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Boosting Agricultural Productivity

INNOVATIONS AND NEW TECHNOLOGIES NEEDED TO ACCELERATE AGRICULTURE GROWTH

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Dr N.C. Patel

Highlights of the Prime Minister's speech on 69th Independence Day

❖ Jan Bhagidari is the biggest asset of a democracy. Be it my Government, letters from citizens, Mann Ki Baat, communication with people...daily Jan Bhagidari is increasing.



❖ Financial inclusion had received a big boost with the opening of 17 crore bank accounts through the Pradhan Mantri Jan Dhan Yojana. The Rs. 20,000 crore deposited in the Jan Dhan accounts reflected the "richness of India's poor" (गरीबों की अमीरी).

❖ Introduced Shramev Jayate Yojana--an effort to change the way we look at the workers of India. Dignity of labour has to be our national duty, it has to be a part of our nature.

❖ Introduction of "neem-coated urea" has helped to end diversion of subsidized urea to non-agricultural purposes.

❖ Stresses on the need for farmers' welfare, and declared that the Ministry of Agriculture would be renamed as the Ministry of Agriculture and Farmers' Welfare.

❖ Government focusing on raising farm productivity, and providing electricity and irrigation to farmers.

❖ Pradhan Mantri Krishi Sinchai Yojana had been launched with an outlay of Rs. 50,000 crore: PM.

❖ The Prime Minister announced the "Start-Up India" initiative, which would encourage entrepreneurship among the youth of India. Each of the 1.25 lakh bank branches, should encourage at least one Dalit or Adivasi entrepreneur, and at least one woman entrepreneur. We are looking at systems for enabling start-ups. We must be Number 1 in start-ups. 'Start-up India' and 'Stand up India'.

❖ Affirmed commitment to provide electricity to all those villages that do not have electricity. The target of providing electric polls, electric wires and electricity to 18,500 villages would be achieved within next 1000 days.

❖ PAHAL scheme for direct transfer of LPG subsidy has resulted in savings of Rs. 15,000 crore.



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Editorial

Addressing the nation from the Red Fort on the 69th Independence Day, Prime Minister Mr. Narendra Modi said, “We need to increase agricultural productivity. Save water, save energy, save fertilizers should be our motto.”

In this issue of the magazine, academicians and specialists discuss measures to boost agricultural productivity through new techniques and innovations. To target all efforts of the government, with the aim of helping the farmer, the Prime Minister announced in his speech that the Agriculture Ministry will be renamed as ‘Agriculture and Farmers’ Welfare Ministry’.

He emphasized that rural and agricultural development can only be complete when welfare of the farmer is also ensured adding that the government will formulate schemes keeping in view some of the personal problems that are faced by the farmers.

Technology-led approach to boost agricultural productivity is essential. The Green Revolution played a major role in reviving Indian Agriculture, however, India is faced with the challenge of ensuring food and nutritional security. To meet this goal there is need to overcome low productivity. The slow-down in agricultural productivity has become the major cause of concern for low agricultural growth.

Over the years, one of the issues in Indian agriculture is declining profitability of most of the agricultural crops and enterprises which is the main cause of alienation of the people from this crucial sector. Technology-transfer in agriculture should focus on key interventions at different stages of the crop starting from land preparation to sowing of the seed, crop protection, harvesting, post-harvest management and marketing. Technology-transfer needs effective interactive groups at the grass root level in the villages. In this issue, we also have a write up on Bio-pesticides, which are the products derived from biological sources and is emerging as new crop protection strategy.

Technology has a major role to play to improve crop productivity. In this regard, introduction of soil health card has been taken by the government. The card will carry crop wise recommendations of nutrients and fertilizers required for farms, making it possible for farmers to improve productivity by using appropriate inputs. About 14 crore Soil Health Cards are envisaged to be issued over the next 3 years.

The Centre has initiated long term measures to boost agricultural by the use of technology and bio-technology. The other areas of emphasis is modernizing irrigation. To help farm-productivity, the government will spend 50,000 crore Rupees over the next five years under the Pradhan Mantri Krishi Sinchai Yojana (PMKSY). □

INNOVATIONS AND NEW TECHNOLOGIES NEEDED TO ACCELERATE AGRICULTURE GROWTH

Dr. Harender Raj Gautam

Agriculture needs continuous infusion of innovation and technology in ensuring global food security, poverty reduction and environmental sustainability. Socio- Economic and Caste Census (SECC) 2011, released in 2015 also indicates that out of 24.39 crore households in the country, 17.91 crore lived in villages and among these, 10.69 crore were considered as deprived households. Agriculture is still the backbone of rural India as the data of SECC indicates that 31.26 per cent of the total rural households are still broadly identified as poor where the main earner has an insecure and uncertain source of income. Increasing urbanization, globalization and demand for high-value products have dramatically changed the global context for agriculture. Agriculture is critical for those who live below the poverty line, as there is an uncertainty from the harvesting point of view.

According to the World Bank, gross domestic product (GDP) growth originating in agriculture raises the incomes of the poorest households by at least 2.5 times as much as growth in other sectors does. Over the years, one of the issues in Indian agriculture is the declining profitability of most of the agricultural crops and enterprises which is the main

cause of alienation of the people from this crucial sector. There are number of factors responsible for the gloom on the faces of the farming community. The real prices of agricultural commodities are not increasing in tune with the increasing costs of critical inputs such as labour, fertilizers etc. that have been mainly responsible for the declining profitability in agriculture. The next challenge is the shortage of quality seeds to achieve the yield potential in different crops. In India, average national yields of most agricultural commodities are about 40 to 50 per cent of the corresponding world averages. The yield gaps in different crops should be seen as an opportunity for future growth and simultaneously our approach should be consistent with agro-ecological, environmental, socio-economic, political and technological settings in the major production regimes.

On an average, rice and wheat yields will need to be enhanced by about 40 percent and pulses, oilseeds, maize, millets, sorghum and horticultural commodities yields by about 50 to 100 percent. The other challenges are inefficiency in irrigation, lack of mechanization, soil erosion, degradation in soil



health, post-harvest losses in crops, and inefficiency in agricultural marketing system among others. The problem of technology fatigue in agriculture is further compounded due to lack of timely information about market prices, crop varieties, production techniques, seasonal risk and disease control strategies. This highlights the importance of effective application of information and communication technologies (ICTs) in agriculture to mitigate the technology gap.

Efficient Use of Water Resources for Irrigation

Irrigation is the most important element in agricultural process. And judicious use of available water resources is the need of the hour. As per official data, around 46.34 per cent of India's net sown area of around 140.80 million hectares was under irrigation till 2011-12. In crops such as oilseeds, pulses and coarse cereals, only 26 per cent, 16.2 per cent and 14.4 per cent, respectively, is under irrigation out of the total area under cultivation. In food grain such as wheat and rice, it is slightly better and of the total area under cultivation around 48 per cent is irrigated. To achieve the target of total irrigation, a massive fund infusion would be needed. Experts estimate it to be in excess of Rs 50,000 crore. The NDA Government has allocated about Rs 5,300 crore for the programme in the Union Budget 2015-16, while in the previous year Rs 1,000 crore was allocated. The state-run National Bank for Agriculture and Rural Development (Nabard) has set a target of providing Rs 30,000 crore as credit to farmers for irrigation over the next three years. Water use efficiency is presently estimated to be only 38 to 40 per cent for canal irrigation and about 60 per cent for ground water irrigation schemes. It is estimated that with 10 per cent increase in the present level of water use efficiency in irrigation projects, an additional 14 million hectare area can be brought under irrigation from the existing irrigation capacities. Efforts are needed in this direction as it would involve a very moderate investment as compared to the investment that would be required for creating equivalent potential through new schemes. In addition, there is need to revive the traditional water reservoirs. There are about 12, 85,000 tanks with varying sizes in the country with a storage capacity of 50 million cubic meters. The tanks are deteriorating, resulting in poor performance. Restoring these traditional water bodies and promoting water harvesting should receive major developmental support.

“Irrigation efficiency in agriculture can be improved by adoption of modern methods of irrigation to achieve the goal of more crop per drop of water.”

The Central Water Commission (CWC) estimates that the ultimate irrigation potential that can be created through major, medium and minor projects would be about 75.9 million hectare irrigation potential making use of ground water has now been assessed as 64 million hectare. Thus the total irrigation potential from surface and ground water sources would be about 139.9 million hectare. The annual replenishable ground water resource for the entire country is 433 billion cubic metre (bcm). The ground water assessed is the dynamic resource which is replenished each year dominantly with the rainfall received in different parts of the country.

Irrigation efficiency in agriculture can be improved by adoption of modern methods of irrigation to achieve the goal of more crop per drop of water. In our country, the area covered under micro irrigation is about 5 lakh hectares. The states which are leading on the micro-irrigation front are, Maharashtra, followed by Karnataka, Andhra Pradesh and Tamil Nadu. Micro irrigation is very popular in 30 different crops especially in wide spaced horticultural crops. Drip irrigation is an effective tool for conserving water resources and studies have revealed significant water saving ranging between 25 and 50 per cent by drip irrigation compared with surface irrigation, with yield increases as high as 100 per cent in some crops under specific locations. Union Government has approved spending of 500 billion rupees over five years to expand irrigation in rural areas to boost crop productivity. A total of 53 billion rupees has been allocated for the irrigation project in the current fiscal year ending on March 31, 2016.

Horticulture has become a key driver for economic development in many states in the country. It contributes 30.4 per cent to GDP of agriculture



More Emphasis Needed on Horticulture

from nearly 13% of the total cropped area and support nearly 20% of the agricultural labour force. India is the second largest producer of fruits (88.97 million metric tons) and vegetables (162.89 million metric tons) in the world after China during 2013-14. Horticulture production (268.9 million metric tons) surpassed food grain output (257 million metric tons) for the first time in 2012-13 which continued in 2013-14, with horticulture production of 277.4 million metric tons in comparison to foodgrain production of 265 million metric tonnes. During 2014-15, India exported fruits and vegetables worth Rs. 7474.14 crores. One heartening sign is that the percentage share of calorie intake from fruits and vegetables has increased from 6.9 per cent in 2004-05 to 7.0 per cent in 2009-10 in rural areas and 7.2 per cent to 8.0 per cent in urban areas during the corresponding period. Central Government has taken major initiatives in 10th and 11th 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 having impact on horticulture development namely, National Horticulture Mission, Horticulture Mission for NE and Hilly Areas and Rashtriya Krishi Vikas Yojana are being implemented simultaneously.

Protected cultivation is a high-tech cultivation which result in 5 to 12 times higher output than cultivation in the open field. Presently, there is nearly 623, 302 hectares of area under protected cultivation in the world. In India, protected cultivation under polyhouses is approximately 25, 000 hectares which is negligible in comparison to some of the leading countries in the field of protected cultivation. States like Andhra Pradesh, Gujarat, Maharashtra, Haryana, Punjab, Tamil Nadu and West Bengal have consistently expanded the area under protected cultivation. Maharashtra and Gujarat had a cumulative area

of 5,730.23 hectares and 4,720.72 hectares respectively. The major crops grown in the protected cultivation are tomato, capsicum, cucumber, melons, rose, gerbera, carnation and chrysanthemum. Floriculture is one such venture which needs high tech protected environment. On the other hand, there are some crops which can also be grown in the open field conditions. But, floriculture is also technology deficient as the farmers are not able to realize the complete potential of the acreage under floriculture. In India, we have about 232.74 thousand hectares area under cultivation in floriculture in 2012-13. Production of flowers is estimated to be 1.729 million tonnes loose flowers and 76.73 million tonnes cut flowers in during the period. The country has exported 22,947.23 MT of floriculture products to the world for the worth of Rs. 460.75 crores in 2014-15 and our main export destinations were United States, United Kingdom, Germany, Netherland and United Arab Emirates. However 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, 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.

Agro-food processing is very important for creating value addition in our agricultural produce which will help in creating higher value for our agricultural produce and also create enormous job opportunities for the rural youth. The total valuation of the food processing industry is expected to reach US \$ 194 billion by 2015 from a value of US \$ 121 billion in 2012. The net export of processed food is expected to outreach its present value of US \$ 43 billion. This sector directly employs 13 million and 35 million

"Start-up India" and "Stand-up India" will be there for the future of the country. And for a bright future of the country "Stand-up India" and Start-up India shall be launched. There are 1.25 lakh banking units i.e. 1.25 lakh branches of banks in the country. Under the Start-up India programme more schemes will be formulated, but every branch must resolve and in the days to come resolve once again to disburse loans for start-ups to the tribals in the locality where there is any tribal habitation, and where there is no tribal habitation, the branch can provide loans to a Dalit or a tribal, give financial support to them and thus enable 1.25 lakh Dalit entrepreneurs to come up. Let there be tribal entrepreneurs in the tribal settlements of this country. These one lakh twenty five thousand branches should promote start-up of women entrepreneurs and help them financially.

people are indirectly involved. Food processing and value addition are other major grey areas which can create a boom in the employment. Our country has not utilized this huge untapped potential. Food processing can reduce the huge losses of Rs. 55, 000 crores in foodgrains, fruits and vegetables. Value addition can be done in foodgrains, fruits, vegetables, dairy products, meat, poultry, fish and medicinal and aromatic plants. Theoretically, one per cent post-harvest loss reduction of horticulture produce is expected to save Rs 230 crores annually. There are number of diversified ventures in agriculture which are suited to almost every region and economic strata of the population. Food Processing Industry is employment intensive. It has been estimated for India that for every Rs.10 million invested, it creates 18 jobs directly and 64 indirectly in the organized sector and 20 jobs in the unorganised sector across the supply chain. At present food processing sector employs about 13 million people directly and about 35 million people indirectly. 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.

Need to Focus on Soil Health

Soil health is of paramount importance to realize the sustainable potential of productivity of cultivable crops. This can be achieved by efficient use of nutrients in the crops and with the right mix of inorganic and organic sources of nutrition. Generally, NPK consumption ratio of 4:2:1 is considered as desirable based on recommendation of 120:60:30 NPK kg/ha dose (4:2:1) for wheat/rice. There is a wide NPK use ratio in Northern Zone (13.5: 4.3:1),

while it is narrower in Southern Zone (2.9: 1.6: 1). It is 5.6: 3.3: 1 in Western Zone and 5.0: 2.4: 1 in the Eastern Zone. The NPK ratio also shows wide variations from State to State. While impressive strides in agricultural production have been made, consumption of NPK fertilizer has increased 28.10 million tons per year. It is assessed that in the country 10 million tons of plant nutrients are removed by various crops in excess to what is being applied in the form of fertilizers. There are about 12 crore farm holdings in the country, soil analyzing capacity of 4 crore samples is required annually to enable analysis of each holding once in three years. This requires a massive expansion in soil testing programme in all parts of the country. There were 1049 soil testing laboratories in 2010-11 with annual analyzing capacity of 1.07 crore samples. As a result, 0.74 crore soil health cards were issued to farmers during 2010-11. Keeping this in view, a centrally sponsored scheme "National Project on Management of Soil Health and Fertility (NPMSHF)" was launched in 2008-09. In addition, States are availing substantial resources for soil testing programme under the "Rashtriya Krishi Vikas Yojana (RKVY)" and "Macro Management of Agriculture (MMA)". The present Central Government plans to equip 14 crore farmers with the soil health cards in the next three years.

Biotechnology

Use of biotechnological tools in agriculture could make food crops higher yielding and more robust to biotic and abiotic stresses. This could stabilize and increase food supplies, which is important against the background of increasing food demand, climate change, and land and water scarcity. In 2012, 170 million hectares (ha) by more than 17 million farmers in around 12 per cent of the global arable land were planted with genetically modified (GM) crops, such as soyabean, corn, cotton, and canola, but most of these crops were not grown primarily for direct food use. In India, genetically modified cotton- Bt cotton was first commercialized in India in 2002 and in 2012, over 7 million farmers had adopted this technology on 10.8 million ha area which is equivalent to 93 per cent of the country's total cotton area. Bt cotton has certainly increased the profitability of the farmers and simultaneously reduced the use of chemical pesticides in this crop drastically. Studies suggest that the introduction of Bt technology has reduced food insecurity by 15 – 20 per cent among Indian cotton growers. But, the use of genetically modified crops was restricted to cotton only due to concerns



Agro- Food Processing

echoed by various environmentalist groups. But, now the Central Government has allowed the trials of other GM crops also which will give a momentum for adoption of other GM crops.

