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## Agriculture & Allied Sector



## KRISHI UNNATI MELA 2018 ORGANISED



*The Prime Minister, Shri Narendra Modi at Theme Pavilion in Krishi Unnati Mela, in New Delhi on March 17, 2018.*

**K**rishi Unnati Mela was organised from March 16 to March 18, 2018 at Mela ground, IARI, Pusa, New Delhi with an objective to create widespread awareness about the latest agricultural technological developments. The fair showcased ways to enhance farmers' income through theme pavilions like micro irrigation, neem-coated urea, soil check/soil health card, reducing input costs through less use of fertiliser, effectiveness of crop insurance scheme and new dimensions of income generation such as animal husbandry, bee keeping and poultry farming. A large number of stalls were set up in the Mela by the central and state governments and various other organisations.

Prime Minister Narendra Modi visited the Mela on March 17, 2018. He went around the theme pavilion and the Jaivik Mela Kumbh and also laid the Foundation Stone for 25 Krishi Vigyan Kendras. He also launched Jaivik Kheti (organic farming) portal, an e-marketing portal for organic products. He gave away the Krishi Karman Awards and the Pandit Deen Dayal Upadhyaya Krishi Protsahan Puraskar.

Speaking on the occasion, the Prime Minister said that such Unnati Melas play a key role in paving the way for New India. Referring farmers and scientists as two sentinels of New India he said that both have to work together to transform agriculture. He said the Kisan Sampada Yojana is helping strengthen the supply chain from the farm to the market, and creating modern agriculture infrastructure. He said Operation Greens, announced in the recent budget, will be beneficial for farmers growing fruits and vegetables, especially Tomato, Onion and Potato. On Pradhan Mantri Krishi Sinchai Yojana he said that it envisions water for every farm.

The PM further said that the Union Government has decided that for all notified crops, MSP will be at least one and a half times the cost. He assured that comprehensive steps are being taken for Agriculture Marketing Reforms. The Prime Minister explained how honey-bees could be an important source of additional income for farmers. The Prime Minister also spoke of the Go-Bar Dhan Yojana for creating compost, bio-gas etc from bio-waste.



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Kurukshetra seeks to carry the message of Rural Development to all people. It serves as a forum for free, frank and serious discussion on the problems of Rural Development with special focus on Rural Uplift.

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# Editorial

**A**gricultural production is not the only output from the rural economy. Agriculture in turn, sets off other near-farm and non-farm economic activities in the rural hinterland. The overall well being of the rural population therefore depends on agriculture as a primary sector, and various associated secondary and tertiary sector activities which support agricultural economy.

This issue deals primarily with allied activities of agriculture which include among others: horticulture; fisheries sector; animal husbandry and livestock; sericulture or silk farming; apiculture or beekeeping; dairy farming and the emerging floriculture or flower farming industry.

The scenario of horticulture crops in India has become very encouraging. The percentage share of horticulture output in Agriculture has become 30%. Fruits and vegetables account for nearly 90% of total horticulture production in the country. During 2016-17, the production of horticulture crops was about 295.2 million tonnes from an area of 24.9 million hectares. According to the Horticultural Statistics at a Glance 2017, the production of vegetables has increased from 58.5 million tonnes to 175 million tonnes since 1991-92 to 2016-17. Apart from the health improvements, the production of vegetables improves the economy of a country as these are very good source of income and employment.

Great potentialities exist for cultivation of flowering plants. Increasing trends in area and production of flowers has been observed since 2003-04 onwards. In addition to the beautification of the local landscape, great scope exists for export of flowers, and floriculture is important for beekeeping industry which too provides an alternate source of income to the Indian farmers.

Department of Agriculture, Cooperation and farmers Welfare has been giving thrust on promotion of scientific beekeeping in the country in view of the crucial role of beekeeping in increasing crop productivity and enhancing farmers' income. Government has initiated various measures to promote beekeeping which include among other capacity building programmes of farmers/ beekeepers, equipment to farmers/ beekeepers for adoption of scientific beekeeping and development of bee breeders.

India is number one in milk production and contributes 19 per cent of the world's total milk production. Dairy farmers' income has increased by 13.79 per cent in the year 2014-17 compared to the previous period. Milk production, which was 155.49 million tonnes during 2015-16, is planned to be increased to 200 million tonnes in 2019-20. The Central Government has established dairy infrastructure development fund (DIDF) at the cost of Rs.10,881 crore for the period from 2017-18 to 2028-29.

Looking at the large potential in the development of fisheries, the Ministry of Agriculture and Farmers Welfare has merged all the existing schemes and started a Rs. 3000 crore umbrella scheme "Blue Revolution: Integrated Development and Management of Fisheries". This scheme includes inland fisheries, aquaculture, marine fisheries comprising of deep sea fishing, mariculture and all the activities of National Fisheries Development Board (NFDB).

It is estimated that Sericulture can generate employment at 11 man days per kg of raw silk production (in on-farm and off-farm activities) throughout the year. This potential is par-excellence and no other industry generates this kind of employment, especially in rural areas, hence, sericulture is used as a tool for rural reconstruction. Tomatoes, Onions, Potatoes are consumed throughout the year in the entire country. For the first time in Budget 2018-19, a new initiative titled "Operation Greens" has been taken so that farmers can get right price and products are also available to the consumers at suitable prices.

Declaration of Organic Farming has also been made in this budget at a large scale. For successful implementation of this, cluster based farming will be promoted and will be linked with the markets. North East and hilly states will get benefit of this scheme.

Recognising the significance of allied sector of agriculture Prime Minister Narendra Modi has also said that along with the Green Revolution and White Revolution, we must stress on Organic Revolution, Water Revolution, Blue Revolution, and Sweet Revolution to increase the income of farmers.

## ROLE OF ALLIED SECTOR IN RURAL DEVELOPMENT

Dr. H.L. Sharma

Agriculture and allied sector play a vital and critical role in a developing economy like India by reducing poverty, unemployment & inequality, ensuring food security and achieving sustainable development. To improve productivity in agriculture the focus of policies has been on the rational use of inputs like seeds, water, fertilisers and machinery.

**A**griculture and allied sector including horticulture, floriculture, sericulture, livestock, bee keeping, forestry & logging, fishery, mining & quarrying etc. play a strategic role in the process of economic development of developing countries like India. During the process of economic development, many structural changes take place in the form of declining share of agriculture & allied sector in national income, output and employment. Indian economy has also witnessed these structural changes particularly after independence. The contribution of primary sector to GDP has steadily declined from 53.71 per cent in 1951 to 17.46 per cent in 2018. However, the declining share of this sector does not undermine its significance in employment generation, foreign exchange earnings and providing food security to the increasing population of the country.

Agriculture is of so much importance in the Indian economy that any positive or negative change in this sector exerts a significant effect on the entire economy. The large scale industries of the country like sugar, tea, jute, textile (cotton, woolen & silk), paper and food processing etc. directly depend upon agriculture and allied sector for the supply of raw material. On the other hand, agriculture also draws inputs like chemical fertilizers, pesticides, power, agricultural machinery (tractors, harvesters, combines, pump sets), tools and implements from industry. This interdependence between agriculture and industry becomes strengthened through the appropriation and generation of various production and demand linkages in these two sectors. Demand for one sector's product pulls demand for another sector in an upward direction, which results in an increase in trade. Thus agriculture, industry and



trade are mutually supporting and complementary to one another.

### **Production and Growth of Agriculture & Allied Sector:**

During the planned era of development, India made a remarkable progress in the production of agriculture and allied sector. Foodgrain production in India went up from 50.8 million tonnes in 1950-51 to 275.7 million tonnes in 2016-17 reflecting an annual compound growth rate of 2.60 per cent (Fig. 1). Whereas, the production of cereals shot up nearly by six times, the production of pulses went up by less than three times during the period under reference. It is noteworthy, that foodgrain production in the country witnessed a higher annual compound growth rate (2.60%) as compared to total population (2.19%) during the period from 1951 to 2017. As a result of rapid growth in foodgrain production, per capita per day availability of foodgrains in India increased from 395 gms in 1951 to 506 gms in 2017.

The diverse agro climatic conditions in India make it possible to grow almost all types of horticultural products like fresh fruits, vegetables, root and tuber crops, flowers, aromatic and medicinal crops, spices and plantation crops. Vegetables are also an important part of horticulture sector. They constitute about 59% of horticulture production in India. In fact, India has emerged as the second largest fruit and vegetable producer in the world after China. The

country occupies first position in the world in the production of fruits like mango, banana, sapota, pomegranate & aonla and vegetables like peas & okra. The total production of spices during 2015-16 stood at 6.4 m. MT from an area of 3.26 million hectare, as per the data released by Ministry of Agriculture and Farmers Welfare in its annual report for 2016-17.

Nearly 19 per cent of the world's total milk production is contributed by India. Total milk production in the country increased from 17 million tonnes in 1950-51 to 155.5 million tonnes in 2015-16 yielding a growth rate of 3.46 per cent per annum. The production of eggs in India increased from 1832 to 82929 million numbers during 1950-51 to 2015-16. The production of fish also went up by 4.14 per cent per annum since 1950-51, having gone up from 0.752 million tonnes to 10.80 million tonnes in 2015-16. Thus, the major live stock products e.g. milk, egg and fish recorded an average annual growth rate of 4.55 per cent during 1950-51 to 2015-16.

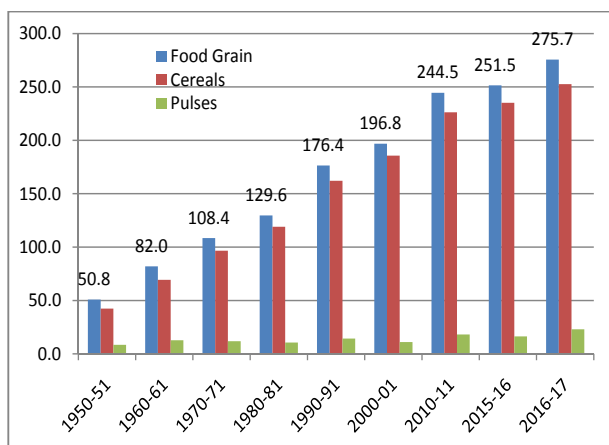
### **Role of Agriculture & Allied Sector:**

Agriculture & Allied Sector play a vital role in Indian economy. The real gross value added (RGVA) at constant prices by primary sector (including agriculture, forestry, fishing, mining & quarrying) which was to the tune of Rs. 150191 in 1950-51, went up to Rs. 2026660 in 2016-17 registering ACGR of 4.2 per cent. The importance of agriculture and allied sector is brought out by the fact that as per Census 2011, of the 313 million main workers in the country,

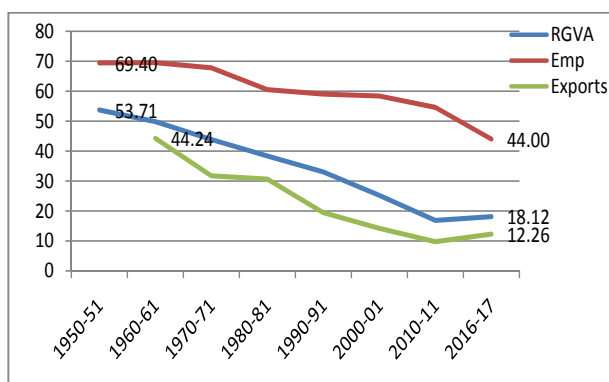
166 million (56.6%) were engaged in these activities. Presently, India is not only self-sufficient in food grains but also exports agricultural commodities. It's export of agricultural & allied products (such as rice, pulses, fruits, vegetables, tea, coffee, tobacco, spices, sugar & molasses, cashew, raw cotton, fish, meat and processed food etc.) which



**Figure 1: Trends in Agriculture Production in India (Output in MT)**



**Figure 2: Share of Agriculture & Allied Sector in GVA, Employment and Exports (%)**



were worth Rs. 284 crores in 1960-61, up surged to Rs. 226775 crores in 2016-17 reflecting a high ACGR of 12.67 per cent. India is among the 15 leading exporters of agricultural products in the world. In this arduous journey of the progress of Indian agriculture & allied sector, we braced multi-pronged strategies and technologies such as green revolution, white revolution, blue revolution, yellow revolution, pink revolution, silver revolution, golden revolution, red revolution, round revolution and now poised for rainbow revolution and ultimately to evergreen revolution.

### Structural Changes:

As the Indian economy diversified and grew up, over a period of time, the contribution of agriculture & allied sector to real gross value added GVA steadily declined from 53.71 per cent 1950-51 to 18.12 per cent in 2016-17 (Fig. 2). Despite a fall in its share in employment, agriculture and allied sector

still remains the country's major source of livelihood for nearly half of the population.

### Government Schemes:

Realising the importance of agriculture & allied sector in the economy of the country, Government of India has taken several steps & measures for its sustainable development. Steps have been taken to improve soil fertility on a sustainable basis through the *Soil Health Card Scheme* launched by the Government of India in February 2015. Under this scheme, samples of soil are taken and tested in the labs to assess the health of soil in the form of presence/absence of required micro-nutrients. Thereafter, the experts suggest the farmers the measures to improve productivity of their soil through the judicious use of inputs.

Presently, the net irrigated area in the country is only 68.1 million hectare which is nearly 48% of net sown area. In order to provide improved access to irrigation and enhanced water efficiency, Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) was launched on 1st July, 2015 with the motto of *Har Khet Ko Paani*. The scheme aims at the expansion of net irrigated area, reduce wastage of water and improve efficiency in the use of water. It also focuses on creating sources for assured irrigation through rainwater harvesting to ensure "more crop-per drop". The scheme was approved with an outlay of Rs. 50,000 crore for a period of 5 years starting from 2015-16 to 2019-20. In 2018-19 budget, a sum of Rs. 2600 crore has been earmarked to boost ground water irrigation in 96 irrigation deprived districts of the country.

Of late, demand for organically produced food grains, fruits, vegetables and drinks etc. is growing rapidly across the globe. Organic farming relies on the application of fertilizers of organic origin such as compost, vermi-compost, green manure, bio-fertilisers and bio-pesticides. It emphasis on the techniques of crop rotation and companion planting, mixed cropping and trap crop etc. Indian farmers, with their traditional methods and techniques of farming are poised to encash the immense export potential of organic farming. In order to promote organic farming in the country, a new scheme named Paramparagat Krishi Vikas Yojana (PKVY) was launched in 2015 by the Union Government. Under this scheme, the willing farmers are required to form a group of minimum 50 farmers with total area of



not less than 50 acres. Each farmer enrolling in the scheme is provided a sum Rs. 20,000 (spread over three years) per acre by the government. This fund can be utilized for obtaining agriculture inputs and transporting the produce to the market.

In order to stabilise the income of farmers by protecting them from the natural calamities a scheme, Pradhan Mantri Fasal Bima Yojana (PMFBY) was launched in April 2016. Under the scheme, in event of any loss to the notified crop (food crop, commercial/horticultural crop and oil seeds) due to any natural calamity, pest or disease, eligible farmers are paid compensation based on the difference between the threshold and actual yield. The threshold yield is calculated based on the average yield for last seven years. The extent of compensation is set according to the degree of loss to the notified crop. The scheme is compulsory for farmers availing institutional loans but optional to others.

The main focus of the Union Budget for the financial year 2018-19 is on strengthening and reviving the agriculture and allied sector in the rural economy. The Government is keen to double the income of the farmers by the year 2022, through launching new schemes which encompass farm activities from seed to marketing. To achieve this target, institutional credit to the farm sector has been increased to Rs. 11 lakh crore in 2018-19 as compared to 10 lakh crore of previous year. Operation Greens has been launched to address fluctuations in the price of perishable agriculture produce particularly tomato, onion and potato (TOP). It aims at promoting and augmenting food processing in rural area with a budgetary provision of Rs. 500 crore. In order to strengthen the agriculture marketing network, there is the proposal to set up Agri Market Infrastructure Fund with a corpus of Rs. 2000 crore. It aims at upgrading and strengthening of existing 22000 rural

*haats* into Gramin Agricultural Markets. Extending the facility of Kisan Credit Card to the farmers engaged in fisheries, aquaculture and animal husbandry, a sum of Rs. 10,000 crore have been allocated to develop this sector. The emphasis is given on creation of rural infrastructure by allocating a sum of Rs. 14.34 lakh crore is also laudable. The failure of crops for consecutive years and low prices of agricultural products have forced the farmers to commit suicides and protests in many states. The Union Budget for 2018-19 promises to fix minimum support price for all *kharif* and *rabi* crops to guarantee farmers at least 50 per cent returns of their production cost. This decision would ensure assured prices to the farmers and indeed will be helpful to achieve the target of doubling their income within the stipulated period.

In a nutshell, agriculture and allied sector play a vital and critical role in a developing economy like India by reducing poverty, unemployment & inequality, ensuring food security and achieving sustainable development. To improve productivity in agriculture the focus of policies has been on the rational use of inputs like seeds, water, fertilisers and machinery. The dynamics of agricultural growth in India reflect a reduction in the share of agriculture & allied sector in national income, output, employment and foreign exchange earnings. But, it still remains the single largest employment generating sector and source of livelihood to a large proportion of population.

To improve production and productivity of agriculture, adoption of quality inputs including high yield variety seeds is critical. There is an urgent need to expand the area under irrigation by adopting the appropriate technologies like sprinkler, drip irrigation and rainwater harvesting. The rational & efficient use of fertilizers and pesticides is also essential in order to increase productivity and avoid crop yield losses due to pests & diseases. Access to institutional credit at affordable rate is also desired to purchase expensive agricultural inputs. Further, the importance of timely Government intervention in agriculture marketing can also not be denied. Last but not least, providing timely advisory services to farmers to adopt best farm practices and technology through market information system is also essential.

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## ALLIED SECTOR AS CATALYST OF ECONOMIC GROWTH

M. Chinnadurai, K.R. Ashok, Anbarasan

Any situational change in the agriculture sector, positive or negative, has a multiplier effect on the entire economy. In recent years, the allied sector of agriculture are gaining importance for augmenting rural incomes. Forestry, Fishery and livestock sector contribute to stability in rural incomes by insulating from income shocks due to crop failures and market risks.

**A**griculture plays a vital role in Indian economy as the other sector viz. Industry and Services. Agriculture sector includes Agriculture (Agriculture proper & Livestock), Forestry and Logging, Fishing and other related activities. Over 58 per cent of the rural households depend on agriculture as their principal means of livelihood. The share of primary sector is estimated to be 20.4 per cent of the Gross Value Added (GVA) during 2016-17 at current prices. Agriculture sector occupies a centre stage in Indian economy embodying three thrust areas: (1) to promote inclusive growth, (2) to enhance rural income, and (3) to sustain food security. As per Census 2011, the total number of agricultural cultivators and agricultural labourers increased from 234.1 million in 2001 to 263 million in 2011.

Any situational change in the agriculture sector, positive or negative, has a multiplier effect on the entire economy. In recent years, the allied

sector of agriculture are gaining importance for augmenting rural incomes. Forestry, Fishery and livestock sector contribute to stability in rural incomes by insulating from income shocks due to crop failures and market risks.

Though the share of agriculture in national income has come down since the inception of planning era in the economy, still it has a substantial share in GDP. Agriculture including allied activities, accounted for 14.6 per cent of Gross Domestic Product (GDP) in 2010-11. Among the various components of primary sector, agriculture accounted for the maximum share of 12.4 per cent, followed by Forestry & logging (1.4 per cent), and Fishing (0.7 per cent), respectively.

The percentage growth of agriculture and allied sector was observed negative at -0.2 per cent in 2014-15. Among the different components in agriculture and allied sector, livestock sector has an impressive growth of 7.3 per cent, whereas



**Table 1: Percentage Share of Agriculture and allied sector GDP to the total GDP  
(2004-05 Prices)**

Particulars	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Agriculture	16.0	15.5	14.7	14.3	13.4	12.3	12.4
Forestry & logging	2.1	1.9	1.8	1.7	1.6	1.5	1.4
Fishing	0.9	0.9	0.9	0.8	0.8	0.8	0.7
Total (Agriculture, forestry & fishing)	19.0	18.3	17.4	16.8	15.8	14.6	14.6

*(Source: Central Statistics Office (As per Provisional Estimates of Annual National Income, 2015-16 released on 31.05.2016).*

**Table 1 A: Percentage Share of Agriculture and allied sector Gross Value Added (GVA)  
(2011-12 Prices)**

Particulars	2011-12	2012-13	2013-14	2014-15
Crops	12.1	11.5	11.3	10.2
Livestock	4.0	4.0	4.0	4.0
Forestry and logging	1.5	1.5	1.4	1.3
Fishing and aquaculture	0.8	0.8	0.8	0.8
Total (Agriculture, forestry & fishing)	18.5	17.8	17.5	16.3

*(Source: Central Statistics Office (As per Provisional Estimates of Annual National Income, 2015-16 released on 31.05.2016).*

other sector (Crops, Forestry, Logging, Fishing and Aquaculture) registered a negative growth.

### **Horticulture:**

Horticulture sector has become one of the major drivers of the growth in the agriculture sector. Horticulture crops, particularly fruit crops are relatively resilient to changes in weather conditions. Vegetables are mostly grown by small and marginal farmers and augment their income. Horticulture also enables the population to enjoy a diverse and balanced diet for healthy living and provides employment opportunities. The sector has gained prominence over the last few years contributing a growing share in GVA of the agriculture and allied sectors.

Government has taken several initiatives like Mission for Integrated Development of Horticulture by adopting an end to end approach for increasing production of horticulture crops and reducing post-harvest losses. Our presence in the global market has been growing. Production of fruits and vegetables has overtaken the production of

food grains in the country. The total horticulture production has increased from 191.8 MT in 2006-07 to about 295.2 MT in 2016-17. It is a matter of pride that India is the second largest producer of vegetables and fruits in the world. The country ranks first in the production of Banana, Mango, Lime and Lemon, Papaya and Okra.

### **Animal Husbandry and Dairy:**

Animal husbandry is an integral component of Indian agriculture supporting livelihood of more than two-thirds of the rural population. Animals provide nutrient-rich food products, draught power, dung as organic manure and domestic fuel, hides & skin, and are a regular source of cash income for rural households. Livestock are natural capital and act as an insurance against income shocks due to crop failure and natural calamities. Animal husbandry and dairying play an important role in socio-economic development of the country. Animal husbandry output constitutes about 30 per cent of the country's agricultural output. The fisheries sector contributed 1.0 per cent of the

total GDP at factor cost and 5.08 per cent of GDP at factor cost from agriculture, forestry and fishing in the year 2014-15. Livestock sector provide regular employment to 11 million in principal status and 9 million in subsidiary status. Women constitute 70 per cent of the labour force in livestock sector as against 35 per cent in crop farming.

