an important disease of pigs. Symptoms like affected pigs are apathetic, anorexia, high fever, coughing and sneezing, difficulty in breathing, red eyes with discharge. The treatment is more effective if appropriate antibiotic is used based on the drug sensitivity of the isolated bacteria.

- Colibacillosis (piglet diarrhoea): It is caused by pathogenic strains of Escherichia coli and i s a disease primarily of the newborn or young pigs. The disease may be manifested by diarrhea,respiratory distress and arthritis. Thorough sanitation, adequate feeding of colostrums and milk during the first few hours after birth is important to reduce the problem. Oral rehydration therapy along with specific antibiotics is useful for the treatment of the affected piglets. Occurrence of most of the diseases can be prevented by following strict hygienic measure and by timely vaccination of pigs. A separate house should be there to keep the animals suffering from contagious diseases.

Other managemental practices

- Culling of animals: Unproductive with very less litter size or with very high interfarrowing period, repeat breeders, aged animals, unproductive b oars etc. are to be culled and sold out for meat purpose.

- Castration of piglets: Male piglets which are unwanted and not fit for breeding purpose are to be castrated just after weaning and may be kept in the farm as fattener animal which later on may be sold for meat purpose.

- Segregation of diseased animal: A separate house should be there to keep the animals suffering from contagious diseases.

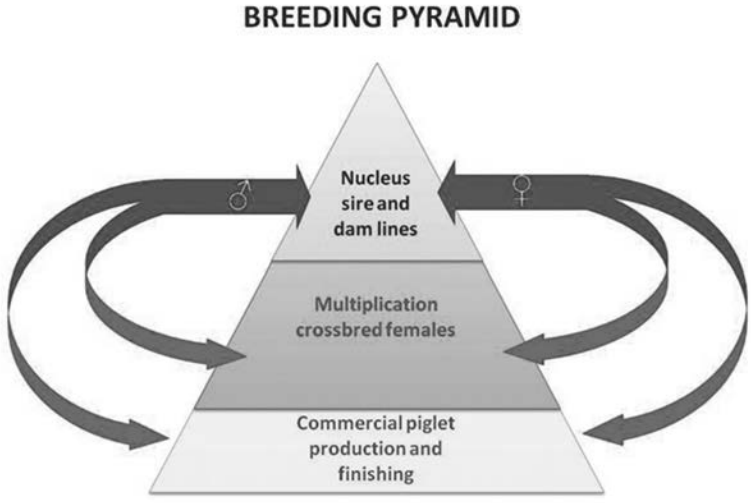
- Record Keeping: The ultimate profit or loss in a farm can only be found out by keeping proper records in the farm which includes data sheet of individual animal, total stock of animals, feed register, expenditure statement etc.

National Guidelines for formulation of State Pig Breeding Policy

The National Guidelines for formulation of State Pig Breeding Policy of Department of Animal Husbandry, Dairying & Fisheries, Government of India will focus on outline of pig-breeding needs of the country, leaving flexibility to States to work upon as per their requirement within the frame-work.

1. Objectives:

1. Genetic improvement of local pigs through selective breeding
2. Conserve/maintain nucleus hard of well developed indigenous pig germplasm.
3. Genetic improvement of local/non-descript animals by crossbreeding and gradually replacing the non-descript animals with crossbred germplasm of desired level of exotic inheritance.
4. Maintenance of well-developed planned crossbred animals at farmers' field.
5. Expansion and strengthening of breeding infrastructure and support mechanism to propagate elite germplasm through Artificial Insemination (AI).
6. Holistic development of piggery sector w.r.t. breeding, feeding, management, housing, value addition and marketing. The target is to improve the integration and position of local farmers and entrepreneurs into a pig-production and marketing value chain.



2. Breeding Policy:

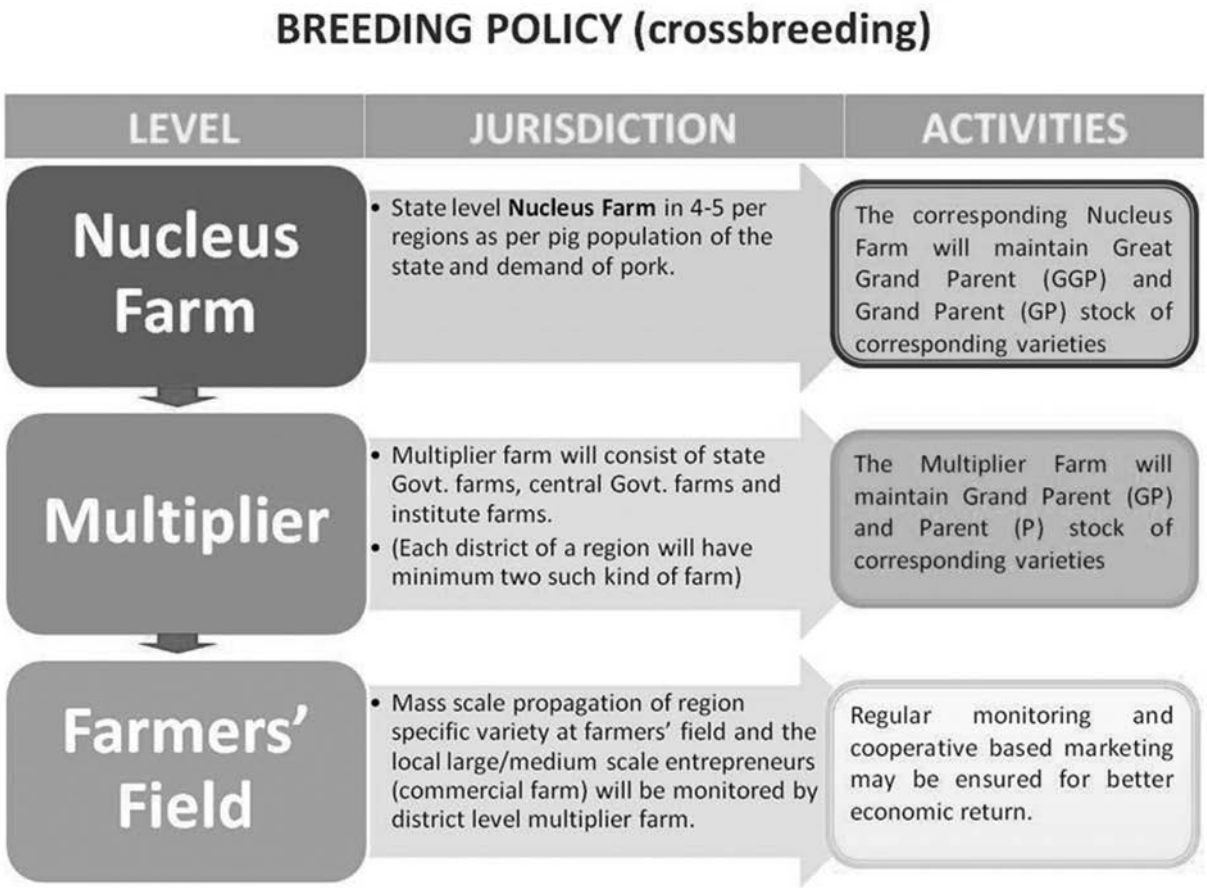
2.1. Recognition and Conservation of Indigenous Germplasm:

1. Breed registration: All the states will take necessary steps for breed registration of indigenous germplasm in collaboration with ICAR-NRC on Pig and ICAR-NBAGR, Karnal.
2. Nucleus breeding farm for such type of indigenous registered germplasm need to establish in its breeding tract separately. Breeding pyramid should be followed for indigenous prized germplasm also.
3. Prized animals may be collected from farmers' field/state/central Govt. farm to the nucleus hard.
4. Pedigreed animals should be propagated only to interested farmers who want to keep local germplasm.
5. No crossbreeding should be allowed to farmers' field for these prized animals.
6. Separate rates and incentive from the state department may be provided to such farmers.
7. Most of the indigenous germplasm are smaller in size with less litter performance. However, in specific cases, indigenous animals with higher litter size and body weight, if available, may be used for upgradation of non-descript animals with proper plan.

2.2. Cross Breeding:

- Crossbred to be propagated in different region:

1.	Northern India	• Large White Yorkshire • Large White Yorkshire cross • Landrace cross
2.	Northeastern India	• Hampshire cross • Large white Yorkshire specifically for Mizoram and Tripura • Triple cross with Duroc as terminal sire • Large Black cross
3.	Eastern India	• Hampshire cross • Tamworth cross (specifically Jharkhand
4.	Central India	• Landrace cross • Large white Yorkshire cross
5.	Southern India	• Large white Yorkshire cross • Triple cross with Duroc as terminal sire
6.	Western India	• Large white Yorkshire cross



Schematic diagram for pig breeding programme in different States

2.3 Breeding with Exotic Germplasm:

1. Import of exotic germplasm, specifically, Hampshire, Large White Yorkshire, Duroc, Landrace and Large Black from reputed source after all bio-security checking. Preference may be given to the first three breeds for import.

2. Import may be done for live animal instead of frozen semen, as the success rate of frozen semen is very low.

3. Developed breed-specific nucleus herd of imported germplasm for subsequent use in crossbreeding programme.

3. Breeding plan:

3.1 Nucleus Farm:

1. Nucleus farm may be of pure exotic breed, well-developed crossbred or pure indigenous breed.

2. Crossbred animals of desired level of exotic inheritance should be maintained. Crossbreeding may be restricted to 50% level of exotic inheritance. However, the level of exotic inheritance may be increased in state-specific breeding programme. In case of nucleus hard of pure animals, mixing/crossing of germplasm must be restricted.

3. Minimum 30 breedable sows unit should be maintained with a sex ratio of 1:3 and thus 10 sires (2 sires from each 5 unrelated sire lines) need to be maintained by each of the unit.

4. Selection of male animals should be based on weaning weight (best 25%) and 8 month body weight (best 5%), based on two stage sequential selection. Selection of female animals should be based on dam's litter size at birth (>7) and weaning weight (best 25%) and number of functional teats (at least 6 pairs of functional teats). However, these can be changed as per performance of local crossbred animals.

5. Centralized data recording system may be initiated. Generation wise genetic evaluation may be carried out to estimate the response to selection. The overall genetic gain due to selection, selection differential and heritability may also be calculated.

6. Inbreeding should be avoided. Replacement of boars need to be done at regular interval of 2 years of productive herd life. Sire exchange programme among the farms will also be helpful to reduce the inbreeding effect. Culled male animals should be castrated before selling to avoid indiscriminate breeding.

7. Three number of farrowing per sow need to be recorded. Three farrowing par sow should be completed in 2 years.

8. Weightage of selection need to be given on litter size and weight at birth and weaning.

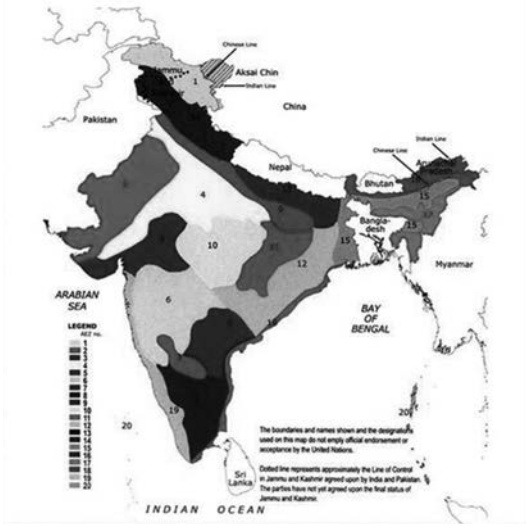
9. Besides routine productive, reproductive, adaptive and carcass traits lifetime production traits may also be recorded.

3.2 Multiplier and Farmers' Farm:

1. Multiplier farm should maintain grand parent (GP) and parent (P) stock of desired variety. The replacement (GP and P) stock of multiplier farm should be made available from nucleus farm. Multiplier farm should produce desired animals for propagation to farmers' field.

2. Breeding plan for farmers' field should be separate with that of nucleus and multiplier farm. They are only to make *inter-se-mating* among the developed crossbred animals.

   No indiscriminate crossbreeding is allowed at farmers' field.



Agro-climatic zone of India

(Source: http://www.nih.ernet.in/rbis/india_information/ecological%20regions.htm)

3.3 Mating system:

All the breeding propagation activity should preferably follow Artificial Insemination (AI) practice. To achieve the target the State level Multiplier farm must have a training center for the local farmers including modest facility/ laboratory for semen collection, evaluation and preservation. However, natural mating in some cases may also be adopted based on infrastructure of different states. Selection of boars in breeding programme should be based on following points:

1. The breeding boars require a recorded pedigree, a quality certificate for the breed issued by the authority for boars used for AI/natural mating.
2. The boars used for AI must be quarterly performance tested for semen quality.
3. The minimum area for keeping a breeding boar is 5 m2 for the local breed and 6 m2 for the exotic breed.
4. The maximum frequency of use of boars is 2 times a week for AI boars younger than two years, 3 times a week for AI boars older than 2 years, and 3 times a week for natural mating boars.
5. The reports on the quality of these boars shall be annually sent to DADF for evaluation.
6. Boars needs to be vaccinated against swine fever, pasteurellosis, foot and mouth disease and other diseases as regulated.
7. A certification system should be implemented step by step for better quality breeding boars and sows for organized farms which can be recognized as certified breeding animals

3.5 Capacity building:

1. Training of farm managers/ large scale entrepreneurs on breeding management
2. Regular/refresher training for technical personnel, para-vets and livestock service provider
3. Training on semen collection and AI to farmers/service provider

3.7 Subsidies and other financial support

1. Easy bank credit facility
2. One time subsidy for smallholders purchasing breeding boars
3. Annual subsidies for using AI services
4. One time subsidy for AI service providers
5. One time subsidy for waste management system
6. Subsidies for the import of GP and PS stocks
7. Price subsidies for indigenous pork producers
8. Subsidies for infrastructure development
9. Tax holiday for specific period for large scale commercial pig farms
4. Development of state specific policy and Implementation

The states having significant effect of piggery in livelihood of the population should work upon as per their requirement within the frame-work of this policy considering following facts:

i) Involvement of cultural and social system of the state.

ii) Sectoral analysis of pig rearers of the states need to be done for formulation of specific policy with zero input, low input and intensive pig farming system.

iii) Formulation of state-specific breeding plan should target the defined single or multiple objectives/breeding goal as mentioned in para 1.

iv) Tentative time span for achieving the breeding objective need to be fixed based on socio-cultural status of the states.

v) State may target to encourage the entrepreneurs and private/ commercial pig farmers.

vi) Policies for development of state specific organic pig farms may be taken up.

vii) State Pig Breeding Policy will be mandatory for importing States before submission of any proposal for import of exotic breeds of pigs

viii) The Policy should target to improve the integration and position of local farmers and entrepreneurs into a pig-production and marketing value chain.

Water Requirements of Poultry

Dr. Jacquie Jacob
University of Kentucky

Water is a critical, but often overlooked, nutrient. Animals can survive longer without food than they can without water. Water is involved in every aspect of animal metabolism. It plays an important role in regulating body temperature, digesting food, and eliminating wastes. At normal temperatures, chickens typically consume twice as much water as feed. During periods of high temperature, water consumption can double or quadruple. To remain healthy, poultry flocks require water of adequate quality and quantity.

Several factors influence water quality, including the color, taste, and odor of water, as well as the presence of bacteria or other microbes, the levels of minerals, and other chemical and physical factors.

Color, Taste, and Odor

It is important that drinking water be clear, tasteless, odorless, and colorless. Water that is contaminated exhibits different characteristics depending on the contaminants.

- The presence of particles such as clay, silt, or organic material can make water cloudy. Such water can interfere with the proper operation of watering equipment and can indirectly lead to adverse effects on flock performance.
- Water that is reddish-brown might contain excess iron.
- A blue hue to water can be an indication of excess copper.
- A rotten egg smell is an indication of hydrogen sulfide in water. Hydrogen sulfide may also combine with iron to form black water (iron sulfide), which can also indicate the presence of sulfate-reducing bacteria.
- The taste of water can be affected by the presence of different salts. A bitter taste, for example, is associated with the presence of ferrous and manganese sulfates.

Bacteria

Bacteria in the water can be an indication of contamination by organic material. Water is normally tested for total bacteria level as well as coliform bacteria level. Coliform bacteria are organisms normally found in the digestive tracts of livestock, humans, and birds. The presence of coliform bacteria is typically an indication of fecal contamination. If water has a high bacterial count, the best option is to eliminate the source of the contamination or to locate an alternative water source. It is not advisable to use disinfectants to maintain safe bacterial levels in a highly contaminated water source. Any disinfectant is likely to fail at some time and expose the birds to high levels of bacteria.

Physical and Chemical Characteristics

The acidity or alkalinity of water is expressed as pH level. A scale from 0 to 14 is used to measure pH. Neutral water, which is neither acidic or alkaline, has a pH of 7. Water with pH lower than 7 is acidic, and water with pH higher than 7 is alkaline. Acidic drinking water can affect digestion, corrode watering equipment, and impair the use of water-soluble vaccines and medications. Poultry prefer water with a pH of 6.0 to 6.8 but can tolerate a pH range of 4 to 8. However, water with a pH less than 6 has been shown to negatively affect chicken performance. When provided water with a pH above 8, chickens might reduce their water consumption. This in turn will affect feed consumption and bird performance.

Hardness refers to the amount of dissolved minerals, such as calcium and magnesium, in water. Hard water has high levels of these minerals and can cause the buildup of sludge in water lines. Hardness reduces the effectiveness of soaps and disinfectants and interferes with the administration of some medications. Although hard water can cause stains and adversely affect watering equipment, hard water has not been shown to have either a positive or negative direct effect on poultry performance.

Mineral Content

A large number of minerals occur naturally in water. They are usually present in amounts that do not interfere with the metabolism or digestive functions of poultry. When the levels of certain minerals are out of balance, however, poultry performance can be adversely affected.

Nitrates and Nitrites

Nitrogen contamination of water usually occurs in the form of nitrates and nitrites. Nitrate (NO3) is produced during the decomposition of organic matter. Nitrite (NO2) is produced during intermediate stages of the decomposition of organic compounds. The presence of nitrates and/or nitrites in water usually indicates that the water is contaminated by runoff containing fertilizer or animal wastes. Nitrates are soluble and may move with surface runoff or leach into the groundwater by percolation through the soil. Nitrate itself is not toxic, but after consumption, microorganisms found in the avian digestive tract convert nitrate to the more toxic form of nitrite. Once nitrite is absorbed into the bloodstream, it binds strongly with hemoglobin (which normally carries oxygen) and reduces the oxygen carrying capacity of the blood. Long-term nitrate and/or nitrite toxicity results in poor growth, decreased feed consumption, and poor coordination.

Sulfate (SO4)

In the presence of magnesium or sodium, high sulfate levels have a laxative effect. Levels as low as 50 mg/L can have a negative effect on flock performance if either the sodium or magnesium level is also 50 mg/L. High levels of sulfate may also interfere with intestinal absorption of other minerals such as copper.

Phosphate (PO4)

High levels of phosphate may indicate water contamination from sewage.

Sodium (Na)

Excessive levels of sodium have a diuretic effect. The normal sodium level in water is about 32 mg/L. Levels above 50 mg/L, together with high levels of sulfate or chloride, have been shown to adversely affect flock performance. High levels of sodium also increase water consumption and litter moisture. This can have an adverse affect on air quality in the poultry house.

Chloride (Cl)

Excessive levels of chloride have been shown to adversely affect metabolism. A normal chloride level is 14 mg/L. Levels of about 14 mg/L, combined with a level of 50 mg/L of sodium, are detrimental to flock performance. Poultry can tolerate chloride levels as high as 25 mg/L as long as the sodium level is in the normal range. High levels of chloride increase water consumption and litter moisture.

Magnesium (Mg)

The normal level of magnesium in water is about 14 mg/L. Poultry that consume water containing high levels of magnesium have loose droppings. Magnesium may interact with sulfate, and it is in the presence of high sulfate levels that magnesium levels are a concern. Levels as high as 68 mg/L have not been shown to adversely affect production when sulfate levels are normal. A level of 50 mg/L of magnesium in combination with a sulfate level of more than 50 mg/L will adversely affect flock performance.

Manganese (Mn)

Excessive levels of manganese can result in an off flavor, reducing water consumption.

Copper (Cu)

In combination with phosphorus, copper plays a role in bone development. Ruminants are more susceptible to copper toxicity than poultry. Too much copper can give the water a bitter taste and might cause liver damage. Problems with copper can occur when dietary molybdenum is either excessive or deficient.

Calcium (Ca)

Calcium does not appear to have a negative effect, even at levels as high as 400 mg/L.

Iron (Fe)

High levels of iron, up to 25 mg/L, have not been shown to adversely affect flock performance, but they will stain waterers. High iron levels may encourage the growth of bacteria that can lead to diarrhea. When iron in the ferrous form is exposed to air, it is converted to ferric hydroxide, which gives water the typical rusty color.

INDIA EXPORT / IMPORT OF AGRO FOOD PRODUCTS

Value in Rs. Lacs

Qty In MT

Product: Poultry Products Import

Country	2014-15		2015-16		2016-17	
	Qty	Value	Qty	Value	Qty	Value
Poland	0.00	0.00	28.54	298.58	63.88	941.24
Germany	544.22	542.47	718.12	696.96	503.68	495.98
Brazil	21.04	168.74	18.85	322.50	21.39	424.07
Canada	0.00	0.00	0.00	0.00	7.61	261.75
United Kingdom	12.05	333.80	0.00	0.00	4.22	231.02
France	179.74	2,144.60	79.50	1,139.88	9.93	186.92
Thailand	3.61	9.76	19.66	55.64	60.43	154.69
United States	45.05	319.26	4.00	106.19	4.00	112.36
Netherland	0.00	0.00	0.00	0.00	5.00	65.44
Singapore	0.00	0.00	0.00	0.00	15.87	31.96
Austria	0.00	0.00	0.03	2.60	0.82	23.94
Spain	0.00	0.00	0.00	0.00	22.51	12.31
Turkey	0.00	0.00	0.00	0.00	1.40	8.83
China P Rp	0.30	0.97	0.00	0.00	0.63	6.42
Denmark	4.22	97.13	0.00	0.00	0.00	0.00
Hong Kong	0.23	1.35	0.00	0.00	0.00	0.00
Italy	0.02	0.84	0.58	19.55	0.00	0.00
New Zealand	3.70	29.54	0.00	0.00	0.00	0.00
Total	**814.18**	**3,648.46**	**869.28**	**2,641.90**	**721.37**	**2,956.93**

Value in Rs. Lacs

Qty In MT

Product: Poultry Products Export

Country	2014-15		2015-16		2016-17	
	Qty	Value	Qty	Value	Qty	Value
Oman	2,21,224.09	14,054.67	3,00,898.18	20,384.43	2,36,915.52	15,932.96
Maldives	76,413.26	3,638.45	1,09,548.54	5,289.90	1,11,837.18	4,890.95
Indonesia	1,655.98	4,163.88	1,397.02	4,539.48	1,437.01	4,528.45
Saudi Arabia	18,470.42	4,771.65	42,087.86	9,563.94	4,973.66	4,190.41
Russia	0.40	1.17	16.25	46.89	1,387.60	3,649.24
Bahrain	25,706.80	2,871.16	38,353.82	4,937.32	28,474.68	3,131.18
Vietnam Social Republic	2,852.39	2,682.76	768.98	2,120.00	1,633.20	2,732.32

Japan	1,718.12	5,624.96	2,539.66	8,018.33	629.81	1,899.31
United Arab Emirates	1,334.85	1,453.49	1,522.51	1,652.28	3,716.36	1,728.29
Nigeria	628.36	390.28	132.04	487.87	408.50	1,436.89
Thailand	680.00	1,210.73	477.77	1,515.45	404.92	1,378.72
Germany	2,980.37	6,266.57	2,336.12	5,794.46	568.00	1,349.84
Afghanistan	77,137.28	2,665.61	51,085.20	1,601.41	26,832.96	1,008.73
Bhutan	721.75	847.02	690.05	800.94	794.94	961.21
Netherland	848.19	1,476.86	875.00	2,441.34	324.12	825.67
Taiwan	85.00	218.36	209.10	556.59	202.00	590.42
Iran	3,550.42	335.16	2,783.70	301.15	7,556.55	552.46
Philippines	114.97	370.88	131.45	495.97	129.68	401.17
Liberia	67,105.68	2,483.14	60,456.96	1,981.67	8,557.12	274.10
United Kingdom	0.24	4.23	3.80	1.52	90.02	227.12
Iraq	0.00	0.00	472.32	20.07	5,667.84	225.64

Source: Source: DGCIS Annual Export

Sustainable Sugarcane Production with Low Cost of Production:

Dr. Suresh Pawar
Executive Secretary, Deccan Sugar Technologist Associations [DSTA]

Sugar Industry in India is one of the most important agro based industry which is highly responsible for creating significant impact on rural economy. Sugar industry meets the large domestic demand sugar, generate surplus energy to meet the increasing energy needs of India. Indian sugar industry has significant standing in the global sugar space &remains a key growth driver for world sugar industry. This industry sharedvision is a reflection of the aspirations of key stakeholders, farmers, millers, Consumers and the government. The sector has a vision for achieving high economic growth, minimising risks, enhancing farmer-miller relationships, meeting the growing domestic demand and contributing to the national food and energy needs.

India is "World's second largest producer of sugar with Annual production of 25-26 Million, followed by Brazil around 36 Million tons. In India five million hectors of land is under sugarcane with 50 million sugarcane farmers and there dependence on this crop. Around 700 sugar mills installed in India and of which nearby 530 are in operation.

75-80% production of sugar is from 3-4 states that is Uttar Pradesh, Maharashtra, Karnataka& Gujarat. India is world's largestconsumer that is whatever we produce, we consume. In India per capita consumption of sugar is around 20 Kg with national consumption around 25 million tons.

National sugarcane area during 2017-2018 is around 50 Lakh hectors with rise of 9.5% area over last season 2016-2017, was 45.64 lakh hectors. Maharashtra state the area for current season 2017-2018 is around 9 lakh hectors with rise of 43% with expected productivity [yield] around 80+ tones per hector against last season 2016-2017, it was 65 tons due to drought season. Looking to global surplus of sugar production around 180 million tons [with 6% rise over average of annual 175 million tons] major from Brazil 23 % , India around 14 % , Thailand 7 % , Chaina 6 % which will have impact on decline of sugar prices in world and domestic market. Sugar season for 2018-19 also looks up world with record national and Maharashtra sugar production. On this background sugar production with competitive production cost hold assumes a greater significance.

The sugarcane is majorbasic row material for sugar industry in India. However the sugarcane productivity in India is low and fluctuating from last 60-70 years.

I] Problems faced by sugarcane producer:

1. Low Sugarcane productivity and recovery due to climate change.
2. High cost of sugarcane production.
3. Lack of three-tire seed chain.
4. Natural Calamities and unpredictable monsoon.
5. Short delayed crushing season and improper planting and harvesting season.
6. Fluctuation in sugar prices.
7. Financial Problems.
8. Small land holdings.
9. Lack of awareness about mechanization.
10. Degraded problematic soils.

II] Measures to overcome the problems:

1. **Improve sugarcane productivity and recovery:**

   Efforts should be made to increase the productivity and recovery through introducing high Yielding, early maturing, drought tolerant sugarcane varieties, advance production technologies and plant protection measures.

2. **Low cost technologies for sugarcane production :**

   The improved sugarcane production techniques are available at research centre level but farmer not follow the techniques due to lack of extension activities and unavailability of finance. At present the cost of production per hectare for Adsali Rs.2, 81, 389, Preseason 2, 53,274 and suru sugarcane it is 2, 20,945. By using the improved technologies like mechanization lowering the cost on seed material, use of INM, IPM, & taking inter crop producer increase the productivity.

3. **Implementation of three tire seed Production Seed:**

   Efforts should be made to develop three tire seed chain among research centre, sugar mills & sugarcane producer.

4. **Timely Availability of Funds :**

   Efforts should be made for availability of funds to producer at village level through different financial bodies.

5. **Implementation of proper planting & harvesting schedule:**

   Sugar factories should make season wise planting harvesting should be done at proper period & motivate the producer to follow it.

6. **Cane Price before starting planting Season:**

   Develop perfect formula based on Rangarajan Committee to calculate can price for producer before starting planting season.

7. **Reclamation of degraded / salt effected soils:**

   Government should made funds available for reclamation of degraded/problematic soils.

8. **Group Farming:**

   Due to small holdings in a state there is scope for group farming this is also helpful for mechanization to overcome the labour problems.

III] Problems Faced by Sugar Mills:

1. Low sugarcane productivity & recovery.
2. Improper planting season & varietal management.
3. Short /delayed crushing season.
4. Fluctuating production trends.
5. High cost of sugar production.
6. Old &absolete machinery.
7. Low per capita consumption.
8. Competition with Khandsari & Gur.
9. Government polices of impact-export.
10. Cane price polices.
11. Bi-products.

IV] Measures to Overcome the Problems.

1. **Improvement in sugarcane productivity & recovery:**

   The average productivity of Maharashtra is 88 t/ha, while in Tamilnadu its more than 110 t/ha in 2014-15. Average sugar recovery in Maharashtra is near about 11.30% in 2014-15. There is scope increase the productivity & recovery of Maharashtra.

2. **Proper varietal management :planting , harvesting & crushing period :**

   Farmers not follow the recommended sugarcane varietal planning, sugar mill not follow recommended harvesting schedule & crushing of harvested cane, that results in to low productivity and poor sugar recovery.

3. **Crushing Season:**

   Manufacturing of sugar is a seasonal phenomenon. Crushing season varying normally from 4 to 6 months in a year. The mills workers remain depend during remaining period. Creating financial problems industry as whole efforts should be made to provide work to workers by modifying the same machinery, manufacturing of bi-products like ethanol & cogeneration etc.

4. **Fluctuating Production Trends:**

   Fluctuating sugarcane production effects the supply of sugarcane to the mills & the production of sugar also varies from year to year.

5. Old & obsolete machinery :

Most of the machinery used in most of the sugar mills are old & needs to be rehabilitation.

6. Low per capita consumption :

The per capita annual consumption of sugar low &this results in low market demand & creates problems of sale of sugar.

7. Competition with Khandsari & Gur :

Khandsari industry is free from excise duty;it can offer higher prices of cane to the cane growers leads to insufficient supply of sugarcane.

8. Government policies of import-export:

India is the 4th largest exporter of sugar in the world. Depending upon the demand & supply situation in the country, the government polices of import-export should be planned well in advance so that the sugar industry cop-up with them.

9. High Cost of sugar Production :

High cost of sugarcane, inefficient technology, uneconomic process of production & heavy excise duty result in high cost of sugar production.

10. Cane Price Policies:

The government should develop a permanent formula based on Rangarajan Committee for calculation of fair & remunerative price (FRP) on basis of that formula. The cane price should be fixed before start of planting season.

11. Bi-Products:

The sugar sector is an energy hub producing not only sugar but also ethanol from molasses & power from bagasse. Sugar mill should not be depend only on sugar but may be engaged in production of bi-products. There are almost 28 bi-products from sugarcane like raw sugar, white sugar, refined sugar, sugar with molasses & bagasses based products.

V] Fluctuating Sugarcane & sugar Production trends:

Fluctuation in area under sugarcane, sugarcane production & sugar production is of cyclic manner. The fluctuation is of natural & induced type.

1. Natural Cyclicality : Natural cyclicality effects the supply of sugarcane to mills & also sugar production .natural cyclicality includes, climatic variations water availability, Pest attacks.

VI] Long Term Measures to Overcome the Problems Faced by Sugar Economy:

1. Buffer fund should be generated during on year by Government and Sugar industry which can be used in off year.

2. Insurance policy by government and banking sector for stability of sugarcane growers and sugar industry.

3. In order to balance sugar demand - supply chain, government policies should encourage production of products other than sugar.

4. Financial support for efficient & effective production technologies by government & banking sector.

VII] Problems Faced by Sugar Consumers:

1. Fluctuation of sugar prices in domestic market.

2. Inferior quality of sugar for consumption.

3. Same rates for household consumption & for processing industry.

VIII] Measures to Overcome the Problems:

1. Sugar prices in domestic market should be sold on fair price.

2. Different rates of sugar for household consumption and for processing industry.

3. Quality sugar should be produced by sugar mills.

Sugarcane

4.23 (a) : All-India Area, Production and Yield of Sugarcane alongwith coverage under Irrigation

Area - Million Hectares
Production - Million Tonnes
Yield - Kg./Hectare

Year	Area	Production	Yield	Area Under Irrigation(%)
1	2	3	4	5
1950-51	1.71	57.05	33422	67.3
1951-52	1.94	61.63	31786	68.8
1952-53	1.73	51.00	29495	66.3
1953-54	1.41	44.41	31497	67.7
1954-55	1.62	58.74	36303	68.8
1955-56	1.85	60.54	32779	67.2
1956-57	2.05	69.05	33683	64.9
1957-58	2.07	71.16	34325	65.2
1958-59	1.95	73.36	37658	67.4
1959-60	2.14	77.82	36414	67.9
1960-61	2.42	110.00	45549	69.3
1961-62	2.46	103.97	42349	68.0
1962-63	2.24	91.91	40996	67.8
1963-64	2.25	104.23	46353	69.6
1964-65	2.60	121.91	46838	71.5
1965-66	2.84	123.99	43717	71.1
1966-67	2.30	92.83	40336	71.0
1967-68	2.05	95.50	40665	74.1
1968-69	2.53	124.68	49236	76.9
1969-70	2.75	135.02	49121	75.5
1970-71	2.62	126.37	48322	72.4
1971-72	2.39	113.57	47511	71.8
1972-73	2.45	124.87	50933	75.0
1973-74	2.75	140.81	51163	76.5
1974-75	2.89	144.29	49855	77.9
1975-76	2.76	140.60	50903	78.0
1976-77	2.87	153.01	53383	77.2
1977-78	3.15	176.97	56160	78.1
1978-79	3.09	151.66	49114	77.8

1979-80	2.61	128.83	49358	77.2
1980-81	2.67	154.25	57844	81.2
1981-82	3.19	186.36	58359	82.3
1982-83	3.36	189.51	56441	80.5
1983-84	3.11	174.08	55978	80.3
1984-85	2.95	170.32	57673	83.6
1985-86	2.85	170.65	59889	84.5
1986-87	3.08	186.09	60444	85.4
1987-88	3.28	196.74	60006	85.6
1988-89	3.33	203.04	60992	86.2
1989-90	3.44	225.57	65612	86.9
1990-91	3.69	241.05	65395	86.9
1991-92	3.84	254.00	66069	88.0
1992-93	3.57	228.03	63843	88.3
1993-94	3.42	229.66	67120	88.8
1994-95	3.87	275.54	71254	87.9
1995-96	4.15	281.10	67787	87.4
1996-97	4.17	277.56	66496	88.1
1997-98	3.93	279.54	71134	91.3
1998-99	4.05	288.72	71203	91.7
1999-2000	4.22	299.32	70935	92.0
2000-01	4.32	295.96	68577	92.1
2001-02	4.41	297.21	67370	91.6
2002-03	4.52	287.38	63576	91.3
2003-04	3.93	233.86	59380	90.7
2004-05	3.66	237.08	64752	91.2
2005-06	4.20	281.17	66928	92.5
2006-07	5.15	355.52	69022	93.2
2007-08	5.06	348.19	68877	93.5
2008-09	4.42	285.03	64553	93.7
2009-10	4.17	292.30	70020	NA
2010-11*	4.94	339.17	68596	NA
2011-12**	5.03	342.20	68090	NA

* Fourth Advance Estimates as released on 19.07.2011.

**First Advance Estimates released on 14.09.2011.

Note : The yield rates given above have been worked out on the basis of production & area figures taken in '000 units.

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation.

4.23 (b): Area, Production and Yield of Sugarcane during 2008-09 and 2009-10 in major Producing States alongwith coverage under Irrigation

Area - Million Hectares
Production - Million Tonnes
Yield - Kg./ Hectare

State	2009-10					2008-09					Area Under Irrigation(%) 2008-09*
	Area	% to All - India	Production	% to All - India	Yield	Area	% to All - India	Production	% to All - India	Yield	
1	2	3	4	5	6	7	8	9	10	11	12
Uttar Pradesh	1.98	47.36	117.14	40.08	59251	2.08	47.20	109.05	38.26	52326	93.2
Maharashtra	0.76	18.11	64.16	21.95	84866	0.77	17.39	60.65	21.28	78969	100.0
Karnataka	0.34	8.07	30.44	10.41	90335	0.28	6.36	23.33	8.18	83018	100.0
Tamil Nadu	0.29	7.02	29.75	10.18	101452	0.31	7.00	32.80	11.51	106197	100.0
Gujarat	0.15	3.69	12.40	4.24	80519	0.22	5.01	15.51	5.44	70181	100.0
Andhra Pradesh	0.16	3.78	11.71	4.00	74101	0.20	4.44	15.38	5.40	78469	93.5
Uttarakhand	0.10	2.30	5.84	2.00	60854	0.11	2.42	5.59	1.96	52243	98.2
Haryana	0.07	1.77	5.34	1.83	72095	0.09	2.04	5.13	1.80	57000	99.1
Bihar	0.12	2.78	5.03	1.72	43422	0.11	2.53	4.96	1.74	44324	28.2
Punjab	0.06	1.44	3.70	1.27	61667	0.08	1.83	4.67	1.64	57654	95.4
Madhya Pradesh	0.06	1.49	2.54	0.87	40821	0.07	1.60	2.98	1.04	42199	99.6
Assam	0.03	0.65	1.06	0.36	39077	0.03	0.65	1.10	0.39	38451	-
West Bengal	0.01	0.33	1.00	0.34	72522	0.02	0.40	1.64	0.57	93085	44.6
Orissa	0.01	0.19	0.49	0.17	61238	0.01	0.24	0.65	0.23	59833	100.0
Others	0.04	1.02	1.71	0.59	@	0.04	0.89	1.60	0.56	@	-
All India	4.17	100.00	292.30	100.00	70020	4.42	100.00	285.03	100.00	64553	93.7

@ - Since area/ production is low in individual states, yield rate is not worked out.

Nte: States have been arranged in descending order of percentage share of production during 2009-10.

* Provisional

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation.

Mr. T Sai Kumar Reddy

BAMBOO – " A GOLDEN REVOLUTION "

Mr. T Sai Kumar Reddy
Managing Director of Maharashtra Bamboo Development Board

INTRODUCTION:

Bamboo is the "The green gold" of the 21st century, with its multiple uses is a gift of mother nature. The "Green Revolution" which chiefly resolved the food supply issue some decades ago, similarly the growing attention of society and recent developments on bamboo will be referred as the "Golden Revolution" in the offing.. The on going bamboo/golden revolution resolve wood supply problems in the future and reduce environment pressure on forests.

There are two markets for the bamboo: traditional and new market. The traditional market covers traditional commodities such as round bamboo furniture, handicrafts and other conventional products. The conventional market is significant and still growing although experiencing problems of increasing labour cost. The second is relatively new phenomenon, it includes industrial new bamboo based products such as pulp, paper, boards, panels, vaneer, charcoal, eatable bamboo shoots and bamboo textiles. Bamboo fibre has proven to be an excellent environment friendly substitute for wood.

GOVERNEMENT OF MAHARASHTRA POLICIES – A BIG BOOST TO BAMBOO SECTOR:

India has 11.4 million hectares of bamboo compared to 5.4 million hectares(INBAR) in China. Though India has maximum bamboo resource in the world bamboo has been a neglected material till recently. Bamboo has immense potential as future material the Government of Maharashtra has constituted a committee vide BBS/C.No241/ F9/ dated 24th July 2015 to draft bamboo policy. Following this the government constituted as board ' Maharashtra Bamboo Development Board(MBDB)' vide BBS/C.No39/F9/ dated 6th August 2016.

On recommendation of the committee Government of Maharashtra has issued a Government Resolution vide BBS / 2017 / C.No. 501/ F9/ dated 11th April 2017 , a revolutionary step to boost bamboo sector, a first in the country by removing TRANSIT PASS(TP) restrictions on bamboo grown on farmers land. The sector is not growing because of the transit rules on bamboo and with the restrictions removed the bamboo sector will see a remarkable growth on non forest areas.

BAMBOO A BOON TO FARMERS – A LIVELIHOOD SECURITY TO FARMERS.

The physical and environmental properties of bamboo make it an exceptional economic resource for a wide range of uses and for poverty reduction. It grows quickly and can be harvested annually without depletion and deterioration of soil. Bamboo can grow on marginal land and waste agricultural field as an agroforestry crop. The bamboo being a species that lasts till it flowers and the life span of bamboo varies from 40 years to 100 years depending on the species. Besides there are sterile bamboo species which do not flower. This character of bamboo means farmer need not sow the bamboo year after year like agriculture plants. The species is also immune to vagaries of monsoon, whether the year experiences excess rainfall or low rain fall the bamboo keeps generating 8 to 10 shoots of new bamboos year after year. Bamboo also contributes for sustainable forest management, which is the need of the time for environment management, as only third year bamboo culms are removed maintaining first

and second year bamboos in the farm. Hence bamboo plantation means sustaining greenery in the field at the same time productivity is obtained in the form of third year bamboos. This species has potential to become livelihood security to farmers.

BAMBOO POLICY

The Bamboo policy addresses the economy based on bamboo, the number of people directly-indirectly employed by the sector, the socio-environmental and cultural contribution that bamboo as a resource makes.

1. Bamboo – A Material Resource;

a. How much bamboo is available as a resource which can be put to use/ applications? The bamboo which is available in Maharastra, what are the applications it canbe put to for the optimum value-generation.

b. The quality of the Available bamboo resource?

c. Where is this resource available? The geography, accessibility etc.

d. How this resource is extracted and what is its supply-chain? The value-chain in the resource-management and supply.

Note:

Is there a case for improving both the quality of currently available bamboo-poles and the quantity or annual yield of the bamboo-poles at annual basis. How much is the potential for improvement in terms of the annual yield and what are the improvements in quality of the bamboo-poles harvested that can be expected.

The current state of harvesting – extraction practices for bamboo from the forests haven't been revised in the span of last 6-7 decades. There is an urgent need for revisiting the efficacy of these practices, institute new set of practices, which will start improving the yield as well as the quality of the yield.

2. Bamboo artisans, crafts - community – Human Resource;

It used to be a common site in many weekly-markets across the State-of-Maharashtra to find various products, house-hold utility items, baskets for agricultural needs and grain storage sold in plenty, providing a dignified and meaningful employment to many thousand families who practiced the craft for generations.

The registered card-holders with the department of forest is around 8000. The assumption is that the number of bamboo-artisans could lie anywhere between 50,000 – 1,00,000.

What is the (Speculative) number of craftsmen directly employed in traditional bamboo-artisinary? What might be the average monthly income? What is the status of these families? Is there a way to improve the monthly incomes, and by how much?

A large chunk of people are employed in the bamboo-based economy beyond crafts-communities. The employment potential or opportunities exists in harvesting, logistics, trading, construction of temporary-structures and Pendals, many other applications.

What could be a speculative number of people employed in the sector directly or indirectly. Can we look at expanding the net, How could we enlarge the employment potential of based on bamboo-resource and by how much.

3. Other components within the Value-chain;

a. Paper – Pulp Industry

b. Urban – market; Scaffolding, Pendals, temporary structures, ladders, fencing etc

c. Rural – market; Household needs, temporary structures (storage shed, livestock shed), Housing (mainly for roofing),

d. Bamboo-Crafts; traditional bamboo products of day to day use, festival specific products and some ritual specific products

e. Fuel, and other applications;

f. High-value addition; Furniture and products for large metro's and exports-market, high-end construction of houses, cottages etc, lifestyle products,

To help us gauge the status, size and spread of the bamboo-sector, we shall do a quick-run of the existing bamboo resource base of Gadchiroli; Average annual yield, the economy which it

propels, the verity of applications and size of economy that it generates, and people who are directly employed. We shall then extrapolate the numbers for the state of Maharashtra, although it is true that it's a little simplistic in nature, still it would give us some idea of the sector.

Area under Bamboo:

Total Forest cover (BWC – Bamboo Working Circle) in **Gadchiroli** is estimated to be around **4,75,,000 hectares** which nearly **3,30,000 hectares is under Bamboo**.

Forest has a three year cycle for Bamboo extraction, so on an average roughly 1,00,000 hectares of forest-under-bamboo is available for extraction or harvesting.

Following steps are recommended for developing artisans in the state.

- Create a special artisan welfare cell within the Bamboo Board/ PCCF office. It should be manned by a Social Worker (MSW). Alternately, this work should be outsourced to a good social work college/NGO in the bamboo sector.
- With their assistance, the number of active card holders (who get nistar bamboo need to be increased to **at least 20,000** (from 7985) in two years and more up to 50,000 thereafter. This will mean supporting about 50,000 (skilled artisan) families (or a population of 2.5 lakhs, considering five people per household) belonging to the weaker sections in the state with minimum expenditure.
- Most artisans, during discussions, indicated that they do not require 1500 bamboos for their work. In fact, their off take is much less. From the data made available by the Forest department, it is seen that the per family release of nistar bamboo to burud families over the years is less than 100 poles per annum, that the 1500 bamboos are only in theory.
- What artisans require is good quality green bamboo, preferably at their doorsteps. Hence, we suggest to reduce the quota from 1500 to 500 per annum, but accommodate more number of artisan families as indicated above .
- The nistar rates can be at 20 to 33% of prevailing market rates for same type of bamboo, and its prices can be adjusted accordingly, instead of relying on rates given in old GRs in which have become out dated.
- Here again we suggest introduction of two slabs, Slab 1 – that is 250 bamboo per annum for identified artisan families and if they are able to consume it then they go to Slab 2 – 500 bamboos per annum if they can off take it for two successive years.
- Since the nistar bamboos are also given to farming families, the need to give them in PESA areas can be revisited , considering that in PESA areas the community has been given management control of bamboo, that is in PESA areas only the genuine artisan families will be getting the bamboo
- Further, there is need to legally examine if the obligation to give to the identified artisans can be shifted to communities themselves in PESA areas as ownership of MFP like bamboo has shifted to the communities themselves.
- The nistar bamboos should be green, or at least freshly harvested . Guidelines on working this is given in later part of report.
- There is a need to update their identity cards, departmental pass books, and also help in opening the bank accounts, give them Aadhar cards etc so that there is proper record keeping in PCCF office and link them with Aadhar based monitoring system to prevent misuse of their quota.
- A software needs to be developed for this purpose
- A sensitization workshop need to be organized for the cutting edge officials like RFOs regarding the needs of buruds. The system of unwanted waiting and visits by the buruds to forest depots needs to be revisited, and system of informing them through mobile apps etc needs to be started.
- We strongly recommend earmarking certain portions of forests where burud HH can manage /maintain the bamboo stocks to meet their needs, as a Joint Forest Management

initiative. Details are given later in this report.

- We suggest that expenditure for strengthening the artisan cell can be tapped from the SC/ST department or similar funds.
- Wherever possible Common Facilities Centre (CFC) consisting of simple equipments must be promoted in burud and other artisan settlements. The Bamboo Board/MSBPA must standardize the CFC equipments to be installed.

Strategic Steps:

Declaring bamboo sector as a priority sector for development:

The first strategic step we recommend is that Government must declare, upfront and clearly that 'bamboo sector ' will be a 'priority sector' for the State and it will develop it substantially in next ten years, considering its potential in employment and its eco friendliness, and also as it makes economic sense. This decision must be taken at the highest , that is at Cabinet level, followed by an operative GR.

All departments of the Government must 'own' the bamboo sector , not just Forest department:

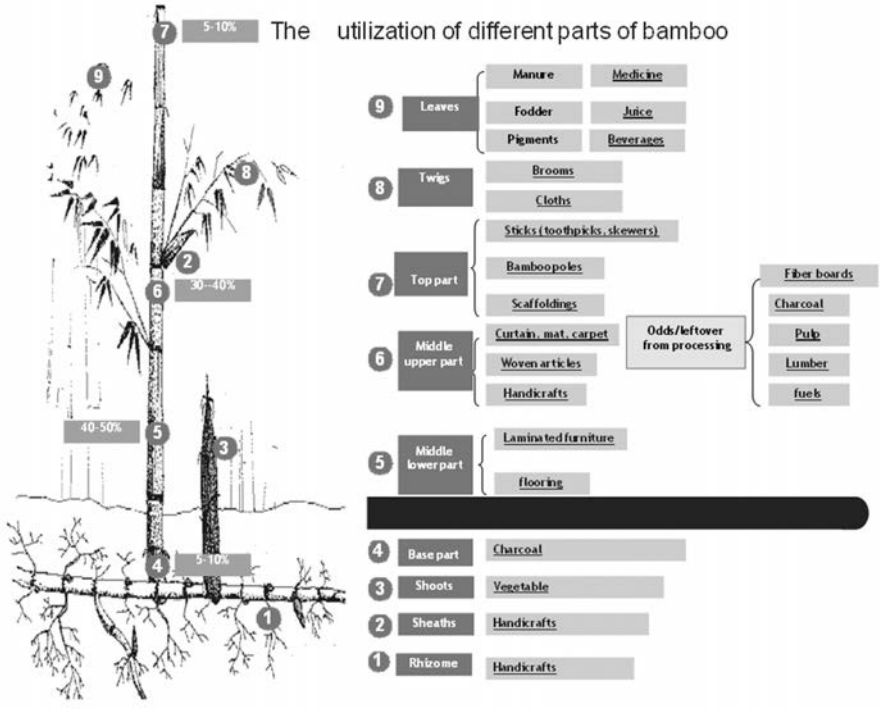
Forest department will certainly be the nodal department for this effort. But all other agencies of the Government must proactively develop this 'priority sector'. It is to be reiterated that the entire sector is to be developed, not just bamboo resources in forests.

The sector must be developed in all parts of the State:

Somehow, the general impression is that bamboo is produced and consumed in tribal areas only. Further, 'bamboo' is often associated with Gadchiroli or Vidharbha. Conscious attempts must be made to dispel this idea, and bamboo clusters and other initiatives must be developed **in all parts of the State**, wherever there is potential. Each area of the State is unique and is bound to evolve in their own way. Development of bamboo sector in different geographies of the State will also help in getting political and policy support for bamboo sector from all parts of the State.

BAMBOO ' THE GREEN GOLD' A 21ST CENTURY / FUTURE MATERIAL.

Bamboo use and trade have been growing rapidly in recent years. Bamboo is becoming popular as an excellent substitute for wood in producing pulp, paper, board and charcoal. It is widely used in construction, either in its natural form or as a reconstituted material(laminated boards and panels). In addition, bamboo shoots have become a popular vegetable with asian cuisine spreading quickly around the globe. All parts of bamboo that is from rhizome, main bamboo, branches to leaf can be converted to some useful product by value addition. Close to about 24 to 26 products can be made of bamboo. The following image provides a glance of its potential.



Note on Sugarcane and Bamboo Plantation

For sugarcane

Schemes for sugarcane

SUGAR PACKAGE

Scheme for Extending Financial Assistance to Sugar Undertakings – SEFASU 2014

GoI issued Operational Guidelines of the scheme SEFASU-2014 vide their letter No. 3/77/2013-AC dated 09 January 2014 advising financing banks to provide loans to sugar mills for the clearance of cane price arrears of previous sugar seasons and timely settlement of cane price of current sugar season relating to Fair and Remunerative Price (FRP) fixed by the Central Government. The loan will be sanctioned to the sugar mills, which have been functional during 2013-14 sugar season and loan would be to the extent of last three sugar seasons' excise duty, cess and surcharge on sugar (including notional equivalence for exports or availed Cenvat). The loan is to be sanctioned for a period of 5 years including 2 years moratorium period. GoI provides interest subvention up to maximum of 12 % or actual rate whichever is lower. Loans sanctioned by 30 June 2014 and disbursed by 30 September 2014 by the lending banks would be eligible for interest subvention facility. State Bank of India (SBI) is appointed as "Nodal Bank" for interacting with Department of Food and Public Distribution and managing the subsidy funded for onward reimbursement to respective banks. NABARD would coordinate on behalf of Cooperative Banks and Regional Rural Banks (RRBs) and would submit claims to SBI for reimbursement.

Scheme of Soft Loan to sugar mills to facilitate payment of cane dues of the sugar season 2014-15

GoI notified a scheme on 23 June 2015 for extending soft loan to sugar mills for payment of cane price arrears of sugar season 2014-15 relating to the Fair and Remunerative Price (FRP) of sugarcane fixed by the Central Government to the sugarcane farmers. The loan will be sanctioned to the sugar mills which have been functional during 2013-14 and 2014-15 sugar season and the quantum of loan would be equivalent to 11% of their reported production of white sugar in sugar season 2013-14 as certified by Central Excise authorities concerned. There will be moratorium of one year on repayment of the loan. Loans sanctioned and disbursed by 30th September 2015 by lending banks, pursuant to Gazette notification, would be eligible for interest subvention facility. Interest subvention upto 10% simple interest or the actual rate charged by the banks, whichever is lower, shall be provided to the sugar mills for a maximum period of one year by GoI. Interest subvention will be released on quarterly basis through the nodal bank, State Bank of India. The operational guidelines in respect of the scheme have been issued by NABARD and forwarded to Rural Cooperative Banks and Regional Rural Banks as NABARD would coordinate on behalf of them.

For details regarding sugarcane subsidies:

http://www.livemint.com/Politics/HYDcHFXL84G8mVwcPhdCfP/Govt-said-to-have-decided-to-pay-Rs45tonne-incentive-to-sug.html

For Bamboo Plantation

Financing Models:

NABARD will promote and fund Bamboo projects under the following models:

1. Setting up of Bamboo nurseries for quality plant production including Tissue Culture plantlets
2. Wasteland development model through BAMBOO under Farm Forestry
3. Bamboo based Agroforestry model

4. Tie -up arrangement with bamboo based industries including handicrafts

5. Cluster development for Artisans and Craftpersons for bamboo product development including marketing

6. Funding under RIDF -JFM model

7. Micro-Finance through NGOs under SHG model wherever feasible

NABARD's strategy

In order to realize maximum benefits from marketing bamboo products, NABARD will adopt the following approaches:

1) Establish supply chain from the farmer's field to large industries viz. paper,wood sustitute, plyboar, flooring, furniture etc. to improve market position. Through this arrangement, industrial farms can have easy access to bamboo raw material at competirive cost on parternership basis. NABARD will see that the business partners provide local producers with high quality planting materials,provide technical guidance, quality control and a buy- back guarantee arrangement including arranging finance wherever feasible.

2) Assist in developing small scale Forest enterprises for using Farm-forest bamboos

3) Assist the entrepreneurs in improving product quality, use of improved machines, tools and releiability for continuous and uninterrupted supply to market chain.TIFAC /IIT-Mumbai has developed effective machineries/ tools for harvesting, cross cutting,splitting, knot removing and processing of bamboos by artisans and small scale industries. NABARD will try to popularise these tools especially to the artisans.

4) Strengthen producer organizations especially the handicrafts sector for easy access to local market. The focus would be on design development, technology upgradation and market facilitation to augment the capabilities of artisans. The handicrafts sector is intimately linked to tourism sector. Hence, promotion of this sector is critical for economic growth of rural areas.

5) Imparting training to the entrepreneurs in association with INBAR, CBTC,NEDFI, etc., through workshop/ seminar to be held regularly in potential regions of the country.

6) Remove regularity barriers especially for free movement of bamboo produced from farmer's fields.

See the following for further details about bamboo in India:

http://nbm.nic.in/PDF/Targets&Achievements.pdf

http://farmextensionmanager.com/English/Agribusiness%20oppertunities/Forestry%20sector/Bamboo%20Cultivation.htm

http://capart.nic.in/scheme/guidelines_bamboo_frame.html

http://commerce.nic.in/eidb/ecomq.asp

Mr. Dinkar Patil

Pollination opportunity : Money beyond honey

Mr. Dinkar Patil
Bee Expert

The importance of honeybees to agriculture – more specifically, the role that the tiny-winged insects play in pollination – is too well-known to require elaboration. Not as well recognised a reality, however, is the destruction of beehives that the indiscriminate usage of pesticides have wrought and, in turn, contributed to a not-insignificant agricultural crisis.

Picture : A beehive box placed in a pomegranate orchard.

Highly cross-pollinated crops like onion, cotton, oilseeds and most fruits and vegetables depend entirely on winged insects that, during their flights to collect nectar, also transport pollen from one flower to another. "Honeybees are best suited to perform this function. Our experiments have shown an average 30 per cent increase in crop yields – from 17-19 per cent for cotton to 48 per cent in sunflower and 150-170 per cent in lychees – if honeybees are artificially introduced in the fields during the flowering stage even in normal conditions," informed LaxmiRao, Assistant Director of the Pune based Central Bee Research and Training Institute (CBRTI).

Not for nothing, then, that as a pollinator insect population has seen reduction – linked to factors from widespread pesticide application and mono-cropping to climate change — it has spawned a business of artificial introduction of beehive boxes. In Maharashtra, there are professional beekeepers now charging farmers anywhere from Rs 1,000 to Rs 3,000 for renting out boxes for a month.

Beekeeping, promoted as a cottage industry by the Khadi and Village Industries Commission, has so far focused mainly on honey. But now, a new demand avenue has opened up for beekeepers — in the form of pollinators-on-hire services. The beehive boxes are kept for a month or so during the flowering season. Once fruit-setting happens, the boxes are removed and taken to the field of the next crop whose flowering is due. Since flowering happens for different crops all through the year, barring the peak summer and monsoon months, there is a steady demand for the services offered by bee-keepers.

The trigona bees require less maintenance, but the requirement is three boxes per acre. Also, mellifera beehives can survive for three years; whereas trigona hives need to be re-populated every year.

According to CBRTI's Rao, the lack of trained bee breeders is a major concern. This is even more so in a scenario where the destruction of the natural habitat for bee populations is already impacting pollination in major crops. "There can be no second Green Revolution without conservation of honey bees. Farmers need to be sensitised about the importance of the winged visitors to their fields," she points out.