Need to Streamline Marketing of Agriculture Produce

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 moderate the prices of the different commodities. Our country incurs too much wastage of its farm produce due to inefficient and antiquated marketing practices. Markets in the agricultural products are regulated under the Agriculture Produce Market Committee Act enacted by state governments. There is need to unify the marketing system as different Agriculture Produce Market Committee have multiplicity of fees and taxes which had a cascading impact on the prices of a commodity when it passes through the supply chain. These charges could be as high as 14.5 per cent in Andhra Pradesh, excluding state value-added tax and close to 10 per cent in Odisha and Punjab.

There are 2,477 principal regulated markets based on geography, called agriculture produce market committee and 4,843 sub-market yards regulated by the respective APMCs in India. Central Government has allocated Rs. 200 crore to the newly created Agri-Tech Infrastructure Fund, which would support online integration of 585 Agricultural Produce Market Committee (APMC) marketing yards in the next three years. Further, Government has cleared last week with an outlay of Rs 5,000 crore for the next five years. 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. The Central Government's proposed online agri-trade platform will initially integrate 585 marketing yards across the country. The software would be provided free of cost to the states and in addition grant of up to Rs 30 lakhs per mandi as a one time measure for related equipment and infrastructure.

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, crop protection, harvesting, post-harvest management and marketing. Technology transfer need effective interactive groups at grass root level in the villages. These groups should become tool of disseminating information about various government sponsored schemes and these entities will help in liaising with various Govt. departments for developmental activities. A comprehensive Kisan knowledge Management Systems (KKMS) should be developed to provide and disseminate information related to the modern technology, modern farm implements, best agricultural practices and post-harvest management including market information. Dissemination of crucial information related to weather data and agro climatic conditions, prices of agriculture produce is needed to the farmers at regular basis. There are various interventions like Village Knowledge Centres, Farm Schools, Farmer's Clubs, Kisan Call Centres, Radio and Television, Mobile Phones, Internet and dedicated 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.

Beyond these key areas, there is need to revamp the research, teaching and extension network of the state agriculture universities. Most of the agriculture universities often face resource crunch in funding their different research, teaching and extension programmes. The funding to these institutions should be increased linked with time bound objectives and with a cap on need-based scientific and other manpower. The central government should also devise effective system in inter-linking the institutes of Indian Council of Agricultural Research and other institutes engaged in agriculture research with the state agriculture universities for pooling of the resources scientific expertise in achieving common objectives. We have the third largest pool of scientific and technical professionals. Hence, agriculture should continue to receive the first priority and best and dedicated efforts of everybody in the ladder of governance and decision making in the field.

(The author is Principal Scientist, Department of Plant Pathology, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh).

PROTECTED CULTIVATION FOR HIGH VALUE HORTICULTURAL CROPS

Dr. Yashbir Singh Shivay and Dr. Najim Ali

The increasing demand by world markets for high quality products has led to more and more agricultural/horticultural crop production systems to protected environments. Covering the crop allows regulation of macro and micro-environments, which facilitates optimal plant performance, extension of the production duration, induction of earliness, and obtaining higher and better quality yields. Protected cultivation of high value vegetables and cut-flowers has shown tremendous potential during the last decade or so at national level in India.

The main purpose of protected cultivation is to create a favourable environment for the sustained growth of crop so as to realize its maximum potential even in adverse climatic conditions. Protected cultivation technology offers several advantages to produce vegetables, flowers, hybrid seeds of high quality with minimum risks due to uncertainty of weather and also ensuring efficient and other resources. This becomes relevant to farmers having small land holdings who would be benefitted by a technology, which helps them to produce more crops each year from their land, particularly

during off-season when prices are higher. This kind of crop production system could be adopted as a profitable agro-enterprise, especially in peri-urban areas. At present, there is a large gap between the demand and production of these crops to meet both quantitative and qualitative needs of domestic and export markets which are difficult to be bridged with the traditional cultivation practices. Thus, protected high value horticultural crops have great potential to enhance the income especially of small farmers in India if appropriate technological interventions are made.



Concept of protected cultivation

Protected cultivation technology is based on greenhouse effect. Greenhouse effect refers to the absorption of infrared energy by the atmosphere and the earth, which maintains the optimum temperature range on the earth that is suitable for life. The earth would be a frozen planet without the greenhouse effect with an average temperature of about minus (-) 18°C. Greenhouse gases like carbon dioxide (CO₂), water vapour, nitrous oxide (N₂O), methane (CH₄) etc allow incoming short wavelength (0.3-2.3 µm) solar radiation to reach the earth surface but restrict the outward flow of long wavelength (> 2.3 µm). They absorb as well as reradiate the outgoing radiation after storing some heat in the atmosphere, which results in the warming of the earth surface through greenhouse effect. Greenhouse is an inflated structure made with galvanized iron (GI) or steel pipes covered with plastics and nets, which can be used for crop production under controlled environmental conditions. Micro climate inside greenhouse is created and maintained for high quality crop production mainly of vegetables and flowers for round the year.

Protected cultivation offers several advantages to produce horticultural crops and their planting material of high quality and yields, through efficient land and resource utilization. Fruits, vegetable and flower crops normally accrue 4 to 8 times higher profits than other crops. This margin of profit can increase manifold if some of these high value crops are grown under protected conditions, like greenhouses, net houses, tunnels etc. Such an agricultural production system could provide a more profitable source of income and employment in rural sector. The amount of post harvest losses in vegetables and cut flowers is very high (20-30%), which can be significantly reduced and productivity can be increased 5-10 times through protected cultivation technologies by taking the crops round the year. Protected cultivation has very high entrepreneurial value and profit maximization leading to local employment, social empowerment and respectability of the growers. Environmentally safe methodologies involving Integrated Pests Management (IPM) tactics reduce the hazards facing the high value products. Fertigation has been found to be one

of the most important production technologies for hi-tech horticulture and protected cultivation. It helps in achieving higher productivity and enhancing the quality of horticultural produce. Precision application of water and nutrient is possible through drip fertigation to attain very high crop water and nutrient use efficiency mainly in protected cultivation.

National Scenario of protected agriculture

Protected cultivation technology is a relatively new technology for our country. The total area covered under protected cultivation in our country is approximately 50,000 hectares. It includes the greenhouse area and low & high tunnels. Faced with constraints of land holdings, rapid urbanization, declining crop production, declining biodiversity and ever increasing population, demand for food, especially vegetables has increased manifold and protected cultivation has offered a new dimension to produce more in a limited area. There has been a very good development in the area expansion of protected agriculture during the last five years in India. The leading states in the area of protected cultivation are Maharashtra, Karnataka, Gujarat, Himachal Pradesh, North-Eastern States, Uttarakhand, Andhra Pradesh, Tamil Nadu, Punjab and Haryana. The states that have consistently expanded the area under protected cultivation for the period of 2007-2012 are Andhra Pradesh, Gujarat, Maharashtra, Haryana, Punjab, Tamil Nadu and West Bengal. Maharashtra and Gujarat had a cumulative area of 5,730.2 hectares and 4,720.7 hectares respectively under the protected cultivation till 2012. The major crops grown in the protected cultivation are tomato, capsicum, cucumber, melons, rose, gerbera, carnation and chrysanthemum. Nursery grown in the protected cultivation is becoming very popular venture for income and employment generation.

Global scenario of protected agriculture

Protected cultivation technology has been continuously growing on a commercial scale in more than 55 countries throughout the world. However, it is being practiced in about 115 countries in the world are into commercially greenhouse vegetable production. In Asia, China is the world leader in greenhouse technology due

to rapid expansion and adoption of greenhouse technology. Presently, worldwide greenhouse scenario is given in Table 1. The total greenhouse area throughout the world was approximately 3 million hectare during the Year 2011. Today Dutch protected cultivation is one of the most intensive farming systems in the world with high levels of output by using the latest technologies. In Europe, Spain is leading in protected agriculture with 52,170 ha mostly under low cost poly houses (Table 2).

Table 1. Global total area in major greenhouse vegetables and flowers producing countries

Country	Greenhouse area (ha)
China (2010)	27,60,000
Korea (2009)	57,444
Spain	52,170
Japan	49,049
Turkey	33,515
Italy	26,500
Mexico	11,759
Netherlands	10,370
France	9,620
United States	8,425

Source: Kacira (2011)

Table 2. Total area in major greenhouse vegetables and flowers producing countries in Europe

Country	Greenhouse area (ha)
Spain	52,170
Turkey	33,515
Italy	26,500
Netherlands	10,370
France	9,620
Poland	7,560
Greece	4,670
Germany	3,430
Romania	2,790
Portugal	2,310

Source: Kacira (2011)

Characteristics of protected agriculture: The major characteristics of protected agriculture are as follows.

- Round the year production of vegetables and flowers
- High yield and good quality production
- Optimum use of water and nutrients
- Minimum use of insecticide and pesticide
- Premium prices to the farmers for their produce
- Suitable for small land holdings
- Suitable for water harvesting

Plant environment interactions for protected agriculture

An understanding of plant-environment interactions is essential for maximizing plant productivity under a set of operating constraints. The growth of plant could be modified by changing the parameters of its surrounding environment, that is, its microclimate. Logically, for a given plant it is possible to arrive at an optimized set of microclimatic parameters in order to maximize the plant growth. A greenhouse is, essentially, a practical means to achieve the maximization of plant productivity by maintaining the optimum microclimate.

Protected structures for growing vegetables and flowers

Vegetable and flower production is significantly influenced by the seasonality and weather conditions. The extent of their production cause considerable fluctuations in the prices and quality of vegetables. Striking a balance between all-season availability of vegetables and flowers with minimum environmental impact, and still to remain competitive, is a major challenge for the implementation of modern technology of crop production.

The crop productivity is influenced by the genetic characteristics of the cultivar, growing environment and management practices. The plant's environment can be specified by five basic factors, namely, light, temperature, relative humidity, carbon dioxide and nutrients. The main purpose of protected cultivation is to create a favourable environment for the sustained growth of plant so as to realize its maximum potential even in adverse climatic conditions. Greenhouses, rain shelters, plastic tunnels, mulches, insect-proof net houses,

shade nets etc. are used as protective structures and means depending on the requirements and cost-effectiveness. Besides modifying the plant's environment, these protective structures provide protection against wind, rain and insects.

Protected cultivation is relevant to growers in India who have marginal and small land holdings, which helps them to produce more crops each year from their land, particularly during off-season when prices are higher. However, growing vegetables and flowers under protected conditions requires comparatively high input cost and good management practices, which have direct bearing on the economic viability of the production system. Even if the protective structures are cost effective, proper planning, management and attention to details are needed to achieve maximum benefits.

Protective structures/methods

The kinds of protective structures for crop production range from simple provisions such as rain shelters, shade houses, mulches, row covers, low tunnels, cloches to greenhouse structures with passive or active climate control. Salient points of various structures are as under:

Greenhouses

A greenhouse is quasi-permanent structure, covered with a transparent or translucent material, ranging from simple homemade designs to sophisticated pre-fabricated structures, wherein the environment could be modified suitable for the propagation or growing of plants. Materials used to construct a greenhouse frame may be wood, bamboo, and steel or even aluminum. Coverings can be glass or various rigid or flexible plastic materials.

Plant environment and greenhouse climate

A plant grows best when exposed to an environment that is optimal for that particular

plant species. The aerial environment for the plant growth can be specified by the following four factors; i) Heat or temperature; ii) Light; iii) Relative humidity and iv) Carbon dioxide

Materials of greenhouses

With the introduction plastic of materials, there are now several alternatives available for greenhouse coverings. A brief description of greenhouse covering materials is given below:

- i) **Glass:** A clean, transparent glass provides the maximum light transmittance to the extent of 90%. However, being heavier in weight, it requires elaborate structure for adequate support. It is brittle and can break with minimum shock or vibrations resulting in high maintenance costs.
- ii) **Acrylic:** This material has long service life, good light transmittance (80%), moderate impact resistance, but prone to scratches. It has a high coefficient of expansion and contraction. Being inflammable and costly, it is not a preferred material.
- iii) **Corrugated/multi wall polycarbonate sheet:** It is available in single or double wall sheets of different thickness. A new polycarbonate sheet has good light transmittance of about 78%, but reduces with age. It has excellent impact resistance and low inflammability. High cost limits its use on large scale.
- iv) **Fiberglass reinforced plastic panels (FRP):** These plastics consist of polyester resins, glass fibers stabilizers etc. It has an initial light transmittance of about 80% and has high impact resistance with a service life ranging from 6-12 years. Good quality FRP materials for greenhouse coverings are not quite assured.
- v) **Polyethylene film:** A clear, new polyethylene sheet has about 88% light transmittance. Its higher strength and low cost have made it most popular replacement to glass. An ultra-violet

The Ministry of the Government of India which was earlier known as "Ministry of Agriculture", from now will be known as the "Ministry of Agriculture and Farmers' Welfare". In days to come schemes for the welfare of farmers will also be formulated alike the schemes for agriculture are prepared, and the Government would make efforts to provide help to the farmers by means of setting permanent system for the problems farmers face in their personal life.

(UV) stabilized plastic sheet can have a service life of 3 years. These sheets are generally available in 7 and 9 meter widths with 200 micron (0.2 mm) thickness.

vi) Thermal and shedding net

Advantages of protected vegetables and flowers cultivation

Protected vegetables and flowers production can reduce the amount of water and chemicals used in production of high value vegetables and flowers compared to open field conditions. The main advantages of protected cultivation are:

- 1) Improved quality and consistency supply of high value vegetables and flowers.
- 2) Year round production of high value vegetables and flowers.
- 3) Adverse climate for production of vegetables and flowers can be overcome by different systems of protected production.
- 4) Multiple cropping on the same piece of land is possible under protected environment.
- 5) Off-season production of vegetables and flowers to get better return to growers.
- 6) Production of high quality and healthy seedlings of vegetables for transplanting in open field supporting early crop, strong and resistant crop stands.
- 7) Use of protected vegetable cultivation and flowers can increase production as well as productivity per unit of land, water, energy and labour. It supports the production of high quality and clean products.
- 8) It makes cultivation of vegetables and flowers possible in areas where it is not possible in open conditions such as high altitudes and deserts.
- 9) It makes vertical cultivation of vegetables and flowers possible using technologies like hydroponics, aeroponics etc and use of vertical beds for production.
- 10) Disease free, especially virus free seed production of costly vegetables and flowers becomes easy under protected structures.
- 11) The potential of poly-house production technology to meet the demand of producing good nutrition and healthy foods and quality

vegetables and flowers free from pesticides can be fully exploited.

- 12) Controlled environmental conditions are used for early raising of nurseries, off-season production of vegetables and flowers, there seed production and protecting the valuable germplasms.
- 13) Vegetable and flower crops can be grown under adverse weather conditions round the year and off-season.
- 14) Management and control of insect-pests, diseases and weeds is easier in controlled conditions.
- 15) Maintenance of stock plants, cultivating grafted plantlets and micro propagated plant is easier than open environment.

Limitations

- 1) Manual or hand pollination in cross pollinated vegetables like cucurbits or development of their parthenocarpic hybrids/ varieties.
- 2) Expensive, short life and non-availability of cladding materials.
- 3) Lack of appropriate tools and machinery, especially in India.
- 4) Structure cost initially looks unaffordable, especially small holdings farmers. Farmers with zero risk affordability do not come forward to adopt it.

Scope of protected agriculture in India

India's first true experience in hi-tech protected cultivation of vegetables and other high-value horticultural produce came through the Indo-Israel project on greenhouse cultivation, which was initiated at Indian Agricultural Research Institute (IARI), New Delhi in 1998, shortly after the establishment of diplomatic ties with that country. However, the Israeli experts left India in 2003 at the end of this five-year project, IARI continued to maintain the facility. Since 2003 this facility is being converted into the Centre for Protected Cultivation Technology (CPCT). During last 11 years, the committed scientists of this centre are managing the whole centre in a scientific manner and are refining and up-scaling the system to reduce costs, besides designing greenhouse structures to suit

local conditions. Protected agriculture is the future agriculture of India due to the fact that the land holdings are decreasing in India due to increasing population. For small land holdings, protected agriculture is very profitable venture. Farmers can build small greenhouses, net houses; nursery, low tunnel greenhouses and can earn more money. The increasing incidence of biotic and abiotic stress parameters also support protected agriculture as future prospects for India. Protected agriculture is rapidly expanding in India as it is suitable for small and marginal land holdings farmers and can be used in areas with scarce water resources and harsh environments.

Limitations of protected agriculture in India

Protected agriculture is capital and technology intensive agriculture. It is a relatively nascent technology for India as it is copied mostly from Israel and European countries. The poor Indian farmers are not able to invest much to build various protected structures and also it requires lots of technical expertise, which is not easily available to Indian farmers. Protected agriculture is also energy intensive agriculture. Energy is also very costly in India, making it difficult for the small and marginal land holdings farmers.