About 20.5 million people depend upon livestock for their livelihood. Livestock contributed 16 per cent to the income of small farm households as against an average of 14 per cent for all rural households. India has vast livestock resources. The 19<sup>th</sup> Livestock Census places the total livestock population at 512.06 million and poultry birds at 729.20 million. Livestock sector contributes 4.11 per cent GDP and 25.6 per cent of the total Agriculture GDP.

### Livestock for Farmers' Economy:

The farmers in India maintain mixed farming system i.e. a combination of crop and livestock where the output of one enterprise becomes the input of another enterprise thereby realizing their source use efficiency. The livestock serve the farmers in different ways.

1. **Income:** Livestock is a source of subsidiary income for many families in India especially the resource poor who maintain few heads of animals. Cows and buffaloes provide regular income to the livestock farmers through the sale of milk. Animals like sheep and goat serve as sources of income during emergencies to meet exigencies like marriages, treatment of sick persons, children education, repair of houses etc. The animals thus, serve as valuable assets which provide economic security to the owners.
2. **Employment:** A large number of people in India being less literate and unskilled depend upon agriculture for their livelihoods. But agriculture being seasonal in nature could provide employment for a maximum of 180 days in a year. The land less and less land people depend upon livestock for utilizing their labour during lean agricultural season.
3. **Food:** The livestock products such as milk, meat and eggs are an important source of animal protein to the members of the livestock owners.

**Table 2: Percentage Growth of Gross Domestic Product (GDP) (2004-05 Prices)**

Particulars	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Agriculture, forestry & fishing	5.1	4.2	5.8	0.1	0.8	8.6
Agriculture	5.5	4.1	6.3	-0.3	0.4	9.5
Forestry & logging	1.8	3.3	1.4	1.9	2.9	2.4
Fishing	5.9	6.6	5.8	2.7	3.2	5.8

(Source: Central Statistics Office (As per Provisional Estimates of Annual National Income, 2015-16 released on 31.05.2016).

**Table 2. A: Percentage growth of Gross Value Added (2011-12 Prices)**

Particulars	2012-13	2013-14	2014-15
Agriculture, forestry & fishing	1.5	4.2	-0.2
Crops	0.2	4.2	-3.2
Livestock	5.2	5.6	7.3
Forestry and logging	0.3	-1.5	-1
Fishing and aquaculture	4.9	7.6	5

(Source: Central Statistics Office (As per Provisional Estimates of Annual National Income, 2015-16 released on 31.05.2016).

4. **Social security:** The animals offer social security to the owners and status in the society. The families especially the landless which own animals are better placed than those who do not. Rearing of animals is a part of the Indian culture.
5. **Draft :** The bullocks are the back bone of Indian agriculture. The farmers, especially the marginal and small, depend upon bullocks for ploughing, carting and transport of both inputs and outputs.
6. **Dung:** In rural areas dung is used for several purposes which include fuel (dung cakes), fertilizer (farm yard manure), and plastering material (poor man's cement).

### Fisheries:

Fisheries in India is a very important economic activity and a flourishing sector with vast potential. Only after the Indian Independence, fisheries has been recognized as an important sector together with agriculture. 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 8.4 million tonnes during 2017-18. This resulted in an unparalleled average annual growth rate of over 4.5 per cent over the years which has placed the country at the forefront of global fish production, only after China. Besides meeting the domestic needs, the dependence of over 14.5 million people on fishing and related activities for their livelihood, Fishery sector also earns foreign exchange to the tune of US\$ 3.34 billion (2017-18) from export of fish and fisheries products. The above facts amply justify the importance of the sector on the country's economy and in livelihood security.



India is also an important country that produces fish through aquaculture in the world. India is home to more than 10 per cent of the global fish diversity. Presently, the country ranks second in the world in total fish production with an annual fish production of about 8.4 million tonnes. As the second largest country in aquaculture production, the share of inland fisheries and aquaculture has gone up from 46 per cent in the 1980s to over 85 per cent in recent years in total fish production. Freshwater aquaculture showed an overwhelming ten-fold growth from 0.37 million tonnes in 1980 to 7.20 million tonnes in 2016, with a mean annual growth rate of over 5.96 per cent. Freshwater aquaculture contributes to over 95 per cent of the total aquaculture production. The country possesses several other endemic potential and cultivable medium and minor carp species having regional demand, such as, *Labeocalbasu*, *L. fimbriatus*, *L.gonius*, *L.dussumieri*, *L.bata*, *Cirrihinuscirrghosa*, *C.reba*, *Puntiussarana*, *P.jerdoni*. and efforts are being made to standardize the technology of mass-scale seed production of these species and their inclusion as a component of conventional carp polyculture, based on their regional importance.

### Forestry:

India is one of the ten most forest-rich countries of the world along with Russia, Brazil, Canada, United States of America, China, Democratic Republic of the Congo, Australia, Indonesia and Sudan. Together, India and these countries account for 67 per cent of total forest area of the world. India's forest cover grew at 0.20 per cent annually over 1990-2000 and has grown at the rate of 0.7 per cent per year over 2000-2010, after decades when forest degradation was a matter of serious concern.

As of 2016-17, India's forest cover was 79.42 million hectares, or 24.16 per cent of the country's total area. In 2015, forestry industry contributed 1.3 per cent to India's GDP. In 2015, the contribution to GDP dropped to 0.4 per cent, largely because of rapid growth of the economy in other sector and the government's decision to reform and reduce import tariffs to let imports satisfy the growing Indian demand for wood products. Significant forest products of India include paper, plywood, timber, poles, pulp and matchwood, fuelwood, sal



seeds, tendu leaves, gums and resins, cane and rattan, bamboo, grass and fodder, drugs, spices and condiments, herbs, cosmetics, tannins. India is a significant importer of forest products. Logs account for 72 per cent of all wood and wood products imported into India due to local preference for unprocessed wood. This preference is explained by the availability of inexpensive labor and the large number of productive sawmills. In trade year 2016-2017, India imported logs worth \$2.57 billion, an increase of about 70 per cent in just 4 years.

Indian market for unprocessed wood is mostly fulfilled with imports from Malaysia, Myanmar, Côte d'Ivoire, China and New Zealand. India is growing market for partially finished and ready-to-assemble furniture. China and Malaysia account for 60 per cent of this imported furniture market in India followed by Italy, Germany, Singapore, Sri Lanka, the United States, Hong Kong, and Taiwan. The Indian market is accustomed to teak and other hardwoods that are perceived to be more resistant to termites, decay and are able to withstand the tropical climate. Teak wood is typically seen as a benchmark with respect to grade and prices of other wood species. Major imported wood species are tropical woods such as mahogany, garjan, marianti, and sapeli. Plantation timber includes teak, eucalyptus, and poplar, as

well as spruce, pine, and fir. India imports small quantities of temperate hardwoods such as ash, maple, cherry, oak, walnut, beech, etc. as squared logs or as lumber. India is the world's third largest hardwood log importer. In 2009, India imported 332 million cubic metres of roundwood mostly for fuel wood application, 17.3 million cubic metres of sawnwood and wood-based panels, 7.6 million metric tonnes of paper and paperboard and about 4.5 million metric tonnes of wood and fiber pulp.

### Conclusion:

Indian agriculture and rural areas are undergoing a considerable change. Rural India is becoming less and less agricultural, and allied activities are now a very important part of the livelihood strategies. The allied agricultural sector contribute significantly to economic growth, income diversification, rural employment and poverty reduction.

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# Kurukshetra

FORTHCOMING ISSUE

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:

Technology for Rural Development

# ECONOMIC PROSPECTS OF DAIRY DEVELOPMENT

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The stake holders are the backbone of dairy development in the country. Dairy sector is an important source of providing livelihood support to the rural population particularly landless and marginal farmers. Of late, it has been realized globally that dairy sector is less vulnerable due to less uncertainty and less impact of climate on livestock in comparison to agriculture, and thereby contributing more to the economy.

India is predominantly considered as agricultural and particularly a milk consumption country. Till now, about 58 % population of the country depends on their livelihood from agriculture and allied sectors. The dietary habits related to milk and milk products, diverse culture and festivals of multi-religion country endowing second largest population in the world. India has accepted the cattle and dairy related products since mythological ages. The scientific revelation and data generation and monitoring since independence showed that the country is unique repository of genetic resources.

## Cattle Population Scenario:

According to 19<sup>th</sup> Livestock Census (2012), Govt. of India, 190.90 million cattle are contributing about 37.28 % of total livestock population in the country. Among bovine population (299.98 million), the cattle shares about 63.72 % and, of the total cattle population, 151.17 million are indigenous cattle and 39.73 million are crossbred cattle.

Till 2017, 43 indigenous cattle breeds whose breed characteristics are well defined have been listed as descriptive cattle in the country. These descriptive breeds of cattle constitute about 25.06 % (37.92 million) of total cattle population. During 1997-2012, crossbred cattle population increased by about 20.18 % where as the indigenous cattle

population decreased by about 8.94 %, though the indigenous cattle are found more sustainable in comparison to crossbred cattle. Indigenous dairy cattle are also known for being more heat tolerant, comparatively resistant to many diseases; need low maintenance cost and higher feed conversion efficiency. Of late, the indigenous cattle in the country are also slowly getting importance due to scientific revelation of functional quality of milk.

## Milk Production Scenario:

During 2014-15 to 2016-17, the Economic Survey recorded the average annual growth rate of milk production around 5.94 %, and as a result, the milk production increased to 163.7 million tons in 2016 – 2017. The per capita availability of milk in the country was also increased to about 352 g/day, though the per capita availability of milk varies dynamically from state to state mainly due to diverse food habits of human population. Analysis of trend of milk production over six decades (1950-51 to 2016-17) shows that the growth of milk production in the country has jumped more than nine times during the period from 17 million tonnes to 163.7 million tonnes and the country remained as the largest producer of milk (19 %) in the world.

## Milk Production from Cattle:

During last five years (2012-13 to 2016-17) as given in Table 1, about 31.26 million tonnes of milk increased in



the country, of which more than 50 % milk (17.61 million tons) was contributed from cattle. The amount of milk production increased from cattle is due to 11.20 million tonnes of milk produced from exotic and crossbred cows and 6.41 million tonnes of milk produced from indigenous cows.

The increase of milk production and productivity of cow has to be looked in two ways i.e how much average milk productivity and production per lactation of cow was increased in our commercial organized herds as well as in the country when we compared the same with developed countries or some developing countries where cattle is the main source of milk production and managed intensively.

In general, it has been observed that milk yield per lactating dairy animal has been more than doubled due to rapid improvement in genetics and management of dairy animals in many countries including commercial herds and organized herds in India. However, in India, about 113.25 million (74.92%) indigenous cattle, still defined as non-descript cattle, are distributed mainly in small herds of 2-3 animals and reared by small and marginal farmers of different socio-economic conditions under diverse 20 agro-climatic zones of the country. Thus though the milk production from cattle has increased in the country, yet the average milk productivity of exotic, crossbred, indigenous and non-descriptive cattle in 2016-17 has been found to be very low as compared to the productivity of the cattle from developed countries.

### Dairy Development Scenario in India:

The dairies in India were developed based on cattle and buffalo as even today, different states and union territories are dominated by either cattle or buffaloes. According to BAHFS (2017),



23 states and 5 union territories have more cattle population where as only five states and two union territories having more buffalo population. Therefore, other than large dairies which prefer milk from crossbred cows because of higher milk productivity and buffalo milk for handling huge amount of milk and processing milk for various milk products, many dairies developed in the country are focussing on cow milk. Further, among the cattle dominating states in the country, three states even surpassed the national average (5.3 %) for significant growth in milk production during 2016-17.

The dairy development in India was the organized effort of the Govt. of India, State Animal Husbandry Departments / Dairy Development Boards, ICAR Institutes, NDDDB, BAIF, Private Organizations, NGOs, NABARD and State Agricultural / Veterinary Universities. The massive scientific dairy development was mostly emerged in 1960 when the country realized the shortage of milk and milk products. During this period, the country initiated the All India Coordinated Research Project on Cattle and also started crossbreeding programme through crossing of exotic dairy breeds primarily Holstein Friesian, Jersey and Brown Swiss with indigenous descript /

**Table 1: The contribution of milk from Cattle in India**

Year	Milk production (MT)		Total milk from cattle	India's milk production (MT)	% share of cattle
	CB cattle	Indigenous cattle			
2012-13	32.38	27.42	59.80	132.43	45.15
2013-14	33.88	28.13	62.01	137.68	45.03
2014-15	36.93	29.48	66.41	146.31	45.38
2015-16	41.93	31.71	73.64	155.49	47.35
2016-17	43.58	33.83	77.41	163.69*	47.29

\* Including 5.62 million tonnes of Goat milk.



non-descript cattle to increase the milk production for dairy development.

The National Dairy Development Board (NDDB) was founded in 1965, with the motto to transform dairying into an instrument for the development of rural India. The major programme for dairy development initiated by NDDB in three phases was Operation Flood Programme during 1970- 1996 with the main objectives of increasing milk production, augment rural income and reasonable prices for consumers. In the Phase-I (1970- 1980), 18 milk sheds in country were linked to 4 metropolitan cities. During 1981-1985 in second Phase, the milk sheds were increased to 136 and 43,000 village cooperatives formed with 4.25 million milk producers. In third Phase (1985-1996), milk production increased from 22,000 tonnes to 144000 tonnes in 1989 by establishing 30,000 new dairy cooperatives and increasing milk sheds to 173. Till 2014-15, total number of dairy cooperatives under NDDB was 1, 65,835.

### **Cattle and Dairy Development in India: Challenges and Strategies**

Looking into the low productivity of animals, rapid increase in human population and the demand of 191 million tonnes milk by 2020 and 230 million tonnes milk by 2035, the dairy development in the country based on cattle genetic resources only is encountering the following challenges:

#### **1. Prioritization of breed:**

Cattle are widely maintained among different species of livestock because of social acceptability and have the genetic potentiality for generating substantial income from milk. There is a need to prioritize based on availability of cattle breeds as per their economic importance which will be helpful for

selecting economically important breeds in order to develop the dairies and at least double their income through sale of milk and milk products.

#### **2. Sustainability of breed:**

To sustain the improved productivity of crossbreds and to minimize the decline in reproductive performance, there is a need to develop the sustainable breeding strategy. Animal Genetics and Breeding Division of NDRI, Karnal has developed the sustainable breeding strategy for HF crossbred cattle and recommended that 61%, 9 % and 30 % weightage to be given to milk yield per day of first lactation length, calving to first A.I and longevity and 57% & 43% to be given to first lactation 305 days milk yield and pregnancy rate for selection of Holstein Frisian crossbred cattle for sustainable performance. Research for developing the weightage to production, reproduction and longevity of indigenous cattle is under progress at ICAR-NDRI.

#### **3. Shortage of Male Germplasm/Breeding Bulls:**

The dairy stakeholders are not able to select the breeds which are adaptable in a particular region due to non-availability of male germplasm of climate resilient breeds. There is a huge deficit of frozen semen doses of different breeds to cover the breedable population in the country. According to 19<sup>th</sup> Livestock Census (2012), the adult female cattle and buffalo population is around 133 million. The country has targeted to cover 50 % (66.5 million) population through artificial insemination by 2021-22. Assuming average two services per conception, the demand of quality semen production are 133 million doses as compared to the availability of 96 million doses at present in the country.

There is a need to identify more high genetic merit bulls and to establish more 'Bull Mother Farms' of various breeds to ensure availability of superior quality male germplasm by 2022 in the country. Production of large number of bulls/bull calves selected on the basis of performance of elite pedigreed dams and progeny performance is an uphill task in the absence of structured programme.

The Department of Animal Husbandry & Dairying, Ministry of Agriculture & Farmers' Welfare, Govt. of India has reoriented/launched



the schemes like National Programme for Bovine Breeding, National Project for Dairy Development, Rashtriya Gokul Mission, National Mission on Bovine Productivity and Central Cattle Development Organization, the outcome of all the schemes are contributing in dairy development in the country.

National Dairy Development Board, Anand, Gujarat has also initiated National Dairy Plan Phase-I and II programme related to different breeds using institutional farms and large farmer's herds for producing a large number of elite bulls through pedigree selection and progeny testing programme in 18 states. The major objectives of all the programmes were to meet the demand of germplasm of high genetic merit bulls of different breeds for frozen semen stations across the country, the supply of semen at the doorsteps of the farmers and to promote the conservation and genetic improvement of indigenous breeds of cattle and buffalo.

#### **4. Assisted reproductive Techniques (ARTs):**

The DADF, MoAFW, GoI has initiated the massive programme on assisted reproductive techniques (ARTs) like adoption of Multiple Ovulation and Embryo Transfer (MOET) technology which will not only help to increase the annual genetic gain for the milk yield by increasing selection differential and intensity of selection and reducing the generation interval for the breed, but also will be able to produce high pedigreed bulls required for dairy development in the country.

#### **5. Sex semen Technology:**

The adoption of sex semen technology in cattle will bring the significant change in dairy development in the country. The dairy stakeholders who are the backbone of dairy development may be able to reduce the economic input substantially by eliminating the burden of unproductive male animals. The DADF, MoAFW, GoI has initiated the sex semen scheme which will not only help to increase the annual genetic gain for the traits by increasing selection differential, intensity of selection and reducing the generation interval for different breeds for faster dairy development, but also reduce the huge burden of non-productive males in the country. The adoption of sex semen technology may also help to produce the desired number of elite bulls in the country.

#### **5. Genomic selection of indigenous breeds of cattle:**

The emerging developments in the areas of molecular genetics have opened the new possibility of identifying and using the significant genetic markers related to reproduction and production performance for genetic improvement of indigenous cattle in India. The marker-assisted selection (MAS) is one of the molecular approaches to be developed under Indian dairy scenario and to be incorporated initially in breeding programme for enhancing the rate of genetic progress of milk yield and milk composition of indigenous cattle.

Genomic selection is a molecular approach which is revolutionizing the concept of selection in animal breeding. Genomic selection refers to selection of elite animals based on genomic breeding values (GEBV). The ICAR with the support of DADF, MoAFW, GoI has initiated to fulfill the far reaching target of developing HD DNA based chips for genomic selection of Sahiwal and Gir cattle, the two important indigenous breeds with large population in the country. The selection of animals through genomic approach will increase the genetic gain for milk yield which is the prime requirement for growth of dairy development. The development and adoption of indigenous genomic selection tools for indigenous cattle breeds will contribute immensely for strengthening the dairy development in the country.

#### **6. Acute shortage of feeds and fodders:**

The feeds and fodder are the essential inputs for milk production of cattle. Crossbred cattle though have the potentiality to produce more milk in comparison to indigenous cattle however they demand more feed and fodder due to large body size and more milk production. At present, there is an acute shortage of feeds and fodders in the country. The DADF, MoAFW, GoI has launched National Livestock Mission (NLM) to cover all the activities required to ensure quantitative and qualitative improvement in livestock production systems and capacity building of all stakeholders. NLM is comprised of 4 sub missions and development of feed and fodder is one of them. Recently Haryana Government has taken the initiative to distribute quality fodder seed mini kits of Berseem and Oat during Rabi season (2017-18) under NLM.

## **7. Reproductive problems:**

High producing cows suffer more reproductive problems including fertility as milk production is antagonistically related to fertility. About 20 to 30 % cows observed repeat breeding due to anestrus, cystic ovary, endometritis and pyometra, resulting in a huge loss of milk in the country. The effort should be made in mission mode to reduce the problem of infertility in cattle for strengthening the dairy development in the country.

## **8. Metabolic diseases and Udder Disorders:**

Metabolic disorders like milk fever, ketosis, downer cow syndrome etc affect high producing dairy cattle immediately after parturition. Besides various udder disorders, most common expensive metabolic diseases in lactating animals are causing huge economic losses in terms of production loss and treatment cost, that needs to be taken care of.

## **9. Implementation of Central and Centrally Sponsored Schemes on health coverage of cattle:**

The centre and state governments have initiated many schemes for prevention of various diseases of cattle that could be effectively implemented so that economic losses in terms of production loss could be reduced substantially. The Livestock Health and Disease Control, the centrally sponsored scheme is implemented since 10<sup>th</sup> Five year plan in order to control emerging and exotic diseases under four components viz., a) Assistance to States for Control of Animal Diseases (ASCAD), b) National Project on Rinderpest Surveillance and Monitoring, c) Professional Efficiency Development (PED) and d) Foot and Mouth Disease Control Programme (FMD-CP). Later on, the scheme was expanded and new components such as PPR Control Programme, Brucellosis Control Programme, National Animal Disease Reporting System, Establishment / strengthening of existing Veterinary Hospitals and Dispensaries were initiated. These schemes assist to collect, compile and distribute monthly animal disease status and helps the states to control spread of diseases. Vaccination and awareness component under this scheme plays a vital role for animal health improvement and Food Safety and Traceability component is also strengthening the dairy development.

## **10. Insurance Coverage of Dairy animals:**

The insurance of the animal asset has significant bearing on income from dairy animals. Livestock Insurance Scheme has been formulated with the objective of providing security to farmers against any eventual loss of their animals due to death, to demonstrate the benefit of insurance of livestock to people, to conquer qualitative improvement in livestock and their products and finally to demonstrate the benefit of insurance of livestock to the dairy development.

## **11. Skilled Human Resource Development:**

The dairy development in any country demands the service of skilled human resources. Therefore, it is of utmost importance to develop well trained, competent and dedicated human resources in order to increase the adoption of artificial insemination, in-vitro fertilization and embryo transfer for productivity enhancement of cattle and buffaloes. Besides, dairy stakeholders should be skilled through training on proper heat detection, clean and quality milk production, balancing of rations and milk processing for increasing the profitability through dairying.

## **12. Development of Dairy Entrepreneurs:**

More initiatives are needed to motivate the dairy stakeholders to become start-up / dairy entrepreneurs in India. The DADF, MoAFW, GoI has initiated Dairy Entrepreneurship Development Scheme for strengthening the dairy development and creating more opportunity for the up-coming dairy stakeholders.

## **13. Strengthening Dairy Development Extension Programmes:**

The dairy development in India demands a networking of various extension activities as the milk procurement is based on different milk shed areas where, the dairy stakeholders are the custodian of different breeds of indigenous and crossbred cattle. The role of extension workers are to be considered as pivotal as they are involved in enhancing the awareness of various dairy development technologies including the impact of climate on milk production.

## **Cattle and Dairy Development in India: Economic Prospects**

Dairy development in India is gaining more attention as livestock sector alone, a major

component of agriculture, contributed about 4.5 % of total GDP and 25.8 % value (Rs. 812352 cr) of total output in agriculture sector at current prices during 2015-16. Among the livestock products, milk alone contributed about 67.72 % (Rs. 550171 cr) of the value of output from livestock sector at current prices during 2015-16 in the country (BAHFS 2017). The roadmaps for increasing the economic prospects through dairy development will be as follows:

#### **1. Remunerative Price of Cow Milk:**

Though the price of milk procurement is a state subject and varies from state to state, region to region and even one location to other location, however, the government should take the initiative to develop the compensatory model for leveling the prices of cow milk as most of the times the fat per cent of cow milk found below 4%. The logic is to obtain the equal amount of cow and buffalo milk the input expenditure does not differ much, though disposing buffalo milk earns more money due to higher per cent of fat in milk.