India Export of Agro Food Products
Product Report/Country Wise

Value in Rs. Lacs

Qty In MT

Product: Artificial Honey, Whether Or Not Mixed With Natural Honey (17029030)

Country	2014-15		2015-16		2016-17	
	Qty	Value	Qty	Value	Qty	Value
United States	405.77	465.18	469.04	590.12	511.13	605.84
Nepal	0.00	0.00	0.00	0.00	20.00	29.40
Oman	0.00	0.00	0.00	0.00	11.15	17.90
Singapore	0.00	0.00	0.17	0.23	8.16	13.86
United Arab Emirates	0.00	0.00	0.65	0.48	1.95	13.18
Seychelles	3.64	5.59	9.51	15.57	4.75	7.18
Malaysia	1.60	0.93	2.80	4.06	3.33	4.01
Iraq	0.00	0.00	0.00	0.00	1.12	3.07
Netherland	0.00	0.00	0.00	0.00	0.28	1.42
Mauritius	0.00	0.00	0.00	0.00	0.20	0.77
France	0.00	0.00	0.00	0.00	0.23	0.68
Australia	0.06	0.11	0.35	0.90	0.00	0.00
Bahrain	0.20	0.22	0.00	0.00	0.00	0.00
Congo D. Republic	0.00	0.00	4.00	2.20	0.00	0.00
Japan	1.50	2.15	0.00	0.00	0.00	0.00
Kenya	0.10	0.16	1.04	0.57	0.00	0.00
Pakistan	0.00	0.00	26.00	9.91	0.00	0.00
Sri Lanka	0.18	0.28	0.00	0.00	0.00	0.00
Total	**413.05**	**474.62**	**513.56**	**624.04**	**562.30**	**697.31**

Source: DGCIS Annual Export

Exports From India

Value in Rs. Lacs
Qty In MT

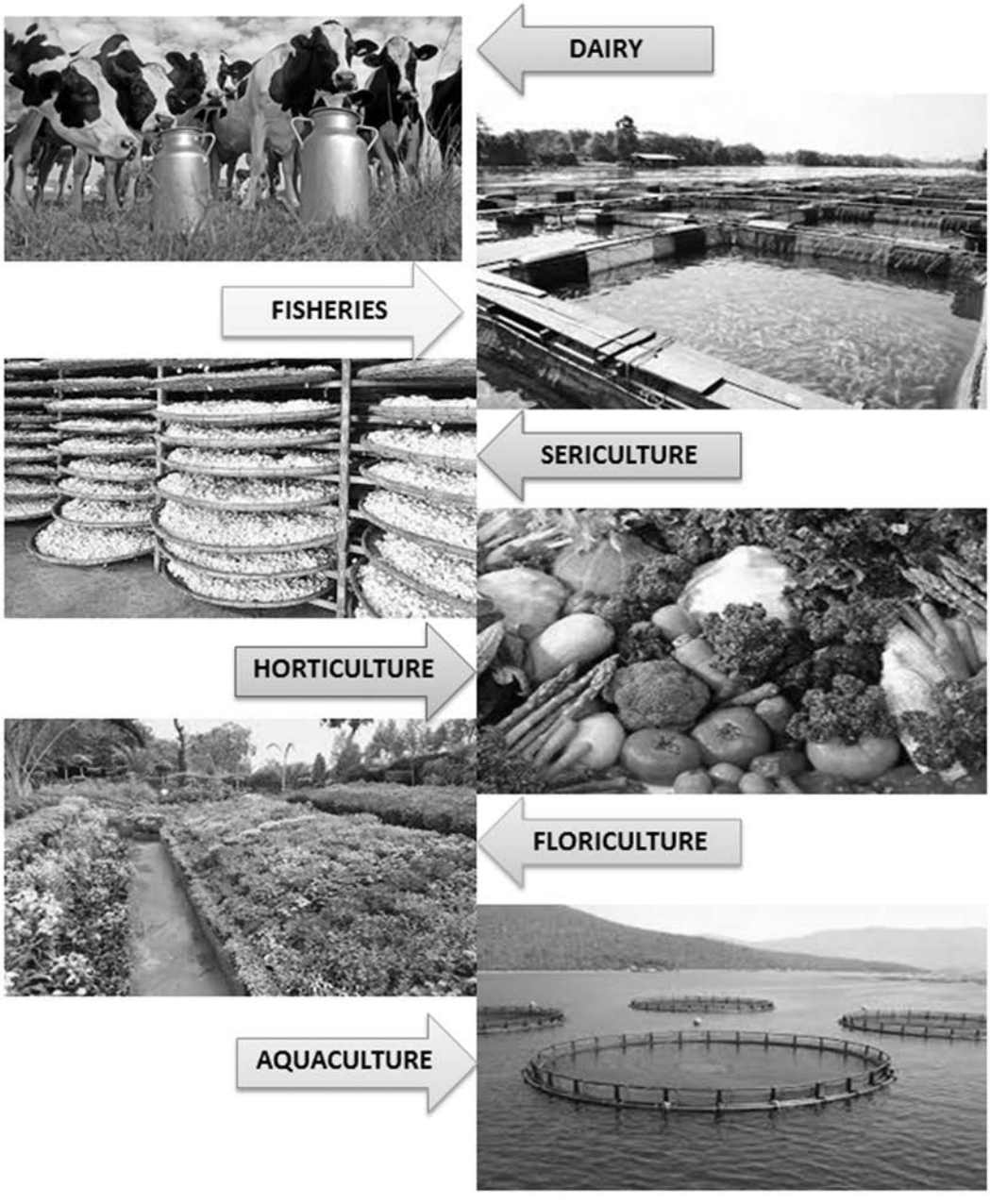
Product: Artificial Honey, Whether Or Not Mixed With Natural Honey (17029030)

Sr. No.	Country	2016-17	
		Qty	Value
1	U S A	39,570.24	45,924.86
2	U Arab Emts	1,269.16	2,084.89
3	Saudi Arab	770.72	1,260.43
4	Bangladesh Pr	717.45	999.83
5	Canada	453.34	755.97
6	Kuwait	255.47	595.60
7	Qatar	236.34	524.77
8	Libya	283.61	513.61
9	Morocco	319.03	441.17
10	Nepal	309.30	432.97
11	Germany	241.75	428.77
12	Yemen Republc	175.02	371.01
13	Oman	180.16	360.20
14	Japan	78.34	300.16
15	Iraq	113.84	155.96
16	Singapore	42.51	132.75
17	Jordan	45.93	105.58
18	Kenya	62.13	104.50
19	Malaysia	47.89	100.08
20	Egypt A Rp	58.00	96.41
21	Sudan	55.28	95.85
22	Bhutan	40.50	84.24
23	Nigeria	31.58	67.62
24	Mauritius	24.89	57.03
25	Baharain Is	40.08	56.42
26	Australia	28.39	49.63
27	Norway	10.00	38.02
28	Bahamas	10.46	28.11
29	Djibouti	15.00	26.54
30	Hong Kong	12.69	25.49
31	Pakistan Ir	7.00	21.25
32	Sri Lanka Dsr	10.05	21.08
33	U K	6.30	19.52

34	Tunisia	5.82	10.04
35	Ghana	1.85	6.74
36	South Africa	1.48	4.97
37	Indonesia	1.74	4.59
38	Maldives	0.84	4.08
39	Switzerland	0.44	2.58
40	Philippines	0.35	0.99
41	Netherland	0.42	0.89
42	Guadeloupe	0.44	0.67
43	Suriname	0.20	0.53
44	Zambia	0.42	0.52
45	Togo	0.21	0.47
46	France	0.14	0.44
47	Seychelles	0.09	0.39
48	Malawi	0.10	0.34
49	Fiji Is	0.10	0.33
50	Uganda	0.18	0.30
51	Tanzania Rep	0.12	0.24
52	Netherlandantil	0.16	0.23
53	Taiwan	0.11	0.23
54	Cote D' Ivoire	0.07	0.23
55	Fr Guiana	0.07	0.12
56	Mozambique	0.05	0.12
57	Spain	0.06	0.10
58	Guyana	0.04	0.08
59	Poland	0.02	0.05
60	Iran	0.02	0.04
61	Gambia	0.02	0.03
62	Cyprus	0.01	0.03
	Page Total	**45,538.02**	**56,320.69**

Source: DGCIS Annual Export

REVOLUTIONS



Dr. A. D. Jadhav

Capt. Dr. L. B. Kalantri

Sericulture for Rural livelihood

Dr. A. D. Jadhav

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Capt. Dr. L. B. Kalantri

Ex-Director of Sericulture

Introduction :

Silk – *The Queen of Textiles* spells luxury, elegance, class and comfort. Mankind has always loved this shimmering fibre of unparalleled grandeur right from the day of its discovery. Exquisite qualities like natural sheen, inherent affinity for dyes and colours, high absorbance, resilience and excellent drape etc. have made 'Silk', the much sought after fabric and inevitable companion of eve, all over the world. Chemically speaking, Silk is made up of proteins secreted by the 'Silkworm' – a tiny caterpillar. These silkworms feed on the selected food plants and spin cocoons as a 'protective shell' to perpetuate its life. Man interferes its life cycle and processes a continuous filament known as Silk and uses in weaving of the dream fabric. Silk the very name evokes delicate feelings and till date no fabric in the world has conquered this Queen of Textiles. And, that's the magic of Silk.

SERICULTURE & SILK INDUSTRY IN INDIA

Sericulture is an ancient industry in India dating back to at least second century BC. India has the unique distinction of being the only country producing all the five known commercial varieties of silk i.e., mulberry, tropical tasar, oak tasar, eri and muga. On the other hand, itstands for livelihood opportunity for millions owing to high employment oriented, low capital intensive and remunerative nature of its production. The very nature of this industry with its rural based on-farm and off-farm activities and enormous employment generation potential has attracted the attention of the planners and policy makers to recognize the industry one of the most as appropriate avenues for socio-economic development of a largely agrarian economy like India. Silk has been intermingled with the life and culture of the Indians. Sericulture in India is a cottage industry with an agro-based industrial super-structure and is practiced in about 54000 villages, occupying 1.94 lakh hectares Sericulture industry provides employment to approximately 7.85 million persons in rural and semi urban areas in India.India is the Second largest producer of silk in the World. Among the four varieties of silk produced, in 2014-15, Mulberry accounts for 74.51% (21,390 MT), Tasar 8.48% (2,434 MT), Eri 16.46% (4,726 MT) and Muga 0.55% (158 MT) of the total raw silk production of 28708 MT.

Of these, a sizeable number of workers belong to the economically weaker sections of society, including women. India's

traditional and culture bound domestic market and an amazing diversity of silk garments that reflect geographic specificity has helped the country to achieve a leading position in silk industry.

Maharashtra – The Silk State:

Maharashtra is a non-traditional state for producing mulberry silk and tasar silk. Sericulture industry has been playing a major role in the employment generation and checking migration of rural labour. The silk production plays an important role towards providing sustainable livelihood to the farmers and tribal communities in the State, which now is gaining popularity with ARM reeling and world famous weaving of Paithani and Vanya silk garments. Intensive Skill Development Schemes(ISDS) and Mulberry Rearers Cooperative Societies (MRCS) and Tasar Rearers Cooperative Societies (TRCS) has to be implemented in the state .

Directorate of Sericulture (DOS), Govt. of Maharashtra:

The government of Maharashtra has formed a separate Directorate of Sericulture at Nagpur, under the administrative control of Textile Department on 1st September 1997 itself to ensure its all-round development. The Department of Sericulture (DOS) is the nodal agency that plans and monitors the development of the industry and is headed by Principal Secretary (Textile) with an extensive network of technical service centers equipped with trained and qualified personnel spread all over **23** districts of Maharashtra to support the Sericulturists. It encompasses a head office with 4 regional offices, 22 district level technical service centers, **29** cocoon purchasing centers, 13 Govt. reeling centers and 10 pilot extension-cum-training centers to support the mulberry sericulture industry.In the tribal districts like Bhandara, Chandrapur, Gadchiroli and Gondia Tasar cultivation is practiced for last 300 years. Maharashtra is growing up as a potential Mulberry raw silk producing State among the non-traditional states. State is producing about 250 mt of mulberry silk and about 15-20 mt of tasar silk.

DOS has a number of plans and schemes to augment the development of sericulture. Besides, technical support, training, propagation of new technologies for better and higher yield, the DOS also assists the sericulturists in getting credit from banks and encourage them by extending subsidies, incentives and other material support for practicing sericulture on scientific lines under Mahatma Gandhi National Employment Guarantee Schemes etc. These projects/ schemes cover the entire gamut of silk industry right from mulberry cultivation to weaving and exports. The thrust is always on adoption of improved and new technologies, higher productivity and quality. Besides, emphasis is also laid on issues like eco-friendly concepts, women empowerment, socio-economic upliftment of the under privileged categories of society, human resource development and skill enhancement.

Mulberry Cultivation;

Soil - There are different types of soil and for good mulberry growth, **black-cotton,** red loamy

Mulberry Cultivation

soil is suitable. The other types of soil are to be modified to suit mulberry growth. Generally, the soil testing of mulberry field is carried out for the following reasons:

- To select suitable soil for mulberry cultivation
- To analyze the fertility status of the soil
- To find out the Acidity, Alkalinity and Salinity levels of the soil
- To fix optimum levels of fertilizers.

Mulberry Varieties:

Selection of good and high yielding mulberry variety like V-1, G-4, G-2 is the basic requirement for practicing successful sericulture. While selecting the variety, the farmers should always look for characteristic like good rooting, fast growth, high yield, wide adaptability to environment and soil conditions, besides resistance to diseases and pests. Characteristic like superior leaf quality and suitability to both young and late age silkworms in different seasons are the most anticipated qualities of a best mulberry variety.

Paired Row System

* It is an advanced type of spacing
* Plant spacing will be (5' + 3') x 2' [(150 + 90) x 60 cm] & (180 + 60) x 30 cm
* Plantation is done in paired rows with spacing of 60 cm between paired rows and 30 cm between plants. The distance between two paired rows is 180 cm.
* Intercultural operations are possible by power tillers and tractors
* Economical to install and operate drip irrigation
* Mulberry leaf quality will be good as plants get more unlight, space in between the rows and better aeration. Intercropping of **vegetables**, **oil seeds** can be taken up in this system

Irrigation:

Irrigation is one of the major requirements for mulberry cultivation. The growth and production of mulberry depends on irrigation, which facilitates better utilization of manures and fertilizers. Normally, irrigation is done once a week or so, depending on the type of soil.

Manuring:

As large quantity of bio mass (leaves) is harvested regularly, the soil nutrients are fast depleted. To rejuvenate and to maintain soil fertility and health, recommended doses of fertilizers and manures should be added to soil at regular intervals in the form of manures and fertilizers. The dose of fertilizers and manure to be applied is determined based on the recommendations of the soil testing report; it differs for rainfed and irrigated gardens.

Diseases and Pests:

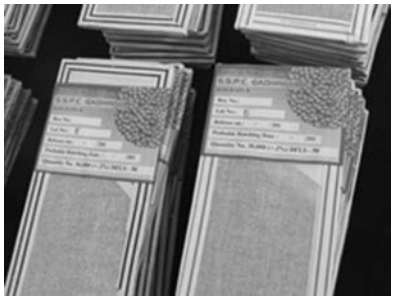
Being a perennial plant, mulberry is exposed to several environmental vagaries and pathogens. Pathogens may be fungi, bacteria, virus, nematode etc. and their infection deteriorates the nutritional qualities of the mulberry which in turn adversely affects the growth and health of silkworms. Many a times, total failure of cocoon crop is also reported.

Kissan Nursery

Mulberry is generally propagated through cuttings; here the chances of failures sprouting and establishment of plants are more therefore it is always desirable to opt for preparation and transplantation of saplings for successful establishment of garden. Since rising of saplings is time consuming and needs advance planning formers prefer to buy and use ready to plant saplings hence large quantity of saplings are made ready for commercial purpose by the farmers. Kissan Nursery is another entrepreneurial venture, which can be done by farmers, women and youth.

Silkworm Rearing:

It is an art & science of timely feeding the required quantity of specified quality feed to the silkworms to produce healthy and good cocoons. The scientific way of rearing silkworm means, providing required temperature and humidity, sufficient space for growth & prevent diseases and pests all leading to sustainable sericulture for higher yield of cocoon and higher returns to Silkworm rearers.



Silkworm eggs

Silkworm breeds play an important role in production of quality cocoons and silk R & D units of CSB and DOS have evolved and developed a number of high yielding silkworm races and hybrids suiting different seri-zones and climatic conditions. Some of the hybrids authorized by CSB like CSR, FC1, FC2, FC1 xFC2 hybrids are quite popular in the field; in fact many breeds have revolutionized the entire scenario of sericulture and silk industry for the better.

HYGIENE: By and large success or failure of a silkworm crop depends on the maintenance of hygiene. They are

a. Hygiene of the rearing house
b. Hygiene around the rearing house
c. Personal hygiene.

Silkworm Egg Procurement And Transportation

* The silkworm eggs are to be procured from authorized grainages.

* Procurement of required quantity and quality silkworm seed has to be planned well in advance for a successful crop.

* The silkworm eggs should be transported during cooler hours of the day as high temperature damages the eggs.

* Transport the eggs in the recommended egg transportation bags to avoid suffocation.

Chawki Rearing:

Rearing of young age silkworms upto 2nd stage or 7-8 days is called chawki rearing. It is always " desirable to have a separate rearing room for chawki rearing to maintain required environmental conditions and hygiene.

Young age silkworm is very important as the success of rearing depends much on it. Chawki worms need nutritive leaves as they grow 400 times in body weight. They need more care and attention, as they are less resistant to diseases.

Maintain an ideal temperature of 26-28°C and 80-90% humidity inside the chawki rearing room.

Mulberry leaves must be succulent, rich in protein and carbohydrates. Tender leaves i.e. largest glossy leaf and 4-5 leaves below it are always good for chawki worms.

Chawki Rearing Schedule

Stage of Silkworm	Temperature (° C)	Relative Humidity (%)	Spacing (Sq.ft/100 dfls)	Quantum of leaf (kg/100 dfls)	No. of feeds/ day
1st instar	28	90	6-24	5-7	3
2nd instar	27	85	24-25	16	3

Late Age Rearing:

Rearing of silkworms from third stage to spinning is called late age rearing. This period lasts for about 14-16 days. The larvae consume more than 90% of the total leaf requirement, during IV & V stages, grow 125 times in weight and 133 times by size and naturally require more bed space. They also need protection from pests and diseases. As the larvae are sensitive to high temperature and humidity, suitable climatic conditions have to be made to make them grow and go on for cocooning.

Requirements:

* Most essentially, a good and productive mulberry garden.

* A separate rearing house with good ventilation.

* Rearing appliances and other equipments.

* Scientific method of rearing.

Shoot Rearing

Worms are reared in shelves/ racks arranged along the rearing house. About 4-5 racks of 5x35 ft. are required to rear 100 dfls. The racks can be made of bamboo or wood and arranged in three tiers with 2 feet gap in between the racks. The sides of the racks are raised to 6" to prevent falling of larvae. The lower tier is

one foot above the ground level. The racks can be either fixed or movable type. Shoots in the rearing bed have to be arranged in such a way that the terminal portions of the shoots are kept alternatively.

Late age Rearing Schedule:

Stage of Silkworm	Temperature (° C)	Relative Humidity (%)	Spacing (Sq.ft/100 dfls)	Quantum of leaf (kg/100 dfls)	No. of feeds/ day
3rd instar	26	80	120-240	140	3
4th instar	25	75	240-4800	460	3
5th instar	24	70	400-1000	2880	3

Matured / Spinning Larvae : Nowadays self- mounting is adopted for spinning. The indications of matured larvae are

- The larva stops eating. Body of the larva shrinks and turns translucent. It excretes softer faeces.
- Larvae start moving around, lifting the head and exhibit a climbing tendency.

Harvesting :

* Harvest cocoons on 6th or 7th day after spinning.
* Place the mountage vertically with hooks facing upwards and loosen the cardboard frames from the wooden frames.
* Cocoon harvester can be used (either machine or wooden pegs) to separate cocoon from cardboard frames.
* Harvesting is done manually by picking the individual cocoons by hand For harvesting uniform and quality cocoons rotary mountages are recommended.

Transportation And Marketing :

Cocoons are purchased by government agencies at minimum support prices. Ramnagram in Bangalore district of Karnataka has largest open cocoon market of the world. Most of the farmers of Maharashtra are selling their cocoons in this market at average prices of Rs 400 - 450 per Kg cocoons of bivoltine breeds

1. After harvesting separate litter from the cocoons.
2. De-floss the cocoons, if they are meant for seed.
3. Sort out melt, flimsy and double cocoons.
4. Pack the cocoons in cloth / gunny bags loosely to facilitate aeration.
5. Always transport the cocoons to market during cooler hours.

Mechanization: Proper maintenance of mulberry garden calls for regular farm operations. Different activities involved in moriculture are labour intensive and time consuming. In recent days, the farmers are experiencing difficulties in effective executions of these operations due to scarcity of labor, which in turn lead to more time consumption and low efficiency. In order to address such constraints, Central Silk Board has developed a number of machines that are user friendly. These machines not only save time and labour but also help in reducing the cost of production in the long run.

Mechanization in silkworm rearing: This has been introduced in silkworm rearing to reduce the cost of production and to save time and labor. It also brings down the prudery and improves the work efficiency. Central Seri cultural Research and Training Institute Mysore has developed a number of machines to ease the processes involved in mulberry cultivation and silkworm rearing

Mulberry Leaf Chopping Machine: Chopping mulberry leaves into small pieces is necessary for feeding the early instar larvae. Conventionally, mulberry leaves are cut manually with a sharp blade and skilled persons are required to cut the leaves.

Flame Gun: Use Flame Gun for disinfection of silkworm rearing house, rearing appliances like rearing stands, mountages etc.

Powder Duster: The silkworms are dusted with bed disinfectants like Reshme Jyothi, Vijeta, RKO, Powders, A & B etc.,

frequently for prevention/control of diseases.

Cocoon Deflossing Machine : The power- operated Cocoon Deflossing machine can defloss 60 / 70 kg of cocoons per hour.

Cocoon of improved silkworm

Silkworm diseases and management: Silkworms are prone to many diseases like Flacherie, Grasserie, Muscardine and Pebrine. These diseases prevails all through the year, Flacherie disease is severe during summer and rainy seasons. The major viral disease grasserie is prevailing all through the year. However, the incidence is more intense during summer and rainy seasons. Pebrine is a dreaded disease caused by microsporidian pathogens. It is confirmed only through microscopic examination of diseased larvae, faeces, pupa, moth or egg. Muscardine and aspergillosis are fungal diseases prevailing during winter and rainy seasons, commonly found in all sericultural areas of the country.

Cocoon

Uzi Fly : Uzi fly is a serious pest inflicting considerable loss to sericulture industry. The cocoon crop loss is estimated between 10-30%. In Maharashtra uzifly incidence was recorded long back. However, its severe incidence is noticed in many districts of western Maharashtra since last 3-4 years, mostly in Pune and Satara districts. Maximum incidence is observed in Oct.-Nov. months.

Post cocoon Technology Reeling : If silkworm rearing and production of cocoons constitutes the agriculture part of sericulture, the processing of cocoons and reeling forms its industrial part. Silk reeling is a process of unwinding of silk filament from the cocoons and combining a number of ends into a single thread suitable for weaving. It is infact an art by itself. Silk reeling is done on a variety of reeling devices namely Charka, Cottage Basins and Multiend reeling machines

Silk Testing & Grading:

The following tests are conducted:

i. Visual inspection
ii. Winding test
iii. Size deviation test
iv. Evenness test} Seriplane Test
v. Cleanness test} Seriplane Test
vi. Neatness test} Seriplane Test
vii. Tenacity & Elongation test
viii. Cohesion test
ix. Boil-off test
x. Exfoliation test

Based on the quality characteristics, raw silk is classified as B to 4A grade.

Training and Entrepreneurship Development: In order to update the technical know-how of the end user & also to disseminate the recent technologies developed in the field of sericulture to boost the productivity, Central Silk Board & Department of Sericulture, is conducting training courses for the benefit of farmers. In recent years sericulture is turning into a business venture and is attracting entrepreneurs. Central Silk Board is encouraging such entrepreneurs by extending required support in the areas of training, technical advice / inputs, preparation of bankable projects, facilitating credit from financial institutions and establishing forward and backward linkages etc. The well-designed training programmes help the entrepreneurs to mould themselves into successful businessmen in silk.

Central Silk Board conducts different training courses at Central Sericultural Research & Training Institute, Mysore, and also at its nested units distributed in Karnataka covering the areas of mulberry cultivation & silkworm cocoon production. Similarly, it conducts training courses on post cocoon technology at Central Silk Technological Research Institute, Bangalore and also at its nested. On the other hand, Department of Sericulture, Maharashtra also organizes training at its training center located in Pune and Amravati through various universities, KVK, RAMETI, and at every district training centers.

Sericulture Quality Clubs / Adarsh (model) farmers

Transfer of technology will be more effective if it happens from farmer to farmer. The main reason being, the psychology of the farmers to follow the footprints of a successful farmer. This perhaps is one of the main reasons for the establishment of sericulture quality clubs. These clubs are run by the farmers for the benefit of farmers. Hence, production of quality silk is possible. Effective utilization of available resources and thereby, achieving the reduced cost of production. Raising of good quality mulberry and production of raw silk. Establishment of Chawki Rearing Centres with well-equipped chawki rearing houses. Supporting the members to adopt new technologies. To assist the members to undertake effective disinfection to prevent the disease occurrence/spread. Supply of quality chawki worms, disinfectants etc. at reasonable prices.

Future Strategies for successful implementation of sericulture in the state - include:

- Adoption of group-based, holistic, cluster-oriented and farmer-centric approach for implementation of need-based Project(s) with clear forward and backward linkages
- System of Command area/ contract farming will be adopted in a cluster to avoid outflow of cocoons, to solve marketing problems, and development of post - cocoon sector
- Skill development, and sharpening managerial abilities and technical skills through appropriate Human Resource Development Programme on a regular basis
- Privatization of Seed Production sector
- Entrepreneurship development in post cocoon sector, concentrating in the areas where specific group of people is located to firm up reeling linkages like Ramanagaram and Sidalghatta in Karnataka
- Development of cooperative culture in sericulture, both in pre-cocoon and post cocoon sectors, by establishing village-level, block-level and district level societies and federating them at apex level
- Involvement of Non Government Organizations, Women Groups, Self Help Groups etc in implementation of the Schemes/Projects/ Programmes
- Integration of sericulture activity with other agro-based rural activities leading to empowerment of rural poor
- Market promotion through exhibitions, product diversification, etc
- Development of seri-systems for implementation and monitoring with role clarity and specific linkages.

Mulberry silk production

- Development of systematic plantation of Improved Mulberry varieties like S1635, S36, V1etc, through saplings with close spacing and assured irrigated facilities
- Popularization of organic farming, green manuring and vermi-composting for soil fertility management and for checking adverse effects of chemical fertilization through use of organic manures
- Setting up quality silkworm seed production infrastructure in private sector by motivating the entrepreneurs and leasing out the state infrastructure facilities
- Development of proper infrastructure facilities like separate rearing house, improved rearing and mounting equipments at farmers' level
- Popularization of high yielding productive hybrids and combinations especially CSR hybrids for bivoltine cocoon production
- Establishment of Cooperative Chawki Rearing Centres for supply of chawki silkworm larvae
- Adoption of Improved silkworm rearing practices developed by CSB Institutes (shelf rearing by shoot feeding technique)

- Contractual disinfection of the rearing houses and appliances to check crop failures and other risks especially in bivoltine rearing

- Setting up of improved silk reeling and twisting units in private sector through individual entrepreneurs, Self Help Groups or NGOs itself

- Strengthening of service sector for supply of farm and non-farm inputs (institutionalizing the input supply), and

- Systematizing the marketing of seri-outputs (establishing forward and backward linkages).

Vanya Silk production

- Harnessing of natural resources for silk production by taking up commercial crop rearing in forests

- Utilization of existing systematic plantation raised under ISTP for seed crop rearing

- Development of systematic plantation of Tasar silkworm host plant species with cost-efficient cultivation practices for conducting seed as well as commercial crop rearing

- Augmentation of Eri silkworm food plants grown for oil seed and utilizing castor plantation for silkworm rearing

- Introduction of improved technologies in pre-& post cocoon activities

- Strengthening of Reeling, spinning and weaving activities through technology intervention and skill up-gradation

- Development of market by diversifying the vanya silk products

- Promotion of private entrepreneurs in pre-& post cocoon sectors like commercial seed production, reeling, weaving, etc.

- Strengthening of service sector for supply of farm and non-farm inputs (institutionalizing the input supply) and

- Systematizing the marketing of seri-outputs

Scheme 1: R&D, Training, Transfer of Technology & IT Initiatives:

Ongoing Schemes:

Following on going schemes will continue during the XII Plan

- Ongoing research activities (350 Research Projects) by 9 main Research Institutes covering both mulberry, vanya silk, pre and post cocoon activities
- Core research activities covering project specific facilities, SRF, JRF, fabrication of prototypes, field testing, demonstration, green house facilities
- Maintenance of Germ Plasm, Breeders stock, surveillance, monitoring
- Mobility, repair, infrastructure improvement, maintenance of infrastructure, Farm maintenance, creation of model farms, irrigation facilities, experimental plots
- Transfer of Technology, Establishment of Soil Testing Lab, disease forecasting, forewarning, Remote Sensing and GIS, Training
- Establishment of Regional Silk Technological Research Institute (RSTRS), Varanasi (UP), Regional Sericultural Research Station (RSRS) in Himachal Pradesh
- Improvement of facilities at CTR&TI, Ranchi, RTRS, Imphal and Bhimatal
- Establishment of Silkworm Seed Technology Lab (SSTL) for Vanya Silk Sector
- Establishment of Tasar P4 stations at Jharkhand, Chhattisgarh and Odisha.
- Replacement of condemned vehicles for mobility
- Cost for engaging skilled workers in R&D units for the skilled activities like; experimental food plant cultivation and maintenance, leaf plucking, pruning, application of farm yard manure (FYM) and fertilizers, cultural operations and irrigation, plant protection measures, disinfection, undertaking experimental rearing activities, grainages activities, field trials, laboratory works, watch and ward work during outdoor rearings for protecting crops from predators in natural Vanya food plantations, cocoon preservation, peduncle cuttings, collection of natural cocoons, sorting, pollarding of tasar food plants, transfer of larvae to the food plants, posts cocoon work in R&D laboratories and testing units like reeling, twisting deguming, silk processing etc. An expenditure of Rs.25.75 Cr has been incurred during first three years and a provision of Rs 37.44 cr has been proposed for 2015-16 and 2016-17 to meet the wages of skilled farm workers engaged in different field units

Restructure / Deepening of ongoing schemes for implementation during 2015-16 and 2016-17

Strengthening of Bivoltine Silkworm and Vanya Silkworm Breeding Laboratories.

Presently the sericulture in India is mostly multivoltine oriented, and a small quantity of bivoltine that is produced is not matching with the International quality. To produce high quality silk, superior robust bivoltine breeds and hybrids which sustain even under adverse climatic conditions prevailing in the tropical conditions are required to be developed. In order to take up silkworm breeding in this direction, it is essential to upgrade the facilities of the Bivoltine Breeding Laboratories of all the three major Mulberry Sericulture Research Institutes located at Mysore, Berhampore and Pampore and facilities under Vanya Silk Sector Breeding Laboratories at CTR&TI, Ranchi and CMERTI, Ladoigarh. The existing breeding laboratories will be upgraded by providing with the modern facilities and equipments to take up the breeding programme.

i. Development of silkworm breeds/hybrids, field testing and commercialization

i) **In collaboration with foreign countries viz., China, Japan, Brazil, Bulgaria etc.**

In addition to the available silkworm genetic resources, it is necessary to collect/ pool the new germplasm accessions with better survival, high silk content and vigour for development of superior silkworm hybrids. By entering into bilateral collaboration with Countries, viz. Japan, China, Bulgaria, Brazil etc., new silkworm accessions with high silk content, disease tolerant and temperature tolerance can be obtained and used for developing high productive silkworm hybrids suitable to tropical and temperate conditions. Consultants from Japan and China will also be invited to work with the counterpart breeders in India to develop and fine tune the breeds suitable to Indian tropical conditions

ii) **In collaboration with IISc, IITs and other reputed institutes within India**

It is also necessary to take up more collaborative works with the reputed institute like IISc, IITs, CCMB etc., to develop high productive and hardy mulberry and vanya silkworm hybrids with the help of modern biotechnological tools.

iii) **Field Level Intervention towards quality and productivity improvement**

a. **Institute Village Level Programme** to be taken up in selected villages directly by the Main Institute to demonstrate the impact of improved technology packages as a model for further replication by the Departments of Sericulture to other Villages. Adarsh Gram Yojana of the Government of India will be taken up under this programme if the village selected is technically feasible for sericulture

b. **Cluster Promotion Programme to be taken up by Research Extension Centre (REC)** covering two blocks where support will be provided for CRCs, improved Rotary Montages and production units for Biological inputs & Seri-Policlinics.

c. **Model Cluster Promotion Programme to be taken up in North Eastern Region** by Research Extension Centre (REC) covering two blocks where support will be provided for Nurseries, CRCs, Rearing Houses, Equipment, disinfection etc. to establish the cluster as role model for the State Departments for further replication. 90 % subsidy will be given for individual farmers/reeler based activity and 100% for group based activities / Common Facility Centre. This programme has been taken up under NERTPS.

d. **Support to CBOs :** Provision has been made for providing support for convergence programme. Support has been proposed to CBOs to meet the committed liabilities of the previous year.

e. **Funding Pattern:** For the above mentioned ongoing scheme components 80% subsidy will be provided to individual oriented schemes (90% in case of special status States) and 100% subsidy for group oriented schemes. The beneficiary contribution is mainly in terms of labour and material input

IV Post Cocoon Sector

Following ongoing components will be implemented with minor modifications during last two years of XII Plan. It is proposed to implement the components through Central Silk Technological Research Institute (CSTRI) & its sub units in coordination with States with a sharing pattern of 75:25 for General States and 90: 10 for Special Status States between CSB and the Beneficiary.

Reeling & Spinning:

1. **Support for establishment of Motorized Improved Charkas to dissuade child labour:**

Turning / rotating charka in a Charka reeling unit is a manual activity and there is scope for engaging child labour for this. In order to discourage employment of child labour and to improve

the working conditions in Charka units, it is proposed to support the establishment of motor driven improved twin Charkha units with required driving arrangements.

2. Support for establishment of Improved Cottage Basin Reeling Units:

Cottage basin system of reeling is an improved technology over Charka and provides better quality silk compared to Charkha. CSB has developed an improved cottage basin reeling technology package for producing better quality silk and it is proposed to support establishment of improved cottage basin reeling units.

3. Support for establishment of Multi-end Reeling units:

CSB has developed a Multi-end reeling technology package for production of international grade raw silk using quality multi x bivoltine and bivoltine cocoons produced in the country. The component envisages support for setting up of 6-Basin and 10-Basin multi end reeling units.

4. Support for establishment of Automatic Reeling units:

With a view to produce international quality raw silk from Bivoltine cocoons produced in the country, support is being provided for establishment of automatic reeling units. The component envisages support towards establishment of 400 ends / 200 ends capacity automatic reeling unit with latest technology for cocoon drying, cooking, reeling, re-reeling etc.

5. Support for establishment of Automatic Dupion Reeling units:

The double cocoons and inferior quality cocoons are converted in to dupion silk yarn on a dupion reeling machine. With a view to provide better value addition to inferior quality cocoons and produce international quality dupion yarn, support is given for establishment of Automatic Dupion Silk Reeling units with imported machinery.

6. Assistance for Twisting Units:

The objective of this component is to enhance profit margin of the multi-end reeling unit by adding a twisting unit so that the unit can go for value addition by way of selling their produce in the form of twisted silk. This component provides support for establishment of twisting units of 480 spindles along with winding and doubling machines.

7. Support for Cocoon Stifling & Cocoon Storage:

(a) Support for setting up of Hot Air Driers:

In Northern and North-Eastern States, sericulture is practiced as a seasonal activity. During the favourable seasons, cocoons are harvested and those harvested cocoons are to be dried & stored for long for its use over a period of six months. In most of the non-traditional States proper cocoon drying facility is not available and it is proposed to support establishment of hot air driers. It is also proposed to support setting up of Conveyor type Hot Air Dryer of 2 MT capacity as a Common Facility as there is a demand to this type of hot air dryers especially in the biannual cropping States like HP, Uttarakhand, J&K etc.

(b) Support for creating Cocoon Storage Facility:

After stifling the cocoons, it is important that these cocoons are stored properly till they are used for reeling. It is proposed to support the creation of standard cocoon storage facility in needy places. The cocoon drying and storage in such places shall work as a common facility benefiting the sericulture farmers and reelers of that region.

8. Support for Pupae Processing & Drying Units:

Silkworm pupa is the by-product of silk reeling which is used for various purposes. Separation of pupa and its treatment is important for better value realization for by-products and for addressing environmental issues associated with traditional pupa processing. The technology package developed by CSTRI aids separation of pelade waste

from pupa, hot air drying of pupae with optimum drying conditions aiding storage of pupa for longer periods without fungal attack. It is proposed to promote preparation of pupa cake for export to countries like Thailand.

9. Support for Vanya Post Cocoon Sector:

(a) Reeling-cum-Twisting Machine: CSTRI has designed and developed a reeling-cum-twisting machine, which is suitable for both tasar and muga reeling. The mechanization of reeling and twisting in one single operation has some definite advantages viz., higher productivity, reduced labour, removal of drudgery and importantly producing better quality twisted yarn.

(b) Wet Reeling Machines (2-Basins of 4-ends each): Tasar reeling is predominantly a dry reeling activity. CSTRI has developed a wet reeling machinery and technology package for production of warp quality tasar yarn.

(c) Motorized / Pedal Operated Spinning Machine: To improve the productivity and quality of hand spun silk yarn, CSTRI has developed motorized/pedal operated spinning machine. This component has made a considerable impact in the field under earlier plan periods.

(d) Solar operated Spinning Machines: CSTRI has developed a spinning machine driven by solar energy to address the requirement of artisans of remote villages where availability of electricity is scarce.

(e) Unnathi Reeling cum Spinning Machine (Jharcraft): Jharcraft which is a Govt. of Jharkhand undertaking has designed and developed a two end reeling-cum-twisting machine which is time tested & suitable for tasar silk yarn reeling & twisting. These machines are well suited for operation on individual basis. The solar operated Re-Reeling Machine developed by Jharcraft will also be popularised

(f) Charaka Reeling machine: There is requirement of weft quality tasar yarn in tasar weaving clusters. In order to make available the required weft quality yarn, the CTR&TI Ranchi of CSB has developed an improved Charaka. The above machine is time tested & suitable for weft tasar yarn production.

(g) Two step Reeling cum twisting machine: This is a region specific tasar reeling cum twisting machine. The above machine has been developed by CSTRI as a region specific machine which can be used effectively for production of both warp as well as weft quality tasar silk yarn.

(h) Improved Cottage basin reeling machine for Tasar: This is a region specific tasar reeling machine developed on the lines of improved cottage basin for tasar raw silk production. The above machine has been developed by CSTRI as a region specific machine which can be used effectively for production of both warp as well as weft quality tasar silk yarn.

i) Tasar Reeling Machine to replace Thigh Reeling: Traditionally, tasar yarn is reeled manually by the women folk, using thigh for reeling & twisting. This manual process is unhygienic & cumbersome. In order to replace thigh reeling, a machine has been developed by the Reelers Community in Champa. The above machine is time tested & gives better quality yarn.

j) Bani Reeling Machine for Muga: CMR&TI of CSB has recommended the inclusion of Bani Reeling Machine for muga reeling as this is a tested and accepted region specific machine.

k) CSTRI studied the improved spinning wheel developed by Jharcraft. The machine is being standardised. This will also be popularised. All the vanya reeling and spinning devices will be provided 100% support

10. **Providing services of Master Reelers and Technicians:**

One of the major constraints for sustaining silk reeling industry in non-traditional States and non-traditional areas of traditional states is the absence of skilled reelers. To overcome this problem, the concept of deputing Master Reelers to existing silk reeling units to train the workers engaged in the units was introduced.

11. **Support for Handloom Sector:** It will be taken up through DC(Handlooms) with part financing from the State Government.

12. **Vanya Silk Marketing Promotion (VSMP) and Product Design, Development & Diversification:** A host of initiatives have been taken by CSB to promote these silks and their exports. Generic and Brand promotion in domestic / overseas markets, product design and diversification through R&D and collaborative projects, upgrading existing production technology, organizing exhibitions in major cities and sponsoring manufacturers to participate in domestic and overseas marketing events and exhibitions shall be focus areas under VSMP. Central Silk Board has established Product Design, Development & Diversification (P3D) Cell with the objectives like Quality up-gradation, Investment generation, Technology absorption, Productivity improvement and Employment Generation. The P3D is involved in design & development of samples, modification in the structure of fabrics, improvements in the existing designs & finishes, diversification in use of silks/ its bye-products viz. medical applications, technical textiles - thermal wear, silk non-woven, cosmetics, UV protective umbrellas etc. P3D is also involved in showcasing and exhibiting the new products and information dissemination of product information to entrepreneurs, exporters, fashion designers, consumers etc. The Cell works in coordination with NID, Weavers Service Centres, HHEPC, Regional Design Centre, NIFT etc. The Cell plays an active role in providing technical inputs in fabric engineering, process parameters, finishing, blending etc..

13. **Flexi Fund:**

It is proposed to create a Flexi Fund for the post cocoon sector to meet some of the need based requirement of the sector, which could not be met by the existing components suggested above. Some of the interventions which are proposed to be covered under the Flexi Fund are;

1) Additional support to machinery manufacturers to cover components like Turnkey concept, 3 years of AMC, initial hand holding and capacity building with a view to make the enterprise viable.

2) Innovative components aimed at quality & productivity improvement, use of non-conventional energy(both pre and post cocoon).

3) Incentivizing quality production like production of quality BV raw silk & incentivizing commendable performance in pre and post cocoon sector.

4) Interest subvention on working capital loan availed by reelers.

Capacity Building & Training

Growth and development of an industry or success of a project depends on the quality of manpower attached to it, their skill levels and their ability to learn and adapt to new technologies & skills-sets. Income generation is also believed to be directly related and proportional to the degree of development of desired skills and traits. Central Silk Board had realized the importance of training and capacity building fairly early and hence, in addition to being a R&D focused organization it has developed a strong training orientation.

Existing system of Capacity Building & Training in CSB:

The R&D institutions of CSB, spread across the country, covering all activities on the silk value-chain pertaining to all the four silk sub-sectors, are intensively involved in training, skill seeding and skill enhancement on a sustainable basis. They are fairly well

equipped with training infrastructure and facilities. These R&D institutes basically impart sector specific technology-based training to farmers, reelers, weavers, entrepreneurs, extension agents and other stakeholders of the silk industry. CSB also runs PG diploma courses for young science graduates and State Govt. sponsored officials both in Mulberry and Vanya sectors.

In addition, CSB has an ISO 9001:2008 quality certified Training Division at its headquarters that is responsible for assessing overall training and capacity building needs of the Silk industry and organizing a variety of skill-based training programmes for in-house officers/ officials and also for the industry stakeholders, potential and existing entrepreneurs/investors.

These programmes are basically meant for:

i) improving the level of information, technical knowledge and skill-sets

ii) encouraging entrepreneurship and investments in the silk sector, iii) exposing the participants to the latest Seri-technologies and practices for better productivity and production of quality silk and iv) motivating the industry stakeholders for taking up and practice silk production activities with added enthusiasm, commitment, technical perfection & futuristic perspective.

Proposed Capacity Building and Training (CBT) under Central Sector Scheme

The Capacity Building and Training (CBT) will be one of the six new components of the Central Sector Schemes on Silk. It has been planned to address the entire capacity building and skill training needs of the Silk Industry through this component with focused involvement of different wings of Central Silk Board. Further, it is proposed to continue the existing CDP sub-components viz. "Skill Training & Enterprise development Programmes (STEP)" and Sericulture Resource Centre (SRC) with modifications, whereas it is proposed to do away with "Beneficiary Empowerment Programme (BEP)" sub-component hitherto being implemented by respective States. The farmers' skill training requirements shall now be the responsibility of CSB R&D institutes and its nested units under the proposed new components. The details of planned initiatives under Capacity Building of Central Sector Scheme are indicated below :

- **Skill Training and Enterprise Development Programme**

  Under "Skill Training & Enterprise development Programmes (STEP)" CSB, proposes to conduct a variety of training programmes to address the in-house and industry's capacity building requirements. The envisaged capacity building and skill training programmes will be organized covering all the silk sub-sectors and activities for the benefit of industry stakeholders and in-house human resources. Majority of the indicated programmes will be organized by the Training Division with the help of CSB units and identified 'CSB Zonal Trainers' In addition, CSB officers/ officials will also be plugged in to useful training programmes conducted by other training agencies of national and international repute.

  The details of planned training modules/progress under **Skill Training & Enterprise development Programmes (STEP)** along with the proposed unit cost, targets and fund requirement are indicated in the following table. Two new sub-components namely - i) "Specialized Overseas Training/ Exposure visit" in reputed international training hubs/ institutes and ii) "Training Impact Assessment Initiative" for gauging the impact of training conducted by CSB have been proposed. With more focus on Capacity Building and Training, internally the Training division shall be strengthened for desired results and visible impact.

Establishment of Sericulture Resource Centre (SRC)

The existing component "Sericulture Resource Centre (SRC)" is also proposed to be continued for the remaining period of XII Plan with revised unit cost of Rs.3.50 lakhs each. These training cum facilitation centres would be established in select Mulberry Bivoltine & Vanya

#	Training component	Duration	Unit Cost (Rupees)	Physical target 2015-162016-17		Fund required (in Cr) 2015-16 2016-17	
Skill Training & Enterprise development Programmes (STEP)							
1	Entrepreneurship Dev. Prog	3-4 wks	500,000/ batch	1	1	0.05	0.05
2	Foundation Trg for new recruits	3-4 wks	750000/ batch	2	0	0.15	0.00
3	Resource Development Prog	1-2 wks	350000/batch	4	6	0.14	0.21
4	Trainers Training Programme	3-5 days	250000/batch	2	0	0.05	0
5	Refresher Training for Scientific & Technical resource	1 wk	200000/batch	2	4	0.04	0.08
6	Competence Enhancement Training for Admn & Accts	3-5 days	150000/batch	0	4	0.00	0.06
7	Management Development Programme	1-5 days	500000 lump sum	25 persons	25 persons	0.05	0.05
8	Focused training for industry stakeholders	1-5 day	150000/batch	6	2	0.09	0.03
9	One day Lecture series	One day	25000/ prog	3	4	0.0075	0.01
10	Technology up-gradation prog	1-2 day	75000/ prog	3	2	0.0225	0.015
11	Specialized Overseas Training /Exposure visit	1 -12 wks	500000/ person	Lump sum	Lump sum	0.40	0.50
12	Training Impact Assessment initiative	At least 1 survey in each quarter	100000/ survey	4	4	0.05	0.05
13	Capital expenditure for purchasing training equipments	-	10,00,000	lump sum	lump sum	**0.10**	**0.10**
	TOTAL			**30**	**30**	**1.15**	**1.155**

clusters to act as an important link between Extension Centres of R&D labs and the beneficiaries. The purpose of these SRCs is - technology demonstration, skill enhancement, one-stop shop for Seri-inputs, doubt clarification and problem resolution at cluster level itself. SRCs will be managed by handpicked lead/ elite farmers or any 'not for profit' organizations, Seri-Societies etc for the benefit of cluster farmers/ sericulturist.

During the first three years a total of 29 SRCs were established and it is proposed to set up a total of 50 SRCs during the remaining period of XII plan. The revised unit cost for establishing and managing each SRC is proposed for Rs.3.50 lakhs, out of which, Rs.3.00 lakh (Capital) has been earmarked for meeting one-time expenditure of construction of Training shed (300 sq ft) and procurement of training /demo equipments viz. TV, projector, black board, basic furniture etc and Rs.0.50 lakh (Revenue) for meeting recurring and miscellaneous expenditure for conducting training. These SRCs would be mandated to conduct at least 12 training /demo sessions every year.

- Capacity Building & Training by R&D Institutes of CSB

In addition to conducting structured training programme (Post Graduate Diploma in Sericulture) the R&D institutes of CSB also conduct

Component	Unit cost (Rs)	Revised Unit cost (Rs)	Year-wise achievement & physical target					Total
Seri - Resource Centre			2012-13	2013-14	2014-15	2015-16	2016-17	
Physical				02	27	20	30	79
Capital Expenses	100,000	300,000				0.60 Cr	0.90 Cr	1.50 Cr
Operational Expenses	150,000	50,000				0.10 Cr	0.15 Cr	0.25 Cr
Total	250,000	350,000				0.70 Cr	1.05 Cr	1.75 Cr

technology-based training and organize Krishi Melas, Farmer's day, farmer's interaction workshops etc. In the present proposal, in place of the existing Capsule and Ad-hoc training programmes, all the popular training modules have been restructured into three modules /sub-components (keeping in view the withdrawal of CDP component - Beneficiary Empowerment Programme) for the remaining two years i.e. 2015-16 & 2016-17 of the XII Plan.

- **Capacity Building in Seed Sector:**

Silkworm seed is the most critical sector that drives the entire silk value chain. The quality of seed determines the quality of industry output. Therefore addressing the capacity building and training needs of this sector is of paramount importance. Different organizations of CSB managing different seed sub-sectors viz. Mulberry, Eri, Tasar & Muga are also responsible for Capacity Building and Training in seed sector. It is proposed to conduct a variety of training programmes as detailed below to cover industry stakeholders like – Pvt. Silkworm Seed Producers, Adopted Seed Rearers, Managers and work force attached to Govt. owned grainages. Depending upon the training need the duration of the envisaged training programme will vary from 1-4 weeks

#	Component	Duration	Unit cost (Rupees)	2015-16	2016-17	Total
1	Structured Training Programmes (Post Grad Diploma in Sericulture)	15 months	250000	0.052	0.052	0.10
2	Farmer's Skill Training	1-2 weeks	3500 / farmer	1.05 3000	1.05 3000	2.10
3	Exposure visits for farmers and grass root extension agents	1 week	2500 / person	0.25 1000	0.25 1000	0.50
4	Technology Orientation Programme	1-2 weeks	3500 / person	1.05 3000	1.05 3000	2.10
5	Organizing Resham Krishi Melas, Awareness programme, Workshops, Seminars, Group discussions, Breeders Meet, Scientists Meet etc.	1-2 days		1.00 100 progs	1.00 100 progs	2.00 200 progs
	Total			**3.40**	**3.40**	**6.80**

#	Component	Duration	Unit cost (Rupees)	2015-16	2016-17	Total
1	**Mulberry :** Training for ASRs, Training for Pvt Graineurs, Need-based Focused Training Progs	1 to 4 weeks	4200/per son	0.42 1000	0.42 1000	1.00 2000
2	**Tasar sector:** Training for ASRs, Training for Pvt Graineurs, Need Based Focused Training Programmes.	1 to 4 weeks	4200/per son	0.0.521 1240	0.521 1240	1.24 2480
3	**Muga sector :** Training for ASRs, Training for Pvt Graineurs, Need Based Focused Training Progs	1 to 4 weeks	4200/per son	0.16 375	0.16 500	0.44 875
4	**Eri sector :** Training for ASRs, Training for Pvt Graineurs, Need Based Focused Training Progs	1 to 4 weeks	4200/per son	0.105 250	0.105 250	0.26 500
	Total			**1.19**	**1.19**	**2.38**

- **Information, Education and Communication:** The scheme envisages print and media and publicity programmes, workshops, seminars, extension, publication, books, video films etc. . . .to educate the stake holders on latest technology packages.

Mr. Krushna Chandra Sahu

MUD CAGE CRAB CULTIVATION (An alternative livelihood option)

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Disasters like cyclones, floods, and sea surges are happening frequently to the 482 kilometres long coastline of Odisha. Changes have been noticed in the entire coastline that would make coastal populations more vulnerable to disasters. After the ravaging effect of cyclonie Phailin during October 2013 in the districts of Ganjam and Puri, Odisha, Indo-Global Social Service Society, with the support of Islamic Relief Worldwide, has taken up mud cage crab farming and other aquatic livelihood restoration measures in the context of weather extremities and disaster related risks.

Most of the fishermen populations along the coastline depend on multiple products and services available in their ecological niches ranging from agriculture, fisheries and coastal vegetation. The livelihood options of the communities living along the coastal tract are in general limited owing to the particular geo-climatological features of the region viz, river mouth area crisscrossed with a number of tidal creeks, limited rain-fed farm lands, saline, brackish, marshy lands, recurrent flooding etc. and oceanic disturbance. The wide range of extreme weather conditions; cyclone, flood and low pressure has increased the uncertainty of their production and income.

Cyclone Phailin in 2013 has caused serious loss of livelihoods to affected families, by ravaging the livelihood assets and resource base and increasing vulnerability to future shocks. The cyclone Phalin during 2013 has caused massive destruction on livelihoods, which are primarily based on agriculture and fishing. Catching and vending of crab, prawn and fish (both fresh and dry), in the local market as well as to the traders, is the common profession. Some are employed with big boats as contract labour.

Looking at gainful use of readily available brackish/saline and fresh water bodies, cage crab cultivation was undertaken as an alternative livelihood option for 45 families in 8 villages in Ganjam and Puri Districts. This is not a common practice in this region as the small and marginal fishermen normally catch fish with 'Khanda' (Nylon monofilament screen barrier) structure which is not enough to sustain families with an average size of 5 members.

Mud crab collection and marketing is done particularly by the small and marginal fishermen who do not have boats to go deep inside Chilika but depend upon the shallow portions for fishing. Their catch is not much and was further decimated following the fury of Cyclone Phailin which damaged their traditional equipment and means of fishing. Indo Global Social Service Society (IGSSS) decided to introduce the practice of

mud crab farming in bamboo cages as an alternative livelihood option, looking at the gainful use of readily available brackish/saline and fresh water bodies (temporarily becomes saline due to sea surge). As the community had enough experience in crab cultivation, material inputs (2 bamboo cages along with 8 kilograms of crab breeds with forceps, basket) were provided to them as part of the intervention.

The average total investment would be Rs.13,400/- while the gross return is around Rs.28,800/- per year. Hence total net profit is estimated to be Rs.15,400/- per year. As very little labour and time is being consumed, it could be a significant contribution to the main income.

Bhubani Das, a young man of Belapada village of Kallikot block of Ganjam district, reveals, "If the support for mud crab cultivation had not reached our village, I might have migrated to the cities outside in search of daily work. "IGSSS came and showed us an organized and planned way to cultivate crabs," say the community members. This has also generated income opportunities by engaging the local traditional bamboo workers to prepare the bamboo cages as per the specifications, and procure crab breeds from the local persons engaged in this trade.

Of his investment of 16 kilograms of crabs, he has harvested and sold 12 kilograms at INR 270/- per kilogram after 2 months and the rest at INR 350/- per kilogram (when the crabs grew bigger after 1 month). This was a side income which did not incur any extra labour. He has tried green crabs from Visakhapatnam, in the year 2016, a better species than the mud crabs which has given more returns as they grow first. If the monsoon remains favourable, then at least 3

Investment cost	**Specification**	**Units**	**Cost in INR**	**Responsibility**
Fixed Cost for one year at least				
Making of Bamboo cage	Size- 6' x 4' 3'	2nos	3800.00	Project
Forceps (Chimuta) for catching	Standard	1 no	140.00	project
Basket (Jhudi) for transporting	Standard	1no	100.00	Project
Total fixed cost			**4040.00**	
Running cost per batch (60-90) days				
Crab breeds		16 kg (Rs.150/- per kg)	2800.00	Project
Crab feed	Puti of birds and animal	1kg per day	20.00	Project participants
Labour	Installing cage, putting crab, Feeding, watching the progress, selling etc.	½ an hr. to 1hr. per day	300.00	Project participants
Total running cost			**3120.00**	
Benefit to be accrued			**Output in Kg.**	**Cost in INR (Rs.320/- per kg. In average)**
Total crab catching one season (60 - 90 days) and selling cost			30 kg	9600.00
Total crab catching in one year and the selling cost. (It is estimated that this activity can be carried out 3 times in a in a year)			90 kg	28800.00
Total selling cost			-	**28800.00**
Fixed investment cost			-	4040.00
Running cost of investment in a year (Rs.3120 X 3 times)			-	9360.00
Total investment cost in a year				**13400.00**
Total profit in a year (28800-13400)				**15400.00**

Cost benefit analysis of crab farming considering the cases in Belapada village

cycles could be completed in a year. Cyclones, floods, droughts, and other calamities, are a threat mostly as they change the composition of the water or cause problems in water availability.

This does need daily monitoring and feeding for the crabs to grow and survive. The crabs become vulnerable when they shed their shells while growing. This makes them vulnerable to other crabs who feed on them. For this it is essential to ensure that the cage is pushed deeper into the mud surface at the bottom of the pond. The crabs can then hide themselves in the mud. The feed provided daily to the crabs is leftovers of chicken and fish (entrails and other discarded parts). Dried fish is also given. The feeding is done once in the evening. Most of these feeds are freely available to the fishermen community, though they may have to pay a little for chicken leftovers.

Farmer Kandha Malik was so motivated by the tangible results that he has increased the number of cages to seven. Kandha is now an example for the whole community and even other fishermen are getting interested in taking up mud crab cultivation. He is now helping other fishermen in making the bamboo cages and is also scaling up his own farm.

Information and Photographs

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Acknowledgement

We acknowledge the cooperation of the staff, the community representatives and the farmers in the intervention areas for their cooperation. The observations are from the field visits and interaction with the farmers.

IGSSS, is a not for profit development organization, established in 1961 to support development programmes across India especially to the vulnerable communities and grass root community based organizations. Currently it is implementing and supporting development programmes in 24 States and two Union Territories in the country through its programmes on Sustainable Livelihood, Disaster Risk Reduction, Gender Equality, and Urban Homeless and Youth Development with special emphasis on women and children.

Islamic Relief Worldwide (IRW) works through Islamic Relief in India (IRI), which has been working with local organisations in India since 1994 – providing emergency relief and implementing development projects.

Mr. Kulbushan K. Sharma

GROW GOLD GET GOLD

Mr. Kulbushan K. Sharma

Former Director Floriculture, Jammu & now Consultant CSIR Aroma Mission III, Jammu.

The Progressive small & marginal farmers of Jammu Division have proved this proverb hundred percent true and authentic by adopting commercial cultivation of Marigold F1 Hybrid (African giant) cultivars 'Garland orange and Garland yellow." The Jammu Division of J & K State is blessed with varied Agro-climatic conditions ranging from subtropical in plains to pure temperate in hills. About 70% of the areas in different districts are rainfed and farmers mostly cultivate crops like Maize, Wheat, & Grams but the areas having good source of irrigation are cultivating Paddy, Maize, Vegetable & Oil seed crops.

The Sher-i-Kashmir University of Agri. Sciences & Technology Jammu (Squast-J) during the year 2009 with the collaboration of Directorate of Floriculture distributed Marigold F1 Hybrid seed to the farmers of Bhaderwah, Tehsil & District Doda under the programme NAIP (National Agriculture Innovation Programme) of ICAR with the

objective to buy back semi dry flowers of Marigold for further supply to USA for extraction of pigment xynthophil and for medicinal use. But after completion of vegetative growth, the farmers of this region got bumper good quality yield of Marigold crop which fetched them very good price in Jammu being city of temples ranging from Rs. 2.00 lac. to Rs. 3.50 lac./acre which was otherwise 5 to 6 times more than traditional farming. Thereafter Dept. Of Floriculture during the year 2009-10 to 2013-14 under Centrally Sponsored Schemes viz. Technology Mission/ MIDH (Mission for Integrated Development of Horticulture & RKVY (Rashtriya Krishi Vikas Yojna) started providing Marigold F1 Hybrid Garland Orange & Garland yellow seedlings to the progressive farmers of Jammu Division for promotion of Commercial Floriculture through the then Principal Secretary to Government Agriculture Production Department J&K State Smt. Sonali Kumar IAS. The farmers earned huge profits i.e. 5 to 6 times more than traditional Agriculture Farming. Thereafter the floriculture department continued this process of providing Marigold F1 Hybrid seed to progressive growers at 75% subsidized cost and the farmers never looked behind. By adopting cultivation of this crop and diversifying traditional farming, the small and marginal farmers not only improved their Socio-Economic status but women farmers too adopted cultivation of Marigold crop.