Future thrust for protected agriculture

Protected agriculture is climate resilient agriculture. It is expanding in India very fast in many states, especially Maharashtra, Karnataka, Gujarat, Andhra Pradesh, Tamil Nadu, Rajasthan, Punjab and Haryana. The government is giving massive subsidy to promote protected agriculture for the farmers. Farmers are being exposed to various demonstrations and training programmes related to various aspects of protected cultivation. Protected agriculture is the future agriculture for the Indian farmers as it is suited for small and marginal land holdings with very less available water. The increasing incidents of disease, pests and unfavourable weather necessitate the use of protected agriculture in India to meet the growing demand of high value vegetables and flowers.

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INNOVATIONS AND RURAL DEVELOPMENT CONCEPT AND APPLICATION

Dr. Mahi Pal

India is one of the fastest growing economies in the world. But at the same time, the challenge before the country is how to ensure future growth in a sustainable and inclusive mode. India has numerous challenges in different nature in terms of health, education, skills, agriculture, urban and rural development, energy and so on. Challenges have also been imposed by exclusive and inequitable access due to multiple deprivations of class, caste and gender. Innovative approaches and solutions, and looking beyond the conventional mode of performing various tasks are required to solve these problems. Innovation could play a pivotal role not only in bringing about triggered growth and competitive environment in it, but also ensure inclusion of vulnerable groups besides making the development environmentally sustainable. Innovation can bring accountability and transparency, good governance, planning and development. In view of the benefits of innovation in terms of , both national and global as well as employment opportunities , competitiveness and sharing of opportunities in the 21st century, the

Government of India has declared 2010-20 as the 'Decade of Innovation'.

The Ministry of Rural Development plays an important role in rural development, which is evident from the mission of the Ministry which says sustainable and inclusive growth of rural India through a multi-pronged strategy for eradication of poverty by increasing livelihood opportunities, providing social safety net and developing infrastructure for growth and improvement of quality of life in rural India. To achieve its mission, the ministry has been implementing various programmes of rural development and poverty alleviation in rural areas with the different level of element of innovation in implementation of these schemes.

In this article , an attempt has been made to demonstrate as to how the application of innovation the implementation of various programmes have become useful in term of employment generation, infrastructural development, access to basic facilities in rural areas.



A brief about Rural Development Programmes

The Ministry of Rural Development (MoRD) has been implementing various schemes for employment generation, infrastructural development, access to basic facilities and social assistance in rural areas. Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is a rights-based wage employment programme implemented in rural areas of the country. It aims at enhancing livelihood security by providing upto 100 days of guaranteed wage-employment in a financial year to every rural household whose adult members volunteer to do unskilled manual work.

National Rural Livelihood Mission (NRLM) seeks to reach out to all rural poor households in the country estimated at 8-10 crore and organise them into SHG and federations at village and higher levels by 2021-22. While doing so, NRLM ensures adequate coverage of all vulnerable groups of rural society, identified through participatory processes and approved by Gram Sabha. Deen Dayal Updhyaya Grameen Kaushalya Yojana (DDU-GKY) is refocusing and re-prioritising NRLM's skilling component so as to build the capacity of rural poor youth to address the needs of both national and global skill requirements.

Pradhan Mantri Gram Sadak Yojana (PMGSY) assists the States with the objective to provide connectivity to eligible unconnected habitations as per Core-Network with population of 500 persons as per 2001 Census and above in plain areas and in difficult areas 250 persons and above. The Programme envisages single all weather connectivity. Indira Awaas Yojana (IAY) aims to provide assistance to the BPL families who are either houseless or having inadequate housing facilities for constructing a safe and durable shelter. National Social Assistance programme (NSAP) provide assistance to poor BPL households – for the aged, widows, disable and also include provision for one time assistance in the case of death of primary bread winner in a BPL family. Sansad Adarsh Gram Yojana (SAGY) announced on October 11, 2014 focuses on integrated and holistic development of villages to enable them as

models for other villages to emulate. Integrated Watershed Development Programme (IWMP) aims for the development of rainfed/degraded areas including wasteland.

The above is a succinct objective of various programmes being implemented by the Ministry of Rural Development.

Wage and Self Employment Generation MGNREGA

Emphasis on Convergence through Proper Implementation of State Convergence Plan, Operationalisation of Cluster Facilitation Team (CFT), Guidelines for Taking up Unskilled Component under MGNREGA in Construction of Houses under Indira Awaas Yojana or such other State or Central Government Scheme, Web Based Management Information System (MIS) for Convergence and IEC have been some of the initiatives for strengthening the programme implementation. It is interesting to note that the Intensive and Participatory Planning Exercise (IPPE) was initiated to prepare the labour budget for financial year 2015-16 in selected 2500 Blocks consisting of around one lakh Gram Panchayats. This exercise has improved the participation of the stakeholders in the planning exercise by involving more than 2 lakh youth, who have been trained in participatory planning technique. After an evaluation of the outcome of the IPPE-I, it is innovated that the exercise will be the same in 2016-17, duly shifting focus on to the livelihoods to be executed in close convergence with NRLM. The IIPE would be the joint exercise of MGNREGA and NRLM machineries, assisted by CSOs and line departments. The focus of this exercise would be on the identification of poorest households based on Socio-economic Caste Census (SECC) database for preparing suitable livelihood plans.

To make NREGA Soft more user friendly and to use data mining techniques for a decision support system Dashboards have been created separately for each level of implementation viz., Gram Panchayat/ Block/ District/ State and National level. Apart from this, a public portal has also been made available on MGNREGA website which allows preparation of reports as per the

requirements of the State Governments and implementing agencies.

Mobile based monitoring system in about 9880 Gram Panchayats have been initiated in both in IPPE and non IPPE blocks. Another innovation has been done by launching a project for livelihoods through full employment under MGNREGA. The project aims at improving the skill-base of the MGNREGA workers, thereby improving their livelihoods so that they move from their current partial employment to full employment status in convergence with DDU-GKY for imparting placement linked skilling courses to members of MGNREGA households who have completed 100 days work in 2014-15.

NRLM

National Rural Livelihoods Mission NRLM recognizes that innovation and entrepreneurship are becoming important for addressing major development challenges related to poverty, inclusion and sustainability. Aajeevika believes that successful innovations can reduce the learning curve for poverty eradication by showing a different pathway out of poverty. Five per cent of the central allocation is therefore, earmarked for innovations, which have the potential for reaching out specifically to the poorest to bring about the largest impact with limited resources. Under NRLM states have been supported in piloting small scale innovations in knowledge, management and communication practices namely community radio(CR), street theatre and folk arts. A pilot project on CR was started in Haryana with the purpose to make understand for increasing the efficiency and efficacy of the social mobilization through community resource persons.

Electronic fund management system (E-fms)

In order to ensure that benefits go to the bank account of individual beneficiary electronically, thereby reducing the different tiers involved in fund flow and also reducing delay in payment electronic fund management system is introduced under MGNREGA. Under e-fms, digitization of all the beneficiary details is necessary (name, job card details bank account number, number of days worked under MGNREGA). Finally, a fund transfer

order/ e- payment file is generated for crediting the wage in the bank account of the beneficiary.

To assess the real time basis SHG-bank linkage, web-portal has been created under NRLM. Best practices have been followed in the states of Bihar, Karnataka, Madhya Pradesh, Rajasthan, Tamil Nadu and Gujarat where different innovations have been under taken to strengthen SHG and Bank linkage, planned approach, organizing credit camps, capacity buildings. These efforts have contributed in social mobilisation, capacity building of different stakeholders which in turn have helped in effective implementation of the mission in rural areas.

Under DDU-GKY, the innovations taken in terms of “Champion Employer” with select Agencies who have individually committed to provide 10,000 jobs in the next two years with career progression, draft qualification pack and national occupational standards for barefoot engineers developed with ILO in consultation with the stakeholders. PFMS has been initiated. It would provide ERP based IT platform for work-flow management, as well as other institution development actions relating to orientation of PIA and HR system for the national and state units.

In order to effectively monitor the entire programme and bring about greater efficiency, accountability and transparency in implementation, a modern web based On-line Management, Monitoring and Accounting System (OMMAS) has been set up under PMGSY. The main Application Software Modules include Rural Road Plan & Core Network, Proposals, Tendering & Contracting, Execution (Physical and Financial Progress), Quality Monitoring, Funds Flow and Receipt & Payment Accounts (work accounts). The web site is www.omms.nic.in. e-Payment, e-Procurement are new dimensions being integrated in it. The PMGSY has been launched in the year 2013-14 and accordingly requisite modules for data entry of proposals have been developed and uploaded on OMMAS. A road list in pdf format generated from OMMAS is now attached with all clearance letters being issued by the Ministry. A new version of OMMAS 2.0 using dot net technology has also been launched.



Under IAY, Awaas soft is a work flow based Management Information System (MIS) designed to capture the implementation process through its target setting and fund management modules. The Beneficiary Management Module captures details of the beneficiary and status of his/her sanction. Real time reports generated by the system are useful tools for monitoring of progress and reporting. The Rural Housing Knowledge Network (RHKN) was launched in collaboration with IIT, Delhi with the objective of compiling a comprehensive nationwide updateable repository of practitioners, institutions and practices related to affordable and sustainable solution for rural housing and develop an interactive web portal to disseminate information in the public domain. The website can be accessed at www.ruralhousingnetwork.in. Besides, providing a

comprehensive list rural housing technologies, their know-how and practitioners and portal has several innovative features such as a cost calculator, videos demonstrating alternate technologies and presentations based on multimedia.

SAGY is primarily about unleashing the power of the people who are expected to inculcate pride in village, encourage societal change/behavioral change, take collective responsibility and initiate projects. The development of gram panchayats identified under SAGY is intended to take place through convergence and implementation of existing government schemes and programmes without allocating additional funds. While different ministries/departments have made changes in 14 of their programmes/scheme guidelines, the ministry is in touch with

The Pradhan Mantri Jan Dhan Yojna had been announced on the last independence day, keeping in mind that even after sixty years of independence; even when the banks were nationalized for the poor, 40 per cent people of the country were without a bank account till the last 15th of August; the doors of the banks were not open for the poor. 17 crore people opened their bank accounts under 'Pradhan Mantri Jan Dhan Yojna'. With a view to extend opportunities to the poor. The Rs. 20,000 crore deposited in the Jan Dhan accounts reflected the "richness of India's poor".

other relevant ministries/departments in this regard. A number of state schemes are required to be converged with this scheme for maximizing benefit.

Socio Economic and Caste Census (SECC)

SECC is itself an item of innovation as evident from the enumeration which has been carried out under it. SECC is a unique paperless Census because enumeration of data was done using 6.4 lakh electronic handheld devices. Household data was taken from the National Population Register along with the temporary identification number. At each stage there was an opportunity for transparency and grievance redressal. A total of 1.24 crore claims and objections were received of which 99.7% have already been resolved. The survey has been completed in all 640 districts.

Impact of Innovation on Rural Development Programmes

The innovation, ideas and ICT have positively impacted on the implementation of the schemes of rural development. Some of the generalization in this regard is given below:

1. The pace of implementation of various programmes has been increased. The innovations which emerged from the field for instance IPPE-II, would be able to create productive assets of prescribed quality and durability, strengthen the livelihood resource base of the poor, proactively ensuring social inclusion and deepening panchayati raj institutions. The use of ICT and mobile devices would transfer the wages of workers in time, which in turn create a demand for jobs by them.
2. Convergence is a buzz word these days. However achieving convergence is not easy because breaking the culture of silo and compartmentalization impede it. But the innovation in terms of provisions in the SAGY and social capital build in the implementation of MGNREGA and NRLM have facilitated convergence which in turn have enhanced the outcomes of various programmes in coordinated mode.
3. The income level of the beneficiaries, small and marginal farmers have also increased which is evident from the field reports. Providing 10,000 jobs under "Champion Employer" in the next two years with career progression etc is an example in this regard.
4. Since innovation has last mile service delivery capacity, it solved problems of poor through employment generation and establishing enterprises.
5. SECC provides very useful data on households about their socio-economic status like housing, landholding/landlessness, educational status, status of women, the differently abled, occupation, possession of assets, SC/ST households, incomes etc. The Ministry has decided to use the SECC data in all its programmes besides using for housing purpose, education and skill development, deepening MGNREGA, National Food Security Act, interventions for differently able, interventions for women headed households, and targeting of households/individual entitlements on evidence of deprivation, etc. The household data is also available for planners of programmes at State, district, Block, Gram Panchayat and village levels. It has shown the path for Mission Antyodaya to work simultaneously in addressing the poverty stricken households through a Gram Panchayat poverty reduction plan. Hence, the outcomes of the SECC would be used for various other developmental uses in the country. It is expected that the data base provided by SECC would be used for decentralized governance, planning and development.

To conclude, the innovations which have been put into practice in the implementation of the programmes helped to increase the effectiveness of the programmes in rural areas. To further accelerate the process of innovations in rural development besides increasing avenues of academic research, awareness among people about the government schemes etc may also be created.

(The author is a senior officer of the Indian Economic Service, presently working as Director, Ministry of Rural Development.)

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GRASS ROOT INNOVATIONS IN AGRICULTURE

Sarita Brara

Popularly known among villagers as “hunase huccha”, a tamarind maniac, Abdul Kadar Nadakattin may have been nick named for his overzealous endeavors to grow Tamarind and processing it but he has several more innovative agricultural implements to his credit that earned him the National Innovation Foundation Life Time Achievement National Award for Grass Root Innovations this year. Apart from growing Tamarind with scarce alkaline water and developing and designing mechanical processes like a device to separate tamarind seeds and a machine for slicing tamarind for pickle making, Abdul Kadar Annigeri in Navalgund taluka of Dharwad district from Karnataka also developed a two wheel tiller, that helps maintain uniform speed of the tractor engine. Its iron wheel instead of the rubber ones avoids the wear and tear thus consuming less fuel. He also innovated a plough blade manufacturing machine used for sharpening the tractor harrow blade for it to last longer the list of his innovations is not complete. A Seed cum fertilizer drill, a machine for sowing seeds of different sizes ensuring proper spacing with inbuilt system to for dispersal of fertilizers, mud and grass. Automatic sugarcane sowing driller which he developed in response to the request from some farmers from Maharashtra to automate the sowing of sugarcane. Abdul took only 6 months to develop this driller, which was purchased by many farmers.

While drip and sprinkle irrigation system utilizes water efficiently what to do when a farmer has to irrigate long and dense crops like sugar cane in a short period of time. Well, Annasaheb Bhavu Udagave, a farmer who had never gone to school found a solution. He innovated a rotor sprinkler, terming it Rain Gun that could irrigate one acre of land in just 90 minutes. Not just that since the Rain Gun sprays at high pressure, pests too are washed away. Also his Rain Gun named after Goddess Chandra Prabha, can be locked into a specific position which ensures that water sprayed is not wasted and the locking mechanism prevents water being sprayed into neighbouring areas. Annasaheb was awarded the first National Biennial award in the year 2001 for his innovative Rain Gun. Hailing from Karnataka, Annasaheb not only has several other innovative agriculture implements to his credit, but even developed prize winning high yielding varieties.

The tractor drawn onion transplanter innovated by Pandharinath Sarjerao from, Sangavi Bhusar village in Ahmednagar district in Maharashtra can perform three functions at a time viz. transplanting the onion, applying the fertilizer and making the irrigation channels. He won NIF's Fifth Biennial Award function for Grassroots Innovations and Traditional Knowledge in 2009.

Sitara Srangar won National First award in 2015 for an improved variety of mustard developed through natural hybridization from Sengri (*Raphanus sativus*) and local variety of Sarso (*Brassica juncea*) followed by selection. The variety is not only high yielding but also has high oil content. It can also be tolerant to pods shattering, water logging and Alternaria leaf blight. The variety takes about 120-130 days to mature. It also performs well in saline water.

Or take the case of Surjit Singh from Karnal who has come out with high yielding and salt tolerant paddy



variety and which is free from foot rot disease and can be grown in three seasons. This basmati variety has been named after him. The seeds of the variety were distributed to about a thousand farmers of salt affected area of Haryana, Gujarat and Bihar and the feedback from farmers there was encouraging.

They are not the only innovators at the grass root level, hundreds of products and innovations developed at the grass root level by the farmers have provided low cost solution to the problems faced by farmers, cost effective farm equipment for small farmers and developing high yielding varieties of various crops from cereals to vegetables and fruits. Necessity, it is said is the mother of invention, so many farmers using their common sense, experience and taking into account their needs and local sources have come out with innovations to solve their problems by themselves.

Though not all such innovation can be translated into successful business ventures but there is no denying that they do provide a practical and affordable solution at a local level. Nonetheless many of the products developed by these grass root innovators from un-organized sectors have been sold in the domestic markets across the country and several of them patented.