#### **2. Dairying with High Producing Cattle**

More efforts should be made to make aware the dairy stakeholders to keep less number of animals with higher productivity ( milk per day per animal) to make the dairy more profitable. The dairying with high producing cattle along with the knowledge of technology will directly transform the growth and economic prospects of dairy development in the country.

#### **3. Promoting Dairy based Precision Organic Farming:**

The concept of organic milk is gaining importance in the country. Looking in to the demand and consumers, preference, the centre and state governments should develop the key scheme for encouraging the dairy stakeholders for dairy based precision organic farming and produce more organic milk to fetch better prices from organic milk disposal.

#### **4. Dairy Development based on A2 brand milk:**

The acceptance of indigenous cow milk as A2 milk is of late gaining popularity as it is available now in the domestic market. In many states, the indigenous cattle breed associations / start up have formed to promote the indigenous cow

milk highlighting the importance of A2 allele and consumers are paying more price per liter of milk due to the health reasons. The economic prospects from dairying may come by developing many dairies in the country based on A2 brand milk in future.

#### **5. Dairy Development based on Milk as Functional Dairy Food:**

The economic prospects of dairy development in future may grow by considering milk as functional dairy food. The availability and consumption of such types of products may improve the bone, heart or gastrointestinal health and thus, will be contributing in the reduction of life-style associated diseases of consumers in India.

#### **Conclusion:**

India is predominantly considered as an agricultural and particularly a milk consumption country. The dietary habits related to milk and milk products, diverse culture and festivals of multi religions country are endowing the second largest population in the world. India has accepted the cattle and dairy related products since mythological ages. The idea of dairy development in India emerged from the demand of milk and milk products as early as in 1875. The dairies in India were developed based on cattle and buffalo as even today, different states and union territories are dominating by either cattle or buffaloes. During 2017, 23 states and 5 union territories have more cattle population where as only five states and two union territories having more buffalo population. Other than large dairies which prefer milk from crossbred cows because of higher milk productivity and buffalo milk for handling huge amount of milk and processing milk for various milk products, many dairies developed in the country emphasize on cow milk. The stakeholders are the backbone of dairy development in the country. Dairy sector is an important source of providing livelihood support to the rural population particularly landless and marginal farmers. Of late, it has been realized globally that dairy sector is less vulnerable due to less uncertainty and less impact of climate on livestock in comparison to agriculture, and thereby contributing more to the economy.

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# NEW DIMENSIONS OF BLUE REVOLUTION

Dr. Ansuman Das & Dr. Jayalaxmi Mohapatra

Integrated fish farming with livestock and horticulture has made the farming practice highly remunerative and farmers' friendly. Through selective breeding, genetically improved Rohu (Jayanti) with 18% higher growth response per generation has been achieved. Almost five-folds growth in mean national pond productivity in last four decades, i.e. from about 600 kg in 1970s to 2900 kg/ha today is a testimony of the sector's vibrancy. With the cap of second largest aquaculture producer in the world, aquaculture today is also considered as a sunrise sector for meeting the increasing fish demand in coming years.

India has a coast line of 8118 km, having a huge potential for aquaculture, inland and marine fisheries. Marine Fisheries is the fastest growing food producing sector in the world with great potential to meet the food, especially protein requirement. As per NFDB, India ranked 3<sup>rd</sup> in fish production and 2<sup>nd</sup> in aquaculture in the world. Fisheries contribute 1.07 per cent of the total GDP of the country. Further, as per the central plan scheme under the banner of **Blue Revolution (Nee Kranti)**, it has been targeted to enhance the fish production from 107.95 lakh tonnes in 2015-16 to about 15 lakh tonnes by the end of Financial Year 2019-20. It is also expected to augment the export earnings with a focus on increased benefit flow to the fishers and fish farmers to attain the target of doubling their income. This targeted production from fisheries can be achieved by integrated technological interventions from various fields besides blending traditional knowledge and scientific principles.

## Biotechnological Interventions:

Aquatic biotechnology has played a crucial role in promoting productivity, boosting efficiency and ensuring sustainability in aquaculture. The key aspects of culture have been optimized through biotechnological application including enhancement of growth rate and feed conversion efficiency, nutrition and product quality, stress modulation, vaccination, disease resistance, modern disease diagnostics and treatment, genetic selection, transgenesis, etc. The genomics and proteomics have the potential to impart production and management of fish genetic resources. **Nano-technology** has opened a new horizon for the analysis of biomolecules, development of non-viral vectors for gene therapy as transport vehicle for DNA, protein or cells, targeted drug delivery, clinical diagnosis, disease therapeutics etc.

**Biotechnological** interventions have shown great promises in applying the tools of bioremediation and probiotics in environmental management of effluents, toxicants and pathogens apart from its impact on induced breeding, sea ranching etc.

**Mariculture** using biotechnological interventions has immense potential being a lucrative sector worldwide. The potential area of biotechnology in mariculture include the use of synthetic hormone (GnRH) in induced breeding, transgenic fish, chromosome engineering, cryopreservation and gene banking, marker assisted genetic improvement and health management. The technical development in transgenesis has expanded the possibilities for producing either sterile fish or those whose reproductive activity can be specifically turned on or off using inducible promoters apart from trait specific gene transfer. Chromosome engineering techniques are important in the improvement of fish breeding as they provide a rapid approach for gonadal sterilization, sex control, and improvement of hybrid viability and cloning.

Biotechnological tools such as molecular diagnostic methods, use of vaccines and immunostimulants are gaining popularity for improving the disease resistance in fish and shellfish species. Biotechnological tools such as gene probes and polymerase chain reaction (PCR) are showing great potential in faster detection of pathogens. The increased application of biotechnological tools can certainly revolutionize our fish farming.

## Information Technology (IT) Interventions:

The main challenges of fisheries development in the country includes availability of accurate

data on assessment of technologies for fin and shell fish culture, yield optimization, harvest and post-harvest operations, fishery resources survey, monitoring and assessment, welfare of fishermen. IT can help to overcome these challenges and also assist people to be heard through social networking and knowledge sharing.

IT is involved at every stage of the fisheries value chain “from catch to counter” and plays a significant role in sector modernization, from resource assessment, capture or culture to processing and commercialization. Some specialist applications includes **SONAR** ( Sound Navigation and Ranging) for locating fish, Global Positioning Systems (GPS) for navigation, **ECHO-SOUNDER** for depth & locating bottom dwelling fishes, mobile phones for trading & emergencies.

IT tools are contributing in very tangible terms to Monitoring, Control and Surveillance (MCS) and Code of Conduct for Responsible Fisheries (CCRF). ITs are now used to support MCS by protecting local fishing grounds from poachers, through the use of GPS, radio telephone (RT) and mobile phones to locate and report abuses monitoring national and regional fishing territories with satellite-enabled tools.

IT tools like community radio, FM radio, DTH TV, video, mobile phones, tele-centers, digital media are now popularizing to share information

and knowledge, raising awareness on issues such as safety at sea, weather and sea state condition, thereby saving their life during natural calamities.

It offers a cost-effective means to discover new fishing grounds and monitor environmental impacts so as to enable commercial fishing vessels to exploit stocks in areas once considered too difficult to fish. Furthermore, as technology improves, fishermen may take greater risks, seeking more distant fishing grounds with greater depth zones.

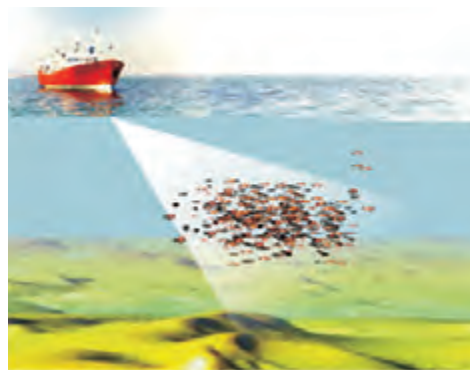
The application of modern IT tools in particular in the fishery sector has generated far reaching results such as wide spread use of mobile phones among the fishermen enable them to fix prices competitively in the open markets so as to earn sizable income. Adoption of post-harvest technology also helps the fishermen to get good value of the harvest.

### Satellite Technology Interventions:

Remote Sensing Technology is used for fishery resource management, their conservation and exploitation. Thus, it helps in making more informed management decisions, in adjusting fishing efforts to conditions of fishing grounds and/or stocks, ensuring sustainable exploitation of marine living resources.

Application of remote sensing in estimating

fishery resources can be assisted by the measurement of the concentration of chlorophyll pigments. It is considered as an index of biological productivity and it can be related to fish production. Today, SST (Sea Surface Temperature) maps are mainly used by the tuna fishing fleets. Satellites can also assist the fishing industry in many ways other than locating of fish such as a) Search and rescue operations: The



Echosounder



(SONAR)

satellite NOAA-8 carries a special sensor, SARSAT (Search and Rescue Satellite Tracking). b) Radar altimeter: measures wave height and the micro topography of the ocean surface c) Synthetic Aperture Radar (SAR) : measures wave length and direction radar d) Scatterometer SASS: measures near surface wind speed over the oceans in all weather conditions e) Weather reports: Environmental satellites such as NOAA, GOES or METEOSAT can provide weather information. f) helps in identifying **Potential Fishing Zones (PFZ)** based on **chlorophyll concentration & sea surface temperature (SST)** g) In providing information on temporal & spatial changes in area under aquaculture, mangrove areas, coral reef mapping.

Implementation of GIS and remote sensing in fisheries is inter-related. The GIS application is commonly employed to display fishing effort in order to control harvest level in certain high pressured fishing ground, while the remote sensing technology mostly applied in the fishing ground forecasting in order to reduce the inefficiency of fishing activity due to time consumed to find fish aggregation, as well as the fuel consumption of the fishing vessel.

The applications of GIS in Fisheries includes:  
 1) Identification of suitable sites for fresh water & brackish water aquaculture. 2) Management of marine fisheries & coastal regulation zone. 3) Study

of land-use pattern including mangroves & forest cover of a particular area. 4) Planning for water body resource zonation & mapping of aquatic species. 5) Study of temporal/spatial changes in fish production & consumption. 6) Environmental Impact Assessment (EIA) 7) Distribution of different fish species in relation to physical habitat characteristics.

The **Global Positioning System (GPS)** is a digital location system based on a constellation of about 24 satellites orbiting the earth at altitudes of approximately 11000 miles. GPS has found its greatest utility in the field of Geographic Information System (GIS).

The applications of GPS in Fisheries are: 1) It provides precision geo location on earth on real time basis for GIS. 2) Provides ground control points (GCP's) for remote sensing applications. 3) GPS helps in field mapping based on the geo location data. 4) In marine fisheries, it allows survey vessel to carry out precise exploratory survey at high sea in deeper waters. 5) GPS is the backbone of VMS (Vessel Monitoring System), and also sends vessel to catch data to the shore station at a specified interval of time for proper monitoring on real time.

**Engineering Interventions:**

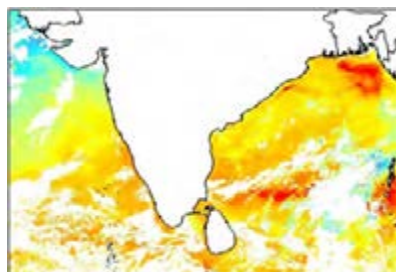
Some of major engineering interventions that need to be addressed to harness increase in fisheries productivity are:

a) Mechanisation of fishing vessels (crafts): Fisheries sector has seen a remarkable growth after 1986 due to intensification of mechanization, motorization of country crafts, multi-day fishing and post harvest technology. The fishermen in the country are now using various types of fishing crafts and gears for fishing.

The major crafts used are of 3 different categories namely mechanized, motorized and non-motorized. The mechanized sector includes trawlers, gill-netters and tuna long-liner vessels. The vessels



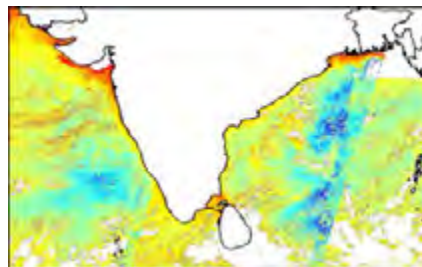
(GPS)



(Sea Surface Temperature (SST) Image retrieved from AVHRR)



(Flow Chart of Potential Fishing Zone)



(Chlorophyll Image retrieved from Oceansat-2 Satellite Data)

Potential Fishing Zone						
MAHARASHTRA						
SATELLITE DATA SHOWS LIKELY AVAILABILITY OF FISH STOCK TILL 19 MAR 2018						
From the coast of	Direction	Bearing (deg)	Distance (km) From-To	Depth (mtr) From-To	Latitude (dms)	Longitude (dms)
Murud	SW	253	87-92	70-75	18 5 15 N	72 9 47 E
Arnalapada	SW	249	78-83	55-60	19 11 57 N	72 3 0 E
Diveagar	SW	250	69-74	52-57	17 57 2 N	72 22 17 E
Mazgaon	SW	254	88-93	76-81	18 8 49 N	72 7 18 E
Kudgaon	SW	252	84-89	63-68	18 0 41 N	72 13 21 E
Revadanda	SW	248	96-101	69-74	18 12 14 N	72 3 42 E
Srivardhan	SW	258	48-53	34-39	17 57 28 N	72 32 23 E

(Actual PFZ Advisory for Fisher folks)

in the mechanized sector use machines for both propulsion and operation of the gear. Major gears used by the mechanized vessels are trawl nets, gill nets, bag nets, hooks & lines and purse seines.

- b) Hatchery construction for quality seed production
- c) Feed Mill for manufacture quality feed for aqua farms.
- d) Manufacture of quality gear materials for fabrication of nets.
- e) Construction of landing centers
- f) Infrastructure development for cold chain process.

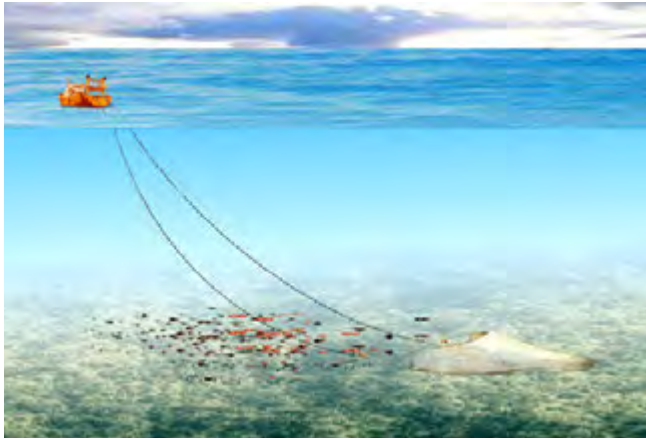
### **Technological Interventions in New National Policy For Marine Fisheries: Leading Towards Blue Revolution:**

On 28<sup>th</sup> April 2017, the Ministry of Agriculture & Farmer's Welfare has come out with a new national policy on fisheries paving the way to achieve "Blue Revolution" through implementation of an ambitious scheme for integrated development and management of fisheries.

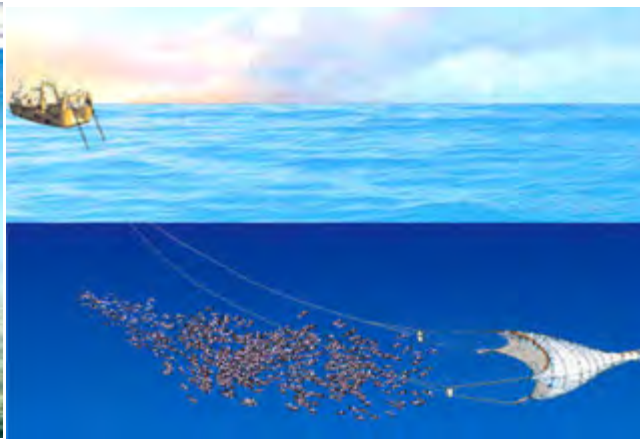
The new policy will cover development and management of inland fisheries, aquaculture, marine fisheries including deep sea fishing and

all activities undertaken by the National Fisheries Development Board (NFDB) towards realizing a 'Blue Revolution' in the country with an outlay of Rs 3,000 crores for a period of five years. Focusing on fisheries, particularly the inland ones, will also help in realizing the goal of doubling the income of farmers in next five-six years by tapping various water bodies including newly dug out ponds across the country.

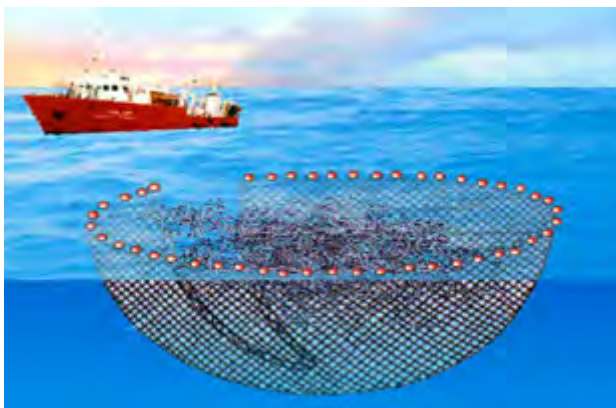
India will provide big private investments in deep sea fishing and take foreign technical support to realize the full potential of the sector, which supports an estimated 4 million fishermen and their family members and contributes Rs 65,000 crore annually to the economy. Billed as the roadmap for a blue revolution, the new National Policy on Marine Fisheries lays emphasis on bringing sustainable utilization of the fisheries wealth from marine and other aquatic resources. Some of the important features of the National Policy on Marine Fisheries 2017 include the use of IT and space technology for improving the capacities of the fishing communities, strengthening the MCS system by introducing chip based smart registration cards for fishermen to avoid the crossing the international marine boundary line. The new policy also focuses on maximizing fleet size, mainstreaming biodiversity conservation in production processes, species specific and area specific management plans, and



(Demersal trawling)



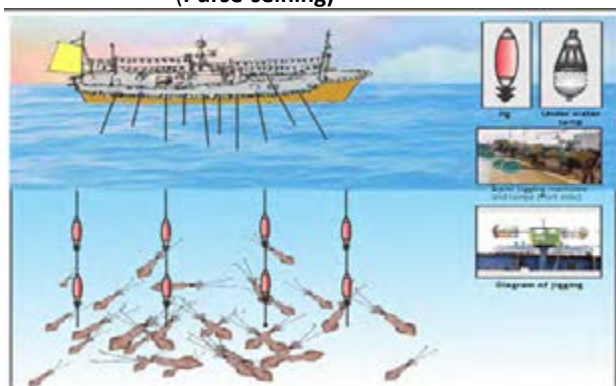
(Pelagic / Mid water trawling)



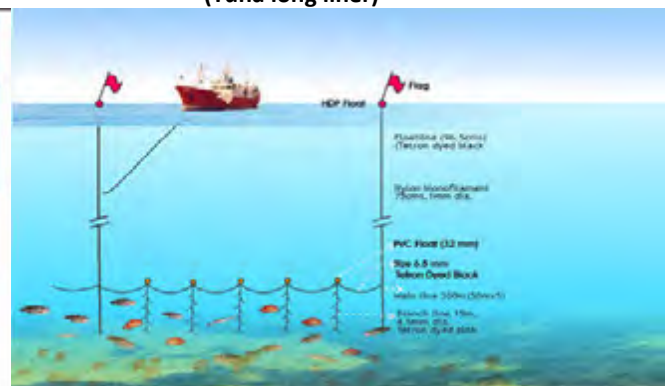
(Purse-seining)



(Tuna long liner)



(Squid Jigging)



(Bottom Set Vertical Long Line)

spatial and temporal measures for sustainable utilization of resources. It is aimed at encouraging an integrated approach on fisheries management, besides blending traditional knowledge and scientific business principles. Simultaneously, the government will also undertake review and periodic evaluation of the existing marine protected areas. Government would also go for providing legislative support to ensure that tenure rights of traditional fishermen are secure

and their livelihood not affected by conservation measures. It says entrepreneurship development, private investment, public-private partnership and better leveraging of institutional finance for marine fisheries sector will be encouraged so as to develop the capacity building for deep sea fishing.

The blue revolution is being implemented to achieve economic prosperity of fishermen and fish farmers and to contribute towards food and



nutritional security through optimum utilization of water resources for fisheries development in a sustainable manner, keeping in view the bio-security and environmental concerns. Under the scheme, it has been targeted to enhance the fish production from 107.95 lakh tonnes in 2015-16 to about 150 lakh tonnes by the end of Financial Year 2019-20. It is also expected to augment the export earning with a focus on increased benefit flow to the fishers and fish farmers to attain the target of doubling their income. The department has prepared a detailed National Fisheries Action Plan 2020 for the next 5 years with an aim of enhancing fish production and productivity and to achieve the concept of Blue Revolution.

Technological interventions in aquaculture and mariculture have led to fisheries development. The sector has shown a considerable diversification in recent years with adoption of other species like catfishes, fresh water prawns, ornamental fishes and cold water fishes apart from Indian major carps in aquaculture; culture of Pacific white shrimp apart from black tiger prawn under brackish water system and **cage culture** of sea bass and cobia owing to their higher market demand and economic advantages. Integrated fish farming with livestock and horticulture has made the farming practice highly remunerative and farmers' friendly. Through selective breeding, genetically improved Rohu (**Jayanti**) with 18% higher growth response per generation has been achieved. Almost five-folds growth in mean national pond productivity in last four decades, i.e. from about 600 kg in 1970s to 2900 kg/ha today is a testimony of the sector's vibrancy.



*A demonstration Cage Culture Farm*



*A Cage is getting ready for installation*

With the cap of second largest aquaculture producer in the world, aquaculture today is also considered as a sunrise sector for meeting the increasing fish demand in coming years.

### **Conclusion:**

Fisheries and aquaculture's contribution to human well-being is widely known. Fish as a protein source, plays an important role in maintaining food security for the human population. The World Health Organization (WHO) reports that over the last four decades fish, crustaceans, and molluscs have contributed to 13.8 - 16.5% of animal protein consumed by human populations (WHO 2016). Meanwhile, in the term of economy, fish products are classified among the most traded commodities and manage to assist creation of employment, income provision and regional economic growth and development. In India, Fisheries was recognized as an important allied sector of Indian agriculture only after independence. The vibrancy of the sector could be visualized by 14-folds increase in fish production in just six decades, i.e. from 0.75 million tonnes in 1950-51 to 11.41 million tonnes at present (2016-17). The unparalleled average annual growth rate of over 4.5% over the years has placed the country on the forefront of global fish production. 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 Rs.37,871 crore (2016-17) from the fisheries produce, amply justifies the importance of the sector on the country's economy and also livelihood security.