Success Story :

There are many success stories on this, but one of the farmers namely Sh. Sandokhu Ram S/o Rasilla Ram R/o Karyali Vijaypur, Samba, was growing Garland Orange F1 Hybrid Marigold Crop (Africian gaint) and conveyed to the farmer community that by cultivating said crop in 1500 Sq.mts.area,he will purchase four tolas of Gold. The Progressive farmers of Jammu Plains having sub-tropical climatic conditions with assured irrigation facility are cultivating Hybrid Marigold –Africa Giant cultivars Garland Orange & Garland yellow twice in a year during December-January & June-July thereby earning Rs.8 to Rs.10 lacs/hac which confirms the proverb GROW GOLD GET GOLD. Now the farmers of Jammu Division are directly procuring Marigold F1 hybrid seed of Pan Amercian seed cultivars Garland Orange and Garland Yellow from M/s K.G. Floriculture ,Sarabha nagar, Ludhiana, Punja. They are earning huge profits since the Department of Floriculture, Jammu, has stopped procuring quality seed for commercial cultivation of Marigold which has tremendous demand in the city of temples

Costus Ignus (Insulin plant)

Mr. Ashok Gupta
Author is Joint Director Floriculture

Insulin plant is an introduction to India from United States of America and is widely sold in herb nurseries. It is called wonder plant and thus very popular for its use in treating diabetes as it reduces blood sugar level very easily and effectively, that is why it is named as Insulin plant. Its botanical name is costus Ignus & its main benefits are:-

Curing Diabetic :- As its name depicts Insulin, leaves are important to control sugar level inside the body, High level blood sugar is very dangerous, eating, drinking the insulin leaves boiling with water will work as to inject the insulin essence to reduce the level of blood sugar.

Smooth Digestion :- Insulin leaves has a lot of vitamins and complex essence which will work as e- Colin bacteria, the one which smoothen the human digestion system. Insulin leaves have high level of fructose to smoothen the colon function system, so drinking the herbal portion of Insulin leaves will make your excretion process smoother.

Anti bacteria :- Insulin leaves has function of anti bacteria compound, the extract of Insulin leaves will kill the bad bacteria naturally inside the urinate pipe and help you to smoothen the urination process.

Natural Anti Oxide :- By regularly drinking Insulin leaves as the tea and coffee substitution, you can get the extra benefits, which struggle and beat the oxidation process inside your body cells.

Liver illness curing :- Routine drinking of extract of Insulin Leaves will help to return the health of liver by eroding the poison to slowly out of way from the lever.

Kidney's Health :- Consuming of Insulin leaves prevent forming of Kidney stones make it healthy.

Bladder Health :- Drinking Extract of Insulin leaves every night before going to bed will stimulate the bladder to work well and smooth the urinating process.

Blood pressure :- Extract of Insulin leaves reduces the hypertension and thus reducing the blood pressure.

Sore throat therapy :- As you know the sensation of sore throat is very hurting and you barely hard to swallow, drink, eat and even talk. Extract of Insulin leaves morning and before going to bed will help in curing the throat infection.

Cancer prevention :- Consuming Insulin leaves regularly, the result will be as good as to prevent the cancer cells in your body.

Improves Immunity system :- Body Immune system can be increased by using Insulin leaves in tea and coffee, Extract of Insulin leaves and honey will increase the immune system of body.

Cholesterol Reducing :- Consuming Insulin leaves continuously every day will help your body to remove the cholesterol from the bad food you eat.

Processing of Insulin leaves :-

Best way to process the Insulin leaves is:

1. By boiling the leaves into water drink it, when it is half.
2. Chew one fresh leaf of Insulin plant.
3. Insulin plant leaf powder1/2 tea spoon twice a week.

Precaution :- Intake of Insulin in any form should be avoided by pregnant ladies and lactating woman's, Further it should be used after consulting the family Doctor. Few plants have been raised in my terrace garden.

INDIA EXPORT / IMPORT OF AGRO FOOD PRODUCTS

Value in Rs. Lacs

Qty In MT

Product: Floriculture Import

Country	2014-15		2015-16		2016-17	
	Qty	Value	Qty	Value	Qty	Value
Netherland	1,362.72	3,290.93	1,373.83	3,408.34	1,947.38	4,386.40
Thailand	1,694.94	4,558.19	1,549.72	4,488.82	1,601.20	4,146.13
Italy	454.55	552.39	258.75	298.54	257.80	1,236.87
China P Rp	539.65	995.95	589.06	1,105.11	508.71	1,113.16
Spain	214.10	220.45	141.70	225.35	521.64	513.16
United Kingdom	17.39	161.66	22.71	235.71	33.57	331.67
Kenya	23.67	134.98	22.96	71.38	45.09	229.34
New Zealand	52.05	128.15	51.37	116.42	90.51	226.64
Israel	29.56	190.19	25.99	205.46	18.88	170.47
United Arab Emirates	18.05	133.90	133.35	453.21	31.01	165.10
Indonesia	9.40	13.50	60.60	100.53	53.39	138.09
United States	25.82	222.29	21.40	181.27	11.63	121.23
South Africa	17.49	47.98	31.35	107.72	30.98	92.23
Chile	0.00	0.00	0.00	0.00	18.04	82.84
Madagascar	32.00	57.46	28.00	46.50	40.08	68.67
Singapore	6.92	33.89	0.00	0.00	13.39	61.78
Taiwan	14.48	67.76	19.76	72.89	12.27	55.01
Poland	3.73	25.81	0.90	8.52	5.75	50.29
Sri Lanka	0.45	2.66	0.00	0.00	0.98	6.83
Vietnam Social Republic	2.63	12.08	0.61	3.26	0.86	6.10
Uganda	1.21	5.67	0.04	0.07	0.76	4.53
Hungary	0.00	0.00	0.00	0.00	1.20	2.72
Japan	1.04	26.74	1.49	5.15	0.20	1.49
Denmark	1.37	8.08	0.00	0.00	0.24	1.24
Guatemala	0.00	0.00	0.00	0.00	0.09	0.90
Ethiopia	13.57	84.31	1.02	2.25	0.11	0.67
Portugal	0.31	1.47	0.00	0.00	0.16	0.64
Greece	12.50	11.92	0.80	3.32	0.15	0.36
Lebanon	0.04	0.24	0.00	0.00	0.05	0.21
Netherlandantil	4.00	18.01	6.00	12.64	0.06	0.12
Cambodia	0.00	0.00	0.00	0.00	0.05	0.11
Argentina	0.00	0.00	0.56	28.95	0.00	0.00
Australia	0.11	0.11	0.04	1.32	0.00	0.00
Belgium	0.27	1.82	0.00	0.00	0.00	0.00
Ecuador	0.01	0.67	1.83	11.56	0.00	0.00
Finland	0.00	0.00	0.20	6.93	0.00	0.00
Jordan	0.00	0.00	8.10	13.97	0.00	0.00
Mauritania	0.14	0.43	0.00	0.00	0.00	0.00
Mauritius	0.74	2.34	0.31	0.99	0.00	0.00
Mexico	5.61	7.04	0.00	0.00	0.00	0.00
Niger	0.08	4.41	0.00	0.00	0.00	0.00
Nigeria	0.00	0.00	5.26	3.40	0.00	0.00
Romania	0.41	6.10	0.00	0.00	0.00	0.00
Sweden	0.00	0.00	3.00	14.57	0.00	0.00
Total	4,813.71	11,326.17	4,768.81	11,440.04	5,550.12	13,381.01

Value in Rs. Lacs

Qty In MT

Product: Floriculture Export

Country	2014-15		2015-16		2016-17	
	Qty	Value	Qty	Value	Qty	Value
United States	5,490.00	9,813.61	5,185.09	9,679.11	3,764.94	9,917.01
United Kingdom	2,557.24	5,947.56	2,197.52	5,597.00	2,473.07	6,878.26
Germany	2,240.04	5,547.21	2,336.20	5,692.88	2,443.70	6,250.06
Netherland	2,060.74	5,125.10	1,883.90	5,567.55	1,811.07	5,803.41
United Arab Emirates	1,582.65	2,204.17	1,499.63	2,699.31	1,441.43	3,444.53
Canada	856.16	1,538.45	945.88	1,736.13	748.53	1,793.18
Singapore	916.94	1,067.92	1,092.47	1,337.17	1,313.94	1,610.41
Italy	561.65	1,207.84	444.91	1,135.73	555.10	1,609.93
Japan	608.91	1,467.35	421.97	1,596.52	365.66	1,481.75
Australia	474.72	1,458.86	380.96	1,330.67	285.39	1,381.21
China P Rp	379.42	851.95	334.52	1,082.84	495.45	1,267.18
Malaysia	297.28	736.72	392.55	810.00	507.89	1,182.76
Poland	280.12	606.16	382.85	807.92	328.56	902.71
Saudi Arabia	220.08	407.93	407.02	641.90	529.57	753.19
Spain	397.41	522.42	175.03	395.41	186.31	660.82
Belgium	241.28	551.90	180.05	490.45	297.79	655.87
Qatar	139.81	255.89	132.68	335.86	155.28	580.45
France	377.38	495.50	255.47	377.62	227.33	559.45
New Zealand	104.00	522.67	114.69	477.53	152.33	528.72
Greece	78.26	168.06	95.18	138.18	227.26	507.92
Switzerland	131.12	180.37	114.53	177.77	193.08	442.00
South Africa	396.83	280.03	421.63	438.45	496.40	439.66
Lebanon	91.18	357.88	114.78	454.70	99.46	425.90
Austria	139.76	298.45	194.66	479.26	171.27	405.70
Hong Kong	18.41	30.99	20.69	43.90	22.11	167.64
Sweden	19.58	45.70	20.66	47.36	82.72	152.48
Indonesia	1.17	3.14	3.58	9.70	10.72	134.40
Morocco	16.18	53.20	8.54	119.53	3.46	133.98
Chile	173.50	282.72	326.66	409.32	63.64	117.44
Mauritius	12.52	97.13	26.49	103.30	10.30	110.51
Jordan	12.40	49.05	13.88	61.78	41.26	108.92
Sri Lanka	109.56	81.41	56.82	81.12	83.63	100.26
Czech Republic	49.57	85.07	70.98	113.33	45.27	96.46
Bangladesh	272.08	52.80	299.00	155.25	78.58	94.26
Nepal	20.89	29.59	67.65	109.02	69.97	85.81
Denmark	14.24	34.26	39.42	33.43	37.17	77.41
Ireland	37.59	57.30	27.59	59.65	45.71	74.59
Portugal	18.25	91.45	228.52	102.54	171.36	73.83
Colombia	15.60	73.43	13.94	42.44	18.15	73.20
Slovenia	77.13	106.05	52.20	100.84	29.63	71.78

Source: DGCIS Annual Export

Aquaculture

- MEDC Research Team

Introduction

Fisheries in India is a very important economic activity and a flourishing sector with varied resources and potentials. Only after the Indian Independence, has fisheries together with agriculture been recognized as an important sector. The vibrancy of the sector can be visualized by the 11–fold increase that India achieved in fish production in just six decades, i.e. from 0.75 million tonnes in 1950-51 to 9.6 million tonnes during 2012–13. This resulted in an unparalleled average annual growth rate of over 4.5 percent over the years which has placed the country on the forefront of global fish production, only after China. Besides meeting the domestic needs, the dependence of over 14.5 million people on fisheries activities for their livelihood and foreign exchange earnings to the tune of US$ 3.51 billion (2012–13) from fish and fisheries products, amply justifies the importance of the sector on the country's economy and in livelihood security.

As the second largest country in aquaculture production, the share of inland fisheries and aquaculture has gone up from 46 percent in the 1980s to over 85 percent in recent years in total fish production. Freshwater aquaculture showed an overwhelming ten-fold growth from 0.37 million tonnes in 1980 to 4.03 million tonnes in 2010; with a mean annual growth rate of over 6 percent. Freshwater aquaculture contributes to over 95 percent of the total aquaculture production. The freshwater aquaculture comprises of the culture of carp fishes, culture of catfishes (air breathing and non-air breathing), culture of freshwater prawns, culture of pangasius, and culture of tilapia. In addition, in brackishwater sector, the aquaculture includes culture of shrimp varieties mainly, the native giant tiger prawn (Penaeus monodon) and exotic whitelegshrimp (Penaeus vannamei). The technologies of induced carp breeding and polyculture in static ponds and tanks virtually revolutionized the freshwater aquaculture sector and turned the sector into a fast growing commercial sector.

Aquaculture in India has evolved as a viable commercial farming practice from the level of traditionally backyard activity over last three decades with considerable diversification in terms of species and systems, and has been showing an impressive annual growth rate of 6-7 percent. While the carp-based freshwater aquaculture, mainly constituted by the Indian major carps, such as, catla, rohu and mrigal, has been contributing over 90 percent of the aquaculture production satisfying the domestic need, the shrimp-based coastal aquaculture contributes to only about 5 percent of the export earnings.

History and general overview

India's aquaculture production can be classified into freshwater and brackishwater production. Freshwater aquaculture production contributes nearly 55 per cent of the total fish production in India. There are 429 Fish Farmers Development Agencies (FFDA) and 39 Brackishwater Fish Farmers Development Agencies (BFDAs) for promoting freshwater and coastal aquaculture. Some of the important species cultured in India are:- Indian major carps and shrimp. Besides these ornamental fish culture and seaweed farming, are slowly gaining importance in the last few years.

Freshwater Aquaculture

As stated earlier, carp culture forms the backbone to freshwater aquaculture practice in India. Carp culture in India was restricted to as homestead backyard pond activity in West Bengal and Orissa until late 1950s, with seed from riverine sources as the only input resulting in low level of production. Importance of fish culture as an economically promising enterprise was gradually implemented in India. By then, non-availability of quality fish seed and lack of scientific culture know-how constrained the growth and further development of carp culture.

The technological breakthrough in induced breeding of carps through hypophysation in 1957 revolutionalized freshwater aquaculture of the country. With assured supply of quality seed, the techniques of seed rearing and grow-out culture of carps had

undergone faster development and refinement through research and development made by the Pond Culture Division of the CIFRI and Government of India respectively, and further by their multi-locational trials by state governments. In fact, the development of freshwater aquaculture in the country only finally became recognized and established following the establishment of the Pond Culture Division at Cuttack in 1949 under the name of the Center of Central Inland Fisheries Research Institute (CIFRI), West Bengal. Significant developments took place thereafter with the standardization of induced breeding techniques and the development of hatchery systems and composite carp culture with the three Indian major carps and three exotic carps, including silver and grass carp, forming the basis for carp polyculture system.

Carp culture, thereupon, during the late 1980s has expanded its dimensions in terms of area coverage and intensity of operation, with Andhra Pradesh, Punjab, Haryana, Maharashtra, etc., taking up fish culture as a commercial farming enterprise. The research and development efforts during the last six decades have placed carp farming as an important economic enterprise as a fast growing industry.

The culture systems adopted in the country vary greatly depending on the input available in any particular region as well as on the investment capabilities of the farmer. With the understanding of the biological basis of fish production, a series of systems are available with varying levels of inputs and outputs, and these can be categorized as low, medium and high input technologies.

In addition, in India, the other types of fish culture also includes Sewage-fed fish culture which is not new as far as India is concerned. It is estimated that at present there are more than 130 wastewater aquaculture units in India covering about 10 000 ha. Almost 80 percent of these are located in West Bengal, where sewage is extensively used as a fertilizer for fish pond. One of the major sewage irrigated fisheries is in Kolkata, popularly known as Vidyarthi Spill area, which is presently known as Salt Lake. Simultaneously, sewage-fed fish culture started in four sites in India, namely: Nagpur, Bhilai, Chennai and Bhopal. In this culture practice, before stocking, bheries are dried up and sewage is allowed to enter bheri.

The fish is currently propagated on a large scale along the north-eastern regions, mainly the State of Assam. Twelve hatcheries are in place along the region. Of late, Government of India permitted culture of pangassius and tilapia species laying down strict guidelines as an alternative crop to carp fishes.

With fisheries development being considered a state subject, each state has a full-fledged Fisheries Department; the Ministry of Agriculture of the Government of India also provides additional coordination of development programmes in the different states and provides for centrally sponsored projects. For encouraging and publicizing freshwater aquaculture, the Indian Government introduced a scheme known as the 'Fish Farmers' Development Agency (FFDA)' during 1973–1974 at the state level. Currently, there are 422 FFDAs providing cover to the districts indicating major potential in the country.

Brackish water aquaculture

Brackish water aquaculture in India, though a traditional practice in bheries (manmade impoundments in coastal wetlands) of West Bengal and pokkali (salt resistant deepwater paddy) fields along the Kerala coast, the scientific farming in the country has been initiated only in early 1990s. In the traditional system of culture, tidal water is impounded in the inter-tidal mudflats by raising bunds. Tidal water with all assorted fish and shrimp seed is allowed to enter through sluice-gates during spring tides.

Harvesting of marketable sized fish and shrimp is done regularly during spring tides through traps placed near the sluice gates. There is no manuring and feeding. Thus, with no additional input, except that of trapping the naturally bred juvenile fish and shrimp seed, these systems have been sustaining production levels between 500–750 kg/ha/year with shrimp contributing 20–25 percent of the total production. In Kerala, two types of shrimp culturing are traditionally practiced in low-lying backwaters. In perennial fields, shrimp culture is carried out throughout the year using trap-and culture method. In seasonal fields, rice cultivation is carried out during monsoon months using local variety, 'Pokkali', and after its

Sl. No.	State/Union Territory	Estimated Potential (Ha)	Area Developed (Ha)	Area under (Ha)	Production (MT)	Productivity (MT/Ha)
1	Andhra Pradesh	150000	84951	36123	159083	4.40
2	Goa	18500	340	31	63	2.03
3	Gujarat	376000	2371	2359	9393	3.98
4	Kerala	65000	14875	12917	5175	0.40
5	Karnataka	8000	1945	394	664	1.69
6	Maharashtra	80000	1330	1486	3513	2.36
7	Odisha	31600	13400	6302	14532	2.31
8	Tamil Nadu & Puducherry	56800	6248	7804	25815	3.31
9	West Bengal	405000	50405	48410	52581	1.09
	Total	1190900	175865	115826	270819	2.34

Table 2: Details of Brackish water area, area developed for aquaculture, area under culture and production as on 31 March 2013.
(Source): Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries. 2014. Handbook on Fisheries Statistics 2014, p. 140

harvest, shrimp culture is practiced by trapping tidal waters.

Facts and Figures

In India, the annual fisheries and aquaculture production increased from 0.75 million tonnes in 1950-51 to 9.6 million tonnes in 2013-2014. Globally the country now takes the second position, after China, with regard to annual fisheries and aquaculture production. According to the FAO, as shown in table 1, the total aquaculture production in 2012-2013 was 4.21 million tonnes. This constituted over a third of the country's total fish production. This quantity is almost fully consumed on the domestic market, except for shrimps and freshwater prawns, which are mainly exported. India is the largest exporter of shrimps to the Netherlands. Specifically freshwater aquaculture experienced over a tenfold growth in the past three decades, 0.37 million tonnes in 1980 to 4.03 million tonnes in 2010. Over ten percent of the global fish diversity can be found on or near the Indian subcontinent and more than 14.5 million people depend on fisheries activities. Nevertheless, the national average annual consumption of fish and fish products in 2010 was 2.85 kg/capita. In the coastal state of Kerala, fish is consumed the most, with 22.7 kg/per capita and in the mountainous state of Himachal Pradesh consumption is with 0.03 kg/capita relatively low. About 40% of the Indian population does not eat fish since they are vegetarian and the remaining 60% only occasionally consumes fish. Lower income and rural families consume less fish than higher incomes or urban families.

Producer	Finfish		Crustaceans	Molluscs	Other species	National total	Share in world total
	Inland aquaculture	Mariculture					
	(Tonnes)			(Tonnes)			(Percentage)
China	23 341 134	1 028 399	3 592 588	12 343 169	803 016	41 108 306	61.7
India	3 812 420	84 164	299 926	12 905	...	4 209 415	6.3
Viet Nam	2 091 200	51 000	513 100	400 000	30 200	3 085 500	4.6
Indonesia	2 097 407	582 077	387 698	...	477	3 067 660	4.6
Bangladesh	1 525 672	63 220	137 174	...	...	1 726 066	2.6
Norway	85	1 319 033	...	2 001	...	1 321 119	2.0
Thailand	380 986	19 994	623 660	205 192	4 045	1 233 877	1.9
Chile	59 527	758 587	...	253 307	...	1 071 421	1.6
Egypt	1 016 629	...	1 109	...	...	1 017 738	1.5
Myanmar	822 589	1 868	58 981	...	1 731	885 169	1.3
Philippines	310 042	361 722	72 822	46 308	...	790 894	1.2
Brazil	611 343	...	74 415	20 699	1 005	707 461	1.1
Japan	33 957	250 472	1 596	345 914	1 108	633 047	1.0
Republic of Korea	14 099	76 307	2 838	373 488	17 672	484 404	0.7
United States of America	185 598	21 169	44 928	168 329	...	420 024	0.6
Top 15 subtotal	**36 302 688**	**4 618 012**	**5 810 835**	**14 171 312**	**859 254**	**61 762 101**	**92.7**
Rest of world	2 296 562	933 893	635 983	999 426	5 288	4 871 152	7.3
World	**38 599 250**	**5 551 905**	**6 446 818**	**15 170 738**	**864 542**	**66 633 253**	**100**

Note: The symbol "..." means the production data are not available or the production volume is regarded as negligibly low.

Table 1: Farmed fish production by top 15 producers and main groups of farmed species in 2012.
(Source): FAO, 2014. The State of World Fisheries and Aquaculture. Opportunities and challenges. Rome: Food and Agriculture Organization of the United Nations, p. 22.

Production techniques

Also Tilapia and Pangasius offer opportunities, especially since the development of cage freshwater aquaculture in lakes. These cages have been developed by the Central Institute of Freshwater Aquaculture (CIFA) and involve Pangasius or Tilapia fish. Instead of 10 ton per ha, now a production

of 3 ton on a surface of 6 by 4 by 4 can be achieved. A focus on the production of tilapia can be a potential new grow market of cheap source of proteins. India requires here a development of production techniques. Although one should take into account environmental sustainability issues with this technique, Dutch expertise with regard to the production enhancement of Tilapia and Catfish can be deployed here.

In addition, the introduction of Recirculation Aquaculture Systems (RAS) is fairly new to India. This system can be beneficial in reducing soil and water related environmental problems. These systems can also be installed closer to consumer centres and thus avoiding transportation costs and difficulties. Moreover, RAS may become more attractive due to increasing land prices. Several Dutch companies have expertise in this high-tech production technique. The development of RAS in India is nevertheless very slow. The lack of practical demonstration opportunities to farmers is a hindrance and also government agencies have not yet taken up the development of RAS. Aside from this innovation, West Bengal is active on the use of wastewater in aquaculture production. Almost 80% of existing primary-treated wastewater fertilizer aquaculture units are located within this state and about 5700 ha is currently used to produce over 7000 tonnes of fish (primarily carp) per year.

Salination

Coastal aquaculture causes the salination of drinking water wells and farm fields and resistance exists against the conversion of farmland for aquaculture. This is the reason why in 1996, the Indian Supreme Court prohibited the construction of shrimp culture ponds within the Coastal Regulation Zone and within a kilometer of Chilka Lake and Pulicat Lake (state of Odisha and Andhra Pradesh). This prohibition is not for traditional or improved traditional ponds. Additionally, the court ruled that an authority for protecting the environment of the coastal area had to be established. This Aquaculture Authority has been founded and resorts under the Ministry of Agriculture. The organization issues licenses to eligible farms, feed and hatchery companies only.

Although the use of farmland for aquaculture is not allowed everywhere, possibilities may exist with the combined use of agriculture and aquaculture through rice cultivation during the rainy months and shrimp cultivation during the rest of the year, as is done in Kerala and West Bengal. Moreover, in line with the Indian priorities, existing swamps and derelict waters offer a huge potential for the production of catfish.

Marine aquaculture

Thirdly, marine aquaculture, focussing on the production of mussels, oysters and seaweeds has experienced a recent increase in production. Nevertheless the production, which mainly takes place in the states of Maharashtra, Gujarat, Kerala, Andhra Pradesh, West Bengal and Tamil Nadu, is still very modest and is often based on traditional practices. For example in 2007 an estimated 10.044 tonnes of oysters and mussels was produced. Additionally, the great existing potential for sea-farming of fin fishes is not utilized, mainly because of technical and marketing issues. There is attention for the development of circular cages and the production of Seabass and Cobia species. Although marine aquaculture at sea is fairly limited, inland and coastal production of saltwater shrimps is more common, as underlined in the paragraph about brackish water aquaculture.

The total export value of marine aquaculture products in 2015-2016 was over 4.7 billion euros. The products exported are mainly shrimps and the export markets (2012-2013) are primarily in South-East Asia (46.34%), followed by the European Union (17.76%) and the United States (11.27%). Vietnam is a major importer of Indian aquaculture products, but re-exports these products again.

Simultaneously, seaweed farming is slowly gaining ground in Palk Bay and the Gulf of Mannar in the state of Tamil Nadu.64 Seaweed farming assures a high profit margin since inputs, such as sunlight and seawater, are free of cost. Banks seem willing to finance large scale production. Production is however very modest as well and the huge potential is currently not exploited. This is also caused because of a low domestic demand. Currently, the seaweed produced is only used for bio-fertiliser and is not yet produced on a large commercial scale. Research into product development is however

undertaken by the Central Salt Marine Chemical Research Institute.

Investments

According to the MPEDA, the lack of available finance is, specifically regarding the development of marine aquaculture, the main challenge. Since the average farmer operates small-scale, they do not have the access to finances to invest in high-tech aquaculture production techniques such as RAS or cage-based aquaculture. Introducing such techniques to India requires an adaption to the Indian situation, taking into account the little financial strength of individual small-scale aquaculture farmers. Focussing on the semi-intensive farmers who do invest will be more beneficial. Dutch companies are already doing research on adapting RAS to the climatological circumstances in Africa. The formation of clusters of cooperating aquaculture farmers may be beneficial. Additionally, famers are in need of insurance schemes. Diseases or weather conditions cause large scale crops loss, which cannot be dealt with by small scale farmers. Introducing an insurance scheme covering the loss of income during a period of for instance two months may be helpful. IFB Agro indicated they already provide insurance schemes to their suppliers.

Post-harvest infrastructure

Another important bottleneck in the Indian aquaculture industry is the production and processing chain. Processing has not kept up the increase in production. Processing plants obtain their machinery from abroad (US, China, Vietnam). For the domestic market (fresh water aquaculture) in coastal states, processing is currently not very relevant, due to the high demand and barely matching supply. Only 30% of the total fish production is processed and there are currently 435 EU-certified processing plants. Poor infrastructure (ports and roads) and storage facilities limit access to consumer market for producers. This, in combination with the climatological circumstances, leads to food waste. For domestic supply, the aquaculture production is transported as live catch or with ice. Enabling an improved access to domestic and international markets will create incentives for producers. Possible opportunities with regard to the development of (cold) chain management exist here. When looking at the fishery sector in a broad sense, cold chain components, as shown in table 3, are limited. Cold chain systems mainly exist for the export market and are insufficiently developed for the domestic market. For the domestic market this is however not a major issue, since demand outdoes supply, which leads to a fast turnover. They currently consist of block ice plants, which provide ice for transport (although tube ice, flake ice and slurry ice are more and more available as well) and few available cold storages.

With regard to infrastructure it is important to note that almost no markets exclusively focusing on fish exist. This, because of involvement of intermediary agents, reduces the market efficiency. Retail suppliers do not have the capacity to invest in cold chain storage. Secondly, existing unorganized markets are unhygienic, which leads to health and safety concerns. Additionally, cold chain systems suffer from a low awareness, especially in more remote areas. Finally, climate issues hinder market access. During the monsoon season, up to 30% of the catch is lost post-harvest. With a specific focus on (cold) chain management in aquaculture and fisheries in a broad sense, the following priorities have been identified by the MPEDA Quality Control Section: the Monitoring of seafood quality in landing and pre-processing centres, providing infrastructural facilities and a mini lab to assure quality, evolving standards for export, based on standards prescribed by such countries and the upgrading of fishing harbours.86 Additionally, there is a need for an increase in production of ice, cold storage facilities at landing centres, more distribution centres, and an improvement of refrigerated transportation methods and facilities at retail markets. For export markets, a clear traceability and certain sustainability standards are important. International

Processing Facilities		Storage Facilities		Handling Facilities		Ice Plant		Pre-processing facilities	
No	Capacity (in '000 MT)	No	Capacity (in '000 MT)	No	Capacity (in '000 MT)	No	Capacity (in '000 MT)	No	Capacity (in '000 MT)
465	20.2	597	224	148	4.4	78	2.2	620	11.7

Table 3: Processing and Storage Infrastructure in India.

companies have to look for reliable local partners. The MPEDA could identify potential local business partners.

Conclusion

India is a large producer of aquaculture and production promises to grow in the future. Andhra Pradesh is the aquaculture state. For brackish water aquaculture (shrimp), Odisha, West Bengal and Gujarat are states where production will increase in the future. Clear business opportunities exist also in Andhra Pradesh with regard to feed additives, processing equipment, quality testing equipment and storage and transportation. This state has the best organised aquaculture sector, which may be easier to enter for foreign companies. Odisha and West Bengal also experience a growing freshwater aquaculture. In West-Bengal the feed sector offers clear opportunities. Joint-venture approaches might be the most successful approach for Dutch companies. Moreover, for the export of shrimps, in general opportunities for Dutch companies exist in improving the processing chain and contributing to the supply of high-quality feed. Also the prevention of diseases and the enabling the provision of high-quality seed and hatcheries are possible sectors of interest to Dutch companies.

The developmental support provided by the Indian Government through a network of Fish Farmers' Development Agencies and Brackishwater Fish Farmers' Development Agencies and the research and development programmes of the Indian Council of Agricultural Research (ICAR) have been the principal vehicles for this revolutionary development. In addition, additional support was also provided by various state governments, host of organizations and agencies like the Marine Products Export Development Authority, financial institutions, etc.

High-tech production techniques might prove more difficult to export since these techniques have to be adapted to the Indian circumstances and price levels before being attractive. Nevertheless here as well, there do exist opportunities, as TNO's testing of an innovative filter membrane in Gujarat proves. Dutch companies have a broad experience in adapting their knowledge of circulation systems, chain approaches, breeding and disease prevention to local circumstances. Entering the market through cooperating with a government institution or a local partner, as is done in other sectors of the economy, might be beneficial. The use of demonstration projects is a way to gain market share more quickly. This is also valid for marine aquaculture. Although not existing on a large scale, large possibilities exist. These possibilities are largely unexplored and will require research and investments by companies willing to enter this sector.

Reference:

http://www.fao.org/fishery/countrysector/naso_india/en

http://www.rgca.org.in/placement/RGCA%20ANNUAL%20REPORT%202014%20-%202015.pdf

http://www.thehindubusinessline.com/economy/agri-business/aquaculture-industry-estimates-1015-growth-in-production/article8135838.ece

https://www.rvo.nl/sites/default/files/2017/04/aquaculture-in-india-report-2017.pdf

https://indianfisheries.icsf.net/en/page/624-Aquaculture.html

Guidelines - Central Sector Scheme on Blue Revolution: Integrated Development and Management of Fisheries, 2016

1. Introduction

Fisheries is a sunrise sector with varied resources and potential, engaging over 14.50 million people at the primary level and many more along the value chain. Transformation of the fisheries sector from traditional to commercial scale has led to an increase in fish production from 7.5 lakh tonne in 1950-51 to 107.95 lakh tonne during 2015-16, while the export earnings from the sector registered at around ^ 33,441 crore in 2014-15 (US$ 5.51 billion). The sector registered an overall annual growth rate of about 4% during the 11th Five Year Plan period. It has contributed about 0.91% to the National Gross Domestic Production (GDP) and 5.23% to the agricultural GDP (2014-15). Constituting about 6.30% of the global fish production and 5% of global trade, India has attained the second largest fish producing and second largest aquaculture nation in the world.

1.2 India is bestowed with varied potential resources in the form of rivers and canals (1.95 lakh km); floodplain lakes (7.98 lakh hectare); ponds and tanks (24.33 lakh hectare); reservoirs (29.26 lakh hectare) and brackish water (11.55 lakh hectare). The marine fisheries resources is estimated at 4.41 million metric tonne and its activities spread along the country's long coastline of 8118 km with 2.02 million square km Exclusive Economic Zone (EEZ) and continental shelf area of 0.53 million sq.km.

1.3 Foreseeing the high potential in the sector, the Hon'ble Prime Minister has called for "a revolution" in the fisheries sector and has named it as **"Blue Revolution"**.

2. Blue Revolution - Neel Kranti Mission

Blue Revolution, the *Neel Kranti Mission* has the vision to achieve economic prosperity of the country and the fishers and fish farmers as well as contribute towards food and nutritional security through full potential utilization of water resources for fisheries development in a sustainable manner, keeping in view the bio-security and environmental concerns. The *Neel Kranti Mission, 2016 (NKM 16)*, being the year in which the Vision has been given by the Prime Minister

will have multi-dimensional approach to all activities concerned with development of the fisheries sector as modern world class industry in India. It will focus on tapping the full production potential and enhance productivity substantially from aquaculture and fisheries resources, both inland and marine. Substantially increasing the share of Indian fisheries in the export area would be a key goal. It will ensure doubling the income of the fishers and fish farmers with inclusive participation of the socio-economically weaker sections and ensure sustainability with environment and biosecurity.

2.1 Vision

"Creating an enabling environment for integrated development of the full potential of fisheries of the country, alongwith substantially improvement in the income status of fishers and fish farmers keeping in view the sustainability, bio-security and environmental concerns."

2.2 Mission

i) Formulation of a Neel Kranti Mission Plan (Blue Revolution Mission Plan) for tapping the full potential of the inland and marine culture fisheries of the country by developing it as a professional modern world class industry. 1

ii) Ensure doubling of income of fishers and fish farmers of the country

iii) Ensure sustainability of, bio-security and address environmental concerns for enabling sustainability of the fishing industry.

2.3 Objectives

i) To fully tap the total fish potential of the country both in the inland and the marine sector and triple the production by 2020

ii) To transform the fisheries sector as a modern industry with special focus on new technologies and processes

iii) To double the income of the fishers and fish farmers with special focus on increasing productivity and better marketing postharvest infrastructure including e-commerce and other technologies and global best innovations

iv) To ensure inclusive participation of the fishers and fish farmers in the income enhancement

v) To triple the export earnings by 2020 with focus on benefits flow to the fishers and fish farmers including through institutional mechanisms in the cooperative, producer companies and other structures

vi) To enhance food and nutritional security of the country.

3. Strategy – Central Sector Assistance Schemes

3.1 The Ministry of Agriculture and Farmers Welfare, Department of Animal Husbandry, Dairying & Fisheries has accordingly restructured the scheme by merging all the ongoing schemes under an umbrella of Blue Revolution. The restructured scheme provides focused development and management of fisheries, covering inland fisheries, aquaculture, marine fisheries including deep sea fishing, mariculture and all activities undertaken by the National Fisheries Development Board (NFDB).

3.2 The restructured Plan Scheme on
has been approved at a total central outlay of Rs.3000 crore for

implementation during a period of five years (2015-16 to 2019-20) with the following components:

i) National Fisheries Development Board (NFDB) and its activities

ii) Development of Inland Fisheries and Aquaculture

iii) Development of Marine Fisheries, Infrastructure and Post-Harvest Operations

iv) Strengthening of Database & Geographical Information System of the Fisheries Sector

v) Institutional Arrangement for Fisheries Sector

vi) Monitoring, Control and Surveillance (MCS) and other need-based Interventions

vii) National Scheme of Welfare of Fishermen.

4. Central Financial Assistance

4.1 The scheme shall be implemented in accordance with the annual budgetary allocation in the Demand for Grants of the Ministry of Agriculture and Farmers Welfare and the Administrative Approval of the Scheme dated 20th May, 2016.

4.2 Broad patterns of Central funding for new projects under four components viz (a) National Fisheries Development Board (NFDB) and its activities, (b) Development of Inland Fisheries and Aquaculture, (c) Development of Marine Fisheries, Infrastructure and Post-Harvest Operations and (d) National Scheme for the Welfare of Fishermen are as below:

(a) 50% of the project/unit cost for general States, leaving the rest to State agencies/ organisations, corporations, federations, boards, Fishers cooperatives, private entrepreneurs, individual beneficiaries

(b) 80% of the project/unit cost for North-Eastern/Hilly States leaving the rest to State agencies/ Organizations, Cooperatives, individual beneficiaries etc.

(c) 100% for projects directly implemented by the Government of India through its institutes/ organisations and Union Territories.

4.3 Projects under the remaining three components scheme namely (i) Strengthening of Database & Geographical Information System of the Fisheries Sector, (ii) Institutional Arrangement for the Fisheries Sector and (iii) Monitoring, Control and Surveillance (MCS) and other need-based interventions shall be implemented with 100% central funding.

4.4 Individual beneficiaries, entrepreneurs and cooperatives/ collectives of the Union Territories shall also be provided Central

financial assistance at par and equal to such beneficiaries in General States.

5. Inclusive Development

5.1 The CSS encompasses inclusive development by providing special care to Fishermen Societies, Cooperative Bodies, Women, Scheduled Castes (SCs) and Scheduled Tribes (STs) and under developed regions etc. by extending adequate financial assistance. Emphasis may also be on promoting investment & entrepreneurship development, arrangements for institutional financing, facilitating backward and forward linkages, training and capacity building etc.

5.2 The States/ UTs shall also accord high priority to the proposals of fishers, fish farmers, fishers cooperatives, SCs/ STs & women and their SHG's, cooperatives, and other weaker segments of the society so as to ensure adequate coverage of such beneficiaries as intended in the scheme.

5.3 The scheme provides greater flexibility and broader scope to mobilize the required financial resources from various sources, including financial institutions to meet the States/ beneficiaries contribution in development of fisheries.

6. Pre-Investment Activities

6.1 The expenditure towards completion of essential pre-investment activities required for project formulation shall be considered for central assistance on a sharing basis as per the funding pattern of the scheme for activities undertaken only 6 months prior to submission of proposal to SG.

6.2 The central funding on completion of essential pre-investment activities shall be restricted to 1% of the total estimated project cost (with a ceiling of Rs. 50 lakh for multi-crore infrastructure projects), which shall be shared as per the funding patterns of the scheme.

6.3 The broad activities involved in project formulation and to be covered for assistance under the scheme are (i) surveys and investigations of all types, (ii) pre-feasibility studies, (iii) preparation of Pre-Feasibility Reports(PFRs), (iv) project planning and designing, (v) preparation of Feasibility Reports (FRs), (vi) Detailed Project Reports (DPRs)/Self Contained Proposals, (vii) Techno Economic Feasibility Reports (TEFRs) and (viii) structural design and detailed cost estimates etc.

6.4 The beneficiaries/applicants shall be required to incur the expenditure for completion of the essential pre-investment activities during the course of project formulation. The project formulation should be complete within the shorter duration. Such expenditure shall be included in the individual DPR with supporting documents/certificates/receipts etc., for consideration under the scheme. The central share of such pre-investment expenditure shall be reimbursed to the project proponent only after the project is approved by the Competent Authority and its successful completion.

6.5 In case the proposal is not approved by the authority or fails to meet its objectives due to its technical viability/ feasibility/ prepared by beyond the scope/ambit of the Scheme, non-producing of required clearances, non-availability of land, environmental and sustainability concerns or any other reason whatsoever, the expenditure incurred for completion of the pre-investment activities shall not be reimbursed under the scheme.

6.6 It is the responsibility of the beneficiaries/applicants to formulate viable/feasible and result oriented proposals etc. The GOI shall not have any commitment to meet the expenditure incurred by the project proponent in formulating unviable and unacceptably proposals.

Appendix-I

I. Development of Marine Fisheries, Infrastructure and Post-Harvest Operations

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
(i)	(ii)	(iii)	(iv)	(v)
1. Development of Marine Fisheries				
1.1	Motorization of Traditional Craft	Upto 1.20 lakh/craft (including fishing gear and propeller)	(a) 50% of the unit cost with a ceiling of 60,000/- per OBM/ IBM in General States. (b) 100% with a ceiling of Rs.1.20 lakh/ craft for UTs.	(i) Beneficiary fisher should own the traditional craft & possess a valid registration certificate under the ReALCraft (uniform registration certificate) and valid fishing license (ii) IBM/OBM (2-stroke and 4- stroke) of capacity up to 10 HP is allowed. (iii) Central assistance shall also be provided for replacement of engine (IBM/ OBM) of more than 5 years old. (iv) This assistance shall be provided to beneficiaries only once in 5 years. (v) The concerned States/ UTs shall procure and supply the IBMs/ OBMs by adopting necessary procurement procedure and codal formalities. (vi) Central assistance shall be provided on the basis of self contained proposals from States/ UTs and also indicating therein the source of the remaining 50% State/ beneficiary share.
1.2	Safety of Fishermen at Sea	Rs.2.00 lakh per kit	(a) 50% of the unit cost with a ceiling of Rs.1.00 lakh per kit in General States. (b) 100% with ceiling of Rs.2.00 lakh/kit for UTs.	(i) Safety kit shall consist of GPS, communication equipment, echo-sounder, lifejackets, lifebuoys, Distress Alert Transmitter(DAT), life-saving appliances (VHF radiotelephones), fish finder, backup battery, search & rescue beacon etc. (ii) Concerned States/ UTs are required to assess specific and essential requirement of items mentioned in (i) above for a particular fishing vessel, including the cost estimate in the proposal. (iii) Beneficiary should possess valid (a) Ownership Certificate, (b) Registration Certificate under the ReALCraft, (c) Fishing License and (d) Biometric ID fishers ID card.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
(i)	(ii)	(iii)	(iv)	(v)
1.3	Assistance to Traditional / Artisanal Fishermen for: (a) Procurement of FRP Boats upto 10m OAL as a replacement for traditional/ wooden boats including nets. (b) Procurement of Insulated Fish & Ice Holding Boxes.	(a) As per actual subject to maximum Rs.4.00 lakh per boat (b) As per actual subject to a maximum of Rs. 25,000/- per boat.	(a) 50% of the unit cost with a ceiling of Rs.2.00 lakh per new boat and Rs. 12,500/- for insulated fish & ice holding box per boat for General States. (b) 100% of the unit cost with a ceiling of Rs.4.00 lakh per new boat and Rs.25,000/- for insulated fish & ice holding box per boat for UTs.	(i) Only Traditional/Artisanal fishermen are eligible for the benefit under this component. (ii) Beneficiary should possess valid (a) Ownership Certificate, (b) Registration Certificate under the ReALCraft, (c) Fishing License and (d) Biometric ID fishers ID card. (iii) Financial assistance shall be limited to a maximum of 2 insulated fish and ice holding boxes of 500kg to 1000 kgs capacity respectively for each FRP boat. (iv) State Govts/UTs shall ensure suitable disposal of the old fishing boats(against which new one is replaced).
1.4	Rebate on High Speed Diesel (HSD) for Fishers		(i) Central rebate shall be 50% and 100% of the Sale Tax relief for the General States and UTs respectively on HSD for fishing purpose with a ceiling of Rs.3.00/litre.	(i) Beneficiary should possess valid ownership Certificate of fishing vessel of less than 20m OAL, Registration Certificate under the ReALCraft, Fishing License and Biometric ID fishers ID card. (ii) Only BPL category beneficiaries shall be eligible for central rebate. (iii) Central Rebate shall be restricted to 500 liters per fishing boat per month during 9 (nine) active fishing months in a year.
1.5	Establishment & Operation of Vessel Monitoring System (VMS)	Actual Cost	100% cost of project implemented by DADF.	(i) FSI/DADF is nodal agency to implement the project. (ii) Maintenance and operational costs of the Hub-station, antenna and all other equipment developed/ installed at Porbandar. (iii) Monitoring and tracking of fishing vessels using space technology and IT tools. (iv) Activities relating to dissemination of information on (a) weather forecast & forewarning and (b) Potential Fishing Zone (PFZ) to marine fishers etc. (v) The activities mentioned in (ii) and (iii) above shall be taken up in coordination (wherever required) with the concerned Central Ministries/ Departments/ Institutes such as MHA, M/o Earth Sciences, M/o Defence, ISRO, INCOIS, NIC, FSI, CIFNET and other Central Govt. Institutes. (vi) Convergence of schemes of these Ministries/ Departments/ Institutes (wherever feasible) shall also be considered. (vii) Development of necessary software, procurement and installation of suitable communication devices/ transponders and essential equipment etc., on board the fishing vessels in a phased manner.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
(i)	(ii)	(iii)	(iv)	(v)
1.6	Promoting Non-Conventional Energy (Nce) Sources for Environment Friendly Fishing Practices	Actual Cost	(a) 50% of the project cost subject to a maximum of Rs.25,000/- per fishing vessel in General States (b) 100% assistance to UTs/ Central Fisheries Institutes/ Organisations for pilot studies and R&D activities.	(i) Assistance for use of solar energy/ other NCE sources in lighting, refrigeration etc. on board the fishing vessels. (ii) Beneficiary should possess valid ownership Certificate, Registration Certificate under the ReALCraft, Fishing License and Biometric ID fishers ID card. (iii) States/ UTs and Central fisheries institutes/ organizations are required to submit self contained project proposals to avail of the assistance.
1.7 1.7.1	Promotion of Mariculture in the form of : Open Sea Cage Culture	Rs. 5 lakh per cage having minimum diameter of 6 meters and depth of 4 meters in case of each circular cage and 96 cubic meter volume (6mx4mx4m) in case of each rectangular cage.	(a) 50% of the unit cost with a ceiling of Rs. 2.50 lakh per cage in coastal States. (b) 100% of the unit cost with a ceiling of Rs. 5 lakh per cage in UTs and for ICAR/ other Central Govt Institutes.	(i) The applicant shall obtain necessary prior permissions from the concerned State/ UT Government and other Competent Authorities for installation of cages in the sea. (ii) Fishermen Cooperative Societies, SC/ST Cooperative Societies, Women Self Help Groups, Registered Companies of Private Entrepreneurs etc. shall be eligible for central assistance for 4 batteries of 5 cages each (20 cages) at a particular location. (iii) The unit cost includes capital, operational and maintenance costs on one time basis. (iv) The applicants shall be required to submit self contained project proposals together with documentary evidence of necessary permissions and technical knowhow to avail of the assistance.
1.7.2	Seaweed Cultivation	Rs.1000 per raft (3m x 3m size).	(a) 50% of the unit cost with a ceiling of Rs.500/- per bamboo raft in coastal States/ UTs. (b) 100% of the unit cost with a ceiling of Rs.1000/- per bamboo raft to UT Administrations, ICAR/ other Central Govt. Institutes.	(i) The applicant shall obtain necessary prior permissions from the concerned State/ UT Government and other Competent Authorities for installation of rafts. (ii) Fishermen Cooperative Societies, SC/ST Cooperative Societies, Women Self Help Groups, Registered Companies of Private Entrepreneurs etc. shall be eligible for central assistance for a cluster of up to a maximum of 500 rafts at suitable sites/ locations. (iii) The unit cost includes capital, operational and maintenance costs on one time basis (iv) The applicants shall be required to submit self contained project proposals together with documentary evidence of necessary permissions and technical knowhow to avail of the assistance. (v) The proposals shall be routed through the concerned State Govt/ UT Administration with clear recommendation.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
(i)	(ii)	(iii)	(iv)	(v)
1.7.3	Bivalve Culture	Rs.15,000 per bamboo rack (5m x 5m size)	(a) 50% of the unit cost with a ceiling of Rs. 7,500/- per bamboo rack in coastal States/ UTs. (b) 100% of the unit cost with a ceiling of Rs. 15,000/- per bamboo rack to UT Administrations, ICAR/ other Central Govt Institutes.	(i) The applicant shall obtain necessary prior permissions from the concerned State/UT Government and other Competent Authorities for installation of racks. (ii) Fishermen Cooperative Societies, SC/ST Cooperative Societies, Women Self Help Groups, registered Companies of Private Entrepreneurs etc. shall be eligible for central assistance for a battery of up to a maximum of 40 racks at suitable sites/ locations. (iii) The unit cost includes capital, operational and maintenance costs on one time basis. (vi) The applicants shall be required to submit self contained project proposals together with documentary evidence of necessary permissions and technical knowhow to avail of the assistance. (iv) The proposals shall be routed through the concerned State Govt/ UT Administration with clear recommendation.
1.7.4	Pearl Culture (marine & fresh water)	As per actual with a ceiling of Rs. 25 lakh per project.	(a) 50% of the unit cost with a ceiling of Rs. 12.50 lakh per project in General States/ UTs. (ii) 80% of the unit cost with a ceiling of Rs. 20 lakh per project in North-Eastern & Himalayan States. (b) 100% of the unit cost with a ceiling of Rs.25 lakh per project to UT Administrations, ICAR/ other Central Govt Institutes.	(i) The applicant shall obtain necessary prior permissions from the concerned State/UT Government and other Competent Authorities for installation of pearl culture rafts. (ii) Fishermen Cooperative Societies, SC/ST Cooperative Societies, Women Self Help Groups, Registered Companies of Private Entrepreneurs etc. shall be eligible for central assistance for one project each group at suitable sites/ locations. (iii) The unit cost includes capital, operational and maintenance costs on one time basis (iv) The applicants shall be required to submit self contained project proposals together with documentary evidence of necessary permissions and technical knowhow to avail of the assistance. (v) The proposals shall be routed through the concerned State Govt/ UT Administration with clear recommendation.
1.8	Management of Marine Fisheries	Actual cost with a ceiling of Rs.5 lakh per project.	100% Central assistance to take up the following activities: (a) Conducting of awareness programmes on conservation & management of fisheries, community outreach programmes on sustainable fishery practices.	(i) The components (a), (b) and (c) in column (iv) shall be implemented through the State Governments, UTs, State agencies/ organisations, corporations, federations, boards, Fishers Cooperatives, Central Fisheries Institutes etc. including ICAR, Central Government organizations/ Departments etc. (ii) The components (d) and (e) in column(iv) shall be implemented through the Central Government agencies/ organizations/ Departments, Central Fisheries Institutes, ICAR, State Governments/ UTs and other Expert Agencies recognized in the field.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
(i)	(ii)	(iii)	(iv)	(v)
			(b) Implementing Code of Conduct for Responsible Fisheries(CCRF). (c) Implementation of FAO guidelines on Small Scale Fisheries. (d) Evaluation of fishing capacity in terms of optimum size of fleet of different types of fishing vessels and suggest measures on sustainable fishery practices. (e) Studies on impact of climate change, natural calamities, pollution etc. on fishery resources.	(iii) The project proponents shall be required to submit DPR clearly indicating the objectives, theme, area of implementation, beneficiaries to be covered, implementation schedule, anticipated outcomes/benefits etc.
2. Development of Infrastructure and Post-Harvest Operations				
2.1	Establishment of Fishing Harbours and Fish Landing Centres	As per actual cost	(a) 50% of the approved project cost to State Governments/ State agencies and (b) 100% to UTs & Central Government Agencies/Organizations for: (i) construction of new Fishing Harbours (major & minor) and Fish Landing Centres and (ii) Up-gradation/ expansion/ repair/ renovation of the existing Fishing Harbours and Fish Landing Centres.	The applicants are required to complete the following formalities: (i) identification/ selection of suitable site/ location. (ii) necessary engineering and socio-economic investigations and surveys, (iii) planning and designing of the Fishing Harbour/ Fish Landing Centre. (iv) hydraulic model studies, wherever required. (v) EIA/ EMP studies as may be required for obtaining environmental clearance. (vi) Land acquisition required for development of the proposed Fishing Harbour/ Fish Landing Centre. (vii) Cost Estimates shall be based on latest SoRs admissible in the project area. (viii) The applicants shall be required to submit self contained project proposals including documentary evidence of (i) to (vii) above to avail of the assistance.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
(i)	(ii)	(iii)	(iv)	(v)
2.2	Assistance for Dredging of Fishing Harbours/ Fish Landing Centres.	As per actual cost	(a) 50% of the approved project cost to State Governments/ State agencies (b) 100% to UTs & Central Government Agencies/ Organizations (c) Full expenses for insurance, dry-docking, repair & up-gradation of the dredger TSD Sindhuraj (owned by DAHD&F).	For dredging projects, the applicants are required to complete the following formalities: **(i)** necessary engineering investigations and surveys. (ii) Assessment of quantum of maintenance dredging & preparation of cost estimates based on latest SoRs admissible in the project area. (iii) submit self contained project proposals including documentary evidence of (i) and (ii) above to avail of the assistance.
3. Strengthening of Post Harvest Infrastructure				
3.1	Development of Post Harvest Infrastructure Projects eligible for central financial assistance under this sub-component are: (i) Ice Plants (ii) Cold Storages (iii) Ice Plants-cum-Cold Storages	Rs.2.50 lakh per tonne	(i) 50% of the unit cost with a ceiling of Rs. 50 lakh per plant project in General States. (ii) 80% of the unit cost with a ceiling of Rs. 80 lakh per plant project in North-Eastern & Himalayan States. (iii) 100% of the unit cost with a ceiling of Rs. 100 lakh per plant project to Central Government Organisations/ Institutions and UTs.	(i) Beneficiaries shall provide documentary evidence of availability of requisite land free from all encumbrances and financial resources along with necessary clearances/ permissions etc. in the DPR. No funds shall be provided for the land. ii) Cost estimates shall be based on the latest SoRs admissible in the project area and prevailing market rates. iii) The beneficiaries shall certify that all operational and maintenance costs of the infrastructure facilities shall be borne by them in future. (iv) The beneficiaries shall submit self contained proposals together with documentary evidences in respect of (i) to (ii) above. (v) The proposal shall be routed through the concerned State Governments/ UTs with clear recommendation.
3.2	Renovation / Modernization of existing (a) Ice Plants (b) Cold Storages and (c) Ice Plants-cum-Cold Storages	Rs 1.50 lakh per tonne	(a) 50% of the unit cost with a ceiling of Rs.30 lakh per plant project in General States. (b) 80% of the unit cost with a ceiling of Rs 48 lakh per plant project in North-Eastern/Himalayan States.	(i) The broad items for renovation/modernization of the existing plants shall include civil works of the existing building, replacement of plants & machineries, electrification & water supply & sanitation works etc., with a view to enhance the efficacy of the existing plant. (ii) The beneficiaries should have the ownership of the existing infrastructure plant/facilities. (iii) Renovation/modernization of existing & operational plants of minimum 10 years old only may be considered for funding on one time basis. (iv) The beneficiaries should clearly indicate the source of balance funding for the project. (v) Cost estimates shall be based on the latest SoRs admissible in the project area and prevailing market rates.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
(i)	(ii)	(iii)	(iv)	(v)
			(c) 100% of the unit cost with a ceiling of Rs 60 lakh per plant project for the plant owned by the Central Government Organisations/ Institutions and UTs.	(vi) The beneficiaries shall confirm that all operational and maintenance costs of the modernized plant/infrastructure facility shall be borne by them. (vii) The beneficiaries shall submit self contained proposals together with documentary evidences in respect of (ii) to (vi) above. (viii) The proposals shall be routed through the concerned State Governments/ UTs with clear recommendation.
3.3	Development of Retail Fish Markets and Allied Infrastructure (Items: Modern hygienic fish market with a minimum of 10 retail outlets, 20 retail outlets, and 50 retail outlets units with common cold storage facility, waste collection & disposal units, fish cleaning and dressing space, auctioning platforms water and power supply facilities etc.)	As per actual with a ceiling of as below: (a) Rs.100 lakh for a fish market of 10 unit retail outlets, (b) Rs 200 lakh for a fish market of 20 unit retail outlets, (c) Rs 500 lakh for a fish market of 50 units or more retail outlets.	(a) For General Stats : 50% of the unit cost with a ceiling of (i) Rs. 50 lakh for a fish market of 10 units of retail outlets, (ii) Rs. 100 lakh for a fish market of 20 units of retail outlets and (iii) Rs. 250 lakh for a fish market of 50 units or more retail outlets. (b) For North-Eastern and Himalayan States : 80% of the unit cost with a ceiling of (i) Rs. 80 lakh for a fish market of 10 units of retail outlets, (ii) Rs. 160 lakh for a fish market of 20 units of retail outlets and (iii) Rs. 400 lakh for a fish market of 50 units or more retail outlets. (c) For Central Government institutes/ organisations including ICAR institutes and UTs : 100% of the unit cost with a ceiling of (i) Rs. 100 lakh for a fish market of 10 units of retail outlets, (ii) Rs. 200 lakh for a fish market of 20 units of retail outlets and (iii) Rs. 500 lakh for a fish market of 50 units or more retail outlets.	(i) Beneficiaries shall provide documentary evidence of availability of requisite land free from all encumbrances and financial resources along with necessary clearances/ permissions etc. in the DPR. No funds shall be provided for the land. (ii) The beneficiaries shall complete the planning, designing of the market facilities and cost estimates etc. through professionals in the subject. (iii) Cost estimates shall be based on the latest SoRs admissible in the project area and prevailing market rates. (iv) The post-construction operational and maintenance costs of the infrastructure facility shall be borne by the beneficiaries. (v) The beneficiaries shall submit self contained proposals together with documentary evidences in respect of (i) to (iv) above. (vi) The proposals shall be routed through the concerned State Governments/ UTs with clear recommendation. (vii) NFDB shall take up development and management of fish markets on commercial approach at feasible locations.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
(i)	(ii)	(iii)	(iv)	(v)
3.4	Setting up of Mobile/Retail Fish Outlet (Kiosk) (Kiosk along with one fish storage/display cabin, one visi cooler, weighing machine, facilities/ utensils for fish cutting cleaning facilities)	As per actual with a ceiling of Rs. 10 lakh per unit.	For General Stats : 50% of the unit cost with a ceiling of Rs. 5 lakh per unit. (b) For North-Eastern and Himalayan States : 80% of the unit cost with a ceiling of Rs. 8 lakh per unit. (c) For Central Government institutes/ organisations including ICAR institutes and UTs : 100% of the unit cost with a ceiling of Rs. 10 lakh per unit.	(i) Beneficiaries shall provide documentary evidence of availability of requisite land (wherever required) free from all encumbrances and financial resources along with necessary clearances/ permissions(wherever required) etc. in the DPR. No funds shall be provided for the land. (ii) Cost estimate for construction of fish retail outlet/kiosk shall be based on the latest SoRs admissible in the project area, and cost estimate for mobile outlet shall be based on prevailing market rates. (iii) The post-construction operational and maintenance costs of the fish retail outlet/kiosk/ mobile fish retail outlet shall be borne by the beneficiaries. (iv) The beneficiaries shall submit self contained proposals together with documentary evidences in respect of (i) to (iii) above. (v) The proposals shall be routed through the concerned State Governments/ UTs with clear recommendation.[[[(vi) Fish retail outlet/kiosk shall be of a minimum floor area of 100 Sq.ft (static). (vii) Priority shall be given to SCs / STs/ women / unemployed youth.
3.5 Assistance for Fish Transport Infrastructure				
3.5.1	Refrigerated Truck/Container af a minimum 10 tonne capacity.	As per actual with a ceiling of 25 lakh per truck.	(a) For General Stats : 50% of the unit cost with a ceiling of Rs. 12.50 lakh per truck. (b) For North-Eastern and Himalayan States : 80% of the unit cost with a ceiling of Rs.20 lakh per truck. (c) For Central Government institutes/ organisations including ICAR institutes and UTs : 100% of the unit cost with a ceiling of Rs.25 lakh per truck.	(i) Maintenance & operational costs of the fish transport vehicles shall be met by the beneficiaries at their own cost. (ii) Government of India shall not be responsible for any losses incurred on procurement, operation, maintenance and management of the fish transport facilities. (iii) Beneficiaries should ensure that fish transport facilities are maintained in operational condition. (iv) Beneficiaries shall be abide by rules/regulations, if any imposed by the concerned State/UT as well as Central Government on maintenance & operation of the fish transport facilities. (v) Beneficiaries shall ensure that the fish transport vehicles/facilities procured under the scheme will be used only for transport of fish and fisheries related items and not for any other purposes.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
(i)	(ii)	(iii)	(iv)	(v)
3.5.2	Insulated Truck of a minimum 10 tonne capacity.	As per actual with a ceiling of 20 lakh per truck.	(a) For General Stats: 50% of the unit cost with a ceiling of Rs. 10 lakh per truck. (b) For North-Eastern and Himalayan States: 80% of the unit cost with a ceiling of Rs.16 lakh per truck. (c) For Central Government institutes/ organisations including ICAR institutes and UTs: 100% of the unit cost with a ceiling of Rs.20 lakh per truck.	(vi) In case, it is found at any point of time that the fish transport vehicles procured under the scheme are used for other than the fisheries purposes, the Government of India will recover the entire central assistance with interest from the beneficiaries. (vii) Beneficiaries will display permanently to the effect that the fish transport vehicle is procured with financial assistance from the Government of India, Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries.
3.5.3	Insulated Truck of a minimum 6 tonne capacity	As per actual with a ceiling of 15 lakh per truck.	(a) For General States: 50% of the unit cost with a ceiling of Rs. 7.50 lakh per truck. (b) For North-Eastern and Himalayan States: 80% of the unit cost with a ceiling of Rs.12 lakh per truck. (c) For Central Government institutes/ organisations including ICAR institutes and UTs: 100% of the unit cost with a ceiling of Rs.15 lakh per truck.	
3.5.4	Autorickshaw with Ice Box	As per actual with a ceiling of Rs. 2 lakh per unit	(a) For General States: 50% of the unit cost with a ceiling of Rs. 1 lakh per unit. (b) For North-Eastern and Himalayan States: 80% of the unit cost with a ceiling of Rs.1.60 lakh per unit. (c) For Central Govt. Institutes/ organisations including ICAR Institutes and UTs: 100% of the unit cost with a ceiling of Rs. 2 lakh per unit.	