These include a low cost paddy thresher developed by Fazlul Haq from Moriabari in Assam. Two hundred and fifty pieces of his innovative implement have been sold across the country. He got the national innovation award in 2011.

A cotton stripper developed by Mansukhbhai Patel, 600 of these highly efficient machines have been sold. In fact, the cotton stripper developed by Mansukhbhai Patel in 2003 was the first US patent granted for an Indian grassroots technology. Many others have also been granted US patents including Mansukhbhai Jagani for a bicycle sprayer and Kanadia Khijibhai for a manual sprayer. Several other such products have got Indian patents. Mansukhbhai Patel, Mansukhbhai Prajapati and Madanlal Kumawat, were named among Forbes' list of seven most powerful rural Indian entrepreneurs in 2010, as "inventions are changing lives" of the people across the country.

While the government, industry and the research organizations have an important role to play in encouraging innovation, the grass root innovations not only provide cost effective solutions but also cater to local needs suitable for local environment.

In country where the small and marginal farmer account for almost 80 per cent of the farming community these grass root innovations play a vital role.

While sometimes, ideas and innovations spread through word of mouth, many a time, these innovative ideas remain localized. To overcome this constraint, Honey Bee Network with a handful of volunteers triggered a movement, over two decades back to scout, spawn and sustain the unaided innovations and outstanding traditional knowledge from the informal sector of our country.

The National Innovation Foundation which provides an institutional support to grassroots innovators and has a large data base of two lakh ideas, innovations or what can be ascribed as traditional knowledge. Many of these are related to agriculture which is the mainstay occupation of rural India.

Set up in the year 2000, the National Innovation Foundation to help India become an inventive and creative society, the Foundation works in partnership with Honeybee Network, Gian, (Grassroot Innovation Augmentation Network) and Sristi, (Society for Research and Initiatives for Sustainable Technologies and Institutions) to provide support right from scouting innovations across the country, documenting, adding value, linking innovation with investment, helping in intellectual property rights management to spreading information and social diffusion. By creating a chain around these innovations the NIF facilitates their transition into self-supporting sustainable enterprises. It facilitates demonstration of their technologies and also establishing linkages with other institutions and networks for dissemination.

The ultimate objective is to make these innovative products available to the masses through the market mechanism.

Taking into account the fact that millions of women in India were involved in tedious and time consuming task of paddy plantation and tea plucking, the NIF announced the Gandhian Inclusive Innovation Challenge Awards to develop new solutions for three challenges that include two related to farming sector paddy transplanter and a tea leaf plucking machine.

Once such innovations emerge it could go a long way not only in reducing time and energy but also the drudgery of women involved in this task.

(The author is a freelance journalist)

HHB67-A BLOCK BUSTER, PEARL MILLET WONDER HYBRID FOR FOOD SECURITY

P SAGAR and R KUMAR

As Pearl millet is an important crop for food, feed and fodder supply in dry land semi arid tropics where it is mainly cultivated under rain-fed conditions and forms an integral component of agriculture and animal husbandry dominated economy of farmers. It is nutritionally superior loaded with marvelous healthy benefits than all other cereals and millets in terms of minerals, dietary fibre fat content and has higher energy 360 Kcals/100g. Its fat quality particularly unsaturated fats oleic acid and linoleic acid are higher and omega3/omega6 fatty acid ratio is also high. Pearl millet as a food is beneficial for cardiovascular fitness and diabetic patients as well. It is a dual purpose crop. Its forage, fodder and grain make important rations for cattle and grain makes good poultry feed. Of late its grain has attained industrial importance especially in brewery and bakery. Population explosion and food demands are going parallel, the demand for

this climate smart nutri-cereal will grow. This will help in promoting the cultivation of pearl millet which does better under drought conditions.

Rajasthan ($\geq 45\%$ area), Maharashtra, Gujarat, UP and Haryana together occupy about 90 % of pearl millet cultivation of 10.62 million ha (average of 1950-2013) in India. The examination of area, production and productivity of pearl millet in India, Haryana and Rajasthan reveal there was less variation in area ($CV \leq 25\%$) over the years (Figures 1,2,3). The production, the function of area and productivity fluctuated very high ($CV \geq 38.36$ to 74.50%). The cause(s) of low production and productivity have been highlighted by Sagar and Singh (1988). The increase in productivity in Haryana, India has been high, but in Rajasthan has not been much but almost proportionate to the country's levels. Population exploitation and food demands are going parallel. It is prophesied



that by 2050 Indian population may rise by 30-40% of present stage and we will need about 350 m tonnes of food grains. Therefore, production per unit needs to be increased.

The adoption of high yielding short duration extra early maturing hybrids particularly HHB67 in poor fertility drought prone conditions has shown great promise the productivity in Rajasthan has also moved considerably i.e. it was 10.75q/ha during the last four years (2010-2013) and cultivation of HHB 67 in more area will further increase production and productivity Pearl millet is and will continue to be an important unignorable crop of rain dependent areas of Rajasthan and Haryana as a buffering mechanism crop.

More than 150 hybrids have been developed and released at the national and state level. During the last two decades. Fifteen HYV (12 hybrids +3 composites) were developed & released by the CCSHAU Hisar during the last three decades. But HHB67 developed at HAU by Kapoor *et al.* (1989) has become famous with the farmers than any other hybrid. There are many pearl millet hybrids available from the public and private sector breeding programmes as well, but hybrids bred at HAU particularly HHB 67 (Kapoor *et al.* 1989) are liked and grown widely. The hybrid HHB67 notified for cultivation in India in 1990 is the first wonder hybrid of world and combines many traits of importance –high yield, extra early maturity (60-62 days), downy mildew resistance, thermo-tolerance, salinity tolerance that allows it to escape terminal drought stress, highest moisture, nutrient and radiation use efficiency and therefore the highest per day productivity, vacates field well in time for conservation of late rainfall for *rabi* sowing and fits well in multiple, inter-cropping systems. It is probably the most popular public sector pearl millet hybrid in India that occupies more than half of the pearl millet area in Haryana and Rajasthan particularly Jaisalmer, Barmer, Bikaner, Churu and Jodhpur drought prone districts.

Food Security

The popularity and role of HHB67 in food security is evident from the fact that the demand of its hybrid seeds has been increasing. The total

quantity of public sector HYV pearl millet seed produced in Andhra Pradesh that is finally certified, of this the seed of HHB67 was 10.52% in 1992 increasing to 50% up to 2004-05 and more than 75% during the last seven years except for 60.79% during 2008-09 and 57.55% during 2009-10. Now it has jumped to 88.77% i.e. 35575.27q of 40074.12 q seed produced during 2011-12. With this quantity of seed available from one source about 889382 hectares area @4kg/ha would have been seeded with HHB 67. The seed is also produced in Gujarat, Maharashtra, Karnataka and Tamil Nadu, but the data regarding the quantity of seed produced in these states could not be obtained. It is presumed that the area growing HHB 67 might have crossed one million hectares. It speaks the merit and adoption of this prominent hybrid which has earned accolades not only from farmers, but also from scientists, administrators and even politicians and ministers.

While the area under HYV in Haryana was 60 % before the release of HHB 67 and productivity was 618 kg/ha, both area under HYV 60.9%, to 82.54% and productivity 900 kg/ha, to 1263 kg/ha has progressively increased during the last three quinquennia (1990- 94 & 2000-04), respectively. It has risen to 2057 kg/ha during 2013 and is highest in the country. The easy availability of parental lines seed and proactive role played by New Nandi Seeds Ltd in multiplication of seed during the first decade of release of this hybrid helped the spread and popularity of this hybrid. Farmers queue up to buy the seed of HHB 67 (Tempest in Test Tube, ICRISAT). The contribution of pearl millet grain to SGDP in Haryana just 0.91- 2.36 % may not be considered appreciable, but is important as more than 50 % is through the cultivation of HHB 67 which is more than Rs.10000 crores. Having performed well over 15 years it started showing susceptibility to downy mildew. It is hoped that this hybrid will continue to be the first love of dry land farmers for decades and would contribute significantly to the economy of dry land farmers.

(About the authors: P. Sagar is a Senior Plant Breeder, Department of Plant Breeding, CCS HAU, Hisar 669, sector 15A, Hisar and R Kumar is Assistant Scientist, Bajra Section, Department of Genetics and Plant Breeding, CCS HAU, Hisar).

PROMISES FULFILLED RESULTS DELIVERED

PRADHAN MANTRI JAN DHAN YOJANA

Promise

"I wish to connect the poorest citizens of the country with the facility of bank accounts."



Action

Pradhan Mantri Jan Dhan Yojana launched on Aug 28, 2014. More than 17 crore bank accounts opened; Over Rs 20,000 crore balance in the accounts as on July 29, 2015.

MAKE IN INDIA

Promise

"I want to appeal to people the world over, "Come, make in India... Come, manufacture in India."



Action

Make in India Programme launched on Sep 25, 2014. FDI inflows increase by 48%. Baseline Profitability Index 2015 ranks India no.1 investment destination in the world.

SWACHH BHARAT

Promise

"The poor need respect and that begins with cleanliness. I, will launch a 'Clean India' campaign from Oct 2, 2014 this year and carry it forward in 4 years"



Action

Swachh Bharat was launched on Oct 2, 2014 to make India clean by achieving ambitious targets of building toilets in schools throughout the country.



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DIGITAL INDIA

Promise

"It is IT that has the potential to connect each and every citizen of the country. We want to realise the mantra of unity with the help of "Digital India"



Action

Digital India Programme on July 1, 2015. The scheme will enhance digital connectivity across the nation. Will boost manufacturing of electronics and reduce imports.

SKILL DEVELOPMENT MISSION

Promise

"Our mission has to be 'skill development' and 'skilled India'. Millions of Indian youth should go for acquisition of skills."



Action

Skill Development Mission Launched on July 15, 2015 to skill 40 Crore Indians in the next 7 years.



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BIO-PESTICIDES : THE REAL NEED FOR ECO-FRIENDLY PEST MANAGEMENT

Dr. Debabrata Panigrahi and Dr. Sabyasachi Biswal

Agriculture is the mainstay of livelihood and continues to be the backbone of Indian economy. It is the single largest sector which provides direct or indirect livelihood to more than 70 per cent of India's population. Besides, it contributes to 1/5th of the total gross domestic product (GDP), employment to 69 per cent of total workforce, 10 per cent of the total export earnings and raw material to a large number of Industries.

Insect pests and diseases continue to be one of the major constraints for optimum crop productivity. More than 30 per cent of the crops are lost after being affected by insects and diseases. Farmers consider pesticides as first line of weapon for control of insect and diseases which affect the crops. However, indiscriminate use of these toxic chemicals has led to serious health hazards for the human beings, as well as to the livestock, aquatic animals, plants and environment. Also this has led to development of resistance, resurgence and secondary pest outbreak of insect pests and the most important is residues of pesticides in food stuffs leading to severe health issues. It is noteworthy that the food production in the

country has not increased as desired in the last two decades, even though the use of pesticides has increased by 20 per cent per annum. According to reports, Indian food products have 25 per cent more pesticide residues over tolerance level as compared to 2.5 percent globally, resulting in rejection of agricultural exports to the tune of Rs 4 to 5 thousand crore annually.

Bio-pesticides are the products derived from biological sources rightly termed as "Crop Health Products" and are emerging as new crop protection strategy. Three broad groups of biological origin are included under bio-pesticides viz. Bio-chemical pesticides (e.g. Plant products like neem, begunia etc. and pheromones), bio-control agents (predators, parasites etc and microbials e.g. bacteria, fungi, viruses etc.), and genetically modified plants created by incorporation of gene. These bio-pesticides when used as a component of IPM for management of pests in all crops or used singly in organic farming for management of pests in medicinal crops, spices and some export oriented crops are cheaper than chemical pesticides by 40-50per cent.



Plant bio Pesticides

Plant products take pivotal position as bio-pesticides because these are bio-degradable, ecologically safe and have significant toxicity on target species. Plants (either their extracts of parts or oils or oilcake etc.) which are used as bio-pesticides are neem, mahaneem, Karanja, Begunia, Mahua, custard apple, tulsi, chrysanthemum, ryania, sabadila, Thuja tobacco piper, onion, garlic, zinger, turmeric eucalyptus, palmarosa, lemongrass, clove, ginger, garlic, citronella, castor etc. These plants contain alkaloids, limonoids (terpinoids) and isoflavonoids which act as pesticides. Alkaloids such of nicotine from tobacco, rotenone from Derris, pyrethrins and cinerins (pyrethroids) from chrysanthemum and limonoids / terpenoids (azadirachtin) from neem make them good plant by pesticides. Bio-chemical pesticides are natural occurring substances such as insect sex pheromones that interfere with mating as well as various scented plant extracts that attract insect pests to traps. Phenomones can manage insect pest by mass trapping, monitoring mating disruption and auto confusion techniques.

Use of Natural Enemies

Use of natural enemies e.g. parasitoids, predators and pathogens for management of pests is other wise known as biological control. It also refers to the various activities of man which enhances the efficiency of the natural enemies already present in the eco-system. The various techniques of bio-control are conservation, augmentation and importation. Conservation refers to actions to preserve and increase the natural enemies by

environmental manipulation like avoiding cultural practices and use of selective insecticides which are harmful to NES, use of appropriate practices which favours the survival and multiplication of natural enemies, providing of alternate hosts, refusia, food like pollen and nectar for adult stages of NES, increased environmental opportunities by increasing bio-diversity etc. Importation / Introduction refers to importing foreign natural enemies to combat the introduced pests. In India 79 species of natural enemies were imported out of which 53 were successfully multiplied and 21 have established in the field.

Augmentation refers to the activities designed to increase the natural enemy population either by propagation and release or by environmental manipulation. It is of two types viz. inoculative release where control is expected from the progeny and subsequent generations and not from release itself and inundative release which involve mass culture and release of natural enemies to suppress pests that have only one or a few generation per year. Natural enemies may be parasitoid which is usually smaller in size, live and complete one stage of life in or on the prey, derive nutrition and kill the prey in the process. Parasitoids may be egg, larval and pupal depending on the stage on which they attack. Trichogramma is the excellent egg parasite which has been successfully employed to manage lepidopterous insects in rice, sugarcane, cotton, pulses vegetables like okra, brinjal, tomato etc. and bracon and goniozus has successfully managed coconut black headed caterpillar predator which is usually larger and stronger than prey and they catch and kill a large number of prey.

The Government has decided to pump in fifty thousand crore rupees in 'Pradhyaan Mantri Krishi Sinchaai Yojna'. We have to launch a movement in our agricultural sector with the mantra of "Save Water, Save Energy, and Save Fertilizers". Hence, "Per drop more crop" is our watchword; each drop of water can contribute towards producing more crop and hence successful farming. "Neem-Coating" is an idea propounded by scientists, and in our country, urea worth millions and billions of rupees is allocated in the names of farmers, but 15, 20 or 25 per cent of this urea is diverted to the chemical factories as raw material. Allocated in the names of farmers, this urea is pilfered through the middlemen. This pilferage of urea cannot be stopped unless we go for cent per cent "Neem-Coating" of urea. Therefore, irrespective of the burden caused to the exchequer, we have accomplished the task of doing hundred per cent "Neem-Coating" of urea. As a result of this, now urea cannot be used for any purpose other than farming. Now, no chemical factory can indulge in any kind of pilferage of urea. The farmers will have as much urea as they need. Since the urea is "Neem Coated", even if they use 10 per cent less of urea, their land will be benefitted with the nutritional value it requires.

The important predators like chrysoperla, cryptolaenus, coccinella, cheilomenes, chilocorus, corulus are amenable to laboratory rearing and effectively manage sucking insect pests like aphid, whitefly mealybugs, thrips, scales, psyllids, plant hoppers, eggs, and young larvae of Lepidoptera of cotton, pulses, oilseeds, vegetables, subabul, citrus and mango etc. Telenomus, Tetrastichus, Apanteles, Gonatocerus, Anagrus Cotesia, Stenobracon, Compoletis, Epipyrops and Brachymeria are important natural parasites and spiders, preying mantids, dragon / damselfly, tiger beetle, pentatomid bugs, water striders, syrphids, mirid bugs and rove beetles are important natural predators which needs to be conserved.