The technological interventions made in the development of fish harvest technologies in areas of modernization of boats and fishing gears, mechanization of propulsion system, introduction of synthetic gear material; developments in acoustic fish detection and satellite-based remote sensing techniques; advances in electronic navigation; enhancement of the fishing capacity, provisions for onboard fish processing and preservation; and improvement of the working conditions not only have been able to sustain the growth of the marine capture fisheries, but also reduced the drudgery of fishermen to a great extent. Appropriate management interventions viz., restriction of fleet size, regulation of mesh size, declaration of closed season, ban on operation of the destructive gears, installation of artificial reefs/fish aggregating device (FAD), promotion of sanctuaries, ranching

of commercially important and threatened species and above all implementation of effective code of conduct for responsible fishing have been suggested as a management measures for long-term sustenance of fisheries.

It is estimated that the fish requirement of the country by 2025 would be of the order of 16 million tonnes, of which at least 10 million tonnes need to come from aquaculture. Therefore, development of road map based on available resources, through technological intervention is necessary to achieve this target.

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## BLUE REVOLUTION : TOWARDS ECONOMIC PROSPERITY OF FISHERMEN

Realizing the immense scope for development of fisheries and aquaculture, the Government of India has restructured the Central Plan Scheme under an umbrella of Blue Revolution. The restructured Central Sector Scheme on Blue Revolution: Integrated Development and Management of Fisheries (CSS) approved by the Government provides for a focused development and management of the fisheries sector to increase both fish production and fish productivity from aquaculture and fisheries resources of the inland and marine fisheries sector including deep sea fishing.



The Blue Revolution is being implemented to achieve economic prosperity of fishermen and fish farmers and to contribute towards food and nutritional security through optimum utilization of water resources for fisheries development in a sustainable manner, keeping in view the bio-security and environmental concerns.

Under the scheme, it has been targeted to enhance the fish production from 107.95 lakh tonnes in 2015-16 to about 150 lakh tonnes by the end of the financial year 2019-20. It is also expected to augment the export earnings with a focus on increased benefit flow to the fish farmers to attain the target of doubling their income.

The Department has prepared a detailed National Fisheries Action Plan-2020(NFAP) for the next 5 years with an aim of enhancing fish production and productivity and to achieve the concept of Blue Revolution. The approach was initiated considering the various fisheries resources available in the country like ponds & tanks, wetlands, brackish water, cold water, lakes & reservoirs, rivers and canals and the marine sector.

# ORGANIC FARMING FOR SUSTAINABLE ENVIRONMENT

Deepranjan Sarkar, Sabuj Ganguly, Shikha

Any activity that causes deterioration of environment, will definitely impact productivity of crops and health of humans. Organic Farming is a system that is based on the four basic principles of health, ecology, fairness, and care for humans as well as ecosystems. Crop diversification, livestock management, and manuring helps in protection of natural resources along with the biodiversity. Low use of non-renewable energy helps in reduced emission of greenhouse gases (GHGs). Nitrate leaching is considerably low in organic system, thus groundwater pollution is prevented.

**W**ith the beginning of Green Revolution in Indian Agriculture in 1965-66, the fertilizer consumption got a huge momentum for sustaining the needs of burgeoning population. Consequently, we reached our targets and became self-sufficient in food grain production. However, the hazards of the intensive agricultural system are threatening as they drastically affect the ecological balance. Thus, we started thinking towards organic farming (OF) systems approach which was existing earlier (ancient time) in our society. The International Federation of Organic Agriculture Movements (IFOAM) is an international organization which regulates the standards of OF and strengthens the organic movement globally in its full diversity by uniting and assisting more than 120 countries about the organic vision of the world. According to IFOAM, "Organic Agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic Agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships



and a good quality of life for all involved". The essence of OF can be viewed as a suitable tool for promoting sustainability in agricultural production.

Sustainable intensification is the process of supplying safe and nutritious food per unit of input, meeting our needs without compromising the ability of future generation to meet their own requirement or needs. Besides other benefits of OF, the system also guarantees the production of healthy foods. This is an important issue because according to the estimates of Food and Agriculture Organization (FAO) in 2015, about 795 million people in the world are still undernourished, i.e., one in nine people. In India, undernutrition and obesity (overnutrition) are the major dual nutrition burdens at present. Recently, Indian Government has approved setting up of National Nutrition Mission (NNM) to overcome the nutrition related problems in the country. Growing concern of food and environmental issues in conventional agricultural system has led to the generation of eco-friendly approaches of farming system, commonly known as OF system. This system includes:

- a) Biological farming.
- b) Nature farming.
- c) Regenerative agriculture.
- d) Alternate agriculture.
- e) Permaculture.
- f) Low input sustainable agriculture

## Concept:

This production management system largely promotes the use of organic materials or on-farm resources (crop residues, animal manures, green manures, on and off farm wastes, growth regulators, biofertilizers, biopesticides, etc.), and

discourages the use of synthetic off-farm inputs (fertilizers, fungicides, herbicides, pesticides, etc.) for maintaining the balance of nature without polluting soil, water, and air to obtain yield for a longer time. It integrates site specific agronomic, biological, and mechanical methods to foster cycling of resources and enhance agro-ecosystem health.

#### **Aims:**

- Exclusion of agrochemicals.
- Maintenance of natural balance.
- Production of nutritious food.
- Enhancement of rural livelihoods with profitable OF.
- Conservation of soil and water resources.
- Systematic raising of livestock along with crop production .
- Conservation or enhancement of biodiversity and eco-system services.
- Prevention of pollution.
- Reduction in use of fossil fuel energy in agriculture.
- Development of more sustainable and productive agricultural system.

#### **Components of Organic Farming:**

- Crop and Soil Management:** The system aims in enhancing the organic matter levels in soil to maintain the long term fertility of soil. In this component, we give stress in selection of variety, timely sowing, crop rotation, green manuring, intercropping with legumes, etc.
- Nutrient Management:** This is dealt with the use of organic materials such as farmyard manure, compost, vermicompost, crop residues, green manures, and cover crops. Crop rotation and biofertilizers are also included for their key role in nutrient cycling.
- Plant Protection:** Insects, pathogens, and other pests are controlled by primarily relying on crop rotations, natural predators, resistant varieties, diversity, and tillage. Thereafter, botanical, thermal, and chemical interventions are applied as a last resort under restricted conditions.
- Livestock Management:** Livestock are reared by keeping full attention to their evolutionary adaptations, behavioral needs, and welfare issues (nutrition, shelter, breeding, etc.).

- Soil and Water Conservation:** Run off which erodes the soil can be prevented by contour cultivation, contour bunding, terracing, grassing the waterways, etc. *In situ* water conservation techniques like broad bed and furrow system, ridge and furrow system, inter-row water harvesting, inter-plot water harvesting, scooping, etc. can be adopted in dryland areas.

Selection of crop is very important in farming to serve many purposes like pigeonpea and moth bean are drought resistant legumes, forage, and cover crops. These can be grown in arid and semi-arid regions to earn maximum benefits. They can be used for combating soil erosion problems and recycling the nutrients.

#### **Importance of Organic Farming:**

Day-by-day, the challenges of agricultural activities are increasing, viz., increased cost of cultivation, water scarcity, availability of labours, etc. Under such conditions if we continue to practice the conventional farming system, then this may aggravate the socio-economic condition along with ecological damages. Therefore, we need to adopt a holistic approach and assess its potential benefits as compared to the intensive farming practices or conventional farming. Figure 1 describes the superiority of OF in different areas. Agricultural system has a greater role to play in the development process of a country, whether in generating employment, mitigating climate change, or in improving nutrition and health. This depends on our wise selection or adoption of smart agricultural methods.

Any activity that causes deterioration of environment, will definitely impact productivity of crops and health of humans. OF is a system that is based on the four basic principles of health, ecology, fairness, and care for humans as well as ecosystems. Crop diversification, livestock management, and manuring helps in protection of natural resources along with the biodiversity. Low use of non-renewable energy helps in reduced emission of greenhouse gases (GHGs). Nitrate leaching is considerably low in organic system, thus groundwater pollution is prevented. The biological activity of soil is enhanced with the addition of organics, and this also helps in maintaining long term fertility of soil.

With reduction of costly external inputs, the production cost also reduces. The risk of main

crop failure is minimized by diversification, agro-forestry, crop rotation, and intercropping. Farmers get high price of organic products, and get access to organic markets. The purchasing power is enhanced.

As farmer gets access to credits, technologies, and markets, his socio-economic condition improves. Further, he is also supported by organizations like non-governmental organizations (NGOs), farmers clubs, self-help groups (SHGs), etc. He can avail the money round the year. Women play a key role in agricultural activities. Their contribution has gained special attention. Women Farmer's Day will be celebrated on 15<sup>th</sup> October. New policies and schemes for women centric activities have been taken by Indian Government for mainstreaming women in agriculture. Diversification (crops, livestock) in OF will generate employment opportunities and rural women empowerment.

In OF, farmers are less exposed to chemicals. Organic foods are nutritious, tasty, and fresh. In most cases, these products are higher in vitamin C, antioxidant, etc. content. They are known for their quality and safety issues. The living standard of the farmer increases with continuation of OF practices.

### Limitations of Organic Farming:

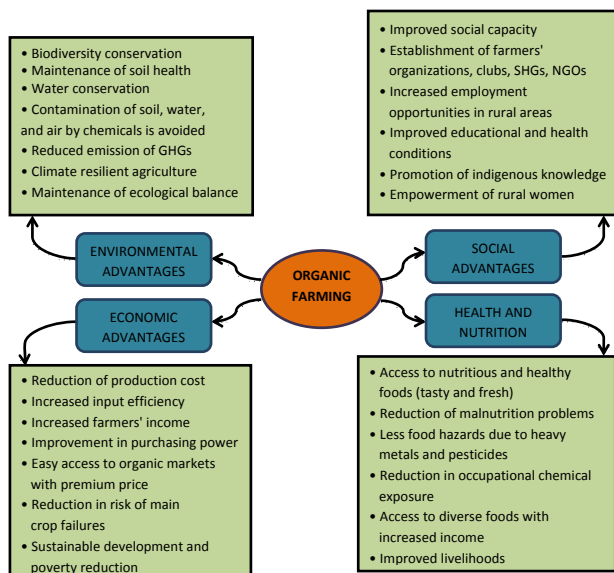
- Time taking process.
- Initially low yields are observed.
- Easy availability of chemicals.

- Requirement of large organic inputs.
- Low availability of quality inputs.
- Marketing facilities are less.
- Certification process.
- Research facilities are less.
- Training facilities for farmers are less.

### Organizations and Government Schemes/ Initiatives promoting Organic Farming:

- **National Organic Farming Research Institute, Gangtok, Sikkim:** This is a research institute recently established for promoting research and education and conducting training on organic production systems, especially in the North East Hills Region of India.
- **National Centre of Organic Farming, Ghaziabad, Uttar Pradesh:** This centrally run institute and its six Regional Centres at Bangalore, Bhubaneswar, Panchkula, Imphal, Jabalpur, and Nagpur has been established for implementing a Centrally Sponsored Scheme (CSS), i.e., National Project on Organic Farming.
- **Participatory Guarantee System (PGS):** A participatory approach for the stakeholders (producers, consumers, retailers, traders and others such as NGOs, Societies/Gram panchayats/ State/Central Government organizations/agencies/farmers, etc.) to assess, inspect, and verify the production practices of each other and take decision on organic certification (PGS-Green and PGS-Organic). The system focuses on assurance of quality at local levels, and is a platform for the participators to build trust, social networks, and exchange knowledge to continue the integrity and movement of organic.
- **Paramparagat Krishi Vikas Yojana:** This is an expanded component of Soil Health Management (SHM) of a major CSS, National Mission of Sustainable Agriculture (NMSA), launched in 2015. The latest technologies of OF are disseminated in villages among youths and farmers by cluster method and PGS certification.

Figure 1: Merits of Organic Farming



### Organic Farming in Indian Economy:

The agriculture sector continues to be vulnerable with fluctuating growth rate due to

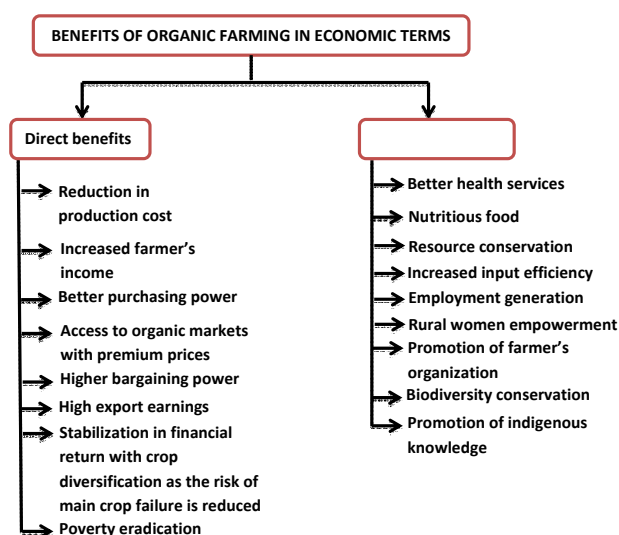
uncertainty of rainfall and raising of temperature (climate change). Therefore, OF has great potential for addressing these issues.

Sikkim is India's first fully organic state. The north eastern states are practicing organic agriculture. In other states, some certified organic farms are run by different agencies. Many developing countries have adopted OF due to its higher profitability leading to sustainable development. The system can directly and indirectly improve the economic conditions of the farmers (Figure 2). Small-scale farmers can also derive economic advantages from it. As they are poor in resources, they are unable to invest in external inputs and energy, and hence substitute these with locally available organic inputs. If the family members are working on subsistence farms, the labor cost also decreases. They sell the organic products and get good economic returns. The income levels of the farmers are increased. OF practices also serve as a low-risk strategy for the farmers as the failure of main crop due to weather vulnerabilities are tackled with crop diversification, intercropping, crop rotation, and agro-forestry. Certified organic foods, viz., basmati rice, cereals, pulses, oilseeds, fruits, tea, coffee, spices, honey, herbal medicines, and their value-added products are produced and available in India. Non-edible products in the organic list include cotton, garments, cosmetics, body care products, and similar products. The demands of organic foods and products are high in foreign, so high export earnings are achievable under this process.

Indirectly, the OF system can provide some economic advantages. With increase in income levels of farmers, their socio-economic conditions improve. The social capacity enhances, and they afford better education for their children. Establishment of SHGs, NGOs, etc. help in easy availability of credits, certification process, etc. Thus, the social capital is increased, and the system also empowers rural youth and women with employment opportunities. Women have more bargaining power, and they also participate in decision making process.

OF aims to work with natural systems, which leads to promotion of indigenous technical knowledge and transfer of knowledge from generation to generation. This helps in preservation of cultural practices and crop varieties. Wild varieties are heritage in the list of germplasm because they

Figure 2: Economic Profitability of Organic Farming



are depleting very fast. The health of farmer is maintained by cultivating organic practices and having nutritious foods. Thus, the living standard of the farmers are increased with OF practices.

### Conclusion:

Organification is the need of the hour to resolve the challenges of agriculture. Low economic returns in the initial stage restrain farmers to adopt OF practices. But this indicates the lack of knowledge about the merits of OF among farmers. Government agencies and schemes should try to fill this gap by giving demonstrations of the techniques of OF to make the farming community expert in the alternative methods of the conventional farming. The system requires good managerial skills to handle all the components in right way to harness maximum benefits of OF. Therefore, the managers of farms also need trainings to enhance the sustainable utilization of resources. More research should be conducted for validation of organic methods in field, as India has huge potential for organic crop production.

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## APICULTURE FOR RURAL LIVELIHOOD

Dr Debjani Dey and Kumaranag K. M.

Beekeeping is an age-old tradition in India but it is considered a no-investment profit-giving venture in most areas. Of late, it has been recognized that it has the potential to develop as a prime agri-horticultural and forest-based industry. Honey production is a lucrative business and it generates employment and can be practiced by farmers for improving their economic condition. Beekeeping is ideally suited for the rural areas because it utilizes only the available resources which otherwise go waste.

**B**eekeeping is an age-old tradition in India but it is considered a no-investment profit-giving venture in most areas. Of late, it has been recognized that it has the potential to develop as a prime agri-horticultural and forest-based industry. Honey production is a lucrative business and it generates employment and can be practiced by farmers for improving their economic condition.

Honeybees are marvelous insects which have fascinated mankind since the dawn of the civilization. The art of their management in easily maneuverable hives and extracting surplus honey is called beekeeping. A honeybee colony has a fascination of its own : naturalists, poets and thinkers have always

admired them for their industriousness, unity, self-sacrifice, calmness of spirit, toleration, equitable division of labour in their colonies and a spirit of social service.

Honey harvesting dates back to 7000 B.C. and is perhaps the only industry which besides the production of honey and beeswax also helps in increased crop production through pollination of crops. Efficient insect pollination is extremely important for continuance and propagation of many plants growing in wild to maintain the stability of ecosystems and environmental quality and thereby helping in the conservation of biodiversity. Though honey hunting in India dates back to ancient times



but it was only half a century ago that rearing of honey bee *Apis cerana indica* F. employing scientific techniques as a cottage industry was introduced on a national scale. During the sixties of the last century, European honeybee *Apis mellifera* L. was introduced into the country, since then it has successfully established in various parts of the country.

The peculiarities of this agro based industry are that it does not require any raw material like other industries. The raw material is in the form of nectar and pollen from flowers which is freely available in nature. Beekeeping is a decentralized, forest and rural agriculture based industry. Beekeeping can be started by anyone who takes interest may be skilled or unskilled, even women can very easily start apiculture and reap the associated benefits. Beekeeping can be started with a few colonies which can be increased to hundreds gradually. It can provide unemployed and underemployed persons with employment and extra income.

Beekeeping is ideally suited for the rural areas because it utilizes only the available resources which otherwise go waste. One of the interesting phenomenons about beekeeping is that it does not compete with any branch of animal husbandry. A beekeeper needs little investment for beekeeping, need not to be a land owner and does not require any sophisticated machinery. Beekeeping is possible in areas where abundant flowering plants providing nectar and pollen are available. Most of the forest

sites, agricultural farms and fruit orchards can be selected as areas for beekeeping.

Honey and beeswax are the commonly known products of this industry. However, a number of by products, viz., pollen, propolis, royal jelly, cerumen etc., which are of great economic importance have added new dimensions to this industry. Though honey and beeswax are the important direct products of this industry, increase in agro horticultural crops owing to the services of bees as effective pollinators is yet another vital factor contributing to national income. The economic returns of increased crop production through cross-pollination by honeybees are difficult to quantify yet these far outweigh direct values of honeybees as producers of honey and other hive products. India is basically an agricultural country with most of its population living in rural areas depending on agriculture, the potential of honeybees as agents of pollination for increasing crop productivity is much more.

At present, approximately there are about 5 million bee colonies in India, which produce seventy five thousand tonnes of honey annually. India is one of the honey exporting countries. The major markets for Indian honey are Germany, USA, UK, Japan, France, Italy and Spain. Honey production in India increased geometrically since 2005, thanks to large scale rearing of *A. mellifera*. The production figures along with the states which produce sizeable quantity of honey have been listed in Table below.

Table : State wise honey production in India (Source: Indiastat, 2017)

State	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
West Bengal	6.34	4.65	5.07	15	15.5	15.6
Uttar Pradesh	14.36	18.32	19.97	12.5	13.5	15.0
Punjab	7.12	5.22	5.69	14	13.8	14.9
Bihar	7.36	7.36	8.02	0.5	7.8	8.8
Himachal Pradesh	2.76	2.03	2.21	5.0	4.8	5.15
Rajasthan	9.6	7.04	7.68	1.8	2.2	4.6
Haryana	5.34	3.92	4.27	4.0	4.3	4.5
Kerala	5.73	4.21	4.59	2.0	2.2	2.5
Karnataka	6.37	4.67	5.09	2.0	1.95	2.0
Andhra Pradesh	7.07	5.19	5.65	1.5	1.6	1.65
Tamil Nadu	6.02	4.42	4.82	1.5	1.45	1.5
Maharashtra	11.79	3.1	3.38	1.0	1.25	1.3
Jammu and Kashmir	2.5	1.83	2.0	2.5	2.0	1.2
India	112.01	84.09	91.66	76.15	80.53	88.9



The beekeeping has a tremendous scope for development of ancillary industries. The untapped potential of beekeeping yet remains to be explored for increasing opportunities for gainful employment and income especially in rural areas.

### Types of Honey-Bees Found In India

In India the existence of honey-bees has been recorded even in ancient history. There are four types of honey-bees native to India. They are 1. *Apis florea* F., the little bee 2. *Apis cerana* F. the common Indian bee. 3. *Apis dorsata* F. the rock bee. 4. *Apis mellifera* L. was introduced during the sixties of the last century has now been established in many parts of India. These bees have been imported with the main objective to get a high yield of honey. The stingless bees comprising of *Tetragonula sp* and a few other genera are also valued for the medicinal properties of their honey.

### Management of Bee colonies for better Productivity:

Honey-bees can be obtained from the following sources: (a) Commercial bee-keepers or Government bee farms or by capturing stray swarms. The beginners should make a start with a few colonies. The number may be increased as experience is gained.

Apiculture requires certain optimum sets of conditions for growth and development. The abundant bee flora must be in the vicinity of one kilometer as the foraging range of our bees is up to one kilometer. A bee-keeper should keep his bee hive in such a place which should not be liable to get affected from strong winds and sun, and away from crowding places. A good source of water should be available nearby especially during summer. The hives should be placed six to ten feet apart on hive stands. The hive entrance should preferably face east. The ground around the hive should be kept free of grass, weeds, black ants, and white ants. The hive should not, however, be opened too often and several operations should be accommodated at one examination which should be carried out on bright sunny days. Bees should not be disturbed on cold, rainy or windy days or at night and Bee-keeper should not be profusely perspiring or smelling of alcohol. The beginner should examine the bee-colony in a proper manner. They should put on an overall and bee-veil, light the smoker and should

approach hive from the side, remove the top cover, blow a few puffs of smoke into the entrance, lift the inner' cover gently and blow a few puff of smokes below it. Take out the frames one by one holding them in a vertical position. Handle gently without any jerk so that the bees are not induced to sting. Hive inspection should be done at least twice a week. Hive record also is to be maintained for each hive for the following, viz., presence of queen, presence of eggs and brood, honey and pollen storage and presence of bee enemies like wax moth, mite, diseases etc.