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
(i)	(ii)	(iii)	(iv)	(v)
3.5.5	Motorcycle with Ice Box	As per actual with a ceiling of Rs.0.60 lakh per unit.	(a) For General States: 50% of the unit cost with a ceiling of Rs. 0.30 lakh per unit. (b) For North-Eastern and Himalayan States: 80% of the unit cost with a ceiling of Rs.0.48 lakh per unit. (c) For Central Govt Institutes/ organisations including ICAR institutes and UTs: 100% of the unit cost with a ceiling of Rs. 0.60 lakh per unit.	
3.5.6	Bicycle with Ice Box	As per actual with a ceiling of Rs. 3000/- per unit.	(a) For General States: 50% of the unit cost with a ceiling of Rs. 1500/- per unit. b) For North-Eastern and Himalayan States: 80% of the unit cost with a ceiling of Rs.2400/- per unit. (c) For Central Govt. Institutes/ organisations including ICAR Institutes and UTs: 100% of the unit cost with a ceiling of Rs.3000/- per unit.	

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
(i)	(ii)	(iii)	(iv)	(v)
4. Innovative activities.				
4.1	Innovative Activities	Actual	(a) 50% of the unit cost with a ceiling of Rs. 50 lakh for each project for General States. (b) 100% of the unit cost with a ceiling of Rs. 100 lakh for the projects directly implemented by the Government of India through its institutes/ organisations including ICAR institutes and UTs.	(i) Innovative activities shall broadly cover fisheries management, conservation, induction of new technology in fishing and allied activities including onboard handling of fish, diversification of species to enhance the production and productivity, new technologies in mariculture, fish culture, Re-circulatory Aquaculture Systems (RAS) with a minimum capacity of 500 tonnes/ year, cage/pen culture including auto feed technology, energy efficient operation of post harvest infrastructure facilities such as FHs/ FLCs etc, fisheries waste management, improvement in hygienic conditions of the post harvest infrastructure facilities including deboning machine etc., post harvest processing and value added products, promotional activities and any unforeseen activities etc. (ii) The States/UTs/ Agencies are requested to submit self contained proposal clearly indicating the innovative activities, capabilities of implementing agencies, anticipated outcomes/ outputs (both in terms of qualitative and quantative) and broad long-term impact on local fisheries etc.

Appendix-II

II. Development of Inland Fisheries and Aquaculture

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
(i)	(ii)	(iii)	(iv)	(v)
1. Development of Freshwater/Brackishwater Aquaculture				
1.1	Construction of New Ponds/ Tanks (including construction of sluice gates, civil works for water supply and aeration appliances, feed storing shed etc.)	As per actual cost subject to a ceiling of Rs. 7 lakh per ha	(a) For General States: 50% of the unit cost with a ceiling of Rs. 3.50 lakh per ha (b) For North-Eastern/ Himalayan States: 80% of the unit cost with a ceiling of Rs. 5.6 lakh per ha (c) For UTs/ Central Govt. Institutes/ organisations including ICAR institutes : 100% of the unit cost subject to a ceiling of Rs. 7 lakh per ha.	(i) Beneficiaries shall provide documentary evidence of availability of requisite land free from all encumbrances and financial resources along with necessary clearances/ permissions etc. in the DPR. No funds shall be provided for the land. (ii) The constructed ponds shall have a minimum water depth of 1.5m. (iii) Central financial assistance shall be restricted to a maximum area of 2 ha for individual beneficiary, 2 ha x number of members for cooperatives/ collectives subject to viability of pond sizes and with a ceiling of 20 ha. for group/collectives. The project proposals in this category shall be routed through the concerned State /UT Government with proper recommendations. (iv) For Central and State Government organizations/ federations/ corporations/ agencies etc financial assistance for quantum of hectarage shall be decided on case to case basis in consultation with the concerned applicant.
1.2	Renovation of Existing Ponds/Tanks (repair and strengthening of bunds, repair of electrical and water supply works and other accessories/ equipment, de-siltation, repair/ installation of sluice gates, site clearing, dewatering etc.)	Rs. 3.5 lakh/ha	(a) For General States: 50% of the unit cost with a ceiling of Rs. 1.75 lakh per ha. (b) North-Eastern/ Himalayan States : 80% of the unit cost with a ceiling of Rs. 2.80 lakh per ha. (c) For UTs/ Central Govt. Institutes/ organisations including ICAR institutes : 100% of the unit cost subject to a ceiling of Rs. 3.50 lakh per ha.	(i) Beneficiaries shall provide documentary evidence on ownership of the existing ponds/ tanks, financial resources along with necessary clearances/ permissions (if any required) etc. in the DPR. (ii) Renovation/repair/de-silting of existing ponds/ tanks, other related civil works etc. may be considered for funding only after 5 years on one time basis. (iii) Central financial assistance shall be restricted to a maximum area of 2 ha for individual beneficiary, 2 ha x number of members for cooperatives/ collectives subject to viability of pond sizes and with a ceiling of 20 ha. for group/collectives. (iv) The project proposals (except for central Govt organizations/ instates) shall be routed through the concerned State/ UT Government with proper recommendations.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
1.3	Renovation of MNERGA Ponds And Tanks, New Water Bodies created under various State Govt/Central programme including wetland development department etc.	Rs. 3.5 lakh/ha	(a) For General States: 50% of the unit cost with a ceiling of Rs. 1.75 lakh per ha (b) North-Eastern/ Himalayan States : 80% of the unit cost with a ceiling of Rs. 2.80 lakh per ha (c) For UTs/ Central Govt. Institutes/ organisations including ICAR institutes : 100% of the unit cost subject to a ceiling of Rs. 3.50 lakh per ha.	(v) Beneficiary organizations/ agencies shall provide documentary evidence on ownership of the ponds/ tanks, financial resources along with necessary clearances/ permissions (if any required) etc. in the DPR. (vi) Renovation/ repair/ de-silting of the ponds/ tanks, other related civil works etc. may be considered for funding only after 5 years on one time basis. (vii) Central financial assistance shall be restricted to a maximum area of 2 ha for individual beneficiary, 2 ha x number of members for cooperatives/ collectives subject to viability of pond sizes and with a ceiling of 20 ha. for group/collectives. (viii) The project proposals (except for central Govt organizations/ instates) shall be routed through the concerned State/ UT Government with proper recommendations.
1.4	Rejuvenation of Urban/ Semi-Urban/ Rural Lakes/Tanks for Fish Culture	Rs.3.5 lakh/ha	(a) For General States: 50% of the unit cost with a ceiling of Rs.1.75 lakh per ha (b) North-Eastern/ Himalayan States : 80% of the unit cost with a ceiling of Rs.2.80 lakh per ha (c) For UTs/ Central Govt. Institutes/ organisations including ICAR institutes : 100% of the unit cost subject to a ceiling of Rs. 3.50 lakh per ha.	(i) Beneficiary organizations/ agencies shall provide documentary evidence on ownership of the ponds/ tanks, financial resources along with necessary clearances/ permissions (if any required) etc. in the DPR. (ii) Renovation/repair/ de-silting of the ponds/ tanks, other related civil works etc. may be considered for funding only after 5 years on one time basis. (iii) Central financial assistance shall be restricted to a maximum area of 2 ha for individual beneficiary, 2 ha x number of members for cooperatives/ collectives subject to viability of pond sizes and with a ceiling of 20 ha. for group/collectives. (iv) The project proposals (except for central Govt organizations/ instates) shall be routed through the concerned State/ UT Government with proper recommendations.
1.5 Inputs Cost for Freshwater Fish Culture and Brackishwater Fish/Shrimp Culture (items at 1.1 to 1.4 above)				
1.5.1	For Freshwater Fish Culture (unit cost includes cost of fish/prawn seed, feed, manure, disease prevention measures, transportation charges etc.) ***(one time grant)***	(a) Finfish Culture: As per actual cost subject to a ceiling of Rs. 1.50 lakh/ha	(a) Central assistance for Finfish culture is restricted at (i) 50% of project/unit cost with a ceiling of Rs. 0.75 lakh/ha for all beneficiaries in general States and (b) 80% of unit cost with a ceiling of Rs. 1.20 lakh/ha. in North-Eastern Himalayan States	(i) This input cost shall be provided for the ponds/ waterbodies mentioned at S.No.1.1 to 1.4 above with the ceiling indicated therein. (ii) Beneficiaries shall be provided central assistance for input costs for the initial crop only in the newly constructed/ renovated ponds/ tanks. (iii) Central assistance for input cost shall be released only after the ponds/ tanks are ready for culture.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
		(b) Freshwater prawn/trout culture: As per actual cost subject to a ceiling of Rs. 2.50 lakh/ha	(b) Central assistance for Freshwater prawn/ trout culture is restricted to 50% of the unit cost with a ceiling of Rs.1.25 lakh/ ha for all beneficiaries in general States and (b) 80% of the unit cost with a ceiling of Rs. 2.00 lakh/ha. in North-Eastern & Himalayan States. (iii) 100% central assistance of input cost to the projects directly implemented by the Government of India through its institutes/ organisations including ICAR institutes and UTs.	
1.5.2	For Brackishwater Fish/Shrimp Culture (unit cost includes cost of fish/shrimp seed, feed, manure, disease prevention measures, transportation charges, etc.) ***(one time grant)***	(a) Finfish Culture: As per actual cost subject to a ceiling of Rs. 2.00 lakh/ha (b) Culture of shrimp such L.vannamei/ P.monodon etc: As per actual cost subject to a ceiling of Rs. 3.00 lakh/ha	(I) Central assistance for Finfish culture is restricted at (a) 50% of unit cost with a ceiling of Rs.1.00 lakh/ ha for all beneficiaries in general States, (b) 80% of unit cost with a ceiling of Rs. 1.60 lakh/ha. to all beneficiaries in North-Eastern Himalayan States. (II) Central assistance for culture of *L.vannamei/ P.monodon etc* is restricted at 50% of the unit cost with a ceiling of Rs.1.50 lakh/ ha to all beneficiaries in general States.	(i) This input cost shall be provided for the ponds/ waterbodies mentioned at S.No.1.1 to 1.4 above with the ceiling indicated therein. (ii) Beneficiaries shall be provided central assistance for input costs for the initial crop only in the newly constructed/ renovated ponds/tanks. (iii) Central assistance for input cost shall be released only after the ponds/tanks are ready for culture.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
			(III) 100% central assistance restricting to the species-wise unit costs as at column (iii) of this item for the projects directly implemented by the Government of India through its institutes/ organisations including ICAR institutes and UTs.	
1.6	Establishment of Fish Seed Hatcheries for Indian Major Carps and other specific cultivable fin fish.	As per actual cost subject to a ceiling of Rs. 25.00 lakh per hatcheries of 2 ha area.	(i) For General States: 50% of the unit cost with a ceiling of Rs.12.50 lakh per hatchery. (ii) For North-Eastern/ Himalayan States : 80% of the unit cost with a ceiling of Rs. 20.00 lakh per hatchery. (iii) Central Govt organizations/ agencies/ institutes including ICAR institutes and UTs : 100% of the actual cost restricting to Rs. 25 lakh per hatcheries.	(i) Beneficiaries shall provide documentary evidence of availability of requisite land free from all encumbrances and financial resources, necessary clearances/ permissions etc. with full technical details including bio-security measures in the DPR. No funds shall be provided for the land. (ii) The project proposals from individual beneficiaries, cooperatives/ collectives shall be routed through the concerned State/ UT Government with proper recommendations. (iii) Proposals from Central and State Government organizations/ federations/ corporations/ agencies etc may be submitted directly to NFDB. (iv) Fish hatchery shall have a minimum capacity of 10 million fry/ year with minimum area of 2 ha. (v) Fish hatchery shall include brooder pond, nursery ponds, rearing tanks, small laboratory, water & electric supply, required infrastructure facilities etc. (vi) The fish hatchery should be managed by the required qualified technical staff. (vii) Beneficiary organisations shall ensure supply of seed produced from the central assisted hatcheries to farmers at affordable/ reasonable price. (viii) Post construction operation, management and maintenance of the hatcheries shall be carried out in a satisfactory manner by the beneficiaries at their own costs. (ix) NFDB shall also directly set up & manage the hatcheries with commercial approach at suitable location.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
1.7	Establishment of Freshwater/ Brackishwater Prawn Hatcheries.	As per actual cost subject to a ceiling of Rs. 50 lakh per unit with a minimum capacity of 5 million post larvae per year.	(a) For General States: 50% of the unit cost with a ceiling of Rs.25 lakh per hatchery. (b) For North-Eastern and Himalayan States : 80% of the unit cost with a ceiling of Rs. 40.00 lakh per hatchery (c) Central Govt organizations/ agencies/ institutes including ICAR institutes and UTs : 100% of the actual cost of projects with a ceiling of Rs. 50 lakh per hatchery.	(i) Beneficiaries shall provide documentary evidence of availability of requisite land free from all encumbrances and financial resources, necessary clearances/ permissions etc. with full technical details including bio-security measures in the DPR. No funds shall be provided for the land. (ii) Fisher cooperatives/ collectives shall be eligible for central financial assistance and should route their proposals through the concerned State/ UT Government with proper recommendations. (iii) Proposals from Central and State Government organizations/ federations/ corporations/ agencies etc may be submitted directly to NFDB. (iv) Beneficiary should have the requisite technical expertise and trained manpower for construction, operation and management of the hatchery, (v) The hatchery shall include brooder pond, PL rearing tanks, small laboratory, water & electric supply, bio-security arrangements and required infrastructure facilities etc. (vi) Beneficiaries organisations shall ensure supply of seed produced from the central funded hatcheries to farmers at affordable/ reasonable price. (vii) Post construction operation, management and maintenance of the hatcheries shall be carried out in a satisfactory manner by the beneficiaries at their own costs. (viii) NFDB shall also directly set up & manage the hatcheries with commercial approach at suitable location.
1.8	Solar Power Support System for Aquaculture	As per actula with a ceiling of Rs. 15.00 lakh per unirt	For General States: 50% of the unit cost with a ceiling of Rs.7.50 lakh per unit. (b) For North-Eastern and Himalayan States : 80% of the unit cost with a ceiling of Rs. 12.00 lakh per unit. (c) Central Govt organizations/ agencies/ institutes including ICAR institutes and UTs : 100% of the actual cost of projects with a ceiling of Rs. 15 lakh per unit.	(i) Solar energy system to operate water pump, aerator and other uses in fish culture and fisheries. (ii) Beneficiaries shall be provided central assistance for procurement & installation of solar power support system for fisheries on onetime basis. (iii) Central assistance for input cost shall be released only after the ponds/tanks are ready for culture.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
2. Cold Water Fisheries and Aquaculture				
2.1	Construction of Permanent Farming Units and Raceways	As per actual cost subject to a ceiling of Rs. 2 lakh per unit of minimum volume of 50 m_3	(a) For General States: 50% of the unit cost with a ceiling of Rs. 1 lakh per unit. (b) For North-Eastern and Himalayan States: 80% of the unit cost with a ceiling of Rs.1.60 lakh per unit. (c) Central Govt organizations/ agencies/ institutes including ICAR institutes and UTs : 100% of the actual cost of projects with a ceiling of Rs. 2 lakh per unit.	(i) Beneficiaries shall provide documentary evidence of availability of requisite land free from all encumbrances and financial resources along with necessary clearances/ permissions etc. in the DPR. No funds shall be provided for the land. (ii) Central financial assistance shall be restricted to a maximum area of 4 units for individual farmer/ beneficiary, 10 units for fisher cooperatives/ federations and Entrepreneurs. The project proposals in this category shall be routed through the concerned State /UT Government with proper recommendations. (iii) For Central and State Government organizations/ federations/ corporations/ agencies etc financial assistance and farming units shall be decided on case to case basis in consultation with the concerned.
2.2	Running cold Water Fish Culture in Earthen Units	As per actual cost subject to a ceiling of Rs. 1 lakh/ unit of minimum volume of 100 m^3	(i) For General States: 50% of the unit cost with a ceiling of Rs.0.50 lakh per unit. (ii) For North-Eastern/ Hilly States : 80% of the unit cost with a ceiling of Rs.0.80 lakh per unit. (c) Central Govt organizations/ agencies/ institutes including ICAR institutes and UTs : 100% of the unit cost with a ceiling of Rs. 1 lakh per unit.	(i) Beneficiaries shall provide documentary evidence of availability of requisite land free from all encumbrances and financial resources along with necessary clearances/ permissions etc. in the DPR. No funds shall be provided for the land. (ii) Central financial assistance shall be restricted to a maximum 4 units of fish culture for individual farmer/ beneficiary, 40 units for fisher cooperatives/federations and Entrepreneurs. The project proposals in this category shall be routed through the concerned State /UT Government with proper recommendations. (iii) For Central and State Government organizations/ federations/ corporations/ agencies etc financial assistance and fish culture units shall be decided on case to case basis in consultation with the concerned.
3. Development of Waterlogged Areas				
3.1	Development of Waterlogged Areas	As per actual cost subject to a ceiling of Rs 5.00 lakh/ hectare.	(a) General States: 50% of the unit cost with a ceiling of Rs. 2.50 lakh per ha (b) North-Eastern & Himalayan States : 80% of the unit cost with a ceiling of Rs.4.00 lakh per ha	(i) Beneficiaries shall provide documentary evidence of availability of requisite land free from all encumbrances and financial resources along with necessary clearances/ permissions etc. in the DPR. No funds shall be provided for the land.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
			(c) Central Govt organizations/ agencies/ institutes including ICAR institutes and UTs : 100% on the actual cost with a ceiling of Rs. 5 lakh per ha.	(ii) Central financial assistance shall be restricted to a maximum area of 5 ha for individual beneficiary, 5 ha x number of members for cooperatives/ collectives subject to viability of pond sizes. The project proposals in this category shall be routed through the concerned State/ UT Government with proper recommendations. (iii) For Central and State Government organizations/ federations/ corporations/ agencies etc. financial assistance for quantum of hectarage shall be decided on case to case basis in consultation with the concerned.
3.2	Inputs Cost (unit cost includes cost of fish/ prawn seed, feed, manure, disease prevention measures, transportation charges etc.) ***(one time grant)***	(a) Finfish Culture: As per actual cost subject to a ceiling of Rs. 1.50 lakh/ha (b) Freshwater prawn/ trout culture: As per actual cost subject to a ceiling of Rs. 2.50 lakh/ha	(a) Central assistance for Finfish culture is restricted at (i) 50% of unit cost with a ceiling of Rs. 0.75 lakh/ha for all beneficiaries in General States and (ii) 80% of unit cost with a ceiling of Rs. 1.20 lakh/ha. in North-Eastern Himalayan States. (b) Central assistance for Freshwater prawn/ trout culture is restricted to (i) 50% of the unit cost with a ceiling of Rs. 1.25 lakh/ ha for all beneficiaries in General States and (ii) 80% of the unit cost with a ceiling of Rs. 2.00 lakh/ha. in North-Eastern & Himalayan States. (c) 100% central assistance of input cost restricting to the unit cost (as at col (iii) of this item) to the Central Govt organizations/ agencies/ institutes including ICAR institutes and UTs	(i) Beneficiaries shall be provided central assistance for input costs for the initial crop only in the newly constructed/ renovated ponds/ tanks. (ii) Central assistance for input cost shall be released only after the ponds/ tanks are ready for culture.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
4. Productive Utilization of Inland Saline/Alkaline Waters for Aquaculture				
4.1	Construction of New Ponds/ Tanks.	As per actual cost subject to a ceiling of Rs. 7 lakh per ha.	(a) For General States: 50% of the unit cost with a ceiling of Rs. 3.50 lakh per ha (b) For North-Eastern/ Himalayan States : 80% of the unit cost with a ceiling of Rs. 5.6 lakh per ha. (c) For UTs/ Central Govt. Institutes/ organisations including ICAR institutes : 100% of the unit cost with a ceiling of Rs. 7 lakh per ha.	(i) Beneficiaries shall provide documentary evidence of availability of requisite land free from all encumbrances and financial resources along with necessary clearances/ permissions etc. in the DPR. No funds shall be provided for the land. (ii) The constructed ponds shall have a minimum water depth of 1.5m. (iii) Central financial assistance shall be restricted to a maximum area of 2 ha for individual beneficiary, 2 ha x number of members for cooperatives/ collectives subject to viability of pond sizes. The project proposals in this category shall be routed through the concerned State/ UT Government with proper recommendations. (iv) For Central and State Government organizations/ federations/ corporations/ agencies etc financial assistance for quantum of hectarage shall be decided on case to case basis in consultation with the concerned.
4.2	Input Cost (unit cost includes cost of fish/ prawn seed, feed, manure, disease prevention measures, transportation charges etc.) ***(one time grant)***	(a) Finfish Culture: As per actual cost subject to a ceiling of Rs. 1.50 lakh/ha (b) Freshwater prawn/trout culture: As per actual cost subject to a ceiling of Rs. 2.50 lakh/ha	(a) Central assistance for Finfish culture is restricted at (i) 50% of project/unit cost with a ceiling of Rs. 0.75 lakh/ha for all beneficiaries in general States and (b) 80% of unit cost with a ceiling of Rs. 1.20 lakh/ha. in North-Eastern Himalayan States. (b) Central assistance for Freshwater prawn/ trout culture is restricted to 50% of the unit cost with a ceiling of Rs. 1.25 lakh/ ha for all beneficiaries in general States and (b) 80% of the unit cost with a ceiling of Rs. 2.00 lakh/ha. in North-Eastern & Himalayan States.	(i) Beneficiaries shall be provided central assistance for input costs for the initial crop only in the newly constructed/ renovated ponds/ tanks. (ii) Central assistance for input cost shall be released only after the ponds/ tanks are ready for culture.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
5. Inland Capture Fisheries (Village Ponds, Tanks etc.)				
5.1	Fish Seed Rearing Units.	As per actual subject to a ceiling of Rs. 6.00 lakh/ha	(a) For General States: 50% of the unit cost with a ceiling of Rs. 3.0 lakh per ha. (b) For North-Eastern/ Himalayan States: 80% of the unit cost with a ceiling of Rs. 4.80 lakh per ha. (c) For UTs/ Central Govt. Institutes/ organisations including ICAR institutes: 100% of the unit cost with a ceiling of Rs. 6 lakh per ha.	(i) Beneficiaries shall provide documentary evidence of availability of requisite land free from all encumbrances and financial resources along with necessary clearances/ permissions etc. in the DPR. No funds shall be provided for the land. (ii) Beneficiaries shall also produce the documentary evidence on availability of fishing rights/permissions from the competent authorities to fish and develop required facilities in around the reservoirs/tanks etc. (iii) Central financial assistance shall be restricted to a maximum area of 2 ha for individual beneficiary, 2 ha x number of members for cooperatives/ collectives subject to viability of fish rearing units and their sizes. The project proposals in this category shall be routed through the concerned State/ UT Government with proper recommendations. (iv) For Central and State Government organizations/ federations/ corporations/ agencies etc financial assistance for quantum of hectarage of fish rearing units shall be decided on case to case basis in consultation with the concerned. (v) The fish rearing units should be planned, designed, constructed and managed under the supervision of qualified technical experts.
5.2	Input Cost (unit cost includes cost of fish/prawn seed, feed, manure, disease prevention measures, transportation charges etc.) ***(one time grant)***	(a) Finfish Culture: As per actual cost subject to a ceiling of Rs. 1.50 lakh/ha. (b) Freshwater Prawn/Trout Culture: As per actual cost subject to a ceiling of Rs. 2.50 lakh/ha.	(a) Central assistance for Finfish culture is restricted at (i) 50% of project/unit cost with a ceiling of Rs. 0.75 lakh/ ha for all beneficiaries in General States and (b) 80% of unit cost with a ceiling of Rs.1.20 lakh/ha. in North-Eastern & Himalayan States. (b) Central assistance for Freshwater prawn/ trout culture is restricted to 50% of the unit cost with a ceiling of Rs.1.25 lakh/ ha for all beneficiaries in General States and (b) 80% of the unit cost with a ceiling of Rs. 2.00 lakh/ha. in North-Eastern & Himalayan States.	(i) Beneficiaries shall be provided central assistance for input costs for the initial crop only in the newly constructed fish rearing units. (ii) Central assistance for input cost shall be released only after the fish rearing units tanks are ready for rearing.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
5.3	Craft and Gear (Unit : boats of appropriate sizes including fishing nets, fish & ice holding boxes etc.).	As per actual cost subject to a ceiling of Rs. 1.00 lakh per unit.	(a) For General States: 50% of the unit cost with a ceiling of Rs.0.50 lakh per unit. (b) For North-Eastern/ Himalayan States: 80% of the unit cost with a ceiling of Rs.0.80 lakh per unit. (c) For UTs/ Central Govt. Institutes/ organisations including ICAR Institutes: 100% of the unit cost with a ceiling of Rs. 1 lakh per unit.	(i) Beneficiaries should provide documentary evidence of availability valid fishing license issued by the competent authority. (ii) The project proposals of individual beneficiary (consolidated), cooperatives/ collectives shall be routed through the concerned State/ UT Government with proper recommendations. (iii) Beneficiaries shall also produce the documentary evidence of availability of fishing rights/ permissions in the reservoirs/tanks etc. from the competent authorities. (iv) For Central and State Government organizations/ federations/ corporations/ agencies etc. financial assistance shall be decided on case to case basis in consultation with the concerned. (v) The fishing craft/boats may also be shared by a group of fishers/ collectives. (vi) Beneficiaries shall be abide by the fishing regulations (if any) on use of size & type of boat/ craft and nets etc. (vii) Central assistance shall also be provided for replacement existing boats of more than 5 years old.
5.4	Construction of Landing Centers (landing & berthing platforms, auctioning platform/hall, net mending shed etc.)	As per actual cost subject to a ceiling of Rs. 4.00 lakh per landing center.	(a) For General States: 50% of the unit cost with a ceiling of Rs. 2 lakh per landing center. (b) For North-Eastern/ Himalayan States: 80% of the unit cost with a ceiling of Rs. 3.20 lakh per landing center. (c) For UTs/ Central Govt. Institutes/ organisations including ICAR institutes: 100% of the unit cost with a ceiling of Rs. 4.00 lakh per landing center.	(i) Beneficiaries shall provide documentary evidence of availability of requisite land free from all encumbrances and financial resources, necessary clearances/ permissions etc. with full technical details of the landing centre in the DPR. No funds shall be provided for the land. (ii) The project proposals of cooperatives/ collectives shall be routed through the concerned State/ UT Government with proper recommendations. (iii) For Central and State Government organizations/ federations/ corporations/ agencies etc., financial assistance shall be decided on case to case basis in consultation with the concerned.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
5.5	Riverine Fisheries Conservation and Awareness Programme	As per actual cost subject to a ceiling of Rs. 4.00 lakh per year.	(a) For General States: 50% of the unit cost with a ceiling of Rs. 2 lakh per year. (b) For North-Eastern/ Himalayan States: 80% of the unit cost with a ceiling of Rs. 3.20 lakh per year. (c) For UTs/ Central Govt. Institutes/ organisations including ICAR institutes: 100% of the unit cost with a ceiling of Rs. 4.00 lakh per year.	(i) The States/ UTs shall submit self contained proposal with full justification & technical details for conservation and river ranching etc.
6. Integrated Development of Reservoirs				
6.1	Integrated Development of Reservoirs (the proposal shall include the need based activities from the broad activities as below: pre-culture preparation, strengthening of bunds, de-silting, de-weeding etc., hatcheries, fish rearing units, fish stocking, cage culture, feed mills, boats & nets, landing centers, cold storages, ice plants, fish transport facilities etc.),	As per actual.	(a) For General States: 50% of the unit cost with a ceiling of Rs. 1 crore per project. (b) For North-Eastern/ Himalayan States: 80% of the unit cost with a ceiling of Rs. 1.60 crore per project. (c) For UTs/ Central Govt. Institutes/ organisations including ICAR institutes: 100% of the unit cost with a ceiling of Rs. 2 crore per project.	(i) This component will be implemented by NFDB with commercial approach. (ii) Beneficiaries shall submit self contained Detailed Project Report (DPR) with full justification & technical details etc. (iii) Beneficiaries shall provide documentary evidence of availability of requisite land free from all encumbrances, financial resources, necessary clearances/ permissions & fishing rights etc. in the DPR. No funds shall be provided for the land. (iv) The DPRs shall also contain details of anticipated direct & indirect employment generation, enhancement of fish production and productivity, improvement of economic status of locals, specific time lines for the implementation of the project etc. (iv) The project proposals of cooperatives/ collectives/ omnibus/ entrepreneurs shall be submitted to NFDB. (v) For Central and State Government organizations/ federations/ corporations/ agencies etc., financial assistance shall be decided on case to case basis in consultation with the concerned. (vi) The central funds will be provided as back-ended subsidy.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
7. Establishing Fish Feed Mills/Plants				
7.1	Small Feed Mill Capacity 1 to 5 quintals/day)	As per actual cost subject to a ceiling of Rs. 10 lakh per plant	(a) For General States: 50% of the unit cost with a ceiling of Rs. 5 lakh per unit for small feed mill. (b) For North-Eastern/ Himalayan States: 80% of the unit cost with a ceiling of Rs. 8 lakh per unit for small feed mill. (c) For UTs/ Central Govt. Institutes/ organisations including ICAR institutes: 100% of the unit cost with a ceiling of Rs. 10 lakh per unit for small feed mill.	(i) Beneficiaries shall submit self contained Detailed Project Report (DPR) with full justification & technical details of the plant etc. (ii) Beneficiaries shall provide documentary evidence of availability of requisite land free from all encumbrances, financial resources, necessary clearances/ permissions etc. in the DPR. No funds shall be provided for the land. (iii) Beneficiaries organisations shall ensure supply of fish feed produced from the central funded feed mill plants to farmers at affordable/ reasonable price. (iv) Post construction operation, management and maintenance of the feed mills shall be carried out in a satisfactory manner by the beneficiaries at their own costs. (v) The project proposals of cooperatives/ collectives/ entrepreneurs shall be routed through the concerned State/ UT Government with proper recommendations. (vi) The Central and State Government organizations/ federations/ corporations/ agencies etc., shall submit the proposals directly to DADF and the financial assistance shall be decided on case to case basis in consultation with the concerned. (vii) NFDB shall also directly set up the feed mill plants with commercial approach at suitable location.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
7.2	Large Formulated Pellet Feed Plant (of a minimum capacity @ 6 to 10 tonne/hour or more)	As per actual.	(a) For General States: 50% of the unit cost with a ceiling of Rs. 1 crore per unit for large plant. (b) For North-Eastern/ Himalayan States: 80% of the unit cost with a ceiling of Rs. 1.6 crore per unit for large plant. (c) For UTs/ Central Govt. Institutes/ organisations including ICAR institutes: 100% of the unit cost with a ceiling of Rs.2 crore per unit for large plant.	(i) This component will be implemented by NFDB with commercial approach. (ii) The project proposals of cooperatives/ collectives/ omnibus/ entrepreneurs shall be submitted to NFDB. The central assistance to these agencies will be provided as back-ended subsidy. (iii) Beneficiaries shall submit self contained Detailed Project Report (DPR) with full justification & technical details of the plant etc. (iv) Beneficiaries shall provide documentary evidence of availability of requisite land free from all encumbrances, financial resources, necessary clearances/ permissions etc. in the DPR. No funds shall be provided for the land. (v) Beneficiaries organisations shall ensure supply of fish feed produced from the central funded feed mill plants to farmers at affordable/ reasonable price. (vi) Post construction operation, management and maintenance of the feed mills shall be carried out in a satisfactory manner by the beneficiaries at their own costs. (vii) The Central and State Government organizations/ federations/ corporations/ agencies etc., shall submit the proposals directly to NFDB and the financial assistance shall be decided on case to case basis in consultation with the concerned.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
8. Installation of Cages/Pens in Reservoirs and other Open Water Bodies				
	Cages/Pens with inputs in Reservoirs and other Open Water Bodies (inputs include : cost of fish seed, feed, manure, disease prevention measures, transportation charges, etc.)	Rs. 3.00 lakhs per cage including installation and inputs for first crop)	(a) General States: 50% of the unit cost with a ceiling Rs. 1.50 lakh per cage to State Government, State Agencies/ Organisations, Corporations, Federations, Boards, Fishers Cooperatives. (b) North-Eastern/ Hilly States : 80% of the project/unit cost with a ceiling of Rs. 2.40 lakh per cage to State Government, State Agencies/ Organizations, Cooperatives, Individual beneficiaries etc. (c) For UTs/ Central Govt. Institutes/ organisations including ICAR institutes: 100% of the actual cost with a ceiling of Rs. 3 lakh per cage.	(i) This component will be implemented by NFDB with commercial approach. (ii) The project proposals of cooperatives/ collectives/ omnibus/ entrepreneurs shall be submitted to NFDB. (iii) The applicant shall obtain necessary prior permissions from the concerned State/ UT Government and other Competent Authorities for installation of cages in reservoirs and other water bodies. (iv) Fishermen Cooperative Societies, SC/ST Cooperative Societies, Women Self Help Groups, Registered Entrepreneurs etc. shall be eligible for back ended subsidy for a maximum of 4 batteries of 6 cages each (24 cages) at a particular location. (v) For Central and State Government organizations/ federations/ corporations/ agencies etc., the number of cages & quantum of financial assistance shall be decided on case to case basis in consultation with the concerned. (vi) The unit cost includes capital, operational and maintenance costs on one time basis. (vii) The applicants shall be required to submit self contained project proposals together with documentary evidence of necessary clearances, permissions etc to avail of the assistance.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
9. Re-circulatory Aquaculture Systems (RAS)				
9.1	Low cost Re-circulatory Aquaculture System (RAS)	As per actual cost with a ceiling of Rs. 15.00 lakh per unit	(a) For General States: 50% of the unit cost with a ceiling of Rs.7.50 lakh per unit/plant. (b) For North-Eastern/ Himalayan States: 80% of the unit cost with a ceiling of Rs. 12 lakh per unit/plant. (c) For UTs/ Central Govt. Institutes/ organisations including ICAR institutes: 100% of the unit cost with a ceiling of Rs. 15 lakh per unit/plant.	(i) Beneficiaries shall submit self contained Detailed Project Report (DPR) with full justification & technical details etc. (ii) Beneficiaries shall provide documentary evidence of availability of requisite land free from all encumbrances, financial resources, necessary clearances/ permissions etc. in the DPR. No funds shall be provided for the land. (iii) DPRs shall also contain details of anticipated direct & indirect employment generation to local populations, enhancement of fish production, specific time lines for the implementation of the project etc. (iv) Project proposals of cooperatives/ collectives/ omnibus/ entrepreneurs shall be submitted to NFDB. The central assistance to these beneficiaries will be provided as back-ended subsidy. (v) For Central and State Government organizations/ federations/ corporations/ agencies etc., quantum of financial assistance shall be decided on case to case basis in consultation with the concerned. (vi) Post construction operation, management and maintenance of the RAS shall be carried out in a satisfactory manner by the beneficiaries at their own costs. (vii) NFDB shall also set up manage the RAS with commercial approach at suitable location. (viii) Infra structure created should have essential requirements for RAS including water treatment units. (ix) The proposed RAS should have a minimum production capacity of 2 MT in each tank of size 5x5x4 m cement tanks.
10. Stocking of Fish Fingerlings in Beels / Wetland				
	Stocking of IMC Fingerlings In Wetlands (*Beels, Chaurs,* etc.) @ 2000 Nos per hectare.	As per actual with a ceiling of Rs.2.50/ Fingerling.	(a) For General States: 50% of the unit cost with a ceiling of Rs. 1.25 per fingerling. (b) For North-Eastern/ Himalayan States: 80% of the unit cost with a ceiling of Rs. 2/ per fingerling.	(i) Beneficiaries shall provide documentary evidence of availability of requisite wetland/ (beels, jeels, chaurs etc.) free from all encumbrances and financial resources along with necessary clearances/ permissions etc. in the DPR. No funds shall be provided for the land. (ii) Central financial assistance shall be restricted to a maximum area of 2 ha for individual beneficiary, 2 ha x number of members for cooperatives/ collectives. The project proposals in this category shall be routed through the concerned State/ UT Government with proper recommendations.

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
			(c) For UTs/ Central Govt. Institutes/ organisations including ICAR institutes: 100% of the unit cost with a ceiling of Rs. 2.50 per fingerling.	(iii) For Central and State Government organizations/ federations/ corporations/ agencies etc. financial assistance for quantum of hectarage shall be decided on case to case basis in consultation with the concerned applicant.
11. Creation of Portal For Advisory Services to Farmers on Mobile and Internet				
11.1	Creation of Portal for Extending Advisory Services to Fish Farmers, through Mobile appliances/applications, Internet (IEC), e-commerce platform for suppliers, traders for end-to-end services to farmers, suppliers, trades and all need based services in fisheries.	As per actual.	100% of the actual cost of the project/ component.	(i) This activity/component shall be carried out through the central Government Institutions/ agencies/ corporations such as NIC, NICSI, Central Public Sector Undertakings (CPSUs), Fisheries Institutes including ICAR Institutes etc. (ii) A dedicated portal for fisheries shall be created to extending of advisories, dissemination of information, networking fish markets and fish landing centres, compilation of various fishers related database, e-commerce platform for suppliers, Traders for end-to-end services to farmers, suppliers, trades and all need based services in fisheries etc. (iii) The agencies shall submit self contained proposals with technical and financial details etc.
12. Training, Skill Development and Capacity Building to Fish Farmers and other Stakeholders in all Fisheries Related Activities both Marine and Inland Fisheries.				
12.1	Dearness Allowance (DA)	Rs. 500/ trainee/day	100% of the actual cost of the training programme.	(i) Training, skill development & capacity building programmes for fish farmers & fishers and other stakeholders shall be carried through State Governments, UTs, Central Government Organizations/ Institutions such as KVKs, ICAR Institutes, ATMAs, ATARIs, Fisheries Institutes, State/ UT owned organizations, State agriculture/ veterinary/ fishery Universities, fisheries federations, corporations etc. (ii) The training batch shall not be less than 50 (fifty) trainees per batch.
12.2	Travelling Allowance	Actual to and Fro fare of restricting to 2nd Class Railway fare		
12.3	Accommodation	As per actual with a ceiling of Rs. 600/- per trainee per day.		
12.4	Distribution of training materials (Rs. 200/- per trainee per programme	As per actual with a ceiling of Rs. 10,000/- per training programme for a batch of minimum 50 trainees.		

Sl No	Component	Unit Cost	Central Financial Assistance	Terms and Conditions
12.5	Food, tea snacks, Refreshment to participants/ trainees during training classes etc: (Rs. 300/- per trainee per day)	As per actual with a ceiling of Rs. 15,000/ per day for a batch of minimum 50 trainees		(iii) Training organization shall submit self contained proposal indicating, details of trainees, training courses, venue, infrastructure facilities available for the purpose, duration of the training programme, availability of boarding and lodging facilities, details of resource persons, anticipated outputs etc.
12.6	Demonstration/ Local field visit (Rs. 200 per training per programme)	As per actual with a ceiling of Rs. 10,000/- per training programme of a batch of minimum 50 trainees.		(iv) Preferably, the trainees shall be identified by the respective State Governments/UTs. The Central Government shall also identify the trainees in consultation (if need be) with the concerned State Governments/ UT.
12.7	Stationeries and other unforeseen items (Rs. 100/- per trainee per training programme)	As per actual with a ceiling of Rs. 5000/- per training programme of a batch of minimum 50 trainees.		

CAREER IN THE FIELD OF HORTICULTURE

Liberty Hyde Bailey
American scholars of horticulture

"Horticulture is the growing of flowers, fruits and vegetables, and of plants for ornament and fancy." Simply put, horticulture is the art and science of plant production for both beauty and utility. We work with fruits, vegetables, ornamental plants, and turfgrass, in a variety of labs, fields, golf courses, and garden centers. Rather than staple crops, horticulture focuses on fruit, vegetables, flowers, and landscape plants. As a result, we use creativity to seek sustainable solutions in horticultural research to enhance health and quality of life for the world at large.

Students in the plant science and food systems majors study horticultural science to be challenged intellectually, to work in a job they love, and to make a difference in the quality of life for countless others. Horticulture affects everyone. As a result, the skills you'll learn here will help you to positively impact the world around you.

Careers in Horticulture

Earning a degree related to horticultural science will prepare you for a variety of careers. Whether you want to work in a lab, a field, a floral shop, at an arboretum, at a botanical garden, on the golf course, or something completely different, the possibilities are endless. Both plant science and food systems majors begin their career experiences early with a required internship and are notified of many other internships and part-time jobs throughout the year.

Some job titles in horticulture include:

- Arboretum Director/Associate
- Botanical Gardens Manager/ Grounds Associate
- Business Owner
- Community Garden Planner
- Entrepreneur
- Extension Educator
- Floral Designer
- Geneticist
- Greenhouse Manager
- Garden Manager
- Garden Center Operations, Sales, Maintenance, Landscaping
- Golf Course Superintendent
- Horticulturist
- Horticulture Therapist
- Horticulture Marketing/Sales Manager
- Landscape Design
- Lawn Maintenance Foreman/ Technician
- Plant Biologist
- Plant Breeder
- Produce Retail Team Member
- Professor
- Research Scientist
- Urban Garden Manager

Operational guidelines on Mission for Integrated Development of Horticulture During XII Plan

1. INTRODUCTION

1.1 Mission for Integrated Development of Horticulture (MIDH) is a Centrally Sponsored Scheme for the holistic growth of the horticulture sector covering fruits, vegetables, root & tuber crops, mushrooms, spices, flowers, aromatic plants, coconut, cashew, cocoa and bamboo. While Government of India (GOI) contributes 85% of total outlay for developmental programmes in all the states except the states in North East and Himalayas, 15% share is contributed by State Governments. In the case of North Eastern States and Himalayan States, GOI contribution is 100%. Similarly, for development of bamboo and programmes of National Horticulture Board (NHB), Coconut Development Board (CDB), Central Institute for Horticulture (CIH), Nagaland and the National Level Agencies (NLA), GOI contribution will be 100%. Guidelines regarding implementation of the scheme are described hereunder.

1.2 MIDH will have the following sub-schemes and area of operation:

Sl. No.	Sub Scheme	Target group / area of operation
1.	NHM	All states & UTs except states in NE and Himalayan Region.
2.	HMNEH	All states in NE and Himalayan Region.
3.	NBM	All states & UTs
4.	NHB	All states & UTs focusing on commercial horticulture
5.	CDB	All States and UTs where coconut is grown.
6.	CIH	NE states, focusing on HRD and capacity building.

1.3 MIDH will work closely with National Mission on Sustainable Agriculture (NMSA) to wards development of Micro-Irrigation for all horticulture crops and protected cultivation on farmers' field.

1.4 MIDH will also provide technical advice and administrative support to State Governments/ State Horticulture Missions (SHMs) for the Saffron Mission and other horticulture related activities like Vegetable Initiative for Urban Clusters (VIUC), funded by RashtriyaKrishiVikasYojana (RKVY)/NMSA.

2. MISSION OBJECTIVES

2.1 Main objectives of the Mission are:

a) Promote holistic growth of horticulture sector, including bamboo and coconut through area based regionally differentiated strategies, which includes research, technology promotion, extension, post harvest management, processing and marketing, in consonance with comparative advantage of each State/ region and its diverse agro-climatic features;

b) Encourage aggregation of farmers into farmer groups like FIGs/FPOs and FPCs to bring economy of scale and scope.

c) Enhance horticulture production, augment farmers, income and strengthen nutritional security;

d) Improve productivity by way of quality germplasm, planting material and water use efficiency through Micro Irrigation.

e) Support skill development and create employment generation opportunities for rural youth in horticulture and post-harvest management, especially in the cold chain sector.

3. STRATEGY

3.1 To achieve above objectives, the mission will adopt the following strategies:

a) Adopt an end-to-end holistic approach covering pre-production, production, post-harvest management, processing and marketing to assure appropriate returns to growers/producers;

b) Promote R&D technologies for cultivation, production, post-harvest management and processing with special focus on cold chain infrastructure for extending the shelf life of perishables;

c) Improve productivity by way of quality through:

   a. Diversification, from traditional crops to plantations, orchards, vineyards, flowers, vegetable gardens and bamboo plantations.

   b. Extension of appropriate technology to farmers for high-tech horticulture including protected cultivation and precision farming.

   c. Increase of acreage of orchards and plantation crops including bamboo and coconut, particularly in states where total area under horticulture is less than 50% of agricultural area.

d) Improve post-harvest management, processing for value addition and marketing infrastructure.

e) Adopt a coordinated approach and promote partnership, convergence and synergy among R&D, processing and marketing agencies in public as well as private sectors, at the national, regional, state and sub-state levels;

f) Promote FPOs and their tie up with Market Aggregators (MAs) and Financial Institutions (FIs) to support and adequate returns to farmers.

g) Support capacity-building and Human Resource Development at all levels, including, change in syllabus and curriculum of graduation courses at Colleges, Universities, ITIs, Polytechnics, as appropriate.

4 HORTICULTURE MECHANIZATION

Horticulture mechanization is aimed to improve farm efficiency and reduce drudgery of farm work force. Assistance in this regard will be provided for activities such as procurement of power operated machines&tools, besides import of new machines (Annexure V). Assistance for horticulture mechanization will also be available to such grower associations, farmer groups, Self Help Groups, women farmer groups having at least 10 members, who are engaged in cultivation of horticultural crops, provided balance 60% of the cost of machines and tools is borne by such groups.

5 TECHNOLOGY DISSEMINATION THROUGH DEMONSTRATIONS/ FRONT LINE DEMONSTRATION

Latest technologies will be promoted on crop specific cultivation, use of IPM/INM, protected cultivation, organic farming through farmer participatory demonstration in a compact area of one ha, which will be organized at strategic locations in farmer's field for which assistance will be limited to 75% of cost. For green house cultivation, area will be limited to 500 sq. meter. Farms in public sector, SAUs, Deemed Universities having faculty in horticulture, could be sites for Front Line Demonstrations, for which 100% assistance will be provided, and maximum assistance will not exceed Rs. 25 lakh per project.

6 INTEGRATED POST HARVEST MANAGEMENT

Under post - harvest management, including that for Medicinal plants, activities like handling, grading, pre- conditioning, packaging, transient storage, transportation, distribution, curing and ripening and where possible long term storage can be taken up. Existing schemes of the

Directorate of Marketing and Inspection (DMI) and National Cooperative Development Corporation (NCDC) will be leveraged to the extent possible. MIDH would include projects relating to establishment of pre-cooling units, 'on-farm' pack houses, mobile pre-cooling units, staging cold rooms, cold storage units with and without controlled atmosphere capability, integrated cold chain system, supply of refrigerated vans, refrigerated containers, primary/mobile processing units, ripening chambers, evaporative/low energy cool chambers, preservation units, onion storage units and zero energy cool chambers. These projects will be entrepreneur driven and provided credit linked back-ended subsidy. PSUs/ Government agencies / Cooperatives / growers' association recognized/ registered by the DMCs, having at least 25 members, will also be entitled to avail assistance for such activities. They may avail back ended subsidy without credit link, subject to condition that they are able to meet their share of the project cost.

7 COLD CHAIN INFRASTRUCTURE

Assistance for setting up of new cold storage infrastructure will be available only to multi-chamber cold storage units with technologies which are energy efficient with provision for thermal insulation, humidity control, advanced cooling systems, automation, etc., having specifications and standards approved by the Ministry. While Cold storages (Long term storage and distribution hubs) upto 5000 MT capacity will be promoted under NHM/ HMNEH sub - schemes (Annexure V), capacity above 5000 MT upto 10000 MT will be promoted under NHB sub-scheme (Annexure VII). In this context, for cold storages, 3.4 cubic metres (cum.) (120 cubic feet (cft.) of chamber volume shall be considered equivalent to one MT of storage capacity. Similarly, for refrigerated transport, 3 cum (106 cft) of chamber volume shall be equivalent to one MT of storage capacity and for ripening chambers, 11 cum of chamber volume shall be equivalent to one MT of storage capacity. Assistance for pre cooling unit will be linked to pack-houses and cold rooms (staging). Similarly assistance for staging cold room will be linked to existing & new pre-coolers.

Extant specifications standards and protocols on cold storage and cold-chain components will be adhered to while approving cold storage projects. Revisions to technical standards and adherence protocols shall be updated by National Centre for Cold-chain Development (NCCD) as necessary when improved technologies and efficiencies are introduced/understood/ approved.

Assistance can also be availed for a combination of PHM infrastructure components by a beneficiary, within the prescribed norms of individual items. Assistance will be available to individuals, Group of farmers/ growers/ consumers, Partnership/ Proprietary firms, Self Help Groups (SHGs), Farmers Producer Organization (FPOs), Companies, Corporations, Cooperatives, Cooperative Marketing Federations, Local bodies, Agricultural Produce Market Committees (APMC) & Marketing Boards and State Governments.

8 ROLE OF NATIONAL LEVEL AGENCIES

8.1. National Horticulture Board (NHB), Gurgaon

NHB will implement programmes as sub-scheme of MIDH. NHB will also house the national level TSG besides the TSG for NHM and NBM and extend administrative, logistical and personnel support towards the implementation of NHM and NBM. Details about NHB are available on its web site (www. nhb. gov.in).

8.2. Coconut Development Board, Kochi

CDB will implement programmes as sub-scheme of MIDH. It will also house the TSG for coconut related programme. Details about CDB are available on its web

site (www.coconutboard.nic.in).

8.3. Small Farmer's Agri-Business Consortium (SFAC), New Delhi

Small Farmers Agri-business Consortium (SFAC) (www.sfacindia.com) will provide necessary handholding with regard to the NE and Himalayan States. It will be lead agency for the formation of of Farmers' Associations/ Groups and their tie-up with financial institutions and market aggregators. It will also house the TSG for HMNEH, CIH and VIUC schemes.

8.4. Directorate of Cashew and Cocoa Development (DCCD), Kochi

DCCD (www.dccd.gov.in) will be responsible for implementing, coordinating and monitoring activities relating to plantation crops, excluding coconut and arecanut and will also be responsible for organizing National level training programmes, seminars & workshops on cashew and cocoa on regular intervals.

8.5. Directorate of Arecanut and Spices Development (DASD), Calicut

DASD will be responsible for implementing, coordinating and monitoring the activities on development of arecanut, spices, and aromatic plants and will be responsible for organizing National level training programmes, seminars and workshops on Arecanut, spices and medicinal & aromatic plants on regular intervals.

8.6. National Committee on Plasticulture Applications in Agriculture & Horticulture (NCPAAH), New Delhi

NCPAH (www.ncpahindia.com) will be responsible for coordinating and monitoring activities relating to micro irrigation, precision farming and hi-tech horticulture implemented through SHMs and Precision Farming Development Centres (PFDCs).

8.7. National Horticulture Research & Development Foundation, Nashik

National Horticulture Research & Development Foundation (NHRDF), Nashik (www.nhrdf.com) will be responsible for implementing programmes relating to development of vegetables including production and supply of quality seeds.

8.8. National Bee Board (NBB)

National Bee Board (NBB) (www.nbb.gov.in) will be responsible for providing technical support as well as implementation of promotional programmes relating to beekeeping (Annexure V).

8.9. National Seeds Corporation, New Delhi

National Seeds Corporation (NSC) (www.indiaseeds.com) will be responsible for taking up programmes for production and supply of good quality seed and planting material.

8.10. National Research Centre for Citrus, Nagpur

National Research Centre for Citrus (NRCC), Nagpur (www.nrccitrus.nic.in) will be implementing the mission mode programme on Technology Mission on Citrus.

8.11. State Farm Corporation of India, New Delhi

State Farms Corporation of India (SFCI), New Delhi will be responsible for development and supply of good quality seed and planting material.

8.12. Hindustan Insecticides Ltd. (HIL)

HIL (www.hil.gov.in) will be responsible for production and supply of good quality vegetable seeds.

8.13. National Institute for Agricultural Extension Management (MANAGE), Hyderabad

MANAGE (www.manage.gov.in) will be responsible for taking up HRD related programme for training field functionaries under NHM and HMNEH.

8.14. Fresh & Healthy Enterprises Ltd. (FHEL), New Delhi

FHEL (www.fhel.co.in) will be responsible for carrying out feasibility studies and preparing DPRs for integrated cold chain for horticulture commodities, involving long distance haulage by Railways

8.15. Agricultural and Processed Food Products Export Development Authority (APEDA), New Delhi

APEDA, (www.apeda.gov.in) Ministry of Commerce will be involved in promoting coordinated development of Agri-Export Zones (AEZ) for horticultural crops and coordinate with MIDH, for promoting export of horticulture crops.

8.16. Directorate of Marketing & Inspection (DMI), New Delhi

DMI will be responsible for providing market intelligence and monitoring of programmes relating to marketing of horticulture crops (www.agmarknet.nic.in).

8.17. Ministry of Food Processing Industries (MFPI), New Delhi

MFPI (www.mofpi.nic.in) will extend its support to establishment of Food Processing units in clusters promoted in MIDH and offer its technical support and assistance, especially in HMNEH areas.

8.18. National Medicinal Plants Board (NMPB), New Delhi

NMPB (www.nmpb.nic.in) would implement its scheme relating to development of medicinal plants in coordination with MIDH.

8.19. Central Institute of Horticulture (CIH), Nagaland

CIH will be responsible for coordinating the activities of technology generation, transfer and dissemination of improved production technologies available in North Eastern Region.

8.20. National Centre for Cold Chain Development (NCCD)

NCCD (http://nccd.gov.in) will guide policy and set standards for development of integrated cold chain in the country, for perishable fruits, vegetables and other allied agricultural commodities to link with markets and also work in close collaboration with industry and other stake holders.

8.21 National Institute of Food Technology Entrepreneurship and Management (NIFTEM), Sonipat, Haryana

NIFTEM (www.niftem.ac.in) will assist in setting up food standards, businesses incubation including knowledge sharing in the field of food technology and management, networking and coordinating with other institutions in the field.