Bacteria, virus, fungi, protozoa, ricketsia and nematodes are the principal groups of insect pathogens and are effective microbial bio-pesticides and can be used in pest management. These pathogens must possess a suitable strain, virulent toxins and persistence (long shelf life) to be a successful microbial bio-pesticide. Among a wide group of entomogenous bacteria, the crystalliferous spore forming, rod shaped, gram positive bacteria *Bacillus thuringiensis* (Bt) proved as potential bio-pesticide which has gained popularity worldwide. The most prominent Bt product is BTK and is sold under trade names viz. Dipel, thuricide biobit, delfin, bactospein, Halt, fighter, bactrin, bioasp and used at 1kg/ ha against different lepidopterous insects. Entomopathogenic viruses can be grouped into two categories viz. Inclusion / occluded viruses (IV) producing inclusion bodies of crystalline protein and non-inclusion viruses (NIV). Based on the shape of inclusion bodies, occluded viruses can be divided into polyhedral viruses e.g. nuclear poly hydrosis virus (NPV), cytoplasmic polyhydrosis virus (CPV) and granulosis virus (GV). All these can be used in pest management and among these NPV has shown the greatest potential because they are more virulent.

Viruses are host specific, no adverse effect on environment, higher acceptability, yields and quality improvement. At 250-500 LE/ ha, HaNPV (heliocel, helicide, biorocil-H and bio-virus-H) and SI-NPV (Spodocide, litucide, biorocil-s and bio-virus-s) can respectively manage pod borer (*Helicoverpa*) attacking pulses, sunflower, Okra, tomato, maize etc and tobacco caterpillar (spodoptera) attacking oil

seeds, pulses and many vegetables, Entomogenous fungi of genera Beauveria, Metarhizium, verticillium Hirsutella, Aschersonia, Lecanicillium, Entomophthora have been used for insect pest management. Amongst these Beauveria are highly effective on lepidopterans, white flies, hoppers coffepodborer, aphids, white grubs, red spider mites etc. verticillium is most efficacious on aphids, jassids and whiteflies and entomophthora on white flies and metarhizium on white grubs and locusts. Entomophilic nematodes like Hexameris, mermis, steinernema, tylenchids and Rhabditids are useful in insect management. Some of the successful examples are agameris against yellow stemborer, Hexameris against BPH, Sugarcane topshoot / early shoot borer and tobacco caterpillar (spodoptera) and steinernema carpocapsee against yellow stemborer and Earcutting caterpillar in rice. Rickettsiella are pathogenic to coleoptera, Diptera, Lepidoptera, Orthoptera etc. of which *R. meldotheae* cause Lorsch disease in white grub, *Nosema locustae*, *Varirimorpha necatrix* used against grasshoppers and caterpillars respectively. The recently discovered cephalogregarine, Gregarina sp attack nymphs and adults of 15 species of grasshoppers. Sporozoa and cnidospora are the protozoans which multiply inter/ intracellularly in the host and kill them. Till date protozoans, rickettsias and nematodes have not been exploited properly for management of insect pests.

Genetically modified plants have created by incorporating Bt gene into the cells of cotton, Brinjal, rice, tobacco, tomato etc to manage bollworm complex, fruit and shoot borer, yellow stemborer, tobacco caterpillar and fruit borer respectively. Now GM plants of Bt cotton are successfully cultivated by managing bollworm complex in cotton in India and GM plants of other crops have been successfully cultivated in USA and European countries by controlling the lepidopterous insects of the crops.

Novel insecticides of Biological origin:

The novel insecticides of bio-logical origin derived from micro-organism like *spinosyns*, *saccharopolyspora spinosa*, a soil bacterium actinomycetes; Avermectins, *streptomyces avermectalis*; Milbemycins *streptomyces hygrosopicus*, a soil based actinomycetes; Diabroactins, *Bacillus subtilis* and *B. Cereus* from

soil bacterium and cartap hydrochloride from *Lumbriconereis hateropoda* a sea annelid which can be used as bio-pesticides.

Bio-pesticides scenario in India :

In India, of all the available pesticides in the market, bio-pesticides contribute only 0.2 per cent in 2000, 2.5 per cent in 2005 which increased upto 5 per cent in 2013. Many bio-pesticides like neem oil, neem kernel extracts, trichogramma cards, Bt, NPV, Metarhizium, Beauveria (to manage insect pests) and trichoderma, pseudomonas (for management of diseases) are now commercially available in the Indian market. Among all these Bt stands first followed by neem in terms of consumption. Now in India, more than 100 companies are involved in manufacture / formulation of bio-pesticides and biocontrol agents and some are being imported. We have succeeded in managing insects like gram pod borer, *Helicoverpa armigera*, Diamond back moth, sugar cane borers, cotton bollworms, mango hoppers, whitefly sugarcane pyrausta and diseases like rots and wilts by the use of biopesticides. Trichogramma, Bracon, chelonus and chrysopa have successfully managed bollworms and sucking insect pests in cotton.

Sugarcane borers have been successfully managed in the states of Tamilnadu, Karnataka, Odisha, Rajasthan, U.P., Bihar and Haryana by use of Trichogramma. Pyrausta in sugar cane have also been successfully managed in the above states by the introduction of *Epiricamia melanoleuca*. Lantana weed has been successfully managed by the bug *Telonomia scrupulosa*. Last decade has witnessed a tremendous breakthrough on standardization for production technique of Trichogramma, Bt, NPV, Beauveria, Metarhizium, pseudomonas, Gliocladium, trichoderma to use them in many insect pests and diseases. Now many research Institutes, state Agricultural universities, Krishi Vigyan Kendras, private organizations are involved in research related to various aspects of bio-pesticides development, usage, quality control but they have not reached in the door step of farmers because of lack of promotional strategies, lack of access, lack of awareness and most important is lack of willingness on the part of extension workers. There are also constraints like, improper and inappropriate quality of bio-pesticides and their delivery system, lack of technical know how and trained personnel for production and use, lack of multidisciplinary approach and improper toxicology

and regulatory matters, Enterprises for bio-pesticides are small and medium and reduction in International and national research support system.

Steps for development and use of bio-pesticides:

- An organization or body need to be established at national level for research and development of bio-pesticides.
- Bio-control agents repository established at project directorate of Bio-logical control (ICAR) Bangalore and all the co-ordinated research projects on bio-control functioning at SAU and research Institutes need to be further strengthened.
- Plant based products / pesticides, bio-control agents, including microbial agents and pheromones should be included in the package of practices, IPM programmes of SAUS, ICAR research Institutes, state Department of Agriculture / Horticulture with a view to reduce / avoid the use of harmful chemical pesticides and promotion of bio-pesticides.
- Registration of bio-pesticides need to be done for commercial sale and supply of quality bio-pesticide to farmers.
- Need based packaging and labeling strategies need to be developed for promotion of bio-pesticides.
- Govt. should provide subsidies / exemptions or reduction of sales tax for survival and establishment of bio-pesticide industry.
- Govt. regulatory procedures should be smoothed further to bring in new bio-pesticides quickly for use by the farmers.
- Research need to be initiated and intensified for achieving in vitro production of microbes and laboratory hosts on synthetic diets.
- Formulation of bio-pesticides need to be done properly and effective delivery systems should be created for early availability of bio-pesticides at the door step of farmers.
- Loaning policy should be liberal for un-employed agriculture graduates with reduced rate of interest as this would help and encourage self-employment.
- Bio-pesticides viz. bio-agents (parasitoids, predators, pathogens), plant based products and pesticides (neem etc.), bio-based seed treating

agents viz. trichoderma and pheromone traps and other bio-based minkits should be supplied to farmers in national demonstration programmes under RKVY, NFSM, ISOPOM, NHM etc instead of chemical pesticides for effective management of insects and diseases etc.

- Tax policies should be liberal for youth and tax concession should also be offered to encourage entrepreneurs.
- The rules for registration of bio-pesticides should be simple and less rigid than those of chemical pesticides. Registration of a microbial pesticides requires toxicological tests for oral, dermal, eye and other health hazards using test animals in USA. If these tests show no adverse effects and the bio-control agent is not a plant pathogen it should be registered and sold. This procedure should be followed in India which will help the bio-pesticide industry and the farming community.

Establishment of better linkage between research and industry as farmer research linkages have already become strong.

Implementation of Insecticides Act, 1968:

Government of India has already included as many as 45 bio-pesticides in the schedule to the insecticides Act, 1968 and 18 bio-pesticides have already been registered by the registration committee constituted u/s 5 of the Insecticides Act 1968 for use in the country. However all the producers of Bio-pesticides, irrespective of private or Government organization are required to have registration of their products under the provisions of the insecticide Act 1968. The details regarding procedure for registration are available on the website www.cibrc.nic.in. But unfortunately it has been brought to the notice of the Govt. of India that many state Agriculture Universities, Krishi Vigyan Kendra, non-Govt. and other private organization are producing bio-pesticides without obtaining registration from the registration committee constituted u/s 5 of the Insecticides Act 1968 and manufacturing licenses from the licensing authority of the concerned state which is against the law and the insecticides Act. Hence to produce and provide quality bio-pesticides (as per the policy of Govt. of India) to the farmers, research organization, institution of State Govt., all the organizations irrespective of Private and Govt. engaged in production of bio-pesticides should take

necessary and pertinent steps for registration of bio-pesticides as per the insecticides Act 1968.

Future thrust and needs:

- Suitable species / strains of bio-pesticides should be indentified for use in different crops and agro-eco system.
- Research on the bio-ecology of pests and their natural enemies including pathogens should be intensified and strengthened.
- Conservation methods of natural enemies should be standardized properly.
- Genetic variability of natural enemies viz. predator, parasites and microbial pathogens need to be identified.
- Net work of bio-pesticide industries should be established and strengthened for proper availability of microbial preparations and bio-agents viz. predators / parasites.
- Proper arrangements should be done for international exchange of beneficial organisms.

Due to growing concern for the consequences of chemical pesticides, bio-pesticides has a tremendous scope in environment friendly pest management in spite of some disadvantages. It is now deemed necessary to impart special emphasis at Institutional level on development of bio-control agents. (Parasites, predatons, microbials), plant based pesticides, pheromones, suitable genetically modified plants and their use at farmers door step. Rich diversity of micro-flora for standardization and use of plant products and microfauna for bio-control agents (parasites, predators, microbials like bacteria, virus and fungi) in the Indian subcontinent provides excellent opportunities for development and use of bio-pesticides for eco-friendly biointensive based pest-management for sustainable and organic crop production. Concerted and need based efforts for appropriate understanding of bio-control agents, plant based products, pheromones, need based genetically modified plants and their effective utilization in eco-friendly pest management will definitely help ecological equilibrium in natural protection of flora and fauna of nature and provide "Food for all" and "Health for all".

(Dr. Debabrata Panigrahi is senior Scientist (Entomology) at R.R.T.T.S. G. Udayagiri (O.U.A.T.) and Dr. S. Biswal is Associate Professor (Agronomy) at College of Agriculture (BBSR) O.U.A.T., Odisha).

LAND AND WATER CONSERVATION: NEED OF THE HOUR

Rajdev Panwar

Agriculture and allied sectors accounted for 13.7% of the GDP (Gross Domestic Product) in 2013 and near about sixty percent of population depend on this sector. All these facts reveals that agriculture plays a significant role in the overall socio-economic development of India, as it is main source of income for people. India exported \$39 billion worth of agricultural products in 2013, making it the seventh largest agricultural exporter worldwide, but inspite of that economic contribution of agriculture to India's GDP it is steadily declining, which shows there are some gaps in achieving desired output by agriculture sector. Agriculture production depends on land, labour and capital availability. Latter factors are only effective, if land is suitable for cultivation. To overcome this problem there is urgent need of land and water management.

REAL PROBLEM

Land and water management comprises of two components soil conservation and water conservation. Both are regarded as important but soil conservation is of primary concern because in India, nearly 80 million hectare area is exposed to the threat of soil erosion, and 43 million hectares area is actually affected. In states like Madhya Pradesh, Rajasthan, Maharashtra and Punjab, up to 15 per

cent of the total land suffers from soil erosion. It is reported that the annual loss of fertility by erosion is 20 times faster than what is lost by growing crops. Each year more than, 10,000 hectares area is exposed to erosion. Nearly 147 million hectare area in India is in need of conservation measures.

Soil erosion causes undesirable change in physical characteristics of soils and damages plant and crops which directly cause less crop production in India. Data reveals that 130 million hectares of land, that is, 45 % of total geographical surface area, is under soil erosion through gorge and gully, shifting cultivation, cultivated wastelands, sandy areas, deserts and water logging, severe landslides and floods, due to cutting of trees for agricultural implements, firewood and timber; grazing by a large number of livestock over and above the carrying capacity of grass lands, traditional agricultural practices, construction of roads, indiscriminate quarrying and other activities. Wind erosion is important cause for expansion of deserts, dust storms, whirlwinds and destruction of crops. Excessive soil erosion, high rate of sedimentation in the reservoirs and decreased fertility has become major environmental problems with disastrous economic consequences in India.

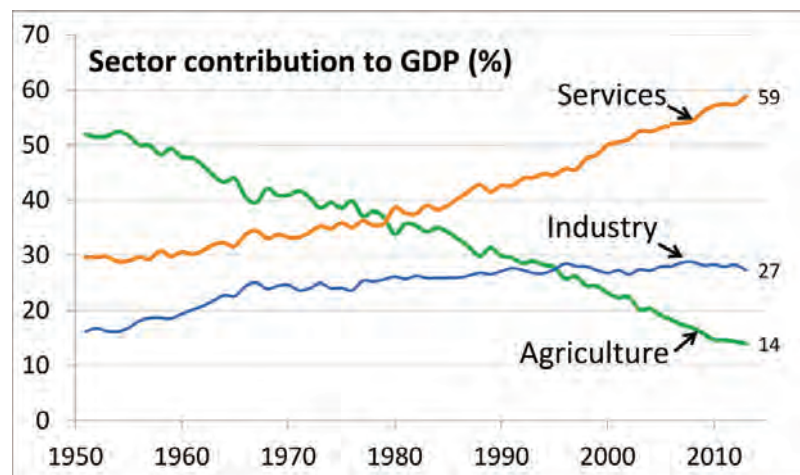


Figure 1. The GDP contribution of various sectors of Indian economy have evolved between 1951 to 2013, as its economy has diversified and developed.

Soil Erosion in Indian Forests

Soil assessment is done dividing soil into different zones which reveals that much erosion is occurring in the central zone and eastern zone of the country. Some problems are common everywhere but others are confined to specific physiographic conditions or in particular geological formations. Northern and central zones have almost identical patterns in the soil eroding and bio-degrading forces. Eastern zone suffers from shifting cultivation and excessive rainfall. Western zone suffers due to aridity. Southern zone suffers from general problems related to aridity, low productivity and shallow soil depth.

Table 1. NBSS&LUP soil degradation classes, derived from 1 : 250,000 soil map (1985–1995)

Classes	Area (in M Ha)
Water Erosion	
Loss of top soil	83.31
Terrain deformation	10.37
Wind Erosion	
Loss of top soil	4.35
Loss of top soil/terrain deformation	3.24
Terrain deformation/Overblowing	1.89
Chemical Deterioation	
Salinization	5.89
Loss of nutrient-acid soils	16.03
Physical Deterioation	14.29
Waterlogging	
Others	
Ice caps/ Rock Outcrops/Arid Mountains	8.38
Total	147.75

Source: NBSS&LUP. 2004

Types of Soil Erosion in India Various types of soil erosion in India is caused by natural factors, like wind and water which are main driving force and artificial factors like deforestation, mining etc. Soil erosion is a process of detachment and transportation of soil by natural agencies of water and wind.

Types of Erosion by Water:

- 1. Splash Erosion:** When falling raindrops splash on the soil, and impact the bare soil into flowing mud.
- 2. Sheet Erosion:** When soil is removed uniformly in a thin layer from the entire surface area, mainly occurs after splash erosion.
- 3. Rill Erosion:** An intermediate stage between sheet erosion and gully erosion which occurs when the run-off water, laden with soil flowing along the slopes, forms fingerlike channels.
- 4. Gully Erosion:** When volume of concentrated run-off increases and attains more velocity on slopes, it converts itself from rill into gullies. Ravines, is an advanced stage, in India ravines cover about 10 million hectares. Gujarat, Maharashtra, Karnataka Madhya Pradesh, Uttar Pradesh are famous for this problem.
- 5. Slip Erosion:** Landslides cause slip erosion—big masses of soil and rock slip down.

6. Stream Bank Erosion: Streams and rivers change their courses by cutting one bank and depositing the silt loads on the others. Meanders and Ox flow lakes sometimes formed in this process.