The management practices are the key to the success of beekeeping. Various management practices include dearth management, winter management, comb management, queen management, honey flow management, pest and predator management etc. Due to climatic and floral conditions in northern states, beekeeping generally starts with build- up period in September to November due to rabi crops. Weak colonies build up and strong colonies store honey. Agricultural crops are seasonal and provide bee forage for limited periods. Bee colonies cannot be sustained throughout the year in any cultivated area, unless it has an integrated intensive agriculture, agro-forestry and social forestry systems. During the forage scarcity periods between two crop seasons, bee colonies will have to be moved to forest areas. Thus, the beekeeping potential for the cultivated vegetation becomes a part of the potential contained in the natural vegetation. Commercial beekeepers migrate colonies from the hills to the agricultural plains of Punjab, Haryana, Uttar Pradesh to avail *Brassica*, *Eucalyptus*, *Trifolium*, *Helianthus* etc. and also to litchi orchards up to April. Sugar and pollen supplement feed are given to compensate the nectar and pollen dearth. During winter, the colonies dwindle due to the temperature fluctuations hence winter packing and sufficient food stores is a prerequisite.

Honey extraction is done when the honey flow begins to slow down, the surplus honey only is removed from the sealed combs. After the work is completed, the empty frames should be returned to the colonies on the same day. After final extraction colony should not be left without any honey stores; some honey stores must be left for their future need. It may also be noted that frequent honey-extraction during honey flow period gives higher

quantity of honey than extraction made at the end of the season.

**Bee-equipments :** The minimum requirement of equipments in bee-keeping are bee-boxes, smoker, and honey extractor. Besides these essentials a beginner should also acquire a bee veil, overalls and hand gloves for protection from bee-sting.

**Bee-pasturage:** Flowers of all plants are not visited by honey-bees, as morphological characters of some of the flowers deter them to reach at the nectaries. However, there are some specific plants that provide them nectar or pollen or both in abundance without any hindrance and these plants are called as bee-flora.

1. **Plant whose flowers are major sources of nectar only for hive-bees are :** Arjan (*Terminalia arjuna*) *Cidrela* spp., Eucalyptus, *Pongamia*, Tamarind, Neem, Willow, *Prosopis*, Parrot plants, and *Justicia* spp.
2. Plants which provide only Pollen are : Date, Pomegranate, Guava, Caster, Rose, Duranta, Isapgol, Maize, Jowar and Sorghum, Poppy, *Zinnia*, Butter cups, Coreopses, Portulaca and *Agretum*.
3. **Plants whose Flowers are Major Sources of Nectar and Pollen both are :** Fruits.: Almond, Apple, Apricot, Banana, Berries, Cherry, Jamun, Pear, Peach, Plum and Litchi; Vegetables: Asparagus, Carrot, Coriander, Cruciferous vegetables, Cauliflower, Radish, Cucurbiteceous vegetables, Melon, Pumpkin, Garlic and Onion; Crops: Berseem, Buckwheat, Cotton, Sarson, Rape and Mustard, Rai, Toria, Sesamum and *Trifolium* spp. ; Ornamentals : Aster, Calendula, Cornflower, Cosmos, Gaillardia, Golden rod, Hollyhock, Sunflower; Roadside trees: Geranium, Indian Laburnum, Siris, Soap nut, Pride of India, *Dalburgia* spp. *Spindus* spp. *Cedrela*' and Willow; Herbs: *Polygonum* spp. Dandelion, Balsam; Shrubs and bushes: *Plecranthus*, Poinsettia, Thornapple, *Origanum vulgare*, Barberry and *Antigonum*.
4. **Some of the Plants whose Flowers are Useless to Honeybees are :** *Antirrhinum* *Bongainvillea*, Candytuft, Canna, *Cineraria*, *Chrysanthemum*, Jasmin, Lantana, Pansy, Flox, *Vinca* and Sweet Peas.

## Increased Income of Farmers from Beekeeping:

**Benefit through increased crop production:** Honeybees as well as other Pollinators play a direct role in increasing productivity of certain crops like Mustard, Coriander, Black Cumin, Sesame, Guava, Oranges, Cucurbits, etc. But awareness among the cultivators is very less for which awareness camps and field demonstration on yield improvement through enhanced pollination are required.

**Benefit through increased honey production:** Skill development and strengthening of existing beekeepers is very important for increasing the productivity of honey. They should be trained on the following aspects of beekeeping, viz., scientific colony management, development of quality nucleus stock for *A. mellifera* and *A. cerana*, queen rearing and colony multiplication, management of pest and diseases in Bees and also safe and judicious application of pesticides on crop plants

**Better price of honey through ensuring its quality:** It is important for the beekeepers to get a remunerative price for their products. Quality of honey determines the price. Therefore, awareness on the part of farmers is required for extraction of sealed honey from super chambers only and storing of honey in clean and food grade containers; provision of quality testing at the point of sale; well-equipped laboratories for monitoring of any possible adulteration; direct linking of beekeepers to the existing cooperatives or formation of more numbers of cooperatives etc. to derive maximum gains from this venture.

**Diversification of apiary products:** In addition to honey, efforts should be made for marketing of other other apiary products, like propolis, bee venom, queen rearing & supply, renting of bee boxes for pollination to orchard owners etc.

## Government initiatives for popularization of Beekeeping:

After independence, Government of India took a policy decision to revive various traditional village industries and an All India Khadi and Village Industries Board (KVIB) was formed in 1954. Through efforts of various organizations like KVIC (Khadi village Industries Commission) and State KVIBs, Beekeepers' Co-operatives, Public Institutions, the beekeeping industry came into limelight of village industries in India within two decades. As



the importance of beekeeping increased, in 1981 an All India Coordinated Research Project (AICRP) on Honeybee Research and Training was launched by ICAR involving Agricultural Universities. Later, a Central sector scheme entitled “Development of beekeeping for improving crop productivity” was launched by Ministry of Agriculture in 1994-95 during the eighth five year plan. The scheme targeted the production and distribution of honey bee colonies, organizing trainings and awareness programmes. A National Beekeeping Board was started to organise beekeeping activities.

Very recently the Department of Agriculture, Co-operation and Farmers Welfare in the Ministry of Agriculture and Farmers Welfare have initiated the establishment of Integrated Bee Development Centers (IBDC) in two phases during the year (2015-16; 2016-17) and 2017-18. In the first phase during 2016-17, ten IBDCs viz., (i) Kurukshetra, Haryana (State Deptt of Hort); (ii) Motihari, Bihar (Rajendra Agricultural University), (iii) Delhi (IARI), Pusa, (iv) Dehradun, Uttarakhand (KVK/GB Pant University of Agriculture & Technology, Pantnagar), (v) Varanasi, UP (Indian Institute of Vegetables Research-IIVR), (vi) Ludhiana, Punjab (Punjab Agricultural University-PAU) and (vii) Imphal, Manipur (Central Agricultural University, CAU) (viii) S.K.University of Agricultural Sciences & Technology (SKUAST), Srinagar, Kashmir (ix) Rajmata Vijayaraje Scindia Krishi Vishwa Vidhyalaya, Gwalior at KVK, Morena, M.P. (x) Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu have been commissioned. In the second phase, 10 new centres, one each in Himachal Pradesh, Gujarat, Tripura, Karnataka, Andhra Pradesh, Chhatisgarh, Jharkhand, West Bengal, Assam & Arunachal Pradesh have been planned to be set up during the year 2017-18. Remaining states will be covered in the coming years.

These centres will serve as Role Models for Scientific Beekeeping with all the necessary infrastructural facilities for nucleus/breeder stock production, collection, handling, storage, marketing and export of honey and other bee products, small honey processing plants, etc. may be developed in integrated manner. Besides, these IBDC's shall function as information & demonstration units also. In these centres (IBDCs) the units of queen bee multiplication, honeybee disease diagnostic lab, extraction & processing units for honey and other bee hive products, development of quality nucleus stock/queen bees of *Apis cerana* and *Apis mellifera*, setting up of Apiary, information centre for scientific beekeeping, honey & other bee hive testing laboratory, beekeeping equipment manufacturing workshop, awareness & training programmes will be set up. Centres will help the beekeepers/farmers of the area in adopting scientific beekeeping and encourage/promote scientific beekeeping in integrated manner in the country. The farmers/ beekeepers will get all facilities related to beekeeping at one place in these centres.

The basic thrust of IBDC is to harness the potential of crops including cereals, pulses, oil seeds, commercial/ horticultural crops by increasing the productivity through improvement of pollination, maximize economic, ecological and social benefit by desirable diversification through bee keeping and consequent production of good quantity and quality of honey and beehive products for domestic and export market. Setting up of Integrated Beekeeping Development Centres (IBDCs)/Centres of Excellence (CoEs) on Beekeeping also helps in developing additional infrastructure for nucleus and breeder stock production, disease diagnosis, processing, storage and marketing of quality lab, honey and bee hive products and provide skillful employment in the country. Based on the area under cultivation in India and bee forage crops, India has the potential to harbor about 100 to 150 million bee colonies while the current figure is less than five million colonies and increase production to 600,000 metric tonnes. Hence there is vast scope for increasing the number of bee colonies.

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# POTENTIAL OF SERICULTURE

Jyothi K K

Sericulture industry provided employment to approximately 8.25 million persons in rural and semi-urban areas in India during 2015-16. 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.

Ever since the beginning of civilization, man has been trying to make use animals around him for various purposes and to rear them for increasing their number. In this also, the major aspects being apiculture (Bee- keeping), lac culture (rearing lac insects) and sericulture (rearing silk moths). Sericulture or silk production is the breeding and management of silk worms for the commercial production of silk. Sericulture is an important industry in Japan, China, India, Italy, France and Spain.

## Introduction:

Employment generation is one of the major potentials of Sericulture and Silk Industry in India. The farm and non-farm activity of this sector creates sixty lakh man days of employment every year mostly in rural sector. The industry helps to create egalitarian distribution of income as it transfers greater share of its wealth from high end urban customers to poor artisan classes.

## Silk Production in India:

Silk is the most elegant textile in the world with unparalleled grandeur, natural sheen, and inherent affinity for dyes, high absorbance, light weight, soft touch and high durability and known as the "Queen of Textiles" the world over. On the other hand, it

stands 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 among one of the most 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. India has a rich and complex history in silk production and its silk trade dates back to 15<sup>th</sup> century. Sericulture industry provided employment to approximately 8.25 million persons in rural and semi-urban areas in India during 2015-16. 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.

## Sericulture:

Sericulture is one of the labour intensive cottage industries involving mulberry cultivation, silkworm rearing and egg production, reeling and weaving of the loom and other post cocoon processes



like twisting, dyeing, painting, finishing etc. along with the utilization of by products, offering a most promising alternative agricultural activity. Sericulture is a way of life in India. Sericulture promotes self-employment and other livelihood activities in the rural economy and helps to accelerate income and provides employment opportunities to 35 million people and is practiced in Karnataka, Andhra Pradesh, Tamil Nadu, Jammu & Kashmir and West Bengal (Mulberry Silk) Jharkhand, Orissa, Chhattisgarh and North-Eastern States (Non-Mulberry Silk).



India has the unique distinction of being the only country producing all the five known commercial silks, namely, Mulberry, Tropical Tasar, Oak Tasar, Eri and Muga, of which Muga with its golden yellow glitter is unique and prerogative of India. Mulberry sericulture is mainly practised in five states namely Karnataka, Andhra Pradesh, Assam and Bodoland, West Bengal, Jharkhand and Tamil Nadu. North East has the unique distinction of being the only region producing four varieties of silk viz., Mulberry, Oak Tasar, Muga and Eri. Overall NE region contributes 18 per cent of India's total silk production. India is the second largest producer of silk in the world. Among the four varieties of silk produced in 2016-17, Mulberry accounts for 71.8% (20,434 MT), Tasar 9.9% (2,818 MT), Eri 17.8% (5,054 MT) and Muga 0.6% (166 MT) of the total raw silk production of 28,472 MT. The demand for superior quality bivoltine silk is increasing in India for domestic consumption as well as value added silk products for the export market.

The Ministry of Textiles Government of India and Departments of Sericulture in various states provide technical and financial assistance for enhancing the bivoltine silk production.

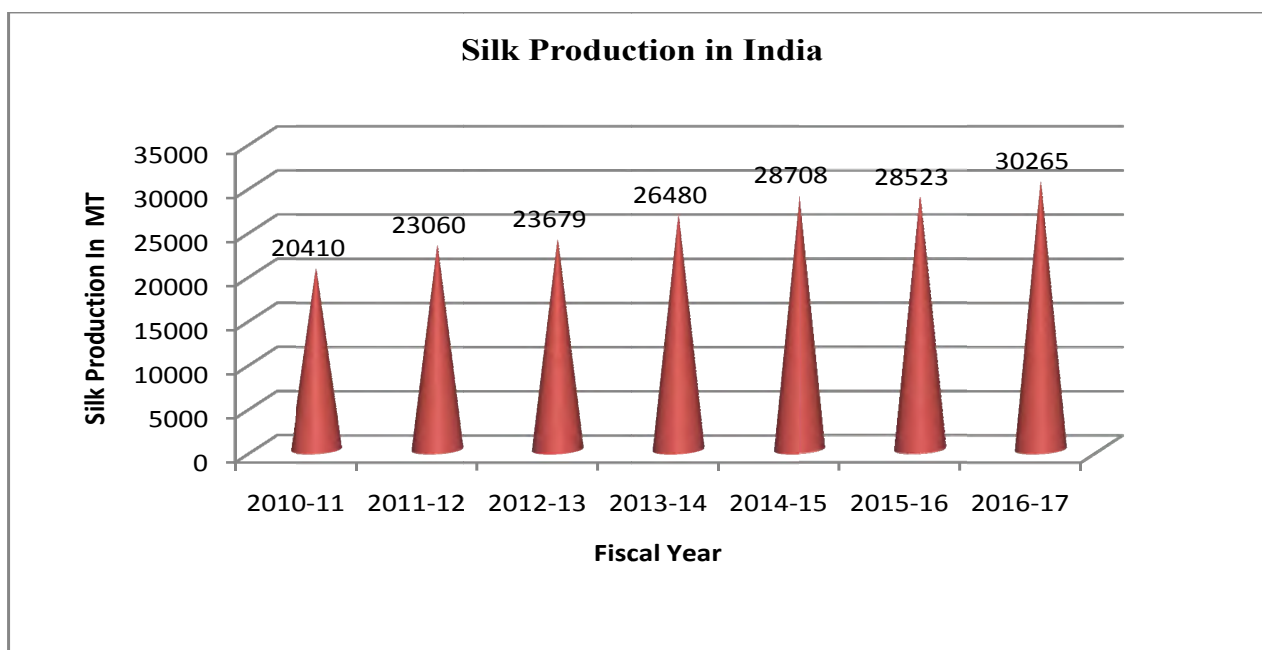
### Types of Silk:

India is home to a vast variety of silk secreting fauna. There are mainly five varieties of silk produced in India such as Mulberry, Tropical Tasar, Oak Tasar, Eri and Muga. Silk from other than Mulberry are known as vanya silk.

### Annual Silk Production in India:

The Central Silk Board publishes the data on the annual silk production in India. The figure given below truly portrays the details of silk production in India for the last few years.

It can be observed from the figure that the silk production has been showing an increasing trend



(Source: Central Silk Board Annual Report, 2017)

over the last few years. For the fiscal year 2010-11, it was 20410 MT (metric tonnes). In 2011-12, it increased to 23060 MT (i.e., an increase of 2650 MT). The year 2012-13 saw a slight increase in silk production to 23679 MT (i.e., an increase of 619 MT). Again, the annual production of silk has increased to 26480 MT in 2013-14 and to 28708 MT in 2014-15. But the fiscal year 2015-16 experienced a slight decrease in silk production (i.e. 28523 MT). There was a recovery in the annual silk production in the year 2016-17.

### Central Silk Board:

The Central Silk Board (CSB) is a statutory body established in 1948 by an act of Parliament. CSB functions under the administrative control of the Ministry of Textiles, Govt of India having the head quarters at Bangalore. The mandated activities of CSB are being carried out by 324 units of it in different states through an integrated scheme for development of sericulture industry with the following four components.

1. Research and Development Training, Transfer of technology and IT initiatives.
2. Seed organization
3. Co ordination and Market development.
4. Quality Certification systems, export, brand promotion and technology up gradation.

### Export of Silk products:

The following table presents the details on export of silk and silk goods in India.

Year	Export of proceeds in crore Rs:
2013-14	2480.89
2014-15	2829.94
2015-16	2495.99
2016-17	1465.86

(Source: Ministry of Textiles GoI)

From the table, one can infer that the export of silk and silk goods is showing a declining trend. The export proceeds of silk and silk products has increased from Rs 2480.89 crores to Rs 2829.94 crores in 2014-15. But from 2015-16 onwards, export proceeds of silk goods began to diminish. In 2016-17, it was again decreased to Rs 1465.86 crores.

### Major Challenges in export of silk products:

- Decreasing demand from major consuming markets.
- Rising prices of raw silk yarn/fabrics.

- Increased competition from blended silk (i.e. synthetic and polyester).
- Changing fashion trends especially in Europe and US markets.
- Lack of availability of quality raw silk and dependence on China for the same.

### Problems of Sericulture farming in India:

- Lack of knowledge, the farmers are less aware of the improved scientific farming techniques.
- Non availability of raw materials also affects silk production.
- Crop failure: especially in the cultivation of mulberry.
- Bio-security measures: proper bio security and sanitation measures with in the silk worm shed.
- Pest and diseases: there is the possibility of silk production to be affected by pest and diseases.
- Health risk – especially for the sericulture farmers and the people who manage silkworm shed.
- Unavailability of government loans and subsidies also discourage silk production.

### Conclusion:

Indian economy regarded as an agrarian economy is witnessing a downward trend in contribution of primary sector which encompasses agriculture and allied activities. Many factors like small and uneconomic holdings, lack of irrigation facilities, limited scope for mechanization, inadequate credit facilities etc can be sited as the reasons for low agricultural production. In order to tackle unemployment, attention should be diverted to the potentials from other activities like Fishing, Poultry farming, Sericulture, Apiculture etc. If proper focus is given to these areas, definitely there will be significant improvements in the contribution of primary sector to national income. The activities like Sericulture can be effectively practiced in rural areas, as it does not need heavy initial investments. Moreover, they create ample employment opportunities for the landless and marginal farmers. The scope of Sericulture is increasing today as it can reduce the evils of poverty and unemployment to a certain extent if properly organized.

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## OPERATION GREENS

Dr Anil Kumar Singh and Dr Preetam Joshi

The real success of Operation Greens (OG) can be acknowledged only when the farmers will get at least 60 to 70 per cent of the price paid by end consumer as well as the end consumers also pay a lesser affordable price. Father of India's Green Revolution M.S. Swaminathan has quoted that "If agriculture fails, everything else will fail". OG is a welcome step by the government to stop the failure of agriculture and to build a better world for the Indian farmer.

Indian economy is largely dependent on agriculture and its allied sector like dairy, forestry and fisheries which accounts for approximately 18 per cent of the total gross domestic productivity (GDP). Fifty seven per cent of the total Indian workforce is directly or indirectly engaged in agriculture or related profession. India is the leading producer of cereals, pulses, spices and spice products. India also ranks in top three in production of paddy, wheat, pulses, groundnut, rapeseed, vegetables, tea, tobacco and many other agriculture products.

Even though Indian agriculture sector got hold of all these accolades since past few decades but still, the economic condition of the Indian farmers, who are the steadfast stakeholder of this largest economic sector, is miserable. There are many problems haunting the agriculture sector in India. Few of them are:

1. **Illiteracy among farmers:** The farmers are not aware of the government schemes and initiatives. Even if they become aware of about
2. **Scarcity of capital:** Just like any other business, agriculture also requires a capital investment. With the advancement of modern agriculture technology, the requirement of capital input is becoming more and more important. Even though the government is giving subsidy to farmers for developing modern agriculture infrastructure and for procurement of modern farm equipments, but farmers need to first pay the entire amount. The subsidy amount is credited to the farmer's bank account only later. Thus most farmers, who don't have initial capital, are unable to avail many of these schemes.
3. **Small and fragmented land-holdings:** Sixty nine per cent of the Indian farmers are marginal farmers and have a land holding



of less than one hectare. This makes the agriculture economically unviable.

4. **High cost of agri-inputs like seeds, agro chemicals and agriculture technology:** The high quality seeds, used in modern agriculture, are very costly and cannot be used to produce seeds for next year. Thus, use of these seeds becomes economically unviable for traditional farmers.
5. **Lack of proper irrigation facilities:** Agriculture in our country largely depends on tropical monsoon, which most of the times is uncertain, unreliable and erratic. Lack of adequate monsoon in totally rain-fed areas leads to complete crop failures. On the contrary, over irrigation in well irrigated areas has led to problems of water logging and soil salinity and alkalinity.
6. **Lack of mechanization and modern agriculture technologies:** Lack of mechanization leads to wastage of human labor and also reduces the agricultural productivity. Their proper and appropriate use can make agricultural operations efficient and quick thus, facilitating multiple cropping.
7. **Lack of information about soil health and its management:** In absence of this knowledge, farmers are not able to decide the best crop for fields and the amount of agro chemical inputs required for their crops. A better knowledge of soil health and its management strategies can greatly reduce the cost of agricultural production.
8. **Poor agriculture marketing services:** Agricultural marketing is still one of the biggest challenges that our country is facing. In the absence of proper marketing facilities, the farmers have to depend upon local traders and middlemen for sale of their agriculture produce. Most of the local traders and middlemen take advantage of farmer's helplessness and buy their produce at throw away prices, thus denying the farmers the price for their labour.
9. **Inadequate post harvest storage and transportation facilities:** One of the major reasons that compels farmers to sell their produce at throw away prices to middlemen

is the lack of appropriate transportation and storage facilities.

A number of steps have been taken up from time to time by different governments to address the above mentioned issues of the farmers but still a lot needs to be done.

**Illiteracy of farmers:** The main reasons for the failure of literacy programs are (1) These programmes are voluntary and not compulsory (2) People don't link literacy to their daily routine life (3) Due to poor economic condition many people are preoccupied with problems of food, health, employment and self-reliance (4) Lack of motivation and missionary zeal among individuals and functionaries involved in these programmes (5) Strong political will. Now its high time to take strong measures to revive these programmes and re-launch them incorporating constructive suggestions proposed by different expert committees.

The **problem of fragmented land** can be overcome by bringing in legislation for consolidation of holdings *i.e* chakbandi. Chakbandi has been enacted and implemented in few states like Punjab, Haryana and parts of Uttar Pradesh but need to be fully implemented across India, especially in population dense states like Bihar, Kerala, West Bengal etc. where the land holdings is less than one hectare.

**Problem of capital scarcity:** To improve the economic conditions of the farmers and capital availability for agriculture, the government of India has taken several steps. Government has come up with several farmer centric credit schemes like (1) Kisan Credit Card: farmers can avail loan for crop sown by using the card. Farmer is also provided crop insurance and risk coverage. (2) Interest assistance schemes: under this scheme the farmers are provided with loan upto Rs. 3 lakh with effective interest rate of 4% interest rates if loans are timely repaid. (3) Investment loan scheme: This scheme provides loan to farmers for investment in irrigation, agriculture mechanization, land development, plantation, horticulture and post harvest management of agriculture produce.