Activity mapping for effective devolution of funds, functions and functionaries under Mission for Integrated Development of Horticulture (MIDH)

A. MIDH FUNDS

S.No.	Scheme sub-component/ funding stream	Allocation (Rs. Cr.)	Percent Allocation based on function (s)						Remarks
			Centre	State	Local government			User group/ civil society	
					District Panchayat	Intermediate Panchayat	Village Panchayat		
1.	NHM	As per annual budget	85	15	0.50-1.00		0.50-1.00		For community tanks, capacity building through HRD, FPO formation.
2.	HMNEH		100	-					
3.	NBM		100	-					
4.	NHB		100	-					Since projects will be implemented by the beneficiaries directly without routing funds through State Government, participation of local government will be to a limited extent in respect of these 3 sub schemes.
5.	CDB		100	-					
6.	CIH		100	-					

B. MIDH FUNCTIONS

S. No.	ACTIVITY DESCRIPTION Activity Category	Union Government	State Government	District Planning Committee	LOCAL GOVERNMENT AND PLANNING BODIES Panchayati Raj System			User Groups. SHGs. etc.
					District Panchayat	Intermediate Panchayat	Village Panchayat	
1.	Setting Standards	Formulate guidelines and cost norms for implementation of MIDH scheme	Disseminate guidelines and norms at District level, preferably in local language	Disseminate guidelines of MIDH.	Disseminate guidelines at block level and below.			
2.	Planning	Provide framework for preparing State Horticulture Mission Document (SHMD) and Annual Action Plan.	1. Prepare strategic plan. 2. Prepare State Horticulture Mission Document. 3. Prepare State Annual Action Plans (AAP)	Formulate District Horticulture Mission Document (DHMD) and District Annual Action Plan (DAAP) Contribute in preparing DHMD and DAAP.	Contribute in selection of crop and activities			
3.	Implementation of sub schemes and components. Planting material, production & productivity improvement programmers, HRD, infrastructure for PHM and Marketing formation of FPO etc.	Release of funds to States/ Agencies by DAC.	Release of funds to District level and State level implementing Agencies.	Prioritize projects as per requirement of district	Select location of activity within the district, select beneficiaries, implement specific projects		Contribute in selection of beneficiaries and implement specific projects, as allocated	Maintain assets created
4.	Monitoring & Evaluation of Projects	1. Review monthly progress through web enabled progress monitoring system. 2. Conduct midterm end Impact Evaluation	1. Furnish monthly progress through web. 2. Conduct concurrent evaluation		1. Review progress at panchayat level on specific activities. 2. Provide feed-back to State Government.		Provide feed back on progress to District Panchayat	

COST NORMS AND PATTERN OF ASSISTANCE UDNER MIDH FOR NATIONAL HORTICULTURE BOARD RELATED ACTIVITIES DURING XII PLAN

S.No.	Item	Cost Norms*	Pattern of Assistance#
A.	DEVELOPMENT OF COMMERCIAL HORTICULTURE##		
A. 1	Commercial Horticulture Development in open field conditions, including components viz planting material, plantation, irrigation, fertigation, precision farming, GAP etc.	Rs. 75.00 lakh /per project (Rs 125.00 lakh for date palm, olive and saffron) for projects covering area over 2 ha.	Credit linked back ended subsidy @ 40% of project cost limited to Rs.30.00 lakh per project in general area and @ 50% of project cost limited to Rs. 37.50 lakh for NE and Hilly and scheduled areas.
A. 2	Commercial Horticulture Development in protected cover.	Rs 112.00 lakh per project covering area above 2500 Sq.mt.	Credit linked back-ended subsidy @ 50% of cost limited to Rs.56.00 lakh per project.
A. 3	Integrated Post Harvest Management Projects e.g. Pack House, Ripening Chamber, Refer Van, Retail Outlets, Pre-cooling units, Primary processing, etc.	Rs. 145.00 lakh per project. The add-on components of pre-cooling, pack house, grading, packing, cold room can be taken up as individual components.	Credit linked back ended subsidy @ 35% of cost limited to Rs.50.75 lakh per project in general areas and @ 50% of project cost limited to Rs. 72.50 lakh per project in NE, Hilly and scheduled Areas, ensuring backward and forward linkage. For standalone projects, NHM norms will be adopted.
B.	CAPITAL INVESTMENT SUBSIDY SCHEME FOR CONSTRUCTION/ EXPANSION/ MODERNIZATION OF COLD STORAGE AND STORAGES FOR HORTICULTURE PRODUCTS		
B. 1	Cold storage units Type 1 - basic mezzanine structure with large chamber (of >250 MT) type with single temperature zone	NHB to take up projects with Capacity above 5000MT upto 10000MT as per following rates. · Rs. 7600/ MT for capacity between 5001 to 6500 MT. · Rs. 7200/MT for capacity between 6501 to 8000 MT. · Rs. 6800/MT for capacity between 8001 to 10000 MT.	Credit linked back-ended subsidy @ 35% of the cost of project (50% in NE, Hilly Areas and scheduled areas) **for capacity above 5000 MT.**
B. 2	Cold Storage Unit Type 2 – PEB structure for multiple temperature and product use, more than 6 chambers (of < 250 MT) and basic material handling equipment.	NHB to take up projects with Capacity above 5000 MT upto 10000 MT as per following rates. · Rs. 9500/ MT for capacity between 5001 to 6500 MT. · Rs. 9000/MT for capacity between 6501 to 8000 MT. · Rs. 8500/MT for capacity between 8001 to 10000 MT.	Credit linked back-ended subsidy @ 35% of the cost of project (50% in NE, Hilly Areas and scheduled areas) **for capacity above 5000 MT.**

B. 3	Cold Storage Units Type 2 with add on technology for Controlled Atmosphere	NHB to take up projects with Capacity above 5000MT upto 10000MT as per following rates. Additional Rs. 10,000/MT for add on components of Controlled Atmosphere technology. **(Appendix II)**	Credit linked back-ended subsidy @ 35% of the cost of project (50% in NE, Hilly Areas and scheduled areas) **for capacity above 5000 MT.**
B. 4	Technology induction and modernisation of cold-chain	Max Rs.500.00 lakh. (Details in **Appendix II**)	Credit linked back-ended subsidy @ 35% of the cost of project (50% in NE, Hilly Areas and scheduled areas) **for capacity above 5000 MT.**
B. 5	Refrigerated Transport vehicles	Rs. 30.00 lakh for 15 MT, and prorata basis for capacities between 9 to 15 MT.	Credit linked back-ended subsidy @ 35% of cost (50% in NE, Hilly Areas and scheduled areas)
C.	TECHNOLOGY DEVELOPMENT AND TRANSFER FOR PROMOTION OF HORTICULTURE		
C 1.	Setting up of block / mother plant and root stock nursery (Area above 4 ha)	Rs. 100.00 Lakh / ha including virus indexing, tissue culture lab etc	Project based – 100% and only through govt. agencyThe component includes mother block of scion and root stock, infrastructure for production of disease free planting material, creation of poly house, green house, net house, screen house, mist chamber, hot beds sterilization of media, working shed, tissue culture lab, referred lab, virus indexing facility, quality control lab, weather station, water supply, irrigation facility, fertigation unit, electric supply with generator, ETP, farm equipment/farm mechanization, tools, portrays, root trainer, container, computer system for data management and analysis etc.
C. 2	Acquisition of technologies including import of planting material from other countries for evaluation and mass multiplication in order to increase production & productivity of horticulture crops	Rs. 50.00 lakh/project	Project based – 100% and only through govt. agency
C. 3	Import/procurement of machines and Tools for horticulture for demonstration purpose (Public sector)	Rs. 50.00 lakh/ machine	100% of total cost and only through govt. agency
C. 4	Development & Transfer of Technology	Rs. 25.00 lakh/ project	100% of total cost and only through govt. agency
C. 5	Long Distance Transport Solution	Project Based	Rs. 2000.00 lakh
C. 6	Product Promotion and Market Development Services- Horti-fairs	Rs. 25.00 lakh	100% of cost by Central Nodal Agency
C. 7	Exposure visit of farmers (Outside State)	Project based as per actual	100% of the cost.
C. 8	Visit Abroad for Government Officers	Rs. 6.00 lakh per participant	100% of air / rail travel and course fee
C. 9	Organisation/Participation in Seminar/ symposia/ workshop for development of horticulture	Rs 10.00 lakh for international event/ Rs 5.00 lakh for national event/ Rs 3.00 lakh for state level event and Rs 0.50 lakh/- for District level event	50% of cost, on actual basis for Pvt. Agencies and 100% for NHB's own events.

OPPORTUNITIES IN THE FISHERIES AND AQUACULTURE SECTOR

Dr. Arun S. Ninawe

Fisheries is an important vibrant sector witnessed as the primary source of protein for millions of the people. Its contributing to the national GDP is around 1.4% and 4.5% GDP contribution to the agriculture sector as a whole. In broad terms it involves capture including inland and sea, aquaculture, gears, navigation, oceanography, aquarium management, fish breeding, processing, export and import of seafood, special products and by-products, research and related activities. India is the fourth largest producer of fish in the world and the second largest producer of inland fish. India's long coastline with rich biodiversity offers great scope for aqua-farming of fish, crustaceans and aquatic plants for recreation or consumption. The sector is considered to be equally important due to the dependence of large section of poor fisherman community as a main source of income generating livelihood source. This has been a highly potential sector to offer huge opportunity exists for the development of fisheries through aquaculture and mariculture farming practices.

During the last six decades the sector has been strengthened with the much needed technical manpower and competent extension personnel with effective transfer of technology. Research and Development has helped the sector in addressing productive issues level and the availability of critical inputs for culture like fish seed, high productive breed and medicine by involving Aquaculturist, farm managers, exporters, traders, breeders and modern fishermen. Being highly remunerative sector it has been considered as a major source of employment generation and career avenues in various branches of fisheries and aquatic sciences.

Eligibility for Entry in Fisheries Science:

To get the entry in fisheries discipline, individuals desirous to become a fisheries graduate has to pass 4 year degree from Fisheries Colleges of State Agricultural Universities. For admission in B. F. Sc (Bachelor of Fisheries Science) course he /she can apply after 10 (+) 2 having PCB group. Admission is given as per merit score of candidates and the availability of seats. Special quota for outside state candidates is allowed to the candidates who have passed entrance exam of ICAR and are gettingfellowship too. Special reserved seats are there for Jammu & Kashmir, Mizoram, Arunachal Pradesh and Nagaland. B. F. Sc involves courses such as inland aquaculture, freshwater aquaculture, mariculture, industrial fisheries, fish processing and post harvest technology, fish nutrition, pathology, environment, ecology and extension. The syllabus contains practical experience like opportunities to work on sea cruise on fishing vessels and for data collection and fishing in processing plants.On-farm studies under Rural Agriculture Work Experience (RAWE) helps students to gain practical learning on aqua farms, hatcheries, fish processing units, value addition, resource management etc. through educational programme of ICAR.

Higher Education:

After completion of B.F.Sc, candidates can opt for M.F.Sc (Master of Fisheries Science) for taking admission in Central Institutes in India through all India level Common Entrance Test conducted by ICAR. There are eight fisheries institutes under the ICAR set up in India mainly CIFE, CIBA, CIFA, CMFRI, CIFT, CIFRI, NBFGR and DCFR. These institutes are engaged in capture, culture, value addition processing, repository, conservation and bio-diversity addressing educational and legal issues in addition to their mandate of research programme. Students can avail opportunities for masters and specialized education upto the doctoral level in these institutes. In addition there are about 18 fisheries colleges under the independent Veterinary and Animal Science University and also State Agriculture Universities offering B.F.Sc and M.F.Sc courses. Based on the availability of the infrastructure and State of Art Facility, fishery colleges are also offering doctoral programmes under their setup. Master's and

Doctor of Philosophy (Ph.D.) programs in aquaculture and fisheries are available through several schools. Students can choose programmes that fit with their research interests in subject areas viz. fish nutrition, water quality, aquaculture engineering, fish genetics, hatchery production and fish pathology. Most master's programs require a thesis, while Ph.D. students are typically required to complete a dissertation. There are research activities in the areas like culture and breeding of fish, integrated fish- livestock farming, fish health management and nutrition, development of post harvest and processing including intensive fish farming and environment management.

Farm Based/ Skilled Based Training:

Krishi Vigyan Kendras under ICAR conducts trainers training in collaboration with their institutes and offering fisheries as a vocational course at 10(+2) level with active assistance from NCERT. Coastal States have fisheries schools at fishermen's dominating villages conducts regular programme on skill development among the fisherman. Training programmes are also offered on Deep Sea Fishing and Navigation by Central Institute of Fisheries Nautical & Engineering Training (CIFNET). The short term duration training in Scuba diving are conducted by various private agencies in India which supports employment generation in the deep sea fishing and resource utilization, mapping and assessment.

Job opportunities

Career for fisheries and aquaculture graduates are available with a variety of employers, including state and central government agencies, academic institutions and fish farms. Government agencies and industry organizations recruit positions like aquaculture farmer, shellfish culturist, hatchery technician, biological science technician, fish research assistant etc. Many career options exist in this field in both public and private sectors in aquaculture to sea farming of fish, shellfish and marine organisms. Entry-level aquaculture jobs require either a high school diploma or an undergraduate degree in aquaculture and fisheries, but more advanced positions require a master's or doctorate degree.

In State Governments, job opportunities exist in fisheries department for fisheries graduate for the post of Assistant Fisheries Development Officer (AFDO)/ Fisheries Extension Officer (FEO) and District Fisheries Development Officer. Career opportunities also exist for high school diploma holders in aquaculture farming. However, an increasing number of employers in this industry prefer job candidates with some post secondary education. Certain aquaculture careers even require a graduate-level education and higher degree programs for research and teaching at many colleges and universities.

In foreign countries associate's and bachelor's degrees in fisheries or aquaculture provide the skills and knowledge needed to pursue a variety of aquaculture careers. Students in 2-year programs can typically pursue an Associate of Applied Science degree to enter the job market upon graduation and can earn an Associate of Science to transfer into a 4 year academic programme. Apart from scope for higher education in fisheries in countries such as USA, Canada, Australia, Japan, China and European countries, there are demands for fisheries professionals in the aquaculture and processing sectors in Gulf and African countries also. There are number of fisheries graduates doing business in foreign countries in field of aquaculture, export & import.

The fisheries graduates and higher qualified personnel gets good job opportunities with attractive salary

and perks. They are appointed as Assistant Director, Research Assistant and Fisheries Inspector etc. in government establishments. The government sectors offer a pay which is less compared to the private sector, but is stable. In private sector, a post graduate in fisheries sciences has lots of opportunities to work as Quality Control Officer, Fish Processor, Aquaculturist, Farm Assistant/ Manager etc. The pay varies according to the type of job and specialization of the candidate.

National/ State Fishery Institutes:

1. Central Institute of Fisheries Education, Versova, Mumbai, www.cife.edu.in
2. Central Institute of Brackishwater Aquaculture, Chennai,www.ciba.res.in
3. National Bureau of Fish Genetic Resources, Lucknow, www.nbfgr.res.in
4. Central Institute of Fisheries Nautical and Engineering Training, Kochi,www.cifnet.nic.in
5. Tamilnadu Fisheries University, Nagapattinam, TN,www.tnfu.org.in
6. Indian Institute of Technology, Kharagpur, W.B,www.iitkgp.ac.in
7. Andhra University, Telibagh, Waltair, A. P, www.andhrauniversity.edu.in
8. Goa University, Goa,www.unigoa.ac.in

Fisheries Colleges under State Agricultural/ Veterinary Universities:

1. College of Fisheries, Shirgaon, Ratnagiri, www.dbskkv.org
2. College of Fishery Science, Telangkhedi, Nagpur, M. S, http://cofsngp.org
3. College of Fisheries, Mangalore, Karnataka, www.kvafsu.kar.nic.in
4. College of Fisheries Science, Pantnagar, UP, gbpuat.ac.in / acads/cfsc/index.html
5. Punjab Agriculture University, Ludhiana, www.pau.edu
6. Institute of Fisheries Technology, Thiruvallur, Chennai,http://iftponneri-tnfu.org/index.php
7. College of Fisheries Science, Kulia, WB, www.wbuafscl.ac.in
8. College of Fisheries, Veraval, Gujarat, http://www.gsauca.in/

NATIONAL FISHERIES DEVELOPMENT BOARD

Guidelines for Mariculture

1.0 Introduction

World aquaculture production (food fish and aquatic plants) has grown significantly during the past half-a-century. FAO statistics shows that from a production of about 1 million tonnes in the early 1950s, the world aquaculture production in 2004 was reported to have risen to 59.4 million tonnes, with a value of US$ 70.3 billion. Of this, mariculture is reported to account for 36% of the total quantity and 33.6% of the total value of aquaculture production. The potentially cultivable candidate species in India include about 20 species of finfishes, 29 crustaceans, 17 molluscs, 7 seaweeds and many other species of ornamental and therapeutic value.

2.0 Objectives of the scheme

- To supplement the marine fish production through:

i. production of fin fish seed by diversification of shrimp hatcheries

ii. open sea cage culture.

iii. Diversified mariculture through molluscan farming

- Popularization of concept of the cage culture through setting of model demonstration and units and imparting training to the traditional fishermen

3.0 Components of Assistance

The NFDB will assist the following components:

i) Production of finfish seed in shrimp hatcheries

ii) Setting up of open sea cage culture

iii) Demonstration of model sea cage culture to traditional fishermen

iv) Marine ornamental fish culture

v) Molluscan farming including pearl culture

3.1 Production of finfish seed from shrimp hatcheries

In view of the need for diversification of the shrimp hatcheries, the scheme provides for production of finfish seed.

THE GROWTH POTENTIAL FOR DAIRY PRO BIOTIC

Gregor Reid

Abstract

There has been a rapid rise in global probiotic use, but more recently a drop in dairy applications in Europe, due to regulatory intransigence and rising costs. This review will propose that it is an ideal time for companies to alter their strategic approach, rather than stop the research and development through an inability to obtain health claims. Opportunities exist to expand production of dairy probiotics in the developed and developing world. Data showing effects against diarrhoea, malnutrition, antibiotic side effects, and their potential to affect allergies and mood, and reduce environmental toxin adsorption, provide the scientific basis for shaping a dynamic future for dairy probiotics.

1. Introduction

The rapid and impressive rise in the sales of probiotic products globally has its roots in the launch of dairy probiotic products, particularly by Yakult, Danone and Valio within the past twenty years. The emphasis placed by these and a few other companies on probiotics that were scientifically and clinically tested, laid the groundwork for future growth, at least until regulators intervened in Europe in the mid-2000s. The support for probiotic food led to the United Nations and World Health Organization assembling an Expert Panel that in 2001 defined probiotics as "Live microorganisms which when administered in adequate amounts confer a health benefit on the host". This definition has stood the test of time and been widely adopted by scientific, industry and regulatory communities. The launch of Activia yoghurt in Canada in 2004 literally transformed the awareness of probiotic concepts. Within one year, an estimated 75% of the 8 million people living in Quebec Province had consumed Activia. This incredible product uptake symbolized an awakening of the public to a concept that made sense health-wise, had a scientific rationale, and had not until then been available. As advocated in 2008, probiotic foods and supplements tested in human studies have since emerged that convey local gut and distant site effects on health.

While market research companies are in the profit-driven business of projecting the future of probiotic sales, they must rely on scientific trends and progress to understand what technologies and approaches are in the pipeline. This paper will review this literature and provide an opinion that probiotic research and development can be the mediators of making health-promoting probiotic dairy products reach consumers worldwide.

2. Probiotics for specific conditions

In almost all cases, dairy probiotics by their nature as a food, are made available to children and adults all year round. This has remained despite attributes of probiotic strains showing some apparently specific characteristics, such as countering seasonal allergies, relieving constipation in adults not children, reducing drug-associated diarrhoea, reducing the duration of acute respiratory infections in otherwise healthy children and adults reducing anxiety, and improving immune parameters in HIV patients. It raises the question of whether someone not suffering from any of these issues need take the probiotic? On the one hand, the clinical effects of these foods are invariably lower than drugs, for example in lowering cholesterol without the side effects and efficacy levels compared with statins, yet on the other hand, probiotics can induce some physiological effects even in a so-called healthy person. For example, four week consumption of Lactobacillus paracasei subsp. paracasei LC01 in healthy adults resulted in reduced faecal Escherichia coli and ammonia, and increases in Lactobacillus, Bifidobacterium, and Roseburia intestinalisand acetic and butyric acid.

The ability of some lactobacilli to produce neurochemicals potentially able to reach the cerebellum via the vagus nerve, raises the question of whether such probiotics could benefit people with mood disorders? Certainly animal studies have shown the microbiota gut-brain signalling can be influenced

by neural, hormonal, immune and metabolic pathways and potentially affect mood, pain and cognition. But, too often in science, evidence obtained in mice is presented as meaning the effects will translate in humans. This is a huge assumption where anatomy, mechanisms, diet, housing, and so many other factors are completely different in humans. In one human study that theorized that disruption of the gut epithelial barrier could lead to inflammation and depression, found higher prevalence of antibodies against enterobacterial lipopolysaccharide in patients with major depression than controls. If probiotic organisms can improve gut barrier resistance, as appears to be the case in vitro and in vivo, their ingestion might have an effect on mood through at least this mechanism. Certainly, there is precedent for food affecting mood, such as fish and vitamins that increase serotonin, a mood regulator produced in the brain.

In a unique study using magnetic resonance imaging, four week intake of probiotic yoghurt affected activity of brain regions controlling central processing of emotion and sensation. Numerous other studies are now underway to explore the extent of gut microbiota-brain signalling and the degree to which probiotic foods can influence it. Of particular interest will be the effect on healthy controls. Clearly, foods should not adversely affect the mood of people deemed healthy. In such studies, behavioural outcomes need to be measured along with gut barrier resistance and where possible levels of neurochemicals in the bloodstream.

Already, some foods are consumed for specific reasons, such as high fibre bran for constipation. Perhaps products taken only at certain times of the year might also find a niche, for example, probiotics to reduce the duration, symptoms and signs of allergy. Given that claims are permitted on over-the-counter medications, it may be feasible to allow food labels to indicate that consumption of certain probiotic yoghurt prior to and during the allergy season might be beneficial. This is the approach taken by vaccine companies that deliver small amounts of an allergen, such as pollen, pet dander or mould, twice weekly for several months, followed by a less frequent maintenance dose. In a pilot study, we selected probiotic strains based upon their in vitro effects at countering allergic immune parameters, and their ability to be formulated into a yoghurt delivery vehicle. One Bifidobacterium adolescentis isolate had never been used in yoghurt, but it was added because of its anti-allergic properties. The yoghurt was well tolerated by the subjects, and although it did not have a statistically significant effect on allergy-related quality of life scores, use of antihistamines, or eosinophil cationic protein concentration in nasal lavage in this small study, it did significantly increase serum IL-10 and IL-12 levels during grass allergy season and TGF-b levels during ragweed season. While a larger sample size is needed to prove cause and effect, these small studies can provide useful information to identify potential responders, as long as conclusions are not over-drawn.

Further evidence of the potential for probiotics to improve quality of life in allergy patients comes from a double-blind, placebo-controlled, randomized trial in which L. paracasei subsp. paracasei LP-33 was given to patients with allergic rhinitis who were already being treated with anti-histidine loratadine. The study showed consistently improved ocular symptoms, but the lack of effect on nasal symptoms, also found in another probiotic study, indicates that prevention and treatment of allergy may need different approaches, with perhaps ingested probiotics to target systemic anti-inflammatory effects and delay the occurrence of allergic symptoms, and locally-administered probiotics to affect the nasal passage.

The intent of these examples is to suggest that some probiotics could target specific conditions, and still be safe for all who use them only as a food. Yoghurt production lines can easily accommodate different batches, and the distribution networks are in place in developed countries, with relatively short shelf-life turnarounds capable of this targeted use. Current regulatory systems were set up long ago to restrict disease treatment and prevention only to drugs, a dogma that needs a radical overhaul, so it would not be possible for such food products to make specific niche claims in many countries. However, consumer knowledge is acquired from many sources, in particular the internet and medical science experts, and dissemination of clinical studies showing such effects could well drive uptake of the given products. As scientists, it

behoves us to educate the public on why scientific studies apply to products.

3. Modification of dairy probiotic formulations

The modification of an existing product is already commonly done through changes to flavour and packaging or addition of fruits, such as prunes for intestinal transit and pomegranate with anti-oxidant or other health benefits. A recent study showed that flavours can alter the genes expressed by probiotic yoghurt organisms, suggesting that a new version of a product that uses a different flavour may have altered probiotic effects. For example, if a natural non-flavoured yoghurt improves digestion of lactose, a claim approved by EFSA, could the effect be altered in the presence of certain fruit additives and does this need to be tested? The implications that all food variations need to be re-tested would have significant implications for the dairy industry and regulators.

Of all the benefits accrued by probiotics, arguably their effect on preventing and reducing the duration of diarrhoea, including antibiotic-associated, has been the most documented. Contaminated food alone contributes to over 1.5 billion cases of diarrhoea in children each year, resulting in more than three million premature deaths, according to the World Health Organization (WHO). As dairy foods are less easy to transport between countries where diarrhoea rates are high, this niche has not been targeted by the dairy industry. But, if probiotic dairy products could be dried and packaged or strains delivered to allow household propagation, the probiotic organism's anti-diarrhoeal attributes might reduce morbidity and even mortality associated with diarrhoea. For this to occur, dairy companies would not only have to dry-powder their products, but also develop networks to appropriately retain bacterial viability over time and in different climates. Sachet and stick forms of probiotics are already sold, and large volumes of skim milk are dried and sold as powder, so the creation of dried probiotic and dried fermented milk is feasible. Certainly, the methodologies exist to achieve this.

4. Diet-based products

With tens of billions of dollar spent in the USA alone on weight-loss programs, including drugs and surgeries, and no clinically proven regimen that guarantees success, is there an opportunity for fermented dairy probiotic products for obesity? Studies emerging from the Human Microbiome Project have suggested that the gut microbiota of obese individuals differs in composition and/or functionality from that of people who are able to remain lean. This implies that obesity is not simply explained by nutritional habits and the reduction of energy expenditure through decreased physical activity, but to a large extent by the organisms in the gut. This has resulted in multiple studies aimed at manipulating these organisms, through intake of prebiotics, probiotics or specific nutrients, or indeed cessation of products such as artificial sweeteners that induce glucose intolerance.

A particularly interesting intervention was tested in Finland, in which 159 women were randomized and double-blinded to receive L. rhamnosus GG or placebo four weeks before expected delivery and postnatally for 6 months. Anthropometric measurements of the children showed that the perinatal probiotic treatment moderated the initial phase of excessive weight gain, especially among children who later became overweight, but it did not affect the second phase of excessive weight gain at age four. This is intriguing as it suggests a potential to program the extent of weight gain.

Some critics have used the weight gain acquired by treatment of livestock as evidence that bacteria, such as Lactobacillus acidophilus used in some probiotic products, cause obesity, but there is no such evidence in humans nor any rationale for this to happen. In particular, there is no genetic or functional reason for one species of Lactobacillus to make people obese, while other species do not. Indeed, ingestion of probiotic yoghurt made using L. acidophilusLa5 and Bifidobacterium lactis Bb12 was found to improve total cholesterol and LDL-C concentrations in a randomized double-blind controlled trial of 60 subjects with type 2 diabetes and low-density lipoprotein cholesterol (LDL-C) greater than 2.6 mmol L−1. Another study showed that probiotic therapy enhanced the effect of metformin in reducing the body mass index and one showed it could induce weight loss in women.

A recent human study suggested that the genetic make-up of an individual can support bacteria, such as Christensenellaceae, and thereby promote a lean figure. This led to the hypothesis that using such a species as a probiotic might alter metabolism and reduce obesity. In a host that is not receptive to this species, perhaps the continual passage of the organism through the gut as a daily probiotic might still confer the desired metabolic outcome. Of course, for such a dairy application, this depends on whether or not these spore-formers could be added safely to milk products, when other spore-forming organisms are infamous for spoilage and causing illness through toxin production.

Non-alcoholic fatty liver disease (NAFLD) is associated with obesity, and may be promoted by bacterial endotoxins that induce steatohepatitis. Encouraging animal studies have led to clinical investigation into probiotics for this disease. A small study suggested that children already suffering from NAFLD might be aided by 8 strain probiotic VSL#3 intake. That product is sold as a dried, high concentration sachet rather than in a dairy carrier, but the potential of the approach working in humans is worthy of further pursuit.

The preliminary finding that prebiotic inulin/oligofructose can decrease fat mass in obese women, apparently by increasing gut Bifidobacterium and Faecalibacterium prausnitzii , is relevant to the dairy field as this mix could be added to fermented milk and delivered as a synbiotic. This would be easier in terms of product development and regulatory approval than having an organism like F. prausnitzii which has no history of safe use in humans, scaled-up commercially as a supplement. One recent trial of 97 children aged 7–18 y, who were overweight and obese (BMI >85th percentile) and randomly assigned to receive placebo (maltodextrin) or oligofructose for 12 weeks, did not find loss of weight or body fat. Nevertheless, the potential for prebiotics to reduce weight gain and increase weight loss by targeting particular gut microbes is worthy of investigation.

5. Probiotic products sold through social businesses

One of the major road blocks to increasing the global impact of dairy probiotics is a failure to reach billions of people in the developing world. There are several reasons for this, including affordability and availability. Milk production is low in much of Africa and South East Asia, where a large number of people reside and major health issues of malnutrition, stunting, infectious diseases, and maternal and infant mortality are high. In countries like India, where milk is available, and often fermented in households, the protective effect of the yoghurt against chronic diarrhoea depends on the strains used, the dose taken, and the extent of exposure to pathogens. If the Dahi products consumed contain Lactococcus lactis ssp. lactis, Lactococcus lactis ssp. cremoris and Leuconostoc mesenteroides ssp. cremoris, it may provide some protection, even though these strains are more noted for conferring flavour than interfering with entero-pathogenic bacteria.

Use of highly documented probiotic strains such as L. rhamnosus GG and L. caseiShirota have been shown to be effective in preventing and controlling diarrhoea in developing countries. But until recently, both strains were protected intellectual property and not available in these countries, and if they were to be sold, the price would likely be well outwith the means of the people who needed them the most. This raises an ethical question of performing such clinical studies then not making an efficacious product available upon its completion.

One solution is to use a generic version of L. rhamnosus GG. A 1 gram sachet with the probiotic and a Streptococcus thermophilus strain is capable of producing 10–100 L fermented milk per batch. The S. thermophilus strain replaces the traditional L. delbreuckii ssp. bulgaricus.

With a break-even point at 10 L, including cost of sachet, milk and labour, there is incentive to produce and market more of this Yoba yoghurt. Even with shipping, the price point of around US$0.65 per sachet is competitive with a single tub of yoghurt sold in retail in Europe. This cost decreases as the number of required sachets increase. Profits of US$0.30 per litre are reached with 100 L of sales, which in rural Uganda is a reasonable return. Two thirds of the yoghurt consumers are regulars and the others incidental. A small

portion includes children/orphans, so the social business model is reaching vulnerable subjects and allowing the translation of dairy research to the consumer. It also delivers health and economic benefits to local people. Growth projections are impressive for such a simple set up.

The Yoba probiotic dairy concept was spurred by a humanitarian initiative set up in Tanzania in 2004, in which community kitchens run by women were established to sell L. rhamnosus GR-1 supplemented yoghurt. It was assumed that the art of fermentation would be widespread, given the history of use in Africa. In fact, this was not the case, and few in the large city of Mwanza, practiced or were aware of how to ferment milk. These Mwanza and Ugandan dairy groups now feeds around 15,000 people each day, illustrating the tremendous potential of social business. There have been numerous positive outcomes including reduction in diarrhoea, rashes and side effects of drug therapy, and in some cases improvements in CD counts in HIV patients.

It is not traditional practice for dairy companies to target amelioration of diseases, mostly because regulatory agencies set up in the past century state that only drugs can prevent, treat or cure disease. Indeed, recent unfathomable policy decisions in the US and Europe have been backward in their approach to probiotics. The development of new probiotic dairy-based foods to counter infectious and other diseases afflicting billions of people and for whom alternative treatment and prevention regimens are ineffective, too expensive or unavailable, could include helping to reduce side effects of drugs, competing with pathogens, enhancing host immune responses to disease, or providing microbes and metabolites that restore and retain homoeostasis. Although claims may not be permitted on the product labels, the scientific results will be published and through traditional and social media, consumers will hear about the results and create a pull for the products. As long as the messaging is consistent with the quality of the studies, probiotic dairy foods could certainly be promoted more widely to reduce and help treat important diseases.

Not all climates are suitable for cows, and therefore milk from goats, camels and buffalo is used by many people. This has been part of traditional food for centuries in areas of the developing world, produced and consumed within households and sold in small quantities in local markets. However, coordination of milk to central processing sites then distribution via cold chains to expansive rural and urban communities either does not occur or is not well-coordinated. With the income per capita too low to support large sales of branded yoghurts and cheeses that are typically sold in Western and Northern countries or South Africa, dairy probiotics must be affordable to all. For example, Zambia has the highest poverty ratio of 86% and is the poorest country in the world, with seven out of ten people living on less than two dollars a day, and an average life expectancy of 51 years. If it could better organize milk centralization it would have the potential to establish a mechanism to produce and disseminate probiotic dairy foods.

In short, dairy science has made many important advances that have led to foods with highly nutritional, health-conferring properties. However, until people in greatest need of such products gain access, we will have collectively failed in our translational endeavours.

6. Detoxification

The final area of discussion that has great potential for dairy probiotics is in detoxification of environmental pollutants. With many deaths worldwide associated with water, air and soil pollution, and anthropomorphic activity increasing levels of toxins, such as heavy metals and pesticides in the environment, efforts are needed to prevent adsorption of these compounds into the body of humans and animals. The toxins, adsorbed acutely or via chronic long term exposure, can affect neurological and cognitive development in children and immune and cardiovascular diseases.

The detoxification potential for dairy probiotics comes from the finding that lactic acid bacteria have an affinity for many toxic metals and various organic pesticides, making it possible to sequester them prior to their adsorption into the bloodstream and tissues. The most recent and encouraging evidence for this comes from a recent study undertaken in

Tanzania. The 30 million people living on Lake Victoria already face major challenges with HIV, malaria, poverty, malnutrition and violence, but added to that they are exposed to high levels of environmental pollutants. Admittedly, the 40 million people living around the Great Lakes of North America are exposed to equally high levels of mercury, while populations in China and India face exposure to a variety of toxic compounds. Unfortunately, while North Americans can choose to avoid eating products of the Great Lakes, people living around Lake Victoria cannot and fish consumption is part of their staple diet. So, although this is far from being an African problem alone, it was decided to study the ability of probiotic yoghurt to sequester heavy metals, following in vitro studies showing this indeed was feasible. The finding of excessive levels of heavy metals in the bloodstream of the Mwanza children compared with Canadian children demonstrated the gravity of the pollution. The reduction in further adsorption of mercury and arsenic after one month of five days per week consumption of probiotic yoghurt was encouraging, albeit not reaching statistical significance. However, three month treatment of pregnant women did show significantly reduced levels of mercury and arsenic uptake. The mechanism involves the binding of the lactobacilli to the metals, as shown by various microscopy techniques. The research has also identified mercury reductase genes as a potential means to further reduce mercury adsorption.

This is a new area of application for dairy science, but other examples exist in countering environmental pollutants. One study, notably from China, has shown that fermented skimmed milk accelerated degradation of organophosphorus pesticides chlorpyrifos, diazinon, fenitrothion, malathion and methyl parathion, in part due to phosphatase production by the lactic acid bacteria. This is interesting not only because of the high use of pesticides in China, but because the dairy market, especially milk and yoghurt, has grown substantially. With pastures at a premium, oil prices fluctuating, and cost of feed escalating, new models are needed to help dairy markets continue to grow.

Another example is the ability of lactobacilli to bind to mycotoxins produced by Aspergillus species in pre- or post-harvest cereals and milk. When tested in humans, a statistically significant decrease in urinary concentration occurred when probiotics were consumed twice daily for five weeks. A staggering 4.5 billion people living in developing countries are estimated to be chronically exposed to largely uncontrolled amounts of the toxins. This exposure significant increases the risk of liver cancer. With in vitro data showing that L. rhamnosus GG reduces aflatoxin B1 transport, metabolism and toxicity to intestinal cells, the Yoba generic version of this strain in probiotic yoghurt could prove effective in high aflatoxin contaminated areas of east Africa.

7. What represents sufficient evidence?

The concept of probiotics is not without its critics, and the insufficiency of clinical trial data, or failings of some study designs are often cited as evidence that probiotics have not been proven to impact human health. Such a topic may warrant a separate review, but some points are worthy of note. It is unreasonable to suggest that naturally occurring food grade bacteria delivered as supplement or food need to be tested to the same extent as novel synthetic chemicals being considered as drugs. Nevertheless, the FDA itself states in relation to drug approvals, "in some cases, FDA has relied on pertinent information from other adequate and well-controlled studies of a drug, such as studies of other doses and regimens, of other dosage forms, in other stages of disease, in other populations, and of different endpoints, to support a single adequate and well-controlled study demonstrating effectiveness of a new use", and "In other cases, FDA has relied on only a single adequate and well-controlled efficacy study to support approval". Still, many drugs are approved with insufficient evidence, as shown in a European study of 200 unique new medicines, 161 standard and 39 orphan medicines, approved by the European Medicines Agency, where the median total number of patients studied before approval was 1708 for the former and 438 for the latter, insufficient to evaluate safety and long-term efficacy. In short, there is no magic bullet for proving efficacy, and all products developed for

human use should be continually monitored and tested. Probiotics are, for the most part, not even attempting to claim efficacy, so the fact that clinical trials (many of which have been cited here) have been performed in randomized, placebo-controlled fashion with hundreds of subjects, is laudable. Critics may not be convinced even by the meta-analyses cited here and elsewhere. Guidelines that provide a third party assessment of the volume of documentation and levels of evidence at least help guide consumers in choosing which probiotic may benefit them. In truth, patients have long relied on healthcare professionals providing them with such advice on drugs, and that process is far from perfect.

The most important point is that all products using the term probiotic should have undergone scientific rigor, be produced to the highest standards possible particularly if used for vulnerable subjects, and be tested in humans as best as is practical and possible. Studies of 20–500 subjects should not be discouraged simply because of size; all studies can reveal useful information. But over-stating effectiveness does not advance the credibility of the field.

8. Conclusions

Many challenges face the dairy industry worldwide. Traditionally strong markets in Europe have been adversely affected by politically motivated legislation, rising production costs and trends towards organic and 'natural' foods. Nevertheless, the globalization of food distribution provides new opportunities, not the least of which are markets in the Middle East and Asia where per capita income can support the purchase of high end dairy products, and there is a custom of eating fermented milk products. The benefits that lactic acid bacteria have provided throughout human evolution need to be re-invigorated through research, development and application. The probiotic market is witnessing unprecedented growth, and the application to dairy products has the potential to improve the lives of millions of people worldwide.

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DAIRY ENTREPRENEURSHIP DEVELOPMENT SCHEME

The Department of Animal Husbandry, Dairying and Fisheries (DAHD&F), GoI launched a pilot scheme titled "Venture Capital Scheme for Dairy and Poultry" in the year 2005-06. The main objective of the scheme was to extend assistance for setting up small dairy farms and other components to bring structural changes in the dairy sector.

During a mid-term evaluation of the scheme, certain recommendations were made to accelerate the pace of implementation of the scheme. Taking into account the recommendations of the evaluation study and the representations received from various quarters including the farmers, State Governments and banks, DAHD&F decided to make some key changes to the scheme, including changing its name to Dairy Entrepreneurship Development Scheme (DEDS).

The revised scheme has come into operation with effect from 1 September 2010.

Objectives of the scheme

- To promote setting up of modern dairy farms for production of clean milk
- To encourage heifer calf rearing, thereby conserving good breeding stock
- To bring structural changes in the unorganised sector so that initial processing of milk can be taken up at the village level itself
- To upgrade the quality and traditional technology to handle milk on a commercial scale
- To generate self-employment and provide infrastructure mainly for unorganised sector

Who can benefit from this scheme?

- Farmers, individual entrepreneurs, NGOs, companies, groups of organised and unorganised sectors, etc. Groups of organised sector include Self-help Groups (SHGs), dairy cooperative societies, milk unions, milk federations, etc.
- An individual will be eligible to avail assistance for all the components under the scheme but only once for each component
- More than one member of a family can be assisted under the scheme provided they set up separate units with separate infrastructure at different locations. The distance between the boundaries of two such farms should be at least 500 metres.

Intensive Dairy Development Programme (IDDP)

Centrally Sponsored Scheme 'Intensive Dairy Development Programme (IDDP)

A brief note indicating status as on 31/03/2013

The Scheme 'Integrated Dairy Development Project (IDDP) in Non-Operation Flood, Hilly and Backward Areas' was launched in 1993-94 on 100% grant-in-aid basis. The main objective of the scheme is as under:

- Developing milch cattle,
- Increasing milk production by providing technical input services,
- Creating infrastructure to improve procurement, processing and marketing of milk in a cost effective manner,
- Ensuring remunerative prices to the milk producers, by strengthening dairy cooperative societies at village level,
- Generate additional employment opportunities,
- Improving social, nutritional and economic status of residents of comparatively disadvantaged areas.

The scheme was modified during March 2005. The modified scheme has been named as 'Intensive Dairy Development Programme' (IDDP) and is being implemented in hilly and backward areas and also in the districts, which received less than Rs.50.00 lakh for dairy development activities during Operation Flood, programme. The funds are now released directly to the implementing agency i.e State Dairy Federation / District Milk Union. The Scheme is being continued during the 11th plan with a total plan outlay of Rs.275.00 Crore as merged scheme together with 'CMP'.

Since inception of the IDDP scheme, 114 projects have been approved. Out of 114 projects, 60 are under implementation and 54 projects have been completed. 261 districts are covered in 27 States and a UT with total outlay of Rs 702.68 crore till 31.03.2013. A total sum of Rs.535.47 crore has been released to the concerned state governments and milk unions/milk federations for implementation of projects upto 31.03.2013.

Physical achievement as on 31.12.2012: These projects have benefited about 24.17 lakh farmers in 32095 villages in various states by procuring over 30.14 lakh litres of milk per day and milk marketing is about 23.34 lakh litres per day. Milk chilling capacity 25.07 lakh litres per day has been created and processing capacity 33.21 lakh litres per day has also been created under this scheme. There is no discrimination of gender and class under the scheme. None of the projects are approved in 2 States namely Delhi & Punjab under IDDP scheme.

Year-wise outlay and expenditure under the scheme for the last 6 years and the current year(2012-13) are given

Rs, in crore

Year	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
BE Provision	23.00	23.00	29.99	32.49	24.80	30.00	55.00
RE	27.00	32.76	32.49	35.49	24.80	51.00	55.42
Actual Exp	33.48	34.68	31.62	31.97	24.40	50.70	55.26

Financial position & Physical Achievement under IDDP Scheme: As on 31/03/2013

FINANCIAL DETAILS	
No. of project approved	114
On-going projects	60
Complete projects	54
Districts covered	261 & 1 UTs
Total approved outlay of the projects	Rs 702.68 crore
Total released of funds	Rs 535.47 crore

Physical progress :

LKgsPD- Lakh Kgs. per day & LLPD – Lakh litres per day

Intensive Dairy Development Programme

Intensive Dairy Development Programme(IDDP) – A Centrally Sponsored Plan Scheme.

Plan allocation and Expenditure incurred under the scheme during VIII, IX, X & XI plan period is as below:

Rs, in crore

Plan	Plan Allocation	Actual Expenditure
VIII	200.00	80.96
IX	250.00	96.98
X	175.00	132.04
XI	275.00 (IDDP+SIQ-CMP)	278.09

Objectives/Aims of Scheme

- Development of milch cattle
- Increase milk production by providing Technical Inputs services
- Procurement, Processing and Marketing of milk in a cost effective manner
- Ensure remunerative prices to milk producers
- Generate additional employment opportunities
- Improve social, nutritional and economic status of residents of comparatively more disadvantaged areas.

Year of the Scheme Started - 1993-94

XIth Plan outlay: Rs.275.00 Crore (merged allocation- IDDP & CMP)

Implementing Agency

- State Dairy Federations / District Milk Union

Target /Beneficiaries

- Rural milk producers irrespective of caste, class and gender. Cattle induction only for SC, ST and BPL families

Pattern of Assistance/Funding and Eligibility Criteria

The pattern of funding is 100% grant-in-aid from Central Government for the districts where investment (central grant) under Operation Flood (OF) programme was less than Rs.50.00 lakh. There is a maximum allocation of Rs.300.00 lakh per district under the programme. For establishment of dairy processing capacity up to 20,000 litres/day will be 100% grant-in-aid basis. Above this cap, OF pattern will be followed, namely, 70% loan and 30% grant.

Year-wise outlay and expenditure under the scheme for the last 6 years are given below:

Rs, in crore

COMPONENT	ACHIEVEMENT
DCS ORGANISED (nos)	32095
DCS FUNCTIONAL (nos)	25624
FARMER MEMBERS (in lakh)	24.17
MILK PROCUREMENT (LKgs.PD)	30.14
MILK MARKETING (LLPD)	23.34
CHILLING CAPACITY (LLPD)	25.07
PROCESSING CAPACITY (LLPD)	33.21

Year	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
B. E Provision	23.00	29.99	32.49	24.80	30.00	55.00
Actual Exp	34.68	31.62	31.97	24.40	50.70	55.26

INDIA EXPORT / IMPORT OF AGRO FOOD PRODUCTS

Value in Rs. Lacs

Qty In MT

Product: Dairy Products Import

Country	2014-15		2015-16		2016-17	
	Qty	Value	Qty	Value	Qty	Value
France	3,373.66	7,312.74	4,536.98	8,857.45	4,091.06	6,531.64
New Zealand	728.90	3,847.65	4,433.79	8,857.57	1,282.00	3,169.94
Denmark	631.32	1,633.59	1,814.57	3,203.22	1,543.43	2,295.92
Uganda	899.05	1,258.53	1,311.70	1,800.76	1,663.89	2,291.38
Italy	276.61	1,573.94	302.43	1,391.88	373.70	1,668.14
United Kingdom	1,165.40	1,565.08	1,174.50	1,497.65	840.56	1,059.50
Nepal	394.58	968.66	331.01	879.92	350.97	925.48
Turkey	1,931.00	1,156.35	373.30	172.39	1,760.00	809.49
Ukraine	25.00	20.87	550.00	246.44	1,013.00	773.97
Germany	330.08	1,351.51	506.44	1,176.68	856.68	765.03
Netherland	538.35	2,558.51	372.58	1,836.70	158.45	663.62
Australia	7.89	60.99	70.08	198.23	113.62	305.82
Switzerland	3.06	26.78	11.68	84.87	701.86	252.37
Uruguay	0.00	0.00	500.00	223.16	500.00	213.36
Sweden	0.01	0.16	0.00	0.00	101.95	149.22
Spain	15.84	81.78	68.30	324.52	51.81	144.93
Kenya	0.00	0.00	31.59	33.03	112.40	143.93
Poland	96.36	105.19	57.62	59.37	223.44	142.02

Value in Rs. Lacs

Qty In MT

Product: Dairy Products Export

Country	2014-15		2015-16		2016-17	
	Qty	Value	Qty	Value	Qty	Value
United Arab Emirates	6,135.99	18,743.92	5,461.66	18,084.33	5,733.87	20,322.35
Bangladesh	10,490.32	22,402.91	5,359.84	9,505.27	7,092.68	12,459.53
Bhutan	3,707.97	4,910.03	2,082.41	3,689.22	4,362.75	10,923.45
Pakistan	7,876.65	17,524.08	6,235.63	12,149.88	4,364.67	8,521.93
Nepal	18,153.59	11,301.70	2,119.48	4,200.65	5,055.48	7,264.83
Singapore	4,225.16	4,642.24	3,865.68	4,592.42	3,585.81	4,838.80
Philippines	1,833.81	4,736.72	932.75	2,056.33	1,840.97	4,135.10
Afghanistan	689.36	1,600.92	1,638.87	3,164.39	1,836.20	3,937.86
Saudi Arabia	682.82	2,247.93	758.63	2,815.94	730.35	2,874.52
United States	552.25	1,745.11	373.20	1,308.26	623.66	2,304.25
Kuwait	824.59	2,435.03	610.63	2,206.31	627.54	2,250.51
Oman	1,043.06	3,344.32	834.60	2,925.13	571.80	2,211.39
Qatar	486.03	1,518.61	628.60	2,134.84	632.08	2,186.48
Australia	526.00	1,820.14	380.05	1,377.98	386.34	1,621.62
Bahrain	455.97	1,369.19	405.45	1,446.57	343.17	1,242.12
Sri Lanka	294.31	777.94	205.13	551.73	279.29	721.52
Hong Kong	1,059.45	1,094.47	377.57	565.75	443.83	687.34
Mauritius	144.26	482.06	109.42	412.86	86.16	402.00
Malaysia	663.06	1,724.87	76.26	215.17	123.22	321.14
New Zealand	124.27	400.81	57.98	162.02	74.50	256.87
Japan	218.93	565.16	24.95	92.79	42.09	174.30
Seychelles	33.39	124.20	39.70	154.83	43.48	156.62
Canada	27.98	50.74	22.49	62.62	44.27	119.07
Thailand	61.21	178.06	20.23	72.00	30.14	116.21

Source: DGCIS Annual Export

Farmers' Contribution To Improving The Value And Uses Of Coconut Through The Maintenance And Use Of Genetic Diversity

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Coconut diversity in the hands of farmers and in research

Farmers who grow coconut are deeply attached to the various products and services of the coconut palm. When they move into areas that are far from optimal for the growing of coconut, they take coconut with them, create and maintain micro-environments which allow it to survive. Over time, farmers have contributed to the adaptation of coconut to a range of different environments by moving and growing coconut to areas and environments which are marginal to coconut production, namely high elevations, higher latitudes, drought prone areas, areas subject to heavy winds and a range of soils from atolls to heavy clay soils. This specific adaptation under farmer management deserves to be understood and supported. Given the high degree of diversity in these populations, many useful genetic traits for resistance and adaptation have been developed and are being maintained by farmers.

It is recognized that formal coconut research has been a recent and under-resourced effort in relation to the distribution and value of the crop, and the complexity of coconut crop improvement (Persley 1992). Some significant achievements have been made by coconut breeders with the release of dwarf hybrids which have higher yields of copra and oil. Where the copra industry is well-organized and efficient, these hybrids have made a positive contribution to coconut productivity and to incomes of coconut farmers. However, many if not most smallholders growing coconut are not well served by industrial copra collecting, marketing and processing infrastructures. The research on coconut as an oilseed has yet to reach the bulk of the coconut producers who are smallholders. This gap may be due to the multiple uses of coconut and the diverse farming systems where it is grown. Narrowing the gap may require a new approach that brings farmers, breeders and genetic resource scientists together to define a wider range of uses for coconut diversity from the genetic level to the final products that reach the consumer.

Coconut diversity and its multiple uses by smallholders

The uses and value of coconut palms to smallholders are far greater than copra and oil. While global and national statistics on coconut production measure yield only in terms of oil and copra, and most coconut research and development has historically been classified as work to improve the productivity of oilseeds, this may not be the way smallholders view the coconut palm. As yet there are few studies which calculate the total value of coconut production by including products other than oil and copra. Where such studies exist more work is needed so that they can improve agricultural statistics, policy and the strategies for coconut research and development. Because many small-scale farmers value coconut palms in a different way from the primary values assigned by formal R&D and national agricultural policy, they remain attached to types of coconut populations which are different from the improved cultivars. In cases where higher yielding coconut varieties are available and supported by development schemes, there is widespread evidence that many farmers continue to prefer their local cultivars (Godoy and Bennet 1991; Lages 1996). The local cultivars they prefer are tall, with a high degree of diversity within populations, and provide a wide range of products for a long time with minimal inputs and labour.

Social scientists have traditionally been called in to explain to the breeders why farmers are not adopting an improved variety. My focus however is different. The focus of this paper is to call for a better understanding of what diversity farmers are maintaining and managing and how this diversity within and between populations of coconuts can be used by both farmer and researcher to improve the value and productivity of

coconut across a range of products and uses.

Adding value to coconut diversity in small-scale farming systems

There are two levels of diversity in coconut. One is diversity between populations resulting from human and natural selection in different environments. This is the source of much of the diversity we still need to understand and conserve for improving the adaptability and pest and disease resistance of coconut. The other is the diversity found within outcrossing populations. All populations of tall varieties fall into this category of allogamous populations with high levels of diversity (Foale 1991). Given the preponderance of tall coconut palms in small-scale, low-input farming systems distributed across a wide range of environments, and the fact that hybrids are predominant in commercial copra production systems in the more favourable areas, it is fair to say that small-scale farmers maintain the greatest amount of genetic diversity in coconut.

Improvement for a multi-purpose smallholder crop

If we are to improve the competitiveness of coconut by broadening the use of genetic diversity to increase the value of coconut products beyond copra, some questions need to be raised. Has the near total focus by coconut breeding programmes on oilseed productivity, led to a narrower evaluation and use of coconut genetic resources, and as a result a narrower range of genetic diversity located, identified, and conserved? From the perspective of an anthropologist concerned with local user's perspective, I would suggest that this is so. Small-scale farmers have a much broader set of useful characters which they value and maintain in their coconut populations. Hence, their preference for the tall, polymorphic coconut varieties with a high degree of genetic diversity within populations. A close partnership between scientists and coconut farmers is needed to identify and use the genetic diversity that exists to maximise the productivity of coconut palms for a wide array of products. Farmers' expertise on characteristics and adaptation of coconut populations for multiple uses is a vital resource to be maintained along with the diverse populations which can provide the genetic basis upon which future multi-purpose coconut improvement will depend. Scientists and farmers together will need to define the goals of coconut research and development. A lack of understanding of the large amount of morphological variation due to the interaction of genotype and environment has in the past led to unrealistic expectations for yield improvement in coconut (Foale 1991).

Where multi-purpose crops are concerned, there will be choices and trade-offs in any improvement programme. Formulation of key strategic objectives should consider whether to use the genetic diversity to select and develop several specific varieties for other uses such as fibre, food, fruit, drink, wood and timber. Alternatively, research can work with farmers to conserve and enhance the existing locally adapted populations while retaining the diversity within populations that enable coconut farmers to provide multiple products. The local varieties may not be high yielding along a single criterion such as oil, but when other uses are included and pest resistance is enhanced they may be more productive overall. This paper does not purport to answer a question that is best answered in consultation between coconut researchers and coconut farmers. However, there is the question of the time and costs of producing a new certified variety in coconut, and the fact that smallholders are likely to retain a preference for a cultivar that is low maintenance and provides a stable yield across a number of characters. It may be unfair to expect the existing infrastructure for coconut research to focus on varietal development for so many diverse objectives and environments. What is feasible and urgent, however, is for researchers to work with farmers to understand better the local coconut populations which they maintain and the link between that diversity and the range of products and uses of coconut.

Breeding objectives, farmer -based characterization and genetic resources

Breeding objectives have been largely focused on the oilseed, improving the oil and copra yield. Other more specific objectives are still focused on the nut, and include improving the protein content, the quality of the fatty acids and other properties of coconut oil and fat

(Santos and Sangare 1991). Not surprisingly, the breeding objectives have influenced the evaluation and maintenance of coconut germplasm by formal institutions concerned with coconut research and development. Coconut research centres have access to a very small fraction of the variability that exist within the species (de Nuce 1991). Much of the diversity which is not accessible to coconut researchers is in the hands of small-scale farmers growing coconuts in diverse environments for many varied uses.

This pool of coconut diversity and knowledge of coconut uses and local varieties presents an important opportunity if coconut improvement is indeed to be based on a partnership with coconut producers who are in general small-scale farmers. It also presents an opportunity to maintain and use the great diversity that exists in coconut populations distributed worldwide in a range of environments. Given the costs in time and resources of coconut germplasm evaluations, working with farmers to assess the characteristic of local coconut populations across a set of key criteria would be a useful first step to sample and identify a broader range of diversity in coconut. This should make an important contribution to both conserving existing diversity and expanding the genetic base of coconut improvement.

Partnership between coconut researchers and farmers is essential at an early stage to define breeding objectives, conservation needs, and potential for genetic enhancement of coconut varieties under low-input systems. Objectives for coconut genetic resources conservation, use and improvement will certainly need to reflect the uses of coconut. In this particular case, the question is not so much one use versus another. Rather, it concerns the definition of primary use, and whether varietal improvement aimed at a primary use, copra for example, will limit the identification and use of a wider range of genetic diversity.

Farmers already have indigenous systems of characterization and evaluation of coconut. Their systems are primarily based on the various uses of coconut. Since our strategy for coconut improvement will depend on improving its adaptability as well as its productivity and marketability across a wider range of products, farmer-based classification and evaluation of coconut populations is particularly useful. Table 1 describes the more important areas where farmer evaluation of coconut diversity can serve as a first step to the identification and use of diversity for coconut improvement as a multi-purpose crop.

At this stage, coconut production systems are threatened and along with it, the livelihood of millions of farmers with few alternatives. Research and development could aim at the generation of several new coconut varieties, each aimed at a single product: wood, fresh fruit, drink, fibre, etc., in the hope of increasing the marketability and value of the specific coconut product. Given the time it would take and the current threats to coconut populations and coconut producers, this would mean that many areas of coconut production might be lost with its attendant genetic diversity. Incomes for millions would continue to erode along with the genetic diversity. Some of the genetic diversity that could provide the basis for future coconut improvement would also be lost. In the light of this scenario, a strategy aimed at identifying and enhancing the genetic resources in locally adapted populations of tall coconut varieties may be the first step. Breeders would have the opportunity to identify adaptive traits and resistance to pests and diseases which could be used in coconut improvement. Farmers might be in a position to receive technical support and develop new markets and postharvest opportunities for diverse coconut products in local industries in the short term. In the longer term, the commercial value and export potential of non-oil and copra products is barely tapped.

Farmer participatory approaches to coconut genetic diversity might contribute to several objectives with high rates of return. One is to develop locally adapted varieties that are able to perform in less favoured environments with few inputs and low levels of husbandry (Persley 1992). Another is to identify uses and techniques to exploit and derive greater value from a wider range of coconut palm products. Farmers are the experts in the multiple uses of coconut palms. Only a few of these are exploited commercially in any single coconut growing region, with the exception of South-Asian countries which have truly seen a

remarkable expansion of coconut products for the home markets. In most cases, for this to occur, the development of harvesting and postharvest processing techniques will have to be oriented to a supply of raw materials that comes from many small-scale farmers.

The ideal coconut palm for these diversified coconut industries will be a multi-purpose tree that retains many of the characteristics of the tall and locally adapted coconut varieties that predominate on small farms. The basis of restoring the productivity of smallholder coconut should begin with an understanding of the value and diversity of coconut populations managed by small-scale farmers. Given the relatively modest investment in coconut research and the vast pool of diversity that remains to be explored, identified and used, the scope for dramatic improvements resulting from a participatory effort is great.

References

de Nuce de Lamothe, M. 1991. Coconut improvement - needs and opportunities. P. 32 in Papers of the IBPGR Workshop on Coconut Genetic Resources, Cipanas, Indonesia. International Crop Network Series No. 8. IBPGR, Rome, Italy.

Foale, M. A. 1991. Coconut diversity - present knowledge and future research needs. Pp. 46-52 in Papers of the IBPGR Workshop on Coconut Genetic Resources, Cipanas, Indonesia. International Crop Network Series No. 8. IBPGR, Rome, Italy.

Persley, G. J. 1992. Replanting the tree of life, towards an International Agenda for Coconut Palm Research. CAB International Wallingford, UK. P.90.

Santos, G. A. and A. Sangare. 1991. Evaluation and utilization of coconut genetic resources. Pp. 70-77 in Papers of the IBPGR Workshop on Coconut Genetic Resources, Cipanas, Indonesia. International Crop Network Series No. 8. IBPGR, Rome, Italy.

Godoy, R. and C. P. Bennet. 1991. The economics of monocropping and intercropping by smallholders: the case of coconuts in Indonesia. Human Ecology 19(l):83-98.

Lages, V.N. 1996. Resource use patterns: the case of coconut-based agrosystems in coastal zones of Kerala, India and Alagoas, Brazil. Working paper #15 -South-South Cooperation Programme on Environmentally Sound Development. UNESCO Paris.

Strength of Indian Coconut Industry

Coconut Development Board

- One of the leading producers of coconuts in the world producing 13 billion nuts per annum.
- Coconut area distributed in 18 states and three Union Territories under different agro-climatic conditions.
- 3000 years' tradition in coconut cultivation.
- Premier coir manufacturing country in the world.
- Producer of best grade milling copra in the world yielding high grade coconut oil known for its aroma and flavour.
- Large number of farmer's co-operative societies in primary processing and marketing.
- Government agencies such as Kerafed, State Trading Corporation, Kerala State Marketing Federation and Karnataka State Marketing Federation in manufacturing and marketing of branded coconut oil in small packs.
- Hundreds of reputed and established private firms in manufacturing and marketing of various coconut products including branded coconut oil in small packs.
- Wide range of coconut products both edible and non-edible available for export.
- Technical know-how and trained manpower for the manufacture of various coconut based products.
- Availability of research support by reputed research organizations such as CSIR, ICAR and DRDO.
- Good number of cultivars / varieties having specific nut characteristics

Coconut Products of India

Convenience products from tender and mature coconut water - Packed tender coconut water, packed coconut water, tender coconut water concentrate, coconut vinegar, canned tender coconut water

A large number of coconut products are manufactured in the country which have both domestic and export market.

Vinegar and soft drink are manufactured in the country from coconut water. Tender coconut water concentrate is another product which is manufactured and marketed successfully. Know-how for the preservation and packing of tender coconut water has been transferred to six firms in the country. Nata-de-coco is a gelatinous delicacy formed by the action of a micro-organism Acetobactor xylinium in a culture medium of coconut water. The know-how for its manufacture is available with the Board.