7. Sea Shore Erosion: Caused by striking action of strong waves.

Factors Influencing Soil Erosion

- 1. Rainfall:** Erosion is dependent on the amount, duration, intensity and frequency of rainfall. In short, by action of rain drops on soil, soil granules are loosened, detached and separated into fine particles. Short time period rainfall with high intensity cause more erosion.
- 2. Slope:** Erosion increases with slope.
- 3. Vegetation cover:** Vegetative cover protects the soil from the impact and dispersing action of the raindrops and acts as a mechanical obstruction to flowing water structure, in addition to absorption and reduction of surface run-off.
- 4. Tillage:** Infiltration and permeability of the soil is improved by the practice of proper tillage but excessive tillage expose soil to wind erosion.
- 5. Nature of the Soil:** Erodability of the soil depends on nature of the soil, particularly its texture, structure, organic matter, amounts and combination of salts present, presence of hard pan in the soil and presence of high water table.
- 6. Soil Moisture:** High water table means low infiltration and permeability, resulting in more surface runoff, and more erosion but on other part deficit rainfall cause loosening of soil enhancing rate of erosion by wind.
- 7. Wind Velocity:** Greater erosive potential, is due to strong wind with high velocity

Causes of Soil Erosion

Main causes of soil erosion are directly related to improper land use (entirely man-made factor), deforestation, faulty cultivation methods, shifting cultivation, overgrazing, diversion in natural drainage

channels by railway embankments and roads, infrastructure development, over exploitation of land, more use of fertilizers, lack of proper surface drainage, denuding forest fires.

Effects of Soil Erosion

Loss of top Soil (most important for crop production), harmful effects of erosion on organic matter and soil structure, decline in soil capacity, increase in salinity and alkalinity of soil, siltation and sedimentation in dams and water storage reservoirs, deposition of sand and gravel on agricultural lands, flooding of Streams.

Methods to Check Soil Erosion

Stubble Mulching:

Leaving or putting crop residue or vegetative litter on the land to protect surface against erosion and to increase infiltration and reducing evaporation.

Strip Cropping

Growing erosion-permitting crops (jowar, bajra, maize) in alternate strips with erosion checking close- growing crops (grasses, pulses).

Organic Manures

Organic manures like cowdung, green manure, farmyard manure etc., to improve soil structure which in turn also increase infiltration and permeability and conserve soil moisture.

Contour Bunding

Dividing slope of the land into smaller, more level strips by constructing mechanical structures of suitable size along contours. Each bund thusholds rainwater within each division.

Terracing:

On steeper slopes, terraces or flat platforms are constructed in steps in a series along the slope. This way water is retained on each terrace which can be used to raise crops.

Constructing Proper Drainage Channels and Plugging the Gullies: These are mainly check dams, to prevent sediment, erosion and sometimes pollutant in flow.



Figure 2. Contour Bunding



Figure 3. Terracing

Basin Listing:

Process of making out small basins at regular intervals on slopes which help in checking the run-off and in conservation of water.

Water Harvesting:



Figure 4 Gully Plugging.

Collection, conveyance and storage of water is termed as water harvesting, which helps in checking the run-off and is part of flood control measure.

Scientific Slope Management:

If the slope is more than normal range, prefer pastures; if still more, forestry; if it is still greater, go ahead with terracing, as part of conservation measure.

OTHER MEASURES: Construction of drop spillways, chute spillways, dams, earthen embankments etc, are some measures to retard flow and reduce erosive velocity.

GOVERNMENT MEASURES : In India one of the major problem is small land holding among farmers which make their economic condition weak and hence they are not able to use new techniques or to change new model for production in their sector. Government of India from time to time initiated new policies and programs to overcome impediments in agriculture and allied sectors.

Summing Up:

From agricultural production to food security, and to uplift economic condition of farmers, it is much important to take measures for soil conservation and for soil health in such a country of small land holdings. Some of the suggested measures are:

1. Linking of **MNREGA** and **SansadAdarsh Gram Yojana** type schemes to grass root level more efficiently to cover conservation measures on broad scale.
2. Linking new initiatives like **Soil Health Card** to **KCC** accounts and credit should be given after testing soil health in proportion to its production capacity which avoid inefficiency of farmers to pay back over burden amount.
3. Availability of human resource power from state agriculture universities and central universities like agricultural engineers and soil water conservation experts and engineers to grass root level of village panchyats to achieve total decentralization in form of grass root inclusion as part of development.
4. Research and extension work should be broad based. Use of more and more biological and mechanical techniques.
5. Where capital inefficiency is present in farmers, direct cash transfer benefits should be given to land holders for farm management practices inspite of supplying subsidies on fertilizers, energy and power resources etc.
6. Farmers' temperament can be changed by engaging them in participation rather than demonstration by extension.
7. Funds should be allocated for different problems in different areas as India has vast diversity in topography and culture, tradition etc.
8. Cooperative associations among farmers should be formed to overcome small land holding problem. Factors among farmers should immediately be removed by expert agencies which are responsible for baulk in forming such associations.
9. Administrative machinery should apply their role strongly for effective management and profit earned by such plans should be distributed among farmers according to their land holding which is best confidence building measure among particular community.
10. Land survey and data should be collected regularly with suitable provision of its monitoring during specific time period. Land should be used according to land capability classification.
11. River watershed should be monitored for erosion individually as it is main source of siltation in conservation structures like spillways, dams etc. Restriction should be placed on more sensitive areas by government is also need of hour.
12. States association should be formed as most rivers in India flows from one or more states. This step reduce dispute on different issues between states.
13. Lastly, reconstruction and rehabilitation work should be performed with priority for those whose rights are affected by any conservation measures.

(The author is a Ph. D scholar and writes on agricultural issues.)

AGRICULTURAL EXTENSION PROGRAMME

Ghanshyam Goel, Samrat Bandopadhyay

Major extension programmes are implemented under the "Sub – Mission on Agricultural Extension" (SMAE) of the National Mission on Agricultural Extension & Technology (NMAET).

Major Agricultural Extension Programmes being implemented in the country

Department of Agriculture & Cooperation

National Mission on Agricultural Extension and Technology (NMAET) – Sub-Mission on Agriculture Extension (SMAE)

1) Support to State Extension Programmes for Extension Reforms:

- Under implementation in 652 districts of 29 states & 3 UTs of the country.
- Promotes decentralized farmer-driven and farmer-accountable extension system through an institutional arrangement for technology dissemination in the form of an Agricultural Technology Management Agency (ATMA) at district level.

2) Mass Media Support to Agriculture Extension:

- Agriculture related programmes are broadcast through 180 Narrow Casting Centres, 18 Regional Centres & 1 National Centre of Doordarshan Kendras and 96 FM Station Radio for 30 minutes five/six days a week.

3) Agri-Clinic and Agri-Business Centres:

- Two months' training is imparted to eligible selected candidates through Nodal Training Institutes identified across the country.

4) Kisan Call Centres (KCCs):

- Provides agriculture related information through toll free telephone lines.
- A countrywide common eleven digit number 1800-180-1551 has been allotted for Kisan Call Centre. The number is accessible through all mobile phones and landlines of all telecom

networks including private service providers. Replies to the farmer's queries are given in 22 local languages.

- Calls are attended from 6.00 AM to 10.00 PM on all seven days of the week.

5) Exhibitions and Fairs:

- Regional Agricultural Fairs are organized by the State Agricultural Universities/ICAR Institutes with the support of DAC to disseminate information on development of agriculture.

6) Information and Communication Technology (ICT) Interventions:

- DAC has developed 80 portals, applications and websites covering both the headquarters and its field offices/directorates.
- The important portals include SEEDNET, DACNET, AGMARKNET, RKVY, ATMA, NHM, INTRADAC, NFSM and APY.
- A Farmers' Portal has been developed to provide advisories to farmers under different subject matter areas upto block level after integrating large number of websites across the country. A SMS portal has also been under operation since July, 2013 providing SMS based advisories to farmers as per their priority.

Indian Council of Agricultural Research

7) Krishi Vigyan Kendras:

- The Indian Council of Agricultural Research (ICAR) has created a network of 642 Krishi Vigyan Kendras (KVKs) in the country to facilitate farmer's access to agricultural technology generated by National Agricultural Research System. As part of this facilitation process, the KVKs access, refine and demonstrate various technologies to find out the suitability and to demonstrate the production potential in farmer's field.
- Besides this, extension related components of other sub-missions under NMAET also are converged at the level of ATMA.

➤ The **Directorate of Extension in State Agriculture Universities** also undertake Farmer Advisory Services, including publishing useful material for farmers and conducting training of extension personnel. Institutes of Indian Council of Agricultural Research (ICAR) also have their Extension Outreach Programmes. In order to assess, refine and demonstrate agricultural technologies/products generated by the National Agricultural Research System (NARS), the Krishi Vigyan Kendras conduct on-farm trials and frontline demonstrations for various crops as also provide training to farmers and extension personnel.

As has been informed in a written reply in

Lok Sabha on 28th April 2015 by Minister of State for Agriculture, Shri Mohanbhai Kundaria, in order to augment manpower for agricultural extension, the Government is implementing 'Support to State Extension Programmes for Extension Reforms (Agricultural Technology Management Agency)' as a part of National Mission on Agricultural Extension and Technology (NMAET).

Kisan Call Centres (KCCs) have been established in the country to provide extension support on telephone to farmers in all States and Union Territories using a toll free number.

(Ghanshyam Goel is ADG (M&C), PIB and Samrat Bandopadhyay is Assistant Director (M&C), PIB New Delhi).

LONG TERM STRATEGY TO INCREASE PRODUCTION AND PRODUCTIVITY IN AGRICULTURE SECTOR

Indian Council of Agricultural Research (ICAR) formulated long term strategies to increase production, productivity and quality of food crops through development of high yielding stress tolerant varieties suited to different agro-climatic conditions of the country. A total of 371 high yielding varieties/ hybrids of different food crops developed by the National Agricultural Research System (NARS) during the last five years (2009-10 to 2013-14).

The various crop production technologies are being promoted under Crop Development Programmes like National Food Security Mission (NFSM), Bringing Green Revolution to Eastern India (BGREI), Rashtriya Krishi Vikas Yojana (RKVY) for increasing production, productivity and quality of food crops.

As has been informed in a written reply in Rajya Sabha on 20th March 2015 by Minister of State for Agriculture, Shri Mohanbhai Kundaria, various issues like Need to revisit the standard of milk in terms of its fat & solid not fat (SNF) content, revision of the existing practices/ protocols with modern interventions, enhancing the shelf life of milk and milk products, low cost processing and packaging technologies for small scale fish producers were discussed in

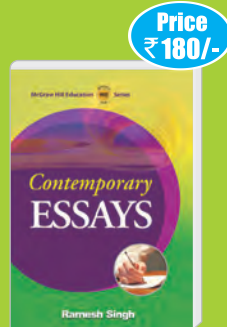
the twelfth Agriculture Science Congress held at the National Dairy Research Institute (NDRI), Karnal. The detailed recommendations are under compilation and will be forwarded to implementing agencies of Government.

The ICAR initiated a network project on "National Initiative on Climate Resilient Agriculture" (NICRA) in 2011 aiming at enhancing climate resilience of Indian Agriculture through strategic research, technology demonstrations, capacity building and sponsored/competitive grant projects. The research on adaptation and mitigation covers crops, livestock, fisheries and natural resource management.

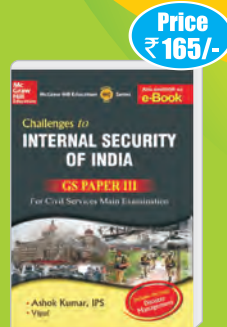
Government of India is also implementing National Mission for Sustainable Agriculture (NMSA) from 2014-15. The National Mission for Sustainable Agriculture aims at making Agriculture more productive, sustainable, remunerative and climate resilient by promoting location specific integrated/composite farming system; soil and moisture conservation measures; comprehensive soil health management; effective water management practices and mainstreaming rainfed technologies.

Source: PIB

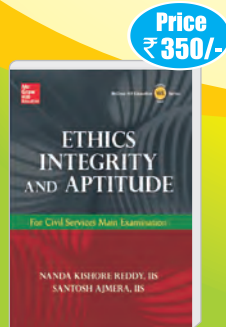
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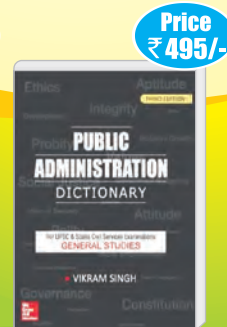
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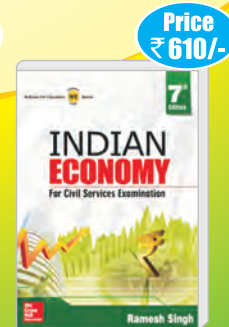
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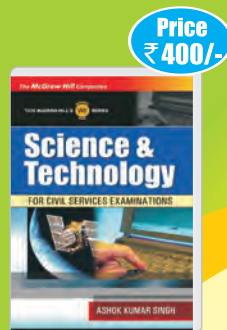
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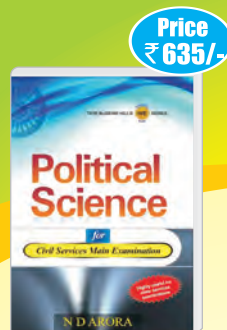
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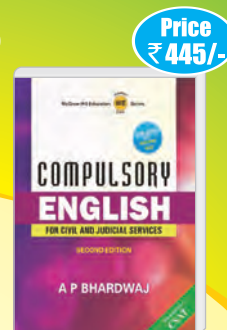
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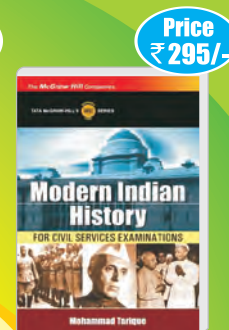
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IT BASED SOIL HEALTH MANAGEMENT-SOIL HEALTH CARD

Dr. N. C. Patel

India during the green revolution witnessed continuous increase in agricultural production and could reach self-sufficiency. However, injudicious and haphazard use of chemical fertilizers while farming has been a matter of serious concern. Secondly, according to reports there has also been stagnation in productivity of crops. In this context, it is important to promote adoption of scientific farming to ensure economic prosperity of the farmers.

Gujarat Experience

A basic soil audit is the first and sometimes the only monitoring tool used to assess changes in the soil. To avoid deterioration of soil in long run and visualizing the importance of balance nutrient in crop production, government of Gujarat decided to embark on a massive programme from 2003, in order to address crucial areas in agriculture sector, which requires immediate attention.

As many as 3 issues were identified. They are:-

- i) Promoting optimum fertilizer use and fertilizer-use-efficiency through soil-test method, by analyzing soil of every farmer's field.
- ii) Developing a crop planning for the rain fed areas which register low and uncertain productivity and remain major reason for poverty among the farmers, and
- iii) More elaborate data base, their quick utilization and networking

to enhance efficient extension services at various levels of Department of Agriculture and Cooperation viz. village, taluka, district and state level offices. The vast nature of the project immediately brought in information technology (IT) as appropriate tool to achieve the goal. When the programme was initiated to issue cards to farmers for soil-test based fertilizer use along with other useful information, it was referred to as "Soil Health Card".

In India, a number of scientifically proven and location-specific technologies are available. There is a need to transfer these technologies to the farmers with greater speed so that productivity and quality are enhanced. Further, these technologies need to be tailor-made for the agro-climatic conditions existing in individual farmer's field. Presently transfer of technology involves training of the extension personnel and their direct contact with the farmers. It has limitations in reaching the farmers individually. The mode of transmission is also tedious and time consuming – scientists to Agricultural Department and percolation down the lane from state level to



district level and then to taluka level and then to villages. It is true that extension work through radio and television has made a mass impact, but the recommendations can only be general and can't be specific to individual farmer.

Therefore, an e - agricultural extension technology was introduced in the 'Soil Health Card Programme'. Since the inputs have been provided as specifically as possible at farmer / village / taluka level by the scientists in various modules, '**Soil Health Card**' programme is able to automatically provide output of specific technologies to a farmer.

Thus, through the '**Soil Health Card**' programme, the Government of Gujarat (GoG) has attempted to promote scientific agricultural technologies by enabling the farmers to get required specific information through use of Information Technology with the following objectives:

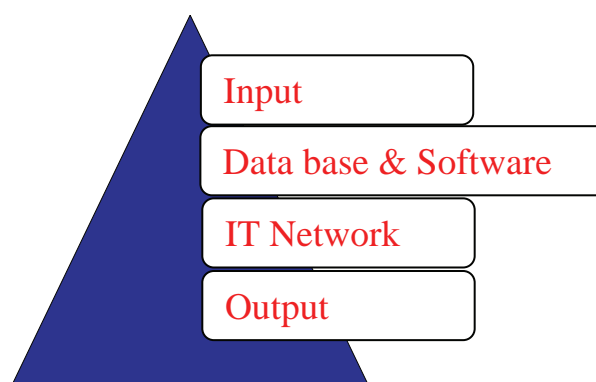
Objectives of the SHC project

- To analyze soil sample of farmers' fields across the state covering all the villages.
- To advocate soil-test based fertilizer rates for different crops grown by the farmer on the basis of the analytical results of soil of his farm
- To suggest possible new crops / cropping system that can give higher income based on Taluka level data on the available soil moisture, harvest and utilization of runoff water, suitability of crops and crop growth period based on moisture utilization of the crops.