**Problems of quality seeds, agro chemicals and modern technologies** can be overcome by (1) solving the problem of credit crunch and (2)



**Table 1: Different schemes launched by Government for benefit of farmers**

Name of Scheme	Purpose	Details
Pradhan Mantri Krishi Sinchayee Yojana	Provide relief to the farmers due to poor monsoon	To provide irrigation facilities to each farmer. To train them for efficient water usage and its conservation.  Make them aware about modern irrigation technologies. Encourage investment in irrigation, water conservation and management sector.
Paramparagat Krishi Vikas Yojana	Promote bio-farming	Farmers are encouraged to adopt bio-farming by forming clusters of 50 farmers with a total land of 50 acres. Every farmer is provided Rs. 20000 per acre for a span of three years. This amount can be utilized for purchase of bio-seeds, other agricultural activities like harvesting, transportation and marketing of agricultural produce.
Soil Health Card Scheme	Provide the nutrient status and fertility of the soil	Soil Health Card provides the information about nutrient status and fertility of the soil which can help the farmers to decide the type of fertilizer and its amount to be added.
Pradhan Mantri Fasal Bima Yojna	to provide relief to the farmers inflicted with the loss of crop damage	In this scheme the crop of the farmers are insured from natural calamities for very small premium of 1.5 – 2% of the amount claimed. Rest of the premium is deposited by the government. Under this scheme, remote sensing, smart phone and drone are used for expeditious assessment of crop damage and quick claim settlement. Even provision has been made to cover the losses in harvesting aftermath scenario
National Agriculture Market (e-NAM)	To provide a electronic platform for marketing of agricultural products	e-NAM is unified national trading portal for agricultural products developed by making a network of existing Agricultural Products Marketing Committee (APMC). The purpose of the NAM is to transport the agricultural product from one market to another in a smooth way, to save the producers from a number of market duties and to provide agricultural product to the consumers on a fair price
India Emergence Campaign through village emergence	To improve means of livelihood, accelerate rural development and strengthen Panchayati Raj	The scheme aims to provide villagers with methodology of scientific farming, use of technology in agriculture and rural development, engagement of scientific experts for knowledge sharing, spreading awareness and training villagers for use of sophisticated equipment and technologies.

(Source: Press Information Bureau, GOI)

dissemination of knowledge and training. To disseminate the latest development in agriculture the Prasar Bharti (Government of India) started a new T.V channel named DD-Kisan, besides several programs on agriculture on national television channel (DD National). A 24x7 Kisan Call Centre facility is available to provide any type of assistance

and information to farmers on telephones and mobiles. Kisan helpline is free of cost and its services are available in different languages. Besides this, all agricultural universities in India are organizing “Krishi Mela” and Training Camps for spread awareness and train farmers in new technologies of agriculture

To tackle the **problem of transportation and sale of agriculture produce**

the government has the scheme of Price Policy for Agricultural Commodities or the Price Support Scheme (PSS). The objective of the PSS scheme is to provide remunerative/guaranteed prices to the farmers for some their produce like oilseeds, pulses and cotton in case their price fall below the minimum support price (MSP). To provide best price of agriculture produce the government has set up several Agriculture producer market and is presently working on linking them digitally to forms electronic National Agriculture Market. Table 1 lists the different schemes launched by the government.



Every now and then there are reports on farmers suicides and protests from different parts of the country. These protests have been revolving around two main issues: Loan waivers and increase in the minimum support price agriculture produce. Thus it has been very challenging for governments to accelerate agricultural growth rates.

The present central government, in Union Budget 2018, has proposed the launch of “Operation Greens” (OG) in the lines of “Operation flood” (OF) with the seed capital of Rs 500 crore. The main aim of the OG is to enhance the income of the farmers. The vision of the government is to double the income of the farmers by 2022. This announcement has brought a new ray of hope to the farmers of our country. In accordance with the government’s vision, the Niti Aayog and economic think-tank has come out with a four – point action plan. This four point action plan includes the following measures:

- a. Better remuneration to farmers for their agriculture produce by reforming the existing marketing structure
- b. Raising the productivity by using modern, scientific, environmentally safe and sustainable agriculture technologies

- c. Reforming the land policy to make farming and economically viable profession even for small marginal farmers
- d. Provide capital support, subsidies and insurance schemes for economically supporting the farmers

Although there is nothing radically new in what has been suggested in “Operation Greens” initiative, it only requires a strong political will and missionary zeal to achieve the target of doubling the farmers income. The farmers are more hopeful this time because the government has shown the successful implementation of other operations like Swachh Bharat Mission recently.

The “Operation Flood” (OF) was launched in 1970 for increasing the milk production and empowering the farmers in a span of mere 46 years transformed India from a milk importer to world’s number one milk producer. The success of the Operation Flood was due to several innovative steps taken during the mission. The government wants to just replicate those steps for Operation Greens.

**Formation of National Agriculture Market (e-NAM) in line with National Milk Grid (NMG):** One of the major reasons for success of the OF was the formation of NMG that connected milk producers in villages to urban consumers. This grid was developed by forming cooperatives of milk producers that effectively removed the middlemen. Removal of middlemen ensured better remunerative price to the producers and also helped to close the demand – supply gaps. Formation of the co-operatives converted this unorganized sector into organized sector. This helped in developing infrastructure for



supplying, processing and direct marketing of milk and milk products.

In OG, the government wants to replicate the same idea by interlinking the different “mandies” under Agriculture Produce Marketing Committees (APMCs) digitally and develop them as e-NAM (electronic National Agriculture Market). The e-NAM will provide a digital platform for marketing of agriculture produce. The scheme has already been launched by the government in 2016, now it is being expanded to connect all 585 mandis under the APMC. As of now 470 mandis have been connected to eNAM and remaining 115 will be connected by 2018. eNAMs will help in free flows of commodities and will help in rationalizing their prices across the country.

**Modernization of agriculture in line with modernization of milk production:** Increased production of milk during OF was achieved by use of modern technologies, better feed and healthcare to cattles and development of high yielding breeds, similarly OG wants to enhance the use of modern and sustainable agriculture technologies for increasing production, better and green control of crop diseases and developing high yielding varieties of routine crops and vegetables. Government is taking all steps to spread awareness among farmers about modern agricultural technologies and empowering them to afford them.

**Revamping of transportation, storage and agriculture marketing facilities:** Agriculture production has been a lesser problem in India as compared to problems of transportation, storage and marketing of agriculture produce. As mentioned earlier, India is the leading producer of many agri products but in absence of proper agriculture

infrastructure for transportation, storage and marketing the farmers do not get fair price of their produce. Thus, a revamping of these facilities is urgently needed. The government has also promised a budget of Rs 2000 crores for development of agriculture infrastructure under Operation Greens and are working on institutional mechanisms for expansion of agricultural warehouses.

Initially, the government has targeted three main vegetables on **TOP** priorities under this mission *i.e.* **T**omato, **O**nion and **P**otato. In the opening years, the government wants to control over the precarious prices of these commodities and to ensure that the farmers are being paid sufficient against the hard work they have done. The booms and burst in prices has compelled many a times the farmers to throw these vegetables on road. Reverse to this, speedy rise in the price (which is most of the time due to stocking and tricky games of traders) also put common man as well as the government in difficult situation.

The main reason of success of OF was that the government has ensured that the 70 percent of the money, paid by the consumers for the milk, reached directly to the farmers. The same needs to be repeated in OG also. This is only possible through linking the major consumption centers to the production centers (without the involvement of mediators), second, establishment of solid infrastructure, starting with modern warehouses/storage houses, to restrict the wastage of vegetables/produce and the third one is connecting the processing industries with organized retailing so that at least one fourth of the vegetables produced at peak time can be diverted to these industries.

The real success of OG can be acknowledged only when the farmers will get at least 60 to 70 per cent of the price paid by end consumer as well as the end consumers also pay a lesser affordable price. Father of India's Green Revolution M.S. Swaminathan has quoted that “If agriculture fails, everything else will fail”. OG is a welcome step by the government to stop the failure of agriculture and to build a better world for the Indian farmer.

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# GOBAR DHAN: WASTE TO WEALTH

Dr. K. Ganesan

The GOBAR-Dhan initiative is expected to create opportunities to convert cattle dung and other organic waste to compost, biogas and even larger scale bio-CNG units. This programme, expected to be launched in April, 2018 aims at the collection and aggregation of cattle dung and solid waste across clusters of villages for sale to entrepreneurs to produce organic manure, biogas / bio-CNG. The scheme will provide many benefits to rural people by keeping villages clean and sanitized, improving livestock health and increasing farm yields. Under it, biogas generation will help to increase self-reliance in energy utilized for cooking and lighting. It will create new opportunities for jobs linked to waste collection, transportation, biogas sale etc.

The Galvanizing Organic Bio-Agro Resources Dhan (GOBAR-DHAN) scheme has been announced by Government of India on 1<sup>st</sup> February, 2018 in the Union Budget. Under this scheme, the cattle dung, kitchen waste and agricultural waste can be utilized to create biogas-based energy. The objectives of this initiative is to make villages clean and to generate wealth and energy from cattle and other waste. The Swachh Bharat Mission-Gramin will pilot this initiative. The GOBAR-Dhan initiative is expected to create opportunities to convert cattle dung and other organic waste to compost, biogas and even larger scale bio-CNG units. This programme, expected to be launched in April, 2018 aims at the collection and aggregation of cattle dung and solid waste across clusters of villages for sale to entrepreneurs to produce organic manure, biogas / bio-CNG. The scheme will provide many benefits to rural people by keeping villages clean and sanitized, improving livestock health and increasing farm yields. Under it, biogas generation will help to increase self-reliance in energy utilized for cooking and lighting. It will create new opportunities for jobs linked to waste collection, transportation, biogas sale etc. According to a study by International Labour Organization during 2014, the productive use of dung could support 1.5 million jobs nationally and there is a significant potential for farmers to generate income from the sale of cattle dung. It will also provide stable fuel supply in market for oil

companies and accessible credit in market through government schemes and banks for entrepreneurs.

## Cattle dung as Manure:

The India's cattle population is around 300 million. On an average cattle produces 4-6 tonnes of fresh dung per year. From this 300 million cattles, approximately 1200-1800 million tonnes dung can be obtained. This quantity is more than sufficient to fulfill the organic manure requirement for 132 million hectares of cultivable lands in India at 9.09 - 13.64 tonnes / ha. In India, 69.9 per cent cattle population resides in rural areas, where cow (*Bos indicus*) is major cattle and generates 9 -15 kg dung/day. Cattle dung can be defined as the undigested residue of consumed food material being excreted by herbivorous bovine animal species. Being a mixture of faeces and urine in the ratio of 3:1, it mainly consists of lignin, cellulose and hemicelluloses. It also contains 24 different minerals like nitrogen, phosphorous, potassium, sulphur, iron, magnesium, copper, cobalt and manganese



that are essential for growth and development crop plants. Cattle dung harbours a rich beneficial microbial diversity, containing different species of bacteria (*Bacillus* spp., *Corynebacterium* spp. and *Lactobacillus* spp.), protozoa and yeast (*Saccharomyces* and *Candida*). Exploitation of cattle dung microflora can contribute significantly in sustainable agriculture. It is one of the bioresources of this world which is available on large scale and still not fully utilized.

### Cattle dung as Vermicompost Bio-Manure:

Vermicomposting is a method of preparing enriched compost with the use of earthworms. It is one of the easiest methods to recycle animal wastes and to produce quality compost. Earthworms consume animal wastes and excrete it in digested form called worm casts. Worm casts are popularly called as black gold. The casts are rich in nutrients, growth promoting substances, beneficial soil micro flora and having properties of inhibiting plant pathogenic microorganisms. Vermicompost is stable, fine granular organic manure, which enriches soil quality by improving its physicochemical and biological properties. It is highly useful in raising seedlings in the nurseries and for crop production and it is becoming popular as a major component of organic farming system. *Vermicompost* contains 5 times the available nitrogen, 7 times the available potash and 1.5 times more calcium than found in good top soil. Several researchers have demonstrated that earthworm castings have excellent aeration, porosity, structure, drainage and moisture holding capacity. Vermicomposting is a highly profitable venture for farmers having dairy units. The approximate cost and benefit under different scale of production is given below.

### Dung as Bio-energy:

Under the scheme, the Government gas announced that it shall be making best use of solid waste excreted out by the cattle into biogas as bio-energy that can be used by the villagers for fulfilling up

their stoves at their homes for CNG and LPG. Biogas, a mixture of different gases produced by anaerobic fermentation of organic matter from methanogenic bacteria, mainly constitutes methane (50-65 %) and CO<sub>2</sub> (25-45 %). One kilogram of cow manure can produce 35 - 40 litres of biogas when mixed with equal amount of water with hydraulic retention time (HRT) of 55 - 60 days maintained at an ambient temperature of 24-26 °C. Cow dung is the major source of biogas gas production in India. The total population of female cows in India is 190.90 million out of which 151 million are indigenous, whilst 39 million are cross breed (Livestock Census 2012). Cow dung generated from 3-5 cattle/day can run a simple 8 -10 m<sup>3</sup> biogas plant which is able to produce 1.5-2 m<sup>3</sup> biogas per day which is sufficient for the family 6-8 persons, can cook meal for 2 or 3 times or may light two lamps for 3 h or run a refrigerator for all day and can also operate a 3-KW motor generator for 1 h. A 1m<sup>3</sup> biogas plant can able to produce 28.78 l/kg (0.028 m<sup>3</sup>) of biogas when daily feed with 22 kg of dung/m<sup>3</sup> which is mixed with equal amount of water with 9-10 per cent of total solids. The maximum production of biogas from that plant is 39.00 l/kg (0.039 m<sup>3</sup>) and 40.04 l/kg (0.04 m<sup>3</sup>) respectively when operated at the temperature of 23.5 °C. On the other hand, farmer also gains 13.87 metric tons of organic fertilizer per year from the biogas plant. Mixture of cow and pig dung (60:40) showed 10 per cent increased methane production. Besides this, there are reports on comparative studies for biogas production where various feedstocks such as kitchen waste, corn waste and spent tea waste have been used along with cow dung in a ratio of 1:1 but they produce less average biogas after 25-30 days; however, cow dung alone produced approximately 50 per cent more biogas than these mixtures, thereby suggesting that other organic sources may produce biogas but cow dung still remains a potential source. A cooperative service society in Punjab, collecting cattle dung and other organic waste to run the biogas plant and providing metered cooking gas to members. Likewise, the Gram Vikas Trust started the GOBAR Bank initiative in Surat, Gujarat, where members bring

Scale	App. cost per annum (Rs.)	App. benefit per annum (Rs.)	Cost / Benefit Ratio
Small	0.52 lakh	0.90 lakh	1 : 1.73
Medium	1.00 lakh	1.85 lakh	1 : 1.85
Large	2.25 lakh	4.50 lakh	1 : 2.00

(Source: ICAR Research Complex for NEH Region, Umiam - 793 103, Meghalaya)

fresh cow dung to the community biogas plant. The dung is weighed and accounted for in their passbooks, In return they get cheap cooking gas as well as bio-slurry, the residue from the biogas plant which is used for vermicomposting and organic farming.

### **Clean India:**

The Gobar-Dhan Yojana will help in keeping the village clean while increasing the income of farmers and cattle herders. Replacement of fossil fuels with agricultural solid biomass by clean fuel like biogas for cooking, lighting and electricity generation would also help in curtailing the Greenhouse Gas (GHG) emissions as well as indoor air pollution. According to the United Nations Food and Agriculture Organization (FAO), the animal waste on this planet produces around 55 - 65 per cent methane, which upon release in the atmosphere can affect global warming 21 times higher than the rate CO<sub>2</sub> does.

### **Biogas slurry as Organic Manure:**

During the process of biogas production, the animal dung is converted into biogas slurry which is good quality manure and can be applied in agricultural fields as soil conditioners. The digested biogas slurry contains rich amounts of macro and micro nutrients that provide essential plant nutrients for longer period. Biogas slurry is a digested source of animal waste and if animal urine is added, more nitrogen is added to the slurry which can speed up the compost-making process in short period of time. This improves the carbon/nitrogen (C/N) ratio in the slurry that provides easily nutrient availability to plants and soil biota. The nitrogen content in the slurry after anaerobic digestion enhances compared to untreated animal manure, thus can be used as organic fertilizer. Biogas slurry as organic fertilizer used in agricultural land would partly or fully offset the need for chemical fertilizers which itself have high energy demand during production. The biogas slurry has 93 per cent water and 7 per cent of dry matter, of which 4.5 per cent is organic matter and 2.5 per cent inorganic matter. Biogas slurry is considered a good source of organic fertilizer as it contains considerable amounts of both macro (N, P, K) and micronutrients (Zn, Mn, B) that are necessary for plant growth. Biogas slurry can also be used to build up the soil health status which is highly essential for crop production. Biogas slurry

provides huge nutrient potential for vegetative and reproductive growth of field crops with long term sustainability. By applying the digested biogas slurry in the field as soil conditioner for long term basis, help in reducing inorganic fertilizer demand and provide an eco-friendly way of maintaining productivity status of the soil. Being fully fermented, biogas slurry is odorless and does not attract flies. It repels termites and pests that are attracted to raw dung and it is proved to reduce weed growth by up to 50 per cent. Biogas slurry is an excellent soil conditioner and enhances the water holding capacity of the soil. It is pathogen-free and the fermentation of dung in the reactor kills organisms causing plant disease. Soil fertility and structure is improved through the use of biogas slurry as an organic fertilizer resulting in improved crop yields and reduced erosion. Major plant nutrients such as NPK are preserved during fermentation process and plants can immediately absorb these nutrients.

### **Income generation through Animal Husbandry:**

This scheme provides sustainability in animal husbandry which plays a vital role in sustainable rural development in India. The cattles provide marketable products that can be produced by small-scale, household production systems and are generally of higher value and less vulnerable to critical harvest timing than many of the agricultural crops. As an agricultural product with relatively high income elasticity, livestock are particularly attractive as a means for rural households to participate in urban-based economic growth. Livestock are also productive assets, which contribute directly to farm output through animal traction and indirectly as a store of wealth for future investment. Finally, they can contribute to soil fertility and recycling of agricultural waste. Many livestock holders can benefit directly from the increasing market demand for livestock products. Furthermore, the poor can also benefit from the fact that livestock development creates demand for labour, supports economic linkages with the feed and processing industries, sustains trade balances, encourages food security through stronger supply and can lead to lower prices for food of animal origin.

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## Swachh Shakti 2018 celebrated on International Women's Day

The Ministry of Drinking Water and Sanitation, in association with the Government of Uttar Pradesh, organized a Women's Convention called Swachh Shakti 2018 on the occasion of International Women's Day, at Lucknow. 8000 women sarpanches, 3000 women Swachhagrahis and women champions from other walks of life from across the country were recognised for their outstanding contribution towards making a Swachh Bharat.

The Minister of Drinking Water and Sanitation, Sushri Uma Bharti, Chief Minister of Uttar Pradesh, Yogi Adityanath, along with other Ministers and dignitaries addressed and honoured women champions. Speaking on the occasion, the Chief Minister, Uttar Pradesh, Yogi Adityanath said that he was confident that the Swachh Shakti of women Swachhagrahis present on the occasion would help take the women empowerment movement forward. He spoke about the power of access to safe sanitation and drinking water to change the lives of women, and also improving the quality of life of rural women, such as, employment generation for rural women, Beti Bachao Beti Padhao and Ujjwala.

The Union Minister of Drinking Water and Sanitation, Sushri Uma Bharti, spoke about the power of women in bringing about change at home as well as in society. She complimented the commitment made by the Uttar Pradesh government to make the State Open Defecation Free (ODF) by October 2018. She said that, in addition to a toilet, it is every woman and adolescent girl's right to have access to a wide choice of products for Menstrual Hygiene Management (MHM).

Last year, 6000 women sarpanches from across the country had assembled in Gujarat on the occasion of International Women's Day under the banner of Swachh Shakti 2017. This year, Uttar Pradesh hosted Swachh Shakti 2018 being the largest State with a massive rural populace. The event included a special exhibition, launch of a film celebrating Swachh Shakti and flagging off of 30 Swachhata Rathes that will travel across the State, spreading the message of sanitation at the grassroots.



Union Minister for Drinking Water and Sanitation Sushri Uma Bharati and Chief Minister of Uttar Pradesh felicitating women for their contribution for Swachh Bharat, on International Womens Day in Lucknow, Uttar Pradesh.

# INTEGRATED DEVELOPMENT OF HORTICULTURE

Dr. Harender Raj Gautam

A National Horticulture Mission was launched in 2005-06 as a Centrally Sponsored Scheme to promote holistic growth of the horticulture sector through an area based regionally differentiated strategies. It is during this period that three flagship schemes namely, National Horticulture Mission, Horticulture Mission for NE and Hilly Areas and Rashtriya Krishi Vikas Yojana having impact on horticulture development were implemented simultaneously.

**H**orticulture has emerged as the vital component of Indian agriculture in the last two decades with spectacular performance in terms of area expansion, production and productivity. Horticulture contributes 30 per cent to GDP of agriculture from nearly 13 per cent of the total cropped area and support nearly 20 per cent of the agricultural labour force. India is the second largest producer of fruits and vegetables in the world after China with contribution of 11.84 and 13.36 per cent in the total world production of fruits and vegetables respectively. In 2016-17, production of horticulture crops comprising of fruits, vegetables and spices touched a record high of 300 million tonnes, surpassing the production of foodgrains for the fifth year in a row. Trends of horticulture growth are continuously on higher trajectory and India is expected to see a new record of horticulture production in 2017-18. According to the first advance estimate of the Agriculture Ministry for the year, the total production is expected to be 305.4 million tonnes- nearly 5 million tonnes more than the production in 2016-17. Higher production is mainly attributed to increase in productivity as sown area under the horticulture crops has increased only marginally over the years. Farmers continue to have inclination in horticulture production due to higher returns. The total sown area had increased from 24.50 million hectares in 2015-16 to 24.85 million hectares in 2016-17 and further to 24.92 million hectares in current crop year (July-June). Simultaneously, the productivity level of the

horticultural crops has also increased by 3.45 per cent in 2016-17 in comparison to the year 2015-16.