Coconut Products :

1. Tender Coconut Water
2. Neera
3. Coconut Flower Syrup
4. Coconut Palm Jaggery
5. Coconut Palm Sugar
6. Copra
7. Coconut Oil
6. Raw Kernel
7. Coconut Cake
8. Coconut Shell based Products
9. Coconut Wood based Products
10. Coconut Leaves
11. Coir Pith

All India final estimates of Area and Production of Coconut - 2015-16

	States /Union Territories	AREA ('000 Hectares)	Production (Million nuts)	Productivity (Nuts/ha)
1	Kerala	770.62	7429.39	9641
2	Tamil Nadu	459.74	6171.06	13423
3	Karnataka	526.38	5128.84	9744
4	Andhra Pradesh	103.95	1427.46	13732
5	West Bengal	29.51	373.58	12658
6	Odisha	50.91	328.38	6451
7	Gujarat	22.81	312.68	13706
8	Maharashtra	22.75	271.24	9775
9	Bihar	14.90	141.38	9489
10	Assam	19.73	132.59	6720
11	Chhattisgarh	1.85	30.54	16508
12	Tripura	7.20	29.51	4097
13	Nagaland	0.33	2.67	8091
14	Others	52.80	388.13	7351
	All India	**2088.47**	**22167.45**	**10614**

Source : Horticulture Division, Dept. of Agriculture & Cooperation, Ministry of Agriculture & Farmers Welfare, Government of India.

World - Area, Production and Productivity of Coconut in Major Coconut Growing Countries - 2014

	Countries	AREA ('000 Hectares)	Production (Million nuts)	Productivity (Nuts/ha)
1	Indonesia	3610.00	16354.00	4530
2	Philippines	3502.00	14696.00	4196
3	India	2141.00	21665.00	10119
4	Srilanka	440.00	2870.00	6523
5	Brazil	251.00	2919.11	11630
6	Papua New Guinea	221.00	1483.00	6710
7	Thailand	206.00	1001.00	4859
8	Mexico	169.00	1118.75	6620
9	Vietnam	159.00	1245.59	7834
10	Tanzania	128.00	545.80	4264
11	Samoa	99.00	267.00	2697
12	Vanuatu	92.00	415.11	4512
13	Malaysia	88.00	653.00	7420
14	Mozambique	81.00	244.06	3013
15	Fiji	62.00	200.00	3226
16	Myanmar	48.00	509.18	10608
17	Solomon Islands	38.00	100.00	2632
18	Ghana	27.00	380.38	14088
19	Jamaica	15.90	98.50	6195
20	Others	818.10	3070.89	3754
	World	12196.00	69836.36	10345

Source: Asian and Pacific Coconut Community (APCC) Statistical Year Book 2014

Area, Production & Productivity of Coconut in India

Year	Area ('000 ha)	Production (Million nuts)	Productivity (Nuts per ha)
1950-51	626.5	3281.7	5238
1951-52	630.2	3306.4	5247
1952-53	627.2	4177.1	6660
1953-54	638.7	3910.5	6123
1954-55	640.0	4264.6	6663
1955-56	647.6	4224.4	6523
1956-57	657.0	4458.0	6785
1957-58	664.1	4501.0	6778
1958-59	691.3	4651.7	6729
1959-60	707.2	4765.4	6738
1960-61	717.4	4639.1	6466
1961-62	723.0	4478.3	6194
1962-63	791.0	4962.6	6274
1963-64	799.0	4736.2	5928
1964-65	847.6	5042.8	5950
1965-66	883.7	5035.4	5698
1966-67	893.0	5191.8	5814
1967-68	923.9	5321.3	5760
1968-69	988.1	5546.2	5613
1969-70	1033.3	5858.7	5670
1970-71	1045.5	6075.0	5811
1971-72	1088.4	6123.7	5626
1972-73	1099.2	5997.2	5456
1973-74	1102.0	5850.6	5309
1974-75	1116.3	6029.6	5401
1975-76	1069.9	5829.4	5449
1976-77	1074.5	5765.3	5366
1977-78	1056.5	5412.6	5123
1978-79	1055.0	5729.7	5431
1979-80	1075.8	5662.0	5263
1980-81	1083.3	5942.0	5485
1981-82	1090.8	5939.9	5445
1982-83	1149.2	6356.1	5531
1983-84	1165.6	5807.9	4983
1984-85	1183.3	6912.8	5842
1985-86	1225.6	6770.3	5524
1986-87	1231.2	6376.8	5179
1987-88	1346.0	7269.9	5401

1988-89	1425.5	8541.4	5992
1989-90	1472.2	9358.8	6357
1990-91	1513.9	9700.2	6407
1991-92	1528.9	10079.6	6593
1992-93	1537.7	11240.9	7310
1993-94	1635.1	11974.7	7324
1994-95	1713.8	13299.6	7760
1995-96	1830.9	12952.3	7074
1996-97	1890.8	13061.0	6908
1997-98	1861.0	12717.3	6834
1998-99	1754.5	12535.9	7145
1999-2000	1768.1	12129.0	6860
2000-2001	1823.91	12678.4	6951
2001-2002	1932.3	12962.9	6709
2002-2003	1921.8	12535.0	6523
2003-2004	1933.7	12178.2	6298
2004-2005	1935.0	12832.9	6632
2005-2006	1946.8	14811.1	7608
2006-2007	1936.8	15840.4	8179
2007-2008	1903.19	14743.56	7747
2008-2009	1894.57	15729.75	8303
2009-2010	1895.20	16918.40	8927
2010-2011	1895.90	16942.92	8937
2011-2012	2070.70	23351.22	11277
2012-2013	2136.67	22680.03	10615
2013-2014	2140.50	21665.19	10122
2014-2015	1975.81	20439.60	10345
2015-2016	2088.47	22167.45	10614

Source: Horticulture Division, Dept. of Agriculture & Cooperation, Ministry of Agriculture, Govt. of India.

GUIDELINES ON COIR UDYAMI YOJANA – A CENTRAL SECTOR SCHEME

1. The Scheme

Government of India has approved the continuation of the credit linked subsidy scheme called Rejuvenation, Modernization and Technology Upgradation of the Coir Industry (renamed as Coir Udyami Yojana) to facilitate sustainable development of the Coir Industry in the country. This will in turn generate more employment opportunities especially for women and the weaker sections of people in rural areas. Coir Udyami Yojana will be a Central Sector Scheme to be administered by the Ministry of Micro, Small and Medium Enterprises. The Scheme will be implemented by Coir Board a statutory organization under the Ministry of MSME as the Nodal Agency at the national level. At the State level the scheme will be implemented through Board's Regional Offices, Sub Regional Offices, Coir Mark Scheme Office and District Industries Centres, Coir Project Offices, Banks and such other offices. The Government subsidy under the scheme released to Coir Board will be routed through the identified banks for eventual distribution to the beneficiaries/entrepreneurs in their bank accounts. The Implementing Agencies viz. Coir Board Offices, DIC, Coir Project Offices etc will associate with reputed Non-Governmental Organizations (NGOs)/reputed Autonomous Institutions/ National Small Industries Corporation/Panchayathi Raj Institutions and other relevant bodies in the implementation of the Scheme especially in the area of identification of beneficiaries, area of specific viable projects and providing training in Entrepreneurship Development, verification of units established under the Scheme.

2. Objectives of the Scheme

The main objectives of the scheme are as under:

(i) To modernize Coir Industry by adoption of modern technology in production and processing of coir and coir products;

(ii) Upgradation of the production and processing technology for improving the productivity, quality and product diversification;

(iii) To increase the efficiency and productivity for enhancing the earnings of the workers engaged in the sector;

(iv) To enhance the utilization of coconut husk and for increasing the production of coir fiber and coir products;

(v) To generate employment in the rural areas of the coconut producing States/Union Territories

(vi) To provide more employment opportunities for women in the rural sector for gender empowerment;

(vii) To enhance the socio-economic conditions of the producers/workers engaged in the industry;

(viii) To contribute to inclusive growth of vulnerable sections of beneficiaries especially those belonging to Scheduled Castes (SC), Scheduled Tribes (ST) and North Eastern Region (NER);

(ix) To give sufficient training to the rural youth of the coconut producing States with an eye on attracting them to the fold of coir sector.

(x) To provide backward/forward linkages to the unit holders to whom assistance is given under the Scheme.

3. Quantum and Nature of Financial Assistance

Level of funding under Coir Udyami Yojana

Beneficiary's contribution (of project cost)	Bank credit	Rate of Subsidy (of Project Cost)
5%	**55%**	**40%**

Note: Maximum admissible cost of the project is Rs.10 lakhs plus working capital, which shall not exceed 25% of the project cost. The banks shall consider composite loan instead of term loan to cater to the working capital requirements also. This should be exclusive of Rs.10 lakhs limit proposed. However, subsidy will be computed excluding working capital component.

Entrepreneurship Development Programme (EDP)

The objective of EDP is to provide orientation and awareness pertaining to various managerial and operational functions like finance, production, marketing, enterprise management, banking formalities, book keeping etc. The EDP will be conducted by Coir Board either directly or through the nodal agencies approved by the Coir Board or Ministry of MSME,

Rural Development and Self Employment Training Institutes (RUDSETI) reputed NGOs, and other organizations / institutions, identified by Coir Board from time to time. The duration of the EDP shall be 5 days. EDP will be mandatory for all Coir Udyami Yojana beneficiaries.

Budget for EDP Charges to the Training Centres : An amount of Rs.2000/- per trainee for a period of 5 days towards course material, honorarium to guest speakers etc. is admissible under the Scheme. Coir Board will reimburse the expenditure to the training centres / institutes chosen for the purpose.

13.3 Reputed NGOs/organizations will also be identified for extending handholding support to the beneficiaries for availing the loan from the Banks under the scheme and setting up of the units.

Awareness Camps

Coir Board will organize awareness camps in the coconut producing states to popularize Coir Udyami Yojana and to educate potential beneficiaries about the Scheme. The awareness camps will involve participation from the men and women, engaged in coir sector, with special focus on special category i.e, SC, ST, OBC, Minorities, and Women etc. The requisite information / details in this regard will be obtained by Coir Board from DICs, State Level organizations like SC/ST Corporation, reputed NGOs, and Nodal Agencies etc. From the awareness camp the beneficiaries will be short listed and sent for training.

Mandatory activities to be undertaken in the awareness camps

i) Publicity through banners, posters and press advertisements in local newspapers etc.

ii) Presentation of the Scheme by Coir Board officials

iii) Presentation by Lead Bank of the area

iv) Presentation by the successful Coir Udyami Yojana entrepreneurs

v) Press Conference

vi) Collection of data from the potential beneficiaries which will include information like profile of beneficiary, skill possessed, background and qualification, experience, project interested etc.

vii) A shelf of projects in coir activities prepared by Coir Board will be circulated for consideration under Coir Udyami Yojana to the implementing offices of the Board, Banks, DICs etc. Further inclusion of the projects will also be made by the Board in consultation with DICs, Banks, other stakeholders etc. Beneficiary will also have the freedom to prepare coir projects as per their requirements. The projects prepared by the beneficiaries will be considered after analyzing the viability of the project.

viii) Marketing support for the products of Coir Udyami Yojana units through the marketing outlets of Coir Board may be provided as far as possible. Coir Board reserves the right to provide such support based on quality, pricing and other parameters from time to time.

All India final estimates of Area and Production of Coconut - 2015-16

	States /Union Territories	AREA ('000 Hectares)	Production (Million nuts)	Productivity (Nuts/ha)
1	Kerala	770.62	7429.39	9641
2	Tamil Nadu	459.74	6171.06	13423
3	Karnataka	526.38	5128.84	9744
4	Andhra Pradesh	103.95	1427.46	13732
5	West Bengal	29.51	373.58	12658
6	Odisha	50.91	328.38	6451
7	Gujarat	22.81	312.68	13706
8	Maharashtra	22.75	271.24	9775
9	Bihar	14.90	141.38	9489
10	Assam	19.73	132.59	6720
11	Chhattisgarh	1.85	30.54	16508
12	Tripura	7.20	29.51	4097
13	Nagaland	0.33	2.67	8091
14	Others	52.80	388.13	7351
	All India	**2088.47**	**22167.45**	**10614**

Source: Horticulture Division, Dept. of Agriculture & Cooperation, Ministry of Agriculture & Farmers Welfare, Government of India.

World - Area, Production and Productivity of Coconut in Major Coconut Growing Countries - 2014

	Countries	AREA ('000 Hectares)	Production (Million nuts)	Productivity (Nuts/ha)
1	Indonesia	3610.00	16354.00	4530
2	Philippines	3502.00	14696.00	4196
3	India	2141.00	21665.00	10119
4	Srilanka	440.00	2870.00	6523
5	Brazil	251.00	2919.11	11630
6	Papua New Guinea	221.00	1483.00	6710
7	Thailand	206.00	1001.00	4859
8	Mexico	169.00	1118.75	6620
9	Vietnam	159.00	1245.59	7834
10	Tanzania	128.00	545.80	4264
11	Samoa	99.00	267.00	2697
12	Vanuatu	92.00	415.11	4512
13	Malaysia	88.00	653.00	7420
14	Mozambique	81.00	244.06	3013
15	Fiji	62.00	200.00	3226
16	Myanmar	48.00	509.18	10608
17	Solomon Islands	38.00	100.00	2632
18	Ghana	27.00	380.38	14088
19	Jamaica	15.90	98.50	6195
20	Others	818.10	3070.89	3754
	World	**12196.00**	**69836.36**	**10345**

Source: Asian and Pacific Coconut Community (APCC) Statistical Year Book 2014

Area, Production & Productivity of Coconut in India

Year	Area ('000 ha)	Production (Million nuts)	Productivity (Nuts per ha)
1971-72	1088.4	6123.7	5626
1972-73	1099.2	5997.2	5456
1973-74	1102.0	5850.6	5309
1974-75	1116.3	6029.6	5401
1975-76	1069.9	5829.4	5449
1976-77	1074.5	5765.3	5366
1977-78	1056.5	5412.6	5123
1978-79	1055.0	5729.7	5431

1979-80	1075.8	5662.0	5263
1980-81	1083.3	5942.0	5485
1981-82	1090.8	5939.9	5445
1982-83	1149.2	6356.1	5531
1983-84	1165.6	5807.9	4983
1984-85	1183.3	6912.8	5842
1985-86	1225.6	6770.3	5524
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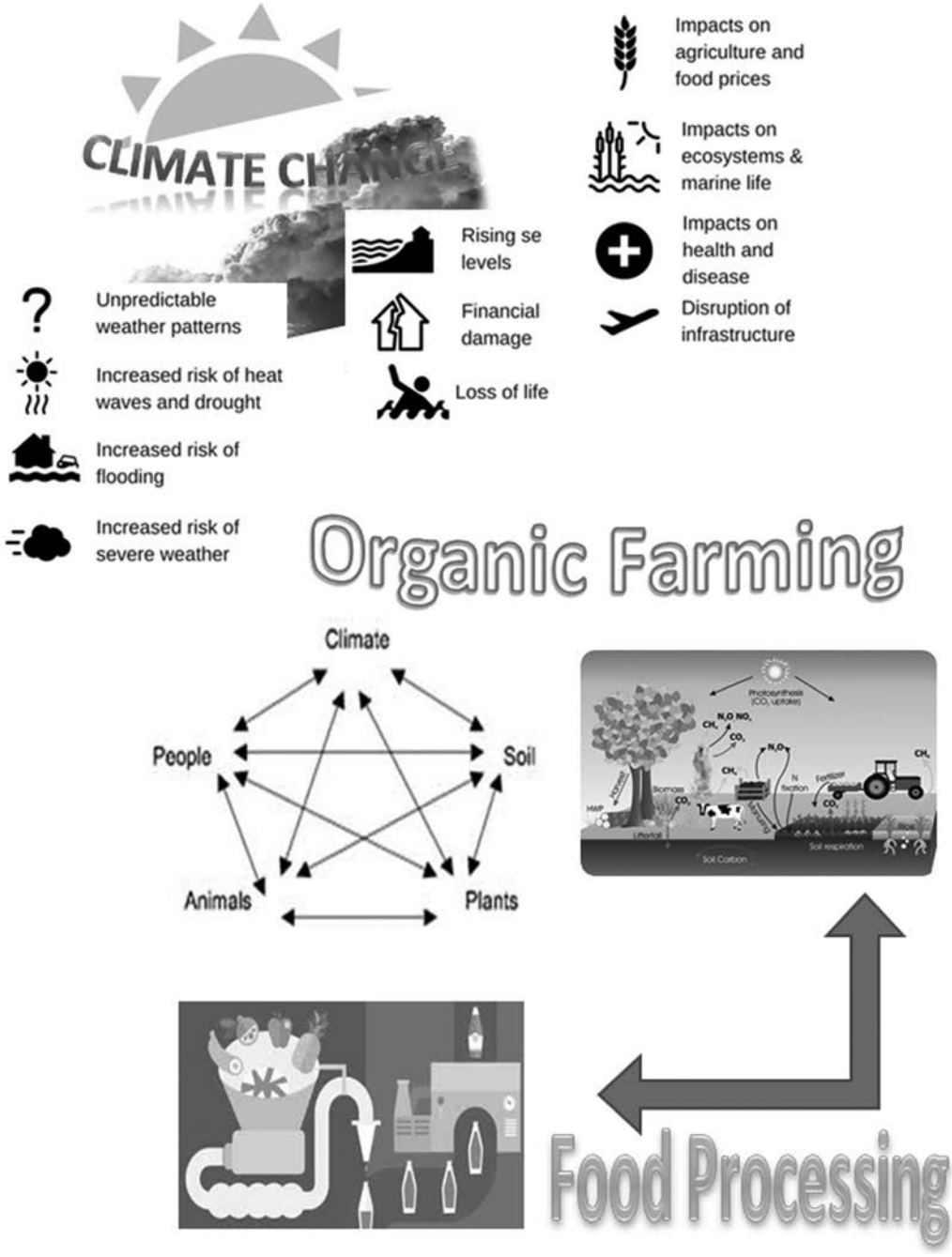
Source: Horticulture Division, Dept. of Agriculture & Cooperation, Ministry of Agriculture, Govt. of India.

FOOD PROCESSING, ORGANIC AGRICULTURE & CLIMATE



A STUDY OF FOOD PROCESSING : THE ESCALATING INDIAN INDUSTRY

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ABSTRACT

Indian sustenance handling goes for purchaser comfort; with push from government for private support is transitioning. The sustenance preparing industry is transitioning it is positioned fifth among ventures of India. Almost, 33% of the whole Indian nourishment piece of the pie involves prepared sustenance. With approach measures from the legislature, the sustenance handling Industry represents 13% of the nation's fares. The business' size is assessed at US $ 70 billion; including US $ 22 billion of significant worth included items. Indians spend half of their family unit consumption on nourishment things at display. The business would make 9 million work openings from the current 1.6 m and speculation of Rs 1,50,000 crore in the coming 10 years.

With more than 1 billion populace and 350 million in number urban white collar class and changing sustenance propensities, the handled nourishment advertise is promising a gigantic potential to be tapped.

Keywords:- Indian, sustenance, nourishment, approach.

Introduction:-

Indian sustenance handling goes for purchaser comfort; with push from government for private support is transitioning. The sustenance preparing industry is transitioning it is positioned fifth among ventures of India. Almost, 33% of the whole Indian nourishment piece of the pie involves prepared sustenance. With approach measures from the legislature, the sustenance handling Industry represents 13% of the nation's fares. The business' size is assessed at US $ 70 billion; including US $ 22 billion of significant worth included items. Indians spend half of their family unit consumption on nourishment things at display. The business would make 9 million work openings from the current 1.6 m and speculation of Rs 1,50,000 crore in the coming 10 years.

With more than 1 billion populace and 350 million in number urban white collar class and changing sustenance propensities, the handled nourishment advertise is promising a gigantic potential to be tapped. A joint report by CII and air conditioning Nielsen (statistical surveying firm), to comprehend request drivers for prepared sustenance delivers the changing Indian feast designs: Working lunch is by all accounts supplanting ordinary dinners in the day, with a requirement for simple bundling. Also, the investigation says, Indians will spend on worldwide foods. Multi-cooking eateries are mushrooming even in little urban areas and towns. This reasons the variety of outside financial specialists coming to India which is driving the development of the business. Like speculations to offer Indians the genuine taste of Italian pasta; combinations from Emilla Romagina are taking a gander at real Indian urban areas to set up Italian sustenance handling plants. Latest one was the proposition from West Midlands of UK to the Service of Nourishment Preparing Enterprises of India. Other remote sustenance organizations like McDonald's, Pizza Hovel, Cadbury's, Tropicana, Pepsi, Coke, HLL, Settle, and so on are as of now procuring immense returns by preparing Indian nourishment for household and worldwide markets. Other than remote Speculators, sustenance handling division is a noteworthy fascination for Indian corporate houses to contribute. Dependence, Godrej, Bharti, ITC, Legend, Ballarpur Ventures, DSCL, Goodbye and Mahindra and Mahindra are conspicuous corporate houses are with end-to-end incorporated operations in the natural way of life.

Nascence of Food processing :-

India is the world's second biggest nourishment maker. However commitment to Gross domestic product is just around 20%, in spite of 60% of Indians utilized in farming related exercises. This is attributable to inappropriate

esteem expansion of the delivered nourishment. With upwards of 20 agro-climatic zones and different soil sorts, a wide range of nourishment sorts is delivered like - organic product and vegetable, fisheries, meat and poultry, drain and dairy, grain and oats, refreshments and buyer sustenances. The wide assortment and vast scale generation guarantee India's nourishment security and consistent fare incomes, beating the world's sustenance creation list in drain, sugarcane, tea, and dairy cattle populace. Be that as it may, the rich sustenance is showcased natural because of lacking framework; it appears that the nourishment preparing industry is still in its early stage. Just 2 % of products of the soil and 15 % of drain are prepared at introduce, regardless of rising interest for handled nourishment. Further, out of aggregate nourishment created in India, scarcely 7 % is prepared, contrasted with China's 23%, or 188% handling in the UK sustenance part. Such generally low level of sustenance preparing is because of deficient saving methods and production network framework. The misfortune from lacking chilly stockpiling is 37% of yearly sustenance generation which is justified regardless of a giant Rs.30, 000 to Rs. 40,000 crore. Other than foundation issues in products of the soil handling, insufficient framework for meat preparing (fish, poultry and dairy cattle meat preparing) likewise exists. Additionally an enormous an overwhelming test is to meet the world's fundamental quality benchmarks of wellbeing and cleanliness models like Sterile and Phyto-Clean (SPS) principles and Vapor Warmth Treatment (VHT) particularly to fabricate the fare potential. This needs sorting out the meat handling industry to hold fast to present day, logical procedures. To defeat the framework lack the business needs a venture of US$ 28 billion. Shockingly, the greater part of the Indian agriculturists are little holders; their normal ranch estimate is 1.6 hectares, and agriculturists are connected with exploitative middle people in the evolved way of life who can't put resources into nourishment handling units either. There an extreme need to incorporate the cultivating with the sustenance preparing.

Finding the Missing Links:-

Earning profits through food processing comes from an efficient backward and forward integration. Even though value addition begins at the post harvest level it needs critical integrated efforts of both pre-harvest and post-harvest functions. In this context Prof. Sukhpal Singh, professor IIMA says -"The stakeholders are expected to face this challenge on a- priori level, because success of food processing industries depends on nature of the produce and the type of processing involved. Integration begins with procurement of such superior quality of seeds". That is because traditional Indian seed varieties do not yield enough pulp content vital to undergo processing. Since the farmers are short in financial and technical abilities: the quality of food produced doesn't meet the required processing standards. They find it hard to link their farming activity with food processing and are unable to reap rewards of value addition. If there must be a way out to the grim situation, then it is finding an end to end link in the food chain. The government has offered opportunities for FDI and private participation: a right direction for the industry's promotion. The outcome of 100% equity from foreign investments, for a majority of processed food items can be seen from the 105 FDI proposals worth Rs. 640 crore approved by the government in last three years. Private companies can integrate the food chain with supplying quality seeds to farmers who get back their fair-share of returns, and the companies can process the food linked to hypermarkets with efficient supply chain infrastructure. Like the successful initiative taken by PepsiCo, which was one of the first to initiate integrated food processing. Initially the tomatoes from the Punjab farms did not meet the standards for making ketchup; neither a logistically efficient nor any procurement model existed. Pepsi had to integrate the farming (supply of superior tomato) activities with the processing infrastructure and only then start the tomato-processing plant in that area. This and other successful experiences are evidences for the government to invite integrated efforts in the food chain by private hands.

Government's Initiative:-

Food processing has been declared as a priority sector. The National Food Processing Policy has been revised for an integrated approach in 2004-05, to facilitate speedy

growth. The aim of the policy is to simplify procedures to comply with the need and growth of the sector. Under infrastructure development, Agro-Food Parks are identified in various Indian cities. Proposals to set up 20 Mega Parks and 50 Food Parks adopting the French Food Park as a model are undertaken by the Ministry of Food Processing Industry. Tapping the industry's export potential is one of the major concerns. Presently, current exports of Indian processed food are worth Rs. 2500 billion. Agri- Export Zones (AEZs) are earmarked with nearness to highways, airports and marketing centers from the areas of food processing. The Policy urges private companies to grow process able varieties under contract farming. Under the AEZ scheme, state governments and private firms are entitled privileges of Special Economic Zones, like tax holidays up to 10 years and duty free imports of capital-goods to set up processing units. To provide financial credit without any bottlenecks NABARD in the present plan is given with a corpus of Rs. 1100 million in single window clearing. This loan is for setting up new unit or to modernize an existing food processing units. Further, the government will give 25 % subsidies for Greenfield projects up to the corpus of Rs 100 crore for Mega Food Parks and up to Rs.105 crore for Food Parks. For holistic approach, R&D initiatives to work on emerging challenges of the food processing technology and food engineering are underway. The industry's revenues can be increased if quality rules of SPS, VHT and the Codex international standards are approved. The Thanjavur paddy processing center will be added to the nationalized list of research institutes. Likewise, Indian packaging Industry is working on low cost and competitive packaging solutions. Packaging costs, 20-70% of processed food.

Growth Potential:-

Over the past decade money spent by Indians on ready to eat food outside home, has more than doubled. While 5 billion USD is spend on ready to eat food this year research estimates it to double up in over five years. This year, the growth in sales (domestic and export) of processed food is more than 150 %, most remarkable are the two sectors which showed remarkable growth in sales. Processed Poultry's sales grew by 64%, and spirits and beverages by 75%. Food process outsourcing is presenting good prospects in multi cuisine hotels and restaurants abroad for processed or semi-processed Indian seafood, dairy and Indian curries. 'Made in India' brands like Amul Dairy, Cobra Beer, Bikanervala Foods, MTR Foods, ITC's Kitchen of India, Satnam Overseas' Basmati rice are finding prime global retail shelf-space. Convenience, variety and health issues are key drivers for quality of packaged food. With clear demand in the future if India can harness its production to the quality its dream to become the world's food basket is sure to come true.

Make in India in food processing sector :-

The Make in India event in Mumbai resulted in an investment commitment of Rs 15.20 lakh crore, half of which will be in Maharashtra. In the week one could see very well-organized commercial event and B2B meetings. There was special emphasis on food processing sector with one hall dedicated for the sector. Ministry of Food Processing, CII and NIFTEM were key organisers. One of the outcomes of the event is that it has established the fact that Indian food processing industry has huge potential for investment and this sector saw huge enquiries. With favourable policy initiatives of Government of India, India beckons to become food basket of world in the coming years. India could be next destination in the world for 'Invest in India in food processing sector'.

Conclusion:-

The food processing industry is of enormous significance for India's development as it has efficiently and effectively linked the nation's economy, industry and agriculture. The linking of these three pillars has synergised the development process and promoted the growth of the nation to a great extent. The food processing industry is one of the largest industries operating in India and is divided into several segments. Government of India has identified food processing sector as one of the key sector for Make in India and thus Ministry of Food Processing Industries is focusing on growth of this sector. Till now India got 42 mega food parks with allocated investment of Rs 98 billion.

Mr. Anshuman Das

I Do Not Want Organic Market – A Monologue

Mr. Anshuman Das

He currently works in Welthungerhilfe, aninternational development organization.

I remember, as a child, my grandmother used to fry paddy seeds on a pan-full of hot sand to make puffed rice – small, yellowish white, popping up like magic seeds in the pan. It was mixed with dry-fried ground nut, fried safflower seed – which made a wonderful evening snack that day. I cannot recall when the urea soaked puffy milky white puffed rice replaced that.

I remember very small sized unknown varieties offish during rainy seasons, collected by small kids and even by elderly ladies from the rice fields or unnamed streams, which were available aplenty in the local market.They were delicious when cooked with mustard sauce or was wrapped in bottlegourd leaves and steamed. I can't recall exactly when those were replaced by frozenMajor Carp injected with formalin.

I remember, going to the market with my father. My father was never asking about whether the vegetables were 'organic' or not. For the last 10 years, and more rapidly in the last 5 years, one needs to go to the shopping malls to buy organic vegetables which is costlier compared to the vegetables available otherwise.

These are not stories, this is Real. These are real for, perhaps, many of us. It is now that we get tomato all through the year, cauliflower in summerand only 2~3 varieties of rice, atta as white as maida.We have more than 50,000 edible plant species in the world, but only a few hundred contribute significantly. Just three of them, rice, maize and wheat - provide 60 percent of the world's food energy intake! How come, despite great progress in increasing productivity in the last century, nearly 800 million people remain chronically undernourished? And India, with so called success with green revolution, still ranks 100thin hunger index among 119 countries in 2017? How come the then Agriculture Minister had made an excitedstatement in 2012 that agricultural exports have jumped nearly 56 percent? While on the one hand India is pushing its agricultural exports, on the other hand, in India, a number almost equivalent to the entire population of America, go hungry to bed. It is a strange paradox of plenty.

Let us set aside this larger socio-politico-economical debate about the country. What about, I, as a middle class consumer or I, as a small farmer in a village, want the market to work for me?

Organic – what is it?

And we have a recent buzz word – 'organic'. Let's dig deep into it.

- Organic is costly in the shopping malls. Should it really be costly?
- If it is grown by no chemical inputs (fertiliser/pesticide) - is it really Organic?
- Is Organic to be grown only for cities and export markets?
- Is certification needed for Organic products?
- Is Organic tastier?
- Can we be healthy if we eat, drink only Organic?
- Are the farmers getting the share of the profits made by the shopping malls?

Answers, of all the above questions is NO!

The idea that Organic farming is merely 'replacing chemical fertilisers with cowdung', is primitive. ORGANIC Farming with underground water, composts/ vermicomposts brought from market, soil used from unknown sources, use of mechanical devices like water pump, use of tractors run by non-renewable energy, hybrid seeds from market – is NOT Organic farming. Organic farming run as a contract farming practiced by corporate bodies with monocrop, acres after acres, is NOT Organic farming. Market driven cash crop farming with vermicompost is NOT Organic farming. Organic produce travelling huge distances on a carbon emitting vehicle is NOT organic.I prefer to use the word 'ecological' farming

instead of organic farming – only because, not all in the name of organic farming is socially just, ecologically sustainable and economically fair.

Are we enquiring these before buying as a consumer?

Ecological farming which focuses on sustainable techniques, self-sufficient in input by recycling agro waste is actually less costly (to the farmer and to the environment - and here I am not talking about a fancy small but rich farmer, in the fringe of urban settlement, growing yellow capsicum for five star customers). But the farmer should get a better price as she is spending more time and she is doing an ecological service to the earth. But when we buy products from the market, are we sure that the farmers are really getting back their investment? Most of the 'organic' products we buy from the shopping complexes are company produced, not from small and marginal farmers.

Small and marginal farmers are still practicing ecological farming.Smallholders play the most important role in world nutrition security and biodiversity conservation as they produce the bulk of all food in developing countries, including 70% of all the millets, tubers, fruits and vegetables. But with huge pressure from the government and tricky marketing strategy of the seed and fertilizer companies, they are slowly converting to non-ecological practices. Are we are concerned about their livelihood and our health as well, OR are we happy with organic apples coming from Newzeland? Are we content with the spices with a stamp of ORGANIC on it which has high certification cost and we are paying for it when we are buying. Why do we burden our small farmers with certification process?Have we ever thought that actually the products which are grown with chemicals should carry a 'danger' sign? Have we ever thought why there are subsidies for polluting the world with chemical fertilisers? Why is there no incentives for farmers growing food ecologically? Have we ever looked into the truly ecological products, perhaps, an old vegetable seller with few assorted products from her garden,selling in one corner of the market?And yes, ecological food is tasty, if it is fresh. With preservatives and a climate- unfriendly tetra packaging– however tasty and long lasting be it, I will not consider it to be Organic. And if you are not following a lifestyle which is sustainable, which is climate friendly – eating Organic produce will not save you from being sick.

Can we become a responsible consumer?

Let me re-write the title. I don't want ORGANIC market, which are usually seen and advertised in the media. We need something else.

What is it?

What is MY type of market

I need a market which has fresh local products. Which has not been doused in chemical colours or toxic elements to look fresh. I am aware that the leafy vegetables get dry if it is kept out for long, or all the brinjals might not look exactly similar if they are local variety. I do not expect tomato in summer. I tell myself to eat only seasonal vegetables. For this, I need to talk to the farmers, and sometimes visit their farm, if possible – so that it helps in growing a sense of trust between the producer and the consumer. So, I do not care about certification. I also want to know clearly, what am I paying for – how much it is for transport, how much for production and how much for packaging (I would prefer a healthy drink from a green coconut paying 10 Rupees extra, than consume a sugar loaded cheaper bottle of fizz drinks, which spends 70% on packaging cost and, maybe, another 28% in advertisement).

Is it very difficult?

Yes it is, if the market is very far from the point of origin of the product. However, for semi-urban market, where farmers are nearby, it is not very difficult – farmers' market in weekend is a common practice in many European cities. So it is the transport which makes it difficult. But it is probably not required to transport all the products all the way from Nainitaal to Nasik.

The food habit of a particular community depends on the ecology of the location - people are used to the food which grows in that particular region. That's how people in Bengal are fond of fish and people of Rajasthan are not. This was the situation about 100 years back. But now, we are in a globalisedmonoculturised era, and

we are used to having the same food everywhere. We would like lobster curry in Rajasthan and have apricots in South Bengal.

Food was never just rice or wheat. We were also used to consuminglarge varieties gathered from the common properties like river, forest, grazing land etc. I am aware, that if I want to have apple from Kashmir – then I have to pay more. But as a consumer, I want to get the logic clear for the price. I want the detailed pricing logic, themovement of product and ingredients reflected in the packet clearly. But, do we know how to read a food packet?

And then there are problems of middleman, taxation on the product and the transport of food product – which are beyond our control. But, actually, as demanded by the present government, the current taxation has been reduced for food and food transportation. Are we aware of that? Are we able to challenge the market with that knowledge when we buy a product?Can we bring more understanding about food beyond our plate?

Can we become an aware consumer?

How is 'market'at the farmer's end?

Small holder farming is mostly subsistence in nature, growing for their own family. But this idea also has changed in this era – a farmer now grow rice to sell rice to buy rice. The diversity of farm has almost come down to 2~3 crops throughout the year. Farmers hardly keep accounts of expenses – they fear market, they fear calculation. They are happy if someone takes the product from their door step, even if in 1/3rd of the market price. Middlemen play an important role in the entire process. There are very few value added products which go to the market – for example, they sell mustard, not the mustard oil. Advance selling of farm-products directly by the farmers, often when the price is lowest in the market, is also very common. There is no farmers'organization locally to deal these issues. Small farmers have limited access to capital and credits.While the industrial scale monocultures have more capital, energy, policy support and subsidies at their disposal. Poor infrastructure, and insufficient transport systems play a vital role for small farmers' poor access to market and getting a low price.

Can we assist farmers to become an enterprenuer? Can we make them understand what we, as customers, are looking for? Can farmers create Common Facility Centres for primary value addition in the village itself, so that the by-product remains in the village itself (for instance, processing mustard oil, so that the cake can be used as fodder) and the value chain is pulled down to the village? So that farmers can play a larger role beyond only the supplier of the raw products in the value chain with lowest profit margin?

There are many schemes to facilitate this, like SFAC, but successful examples are few. As consumers, we cannot agree to buy a soggy product which is not well packed, aggregated, cleaned or handled hygienically.In most of the cases, small holder products, if there is any, are not up to the market demand. Quality is not maintained and there is a failure in continuous supply. It remains, most of the times, anexample of project driven exercise. When we invest in business, when we buy shares, can't we invest on such rural sustainable business? Can we also think of an idea of small holder brand - as opposed to the monopoly of food companies? Can consumer and producer connect each other to bring in more transparency in food value chain?

Can consumer and producer understand each other?

60% of Indians are farmers, even they are also consumers. Their food sovereignty can be created by self-sustained diversified family need based production system. A larger 'produce locally-market locally' idea, which will have less of extra price added to food over the cost of production, can be tried out at block level by mapping food demand, available production space and creating consumer-producer alliance. Let us not shift the debate from the 'food sovereignty' domain to the domain of 'access to food' only, while talking about consumption in the rural areas. The 'access' often creates further dependency on the system.

It is high time, we try to mould the market as a responsible food producer and consumer, else we will have to put up with what the market feeds us – be it puffed rice with urea or frozen fish with formalin.

Mr. Nitin Shende

Organic Farming - Need of Future ....

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India is one of the largest agriculture producer countries in the world. Approximately 50 % of population is engaged directly or indirectly in agriculture. If we compare population involved in agricultural sector with agriculture GDP, then ratio has not shown any improvement in last many years, which need to be studied to improve productivity and efficiency of sector.

Indian agriculture has its own challenges such as low Illiteracy rate in population engaged in agriculture, marginal land holding of farmers, lack of scientific and technical knowledge, large geographical spread, uncertainty of market, climate change, agricultural policy implementation etc.

To meet the demand of quality and residue free food is a major challenge in the world. Population consuming food, which has residue of pesticide, fertiliser and chemicals used to improve shelf life of fruits and vegetable are generating hazardous effects on human health. This is one of the bigger challenges like pollution and climate change. This will require corrective action with immediate effect.

To meet required food demand of country and to be self-sufficient in food, India needs to fix up a long term goal and to implement corrective action to bring about a revolution in this sector. It is not only about meeting food demand of country but its need to provide qualitative and quantitative residue free agriculture produce to every Indian, which will make country healthy.

Today there is need to implement sustainable farming practices in India. If farmer wants to adopt this practice then he has no alternative but to adopt organic farming practices. Developing organic farming or implementing organic farming practices on farm requires minimum 4-7 years of continuous effort by farmer. Organic farming is not only practice; it is reestablishment of micro ecosystem and food chain at farm. This ecosystem works on its own, natural adoption enhances the performance of flora and fauna to boost crop productivity. Ecosystem develops good health of soil and crop to improve immunity levels which keep diseases and pest away from the crop. We can also increase the water holding capacity of soil by increasing humus in soil. Maintaining Carbon to Nitrogen (C:N) ratio is very important to increase the biological activity of microorganisms. Desired activity of microorganisms increases the

decomposition rate of crop residue with minimum time. This makes quick availability of nutrients to crop.

If we avoid human interference and allow nature to work on its own then it will build its own ecosystem, which will result in to qualitative crop yield. Farmer must act as observer to such ecosystem and provide support whenever it is required. This will save farmers time, and this saved time can be used more effectively in skill development, training and education.

We do organic farming. Our farmer group has experience of 30 to 35 years in organic farming. We grow cereals, pulses, fruits and vegetable. Our crop yield is satisfactory with zero expenditure on seeds, pesticides and fertilizer. We use improved variety of seed, bio pesticides and bio fertilizers. Our organic cultivation practice gives us improved quality and residue free yield. Improved quality of agricultural produce will give better shelf life. We are currently working on setting up a marketing system which will help us to market our organic produce in metros. Research is also going on to do value addition to organic grains, pulses and fruits. Value addition to organic produce will increase profit margins of farmers.

Our collective efforts in this sector have helped us to gain momentum and build a strong confidence in organic farming. Nurturing idea of organic farming will build healthy India; let's make our nation as self-sustainable as possible in 'Organic Food'.

Mr. Kulaswami Jagannath Jena

Women in Agro-Ecological Farming: A Self Reliance Path Towards Food Security & Sovereignty

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A woman farmer observing the flower of maize

Agro-ecology is used as strategic application to amplify diversified agro-ecosystem. Agro-ecological models have produced impressive economic results in terms of yields, productivity, nutrition and efficiency. It also makes a significant contribution to food security and sovereignty. Monoculture is replaced by biodiversity, and women farmers have an equal status with men in agro-activities.

Southern-Western Odisha is largely agro-economy based region which is bequeathed with natural resources where 75-80% people depend on agriculture. But it is brazened out the climatic challenge that annually pretenses threats to food, livelihood and ecological security of tribal communities. Due to hasty environmental degradation, deforestation, and challenging climatic conditions the food production and income has been affected severely throughout the year in the concerned region. The small tribal farmers of Rayagada and Kalahandi districts in Odisha have shown the path of self reliance over the years of steady exercise of right to land, water, and forest to define their own food system to ensure food sovereignty. Agragamee – a pioneer NGO of Odisha has promoted family and community based agro-ecological models of food production, in practice and in order to help tribal people's food security and food sovereignty.

The tribal communities in southern-western districts of Odisha have developed their livelihood systems which result in a cultivation of a wide range of products including a wide variety of cereals, millets, pulses, oil seeds and tubers as well as fruits. Their practice of diverse crops under integrated farming system in 1 acre of family farm has not only helped them to ensure food security but also to move a step ahead to attain food sovereignty. Moreover, it has provided a sustainable path of livelihood and food security even in the times of worst droughts and famines. The practice of shifting cultivation, which was once a form of cultivation, has now harmonized with the ecosystems in its steady rhythm of mixed-cropping. The Kondhs, Jhodias and Parajas of these regions have reigned supreme and become self reliant and independent.

Journey of Model Eco-Village

Fruit-bearing trees like mango, cashew, litchi and guava have been introduced as part of promoting horticultural species along with forest species. These plantations were taken up on slopes above 30 degrees. Using sophisticated equipment, land survey and settlement processes

Model Family Farm at Kukudagad village in Kshipur Block, Rayagada District

were conducted in 150 villages in 3 blocks. Soil conservation measures have been undertaken, like trace bunding and vegetative bunds on the hill slopes, checking gully and ravine formation through appropriate drainage treatment.

By the end of September 2017, more than 6500 households have been adopting Family Farming. As a result, between the 2013/14 and 2016/17 seasons, there was a 120 percent increase in the land on which Family Farming was being practiced. Typically, most cereals and legumes grown in these areas are consumed in the household, while the surplus generally is sold to support household income and look after children's education and their health expenses. In 2010, total 117000 fruit plants had been planted by 1800 farmers. This crop combined with the sale of surplus cereals and legumes, will eventually enable these small farmers to purchase their own inputs, thus eliminating their need for external support.

Key Impacts of Agro-ecology:

It has been proved that agro-ecology is an organic solution for making profit by increasing agro-production for small farmers. Let's overlook the journey how agro-ecological methods contribute to a farmer's income and better health underlining the significance of harmony with environment.

Livelihood Security and Sustainable Path of Economy

The agro-ecological practices have been largely enhancing the income of small farmers. They have ended up taking loans for the investments on capital, chemical fertilizers, land and water etc. Now, they are not depending on external inputs. Innovative irrigation practices with small size of land and bio-inputs are self-made from farm resources. In case of crop failure, the farmers are no more crippling in indebtedness. Agro-ecology is certainly a proven model to reduce the magnitude of farmer's suicide. The small farmers have been taking up animal rearing as income generation activity. Total 1500 farmers in 150 villages were encouraged to save more money to buy more livestock, land, and enhance irrigation systems, which added sustainable income opportunities to ensure livelihood security.

Benefits of Agroecological Practice

The small farmers have been benefitted by agro-ecological practices to increase the production of crops and restore soil balance.

A woman farmer is harvesting pearl millet in her family farm

Agroecological Practice	Benefits
Zero Tillage Farming/Natural Farming	It improves soil fertility including freshening, water permeation and retention capacity with organic matter.
Integrated Nutrient Management	Using vermin compost, pit compost, liquid manure, green manure and nitrogen fixing crops reduce the use of chemical fertilizers.
Innovative soil and water conservation	Reduce soil erosion, increase soil fertility and moisture retention through trace bunding, trench-cum-bund and necklace bunding etc.
Inter-cropping and Mix-Cropping	It increases the productivity and production of the soil and crop respectively. It also gives the farmers a healthy return during the gestation period.
Integration of livestock with crop	It allows high biomass output and maximum nutrient recycling and strengthens the economy through livestock rearing.
Seed-Cum-Grain Banks (SCGBs)	The SCGBs reduced the dependency of farmers on unscrupulous moneylenders and the market which led self-sustainability thereby enduring recurrent climate change and enabling food security.

Change Makers Show the Way of Reclaiming of Diverse Food System:

Over the years, the work of the Mahila Mandals (Women Groups) in 65 villages has resulted in 2275 acres of fallows reclaimed, and one million kilograms of extra food produced every season. 2000 employment days have been created per village with 40 person days employment generated per acre. Alongside the extra fodder generated, is worth 6,000 cattle and 1000 extra meals per family. Overall this implies increased fodder, increased livelihoods and increased wage income incorporating the principles of food sovereignty. The Mahila Mandals continue their effort toward ascertaining food sovereignty in their villages and also convince neighboring villages for the same.

A woman farmer is harvesting ride gourd

Sumani Jhodia : The Change Maker of Sustainable Development

Sumani Jhodia, a sixty two years old woman belongs to Jhodia tribe of Siriguda village of Kashipur block in Rayagada district, Odisha. Earlier Sumani Jhodia was practicing shifting cultivation on hill slopes. She was growing ragi and paddy for the consumption of her family. But the condition of her family changed when she practiced the methods of agro-ecology for several years now.

Sumani Jhodia has been practicing multiple cropping for food security. Mixed cropping has helped the crops to grow better in just under a year. The bigger problem that she faced was water supply, an issue faced by her entire village. To trigger the said issue the youth and old farmers came together to dig channel to get the nearby stream water to their farms. Now, the channel holds the rainwater above the ground and recharges ground water as it seeps down. This ensured irrigation for their farms

Sumani Jhodia howening mix-cropping of okra maize pumpkin

throughout the year, even in the absence of rainfall.

She smiles with satisfaction: "I grow many vegetables and fruits on my farm now. We make our compost here and have good water supply. My grandchildren will not face hunger like us and have healthy food to eat. Now, I have sustainable source of livelihood for me and my next generations."

Now she grows vegetables, fruits and raised nursery with six varieties of mango sapling. She sells the said products at the local market of Kashipur. In 2016 she had raised 6000 sapling of over six varieties of mango and has already sold 4500 grafted plants in 2017 @ Rs. 25/- of total Rs. 1,12,500/-. Her family now has food supply all year round. The village seed cum grain bank has stored supply for three years for the entire village of 62 households.

Conclusion :

Agro-ecology is becoming a promising agricultural practice for small farmers. This technique not only aims for the sustenance of small farmers but also resists the corporate agriculture model pushed through the green revolution and gene revolution. The small tribal farmers proved that food security cannot be achieved without taking full account of those who produce food. Any discussion that ignores their contribution will fail to eradicate poverty and hunger. Food is a basic human right. This right can only be realized in a system where Food Sovereignty is guaranteed. We don't need to produce more food to end the world hunger. We need to create an equitable food system for the people who actually produce the world's food. Small farmers need more access to land, water, forest, and basic infrastructure services, rather than GMOs, large scale agriculture, or global markets. The journey has already begun and it is quite visible amongst the small farmer's gleaming face, health, household economy, and diverse nutritious food items in their food basket!

A woman chuckles in Development of Commons

Adapting agriculture to climate change by local communities: Evidence from Dhule and Ahmednagar villages

Ms. Anuradha Phadtare

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Agriculture is the major land use across the globe as well as in India. As per the latest available land use statistics (2012-13), out of the total land mass of 328.73 million hectares in the country, about 181.95 million hectares of land is agricultural land, which consists of 139.9 million hectares net sown area, 3.2 million hectares miscellaneous tree crops and groves, 12.6 million hectares culturable wasteland and 26.3 million hectares of fallow land.

Agriculture also serves as a major economic, social, and cultural activity, and it provides a wide range of ecosystem services. Prominently, agriculture in its many different forms remains highly sensitive to climate variability, the dominant source of the overall inter annual variability of production in many regions and a continuing source of disruption to ecosystem services. Numerous factors figure and drive the agricultural sector. Market fluctuations, changes in domestic and international agricultural policies such as the form and extent of subsidies, incentives, tariffs, credit facilities, and insurance, management practices, terms of trade, the type and availability of technology and extension, land-use regulations and biophysical characteristics like availability of water resources, soil quality, carrying capacity, and pests and diseases etc. are among the set of primary influences. Given its inherent link to natural resources, agricultural production is also at the mercy of uncertainties driven by climate variation, including extreme events such as flooding and drought. Since the last decade or so, climate change in terms of long-term changes in mean temperature, precipitation, as well as an increased frequency of extreme climate effects has gradually been recognized as an additional factor which, with other conventional pressures, will have a significant impact on agricultural productivity and cropping systems. So here deliberately we use the term "adaptation" to include the actions of adjusting practices, processes and responses to cope up with the situation by the local communities. Climate change and variability is one of the biggest global threats to agricultural production for the current and future generations. There is evidence that climate change has greatly modified the hydrological cycles, rainfall and temperature patterns in many parts of the world. The effects of climate change and variability, however, vary across regions, farming systems, households and individuals.

There is an immense diversity of agricultural practices because of the range of climate and other environmental variables; cultural,

Figure 1 : Group discussion under progress at HivareKorda, Parner

institutional, and economic factors; and their interactions. This means there is a correspondingly large array of possible adaptation options. The objectives of this article are first to outline this climate variability that is experienced by local communities, how does it impact on agriculture or cropping systems, and what are the coping mechanisms to adapt to the situation. Most important thing is to assess the benefits of adaptation and disadvantages of mal adaptive practices. Secondly, to suggest some general pathways that can help to adapt the situation in a more practical way. Accordingly, WOTR has come forward with such an effective uptake of adaptations; developed an adaptation framework to engage and to influence all decision makers, farmers, agribusiness, and policymakers that builds on the existing substantial knowledge of agricultural systems.

About study sites:

To catch different adaptation practices in various climatic risks we took different locations for similar study. We selected two villages from Parner block of Ahmednagar district and other two villages from Sakri block of Dhule district. The sub-districts fall into two distinct transitional agro-climatic zones[1]. Sakri block is located in transitional zone-II, which is a wider strip running parallel to eastern side of Sub Mountain zone, whereas Parner is located in scarcity zone, at the foothills of the mountain and is a semi-arid region. Although the western mountainous region and semi-arid area forms quite a different agro-climatic zone due to differences in the temperatures and rainfall, the monsoon, winter and summer months of the year are almost same. The average rainfall for Sakri region is 700-1200 mm, whereas for Parner it is less than 750 mm. The mean annual temperature varies from maximum of 41°C to minimum of 14-15°C in Parner. In Sakri temperature ranges from maximum of 40°C to minimum of 5°C. Focused group discussions were conducted in these four villages about climatic risks faced by communities, its impact and coping mechanisms.

Results and discussions:

Case I Sakri village:

In recent years, the Sakri region has been facing frequent weather variations like hailstones, high intensity rainfall, late onset of monsoon, cold waves, prolonged dry spells, drought and drought like situation etc. 2012 onwards they are facing drought and drought like situation and hailstones more frequently, which have a direct impact on the livelihoods of the villagers. Insufficient rains and prolonged dry spells affect germination reducing crop yields. Excessive and unseasonal rains damage standing crops, which in turn reduce food availability and wage labour availability. Particularly for the small and marginal farmers, soil erosion happens. Weather variations have increased the occurrence of disease on crops like wheat, chilly, gram, onion etc. Almost 50-60 per cent crop losses have been facing by villagers in this region in every year due to any of this climate variability. In Sakri region dominant population is Scheduled tribes. They are nature friendly and livelihoods are based on ecosystem only. But since last 10 years precipitation and temperature has been changed local communities have changed their cropping system like in past 15-20

Figure 2 : Tomato crop using drip in summer season at Hivare Korda, Parner

[1](http://mahaagri.gov.in/cropweather/agroclimaticzone.html#skcz

years. Before communities used to sow finger millet, small millet (Sava) and other minor millets enormously but today these crops having high nutritive are going to vanish. In one of the villages in this region called Chorwad earlier approximately 116 ha area came under small millet cultivation and now it reduced to 5-6 ha. Most of the farmers shifted towards cash crops and chemical have agriculture instead of organic. Due to chemical fertilizers they saw adverse impact on soil fertility in drought situation. Though agriculture is their primary occupation but does not serve sufficient income to the family due to unpredicted weather variability and other externalities like market fluctuations. So in this region almost 80 percent people migrate at the district places in search of livelihood and borrowed money from money lenders with high rate of interest whereas most of the farmers sold the livestock in distress situation. Villagers also shared that the government has provided some compensation for the crop loss; however this is less than the actual costs incurred. So in crisis situation farmers do something to cope with or to make fit the situation but some of the practices are mal-adaptive in nature. This could impact badly for long run.

Case II Parner villages:

Villages in Parner region as well facing weather variations like Sakri villages since past 10-15 years like drought and drought like situation, increase temperature in summer, less annual rainfall and limited cold days in winter etc. 2010 onwards they are facing drought and drought like situation and last 3 years they faced consecutive years of drought. This has had adverse impact on cropping system of the villagers, due to drought and drought like situation reduced crop yield, net sown area has decreased, decrease in ground water table, skipped rabi season crops etc. Less annual rainfall damages crops which turns towards non availability of wage labour, occurrence of pest attack on crops has increased. Due to increase in summer temperature soil get hardened and crop collapses like tomato and onion. In these villages approximately 30-40 percent losses happened. Although Parner falls under scarcity zone these villages have irrigation facilities like wells through which they can save crop's life. Still with this region's farmer practicing flood irrigation mostly, this can lead towards water exploitation. Interestingly, farmers revealed from one of the village called Hivarekorda that, "looking after consecutive years of drought we changed our cropping pattern and started to cultivate less water intensive crops as well as started drip irrigation method." Other village farmers revealed that they called tankers to save crop's life and over usage of chemical fertilizers and pesticides to control over the pest and diseases. This could lead towards the decreasing soil fertility and crop health. Some of the villagers migrate seasonally in search of livelihoods.

Climate Projections Of The Region[2]:

Future projections show that the months of January to March, which are said to have unseasonal rainfall in the past, indicate very low rainfall in the future. The month of June during which usually the monsoon commences, and July & August also indicate low rainfall in comparison to the past. The later monsoon month of October shows relatively higher rainfall in future projections. Rising trend in temperature may cause erratic rainfall in the monsoon and post monsoon season. Future projections also show decreasing trend in minimum temperature. The decrease in minimum temperature can lead to prolonged summer season with high temperature during monsoon seasons. The colder winters that prevail at present are predicted to change to warmer winters as the minimum temperature increases. The fluctuations in winter temperature severely affect the crop growth. The minimum temperature shows a least increase in the month of December i.e. -0.05°C in near century (2016-2030). The months of March to June show change in near century is less i.e. 1.38°C of maximum temperature.

Based on historic climate data and experiences of local communities we have also analyzed future climate projection data to create awareness of the farmers for future climate variations so that adaptation will be done easily.

The two main types of adaptation are autonomous and planned adaptation. Autonomous adaptation

[2](https://cds.nccs.nasa.gov/nex-gddp/

is the reaction of, for example, a farmer to changing precipitation patterns, in that s/he changes crops or uses different harvest and planting/sowing dates. Planned adaptation measures are conscious policy options or response strategies, often multisectoral in nature, aimed at altering the adaptive capacity of the agricultural system or facilitating specific adaptations. For example, deliberate crops selection and distribution strategies across different agro-climatic zones, substitution of new crops for old ones and resource substitution induced by scarcity (Easterling 1996). So here the following Table is an example of how farmers could come up with the planned adaptation.

Conclusion:

There is an increasing urgency for a stronger focus on adapting agriculture to future climate change. There are many potential adaptation options available at the management level that can be done at local level, often variations of existing climate risk management. However, there are as yet relatively few studies and tools that assess both the likely effectiveness and adoption rates of possible response strategies like WOTR has developed a tool called CoDriVE-PD (Community Driven Vulnerability Evaluation Program designer). Based on the results of this tool adaptation plan can be done at local level. This will also help to achieve sustainable development goals (SDGs) from the bottom up.

Climate risk	Impact	Coping strategy in crisis period	Adaptive/ mal adaptive	Alternatives
Drought and drought like situation	Reduction in yield	Change in cropping pattern, Less water intensive crops taken	Adaptive, it saves water and is cost effective	Promotion of less water crop varieties, Crop demonstrations, Farmer field schools to promote these crop varieties
	Decrease in net sown area	No response	Mal adaptive	
	Decrease in ground water table	Use micro-irrigation for saving crop	Adaptive, sustainable it saves water	Linkage with government departments for subsidized micro irrigation
	Crops collapsed	Migration in search of livelihoods	Mal adaptive, uncertainty of work opportunities	Promotion of non-farm livelihoods through SHGs, skill based livelihoods
		Called tankers for irrigation	Mal adaptive, not sustainable requires monetary support	Promotion of farm ponds with surface run off

Dr. Dhananjay Samant

Climate Change and the Development of Sustainable Agriculture in India

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Abstract

All over the world, and particularly in India, climate change is exacerbating the myriad challenges facing agriculture, which is adversely affecting the productivity of the land. The analysis below attempts to investigate how sustainable agriculture can become a reality in the midst of inevitable and relentless climate change. The paper begins with a broad introduction of the agricultural sector in India and how climate change is impacting it. The importance of water management in this fragile scenario is explored and the role of the circular economy in promoting sustainable agricultural development is touched upon. The study ends with suggestions for a methodically coordinated policy response to climate change revolving around the wider concept of sustainable productivity growth in the agricultural sector.

Keywords : Sustainable agriculture, climate change, food security, water management, circular economy, cooperative movement, institutional reform

Introduction

Only about 35% of total agricultural land in India is irrigated and 66% of cultivated land is entirely dependent on rainfall. India's fragile agricultural economy is particularly prone to damage from the vagaries of climate change, which causes increased water stress leading to inadequate water supplies for irrigation. Already, rises in average temperatures, changes in rainfall patterns, increasing frequency of extreme weather events such as severe droughts and floods and the shifting of agricultural seasons have been observed in the different agro-ecological zones of India. Long drought spells during the *kharif* season and rising temperatures and unseasonal rains during the *rabi* season have caused distress to the farming communities all over the country. This has translated, over time, into sustained food price inflation in India, naturally affecting the poorest the hardest.

Experts broadly concur that climate change will, in the long term, lead to worsening environmental conditions in some arid and semi-arid regions where agricultural production is already affected, while the temperate regions in particular, but not solely, are likely to emerge as the winners. Clearly, climate change will necessitate some readjustment of agricultural production patterns around the world, as well as increased risks of local or regional supply problems that could add to future food insecurity. The only way out is to engage aggressively in direct investment in contemporary agricultural research and development which will enhance the resilience of the small farmers towards environmental unpredictability and resource constraints. With over two-third of India's population continuing to depend directly or indirectly on agriculture for both subsistence and employment, it still remains the backbone of the economy.