Use of Information Technology (ICT) in agriculture

The information and better communication are critical requirements for sustainable agricultural development. Modern communication technologies when applied to conditions in rural areas can help to improve communication, increase participation, disseminate information and share knowledge and skills.

Government of Gujarat selected the Anand Agricultural University (AAU) to establish and implement the state wide programme of the '**Soil Health Card**'. Under this programme, AAU developed the web-based application software,



which generates and provides the fertilizer recommendations on the basis of soil analysis and the nutrient requirements of the crop for each field. This would increase the efficiency of the fertilizer use and reduction in use of the fertilizer.

Structure of SHC project (e-krisi kiran programme)

The architecture of the e-krisi kiran programme consists of four components viz., (1) Input, (2) Data base and Software, (3) Network and (4) Output. The details are as under.

(A) Input

To achieve the objectives of the programme, utilizing various applications, a number of basic information are required to be fed to the system. These information / data were collected from various government departments, agricultural universities, and NGOs in the state. Some of the important ones are given below.

- Information on individual farmer
- Soil-test values of individual farmer's field: values of EC, pH, organic carbon and available phosphorus and potassium.
- Soil characteristics
- Meteorological data
- Agro-climatic zone wise cultivation practices of all crops
- Data on economics (Taluka-wise and crop-wise)
- Recommended fertilizer dose
- Information for crop planning
- Agricultural Production Planning

(B) Database and Software

- The system can generate recommendation of the fertilizers needed for a particular crop based on a nutrition status of farmer's soil on the basis of low, medium, high soil fertility rating.
- The system can generate recommendation of the possible alternative crops to a farmer for better crop production based on his cropping practice and weather condition in his area considering the facts like moisture availability index, available water capacity, length of growing period, surplus water and supplementary irrigation.
- The system can generate recommendation of the alternative crops with a generic ranking of crops in terms of profitability, looking into the various costs involved for producing that crop.
- The system can generate statewide, districtwise, talukawise and individual farmerwise model action plans for crop production.
- The system can generate various FAQ's for farmers about agriculture and animal husbandry in a well classified manner.

(C) Network

The main server is maintained at the State capital and the replica server is at ITC, AAU, Anand. In case of any damage to one data base, the other will serve the purpose. Besides, there is a web server at the agricultural universities at Navsari, Dantiwada and Junagadh. The Programme is a plug-in network to the Gujarat State Wide Area Network.

(D) Output

(i) Soil Health Card

Soil health and its fertility play a key role in crop production. Soil analysis is the means to know the soil health. However, till recent past, fertilizer recommendations for different crops are made on the basis of agronomical practices and not on the soil test base. Soil test based recommendation

for fertilizer use will not only increase the crop production with judicious investment on fertilizer use but will also help to keep the soil productivity sustainable.

The English version of printed farmer's soil health card is given as under.

The General Information of farmer, Land Information, Soil analysis information, Crop-wise fertilizer recommendations and Ready Reckoner for calculating the quantity of fertilizer are the main information given in the Soil Health Card.

Soil health data and their use

The SAUs (Gujarat), through field experiments, work out fertilizer requirement of each crop, But, this dose needs to be adjusted according to the actual nutrient status in farmer's field. When a nutrient status is low, the dose of that nutrient fertilizer is slightly increased, when the nutrient status is high, the fertilizer dose is reduced. Though, the government soil testing laboratories (STLs) have been doing this job, a need to revitalize this programme was taken up to accord top priority to soil health and promote optimum fertilizer use and its use efficiency.

The Government of Gujarat initiated the Soil Health Card related activities during the year 2003, Today, the data bank has more than 42 lakh soil data. The data are now available as individual farm value, means, range and percentage of low, medium and high groups. For any given set of data of any given farmer's field, the fertilizer requirement of crops can be obtained.

(7) Crop wise Fertilizer Recommendation on the basis of soil analysis.
(Supply recommended fertilizers as basal dose and in top dressing)
Note: Soil characteristics illustrated in this card is pertaining to this survey number only. Soil characteristics vary for different survey numbers. Use of fertilizers in accordance with soil analysis of individual field is more beneficial.

Season	Crop	General recommendation of fertilizers by Dept. of Agriculture (kg/ha)			FYM (Tonne/ha)	Recommendation on the basis of soil analysis (kg/ha)		
		N	P ₂ O ₅	K ₂ O		N	P ₂ O ₅	K ₂ O
Kharif	Banana	180	90	180	15	200	60	180
Kharif	Paddy	80	20	0	8	90	20	0
	Paddy (Drilled)	50	25	0	10	55	25	0
	Medium late (T.P.)	100	25	0	10	110	25	0
	Early Maturing (T.P.)	120	30	0	10	150	30	0
	Late Maturing (T.P.)	120	30	0	10	150	30	0
Kharif	Tobacco							
	Bidi Tobacco (Hybrid)	220	0	0	13	240	0	0
	Bidi Tobacco (Improved)	180	0	0	13	200	0	0
Kharif	Castor							
	Irr. Castor	75	50	0	10	85	50	0
Kharif	Pearl millet							
	Hy. Pearl millet (Rain fed)	80	40	0	13	90	40	0
Kharif	Chilly							
	Chilly	100	50	50	10	110	50	50
Rabi	Culticut Tobacco							
	Guj. Culticut-1	200	0	0	10	240	0	0
	Guj. Culticut-2	180	0	0	10	185	0	0
Rabi	Wheat							
	Late sowing	80	40	0	13	90	40	0
	Timely sowing	120	60	0	13	150	60	0
Rabi	Chickpea							
	Chickpea	20	40	0	10	25	40	0
Rabi	Potato							
	Potato	200	100	200	25	220	100	200
Summer	Paddy							
	Summer Paddy	100	30	0	10	110	30	0

SOIL HEALTH CARD
DEPARTMENT OF AGRICULTURE
GUJARAT STATE
Year : 2008
SOIL HEALTH CARD NO: SHC00027842

(1) Farmer's Name : Pursotambhai Hirabhai Patel
(2) Village : Zarolla Taluka : Borsad District : Anand
(3) Account No : 280
(4) Land / Soil detail as per account :

Serial	Survey No.	Area (Ha.)	Soil Type
1	1004-2	00 : 40 : 00	Sandy loam
2			
3			
4			
5			

(5) Fertility class as per soil analysis of the village :

Serial	Fertility Class	Nitrogen	Phosphorus	Potash
1	Low	✓		
2	Medium		✓	
3	High			✓

(6) Details of individual soil analysis : Survey No. : 1004-2

Sl. No.	Detail	Result	Interpretation of Result
1	pH (Soil Reaction)	7.20	Normal
2	E.C. (Total Dissolve Salt: dSm/m)	0.59	Normal
3	Organic Carbon (%)	0.26	Low
4	Available Phosphorus (kg/ha)	43.00	Medium
5	Available Potash (kg/ha)	254.00	Medium

pH
Acidic : 6.5 or less
Normal : 6.5-8.2
Alkaline : 8.2 or high

E.C. (Electric Conductivity)
Normal : Less than 1.0
Medium : 1.0 to 3.0
Harmful : 3.0 or high

Further as a part of this exercise, the guideline followed for the interpretation of the soil data to adjust the fertilizer requirement of the crops was updated to include the current recommendations of the SAUs (Gujarat), which are specified to agro-climatic zone or its sub-unit (agro-ecological situations) in the state, specific crop varieties and even crop sequences and irrigated and rainfed conditions, the recommendations include those on integrated nutrient management and fertigation, the revision also incorporated.

(ii) Village soil health card

In general it is perceived that the land of different fields in a same village may have less variation in respect of the soil fertility. Hence, the fertility index is calculated from the available reports of the soil analysis of the fields of same village and on the basis of fertility index, the farmers who had not done the soil testing were also recommended for the requirement of the fertilization of each crop.

Access to Soil Health Card

The individuals soil health card or the village soil health card can be viewed / accessed through internet.

However, it is presumed that the farmers may not have easy access to the internet, hence, Govt. of Gujarat made provision to supply printed copy of the individual soil health card to all the farmers. Moreover, the printed color copy of the village soil health card is also supplied to each gram Panchayat during Krishi Mahotsav regularly during past several years.

(iii) Alternative Crop Planning

Crop planning for rainfed crops is based on LGP (length of growing period). The LGP is derived from MAI (moisture availability index), which in turn is obtained from AWC (available water content). In this exercise, soil type, bulk density, available water in soil, rainfall (average of 80 years), PEI etc. are taken into consideration. Surplus rain water available for recycling through farm pond is also obtained. The data have been worked out for all the Talukas of Gujarat. Farmers require the guidance on the best possible alternative crop which can be grown on his farm considering

soil and meteorological parameters. Moisture availability index is the base for the suggestion of crop planning.

The availability of water in the soil during the course of crop growth determines largely its yield. Soil water availability depends on rainfall, PET, types of soil and crop water use. Though the availability in amount and distribution of rainfall and PET (across location) undoubtedly affect the duration & characteristics of growing season, the differences in soils, especially in respect of moisture storage and release characteristics strongly influence the agricultural importance of rainfall. Thus, a study of soil water balance is a pre-requisite in planning rain-fed farming for optimum rainfall use. Guideline developed for planning of un-irrigated crop based on LGP are given in **Table 1**.

(iii) Crop Cultivation Practices

The Farmer will require to know the scientific cultivation practices of the suggested alternative crop, therefore the detail package of practices for cultivation is also given as hyperlink with each name of the crop. Thus, existing crop and their economics V/S suggested alternative rain fed / irrigated crops with their economics and package of practices for cultivation of all the crops can be viewed by the farmers in detail through internet.

(iv) Model Action Plan

The function of the Action Plan Module is to capture all kinds of agricultural, demographic, geographic, climate and socio-economic data associated with a Taluka so that these inputs can further be used to decide about the effectiveness of the recommendations given to the farmer. This module can also produce different kinds of reports and analysis for the scientists / planners so as to enable them for better decision making.

(v) FAQ and Solution of Queries

The Question - Answer bank is maintained in a classified way for the frequently asked questions by the farmers. The answers of such questions are prepared by the concerned scientist, so that firsthand knowledge of research recommendations may be available to the farmers. If a farmer requires more details of technology or has any problem

Table 1: Chart prepared by AAU scientists showing suitability of different crops grown in Gujarat for various Length of Growing Period (LGP)

LGP (days)	Crop Name			
	<i>Kharif</i>	<i>Rabi</i> (based on conserved moisture)	Horticulture crop low lying area	
< 60	Kidney bean			
69 - 90	Kidney bean Green gram Black gram Cowpea		Garlic Ginger Brinjal Arid fruit Drumstick Aonla Pomegranate Lemon Jivanti Mango Guava Castard apple Ber	
90-120	Pearl millet Minor millet Groundnut Indian bean Maize Sorghum Rice Forage pearl millet	Green gram Clusterbean Udid bean Barley Seasamum Sunflower		
	Deep rooted crops Tobacco Pigeonpea Cotton Castor			
120-150	Seasamum Rice Pigeonpea Tobacco Cotton Castor			
150-180	Cotton Pigeonpea Sorghum Chilly	Tobacco Castor Indian bean		
180-210	Cotton Pigeonpea			
< 210	All <i>kharif</i> crops			
Crop which can be taken by supplementary irrigation				
Chickpea Wheat (Durum) Oilseed Safflower Mustard Barley		Cotton Garlic Cumin Cluster bean (Seed production) Sunhemmp (Seed production) Fenugreek		

he can send his problem through the query form available on the system.

Impact of Soil Health Card Programme (SHCP)

Pre-Deployment Scenario

- Soil analysis data were not available with farmers,

so inadequate use of fertilizers being carried out leading to unnecessary use of fertilizers.

- Proper, efficient and maximum production of crops was not achieved.
- Alternate crops production was not known to the farmers in case of rain fed farming.

Post-Deployment Scenario

- Recommendation of appropriate rate of manure and fertilizer to each crop on the basis of analysis of soil sample obtained from the farmer's field.
- Farmers tend to use only N (urea) or N and P (urea and DAP) and ignore depletion of other nutrients. The soil test based recommendation helped in restoring balanced nutrition to crops.
- Because of tropical conditions, built up of soil organic matter is less in our soils. Further, in dry lands and economically constraint situations, very limited or no manure is added. This has led to depletion of organic carbon in soil so vital for many important physical, chemical and biological properties of soil, which ensure crop productivity. Inclusion of manure rates as a general management practice and through specific Integrated Nutrient Management (INM) practices will help in overcoming the depletion of organic carbon in soil.
- The present SHC programme helps in avoiding excess use of fertilizers and the excess expenditure that goes with it. Use of excess fertilizers can be detrimental for productivity and crop growth.
- The e-data bank will enable the administrators and experts to monitor the changes (depletion/accumulation) of nutrients besides EC and pH. Salinity increases when excess use of canal water or poor quality water is used for irrigation. Similarly continuous use of acid forming fertilizers, occurrence of acid rain in industrial zone or use of acidic effluent water etc. can reduce the pH. The e data bank will help in monitoring such changes.
- The data bank can be used advantageously by the extension workers to locate suitable farm for fertilizer related demonstration programme.
- Attempt is also made to give specific recommendation for specific crop sequence. This will help in increasing fertilizer use efficiency

Lessons learnt from the Project

By the way of holistic approach of Soil Health Card Programme, millions of the farmers of Gujarat state have information available on:

- Soil Fertility

- Soil nutrient status and recommendation for fertilizer requirement
- Reclamation of saline or alkaline soil on the basis of soil analysis
- Integrated nutrient management to enhance productivity of crops
- More return by reducing cost of fertilizers

Spectacular awareness created among the farming community of the state for balance and judicious use of chemical fertilizer and also enhance the use of compost fertilizer, varmi composting and liquid bio-fertilizer which in long run improve the knowledge of farmers towards the plant nutrition as whole.

The programme of Soil health card has been taken on mission mode since 2009-10 involving various agencies/Govt dept like science colleges arranged by Department of Education, APMCs of Gujarat state Agriculture marketing Board and co operation of Government of Gujarat, Sugar co operatives etc.

This programme is the unique example of co-ordinated effort of various departments having different mandates but worked on a common platform to perform their roles individually. It has given wonderful result in the form of providing value added services to farmers. The Department of Agriculture managed over all implementation of programme, under take the task of collection of soil samples from the farmers field and send same to concerned soil testing lab and finally provide technical know how to end-user by the way of educating farmers through demonstration and farmer field school.

Other agencies like science colleges, Sugar co-operatives, Govt boards & co-operatives, Agriculture Produce Marketing Committees (APMC) extend their role by way of providing soil sample analysis facility in their lab, Govt of Gujarat having only 20 Soil Testing Laboratories having annual analysis capacity of 2.0 lakh soil samples. This programme brought the revolutionary change in soil samples analysis capacity, now a days Gujarat State having 13.40 lakhs Soil sample analysis capacity per annum as given in **Table 2**.

Table 2: The soil testing infrastructure in the state

Department / Agency	Total STLs	Annual analysis capacity (No of samples)
Agriculture Department	22	2,20,000
Agriculture Produce Marketing Committee (APMC)	62	6,20,000
Gujarat land development corporation (GLDC)	1	10,000
Gujarat state seed corporation (GSSC)	1	10,000
Sugar co-operatives	16	1,60,000
Science Colleges	32	3,20,000
TOTAL UNIT	134	13,40,000

Further, this Programme also brought few changes in nutrient analysis concept. Before 2009, soil samples were analysed only for five parameters like N, P, K (Major elements) as well as EC and PH. The state Government has added facilities for analysis of secondary nutrients (Ca, Mg, S) and micronutrients (Zn, Fe, Mn, Bo). Now the state is having a capacity to analyse 5.0 lakh soil samples for secondary and micronutrient per annum in 50 micronutrient soil testing laboratories (MSTLs) as shown in **Table 3**.