## Strengths of Horticulture Sector

The area under fruit crops during 2015-16 was 6.4 million ha with a total production of 91.4 million metric tonnes (MT). During the period, production of fruits increased by about 39 per cent while the area increased by about 7 per cent. Over the last decade, the area under horticulture grew by about 3 per cent per annum and annual production increased by 5.4 per cent. India has retained its status as the second largest producer of fruits in the world. The country is first in the production of fruits like mango, banana, sapota, pomegranate and aonla. India continued to be second largest producer of vegetables after China. India is a leader in production of vegetables like peas and okra Interventions for better production technologies in horticulture in the country, have led to an increase in per capita availability of fruits from 133 gm/person/ day in





2004-05 to 200.6 g/person/day in 2016-17. Similarly, per capita availability of vegetables has increased from 264 g/ person/day in 2004-05 to 355 g/person/day in 2015-16. Vegetables are important crops in horticulture sector, occupying an area of 9.6 million ha during 2015-16 with a total production of 166.6 million MT with average productivity of 17.4 tonnes/ha. In fact, vegetables constitute about 59 per cent of horticulture production. Spices are important component of horticulture and India is the largest producer, consumer and exporter of spices and spice products. Total production of spices during 2015-16 was 6.4 million MT from an area of 3.26 million MT. In monetary terms, Total value of output of horticultural crops is Rs. 370500 crores.

### Recent Policy Initiatives

The budget for 2018-19 clearly reflects the commitment of the government towards agriculture and farmers welfare as well as the Government's resolve to double farmers income by 2022. The budgetary allocation of Agriculture and Farmers Welfare Ministry was Rs. 51,576 crore for the year 2017-18 which has been increased to Rs. 58,080 crore for this year. Central Government has taken major initiatives in 10<sup>th</sup> and 11<sup>th</sup> Five Year Plans for accelerating the growth of horticulture in the country. A National Horticulture Mission was launched in 2005-06 as a Centrally Sponsored Scheme to promote holistic growth of the horticulture sector through an area based regionally differentiated strategies. It is during this period that three flagship schemes namely, National Horticulture Mission, Horticulture Mission for NE and Hilly Areas and Rashtriya Krishi Vikas Yojana having impact on horticulture development were implemented simultaneously. Success of these schemes prompted the Central Government to launch Mission for Integrated Development of Horticulture (MIDH) during XII Plan (w.e.f. 2014-15) for holistic growth of the horticulture sector covering fruits, vegetables, root and tuber crops, mushrooms, spices, flowers, aromatic plants, coconut, cashew, cocoa and bamboo.

### Food Processing and Value Addition:

The budget for 2018-19 proposes to set up state-of-the-art facility in 42 mega food parks which are in different stages of functioning. The announcement assumes significance as the Commerce Ministry is working on a comprehensive policy covering issues



such as logistics to promote export of agricultural commodities like tea, coffee, fruits and vegetables. This scheme has been designed for higher price for farmers from their produce, creation of high quality food processing infrastructure, reduction in food wastage, and creation of an efficient food supply chain, among others. To support this initiative, the funding for Ministry of Food Processing has been doubled from Rs 715 crore in 2017-18 to Rs 1400 crore in 2018-19. Last year, Dairy Processing and Infrastructure Development Fund have been set up under NABARD with a corpus of Rs 8,000 crores over 3 years. The fund was started with a corpus of Rs 2,000 crores. Food processing industry has huge potential of employment generation, keeping in view the availability of variety of horticultural produce in the country. It has been estimated for India that for every Rs.10 million invested in food processing, it creates 18 jobs directly and 64 indirectly in the organized sector and 20 jobs in the unorganised sector across the supply chain. As per the Annual Survey of Industries 2013-14, the food processing industry as compared to other industries in the registered sector has the largest number of factories and engages largest number of employees. For the projected growth in the Food Processing Industry, it is expected that the requirement of human resource would be about 17.8 million in 2022.

### Emphasis on Better Post-harvest Handling and Cold Chain Facilities

In India, there is a need to upgrade cold chain logistics for better post-harvest handling of the horticultural produce. The present capacity of cold storage is estimated at around 32 million tonnes in the country. Ministry of Food Processing Industries has launched 'Pradhan Mantri Kisan Sampada' Yojana for Integrated Cold Chain and Value Addition Infrastructure' for which expression of interest is invited from time to time. The Ministry is providing

financial assistance in the form of grant-in-aid of maximum Rs.10 crore per project for setting up of integrated cold chain and preservation infrastructure facilities without any break from the farm gate to the consumer. The integrated cold chain and preservation infrastructure can be set up by individuals, groups of entrepreneurs, cooperative societies, Self Help Groups, Farmer Producer Organizations, Non Government Organizations, Central/State PSUs, etc. The scheme is primarily private sector driven and proposals under this scheme are invited through Expression of Interest (EOI). So far, 134 Integrated Cold Chain Projects have been sanctioned by the Ministry in the country to reduce the cold chain gap. Of this, 88 Integrated Cold Chain projects have achieved completion and commenced commercial operation, 46 Integrated Cold Chain projects are in various stages of implementation. In addition, National Horticulture Mission (NHM), National Horticulture Board (NHB), and National Cooperative Development Corporation (NCDC) under Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture & Farmers Welfare and Agricultural and Processed Food Products Export Development Authority (APEDA) under Department of Commerce, Ministry of Commerce and Industries, Government of India are also providing assistance for setting up cold storages under their respective schemes. In 2016-17, 4 Mega Food Parks and 29 Cold Chain Projects were operationalized. In addition, Central Government has also approved setting up of 100 cold chain projects and 250 units under the scheme of creation/expansion of food processing and preservation. The projects set up under the Schemes of this Ministry are granted financial assistance at a higher rate in difficult areas and North East Region as compared to general areas.

### **Better Pricing of Crop Harvest:**

Marketing system also need strengthening and modernization in realizing better prices for the crop produce for the farmers. Last year, the coverage of National Agricultural Market (e-NAM) was expanded from the current 250 markets to 585 APMCs. This year, Rs. 2,000-crore fund has been provided for the development of agri-markets. This initiative will help upgrading agricultural marketing infrastructure in the 22,000 Grameen Agricultural Markets (GrAMs) and 585 APMCs. To have a crop specific approach, 'Operation Greens' has been launched for some important vegetable crops like tomato, potato and

onion with an allocation of Rs. 500 crore. In another significant move, Central Government shall support organized cultivation and associated industry with allocation of Rs 200 crore for this purpose. Government will extend a favourable taxation treatment to Farmer Producers Organisations (FPOs) for helping farmers aggregate their needs of inputs, farm services, processing and sale operations. Provisions for the institutional credit for agriculture sector has also been increased from Rs 10 lakh crore in 2017-18, to Rs 11 lakh crore for the year 2018-19.

### **Strengthening of Irrigation Potential:**

According to a recent concept paper of NITI Aayog, out of 160 million hectares of cultivable land in India, only about 65 million hectares or 41 per cent is covered under irrigation. Further, just 8.6 million hectares are currently covered under micro-irrigation compared to a potential 69.5 million hectares. The Central Government continue to invest in irrigation and this year ground water irrigation scheme under Prime Minister Krishi Sinchai Yojna- Har Khet ko Pani will be taken up in 96 deprived irrigation districts where less than 30 per cent of the land holdings gets assured irrigation presently, with budget provision of Rs. 2600 crores.

### **Development of Technology-based Precise Crop Production Packages**

There is need to make use of Space Technology in making a weather-based and soil-characteristics based profile of the cultivable land in different parts of the country. The Agriculture Ministry is working on a project called CHAMAN (Coordinated Horticulture Assessment and Management using geo-informatics) which is making use of satellites and remote sensing technology. CHAMAN project will help in accurate forecasting of area and production of seven major crops in about 185 districts across India. The study will be taken up in Eight States namely, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Gujarat, Madhya Pradesh, Haryana and Himachal Pradesh. Under the project, the ministry will use remote sensing and geo-informatics data to integrate information on weather, soil, land-use, and crop mapping to prepare horticulture development plans.. The project is being implemented by the Delhi-based Mahalanobis National Crop Forecast Centre and is likely to be completed by March. The idea is to use space technology to identify crops



suitable to different areas and raise production of horticulture crops.

### High-tech Crop Production Demonstrations

The Central Government has taken initiatives to establish centres of excellence for different horticultural crops for motivating the farmers and adoption of modern technologies of horticultural production. So far, 20 centres of excellence are functioning in different states and five more are ready to start. Among these centres, for vegetables it is in Karnal (Haryana); for mangoes in Dapoli (Maharashtra); for citrus fruits in Nagpur (Maharashtra), both in Maharashtra and one for pomegranates in Bassi (Rajasthan). Some State Governments have also taken such noble initiatives to boost the horticulture production.

### Priority Issues for the Future

**Quality Planting Material:** Availability of quality planting material is the basic need for expansion of truthful horticulture industry. However, unorganized sector is the source of more than 60 per cent planting material. Further, most of the nurseries in production of horticulture planting material are engaged in ornamental plant production and are concentrated in the vicinity of towns and cities. As per the star-rating programme of the National Horticulture Board (NHB), of the 689 nurseries rated none was 5-star rated and only 25 were 4-star rated.

**High Density Planting (HDP):** High density planting accompanied with assured irrigation and higher application of essential nutrients can be an important technological intervention for increasing the productivity in important fruit crops. HDP increases the plant population per unit area which result in higher yield of fruit crops. HDP technology

has been successfully tried in banana, apple, papaya, mango, guava and citrus with development of their package and practices. In Himachal Pradesh, a World Bank aided project of Rs. 1134 crore is in operation where HDP in approximately 18000 ha area is one of the important component for productivity enhancement in apple. In J & K also, the Government has launched HDP scheme in apple with 50 per cent subsidy to the farmers. In **2017, more than one lac plants were planted in 110 orchards in J & K which were imported from Italy and Netherlands.**

**High-tech Protected Cultivation:** Protected cultivation is high-tech cultivation which result in 5 to 12 times higher output than cultivation in the open field. Greenhouse crop production is spread over in an estimated 405,000 ha of greenhouses in more than 55 countries in the world on a commercial scale and it is continuously growing at a fast rate internationally. In India, protected cultivation under polyhouses is done in approximately 25, 000 hectares which is negligible in comparison to some of the leading countries in the field of protected cultivation. Spain is the leader in the protected cultivation with 60,000 ha area under polyhouses and greenhouses. Other leading countries in protected cultivation are The Netherlands with 34, 000 ha, China is having more than 24, 000 ha and Israel is also having more than 20, 000 ha area under protected cultivation. Our yield potential is still lower in comparison to world leaders in protected cultivation. In Haryana, National Horticulture Mission (NHM) has joined hands with Israel to rope in farmers in protected cultivation in vegetable farming. Under this programme, Indo-Israel Centre for Excellence in Vegetables has been established at Gharaunda near Karnal and the project is spread over 15 acre and doing a business of Rs 55 lakh per annum. On an average, setting up a green house or poly house on one acre of land requires around Rs 40 lakh (Rs 900 per sq m) and in one year it gives a minimum return of around Rs 60 lakh.

**Strengthening of Logistics for Better Post-harvest Handling of Crop Harvest:** Presently, we lack in adequate and proper infrastructure for handling and transport of the horticultural produce. Such facilities are essential to increase our exports to the other countries. As majority of horticultural produce is perishable in nature, there is need for setting up of international air cargo services and cold storage facilities at all the major airports. As Bengaluru Airport has already been equipped with

such facilities, it has resulted in the boosting of the floriculture sector in and around Bengaluru.

**Need to Streamline Marketing of Crop Harvest:**

Our system of marketing also needs major technology and capital intervention to modernize and unify the marketing network in different parts of the country. Such interventions will help to raise the income of the farmers, reduce the post-harvest losses in the crops and will also help in moderating the prices of the different commodities. Marketing system can be unified through online agri-trade in which Karnataka has done exemplary work. The state has integrated 55 mandis with trade to the tune of Rs 8,500 crore. The Centre's proposed Online National Agriculture Market (NAM) will adopt many of the best practices from this model but also look at similar reform initiatives in other states to incorporate the same into its design.

**Infusion of Recent Scientific Advances in Crop Production Technologies:** Considerable advances have been made in the developed nations with respect to new types of sensor technologies, decision-support tools, and automated irrigation control technologies. These techniques have significantly improved the efficiency and reliability of the technologies and decreased purchase and operating costs. Use of wireless sensor based irrigation network (WSIN) has potential benefits in terms of reduced use of water and decreased CO<sub>2</sub> emissions. But more importantly, it will help in reducing application rate of nutrients considerably (up to 40%) and also the runoff rates of applied nutrients (up to 40%).

**Need to Modernize Technology Transfer Tools:**

Technology transfer in agriculture should focus on key interventions at different stages of the crop starting from land preparation to sowing of the seed, availability of the quality planting material, crop protection, harvesting, post-harvest management and marketing. A comprehensive Kisan knowledge Management Systems (KKMS) should be developed to provide and disseminate information related to the modern technologies, modern farm implements, best agricultural practices and post-harvest management practices, including market information. Farmers need crucial information related to weather data and agro-climatic conditions, prices of agriculture produce at regular basis for correct decision making about the farm operations. There are various interventions like Village Knowledge Centres, Farm Schools, Farmer's Clubs, Kisan Call Centres, Radio and Television, Mobile Phones, Internet and dedicated television

Kisan Channel of Doordarshan which are making a good impact and their delivery system should be made more effective and target oriented. Community Radio Stations should be established in Agriculture Universities and institutes for the dedicated services of technology dissemination. Gram Panchayats should be developed as the knowledge centres with broadband internet connectivity and facilities of video conferencing with technology generators and disseminators.

**Need for Integrated Disease and Pest Management Strategies:**

There is a need for more emphasis on Integrated Pest Management (IPM) to manage the target pests effectively with reduced synthetic pesticides and development of new non-chemical, eco-friendly approaches such as botanicals, bio-control agents and semio-chemicals. Further, bio-intensive IPM and IDM strategies should be developed in order to reduce the development of resistance to pesticides and mitigate pesticide residue problems in horticultural produce. Such efforts will help in reducing the cost of production, increase the nutritional quality of the harvest and also have a positive impact on the exports of horticultural produce.

**Strategies to Mitigate Climate Change:** The seasonal temperature changes could cause shifts in agro-ecological regions and emergence of completely new areas suitable for various horticultural crops. Thus, climate change will significantly influence productivity, production and quality of horticultural crops. In temperate and sub-tropical crops, there will be area shift in cultivation which is visible in Himachal as apple cultivation is shifting to higher elevations. Such changes will necessitate the change of crops in different areas, varietal changes and changes in crop production technologies.

Horticultural crops are giving more output per unit of land in terms of production and income. This is an important factor for making farming viable and attractive. Budgetary support and infusion of new technologies in the production of horticultural crops can give a phenomenal boost to the agriculture economy. Thus, horticulture can act as catalyst in achieving the target of doubling the income of the farmers by 2022.

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# INDIA 2018



A Comprehensive Digest for  
Government of India's  
policies, programmes and  
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## FLORICULTURE INITIATIVES IN INDIA

Dr. K. Baby

India is the world's 2nd largest consumer base and fastest growing retail destination for Flower, Plant and Green Industry. With over 300 million population of middle and higher income group against over 1.2 billion population. The increasing per capita income is pushing people to lead a lavish life. Flower decoration in houses is gaining momentum with the changing life style of the people in India. Thus flower consumption is growing at a whopping speed. Numerous festivals have added to the demands of flowers and have made India a floral super power of the future. A huge domestic market supports and high quality import & export oriented floriculture industry is providing a unique competitive edge to all the stakeholders. India, China, Bangladesh, Sri Lanka and Pakistan along with other countries of the region make South Asia, the world's largest market and India is emerging as world's fastest growing flower and gardening market.

**F**loriculture or flower farming is the study of growing and marketing flowers and foliage plants. Floriculture includes cultivation of flowering and ornamental plants for direct sale or for use as raw materials in cosmetic and perfume industry and in the pharmaceutical sector. It also includes production of planting materials through seeds, cuttings, budding and grafting. In simpler terms floriculture can be defined as the art and knowledge of growing flowers to perfection. The persons associated with this field are called floriculturists. Worldwide more than 140 countries are involved in commercial Floriculture. The leading flower producing country in the world is Netherlands and Germany is the biggest importer of flowers. Countries involved in the import of flowers are Netherlands, Germany, France, Italy and Japan while those involved in export are Colombia, Israel, Spain and Kenya. USA and Japan continue to be the highest consumers.

### Floriculture in India:

Floriculture is an age old farming activity in India having immense potential for generating gainful self-employment among small and marginal farmers. In the recent years it has emerged as



a profitable agri-business in India and worldwide as improved standards of living and growing consciousness among the citizens across the globe to live in environment friendly atmosphere has led to an increase in the demand of floriculture products in the developed as well as in the developing countries worldwide. The production and trade of floriculture has increased consistently over the last 10 years. In India, Floriculture industry comprises flower trade, production of nursery plants and potted plants, seed and bulb production, micro propagation and extraction of essential oils. Though the annual domestic demand for the flowers is growing at a rate of over 25% and international demand at around Rs 90,000 crore India's share in international market of flowers is negligible.

Government of India has identified floriculture as a sunrise industry and accorded it 100% export oriented status. Owing to steady increase in demand of flower floriculture has become one of the important Commercial trades in Agriculture. Hence commercial floriculture has emerged as hi-tech activity-taking place under controlled climatic conditions inside greenhouse. Floriculture in

India is being viewed as a high growth Industry. Commercial floriculture is becoming important from the export angle. The liberalization of industrial and trade policies paved the way for development of export-oriented production of cut flowers. The new seed policy had already made it feasible to import planting material of international varieties. It has been found that commercial floriculture has higher potential per unit area than most of the field crops and is therefore a lucrative business. Indian floriculture industry has been shifting from traditional flowers to cut flowers for export purposes. The liberalized economy has given an impetus to the Indian entrepreneurs for establishing export oriented floriculture units under controlled climatic conditions. Agricultural and Processed Food Products Export Development Authority (APEDA), is responsible for export promotion and development of floriculture in India.

### Economics of Floriculture:

Floriculture is an age old farming activity in India having immense potential for generating gainful self-employment among small and marginal farmers. In the recent years it has emerged as a profitable agri-business in India and worldwide as improved standards of living and growing consciousness among the citizens across the globe to live in environment friendly atmosphere has led to an increase in the demand of floriculture products in the developed as well as in the developing countries worldwide. The production and trade of floriculture has increased consistently over the last 10 years. In India, Floriculture industry comprises flower trade, production of nursery plants and potted plants, seed and bulb production, micro propagation and extraction of essential oils. Though the annual domestic demand for the flowers is growing at a rate

of over 25% and international demand at around Rs 90,000 crore India's share in international market of flowers is negligible. However, India is having a better scope in the future as there is a shift in trend towards tropical flowers and this can be gainfully exploited by country like India with high amount of diversity in indigenous flora. After liberalization the Government of India identified floriculture as a sunrise industry and accorded it 100 percent export oriented status. The liberalization of industrial and trade policies paved the way for the development of export oriented production of cut flowers. The new seed policy has already made it feasible to import planting material of international varieties.

### Economic Importance of Flower Production:

- Perfume industries can be established in the country which can help improving national economy.
- Flowers can be a source of earning huge foreign currency by exporting them.
- Flowers can be considered as a commercial commodity. Commercial flower production may be helpful in increased earning of the grower.
- Establishment of flower production farms and perfume industries can help solving unemployment problem to a large extent.
- It provides scope to bring more unused land under flower cultivation.

### Flower Export Marketing Scenario:

- On the export front the floriculture industry has seen a steady 20% annual growth
- The country has exported 22,086.10 MT of floriculture products to the world for the worth of Rs. 548.74 cores/ 82.05 USD Millions in 2016-17

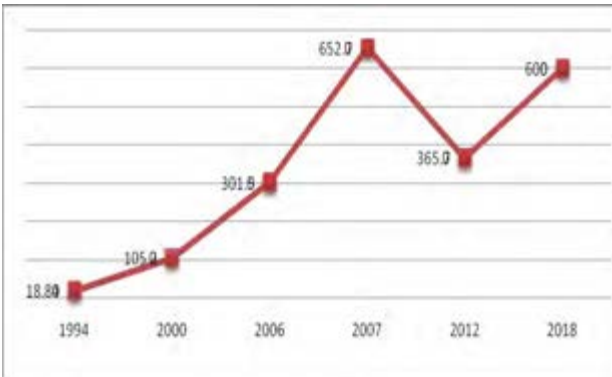
### Agri -Export Zone (AEZ) of India

Sl. No	State	Districts / Area
1	Karnataka	Bangalore (Urban), Bangalore (Rural), Kolar, Tumkur, Kodagu and Belgaum
2	Uttarakhand	Dehradun, Pantnagar, Udham Singh Nagar, Nainital and Uttarkashi
3	Maharashtra	Nasik, Sangli, Sholapur, Satara, Ahmednagar
4	Tamil Nadu	Dharmapuri

(Source: National Horticulture Board (NHB))

- The domestic flower trade has seen a huge upswing, both in terms of volume, over the past decade
- Cultural and seasonal factors have turned floriculture in to one of the vital commercial trades in agriculture
- About 248.51 thousand hectares area was under Cultivation in floriculture in 2016-17. Production of flowers are estimated to be 1,658 thousand tones loose flowers and 472 thousand tones cut flowers in 2016-17
- The country has exported 22000 metric tons of floriculture products worth of Rs. 547.71 crore in 2016-17 and 600 crore in 2018

**India's Flori Export 1994-2018**  
(Figures in Crores of Rupees)



(Source: AEDA 2018)

- Major export destination are the US, Germany, the UK, Netherlands, and the United Arab Emirates
- Maharashtra, Karnataka, Andhra Pradesh, Haryana, Tamil Nadu, Rajasthan, West Bengal have emerged as major floriculture centers.

### Import Status:

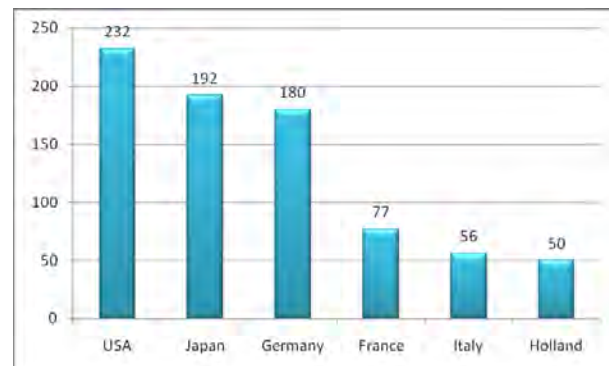
World trade on floriculture produces like cut flowers, ornamental plants, flowering plants, flower seeds and plantlets gaining tremendous momentum. Many countries, particularly the developed ones, are importing flowers to meet their internal demand. It will be worthwhile to mention that the annual import figures of some of the largest importers on flowers – USA ( 232 Crores US dollar) Japan ( 192 Crores US \$ ), Germany ( 180 Crores US \$) France (77 Crores Us Dollar), Italy (55.6 Crores US Dollar), Holland (50 Crores US Dollar).

The other importers like Switzerland, Sweden, Denmark, Belgium, Middle-east countries etc. also import a sizable amount of cut flowers. In recent past, Israel has come up as the biggest grower of flowers, using modern agro-techniques like glass-house culture, drip irrigation, liquid pesticides & fertilisers application along with drip irrigation channels, Tissue Culture. It may be mentioned that the roses of Israel adjudged to be the best in the World. Via-a-vis such a huge market potential of floriculture produce, India's contribution is not at all encouraging as its flower export amount to 30 lakh US dollar only, hence India has to do a lot to exploit this agro-business.