The impact that climate change will have on food production is uncertain, but many domain experts believe that it will lead to a worsening of conditions for agricultural production in some countries or regions already facing unpredictable climatic and natural conditions. They also agree that there will be an increase all over the world in the incidences of extreme events such as drought, heat-waves, earthquakes, and floods. A combination of better functioning, more mature, and deeper markets for agricultural commodities and improved supply capacity and flexibility will allow countries in the most

vulnerable geographical areas to grapple with these issues and minimize the adverse effects of climate change, at least for prolonged periods.

Climate-Smart Agriculture

A proactive adaptation strategy is the key to dealing with the growing global menace of climate change. More than a billion farmers and 570 million farms around the world are on the front line of climate change and facing severe challenges from global warming. Despite that, we are expecting more and more from our agricultural sector than ever before. Farmers need to transit smoothly to a more sustainable food production system and enhance their resilience. To feed nine billion people in the world by 2050, global food production needs to increase annually by at least 70%.

Time tested practices such as inter-cropping, crop rotation and multiple cropping could be used to combat climate change. Global best practices should also be followed for the development of animal husbandry, conservation of soil health, and water management (including irrigation). Minimizing agriculture's greenhouse gases emissions, using all available inputs more cost-effectively, and building more efficient commodity markets are also an integral part of equipping the sector to deal with climate change. The best way to reduce greenhouse gases emissions ssociated with agriculture is to produce and consume foodstuffs locally as much as possible and to cut down on distances involved in their transportation. Even though that is not always possible, it will help to achieve food security by minimizing logistics-related costs, and encourage the development of local entrepreneurship.

Climate change is a massive socioeconomic challenge but it also presents us a unique opportunity to harness our creativity and devise innovative solutions to feed humanity while simultaneously restoring the dignity of the farmers and their pride in their profession. Farms of all sizes everywhere need to gear themselves up to the inevitability of a changing environment. All of us also need to support the necessary institutional and technological changes that will enhance agricultural productivity globally.

Climate change affects crops, activities, and the daily life of farmers, and so it is too important to be left to the wisdom of governments alone. Following the right agrarian practices will increase farmers' incomes in a sustainable and equitable manner, and reduce the chances of food insecurity. A global transition to a more resilient and sustainable agricultural system that relies increasingly on natural, biological, and organic (as opposed to chemical) processes can help us achieve a hunger-free world within a decade or two. Thus, adopting climate-smart agricultural practices is no longer optional.

Water Management and Sustainable Agriculture

In an era of accelerating climate change, the astute management of water resources has to be given top priority. According to UN projections, India's urban population is expected to rise to 50% of its total population by 2050. That would imply an addition of hundreds of millions of people in parts of the country prone to water scarcity … which is not a sustainable scenario. Inequity in water availability has attracted political attention and it has become fertile ground for several inter-state and intra-state disputes, which are costing the nation dear, both economically and in terms of its global image. Unless water resource planning is given utmost precedence in the nation's policy agenda and innovative options like local water harvesting, protection of local water systems, adequate sewage treatment and recycling, participatory governance by stakeholders etc. are urgently resorted to, such undesirable issues will only escalate, and make the concept of sustainable agriculture just a mirage.

Water management for sustainable agriculture needs a multipronged approach. In this regard, there are prolonged debates amongst scientists as well as amongst other stakeholders. Given that an influential section of society often distrusts the scientific community, the solution ultimately opted for usually has a strong political underpinning, and it may not necessarily be in the best long-term interests of the nation. In India, the prevailing water resource management practices tend to be subtly biased towards the rich and the influential, and they are often

responsible for the declining agricultural productivity in much of the country.

A lot of India's topography is rugged and although large rivers occasionally cause flooding, insufficient water for farming often results due to inadequate infrastructure for water storage and irrigation. Rain-fed cultivation and traditional flow irrigation systems have served Indian farms and farmers well in the past. However, in recent years, climate change, erratic rainfall, and prolonged droughts have forced the agricultural community to consider alternative land uses and more innovative irrigation systems, as well as the adoption of modern technology. Under the circumstances, the myriad productivity benefits offered by drip irrigation vis-à-vis traditional flow irrigation should be seriously considered by both policymakers and farmers.

Public policy's financial architecture needs to incentivize emerging technologies to not only change the paradigm of water management practices in India but also to enhance the ability of the poor in water rich regions to invest in irrigation and boost farm productivity. In this context, micro-irrigation techniques have an important role to play by enhancing the ability of the socioeconomically marginalized to maximize agricultural productivity from the limited water supplies they have access to. In the background of relentless climate change, such measures will go a long way in making food security a reality for almost a billion people in the developing world.

Climate Change and Food Security

Climate change is having huge repercussions on all aspects of agricultural productivity and food security. It is a key factor underlying the massive global migration from rural to urban areas. With a rising frequency of storms, hurricanes and other unpredictable natural disasters in much of the world, the livelihoods of climate-vulnerable communities (where agriculture predominates) will become even more precarious, and food security will be further affected.

The way out is to create socioeconomic conditions that will allow agricultural communities to live where they belong and steadily develop their resilience through appropriate education and training programmes. In India, in particular, the cooperative movement can play a catalytic role in the development of sustainable rural livelihoods. Rural economies of scale and scope are often the result of well-managed cooperative movements – Amul, in India, being a classic example. The self-help and voluntary nature of cooperatives explain how they can deal successfully with small and dispersed agricultural products and services like microfinance, rural electrification, crop rotation in remote areas etc. For a variety of reasons, the government and the private sector often do not seem to handle these vital issues pertaining to rural development cost-effectively.

Sustainable Agriculture and the Circular Economy

A circular economy is today a viable alternative to a traditional linear (make, use, dispose) economy. In a circular economy resources are kept in use for as long as possible and maximum value is extracted from them while they are being employed. At the end of their service life, products and materials are recovered and regenerated to the extent possible. A circular economy helps reduce waste, drives greater resource productivity, enhances economic competitiveness, and reduces the adverse environmental impacts of production and consumption within the system.

Sustainable agriculture is an integral part of a circular economy as it will be necessary to provide food security and counter the deleterious effects of climate change. As water scarcity and droughts are likely to occur more frequently in future, maximizing the productivity of the land via targeted water management programmes remains a viable option. Setting minimum requirements for reuse of water for agricultural irrigation and groundwater recharge has the potential to boost water reuse, and thus, contribute to enhancing agriculture's sustainability. The development of the circular economy is a fundamental way to achieve agricultural sustainability at a national and international level. This will also help to generate some relatively permanent form of employment in the global economy.

In moving to a circular economy, achieving the desired objectives over time and space will require large and sustained investments in storage infrastructure, including surface or groundwater reservoirs, storage tanks, pipes, canals, bore wells, pumps, sewage treatment plants, hydroelectric generating systems etc. It may even necessitate the removal of some of them, to make the remaining more cost-effective.

On its part, a circular economy will facilitate the returning of water and nutrients to the agricultural system, thus enabling its rejuvenation and sustainability. Ultimately, it is a regenerative and sustainable agricultural system, innovatively combining technology and tradition, which will be needed to meet India's growing food demand. Many contemporary agrarian issues pertaining to environmental pollution, ecological damage and resource depletion in rural areas can also be effectively addressed by the development of the circular economy.

Conclusion

The concept of sustainable agriculture has essentially resulted from a growing concern about the long-term future of the human race, and the fact that the true socioeconomic impact of climate change is often still not recognized. There is increasing evidence that our current agricultural practices, and management activities and actions, even at a local level are often not sustainable and can significantly affect the wellbeing of the nation's populace and sometimes have an impact even beyond the country's borders. In this context, water resource management has a critical role to play and it is not of concern only to those living within its geographic proximity.

In the agricultural sector, both problems and opportunities change over time. Just as the instruments to achieve sustainable agriculture alter both temporally and spatially, so do the processes of planning and implementation to zero in on these moving targets. In any modern economy, policymaking ought to meet not only the changing demands and aspirations of its citizenry, but also evolve proactively in response to new perceptions of how to prepare more effectively for an increasingly uncertain ecological future. At the national level, the signals sent out by the larger social, economic and environmental policy settings should support the objectives of a sustainable, climate friendly, resilient and productive agricultural sector. At the state level, governments should strengthen consistency of local policy and rationalize the system of financial incentives within the overall agricultural policy set by the Central Government. Thus, and especially in India, strategic government intervention at various levels is often necessary to achieve agricultural growth along with social and distributive justice.

Cost-effective solutions to develop sustainable agriculture in the country amidst the growing challenges posed by global warming and climate change, will necessitate a complex integration of modern infrastructure with acute insights into the socioeconomic aspirations of the citizenry as well as the prevailing regulatory constraints. Understanding the intricate cause and effect relationships between processes and structures in the rural economy, and their temporal and spatial dimensions, leads to a more integrated and interdisciplinary approach to the development of sustainable agriculture. That insight is precisely what policymakers in India should aim to obtain. Even though much has been achieved on the sustainability front, a lot more is still required to be done, if we are to achieve long-term food security amidst the inevitable spectre of climate change. A deep-rooted institutional reform to boost the resilience of India's agricultural sector is now not just feasible, but also imperative.

References

1. Guido Schmidt-Traub: *Three challenges we must overcome to secure the future of food.* Reprinted in *The Guardian* 2017.

2. OECD: Trade and Agriculture Directorate - *Agriculture and Climate Change,* September 2015, OECD Publishing, Paris.

3. M Dinesh Kumar: *Food Security and Sustainable* Agriculture in India: The Water Management Challenge, International Water Management Institute, Working Paper 60, 2003.

Dr. S. B. Goilkar

India Reported 5% Deficient Rainfall During Monsoon Season (June-Sept) 2017

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The overall rainfall over the Indian sub-continent reported 5 per cent deficiency during the monsoon season, June to September, 2017. Some Northwest and Central parts of the country including Punjab, Haryana, Chandigarh, Western and Eastern UP Eastern MP and Vidarbha received deficient rainfall, while Western Rajasthan, Saurashtra, Navi Mumbai Municipal Transport (NMMT), Rayalaseema and Tamil Nadu and Pondicherry received excess rainfall. The remaining parts of the country received normal rainfall during the monsoon season 2017.

The overall rainfall throughout the season could be considered as untimely, erratic, and un scattered, due to which sowing of kharif crops was down by 5.67 lakh hectares, compared to sowing area recorded during earlier monsoon season of 2016. In some parts of the country the crops got withered, while at other places the crops were washed away by floods. Resultantly, kharif foodgrain production is estimated lower by 3.67 million tonnes during the current year. The storage level of 91 reservoirs of the country is estimated at 66 per cent as on 28th September, 2017, compared to 74 per cent at the end of the monsoon season of the last year and 75 per cent storage of last 10 years average.

Most Indian agriculture relies upon vagaries of the monsoon, as timely, widespread and proportionate rainfall is crucial for expected yield. The Southwest monsoon also is crucial for maintaining underground water level as well as surface water storage of the country, useful for irrigation, meeting industrial needs and for generating power.

In its first forecast released on 18th April, 2017 the Indian Meteorological Department (IMD) forecasted the monsoon at 96 per of the normal rainfall for the monsoon season 2017. This was termed as the most accurate forecast since 2008, as the difference between the forested and actual rainfall was just 3 per cent. During the year 2008, the difference between forecasted and the actual rainfall was 1 percentage point. The weather office was similarly accurate in 2011, when the difference was 3 percentage points. 2017 has been the fourth straight year in which the national weather office has overestimated likely rainfall. The IMD released its second forecast on 6th June, 2017, regarding the likely rainfall of 98 per cent of the normal during 2017 monsoon season.

The IMD for the first time adopted Monsoon Mission Coupled Forecasting System (MMCFS), a dynamic model, based on a US model to improve the accuracy of its forecasts. Since 2012, IMD has been using the dynamical global climate forecasting system (CFS) model developed internally. The latest forecasts were based on these two models.

The weak La Nina conditions developed in the later part of the last monsoon season peaked in December 2016 and started weakening thereafter then started prevailing neutral conditions over the equatorial Pacific. The atmospheric conditions over the Pacific also were observed as neutral El Nino conditions. Also it was observed that neutral Indian Ocean Dipole (IOD) conditions were prevailing over the Indian Ocean. The extreme sea surface temperature conditions over the Pacific, particularly El Nino conditions over the Pacific and positive IOD development over the equatorial Indian Ocean were projected to have a strong influence on the Indian monsoon.

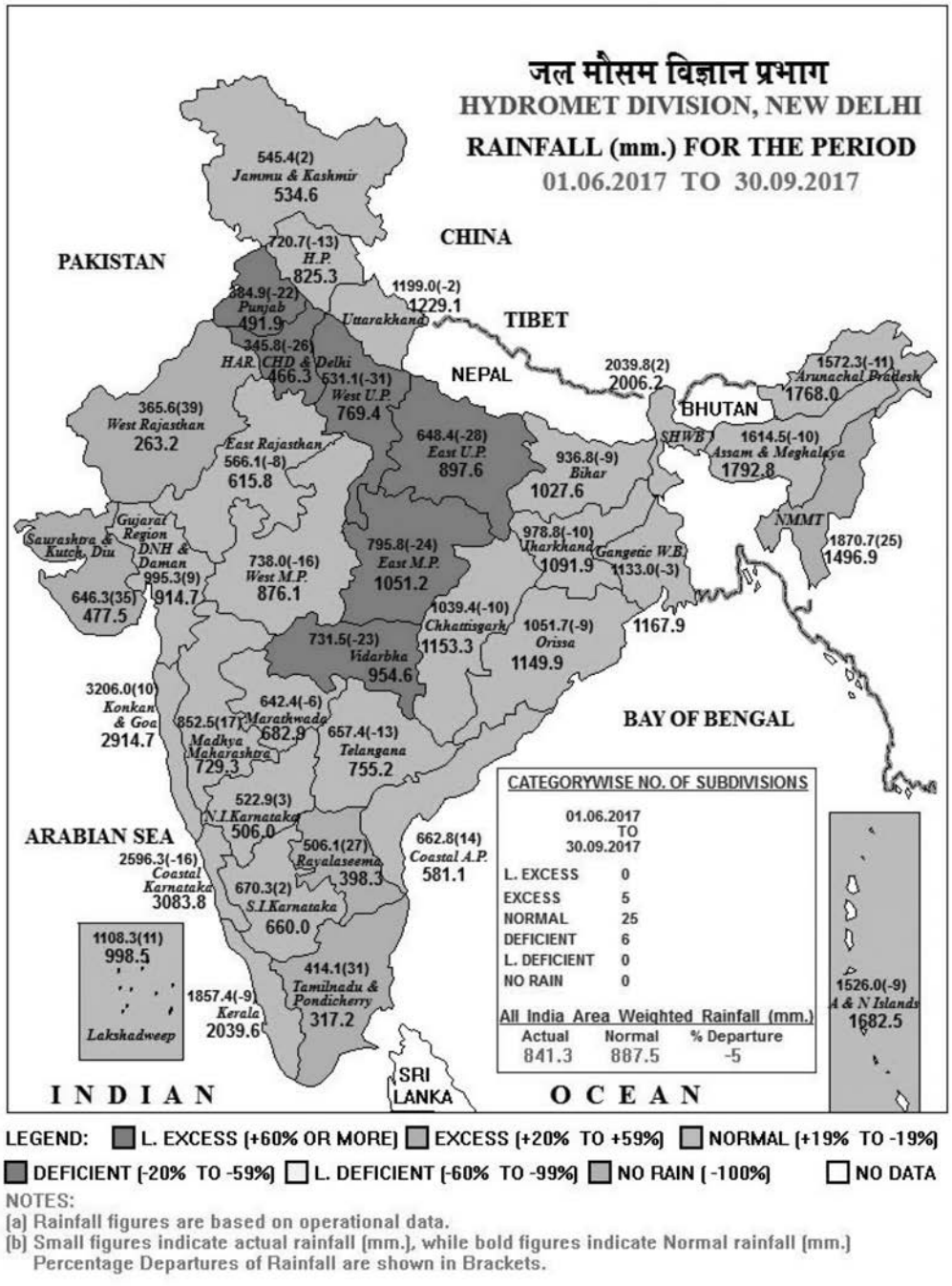
El Nino is the warm phase of the Southern Oscillation (commonly called ENSO) and is associated with a band of warm ocean water that develops in the central and east-central equatorial Pacific. La Nina is sometimes referred to as the cold phase of ENSO. These deviations from normal surface temperatures can have large-scale impacts not only on ocean processes, but also on global weather and climate.

Rainfall (mm) for the period 1.6.2017 to 30.9.2017

Sr. No.	Sub-divisions	Normal	Actual	% change
1.	Jammu & Kashmir	534.6	545.4	2
2.	Himachal Pradesh	825.3	720.7	-13
3.	Uttarakhand	1229.1	1199.0	-2
4	Punjab	491.9	384.9	-22
5	Harayana-Chandigarh, Delhi	466.3	345.8	-26
6	West U P	769.4	531.1	-31
7	East U P	897.6	648.4	-28
8	West Rajasthan	263.2	365.6	39
9	East Rajasthan	615.8	566.1	-8
10	West M P	876.1	738.0	-16
11	East M P	1051.2	795.8	-24
12	Saurashtra & Kutch, Div	477.5	646.3	35
13	Gujarat Region, DNH & Daman	914.7	995.3	9
14	Bihar	1027.6	936.8	-9
15	SHWB	2006.2	2039.8	2
16	Arunachal Pradesh	1768.0	1572.3	-11
17	Assam & Meghalaya	1792.8	1614.5	-10
18	NMMT	1496.9	1870.7	25
19	Jharkhand	1091.9	978.8	-10
20	Gangetic WB	1167.9	1133.0	-3
21	Chhatisgarh	1153.3	1039.4	-10
22	Orissa	1149.9	1051.7	-9
23	Vidarbha	954.6	731.5	-23
24	Konkan & Goa	2914.7	3206.0	10
25	Madhya Maharashtra	729.3	852.5	17
26	Marathwada	682.9	642.4	-6
27	Telengana	755.2	657.4	-13
28	N I Karnataka	506.0	522.9	3
29	Coastal Karnataka	3083.8	2596.3	-16
30	S I Karnataka	660.0	670.3	2
31	Rayalaseema	398.3	506.1	27
32	Coastal A P	581.1	662.8	14
33	Kerala	2039.6	1857.4	-9
34	Tamil Nadu & Pondicherry	317.2	414.1	31
35	Lakshadweep	998.5	1108.3	11
36	A & N Islands	1682.5	1526.0	-9
	All India weighted rainfall (mm)	**887.5**	**841.3**	**-5**

Data Source: Indian Meteorological Department (IMD)

As estimated by the IMD the overall average weighted rainfall during the monsoon season 2017 was 841.3 mm, 5 per cent lesser than 887.5 mm estimated as normal rainfall. Of the 36 meteorological sub-divisions 25 sub-divisions reported normal rainfall, while 5 meteorological sub-divisions, West Rajasthan, Saurashtra, NMMT, Rayalaseema and Tamil Nadu and Pondichery reported excess rainfall.



Six sub-divisions, Punjab, Haryana, Delhi, West-UP, East UP, East MP and Vidarbha reported deficient rainfall during the monsoon season under review. Although, Haryana, Punjab, West MP and East MP witnessed good rainfall during June, the sub-divisions reported deficient rainfall in August and September.

The onset of monsoon was earlier this year on 30th May. Most parts of the country witnessed a good start of rainfall during the month of June. Northwest and Central India along with the Southwest Peninsula received good rainfall in June. These showers were due to the presence of frequently appearing Western disturbances and induced cyclonic circulations. Northwest India in particular witnessed good rains throughout June and ended with a surplus of 52 percent.

Onset and Withdrawal of Monsoon

Monsoon Year	Onset	Withdrawal Begins	Seasonal Rainfall (% of LPA)
2011	May 31	Sept 23	102
2012	June 5	Sept 24	95
2013	June 1	Sept 09	106
2014	June 6	Sept 23	88
2015	June 5	Sept 04	86
2016	June 8	Sept 15	97
2017	May 30	Sept 27	95

Long-period average (LPA) is average of rainfall between 1951 and 2000 which is 99 cm

Normal Monsoon 96-104% of LPA, Above normal – 104-110%, Excess Monsoon ≥ 110% of LPA, Deficient Monsoon ≤ of the LPA

Initially, Southwest monsoon was active over the areas it had made an onset at. The west coast was observing good rains in the beginning. Thereafter, there was a slight lag and monsoon had become normal over the regions. As monsoon spread its wings further, weak monsoon conditions were observed during the beginning of the third week of June. In fact, rainfall activity had reduced over almost the entire country. However, in the fourth week of June, monsoon surge once again became active over many parts and good rains began to lash many parts.

However, SHWB & Sikkim, Gangetic WB, Odisha, Jharkhand, Bihar, East UP, West UP, East MP, Saurashtra & Kutch, South Interior Karnataka and parts of Maharashtra experienced deficient rainfall during June, by which time sowing of kharif crops was delayed.

The first month of Southwest Monsoon 2017 ended on an exceptionally good note. Heavy to very heavy rain was recorded in many areas of the country. In fact, flood like conditions were observed in several areas of Northeast India. Delhi also witnessed heavy rain in June. As on June 30, the cumulative rainfall stood at a surplus of 4 per cent.

The Southwest monsoon covered most parts of the country in July. The overall rainfall in June was 170.2 mm, 15 per cent higher than June, 2016. However, rainfall in July, 2017 recorded 290.6 mm, which was 6 per cent less as compared to the previous year.

Second half of July saw massive flooding across Gujarat, South Rajasthan, parts of Madhya Pradesh, Odisha, Chhattisgarh and Assam. The heavy rain was due to the formation of low pressure areas over the central parts of the country. The regions which remained deficit were Marathwada, Tamil Nadu, Interior Karnataka and West Uttar Pradesh. With this, countrywide cumulative rainfall recorded surplus by 2 per cent by July end, with the country recording 460.2 mm of rain against the normal average of 452.8 mm.

In the month of August, rains reduced further with the countrywide cumulative rainfall ended with 3 per cent deficiency. The lowest rainfall receiving area was Northwest India. Rainfall statistics revealed a sudden shoot-up in deficit over meteorological sub-divisions of West Uttar Pradesh (37 per cent) and Haryana-Chandigarh-Delhi (32 per cent) at the end of August. Elsewhere, the deficit moderated to below 25 per cent, as in South Interior Karnataka and East Uttar Pradesh (20 per cent each); Kerala (21 per cent); East Madhya Pradesh and Vidarbha (24 per cent each). South India was rain deficient by 7 per cent, Central

India by 5 per cent, and Northwest India by 3 percent. The only region where rains were normal was East and Northeast India.

The Southwest monsoon continued to be normal in September over most parts of the country. However, Eastern part covering Nagaland, Manipur, Mizoram and Tripura experienced heavy rain during second half of August and the whole of September. Jammu and Kashmir received very heavy rain during entire June and the first half of July. However, the intensity of rainfall reduced during the second half of July and the first half of the August and thereafter reported normal till September end. Similarly, West Rajasthan experienced very heavy rainfall from second week of June till second week of August and thereafter heavy rainfall. Gujarat and Saurashtra received surplus rainfall during the second half of the monsoon season.

The overall rainfall over India during the monsoon season shows its erratic coverage. Some parts of the country received deficient rainfall, while some other parts suffered floods. The unequal and erratic rainfall has been due to changes in atmosphere caused by rising global warming and pollution. Parts of Karnataka, Maharashtra, Haryana, Punjab, UP, MP and Kerala received deficient or scanty rain during the first half of the monsoon season, due to which sowing of kharif crops was delayed on most of these regions. At some places sowing was completed, but the crops was withered due to deficient rainfall.

At the same time, regions such as Assam, Manipur, Arunachal Pradesh, Gujarat, Bihar, Uttarakand, parts of Uttar Pradesh and Orissa witnessed heavy rainfall, by which crops were washed away, affecting transportation and normal life of the people. As of 24 August, 32.1 million people were reported to be affected by flooding across Assam, Bihar, Uttar Pradesh, and West Bengal. More than 600 people were known to have died. Those affected by the floods were evacuated to safer places by the army, police and navy with boats and helicopters. Almost 2,000 relief camps were established to provide food and shelter to the flood affected people. The Prime Minister announced Rs. 20 billion for relief, rehabilitation, reconstruction and flood mitigation.

In Gujarat, floods reported to have caused 224 deaths during the first half of the monsoon season. For the third consecutive year, monsoon season has been marked by flooding in the northwest and northeast regions. Heavy rainfall of 298 mm halted Mumbai and suburbs on 29th August disturbing transportation, in which 10 people were reported to have lost their lives.

As observed during last few years, most parts of the country witnessed post-monsoon heavy rainfall till third week of October, including this year. The rainfall in October normally turns from the Northeast. Kolkata, Mysore, parts of Maharashtra including Mumbai and its suburbs, Western Maharashtra and parts of Karnataka experienced post-monsoon heavy rainfall during the second week of October, resulting into floods in some regions. Although these showers are helpful for rabi crops and strengthening water levels of reservoirs, the untimely showers are expected to harm kharif crops.

Reservoir Storage Status (As on 28.9.2017)

S. No	Region / State	No. of Reservoirs	Live Capacity (BCM)	Live Storage (BCM)			Storage as percentage of live capacity at FRL			% Depar From 10 yrs
				Current Year	Last Year	Last 10 Yr	Current Year	Last Year	Last 10 Yr	
North Region										
1	H. P.	2	12.39	10.69	8.91	10.45	86	72	84	2
2	Punjab	1	2.34	1.69	1.63	1.55	72	69	66	9
3	Rajasthan	3	3.28	2.64	3.25	2.70	81	99	82	-2
Sub Total		**6**	**18.01**	**15.02**	**13.79**	**14.70**	**83**	**77**	**82**	**2**

Eastern Region										
1	Jharkhand	5	1.79	1.32	1.40	1.26	73	78	70	4
2	Odisha	7	15.33	11.36	12.69	12.09	74	83	79	-6
3	W. Bengal	2	1.39	1.06	1.22	0.90	76	88	64	18
4	Tripura	1	0.31	0.29	0.26	0.19	93	82	61	51
Sub Total		**15**	**18.83**	**14.03**	**15.56**	**14.44**	**75**	**83**	**77**	**-3**
Western Region										
1	Gujarat	10	13.00	9.21	10.75	10.78	71	83	83	-15
2	Maharashtra	17	14.07	11.58	11.40	10.81	82	81	77	-3
Sub Total		**27**	**27.07**	**20.79**	**22.15**	**21.59**	**77**	**82**	**80**	**-4**
Central Region										
1	U P	2	6.36	4.37	5.17	3.48	69	81	55	26
2	Uttarakhand	2	4.81	3.69	3.56	3.81	77	74	79	-3
3	W. Bengal	6	27.32	16.78	26.82	21.09	61	98	77	-20
4	Chhattisgarh	2	3.81	2.51	2.86	2.95	66	75	77	-15
Sub Total		**12**	**42.30**	**27.35**	**38.40**	**31.34**	**65**	**91**	**74**	**-13**
Southern Region										
1	AP & TG	2	15.13	4.43	6.29	10.58	29	42	70	-58
2	A P	1	1.99	0.55	0.79	0.93	27	40	47	-41
3	Telangana	2	2.92	1.34	2.92	1.79	46	100	61	-25
4	Karnataka	14	23.49	15.17	13.28	18.48	65	57	79	-18
5	Kerala	6	3.83	2.51	1.82	2.70	66	47	70	-7
6	T N	6	4.23	2.24	1.59	2.48	53	38	59	-10
Sub Total		**31**	**51.59**	**26.23**	**26.69**	**36.95**	**51**	**52**	**72**	**-29**
Country as a Whole		**91**	**157.80**	**103.43**	**116.59**	**119.02**	**66**	**74**	**75**	**-13**

Data Source : Central Water Commission

Water storage status of 91 reservoirs of the country shows that the water reservoirs filled 66 per cent of full reservoir level (FRL) as on 28th September, 2017, as against 74 per cent filled in the earlier monsoon as on 30th September, 2016, and was 75 per cent of last 10 years average.

The live storage estimated to 103.429 billion cubic metres (BCM) as on 28th September, 2017, against 116.590 BCM estimated during the corresponding period of last year. The average of last 10 years' live storage was 119.015 BCM. Thus, the live storage available in 91 reservoirs as on 28.09.2017 accounted 89 per cent of the live storage of corresponding for period of last year and 87 per cent of storage of average of last ten years. The overall storage position was less than the corresponding period of last year in the country as a whole and is also less than the average storage of last ten years during the corresponding period.

a) North Region : The northern region includes States of Himachal Pradesh, Punjab and Rajasthan. The water storage level of 6 reservoirs of the Northern region was recorded at 15.02 BCM, accounting for 83 per cent of the total live storage capacity of 18.01 BCM. The storage during corresponding period of last year was 77 per cent and average storage of last ten years during corresponding period was 82

per cent of live storage capacity of these reservoirs. Thus, storage during current year is better than the corresponding period of last year and is also better than the average storage capacity of last ten years during the corresponding period.

b) **Eastern Region :** The Eastern region includes States of Jharkhand, Odisha, West Bengal and Tripura. The water storage of 15 reservoirs in this region was recorded at 14.03 BCM, accounting for 75 per cent of total live storage capacity of 18.81 BCM. The storage during corresponding period of last year was 83 per cent and average storage of last ten years during corresponding period was 77 per cent of live storage capacity of these reservoirs. Thus, storage during current year is less than the corresponding period of last year and is also less than the average storage of last ten years during the corresponding period.

c) **Western Region :** The Western region includes States of Gujarat and Maharashtra. The total live storage of 27 reservoirs of the region recorded at 20.79 BCM, accounting for 77 per cent of total live storage capacity of 27.07 BCM. The storage during corresponding period of last year was 82 per cent and average storage of last ten years during corresponding period was 80 per cent of live storage capacity of these reservoirs. Thus, storage during current year is less than the storage of last year and is also less than the average storage of last ten years during the corresponding period.

d) **Central Region :** The Central region includes States of Uttar Pradesh, Uttarakhand, Madhya Pradesh and Chhattisgarh. The total live storage of 12 reservoirs in this region recorded to 27.35 BCM, accounting for 65 per cent of total live storage capacity of 42.30 BCM of these reservoirs. The storage during corresponding period of last year was 91 per cent and average storage of last ten years during corresponding period was 74 per cent of live storage capacity of these reservoirs. Thus, storage during current year is less than the storage of last year and is also less than the average storage of last ten years during the corresponding period.

e) **Southern Region :** The Southern region includes States of Andhra Pradesh, Telangana, Karnataka, Kerala and Tamil Nadu. The total live storage of 31 reservoirs in this region recorded 26.23 BCM, accounting for 51 per cent of total live storage capacity of 51.59 BCM of these reservoirs. The storage during corresponding period of last year was 52 per cent and average storage of last ten years during corresponding period was 72 per cent of live storage capacity of these reservoirs. Thus, storage during current year is less than the corresponding period of last year and is also less than the average storage of last ten years during the corresponding period.

Sowing Status :

Although, the overall rainfall was almost normal during the year, the sowing of kharif crop reported lesser area at 1,060.63 lakh hectors during the monsoon season, 2017, as against 1,066.30 lakh hectors reported during the corresponding earlier season. However, the sowing area during the current year was more than the normal sowing area of 1,058.62 lakh hectors.

Area sown under kharif crops (Lakh Hectors)

Crops	Normal Area	2016-17	2017-18 (as on 29.9.2017)
Rice	395.94	382.37	379.00
Pulses	105.58	147.47	142.01
Coarse Cereals	192.15	190.21	186.51
Oilseeds	184.05	190.26	173.41
Sugarcane	50.05	45.64	49.95
Jute & Mesta	8.39	7.57	7.08
Cotton	122.45	102.79	122.59
Total	1058.62	1066.30	1060.63

Data Source : Ministry of Agriculture, GOI

Sowing of rice covered 379 lakh hectors during the monsoon season 2017, as against 382.37 lakh hector area covered during the earlier monsoon season. Area under pulses, coarse cereals and oilseeds was also down in 2017, as compared to the earlier year. However, area under sugarcane and cotton was higher than the area sowed a year ago.

Kharif Foodgrain Production Estimates for 2017(Million Tonnes)

Crop	2014-15	2015-16	2016-17	2017-18
			4th Adv Estimate	1st Adv Estimate
Rice	91.39	91.41	96.39	94.48
Jowar	2.30	2.42	2.75	2.15
Bajra	9.18	8.07	9.80	8.66
Maize	17.01	16.05	19.24	18.73
Ragi	2.06	1.82	1.40	1.61
Small Millets	0.39	0.39	0.42	0.33
Coarse Cereals	30.94	28.15	32.71	31.49
Cereals	122.34	119.56	129.10	125.96
Pulses	5.73	5.53	9.42	8.71
Total Foodgrains	**128.06**	**125.09**	**138.52**	**134.67**
Oilseeds	191.89	166.80	224.01	206.79
Cotton	348.05	300.05	330.92	322.73
June & Mesta	111.26	105.24	106.00	103.28
Sugarcane	3623.33	3484.46	3067.20	3376.95

Data Source : Ministry of Agriculture, GOI

Considering the coverage of monsoon and area sown, the Agricultural Department of the Government has estimated kharif foodgrain production lower at 134.67 million tonnes for the year 2017, as compared to 138.52 million tonnes estimated for the earlier year. Production of rice, jawar, bajra and maize is estimated to be lower than the production estimated for the previous year.

Dr. B. Venkateswarlu

Impact Of Droughts In Marathwada And Coping Strategies

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Background

Agriculture in Maharashtra is extremely diverse. The state has regions in Konkan receiving more than 3000 mm rainfall and districts in the scarce rainfall zone receiving as low as 550 mm rainfall. Historically, the cropping pattern in the state has followed the rainfall pattern and soil types with horticulture in Konkan, sugarcane in western Maharashtra, rice in eastern Vidarbha and rainfed crops like coarse cereals, pulses, oil seeds and cotton in Marathwada and western Vidarbha.

Marathwada comprising eight districts (Aurangabad, Jalna, Parbhani, Nanded, Latur, Beed, Osmanabad and Hingoli) is traditionally a drought-prone region. The situation has worsened in recent period with severe rainfall deficiency during three out of five years since 2010. After a severe all India drought in 2012, the region experienced a deficit of 35-45 per cent in 2014 and in 2015. These consecutive droughts had a crippling effect on the rural economy. It is no surprise that Marathwada has become one of the hot spot of rural distress.

The region has struggled with frequent droughts with as many as 12 moderate to severe droughts and 21 mild droughts in the last 55 years (see figure 1).

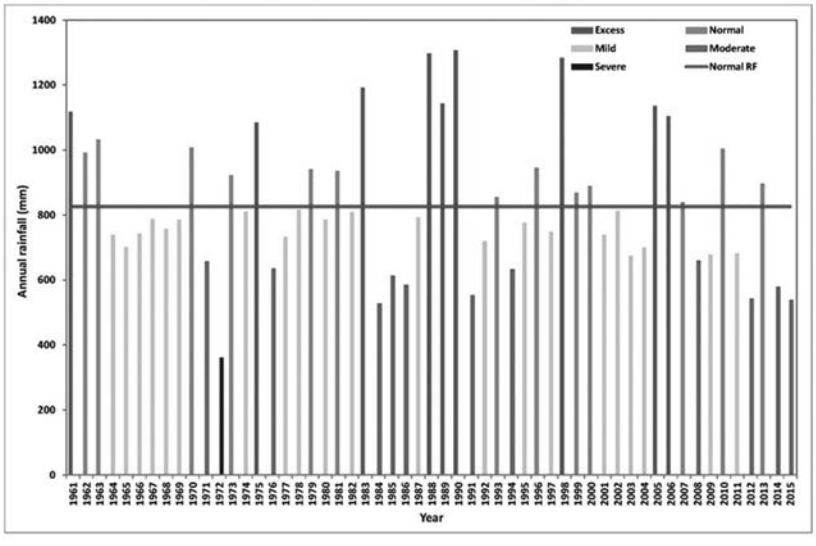


Fig.: 1. Frequency of drought occurrence in Marathwada (1961-2015)

Shifts in cropping pattern

However the impact of droughts in the region has further exacerbated with a significant shift in the cropping pattern during the last three decades. (Venkateswarlu, 2015) This shift happened mainly due to the farmers urge for higher returns, market demand and availability of improved varieties in crops like soybean, cotton and maize. Area under cotton has increased from 7.40 lakh ha to18.34 lakh ha during 1990-91 to 2014-15, sugarcane area from 1.18 lakh ha to 2.19 lakh ha and soybean from 0.01 lakh ha to12.22 lakh ha. Horticulture area has also increased considerably in all districts of the region. In the same period, there is a significant decrease in area under jowar from 20.89 lakh ha to 11.94 lakh ha, bajra from 4.68 lakh ha to 2.20 lakh ha, oilseed crops like groundnut from 2.02 lakh ha to 0.42 lakh ha and safflower from 3.28 lakh ha to 0.67 lakh ha.

This change has improved the gross returns per ha and economic status of the farmers; at the same time increased the demand for water. It is well known that agriculture in Marathwada is primarily rainfed with 87 per cent area under rainfed. Even if we make further investments on irrigation, much

of the area (>75%) in the region will remain rainfed. Therefore, the success of agriculture in the region depends on how efficiently available water is managed, both from rainfall and ground water.

Impact of droughts

Delay in arrival of monsoon and droughts are not new to Marathwada. Crop yields decline due to delay in planting and mid season breaks. Breaks in monsoon up to 30 days are not uncommon in the region. Analysis of the occurrence of dry spells based on 30 year data (1981 to 2010) indicated that different districts in the region encounter dry spells of 19-24 days in July; 17-28 days in August and 16-32 days in September-October. Second fortnights of June and July are the most vulnerable periods for critical dry spells whereas negative impacts on yields are maximum due to dry spells occurring in September which coincides with reproductive stage in many kharif crops. (Kamble et al, 2013). However, droughts of same intensity as in the past are impacting more adversely today mainly because of shift in area towards high water demanding crops. For example, the sorghum crop in Marathwada was able to stand with dry spells up to15- 20 days but soybean which replaced sorghum in large areas cannot with stand dry spell of more than 10-15 days without affecting growth and yields. When monsoon breaks occur during the season with prolonged dry spells, soybean yields particularly in light soils decline significantly despite the availability of relatively drought tolerant variety like MAUS 71 from VNMKV, Parbhani.

Food grains

The normal rainfall along with deviation in all the districts of Marathwada for the last five years is presented in table 1. The normal rainfall of the region is 839 mm. However during the last five years (2010-2014) the region has consistently received less rainfall except 2013. During 2015, Parbhani district received nearly 50 per cent less rainfall followed by Latur and Osmanabad. During 2014, Nanded district received nearly 57 per cent less rainfall followed by Parbhani, Jalna, Latur and Beed. In 2012 also, the region experienced nearly 35 per cent less rainfall than normal. Jalna district received nearly 56 per cent less rainfall followed by Aurangabad and Osmanabad (table 1). Likewise, the impact on production in food grains is presented in table 2. The decline in total food grain production was generally related with the decline in rainfall. Maximum decline occurred in 2014-15, when the rainfall deficit was also quite high (43 per cent). However, despite 35 per cent deficit rainfall in 2012, the negative impact on food grain production was only 18 per cent. This was largely due to the differences in the distribution of rainfall. This became more evident when the impacts on individual crops were assessed. For example the average productivity of soybean which is a major crop in Marathwada is1332 kg/ha. The crop did not experience any yield decline during 2012-13 despite 35 per cent deviation in rainfall. On the other hand, the productivity declined by 68 per cent during 2014-15 when the rainfall deficit was 45 per cent. The distribution of rainfall during 2014 was quite erratic, with practically no rain during entire September when the crop was in flowering stage. Similar trends were noted in other crops like pulses and oilseeds. The data indicated that distribution of rainfall is more important than the total quantum.

Table: 1. District wise deviation of rainfall in Marathwada region

mm

District	Normal rainfall	Actual rainfall				
		2010	2011	2012	2013	2014
Aurangabad	734.1	887.9	589.2	375.5	736.4	527.3
		(21.00)	(-19.73)	(-48.84)	(0.31)	(-28.17)
Jalna	750.4	894.2	560.7	324.6	844.1	426.7
		(19.16)	(25.27)	(-56.74)	(12.48)	(-41.13)
Beed	743.4	962.4	740.2	461.1	729.9	423.4
		(29.45)	(-0.43)	(-37.97)	(-1.81)	(-43.04)
Latur	871.8	1052.3	710.4	760.5	966.2	496.0
		(20.70)	(-18.51)	(-12.76)	(10.82)	(-43.10)
Osmanabad	807.2	1035.7	540.2	400.7	726.2	505.2
		(28.30)	(-33.07)	(-50.35)	(-10.03)	(-37.40)
Nanded	1017.5	1125.8	708.1	662.7	1111.9	436.5
		(10.64)	(-30.40)	(-34.86)	(9.27)	(-57.10)
Parbhani	830.3	1013.3	667.5	637.2	968.0	448.3
		(22.04)	(-19.60)	(-23.25)	(16.58)	(-46.00)

Hingoli	956.3	1246.9	764.1	711.1	1174.8	549.1
		(30.38)	(-20.09)	(-25.64)	(22.84)	(-42.58)
Marathwada region	838.87	1027.31	660.05	541.67	907.18	476.56
		(22.46)	(-21.36)	(-35.42)	(8.14)	(-43.19)

Table: 2. District wise deviation in production of food grains in Marathwada region

00MT

District	Average	2010-11	2011-12	2012-13	2013-14	2014-15
Aurangabad	7074	10072	7805	4158	10125	3209
		(42.38)	(10.31)	(-41.50)	(43.12)	(-54.64)
Jalna	3009	4939	3359	1662	4294	789
		(64.14)	(11.63)	(-44.76)	(42.70)	(-73.78)
Beed	3801	4917	3879	2262	5001	2945
		(29.36)	(2.05)	(-40.43)	(31.57)	(-22.52)
Latur	4272	4910	3927	5062	5678	1783
		(14.93)	(-8.07)	(18.49)	(32.91)	(-58.26)
Osmanabad	3782	4878	4563	2141	5297	2029
		(28.97)	(20.65)	(-43.38)	(40.05)	(-46.35)
Nanded	3198	4102	3797	3860	2930	1303
		(28.26)	(18.73)	(20.70)	(-8.38)	(-59.25)
Parbhani	3365	3542	3747	3558	4049	1930
		(5.26)	(11.35)	(5.73)	(20.32)	(-42.64)
Hingoli	2536	1949	2177	2661	2880	3013
		(-23.14)	(-14.15)	(4.92)	(13.56)	(18.80)
Marathwada region	31036	39309	33254	25364	40254	17001
		(26.65)	(7.14)	(-18.27)	(29.70)	(-45.22)

Figures parentheses are percentage deviation from average production.

Stunted growth of soybean crop in 2014-15 due to drought

Wilted soybean crop allowing grazing by animals due to drought in 2014-15

Horticulture crops

Horticulture crops are more vulnerable to droughts because of their higher water requirement. There has been a significant expansion of area under horticulture in Marathwada due to promotional activities under National Horticulture Mission. Many farmers have taken up plantations on shallow soils with low water holding capacity. When there are consecutive droughts and the sources of ground water dry up, orchards taken up in light soils undergo wilting and farmers are forced to uproot the trees. Vasantrao Naik Marathwada Krishi Vidyapeeth, (VNMKV) Parbhani, has evolved technologies to save such orchards at least in medium and deep soils through mulching, pruning, use of anti-transparent and other disease control measures (Dhawan, 2012)). The university has organized a campaign to save sweet orange orchards in 2012 and also in 2014-15 with encouraging results.

Drying of sweet orange orchards due to drought in 2014

Livestock and fodder availability

The major impact of consecutive droughts on livestock production is equally severe. In some of the drought prone states like Gujrat and Rajasthan livestock sector helps

farmers to overcome the drought impacts when crops fail, because feed from trees and agroforestry systems provides major support. However, in Marathwada the tree cover is less than one percent and entire livestock production depends on crop residues or fodder grown under irrigation. Therefore when crops fail, the animals do not get any fodder. The change in cropping pattern as described above has also exacerbated the fodder shortage. With drastic fall in sorghum and bajra area, both dry and green fodder availability in the region has declined. In other words, the cropping pattern change has indirectly affected the live stock sector in Marathwada and lowered the farmer's capacity to cope with droughts. The Government of Maharashtra organizes cattle camps to tide over the temporary fodder shortage and sale of cattle by farmers during droughts. While this may save the lives of animals, the milk production and incomes decline during droughts.

A view of cattle camp organized in Beed district in 2015

Climate change dimension

Climate change is emerging as a major problem globally and more so in tropical countries like India which depend on monsoon rainfall. The average annual temperature in India has risen by 0.70C in the last 100 years and it is expected to increase by 4.50C by end of this century (Aggrawal et al, 2009). This warming will increase water requirement of crops due to more evapo-transpiration. In other words, we need more water in future to produce same quantity of crops. Although the total rainfall has not changed significantly in India, the distribution over time and space is becoming highly erratic with long dry spells and heavy rainfall occurring in few days. Such heavy rainfall events in short time cause soil erosion and runoff and do not recharge ground water effectively. Most of the climate models predict that such erratic rainfall pattern and extreme events will further increase in future. In other words, regions like Marathwada might receive heavy rains in 2 to 3 days followed by long dry spells. This affects crops both due to drought and water logging. Therefore water management becomes a crucial issue under climate change scenario. Water conservation programmes at village level which conserve soil, allow infiltration of rain fall in to the profile and recharge ground water are the only way to face climate change situation in Marathwada. The jal yukt shivar programme which focuses on village level decentralized water conservation launched by the Government of Maharashtra is an ideal strategy and the best answer to tackle the future climate change in Marathwada.

Extreme weather events

The frequency of extreme weather events like hail storms, frost and unseasonal rains is projected to increase in future due to climate change. These events during the last 2 years have played havoc with agriculture in Maharashtra. Hail storms are common in March but generally occur in isolated places for 1 or 2 days. Historical data suggest that Vidarbha region generally experiences more hail storms. However during the last 2 years, hail storms are occurring in all parts of the state including Marathwada on larger areas and for longer duration. Hail larger than size of 8.4 mm has occurred in Beed, Nanded and Osmanabad districts during 2014 and 2015 damaging standing crops like Banana, Sweet orange, Vegetables, Chickpea and Wheat. Horticulture crops were found to be highly vulnerable to hail storms and unseasonal rains. In other words, such impacts of changing climate are likely to further compound the problems to agriculture sector in Marathwada which is already facing severe water crisis. The historical data on hailstorm occurrence and damage caused in Marathwada is given in table 3. Maximum hail storms occurred during February – March. Currently there is no system of prediction and forewarning of hailstorms in Maharashtra and therefore farmers are incurring heavy losses. Currently a standardized system of damage assessment due to hail is not available unlike droughts. However, the National Institute of Abiotic stress Management, Baramati has evolved some management practices for post hail recovery (Bal et al, 2014). Use of bio regulators like thio urea (0.02%) and potassium nitrate

(2.0%) helped in quick post hail recovery in pomegranate. Farmers in Nashik districts of Maharashtra have devised aluminum cones to protect grape bunches from hail damage. There is an urgent need to assess the quantum of hail fall and develop a clear methodology for crop loss assessment in addition to development of post hail recovery technologies.

Strategies to cope with droughts

To cope with recurrent droughts and crop losses in Marathwada, short term and long term strategies are required with a mix

Table: 3. Crop damage in Marathwada due to hailstorms

Year	Month	Date(s)	No.of Events	Area Affected	Intensity	Damage / Loss
1989	Mar	9-11	1	Aurangabad, Beed, Jalna, Latur,Nanded, Osmanabad, Parbhani	Heavy	Standing rabi and mango crops extensively damaged.
1997	Jan	28	1	Aurangabad	Severe	Wheat crop affected.
1997	Jan	12, 18	2	Beed	Heavy	500 acre crops damaged in Bhamori, Gat¬lakhedi, Rasgaon and Segaon. Beed Tq. Worst affected. Loss of Rs.90 lakhs.
1997	Mar	26, 27 & 28	1	Beed, Latur, Osmanabad	Heavy	NO INFORMATION
1998	Mar	18	1	Latur, Nanded, Parbhani	Heavy	Extensive damage to crops reported.
1999	Jan	3	1	Aurangabad	Moderate	Tur, wheat, jowar, maize and grapes damaged.
2002	Feb	10	1	Aurangabad, Jalna	Heavy	Wheat, gram, iowan, mango, grapes, onion, chilly and tur crops extensively damaged.
2002	Feb	7	1	Parbhani	Moderate	Wheat, jowar, tur, gram crops in Yeldari, Munjmkhed, Hivarkheda etc. Destroyed
2002	Jan	8	1	Latur, Nanded	Severe	Damage to crops also reported.
2005	Jan	30	1	Hingoli, Nanded, Parbhani	Moderate	Damage to rabi crop and pulses reported.
2014	Feb, Mar	22,23 8,9	5	All Marathwada	Severe	All rabi crops. Horticulture worst affected. Animals also died.
2015	Mar, Apr	15 13,14	4	All Marathwada	Severe	All rabi crops. Horticulture worst affected. Protected Hort worst sufferer

Source: IMD, VNMKV and Dept. of Agriculture, Maharashtra

Severe hailstorm in Beed district damaged standing crops (March, 2015)

of technology and policy solutions (Venkateswarlu and Shanker, 2009). The most important short term strategy is water management. This includes continued focus on water conservation, watershed management, and effective methods of irrigations like drip and sprinkler and large scale adoption of mulching technologies. In the long term, however we need to match the cropping pattern with rainfall pattern, soil types and ground water availability. For example, the area under sugarcane has to be regulated in water stressed areas of Marathwada and all area must be brought under drip irrigation. Recent study by South Asia Network on Dams, Rivers and People (SANDRP) revealed that water used for irrigating 1 ha of sugarcane can irrigate 25 ha of tur crop with 1 protective irrigation. Research across the country by ICAR showed that one protective irrigation for tur crop during flowering can increase yields by 50 to 60 per cent. In other words, using the available water in drought prone area like Marathwada for protective irrigation of pulse crops in place of regular cultivation of sugarcane will not only benefit more number of farmers but also meets the shortage of pulses which are being imported.

Based on research carried out under the All India Co-ordinated Research Project on Dryland Agriculture (AICRPDA), large number of drought management practices have been recommended for different agro-climatic zones of the country. These include use of short duration varieties, in situ moisture conservation, supplemental irrigation with harvested rain water, seed priming, mulching, use of anti-transparants, inter cropping and integrated farming system approach (Vittal et al, 2003). For Marathwada region, short duration varieties of kharif sorghum, red gram and soybean are recommended. Broad Bed and Furrow system helps in conservation of moisture in vertisols and helps in overcoming in the intermittent drought effects.

Another important strategy is to create awareness among farmers on the suitability of crops for different soil types. In shallow soils of Marathwada with less than 30 cm depth, kharif jowar or jowar+tur inter cropping systems are more suitable than soybean, but farmers cultivate soybean in all types of soils and lose the crops when drought occurs. As a simple thumb rule, if the soybean crop wilts with a 10-15 days dry spell, such soils should be used for jowar or tur because in Marathwada 10-15 days dry spells are quite common. Likewise soil depth should be a major deciding factor for taking up fruit orchards in Marathwada region. If the soils types are very shallow, the orchards dry out in severe drought years like 2012. All agriculture universities in Maharashtra have recommended many water conservation and mulching technologies to save orchards during dry spells which needs to be popularized among farmers.

Groundwater recharge is yet another strategy for the state which should receive highest emphasis. Cost effective technologies are available to recharge ground water at community level through percolation tanks, nala bunds, and individual open wells, and bore wells through diverting field runoff directly in to the wells by passing through the filter beds. These are already included in the jal yukt shivar programme. The State and Central Ground water boards have mapped areas where the ground water exploitation is very high. In such tahsils, recharge of open wells and tube wells should receive highest emphasis in the jal yukt shivar programme. Ultimately adequate water literacy and awareness on water budgeting at village level has to be made among farmers. This should be the guiding principle in crop planning in drought prone areas.

It is well known that millets are the most climate resilient crops. These crops have lost the area due to falling market demand, changing food habits and late rains in September damaging crops like sorghum. However there is an urgent need to revive interest in these crops among farmers and consumers. There are many value added products available now from millets across the country. Some states are organizing millet festivals to create awareness among people and increase the demand. The Karnataka Govt. has announced

a bonus of Rs.500/Q over the support price for ragi. With steady efforts and favourable policies, the area under sorghum and other millets can be revived in drought prone areas like Marathwada. This will indirectly help the livestock sector through availability of green fodder and stabilizes farmers income during droughts. Farmers who adopt integrated farming system also can cope with droughts effectively. In chronically drought prone areas, it is very important to promote allied sectors like livestock and poultry along with crops.

Protected cultivation through green houses and shade nets reduces losses during hail storms, frosts, heat waves and cold waves. Many countries in Europe are increasingly adopting this technology in horticulture. Maharashtra is already a leader in protected cultivation. This technology should be seen as a climate resilient strategy besides using water and nutrients effectively. This sector need to be encouraged more and more in future even in field grown horticulture crops by providing incentives to the farmers and improved technologies from agricultural Universities.

Finally to face the challenges of droughts in long term our agricultural research programmes need to be strengthened and reoriented. We need to evolve varieties with multiple abiotic stress tolerance (e.g. drought, excess water, heat and cold, etc.). The advance weather forecasting system needs improvement. Development of drought proofing technologies in agriculture requires long term investments in research in crop breeding, water management and weather forecasting. Rejuvenation of traditional water harvesting structures and area treatment for farm level water conservation are however the most important steps.

Conclusion and recommendations

In conclusion, tackling droughts in Marathwada requires a multipronged strategy involving policy changes, application of new technologies and awareness generation among stakeholders on prudent use of water. The following specific recommendations are made.

- Continued focus on water conservation programmes like Jal Yukt Shivar. The drainage line treatments are to be combined with area treatments along with in situ conservation practices like broad bed furrow planting.
- Organizing massive awareness programmes and financial support for recharge of ground water in open wells and tube wells.
- Discourage high water demanding crops like sugarcane in Marathwada and promote pulses and oilseeds with supplemental irrigation.
- Promote coarse cereal crops like sorghum and millets in light texture soils to ensure fodder security to the livestock which helps farmers to cope with droughts.
- Give consideration to land suitability and rainfall pattern while promoting horticulture crops that require more water.
- Improve the weather data collection infrastructure up to taluka level and effectively disseminate the weather forecast and agro advisories to as many farmers as possible through mobile platform.
- Increased adoption of weather based crop insurance for risk mitigation particularly for small and marginal farmers.

References:

Aggrawal, P.K. 2009. Global Climate Change and Indian agriculture; Case studies from ICAR network project, Indian Council of Agricultural Research, pp 148.

Bal, S.K., Saha, S., Fand, B.B., Singh, N.P., Rane, J. and Minhas, P.S. 2014. Hailstorms: Causes, Damage and Post-hail Management in Agriculture, NISM, Baramati, Technical Bulletin-5 pp: 1-44.

Dhawan, A.S., 2012. Special Technology Mission of MKV, Parbhani to save fruit orchards in drought hit region of Marathwada, Technical Bulletin, Marathwada Krishi Vidyapeeth, Parbhani, pp : 1-35.

Kamble, A.M., Bhuibhar, B.W., Jadhav, M.G., Pendke, M.S., Choulwar, S.B., and Kadale, A.S. 2013. Technical Bulletin on Rainfall-Dry spell analysis for crop planning in Marathwada region of Maharashtra, pp: 1-34.

Venkateswarlu B, Shanker AK (2009) Climate change and agriculture: Adaptation and mitigation strategies. Indian Journal of Agronomy 54:226-230

Venkateswarlu, 2015. What has gone wrong in Marathwada?. Governance Now, Sept. 2015 (II), pp 48-49.

Vittal, K.P.R., Singh, H.P., Chary Ravindra, G., Sankar Maruthi, G.R., Prasad, Y.G.,l Rao Srinivasa, M., Samra, J.S. and Singh Gurbachan 2003. Improved Agronomic Practices for Dryland Crops in India, pp 1-210.

AGRI TOURISM DEVELOPMENT CORPORATION, PUNE

Agri tourism is an activity hosted by the farmer's family that complements and connects farming to tourism experience giving the farmer a sustainable income source all year round.

Shri Pandurang Taware was the brainchild behind this Sustainable thought. He started by conducting a survey of urban dwellers to infer the number of people who are still attached to their villages in any which way. It was concluded that around 43% of urban dwellers did not have any relatives residing in the villages or their children had never visited any village so far in India. This widening gap encouraged him to form a link between urban dwellers enthusiasm for tourism with the Farmer's need for Agriculture. Thus began the journey of Agri Tourism on an official platform since 2004.

Beginning with the first trip at Baramati Agri Tourism, this model has been replicated in 750 Agri tourism centres across 30 Districts in Maharashtra. The survey conducted in 2014, 2015, 2016 shows that 0.40 million, 0.53million, 0.7 million tourists have visited these centres respectively generating a revenue of 35.79 million Indian rupees to farmers' family. The Government of Maharashtra accepted with open arms as Agriculture Tourism was given a major boost in Maharashtra Tourism Policy 2016.

ATDC owns the pilot Agri tourism project of 28 acres in Palshiwadi, Tal Baramati Dist Pune, and 70 kms from Pune city. The main activities include operating its Agri tourism centre along with encouraging more farmers to take up Agri - Tourism and conducting training and research programs. Tourist reservations for all centres are booked under this umbrella organisation. This saves on the marketing cost of the farmers.

OBJECTIVES:

1. To **develop and promote agricultural tourism** through ATDC's projects, training and support as a potential vehicle for diversifying and stabilizing rural economies.

2. To create **jobs**, increase **farming community's income**, provide a broader market base and opportunities for on-farm employment so they do not have to migrate to urban areas.

3. To provide additional Agri Tourism income to **improve their livelihoods**, preserve and perform traditional forms of art and music in rural areas

4. To **increase awareness of local agricultural products**, enhancing the understanding of the importance of maintaining agricultural lands, thereby strengthening the long term sustainability of small farms.

With the only objective of proving the farmers as our Indian assets, ATDC, along with the support of the Nation, would continue towards its journey of maintaining "**Farm in the family and Family in the farm**".

Maharashtra State Agri and Rural Tourism Co-Operative Federation Ltd - MART

Agri Tourism is the holidays concept of visiting a working farm or any agricultural, horticultural, for the purpose of enjoyment, education, or active involvement in the activities of the farm. The concept of Agri tourism is a direct expansion of ecotourism, which encourages visitors to experience agricultural life at first hand.

"Tourism is becoming increasingly important to the economy". Agri tourism is one alternative for improving the incomes and potential economic viability of small farms and rural communities. Some farms of agri tourism enterprises are well developed in Maharashtra.