Table 3: Facility available for micronutrients analysis

Sr. No.	Department / Agency	Total STLs	Annual analysis capacity (No. of soil samples)
1	Agriculture Department	11	1,10,000
2	APMC	13	1,30,000
3	GLDC	1	10,000
4	GSSC	1	10,000
5	Sugar co-operatives	16	1,60,000
6	Science Colleges	8	80,000
TOTAL UNIT		50	5,00,000

This programme generate the employment opportunity at village level for deserving youth who join with activity of collection of soil samples from the farmers fields. These youth are selected on merit basis and they are given training for collection of soil samples, marking of samples and collection of miscellaneous information of farm imparted prior to engage them in this activity. Government of Gujarat has made a provision to outsource the activity of soil sample collection at village level and a provision of Rs. 15 made for collection of one soil sample. In this way this, programme provide immense experience to the department of Agriculture to provide quick, reliable services of soil testing and advisory for plant nutrition to the farmers of the state to increase the agriculture production in sustainable manner applying scientific agriculture practices evolved by state agriculture universities (SAUs) and institution working at national level.

Outcome of the programme on balanced use of fertilisers

The changes in fertilisers (NPK) consumption observed in Gujarat as an impact of Soil Health Card programme are indicated in **Table 5**.

Table 5: Total fertilisers (NPK) consumption and NPK ratio in Gujarat

Year	Nitrogen	Phosphorous	Potash	Total	N : P : K Ratio
2006-07	9.27	3.61	1.20	14.09	7.72:3.01:1.00
2007-08	10.53	4.25	1.46	16.23	7.20:2.91:1.00
2008-09	10.69	4.65	1.82	17.17	5.87:2.55:1.00
2009-10	10.69	4.83	1.87	17.39	5.72:2.58:1.00

The ideal ratio for NPK consumption is 4:2:1. It has been noticed that the NPK consumption Ratio for the year 2006-07 was 7.72 : 3.01 : 1.00 and for year 2009 -10, it was 5.72 : 2.58 : 1.00. Thus, the NPK consumption Ratio is decreased in 2009-10 as compared to previous years. This trend of fertilizer consumption is more or less continuing in the state. Therefore, use of chemical fertilizer constantly heading towards ideal ratio in the state.

Future Road map of the project

This programme has created lot of awareness among farmers for balance and judicious use of fertilizers with the co-ordinated efforts of various Government agencies. Awareness created among farmers of the state through the largest agriculture extension campaign, i. e, krushimahotsav organized every year in the month of April –May where in various advisory on good agricultural practices given to farmers by technical experts and agricultural scientist.

Next phase of the project is to link each and every farmers with Government of Gujarat official web portal i-khedut portal where in farmers can collect (now voluntary) *khatar adhikar patra* (Fertilizer authorization letter) which authorize the farmers to receive precise quantity of fertilizers, from a particular dealer of fertilizer in area, calculated on the basis of soil testing report and scientific crop recommended practices. In this way, each and every farmers will be connected with Government portel and get the assured quantity of fertilizers in days to come. This future plan will ensure farmers for real time available fertilizers and also reduce the risk of unauthorized usage of fertilizer in industrial sector and also reduce the burden of subsidy on the Government of India in long run.

Utility of the programme in other states.

The application of Soil Health Card Programme can be successfully made for the remaining states of our country with a required modification in location specific technology and vernacular language of the respective state.

The Soil Health Card Programme (e-Krishi Kiran) of Anand Agricultural University bagged

several awards and recognition during last 8 years from different organizations. The brief details are given below.

1. The e-Krishi Kiran Programme (Soil Health Card) of Information Technology Center, AAU has won the Special Mention Award for “Best Government to Citizens (G2C) Initiative of the Year” at the eMaharashtra Awards 2013, Mumbai.
2. EDGE 2011 Winner for Soil Health Card - Information Week honors organizations that use IT for maximizing business impact.
3. Bronze Icon Award - The 12th National Award was conferred on Anand Agricultural University for e-Governance (2008-09) by Department of Administrative Reforms and Public Grievances jointly with Department of Information Technology, Government of India, New Delhi, on 12 February 2009 at Goa for its contribution in the area of Outstanding performance in Citizen-Centric Service Delivery.

Conclusion

The IT based soil health management approach to provide balanced nutrition to the crops will greatly strengthen overall development of agriculture. Today, the information reaches to farmers through different sources but now farmers can get all necessary information through Kiosk. This will ultimately encourage scientific agriculture in each village and lead to increase in farmers’ prosperity, sustainable production and eco-friendly environment.

(The author is Vice Chancellor Anand Agricultural University, Anand)

Kurukshetra

FORTHCOMING ISSUE

October 2015

:

Khadi and Rural Employment

GOVERNMENT'S FIRST 15 MONTHS, A GREAT PERIOD FOR RURAL DEVELOPMENT

R. C. Rajamani

With the majority of Indians living in villages, rural welfare is crucial to the overall national progress, development and economic growth. There may have been phenomenal urban growth in the recent decades, but the nation still lives in 600,000 villages.

No wonder successive governments have paid special attention to rural development since Independence. This is one area which has always received bi-partisan support and knows no political divide.

NDA Government's Focus on Rural Development

The new government which took over at the Centre some 15 months ago, has continued the course and also added new dimension to rural development with some brave, new welfare schemes to benefit farmers and rural labour force which normally comes from the socially and economically weaker sections.

The government utilised the two full fledged central budgets it has presented so far to give a forceful thrust to new welfare schemes and also strengthen and improve the old programmes.

The government laid special stress on rural development in its 2014-15 and 2015-16 budgets. In the latest budget, the farm sector received increased allocation.

The overall plan expenditure may look modest but with the implementation of 14th finance commission recommendations, the states get clear 10 per cent more share of central pool of taxes at 42 per cent. This gives them substantial hike in resources that are untied thereby helping them to design and provide more resources in the rural programmes that require more money. The budget also provided significant resources for rural development. Apart from specific allocation of Rs 79,526 crore, several initiatives and allocations for infrastructure, railways and social schemes for poor will benefit rural folks as these investments are going to be for 60 per cent of 1.2 billion population living in rural areas.

As Finance Minister Arun Jaitley noted, conditions have been created for stepping on the pedals for sustainable poverty elimination, job creation and durable double-digit economic growth, which meant more rural prosperity.

Financial transformation through 'Pradhan Mantri Jan Dhan Yojana'

A major development is the success of Jan Dhan Yojana. Through this programme 12.5 crore unbanked families, mostly in rural areas have been brought into the financial mainstream. This has given a solid launching pad to carry out successfully various social programmes. This has led to the launch of game changer JAM Trinity programme – Jan Dhan, Aadhar and Mobile—to implement direct transfer of benefits mostly to rural poor in a leakage-proof, well targeted and cashless manner.

Past experience has shown that leakage has been a bane of social schemes. So much so that welfare schemes have failed to achieve the desired and full results for long decades. JAM will ensure that the rural schemes are more effective, efficient and better targeted. The budget also puts in place a roadmap that aims at double-digit economic growth that is “feasible very soon”. This will immensely benefit rural India. The Dhan Yojana will facilitate financial inclusion that the government is committed to.

Emphasis on Infrastructure Projects

The budget contained a 13-point agenda that is to be implemented by 2022, the 75th year of independence with a sizeable rural component. This comprise a roof for each family in India—that is six crore houses to be built of which 4 crore houses in rural areas with 24-hour power, clean drinking water, a toilet and road connectivity. Electrification of all the remaining 20,000 villages in the country by 2020. Connecting each of 1,78,000 unconnected habitations by all weather roads. This meant completing one lakh km of road currently under construction and building of additional one lakh km of road. Increasing farm productivity through irrigation and other measures.

To bring on par North Eastern and Easter regions, which are at present lagging behind particularly in economic development.

Apart from the large increase in the devolution to states due to the recommendations of 14th finance commission, adequate provision is being made for the schemes for the poor - Rs 68,968 crore to the education sector including mid-day meals, Rs 33,152 crore to the health sector and Rs 79,526 crore for Rural development activities including Mahatma Gandhi National Rural Employment Guarantee programme, Rs 22,407 crore for housing, Rs 10,351 crore for women and child development, Rs 4,173 crore for Water Resources and Namami Ganga (cleaning of the river).

Farm credit is raised to Rs 8.5 lakh crore next fiscal year from Rs 8 lakh crore this financial year.

Mudra Bank: A Game Changer

The budget proposed to create a Micro Units Development Refinance Agency (Mudra) Bank. This is a major attempt to generate employment in rural areas particularly in weaker sections of the society. There are 5.77 crore small business units, mostly individual proprietorship, which run small manufacturing, trading or service businesses. Sixty-two per cent are owned by scheduled castes, scheduled tribes or other backward communities. Mudra bank will have a corpus of Rs 20,000 crore and credit guarantee corpus of Rs 3,000 crore. Mudra bank will refinance micro finance institutions through a Pradhan Mantri Mudra Yojana. These measures will greatly increase the confidence of young, educated or skilled workers, who would now be able to become first generation entrepreneurs; existing small businesses, too, will be able to expand their activities.

Working capital requirement of micro, small and medium enterprises, located substantially in rural areas will also get a boost with the establishment of Electronic Trade Receivables Discounting system soon. This will help in financing of trade receivables of MSMEs, from corporate and other buyers, through multiple financiers. This should improve the liquidity in the MSME sector significantly. To increase access to the formal financial system government proposed to utilise the vast postal network with nearly 1,54,000 points of presence spread across villages of the country.

Impetus on Social Security Schemes

The budget also raised allocation for rural health and social security. To promote Jan Suraksha, Pradhan Mantri Suraksha Bima Yojna has been launched to cover accidental risk of Rs 2 lakh for a premium of just Rs 12 per year. Similarly Atal Pension Yojana, which will provide defined pension, depending on the contribution and its period. Government will contribute 50 per cent of the beneficiaries' premium limited to Rs 1000 each year for five years in the new accounts to be opened in the next nine months.

Government also proposed to create senior citizen welfare fund utilising unclaimed deposits of about Rs 9,000 crore in Public Provident Fund and Employees Provident Fund. The corpus will be utilized to subsidise the premium of vulnerable groups such as old age pensioners, BPL card-holders, small and marginal farmers and others. Details of the scheme will be announced later this month. This social security schemes will largely benefit rural population. Of the 10.5 crore senior citizens in the country, seventy per cent live in rural areas and a large number are in rural areas.

The Budget also allocated Rs one lakh crore allocation to National Bank for Agriculture and Rural development will have positive impact on the rural infrastructure. The long-term credit fund has been provided 15,000 crore in the next financial from Rs 5000 crore in the current financial year. This will help in pushing agro-based rural industries. Rural roads get Rs 25,000 crore allocation.

In his Independence Day speech, the second after he took over, Prime Minister Narendra Modi proudly declared that

17 Crore people opened their bank accounts under Pradhan Mantri Jan Dhan Yojna. With a view to extend opportunities to the poor these bank accounts could be opened with zero balance. He also mentioned the launch of

Prime Minister's Jeevan Jyoti Bima Yojana for 90 paise a day, even less than 1 rupee. So it is Rs. 330 annually for the health of one's family - and for the security of one's family- insurance of 2 lac rupees.

The "Swachh Bharat" will be a tribute to Mahatma Gandhi on his 150th Birth anniversary in 2019 when the nation will hand over to his memory the completion of the Clean India programme.

The Prime Minister also referred to the deficient rainfall during the current monsoon. The farmers need water and electricity. Government has decided to pump in fifty thousand crore rupees in Pradhan Mantri Krishi Sinchaai Yojna.

“How will the water reach the farms? Water will have to be saved. We have to launch a movement in our agricultural sector with the mantra of Save Water, Save Energy, and Save Fertilisers. Hence, Per drop more crop is our watchword; each drop of water can contribute towards producing more crop and hence successful farming.”

To sum up, after it took over power at the Centre in May 2014, the NDA government unveiled a brave, new programme of inclusive economic growth and social welfare. The plan envisages enhanced health, nutrition, basic education, especially of the girl child, women and child development. There is a special scheme for the educational needs of children of the largest minority community – Muslims.

The government has used the two budgets it has presented so far to unveil its economic and social agenda.

Despite a most disruptive monsoon session of parliament, the government used whatever time it got to push legislation for the poor and rural development. It got parliament's approval for additional spending of Rs 40,882 crore to finance MGNREGA, the National Food Security Act and the Integrated Child Development Scheme.

This was done through supplementary demands for grants (General) 2015-16.

The bulk of additional funds will go to ICDS that provides free food to 85 million children. The main health department will see its budget rise by 2 per cent, while the budget to fight HIV/AIDS will see a nominal increase. The HIV prevention programme has been suffering funding shortages in several states.

Government will also provide more resources for flagship schemes such as Atal Pension Yojana and also launch their new variants.

Social security schemes — the Pradhan Mantri Suraksha Bima Yojana (PMSBY), Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY) and Atal Pension Yojana (APY) — were launched in May with the objective of providing universal social security.

So far, 7.84 crore people have registered under PMSBY, 2.70 crore under PMJJBY and 4.69 lakh subscribers have joined APY.

At present, only 11 per cent of the population is covered under pension schemes while only 20 per cent of the people are insured and the government wants to improve the situation by bringing maximum people under these benefits.

Pradhan Mantri Jan Dhan Yojana (PMJDY) has seen opening of 16.73 crore accounts within a year with a total deposits of Rs 19,990.52 crore.

Under the PMJDY the number of zero balance accounts has come down from initial 75 per cent to 52 per cent. As on July 8, 2015 as many as 14.86 crore Rupay cards had been issued under the scheme to account holders. Also 114 claims were made till July 10, 2015 and 54 already settled.

Under the pension scheme, 4.69 lakh people have subscribed and out of that, 3.48 subscribers have already received their Permanent Retirement Account Number (PRAN). A total corpus of Rs 14.91 crore has been accumulated so far under the scheme.

All in all, the first 15 months of the new government have been a great period for rural development.

(The author is a Senior Journalist based in Delhi)

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Shri Narendra Modi
Hon'ble Prime Minister



Ministry of Rural Development
Government of India

Initiatives of Government of India's Ministries of Rural Development, Panchayati Raj, Drinking Water and Sanitation, in Bihar



Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)

- Rs.959.68 crores released to Bihar during 2014-15 and Rs.1,024.12 crores released in 2015-16.
- Five lakh works taken up in the State, with focus on agriculture, soil & water conservation and allied activities.
- 83.6 lakh person days generated during 2015-16, in the state (24.79% person days for Scheduled Castes, and 42.9% person days for women).



Indira Awaas Yojana (IAY)

- Rs.1,034.88 crores released to Bihar in 2014-15 and Rs.1,032.03 crores allocated in 2015-16.
- In 2014-15 and 2015-16, 5.60 lakh Indira Awaas units provided to Bihar.



Pradhan Mantri Gram Sadak Yojana (PMGSY)

- Rs.2,280 crores allocated to Bihar in 2015-16, which is 47% higher than previous year and 160% higher than 2013-14.
- In 2014-15 and 2015-16, a total of 4,697.42 kms of PMGSY roads constructed in the State.

National Social Assistance Programme (NSAP)

- Rs. 918.92 crores released to Bihar in 2014-15 and 2015-16, covering 53 lakh beneficiaries.

Saansad Adarsh Gram Yojana (SAGY)

- 168 Gram Panchayats in Bihar will become Adarsh Grams by 2019.



National Rural Livelihoods Mission (NRLM)

- During 2014-15, about 41,245 SHGs, covering 4,92,670 families, supported by SRLM and 1718 Village Organisations (VOs) promoted.
- 16,689 SHGs received Revolving Fund (RF) and Rs. 25.01 crore has been disbursed.

Land Resources

- 123 projects under Integrated Watershed Management Programme (IWMP), covering an area of 6.12 lakh hectares with an allocation of Rs.840.93 crores sanctioned so far to Bihar.
- Under National Land Records Modernization Programme, Rs.77.32 crores released to Bihar for computerization of Land Records data and Revenue Survey Maps.

Panchayati Raj

- Under 14th Finance Commission 8971 panchayats of Bihar will receive Rs.2269 crores in 2015-16 and Rs. 21,000 crore in five years (2015-16 to 2019-20).

National Rural Drinking Water Programme

- During 2014-15 and first half of 2015-16, a total of Rs.473.07 crores released to Bihar for Rural Water Supply under National Rural Drinking Water Programme (NRDWP). 12236 rural habitations have been covered so far and another 5480 rural habitations will be covered during 2015-16 in Bihar.

Swachh Bharat Mission (GRAMEEN)

- For making the country open defecation free by October, 2019, the Government of India provides technical and financial assistance to the States under Swachh Bharat Mission.
- Rs.361.22 Cr. Of Central share under SBM(G) to Bihar, for providing assistance to households for construction of Individual House Hold Latrines(IHHLs) and also taking up Solid and Liquid Waste Management Projects.
- 2,03,247 individual toilets were constructed during the period from 26th May, 2014 upto 4th August, 2015 in Bihar.

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