### Flower Cultivation:

Among states, Karnataka is the leader in floriculture with about 29,700 hectares under floriculture cultivation. Other major flower growing states are Tamil Nadu and Andhra Pradesh in the South, West Bengal in the East, Maharashtra in the West and Rajasthan, Delhi and Haryana in the North. The expert committee set up by Govt. of India for promotion of export oriented floriculture units has identified Bangalore, Pune, New Delhi and Hyderabad as the major areas suitable for such activity especially for cut flowers. Of the four zones identified as potential centers for flower production namely Bangalore, Hyderabad, Pune and New Delhi, the area around Bangalore and Pune have got the advantage of ideal climatic conditions where the temperature ranges between 15 to 30°C. In view of this, the units established in these locations do not require either cooling or heating system. As a result maximum number of units has been established in these locations. There are more than 300 export oriented units in India. APEDA (Agricultural and Processed Food Products Export Development Authority) is the registering authority for such units.

**Largest Flowers Importers**  
( figures in crore US \$)





## Marketing:

In India, marketing of cut flowers is much unorganized. In most of the Indian cities, flowers are brought to wholesale markets, which mostly operate in open yards. From here the flowers are distributed to the local retail outlets which more often than not operate in the open on-road sides, with different flowers arranged in large buckets. In the metropolitan cities, however, there are some good florist show rooms, where flowers are kept under controlled temperature conditions, with considerable attention to value added service. The government is now investing in setting up of auction platforms, as well as organized florist shops with better storage facilities to prolong shelf life. The packaging and transportation of flowers from the farms to the retail markets at present is very unscientific. The flowers, depending on the kind, are packed in gunny bags, bamboo baskets, simple cartons or just wrapped in old newspapers and transported to markets by road, rail or by air. However, the government has provided some assistance for buying refrigerated cargos and built up a large number of export oriented units with excellent facilities of pre-cooling chambers, cold stores and reefer vans.

## Export Constraints:

In spite of an abundant and varied production base, India's export of floricultural product is not encouraging. The low performance is attributed to many constraints like non-availability of air space in major airlines. The Indian floriculture industry is facing with a number of challenges mainly related to trade environment, infrastructure and marketing issues such as high import tariff, low availability of perishable carriers, higher freight rates and inadequate refrigerated and transport facilities. At the production level the industry is faced with challenges mostly related to availability of basic inputs including quality seeds and planting materials, efficient irrigation system and skilled manpower.

## Government Programmes and Policies:

Department of Agriculture and Cooperation under the Ministry of Agriculture is the nodal organization responsible for development of the floriculture sector. It is responsible for formulation and implementation of national policies and programmes aimed at achieving rapid agricultural growth through optimum utilization of land, water, soil and plant resources of the country. Production of cut flowers for exports is also a thrust area for

support. The Agricultural and Processed Food Products Export Development Authority (APEDA), the nodal organization for promotion of agri exports including flowers, has introduced several schemes for promoting floriculture exports from the country. These relate to development of infrastructure, packaging, market development, subsidy on airfreight for export of cut flowers and tissue-cultured plants, database up-gradation etc. The 100% Export Oriented Units are also given benefits like duty free imports of capital goods. Import duties have also been reduced on cut flowers, flower seeds, tissue-cultured plants, etc. Setting up of walk in type cold storage has been allowed at the International airports for storage of export produce. Several schemes have been initiated by the Government for promotion and development of the floriculture sector including "Integrated Development of Commercial Floriculture" which aims at improvement in production and productivity of traditional as well as cut flowers through availability of quality planting material, production of off season and quality flowers through protected cultivation, improvement in post harvest handling of flowers and training persons for a scientific floriculture. Many state governments have set up separate departments for promotion of floriculture in their respective states.

## Conclusion:

Floriculture has emerged as an important agribusiness, providing employment opportunities and entrepreneurship in both urban and rural areas. National Horticulture Board helps one to establish a flower business. Agricultural and Processed Food Products Export Development Authority helps entrepreneurs with cold storage facilities and freight subsidies. It has been found that Commercial Floriculture has higher potential per unit area than most of the field crops and therefore a lucrative business. During the last decade there has been a thrust on export of cut flowers. The export surplus has found its way into the local market influencing people in cities to purchase and use flowers in their daily lives. Floriculture thus, offers a great opportunity to farmers in terms of income generation and empowerment. Small and marginal farmers may also use every inch of their land for raising the flower and foliage crops. Floriculture also offers careers in production, marketing, export and research.

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## SUCCESS STORY

# RYTHUNESTHAM FOUNDATION: HARBINGER OF INNOVATIVE AGRICULTURAL PRACTICES

N. Chandrasekhara Rao

The activities of RythuNestham Foundation have to be viewed as a part of a trend of emerging private initiatives in various parts of the country in the challenging area of agricultural extension. The innovative efforts of this Foundation and the robust response from the farming community in transferring technologies, good agricultural practices including organic agriculture, and new directions like urban agriculture indicate the way forward for the country's agriculture in general and for driving up farmers' income in particular.

### Emerging Private Initiatives in Technology Transfer:

Theoretical perspectives on investments in development of country's agriculture by eminent scholars hypothesise that the uncertain and unremunerative nature of this agriculture deter investments and private enterprise. Developmental plans in India had been based on this broad assumption in regard to agriculture. Massive poverty with stagnant agriculture for over two centuries riddled with humongous illiteracy constituted two big conundrums of development at that time. The policy makers were left with no option of relying on private initiative to achieve the goals of agricultural development and poverty reduction. Consequently, building institutional infrastructure for public research on technologies had to go hand in hand with dissemination efforts involving public extension services through state agricultural departments and universities. This strategy was largely successful in circumventing intractable food shortages, galloping prices and the spectre of ship-to-mouth existence and attendant adverse consequences.

This scenario has been changing for better since the early Nineties after four decades of Independence. Consistent rise in incomes and demand for agricultural products catalysed private investments and initiatives initially in irrigation followed by food processing industries and lately in agricultural extension. Agricultural extension is by far the most challenging service for country's agriculture with 86 per cent of the farmers being small and resource poor. The models of western

countries where farmers pay for technical advices, though floated in the initial days of reforms, could not be replicated and failed to take off. Therefore, non-profit organisations and individuals have a role to play in this regard and country has been witnessing several initiatives across the states in different forms. A case in point is the altruistic services being rendered by *RythuNestham* Foundation (<http://www.ritunestham.in>) in the Telugu speaking states of Telangana and Andhra Pradesh.

### *Rythu Nestham* Foundation:

This Foundation has been run by the son-of-the soil Y. Venkateswara Rao as a non-profit entity and multiple activities without any grants. At the core of this Foundation's activities is the publication of three monthly magazines entitled *RythuNestham*, *PasuNestham* and *PrakrutiNestham* for crop agriculture, animal husbandry and organic farming, respectively. The crop agriculture journal was started in 2005 followed by others with a gap of few years and have been published without any interruption with senior scientists in managing editor positions, though these are not exactly commercial viable. The Foundation claims to have a combined reach of 35 lakh farming households to these journals. Scientists from agricultural, horticultural and veterinary universities write articles, answer questions, bring out seasonal alerts on pest and diseases as well as advices on crop-mix, seeds, marketing and provide feedback on ground level issues to policy makers. Besides, these three journals have interactive question and answer by eminent scientists for the benefit of farming community. Several books were

published containing issues of immediate relevance to field level problems. Most popular among them were on package of practices for agriculture and horticultural crops, weed control methods, organic farming and livestock protection. Several governmental and quasi-governmental agencies have been cooperating with the Foundation in enlarging the access and spread of these journals and books.

The digital revolution methods have also been leveraged by the Foundation to disseminate information on cutting edge technologies and agronomical methods. It has developed an android app in 2017 to advise farmers on all related activities for organic agriculture including links to marketing of their crop, fruit, flower, livestock, dairy and fishery produce and is claimed to have 10000 registered farmers at the end of 2017. It created a two way interaction with scientists, subject matter specialists and progressive farmers with hands-on experience. It also links producers to the consumers directly reducing reliance on intermediaries. The Foundation has been harnessing YouTube by posting several stories, besides using its own website. All these initiatives have been receiving good response with a combined audience of more than a million.

Apart from publishing and digital methods, the Foundation has been making consistent efforts to espouse the cause of farmers through diffusion of good agricultural practices (GAPs) and organic agriculture by directly reaching out through trainings, seminars, workshops and mobile vans. It established a training centre in one of the villages in Guntur district and organises trainings on organic agriculture in the weekend using the demo farms maintained for the purpose. Several subject matter specialists, government officials and political leaders participate in these trainings to give useful messages to farmers.

**Urban Agriculture:** Rapid strides have been made in urban agriculture in several countries, especially those with severe land scarcity like in China. Moreover, growing health consciousness among the urban population and need to match the supply demand gap between the production and demand for burgeoning population make it desirable to produce as much as possible using urban agriculture methods. The most crucial of the urban agriculture is the roof top gardening.

Few start-ups entered this segment for generating their business profits as well as for sustainable urban agriculture. Examples include The *Living Greens* from Jaipur, *iKheti* from Mumbai, *Khetify* and *Edible Routes* from Delhi, *Homecrop* from Hyderabad and *Greentechlife* and *SquarefootFarmers* from Hyderabad. While there are plenty of hobbyists, and family-and-friends farmers, neither the governments nor non-profit organisations have recognised the potential, need and are not working on it. *RythuNestham* Foundation, to its credit, has been making efforts to spread awareness and helping interested urban dwellers by organising workshops and training programmes on roof top gardening, nursery maintenance and homestead gardens in the cities of Hyderabad, Vijayawada, Guntur and Visakhapatnam. Going by the big numbers of people attending these events, the response can be termed as overwhelming and more than expected, indicating the changing times. The efforts of this Foundation might be a harbinger of times to come and for the needed changes in the direction of efforts in feeding the urban ecosystem for fruits, vegetables and other niche products.

The activities of *RythuNestham* Foundation have to be viewed as a part of a trend of emerging private initiatives in various parts of the country in the challenging area of agricultural extension. The innovative efforts of this Foundation and the robust response from the farming community in transferring technologies, good agricultural practices including organic agriculture, and new directions like urban agriculture indicate the way forward for the country's agriculture in general and for driving up farmers' income in particular. These initiatives and individuals have to understand the welfare needs of masses and adopt a practical approach to agriculture diffusing good agricultural practices tailor-made to agro-ecological zones. Their efforts will achieve better results when they work in tandem with governmental and quasi-governmental agencies on addressing key challenges of the times. On the other hand, policy makers might do well to recognise successful private initiatives and internalise their efforts in broader developmental efforts by mainstreaming their activities.

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# VACCINES: A CRUCIAL PILLAR OF PUBLIC HEALTH

Dr. Manisha Verma

Till now, more than 2.5 crore children and 68.7 lakh pregnant have been covered in 528 districts. The first two phases of Mission Indradhanush have led to an increase of 6.7% in full immunization coverage per year as compared to 1% increase/year in the past. In October 2017, the Prime Minister launched Intensified Mission Indradhanush with a sharper focus on districts and urban slums with the slowest progress. A total of 190 high-focus districts and urban areas across 24 states have been selected for intensified efforts. The aim is to achieve 90% immunisation by December 2018.

Immunisation seems to have taken centre-stage as a crucial pillar of public health and as a development promoting agenda. Several countries are positioning immunisation as an important component of Sustainable Development Goals 2030. Hashtags such as #VaccinesWork on popular social media platforms are stoking the debate surrounding vaccines-are they needed? How many are needed? Are there any side effects?

The importance of vaccines in India cannot be overemphasised. But the story of India is one of diversity and complexity. With the second largest population, around 2.7 crore children are born every year. India also has the largest burden of under-five mortality, more than what prevails in some of the poorest countries in the world. The Under-Five Mortality Rate in India is 43/1000 live births (Sample Registration System(SRS) 2015), while the Infant Mortality Rate is 34/1000 live births (SRS 2016) and Neonatal Mortality Rate is 25/1000 live births (SRS 2015). This translates into an estimated 10.8 lakh under-5 child deaths annually. Vaccine-preventable diseases such as pneumonia (15%) and diarrhoea (12%) are the leading under-five childhood killers. One child loses his/her life to pneumonia and diarrhoea every two minutes. Approximately one lakh children die due to rotavirus induced diarrhoea alone.

Immunisation is widely accepted as the most cost-effective public health intervention that is capable of yielding manifold returns. While a large percentage of under-five mortality in India can be

averted through vaccination, it has other benefits too. According to a study published in Lancet in 2014, investing in health and increasing health expenditure by just \$5 per person per year up to 2035 in 74 high-burden countries could yield up to nine times that value in economic and social benefits. These returns include greater growth in gross domestic product (GDP) through improved productivity and prevention of the needless deaths and disease.

India however faces three prominent challenges. Firstly, at 62% (as per the National Family Health Survey-4 (NFHS-4) in 2016-17), the full immunisation coverage is considered a low level. There was a limited basket of vaccines. Also, there have been issues regarding the quality and logistics of vaccine management for such a vast country.

Recognising the potential of vaccines, the government has taken multiple steps to boost the scope and span of immunisation. The Universal



Immunisation Programme (UIP), launched in 1985, is one of the largest immunisation programs of the world in terms of the geographical spread and diversity of areas covered, quantities of vaccine used and immunisation sessions, and the beneficiaries. Under this programme, about 27 lakh children are immunised every year against 12 deadly diseases, more children than any other similar programme in the world. More than 90 lakh immunization sessions are conducted annually. This has also been acknowledged to be largely responsible for reduction of vaccine preventable under-5 mortality rate.

Figures narrate that the full immunisation coverage (FIC) expanded very slowly at 4% between 2009 and 2013. This means, every year it grew at merely 1%. For the country to reach coverage of 90%, it would take another 25 years. To hasten the rate to at least 90% coverage till 2020, the Health Ministry launched Mission Indradhanush (after the seven colours of the rainbow, termed as Indradhanush in Hindi) in 2014, where seven vaccines (diphtheria, whooping cough, tetanus, polio, tuberculosis, measles and hepatitis B, meningitis and pneumonia due to Haemophilus influenzae type B; Japanese Encephalitis is also being provided in selected endemic districts of the country) would be given to all those children and pregnant women who have missed out or left out under the routine immunisation rounds, covering all remote, far flung and difficult to reach areas. It targets those areas where the number of unvaccinated and partially vaccinated children is the highest. These include populations living in areas such as urban slums, nomadic sites, brick kilns, construction site, migrant settlements such as fisherman villages, riverine areas with shifting populations, underserved and hard to reach populations such as forested and tribal populations, hilly areas, and areas with low Routine Immunisation coverage. Till now, more than 2.5 crore children and 68.7 lakh pregnant have been covered in 528 districts. The first two phases of Mission Indradhanush have led to an increase of 6.7% in full immunization coverage per year as compared to 1% increase/year in the past. In October 2017, the Prime Minister launched Intensified Mission Indradhanush with a sharper focus on districts and urban slums with the slowest progress. A total of 190 high-focus districts and urban areas across 24 states have been selected for intensified efforts. The aim is to achieve 90% immunisation by December 2018.



There has been a concerted effort to expand the basket of vaccines. New vaccines have been added in the past few years. In 2016, Rotavirus vaccine was introduced to combat Rotavirus Diarrhoea which can lead to malnutrition, stunted growth and even death. The vaccine is indigenously developed and is presently introduced for nine states namely Andhra Pradesh, Haryana, Himachal Pradesh, Odisha, Assam, Tripura, Rajasthan, Tamil Nadu & Madhya Pradesh. Till December 2017, more than 1.42 crore doses of Rotavirus vaccine have been administered to children. Further, with a target to free India's children from the highly contagious measles disease by 2018, the Measles-Rubella (MR) vaccine has also been launched this year. The scale-up is happening rapidly, covering five states in the first phase, eight more in the second and across the country over the next couple of years. The aim is to cover around 41 crore children in the age group of 9 months to 15 years. The MR vaccine has been given to more than 7.66 crore children till now. Pneumococcal Vaccine (PCV) has been launched in May 2017 for reducing infant mortality and morbidity caused by pneumococcal pneumonia which is responsible for an estimated annual 5.6 lakh cases and more than one lakh deaths. The vaccine is initially introduced in Himachal Pradesh, select districts of Uttar Pradesh and Bihar. Till January 2018, around

14.37 lakh doses of PCV have been administered to children. As part of the global polio endgame strategy, Inactivated Polio Vaccine (IPV) was introduced in the UIP in Nov 2015 and expanded across the country by June 2016. Till December 2017, around 3.87 crore doses of IPV have been administered to children.

In addition to expanding the scope of immunisation, the quality of vaccines through maintenance of the right temperature all through the logistical chain is just as crucial. It is also vital that program managers have real time information about the available stock of vaccines so that they do not face a stock-out situation. To ensure these, the Ministry of Health and Family Welfare launched an innovative digital platform to monitor the vaccine supply chain in real-time, called the Electronic Vaccine Intelligence Network (eVIN). eVIN makes available complete information on the amount of vaccines received, used, transferred and discarded at every cold chain point, now geo-mapped and coded, and sends alerts to relevant authorities if the stock position for each vaccine is less than the minimum recommended level, or exceeds the maximum level, is completely stocked-out or nearing expiration date. This access to real-time information on vaccine stocks and flows helps officials to make informed decisions, thereby reducing imbalances in vaccine supply management. It now takes just three days on an average to replenish vaccine stocks, down from more than five days in as little as six months from the introduction of eVIN. Frequency of stock outs has reduced by 70 percent. This system also helps track the storage temperature of vaccines, which is critical to their efficacy and potency. By streamlining the vaccine flow network, eVIN is helping to better identify and address the barriers to immunisation in hard-to-reach communities, in turn ensuring equity through easy and timely availability of vaccines to all children. Soon, eVIN will be scaled up to cover 27,000 vaccine storage points across the country.

The efforts are seen to bear fruits. The country was declared free of polio in 2014, and has remained so due to the nation-wide Pulse Polio Immunisation

programme. An extremely high level of vigilance through Acute Flaccid Paralysis (AFP) surveillance across the country for any importation or circulation of poliovirus and Vaccine Derived Polio Virus (VDPV) is being maintained. Another monumental public health achievement has been validation of India for Maternal and Neonatal Tetanus Elimination (MNTE) in April 2015, much earlier than the global date of December 2015. This is another milestone India has crossed in public health. It has been possible through high routine immunization coverage, health systems strengthening, promotion of institutional/clean delivery/clean cord practices and effective surveillance system.

The infant mortality and under-five mortality rates are also declining. Between 2013 and 2015, an estimated 2.7 lakh children were saved, whereas during 2005-2015, death of one million infants was averted. The Infant Mortality Rate has declined from 37 in 2015 to 34 per thousand live births in 2016 and shown 8.1% decline as against 5.1% in the previous period. Whereas, the under-five mortality rate has considerably declined from 126/1000 live births (1990) to 43/1000 (2016). Much of this success can be attributed to the immunisation programme in the country.

Full immunisation of a country with a birth cohort as big as India's, needs complementing finances also. Governments sometimes don't have enough in the face of competing demands. Although as a public policy strategy, investing in the health of children makes sense. Healthy children grow into healthy and productive adults, adding value to the demographic dividend of any nation. The commitment of the government towards this is reflected in the National Health Policy 2017 where 2.5% of the GDP is envisaged for the healthcare sector, in a phased manner.

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#### Corrigendum

In the March 2018 issue of Kurukshetra, the heading of the lead article contributed by Shri Amarjeet Sinha, Secretary, Ministry of Rural Development was misspelt as 'Citiezen Centric Rural Growth'. The same should be read as 'Citizen Centric Rural Growth'. The error is regretted.

Kurukshetra Team

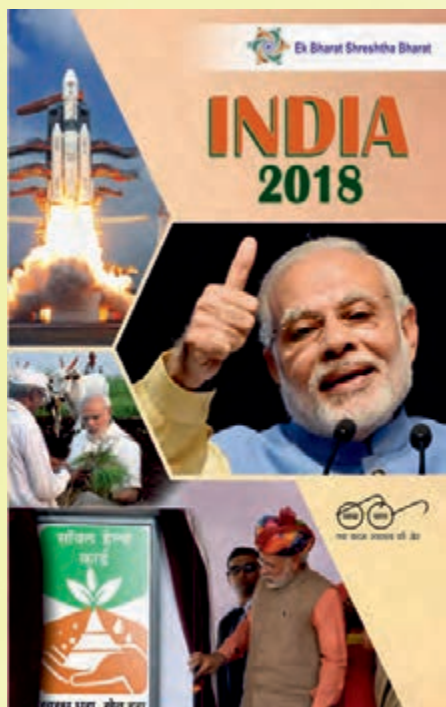
## INDIA 2018 RELEASED

INDIA/BHARAT- 2018, prestigious Reference Annuals published by Publications Division were released by the Honb'le Minister for Information and Broadcasting Smt. Smriti Zubin Irani on February 27, 2018. The e-versions of the flagship publication were also released simultaneously. The informative annual published every year entered it's 62nd year of publication. These publications deal with all aspects of the country's development from



*The Union Minister for Textiles and Information & Broadcasting, Smt. Smriti Zubin Irani releasing Reference Annual book India-2018 and Bharat-2018, published by Publications Division, in New Delhi on February 27, 2018. The Secretary, Ministry of Information and Broadcasting, Shri N.K. Sinha and the Director General, Publications Division, Dr. Sadhana Rout are also seen.*

rural to urban, industry to infrastructure, science and technology to human resource development, art and culture, policy, economy, health, defence, education and mass communication. The Annual also gives a glimpse of the flagship programmes of the Government, important events of the year and the vital statistics of Indian States and Union Territories.



The electronic version of the book is prepared in the most commonly used e-PUB format and can be accessed on a variety of devices such as tablets, computers, e-readers and smartphones. The eBook conforms to the best international standards technically and is the replication of the print version of the book. It has a variety of reader-friendly features for better communication like hyperlinks, highlighting, book marking and interactivity.

Speaking on the occasion, Smt. Smriti Zubin Irani said that the online version of India /Bharat 2018 will help researchers and students who often look for information on internet. It will be a referral book not only for those who study administration but also for researchers and the student community, she added.

The Printed Book (p-book) is priced at ₹ 350 and can be purchased from 8 sales emporia and 3 regional offices of DPD and its authorised agents across the country. It is also available for online sale through Bharatkosh portal which can be accessed

directly as well as through Publications Division's website, [www.publicationsdivision.nic.in](http://www.publicationsdivision.nic.in)

The eBooks priced at ₹ 263 are available on e-Commerce platforms Amazon and Google Play Books.

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