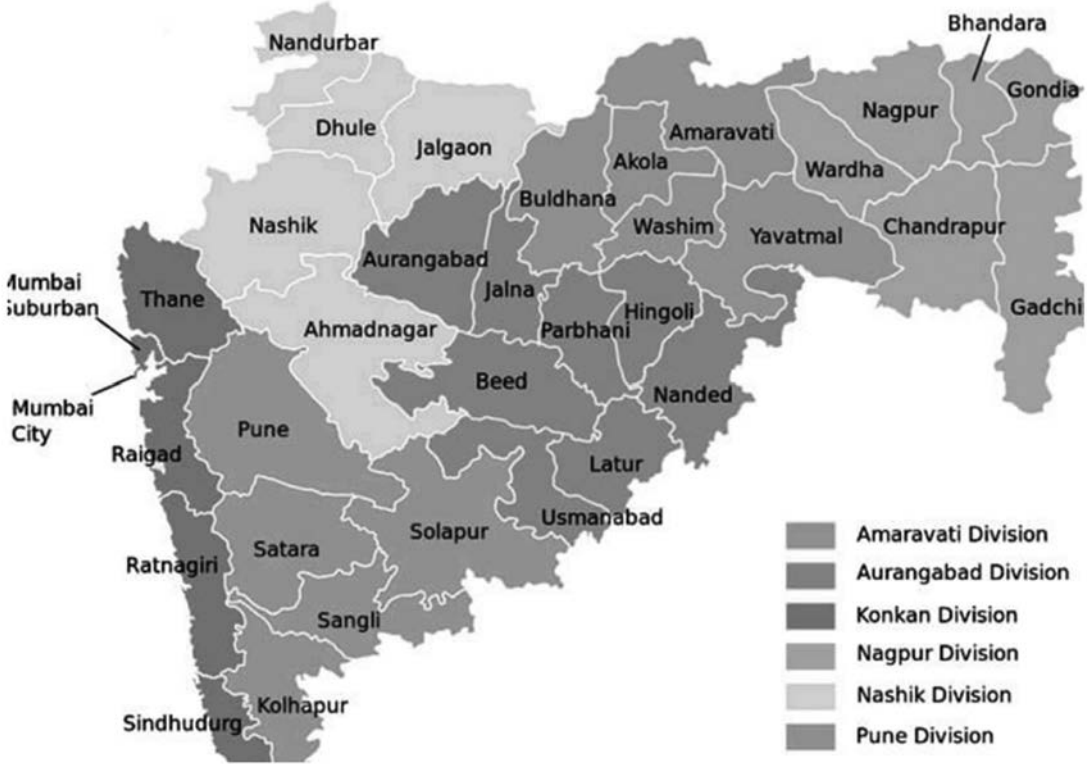
Including fairs and festivals other possibilities still offer potential for development. In India small farm center has developed an agri tourism database that "provides visitors and potential entrepreneurs with information about existing agri tourism locations throughout the state. "Agri tourism projects reinforce what need to support local growers and sources and allow the visitors to experience what it is to be part of the land. The publication promoting tourism in rural India explains the need for planning and marketing your rural community and weighing the pros and cons of tourism. According to the publication, local citizen participation is helpful and should be include in starting any kind of a tourism program. Citizen participation in planning tourism can contribute to building a successful program that enhances the community.

REQUIREMENTS TO AGRI-TOURISM CENTRES

Researcher has identified the minimum requirements for the agro-tourism centre. To develop an agritourism in their farm, the farmer / farmers must have basic infrastructure and facilities in their farm as follows:

Infrastructure

- Accommodation facilities at same place or alliance with nearest hotels.



- Farmhouse, which has the rural look and feel comfortable along with all minimum required facilities.
- Rich resources in agriculture namely water and plants at the place.
- Cooking equipments for cooking food, if tourist have interested.
- Emergency medical care with first aid box.
- The well or lake or swimming tank for fishing, swimming
- Bullock cart, cattle shade, telephone facilities etc

Facilities

- Offer authentic rural Indian / Maharashtrian food for breakfast, lunch and dinner.
- Farmers should offer to see and participate in the agricultural activities.
- Offer an opportunity to participate in the rural games to the tourist
- Provide information them about the culture, dress, arts, crafts, festivals, rural traditions and also give possible demonstration of some arts.
- Offer bullock cart for riding and horse riding, buffalo ride in the water, fishing facility in your pounds or nearest lake.
- Offer fruits, corns, groundnuts, sugarcane and other agro-products as per availability.
- Show local birds, animals and waterfalls etc and give authentic information about them.
- Must provide safety to tourists' with the support of alliance hospitals.
- Available some agro-product to purchase to the tourist

BENEFITS OF AGRI-TOURISM CENTRES

Agro-Tourism has the potential to change the economic face of traditional agriculture. The benefits

of agro-tourism development are manifold. It would bring many direct and indirect benefits to the farmers and rural people. Some of the benefits are following:-

- Employment opportunities to the farmers including farm family members and youth.
- Cultural transformation between urban and rural peoples including social moral values
- Farmers can improve their standard of living due to the contacts with urban peoples.
- Benefits to the urban peoples, they can understand about the rural life and know about the agricultural activities.
- It support for rural and agricultural development process.
- Help to the reduce burden on the other traditional tourist centres.

NEED OF PROMOTION AGRI - TOURISM IN MAHARASHTRA

Agriculture business is becoming more unsecured in the Maharashtra due to the irregular monsoon, unsecured product prices. Many farmers cannot afford it and have a problem of indebtedness. Due to the agricultural problems some farmers are committed to suicide in various districts of the Maharashtra. More than 29,000 farmers committed suicide between 1997 and 2005 in the Maharashtra, official data show, no other state comes close to that total. Hence, there is need of start any of allied agri-business to support their farming and create allied income source from farm.

In order to encourage farmers for establish small and viable agro-business activity, such as agrotourism. It offers several potential benefits to farm operators. It can help supplement income generation

The Maharashtra has a great potential of agro-tourism due to the beautiful natural site and basic infrastructures.

AGRI-TOURISM POTENTIAL IN MAHARASHTRA

Maharashtra is the third largest state of India, both in area and population. It is located on the west coast of India with a 720 km long coastline along the green Konkan region. Nestled in the Western Ghats and the Sahyadri mountain range are several hill stations and water reservoirs with

semi-evergreen and deciduous forests. There are many tourist centres in Maharashtra which are the supporting natural environment for the agro-tourism centres in Maharashtra.

Maharashtra has a total 22368 thousand hacter area uder the agriculture and 36122 thosaunds of livestock and principal crops include rice, Jowar, Bajra, wheat, pulses, turmeric, onions, cotton, sugarcane and several oil seeds including groundnut, sunflower and soyabean. The state has huge areas, under fruit cultivation of which mangoes, bananas, grapes, and oranges etc.

Maharashtra is blessed with a rich and diversified cultural heritage. The state has several communities belonging to different religions, and a number of festivities colours the culture of Maharashtra with the spirit of exuberance. Some of the popular festivals that are celebrated in

More than 4.11 (43 percent of total) core populations is living the urban areas of the Maharashtra, which will can becomes a customers' of the agro-tourist centres are located in the rural areas. Other than nature and culture there is an enough road and rail connectivity in urban rural areas to travel in rural Maharashtra. Maharashtra abounds in numerous tourist attractions ranging from ancient cave temples, unspoiled beaches, ancient forts and monuments, forests and wildlife, unique hill stations, pilgrimage, centres, and a rich tradition of festivals, art and culture. About 25 more such locations have been identified in Maharashtra as rural agro-tourist destinations. Thus all the districts of Maharashtra have a tourism potential. Some following notable factors are helpful to the agro-tourism in Maharashtra.

- Tourist places are already exist to support Agro-Tourism
- Good communication and transport facilities
- Green house cultivation of long stem cut flowers, vegetables, fruits etc.

CONCLUSIONS AND POLICY IMPLICATIONS

Maharashtra has a great potential to the development of agro-tourism, because of natural conditions and different types of agri products as well as variety of rural traditions, festivals. More than 45 percent of population is live in the urban areas and they want enjoy rural life and to know about the rural life. It is an opportunity to develop an agro-tourism business in Maharashtra, but there is a problem of awareness about this business among the farmers including the problem of the finance and proper vision point.

Hence, the agriculture departments of the districts', Agriculture Universities should try to give orientation about it and provide some innovative ideas regarding to the Agro-Tourism. The government should try to provide optimum financial aids to the agro-tourism activities in the Maharashtra by the grants and institutional finance. Bank should provide optimum financial help for the agro-tourism activities in the Maharashtra. Union of the agro-tourism service providers is also another need of these farmers which helps to the agricultural tourism network in the India including Maharashtra.

TECHNOLOGY AND MANAGEMENT

From Olden Days

To

Now- A- Days

Dr. C. D. Mayee

TECHNOLOGY RESCUED INDIAN AGRICULTURE, WHY DO WE SHY AWAY FROM IT NOW IN CURRENT CRISIS

Dr. C. D. Mayee

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INDIAN AGRICULTURE SCENARIO

Agriculture in India provides a livelihood for the majority of 600 million rural people who live in nearly half a million villages spanning the length and breadth of the country. India's economic growth and prosperity as a nation depends on the annual rich harvest of crops, the principal source of food, feed and fibre. If agricultural productivity is high it benefits the economic activity of the farmers. Thus, productivity improvements in agricultural commodities are a basic priority to be linked to profitability and sustainability if the income of the farmers is to be doubled in the next five years.

One of the major challenges before Indian Agriculture is growing population. The National Commission on population estimated that India's population will be 1.4 billion in 2026 and hence the population growth coupled with rapidly improving living standards naturally shall hike the demand for food, feed, fibre and fuel continuously. Another daunting challenge is to bridge the widening gap in per capita income between agriculture and other sectors as is evident from the downward share of agri-sector in GDP, but there is no commensurate decline in the number of people dependent on agriculture for livelihood. It is, therefore, vital to deploy new technologies and higher investment to achieve desired growth in agriculture. Crop sector is dominant in agriculture and hence increasing productivity with profitability which calls for production to marketing as a system of agriculture is highly desirable for improving the farmer's income. Technological support has helped to mitigate the crisis encountered in the past. Recent years to remind of sign of gloomy days of agriculture witnessed prior to green revolution. Growth in agriculture is decelerating. Climate change is looming in the horizon restricting agriculture's growth. Farmers are agitating for better returns from their produce. Exports have declined. The country is already importing huge quantities of pulses and oils. Thus, agriculture is not all that well, and yes, it needs another technology support to mitigate the new crisis.

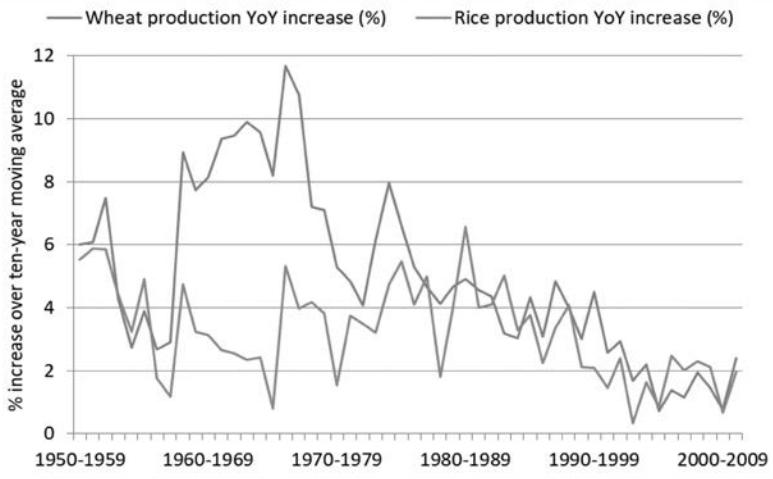
TECHNOLOGY - LED GROWTH IN THE PAST

Post-independence India suffered the first shock when the country had to import red wheat and milo sorghum under PL480 agreement from USA to feed the population. The country survived as the "ship-to-mouth turned the table around using appropriate technology". Green revolution during 1960s and 70s which resulted in unprecedented increases in food production is considered the first technological development in independent India. The development of semi-dwarf Norin 10 wheat cultivars which featured Rht1 and Rht2 genes that dwarfed wheat plants by half was a major breakthrough in traditional plant breeding. This dwarfing produced wheat plants which were less prone to lodging; responsive to up-take of nutrients and thus gave high productivity. A series of semi-dwarf cultivars produced by CIMMYT in Mexico and later used in India to produce the high yielding input responsive rust-resistant wheat cultivars brought about a wheat revolution. Wheat productivity tripled from 827 kg per ha to in 1965 to 2679 kg/ha in 1996. Similarly, in 1996-97 rice production touched 82 m tonnes with productivity of 1900 kg/ha (Figure 1). Here also the revolution came because of introduction of genes for dwarfness in rice which were associated with high crop yield. Farmers in Northern India rapidly adopted the semi-dwarf wheat and rice technologies and became the

food bowl of India. Therefore, the dwarfing genes in wheat and rice are classical examples, which stands testimony to the power of genetic technology that ushered the green revolution and subsequently helped productivity gains.

rise to private seed companies and quality seed production which engaged more than a million farmers in the production business and a few thousands non-farmers in processing, and the supply chain.

Figure 1. Changes in wheat and rice production expressed as % increase over a ten year moving average from 1950-51 to 2010-11



Source: Choudhary, B. et al. (2014). Regulatory options for genetically modified crops in India. Plant Biotechnology Journal, 12, 135-146.

Yet another revolution occurred using the genetic technology of heterosis breeding or hybrid technology. Indian Agriculture is predominantly rain-dependent and nearly 60 per cent crops are grown as rainfed. Hybrid technology sparked the cultivation of dryland crops in mid seventies and production rose dramatically. Hybrids of pearl millet, sorghum, cotton that could survive despite erratic monsoon rains gave farmers a new confidence in cultivation. The technology developed for cross-pollinated crops has now been extended to self-pollinated crops like, rice, and mustard. Currently hybrid technology is extensively adopted in nearly three dozen crops in India. The technology also gave

BIOTECHNOLOGY - AIDED GROWTH IN PRESENT CASES

In the last decade, precisely in the beginning of the current century, Biotech-aided growth has taken the technology platform which featured the application of biotechnology to crops. Genetic enhancement has been successful in meeting the demands of the ever-increasing population largely because of discovery and use of novel genes. The conventional methods are limited by sexual compatibility barriers. With the advent of new biotechnology tools and techniques, it has been possible to access genes from diverse biological systems and deploy them in target species. Use of crystalline protein genes from the soil bacterium, Bacillus thuringiensis in genetic engineering of crops like corn, and cotton, clearly depicts how genes from evolutionarily distant organism can bring new revolution in agricultural production and benefit farmers. Besides Bt genes, several other genes have also been prospected, and validated and are being deployed to gain commercial advantage. Using the tools and techniques of biotechnology and genetic engineering several new technologies have emerged, and adopted in the world. Three such biotechnology-assisted developments that benefit the Indian farmers in crop sector due to their commercialization are micropropagation, marker-assisted breeding, and transgenic technologies.

1) Development of tissue culture technology for rapid multiplication of disease-free, quality planting material has been highly successful in a number of vegetative propagated crops. In India commercial tissue culture plantlets are available in banana, sugarcane, pomegranate, citrus and a few others. Attempts to expand these technologies for date palm and many forest crops, medicinal and aromatic plants are in process.

2) Marker-assisted selection or breeding has been a new tool with the breeders for precisely moving genes using markers for desired traits without altering the architecture or morphology of plants. Recently great

success has been achieved in improving Basmati rice in to Pusa Basmati 1, highly resistant to bacterial blight - a serious disease of basmati rice. The MAS technology is currently used extensively for crop improvement.

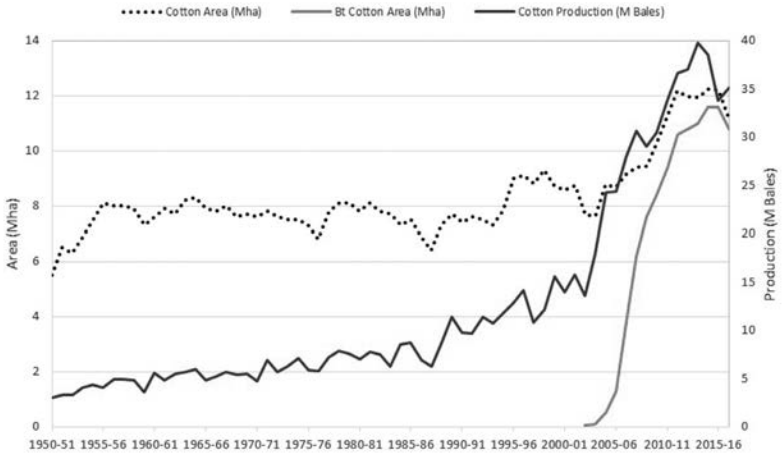
3) Commercial approval to cultivate genetically modified Bt cotton, first used in 2002, commenced the era of transgenic technology in India. Bt cotton benefitted the producer farmer by enhancing the cotton yield, the processor for getting sufficient raw material, and the country, by regularly exporting 8-9 million bales. Prior to 2002 the cotton yields were stagnant at 300 kg lint per ha for more than 20 years. Every alternate year the crop suffered due to bollworm damage. Bt introduction altered the scenario and doubled the yield in five years after introduction. India became the largest player in cotton production (Figure 2).

WHY SHY AWAY FROM TECHNOLOGIES OF FUTURE?

Transgenic or genetically modified technologies have been used profusely in crop improvement and commercialized in many countries. Unfortunately, commercial approvals for GM crops has been practically stalled in India due to misinformation and lack of understanding of such technologies to the public. Bt brinjal, GM mustard, stacked trait Bt/HT cotton and stacked trait Bt/HT maize and many such crops are approved by technical committees but withheld for political clearance. A new generation of crops known as "gene-edited" rather than genetically modified are coming to market. Gene edited crops are created through new tools that strip and tweak DNA/RNA at a precise location. The crops developed using gene-edited technologies, at least, for now, largely fall outside of current regulations in many countries including USA, Spain and the Netherlands. India is still grappling with GM crops and their products with activists stalling their development. Unlike other methods of genetic engineering these techniques, like CRISPR-which allows scientists to edit genomes with unprecedented precision and flexibility using bacteria, so far have generally not been used to add genes from other organisms into crop plants. First generation CRISPR-Cas9 system allows permanent modification of gene(s) within organisms by either silencing the gene(s) or by adding gene(s) for desirable traits in the plant genome. Integration of genomics efforts with transgenic transformation capabilities and gene-editing enhancements will open new vistas of crop improvement targeted at simple traits such as low saturated & high oleic edible oil, gluten reduced wheat, high fiber wheat, Orobanche tolerant mustard, allergen free peanuts to complex traits such as salinity and drought tolerance etc.

Given the disruptive nature of gene-edited technologies coupled with transgenic technologies, India must accelerate the process of establishing its regulatory system on gene-edited technologies, and facilitate the process of developing capacities of public sector institutions to harness the benefits of 21st century biotechnology innovations for farm prosperity and food security of a 1.3 billion nation. Let us not shy away from adopting the new technologies for the benefit of farmers, and the nation as they alone can improve the sustainability of agriculture through higher productivity and profitability.

Figure 2. Adoption and Impact of Bt Cotton in India, 2002 to 2016



Source: Analyzed by South Asia Biotechnology Centre, 2016

Mr. Nitin Kher

AGRICULTURE PUZZLE

Mr. Nitin Kher

Author is an accomplished Investment Banker, with over 25 years of comprehensive experience in the entire gamut of financial services including Merger / Acquisition / Joint Venture Transactions / Valuation & Business Negotiations / Drafting of Legal Documents / Resolution of Commercial Disputes through Settlement.

Agriculture and its associated problems have been a never ending story since independence, always hitting newspaper headlines for some reason or the other. During last three years both the Central and State Government have taken path breaking initiatives such as Soil Testing, Crop Insurance, Amendment to APMC Act (whereby it is not necessary to sell through APMC) Neem Coating for urea and its free availability, Loan Waiver Scheme, Contract Farming Initiatives, Jal Shivar Abhiyan etc. which deserve accolades. While these initiatives help in strengthening agriculture infrastructure and policies towards farming community, what is more important is to ensure fair price to farmers which is the only lasting solution to make agriculture a self-sustaining occupation.

While Part I of farmers' recent agitation was centered around loan waiver, the Part II of farmers' agitation will be centered around increase in Minimum Support Price (MSP) to cover 50% mark-up over cost of production as recommended by Swaminathan Commission Report. While this may ensure fair price to farmers, it will have cascading effect on retail inflation as food items have 46% weight in retail inflation. The price should be fair to both farmers and consumers. I am of the considered view that government has a role to play in supply chain management – from farm producer to end consumer.

The objective of this article is to suggest measures:

1. To maintain & control price levels of essential commodities throughout the year
2. To ensure fair price to both farmers & consumers
3. To make "Carteling and Hoarding" economically unviable

In past two years i.e. during 2014-2015 and 2015-2016, we have witnessed divergent scenarios namely "Poor Monsoon, Crop Failure, Drought" and "Good Monsoon and Bumper Crop" and under both scenarios, farmers and consumers have suffered.

During October – November 2015, the government was caught unware when there was a sudden spurt in price levels of essential commodities, be it ONIONS or TUR DAL and it was compelled to take desperate and reactive measures by cracking down on hoarders, imposing stock limits, and importing commodities. However, by the time the confiscated commodities were released in the market and the situation was brought under control, opposition parties screamed, the public lost its patience, and the government credibility was lost.

Crack down on hoarders is not a permanent solution and it may give rise to 'Raid Raj' which will bring discredit to the government which is perceived to be "Business Friendly".

When headlines like **"Probe Pulses Scam, axe food minister"** appear in newspapers, government is compelled to take knee-jerk measures, but such measures have failed to deliver on ground results immediately.

When onions were sold in the market for Rs.70 /- per k.g., the farmers did not get even Rs.7 /- per k.g., the difference was pocketed by hoarders and cartelers. When Tur Dal prices touched Rs. 200 to Rs. 250 per k.g., the government cracked down on hoarders and seized Tur Dal worth Rs. 450 crores in Maharashtra alone. The magnitude of hoarding suggests that it is not a handiwork of traders in ordinary course of business who do not have such financial

wherewithal. It certainly has the direct or indirect backing of certain influential political parties who use funds to finance elections.

India Today in an article titled "The Great India Dal Scam Revealed" dated 24th November 2015, exposed the modus operandi of satta traders / operators. The operators first identify which crop is likely to fail, then form a cartel and devise a strategy to artificially inflate prices. Large imports are made from all major supplying countries like Myanmar and Africa and the most crucial link of modus operandi is that they hoard it at foreign ports.

Times of India reported on 26th January 2016 that Intelligence Bureau (IB) alerted government of pulse importers forming cartels to make killing in red lentils (masoor dal). The report had named companies buying masoor in large quantities and cornering stocks in Canada, which is the largest exporter of red lentils to India. While steps must be taken to ensure that traders do not exploit the situation, we must also realize how traders are hundred steps ahead of us. They have better assessment of harvest and map potential country where produce is available. They buy most of produce by the time government starts planning.

Therefore, the crackdown on hoarders and taking punitive action such as arrests is not a solution to break cartels. The "Economics of Scam" operate behind these illegal activities where the gains are so enormous that arrests do not act as deterrent. "Raids & Arrests" are neither permanent solution to food inflation nor offer fair price to farmers. **The only solution is "TO MAKE CARTELING AND HOARDING ECONOMICALLY UNVIABLE"**.

Margaret Thatcher once said 'it is not the business of government to do business', she probably would not have realized the magnitude of impact the hoarding and carteling could have on the economy. In my humble opinion **to understand dynamics of market forces the government should participate in the market. Market is smarter than any administrative measure. Pro-active participation in market will lead to definitive results compared to passive coercive action such as penalty and arrests.**

In view of above, I propose the following action plan in the public interest.

1. Float a 'Maharashtra State Trading Corporation' (MSTC) to trade in commodities within Maharashtra under direction and supervision of professional management having in-depth knowledge of supply chain and market dynamics. Management should have foresight and understanding of market situation to take 'preemptive action' to check-mate cartelers' strategy.

2. The MSTC should endeavor to control at least 25% of market of essential commodities. According to economic theory of cartel, the cartels fail once the dominant player (having market share of 25% or more) reduces the prices. In 1980s carteling by OPEC countries failed on this account.

   Since demand for essential commodities is price sensitive, it would be possible for MSTC to capture significant market share in short time.

3. The MSTC should buy directly from farmers and market products through 'Ration Shops'. MSTC can play crucial role in maintaining price levels during both drought situation and bumper harvest.

   If for example, when onions are sold in the market for Rs.70 /- per k.g., the farmer does not get even Rs.7 /- per k.g, government should buy onions directly from farmers @ Rs 10 /- per k.g. and sell in the market @ Rs.18 per k.g., the prices of onions will crash. Similarly, during bumper crop when onions are selling at low prices say Rs 7 /- per k.g. Government can buy at high price say Rs 10/- per k.g., the price levels will stabilize. It will act as 'minimum support price' to farmers.

   In June 2017 when onions were being sold at Rs 1 and Rs 2 per k.g., Madhya Pradesh Government took decision to buy onions at Rs 8 per k.g. not knowing what to do with so many onions. MSP whether for onions, rice or tur dal is only one part of agriculture puzzle and a robust distribution channel is a much-needed missing piece to solve this puzzle. In the absence of distribution channel, government is forced to play into hands of traders, marketers

to immediately dispose of the agriculture produce procured under MSP.

4. In any 'Business to Consumer' i.e. B2C business distribution channel is key and fortunately government is blessed with robust distribution channel in the form of 'Ration Shops' across all cities and villages at all convenient locations.

5. The 'Ration Shops' are required to be re-branded as "Maharashtra Convenience Stores". At present government sells commodities to Below Poverty Line (BPL) families through ration shops. Those having white ration cards or with higher income do not visit ration shops at all. By re-branding ration shops as 'Maharashtra Convenience Stores" or "Maha-Ganata Stores", the scope of activities will get extended to cover both 'Ration' and 'Non-Ration' commodities. It will be a win –win situation for all namely ration shop owners, public and the government.

   Due to Pan - Maharashtra presence, visiting 'Maharashtra Convenience Stores' will be more convenient to general public than visiting selected few Apna Bazar Stores, Sahakari Bhandar stores, D Mart, Reliance Fresh, Big Bazar etc. During Ganesh Chaturthi, Tur Dal was made available by government @ 95/- per k.g. in 23 select stores across Mumbai. However, it did not serve any purpose as it failed to address critical mass.

   According to clause 9(9) of Ministry of Consumer Affairs, Food and Public Distribution Order G.S.R. 213 (E), New Delhi dated 20th March 2015, ' the state government **shall** allow sale of commodities other than food grains distributed under the Targeted Public Distributed System at the fair price shop to improve the viability of the fair price shop operations'.

   When central government has recognized the importance of ration shops in public distribution system and directed the states to do the needful, the state government should make supplies of essential commodities available through 'Maharashtra Convenience Stores' 24/7 on all 365 days and also run a sustained campaign like Swatch Bharat Abhiyan to bring awareness amongst the public.

6. The government should take help from FMCG experts to establish supply chain both in local and international markets. Companies like Parle and Britannia do not disturb the price point of Rs. 5 per packet of biscuits because of robust supply chain and long-term supply arrangements of raw materials.

7. Today Food Corporation of India buys commodities and stores in warehouses as buffer stocks to be released in market during emergency. Should Food Corporation of India trade on daily basis and the supplies reach market 24 / 7 on all 365 days, the prices will stabilize.

   According to central government report "Economics of food grains management in India", Ministry of Finance, September 2010; the margin of stocks above the minimum buffer stocks has been increasing over the years between 2003-2010. This could lead to the rotting or hoarding of food grains.

   The holding of stocks above the minimum buffer norms also adversely impacts prices of grains in the open market. This affects poor households, which buy the remaining requirement of food grains from the open market. In a discussion paper, the then Chief Economic Advisor, Kaushik Basu noted that the centre holds food reserves significantly higher than the stated buffer norms. He argued that food grains need to be released into the market to contain food-price inflation

8. Government should immediately commence pilot project in 4 cities – Mumbai , Pune , Kolhapur and Nagpur and select 5 to 6 commodities to start with namely:

   a. 2 to 3 types of pulses – tur dal, mug dal, chana dal

   b. Wheat

   c. Onions and potatoes

9. The Rs.500/- crore 'price stabilization' fund announced by central government did not have much impact on controlling prices. Even talks with Food & Grains Association did not yield positive results because

they have no control over lakhs of traders spread across the country. Talks with trade and manufacturers' association can yield positive results when there are few suppliers like in case of cement industry where number of manufacturers having million-ton capacity are not more than 10 all over India.

The prices can only be controlled if supplies are made available in market 24/7 on 365 days a year.

10. Recently central government has launched e-National Agricultural Market (e-NAM) connecting 21 wholesale markets (mandis) from eight states, a first step towards 'One Nation, One Market". Till December 2016, 31 lakh tonnes of agriculture produce worth Rs.6,13,890 crore was sold on e-NAM platform. The number of users till December 2016 consists of 8.55 lakh farmers, 59,155 traders and 30,790 commission agents. The phase II of the project will include interstate trading of commodities. This will help in controlling only wholesale price inflation. However, to control retail inflation the state government should take initiative of 'Maharashtra Convenience Stores' which will serve as **last-mile connectivity to consumers.**

11. If 100% government effort and 100% ownership of Maharashtra State Trading Corporation is not feasible, the government should form a Joint Venture with a reliable company having expertise in food procurement and distribution whereby the government will contribute capital in the form of intellectual property rights of vast distribution network of 'Maharashtra Convenience Stores' (i.e. ration shops) and the JV partner will bring in required cash in an agreed percentage shareholding.

    There is no accurate data available about number of ration shops in Maharashtra. Assuming 1,00,000 ration shops in entire Maharashtra, the valuation of distribution network shall not be less than Rs 100 crores (1,00,000 x Rs 10,000 per shop)

12. Ensuring fair price to farmers will strengthen their financial position and they will be in a better position to handle drought type situation through savings and not commit suicides. They will be in a position to repay loans and provide for contingencies. This will save government from providing subsidy, grants, loan and interest waiver and conserve resources. It will be a win –win situation for government by keeping both farmers and consumers happy. Fair price to farmers will make farming a self-sustaining occupation.

13. Like minimum support price mechanism for farmers, the government should introduce cap on MRP of essential commodities packaged or not. Supreme Court has recently upheld Center's powers to limit prices of essential commodities to curb profiteering by pharma companies. (Reported in Times of India dated 22-10-2016)

14. If the above scheme is implemented professionally, it will provide permanent solution and take away government botheration and save lot of unproductive effort and energy. Government will have enough time to focus on development and public welfare.

In the end, I would like to conclude saying:

ONLY GOOD ECONOMIC FORCES CAN BEAT BAD ECONOMIC FORCES,

MAY GOVERNMENT BE THE CHANGE AGENT!

Prof. Dr. Firdos T. Shroff

TEN Technological innovations - Revolutionizing Indian Agriculture – Building START-UPS

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Introduction :

Agriculture development is the need of the hour. Contribution of agriculture sector to the GDP is abysmally low for a sector that employs about 50 per cent of the country's population. However, this is mainly due to the farmers' inability to generate income from their crops and curb their growing debt. What can we do about it? Some Startups came up with an innovative answer to that question.

Here are ten notable innovations such companies have produced that are revolutionizing Indian Agriculture.

1. Barrix Ago Sciences :

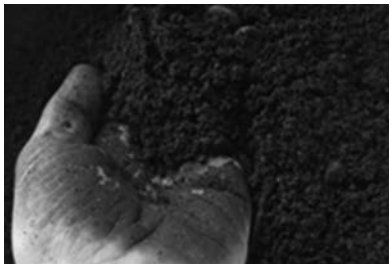
The Bangalore-based startup offers eco-friendly crop protection methods after much research on products that support organic farming to increase crop produce and quality with minimal expenditure.

Products:

- Barrix Catch Fruit and Fly Lure + trap: Toxic pesticides contaminate water, soil and leave behind harmful residue, besides being expensive. Barrix's pheromone-based pest control traps have artificially synthesised smelling agents that attracts and traps pests. Instead of eating the crops, the pests are attracted to the pheromones in the traps.

- Fly pest sticky sheet: Barrix uses bright yellow and blue coloured recyclable sheets of wavelengths between 500 nm to 600 nm, proven to effectively attract and trap at least 19 high-risk pests from a long distance.

2. AnulekAgrotech



Set up by Mumbai - based entrepreneurs, Anulekh focuses on increasing soil fertility to achieve higher agricultural productivity and crop yield with lower resource use.

Product:

BIOSAT: BIOSAT (Biochar based organic Soil Amendment Technology), a soil additive, is made of biochar mixed with different organic nutrients. The product preserves soil fertility, traps carbon emissions, maintains the topsoil strength and increases crop production, thus reducing dependency on chemical fertilizers.

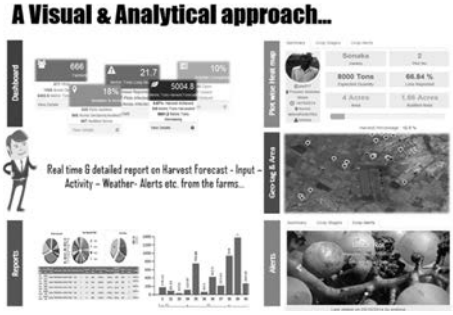
3. Mitra:

A Nashik-based startup, MITRA (Machines, Information, Technology, Resources for Agriculture) aims to improve mechanization at horticulture farms with the use of R&D and high quality farm equipment.

Products:

Air blast sprayers: Developed for fruits and vegetables in general, and grapes and pomegranates in particular, the sprayers, used to add hormones that help the growth of crops, reduce the expenditure on manual labour and are less time-consuming

4. Crop in Technology Solutions :

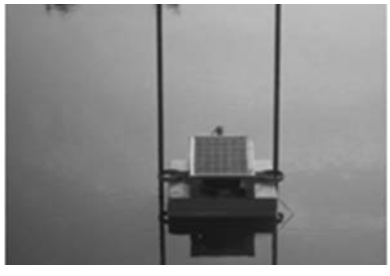


A farming technology solutions startup founded by a Bangalore software engineer, it provides agri businesses the technology and expertise to create a smarter and safer food supply for consumers around the world.

Product:

CropIn offers information on a cloud-based platform, integrated with a mobile app for Android. Called Smart Farms, it allows large food companies to track the growth of crops on farms around the country with details about what the crop is and the conditions it is grown in to help companies remotely monitor farms, interact with farmers and make every crop transparent and traceable. It also aids farmers in adopting global agricultural practices and improves productivity by offering productivity insights and harvest forecasts.

5. Eruvaka Technologies:



An organisation based in Vijayawada, Andhra Pradesh, its mission is to accelerate the use of technology in aquaculture, an area where farmers face problems due to unavailability of adequate technology to measure and control water health.

Product:

To help farmers monitor aquaculture ponds, Eruvaka Technologiesdevelops solar-powered flouting buoys that measure different water parameters, such as oxygen levels, temperature and pH range, crucial for the growth and survival of fish and shrimp. The collected information is uploaded on the cloud and transmitted to individual customers through an Android app, SMS, voice call or the internet. Farmers can also remotely control automated equipment such as aerators and feeders.

6. Skymet :

Skymet is India's largest weather monitoring and agri-risk solutions company. According to their website, they are the experts in measuring, predicting, and limiting climate risk to agriculture, thus reducing losses incurred due to bad weather conditions.

Product:

Launched to aid farmers, Skymet's weather website offers services such as weather forecast, crop insurance and agri-risk management. Prediction of weather conditions can help prepare the farmers for a drought or heavy unseasonal rainfall and help them take appropriate preventive measures. They claim to accurately measure and predict yield at the village level for any crop.

7. Ekgaon :

A Gujarat-based venture started in 2001, Ekgaon Technologies is an IT based network integrator that provides a technology platform and offers a range of services to farmers in rural areas including financial, agricultural inputs, and government assistance.

Products:

- Financial: A mobile phone enabled financial services delivery platform, it provides information on microfinance institutions and banks for delivery of door-step services such as credit, savings, remittance, insurance, investment and mortgage.

- Agricultural: Offered in Hindi, Gujarati and Tamil languages, the system uses mobile, voice recognition, interactive voice response system (IVRS) and web technologies to provide information on weather, commodity market prices, soil nutrient management and crop management.

- Citizen: The web and mobile applications help citizens monitor the delivery of government programmes and services entitled to them.

8. Digital Green:

Digital Green is a not-for-profit international development organisation that focuses on training farmers to make and show short videos where they record their problems, share solutions and highlight success stories as community engagement to improve lives of rural communities across South Asia and Sub-Saharan Africa.

Products:

- It uses technology - enabled behaviour change communication that is cost-effective, scalable and brings together researchers, development practitioners, and rural communities to produce and share locally relevant information through videos.

- Two social online games Wonder Village and Farmer Book: In the games, players simulate a village economy and relate with actual farmers that Digital Green works with, on the field. The players are placed in a resource-constrained setting in which they have to complete quests such as set up paddy and maize farms and supply raw materials to the farmers' markets.

9. FrontalRain Technologies:

The Bangalore-based agri-tech startup seeks to deliver affordable advanced technology solutions for emerging companies and take technology to remote corners of the country.

Product:

The company's offering Rain+, according to their website, is a comprehensive suite of products on the cloud for food and agribusinesses. Rain+ can help companies at every stage of the value chain starting from growing, processing, logistics, wholesale trade, retail trade and exports. This technology, accessible through desktop, tablet and mobile devices, is used by companies dealing with commodities like spices, herbs, basmati rice, seeds, animal feed, sea food, dairy and edible oil.

10. Agrostar:

A Pune-based 'direct to farmer' m-commerce platform, Agrostar strives to provide quality agro inputs at the farmers' doorstep.

Product:

AgroStar enables farmers to procure a range of agricultural goods such as seeds, crop nutrition, crop protection and agri-hardware products by simply giving a missed call on the company's 1800 number or through their mobile app to eliminate unavailability of products, substandard products, duplication and adulteration.

Conclusion :

The above start-up innovation is supported by the 'Deshpande Foundation India' that is based out of Hubli, Karnataka and is building a nurturing ecosystem for entrepreneurship, innovation, and local, grassroots efforts so that young people can transform this growing country.

Reference :

http://www.thealternative.in/business/10-technological-innovations-revolutionizing-indian-agriculture/ - Deshpande Foundation

National Food Security Act & the Customer

Adv. Guri Chandrayan,
Central Executive Member, All India Cosumer Panchayat

Courtesy : Dept. of Food & Public Distribution, Government of India

The primary policy objective of the Department of Food & Public Distribution is to ensure food security for the country through timely and efficient procurement and distribution of food grains. This involves procurement of various Food grains, building up and maintenance of food stocks, their storage, movement and delivery to the distributing agencies and monitoring of production, stock and price levels of food grains.

The focus is on incentivizing farmers through fair value of their produce by way of Minimum Support Price mechanism, distribution of Food grains to Below Poverty Line (BPL) families and covering poor households at the risk of hunger under Antyodaya Anna Yojana (AAY), establishing grain banks in food scarce areas and involvement of Panchayati Raj Institutions in Public Distribution System (PDS).

As passed by Parliament, Government has notified the National Food Security Act, 2013 on 10th September, 2013, with the objective to provide for food and nutritional security in human life cycle approach, by ensuring access to adequate quantity of quality food at affordable prices to people to live a life with dignity. The Act provides for coverage of upto 75% of the rural population and upto 50% of the urban population for receiving subsidized foodgrains under Targeted Public Distribution System (TPDS), thus covering about two-thirds of the population. The eligible persons will be entitled to receive 5 Kgs of foodgrains per person per month at subsidised prices of Rs. 3/2/1 per Kg for rice/ wheat/coarse grains. The existing Antyodaya Anna Yojana (AAY) households, which constitute the poorest of the poor, will continue to receive 35 Kgs of foodgrains per household per month.

The Act also has a special focus on the nutritional support to women and children. Besides meal to pregnant women and lactating mothers during pregnancy and six months after child birth, such women will also be entitled to receive maternity benefit of not less than Rs. 6,000. Children upto 14 years of age will be entitled to nutritious meals as per the prescribed nutritional standards. In case of non-supply of entitled foodgrains or meals, the beneficiaries will receive food security allowance. The Act also contains provisions for setting up of grievance redressal mechanism at the District and State levels. Separate provisions have also been made in the Act for ensuring transparency and accountability.

Subsidised prices under TPDS and their revision : Foodgrains under TPDS will be made available at subsidised prices of Rs. 3/2/1 per kg for rice, wheat and coarse grains for a period of three years from the date of commencement of the Act. Thereafter prices will be suitably linked to Minimum Support Price (MSP). In case, any State's allocation under the Act is lower than their current allocation, it will be protected upto the level of average offtake under normal TPDS during last three years, at prices to be determined by the Central Government. Existing prices for APL households i.e. Rs. 6.10 per kg for wheat and Rs 8.30 per kg for rice has been determined as issue prices for the additional allocation to protect the average offtake during last three years.

Identification of Households: Within the coverage under TPDS determined for each State, the work of identification of eligible households is to be done by States/ UTs.

Nutritional Support to women and children: Pregnant women and lactating mothers and children in the age group of 6 months to 14 years will be entitled to meals as per prescribed nutritional norms under Integrated Child Development Services (ICDS) and Mid-Day Meal (MDM) schemes. Higher nutritional norms have been prescribed for malnourished children upto 6 years of age.

Maternity Benefit : Pregnant women and lactating mothers will also be entitled to receive maternity benefit of not less than Rs. 6,000.

Women Empowerment: Eldest woman of the household of age 18 years or above to be the head of the household for the purpose of issuing of ration cards.

Grievance Redressal Mechanism : Grievance redressal mechanism to be set upat the District and State levels. States will have the flexibility to use the existing machinery or set up a separate mechanism.

Cost of intra-State transportation & handling of foodgrains and FPS Dealers' margin : Central Government will provide assistance to States in meeting the expenditure incurred by them on transportation of foodgrains within the State, its handling and FPS dealers' margin as per norms to be devised for this purpose.

Transparency and Accountability: Provisions have been made for disclosure of records relating to PDS, social audits and setting up of Vigilance Committees in order to ensure transparency and accountability.

Food Security Allowance: Provision for food security allowance to entitled beneficiaries in case of non-supply of entitled food grains or meals.

Penalty : Provision for penalty on public servant or authority, to be imposed by the State Food Commission, in case of failure to comply with the relief recommended by the District Grievance Redressal Officer.

Functions

- Implementation of the public distribution system with special focus on the poor.
- Provision of storage facilities for the maintenance of central reserves of food grains and promotion of scientific storage.
- Formulation of national policies relating to export and import, buffer stocking, quality control and specifications of food grains.
- Administration of food subsidies relating to rice, wheat and coarse grains.
- Policy matters relating to sugar and sugarcane sector, fixation of fair and Remunerative Price (FRP) of sugarcane payable by sugar factories, development and regulation of sugar industry (including training in the field of sugar technology) and sugar supply for PDS.
- Supporting industries, the control of which by the Union is declared by Parliament by law to be expedient in public interest, as far as these relate to vanaspati, oilseeds, vegetable oils, cakes and fats.
- Price control of, and inter-state trade and commerce in, and supply and distribution of Vanaspati, Oilseeds, Vegetable oils, Cakes and Fats.

5 Individuals in the following priority groups are entitled to an AAY card, including :

i) Landless agricultural labourers,

ii) Marginal farmers,

iii) Rural artisans/craftsmen such as potters and tanners,

iv) Slum dwellers,

v) Persons earning their livelihood on a daily basis in the informal sector such as porters, rickshaw pullers, cobblers,

vi) Destitutes,

vii) Households headed by widows or terminally ill persons, disabled persons, persons aged 60 years or more with no assured means of subsistence, and

viii) All primitive tribal households. Entitlements under TPDS Eligible beneficiaries are entitled to subsidised food grains such as wheat and rice. States have the discretion to provide other commodities such as sugar, kerosene, and fortified atta under TPDS.

State governments are responsible for ensuring and monitoring, vigilance committees to be set up at state, district, block and ration shop levels appointing district grievance redressal officers; establishing State Food Commissions; and vigilance committees at state, district, block and ration shop levels.

The successful implementation of this Act is necessary to present malnutrition and deaths due to starvation. It may be modified to include certain other food items like sugar, pulses, grains etc which could particularly benefit the poor. Care should also be taken to disseminate this information thoroughly to the masses.

IMPACT OF AGROVISION

AGROVISION: CENTRAL INDIA'S MEGA EVENT THAT IS AIDING TRANSFORMATION OF DRY-LAND AGRICULTURE

Despite the country makingsignificant progress in key economic sectors, it is disheartening to see the socio economic condition of Indianfarmers in general and Vidarbha in particular. With technological inputs and innovation in farming sector the overall production and productivity has improved but the profitability of farming has not kept pace with profitability in other sectors like services, employment and others.As a result the enhanced productivity has not been translated into real income of the farmers.This has been the major reason of current farm distress. Thusthe revival of agriculture is not an option but an imperative — after all, about 50 per cent of our population is dependent on it.

We are aware that, Vidarbha with its 8 districts and its surrounding region have been blessed with the fertile soil, ample rains and many favourable factors however agriculture of Vidarbha which is 87% rain-dependent has been dominated by only a few crops like cotton,soyabean and few pulses. Livestock situation is grim and allied profession of agriculture such as: dairy, poultry, goatry, piggery, sericulture, mushroom cultivation, bee keeping, medicinal and aromatic crop production etc are extremely limited. Primary agriculture is dominant and farmers are not getting worth of their efforts in return. We realized this gap and decided to alter the situation by educating,innovating and encouraging the farmers to diversify the dry land cultivation, support the crop–based system with horticulture,livestock keeping, allied professional and create a value chain for the farmers produce.

8 years ago we started an initiative "Agrovision"tosupport

faster agricultural development, accelerate the growth of agri-business and ensure a decent & fair standard of living for the farmers and their families. Under the able guidance and leadership of Hon'bleShri Nitin Gadkari, Chief Patron, Agrovision;Minister of Road Transport, Highways & Shipping; Water Resources, Ganga Rejuvenation,Dr. C. D. Mayee, Chairman - Advisory Council, Agrovision; Former Chairman, Agricultural ScientistsRecruitment Board (ASRB) ICAR.

Agrovisionhas been meticulously working to bring the latest practices,technologies, products and services not only from India but other parts of the world at one place.Through Agrovision, we are taking special efforts to educate farmers about the modern farm practices and new technologies. Here farmers, researchers, entrepreneurs, policy makers & other stake holders connected with agriculture come face to face to deliberate & discuss about various developments as well as current challenges in agriculture.

Agrovision is a unique combination of Exhibition, Workshops, Conference, Expert Panel Discussions etc. and it has become an annual feature. Through informative and interactive Workshops, an extensive Exhibition and a thought provoking Conference, Agrovision wants to enlighten and empower the farmers in particular and agriculture sector in general. Agrovision serves as a comprehensive platform to meet lakhs of farmers from the districts of Vidarbha and adjoining states and districts of Maharashtra.

With a roaring response from the farmers during the last eight editions, the Agrovision has beensuccessful in establishing itself as a major agricultural summit of the Central India. We are sure that growth of thissector will create a new class of young entrepreneurs, new satisfied farmers and possibly evenfarmers turned entrepreneurs, creating a win win situation for all.

Educate, Encourage and Empower is our motto and we continue to do that for the farmers so thatthey not only increase their income, but also contribute significantly in the nation's economy to callit in true sense the agro-based economy.

The participation of farmers has been increasing year after year and previous edition was visited by over Lakhsof farmers and more than 30,000 farmers attended the workshops, from the adjoining districts of Maharashtra and states like Andhra Pradesh, Telangana,Chhattisgarh and even from the states like UP, Bihar, Haryana.

Agrovision is one such genuine initiative, which is providing an integrative framework and a platform to bring all the stake holders consisting of farmers, Government, NGOs, Scientists,

Industry under single umbrella to deliberate and debate at different levels for all around growth of agriculture.

It is a great victory to see that Vidarbha once was known for the crops of Cotton, Soybean and Oranges but in recent years other crops like Sugarcane, Rice, Pulses, Pomegranate, Turmeric, Ginger have seen a remarkable production in Vidarbha. The real impact of this event can be gauged from the fact that many farmers are now planting pomegranate,custard apple,amla, dragon fruit and other dry land fruit crops and getting huge benefits of farming. A current evaluation of impact has shown that in the last five years pomegranate cultivation which was just 100 acres in Vidarbha in 2010-11 has now reached 5000 acres in all the western Vidarbha districts. Milk production has shown an upward trend making NDDB possible to create special facilities of processing. Sugarcane cultivation and sugarproduction has given a leverage to farmers to have a modern living.

In Central India, farmers now await for the arrival of Agrovision to learnnew innovations in agriculture. It has achieved its goal in creating the awareness in diversification of farming from cotton-soyabean, millet and making a shift to Dairy, Horticulture, Sericulture, Bee Keeping, Floriculture,Polyhousefarming, Processing etc.

Just fewexamples are that after learning about Pomegranate cultivation many farmers from Vidarbharegion have turned to Pomegranate. On the other hand Farmers have understood the importance of livestock management and have started looking at Poultry, Dairy, Goat Keeping and Fisheries for their additional income.

Through Agrovision Foundation we have started various training programs for the farmers to train and educate them about the latest technologies and innovative methods to increase the farm yield. At present, 21 topics have been identified and so far we have conducted training programs on 17 topics. The training programs are getting an excellent response and in future, we plan to set up a proper training institute where more exhaustive programs can be conducted along with field visits

and farmers can have lodging and boarding facilities in the institute.

In the journey of last 8 years our observation is that the farming community is ready to adopt new technologies and alternate cropping for sustainability.

About 9th Agrovision

The 9th edition of Agrovision is scheduled to be held from 10– 13 November 2017 at Reshimbhag Ground, Nagpur. The 9th Agrovision consists of Free Workshops for farmers, a National Expo, Conference on Dairy Development in Vidarbha and Experts' Panel Discussion on 'Surplus Management in Agriculture'. The theme for 9th edition is 'Educating and Encouraging Farmers for Prosperity'.

Free Workshops for the farmers is a special feature of Agrovision which are conducted by experts from Agri Universities, ICAR Labs, NABARD, Industry etc. Covering a wide spectrum of topics, these workshops are aimed at educating and empowering the farmers for their sustained development.We organize workshops for the farmers onvarious subjects like farm practices, mechanized farming, irrigation techniques, tissue culture, pre and post harvest management, green houses/net shed, nursery and enhancing the supplementary income of thefarmers through livestock etc. This year a special workshop is organized on "Bamboo Cultivation & Opportunities".

The National expo is a major attraction with participation of over 300 organizations from all the sectors of Agriculture. Organizations related to agri inputs and allied sectors, machinery & equipment, fertilizers and pesticides, growth regulators, government departments, directorates, corporate participate in the expo.The expo is held in covered hangers of around 8,000 to 10,000 sq feet plus Open to Sky area of around 3,000 to 4,000 Sq feet.

To educate the farmers about enhancing the supplementary income through livestock

management, we conduct workshops every year. This year in exhibition, a special pavilion on Animal Husbandry will be created to showcase the live display of various breeds of cows, buffalos, goats, poultry etc. The Department of fisheries will also participate to display the various breeds of fishes and educate them about additional sources of income through livestock management.

As a part of Agrovision, we organize a Conference to bring together policy makers, industry, agri entrepreneurs and experts from different parts of the Vidarbha and all over the country to exchange knowledge and ideas and come out with recommendations. This provides an insight over the entire process which is beneficial for the businessmen, agri professionals/entrepreneurs. In 9th Agrovision, Conference on "Dairy Development in Vidarbha" will be organized.

An Expert Panel Discussion will be organised on Surplus Management in Agriculture. This subject is chosen considering the fact that many a times commodities in agriculture which are produced in surplus & therefore the market prices falls miserably and are not sustainable for farmers. To discuss the problem and to suggest the means for improvement, a special discussion is organized during this episode of Agrovision. It will help in developing sound recommendations to the government. The discussion shall have eclectic mix of only 15-20 eminent key players in this sector.

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NEWS IN
MEDC

National Conference of Urban Co-Operative Banks on "Leveraging Co-operative Banks reach for Inclusive Growth"

A successful event of National Conference of Urban Co-operative Banks "Leveraging Co-operative Banks reach for Inclusive Growth" wasorganised by MEDC on 7th October 2017 at Y. B. Chavan Centre, Mumbai.

The Conference was attended by over 250 bankers, academicians, businessmen etc. from all over the region. The eminent speakerswere having rich experience in various verticals of co-operative banks.

The inauguration of the Conference was done by the eminent dignitaries from the Co-operative banking sector.

[Left to Right: **Mrs. Meenal Mohadikar** (Vice-President, MEDC), **Shri. Udaykumar Gurkar** (Chairman, SVC Bank), **Cdr. Dipak Naik** (President, MEDC), **Shri Sunil Gaitonde** (Vice-Chairman, NKGSB), **Shri R. B. Shandilya** (President (Officiating), NAFCUB), **Shri Neeraj Nigam** (CGM, RBI), **Shri Mohan Tanksale** (Strategic Consultant, SWIFT India), **Shri Jyotindrabhai Mehta** (President, SahakarBharati), **Shri Milind Kale** (Chairman, Cosmos Bank), **Shri Ravi Boratkar** (Vice-President, MEDC), **Shri Subhash Mohite** (Chairman, Pune District Nagarik Sahakari Banks Association Ltd., Pune) & **Shri Anil Gachke** (Chairman, MEDC Industries Committee)]

The Conference was classified in 4 Technical sessions which sed focus on the problems faced by banks, opportunities in the coming era, and regulatory issues and reforms for co-operative banks. The Technical Sessionswere named as follows:

Technical Session I : Policy and Legal Issues

Smt. Smita Sandhane, MD, Saraswat Bank

Shri P. K. Arora, Rtd. Chief General Manager, RBI

Shri Sunil Gaitonde, Vice-Chairman, NKGSB

Mr. Percy F. Bharucha, Hon. Managing Director, TheKalupur Comm. Co. op. Bank Ltd.,

Technical Session II: Technology & Future Banking

Mr. Deepak Ghaisas – Chairman, Gencoval

Smt. Swati Pande, CEO, MSCBA Ltd.

Shri Satish Utekar, EX- CEO, TJSB

Shri Yusuf Lanewala, Non- Executive Chairman, Mindteck

Shri Sujit Panda, Vice-President, Reliance Communications Infrastructure Ltd.

Shri Punit Jain, CEO, Nelito System Ltd.

Technical Session III: Operational Issues & Capacity Building

Shri Chandrasekhar Vaze, Chairman, Janakalyan Sahakari Bank

Shri Gautam Thakur, Chairman, Saraswat Bank

Shri Chintamani Nadkarni, MD, NKGSB

Shri Umesh Paliwal, Ex- ED, SME, RBI

Shri B. Raj Kumar, Dy. Chief Executive, IBA

Shri S. G. Date, CEO, JanKalyan Sahakari Bank

Technical Session IV: RBI related Regulatory Issues & Changes

Shri Jyotindrabhai Mehta, President, Sahakar Bharati, Chairman, Gujarat Urban Co-op. Banks Federation & Director, Rajkot Nagarik Sahakari Bank

Shri V. S. Das, Rtd ED, RBI

Shri P. K. Arora, Rtd. Chief General Manager, RBI

Shri Milind Kale, Chairman, Cosmos Bank

Shri Mohan Tanksale, Strategic Consultant, SWIFT India

Hon'ble Minister for Surface, Transport & Water Resources, Shri Nitin Gadkari Visits MEDC Office

Hon'ble Minister for Surface, Transport & Water Resources Shri Nitin Gadkariji visited MEDC Office on 28th October 2017. He appreciated MEDC's Publications on "Water" & "Aerospace Industry". He expressed his desire to see more research publications from MEDC over the coming years.

The Bank Bailout: Creating more problems than it solves

The government has recently announced an aggressive Rs. 2.11 lakh crore capital infusion plan for the NPA affected public sector banks (PSBs) over a two year period. Out of this, Rs. 1.35 lakh crore will be via the issuance of recapitalization bonds which are a restructured financial product involving no cash flow. Of the remaining Rs. 76,000 crore, Rs. 18,000 crore will come from the Budget and Rs. 58,000 crore will be raised from the market. Even though some experts have hailed this a monumental step which has become necessary in the current scenario, a closer look reveals that unless accompanied by fundamental reform in the banking sector, such a move is tantamount to only sweeping a nagging socioeconomic issue under the carpet.

The reason Indian PSBs need to be bailed out so often, is primarily that they belong to the public sector, and so, are subject to constant political interference regarding their lending activities. Manly PSBs are now ignoring their raison d'être - providing their clients with a high quality banking service - and are toeing the government line out of sheer expediency. This is not always in the best interests of their customers. Unless PSBs are allowed to be genuinely independent of government diktat or shrink into oblivion as private banks expand their sphere of influence and market forces play out their role, such periodic recapitalizations are meaningless. Also, in India, recapitalization is less about boosting the bottom-line of banks and more about saving them from insolvency.

Of course, this is not to absolve the PSBs of all responsibility. After all, they do not have – and do not even seem to be making a concerted effort to develop – adequate in-house expertise for accurate project evaluation. They also seem to be unable or unwilling to purchase this expertise from third party vendors. This is also a key factor leading to their inability to distinguish the good loans from the bad (and convince the government accordingly), leading to a huge rise in NPAs in the financial system. By end June 2017, the total bad loans of the country's 38 listed commercial banks crossed Rs. 8 lakh crore and accounted for nearly 11% of the total loans given by the banking sector.

The effect of such a massive bailout on the economy as a whole will not be too sanguine. After all, so far India has stuck to the path of fiscal consolidation reasonably well. On the global front, where credit ratings matter, it will be hard to claim that the country has a long run strategy of fiscal responsibility when there is such a massive and sudden increase in public debt, which could lead to inflationary expectations and macroeconomic destabilization. The global perception will also be that the government is keeping itself open for similar financial calls on the exchequer in the future, and so is not to be fully trusted regarding its assurances of fiscal prudence. That is likely to impact the inflow of much needed foreign capital into the economy.

Unfortunate as it sounds, one of the biggest gainers from India's banking system has been shadowy businesses who happen to have the right political contacts. As far as the NPA issue goes, such a bank bailout is not the solution – in fact, it may even aggravate the problem. The PSBs will not be incentivized to function as they are intended to, and they could even get a misplaced confidence that should their balance sheets turn unhealthy in future from inevitable and prolonged political meddling, the government is always there to bail them out. Needless to say, all this will occur ultimately at the expense of the taxpayer and the nation's global image.

From a political viewpoint, the proposed bank bailout is certainly a deft move. Even from the short-run economic perspective, it makes some sense … after all, one cannot wait endlessly for PSBs to resolve their issue of stressed assets, especially when green shoots are now becoming visible in some key sectors of the economy. However, from the long-run economic point of view, some deep introspection needs to be done as to the implications of such a bailout, not only on the efficacy of the banking sector but also on the fiscal credibility of the nation. Resorting to financial engineering and accounting sleight of hand is not the way to boost the strength and sustainability of the PSBs, and that of the economy, as a whole.

Even as we go to press a very large number of skeletons are tumbling out of the cupboard two days before the anti-black money day. We are referring to the "Paradise Papers". More about this and the fall out of "panama Papers" next month.

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