

KURUKSHETRA – FEBRUARY 2019 ISSUE

BOOSTING AGRICULTURAL GROWTH

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Chapter 1: Introduction

Agriculture as a source of livelihood is the largest sector of the Indian Economy. In order to accelerate productivity of this sector, it is crucial to focus on the progress of its components such as soil, irrigation, seeds, fertilizers and pesticides, modern farm technology, allied activities like horticulture, floriculture, fisheries, animal husbandry and poultry, value addition through food processing and marketing system.

- The government is committed to **doubling farmers' income by 2022**.
- **Soil Health Card Scheme** has been taken up across the country, with the objective to enable the farmers to improve soil health and its fertility.
- Significant increase in urea production has helped fertilizer distribution. 100% Neem coated Urea has resulted in improved soil quality and prevented diversion of fertilizers for other purposes.
- **Pradhan Mantri Krishi Sinchai Yojana** has been formulated for improving efficiency – 'More crop per drop', extending coverage of irrigation 'Har Khet Ko Pani'
- Various steps have been taken to save farmers' from being exploited in the hands of informal credit sources.
- **Pradhan Mantri Annadata Aay Sanrakshan Abhiyan** (PM-AASHA) provides for a holistic arrangement for assurance of a remunerative price environment for farmers.
- Initiatives like **e-NAM** – Electronic National Agriculture Market has helped facilitate better marketing of agricultural produce.
- Investments have been made in warehousing and cold chain to prevent post-harvest crop losses.
- **Operation Greens** is in place to address the price volatility of perishable items like tomato, potato and onion.
- Focus is also laid on allied agricultural activities like fisheries, aquaculture and animal husbandry to supplement farmers' income.

As a result of various policy initiatives taken by the Government, the country has witnessed record food grain production in 2017-18.

Chapter 2: New Dimensions of Development in Agriculture

Agro-products such as tea, rice, sugar, tobacco and spices contribute significantly in international trade and India exports these products in a big way. The proper development of agriculture sector leads to increase in exports and reduction in imports. As a result, it helps in balance of payments in favour of the country and also save foreign currency. These savings can be utilised in the import of more essential items, raw material, machinery, equipment and other infrastructure related items needed for the country. This accelerates the pace of economic development and strengthens the economy of the country.

Importance of Agricultural Sector:

- Agriculture including crop husbandry, animal husbandry (dairy, poultry, etc.), fisheries, forestry, agro processing, etc., provides the underpinning for our food and livelihood security.
- Agriculture provides significant support for economic growth and social transformation in the country.
- As one of the world's largest agrarian economies, agriculture sector (including allied activities) in India accounted for 14.8% of the GDP (at 2011-12 prices) in 2017-18, compared to 18.9% in 2004-05 and around in 1990-91.
- Its role remains critical as it provides employment to around 50% of the workforce.
- Agriculture and Food Security are among the most important areas for the government of India. Its main objective is to ensure food and nutrition security at cost-effective prices in an environment-friendly way.
- Agriculture sector in India is providing entrepreneurial and employment opportunities to a large number of rural people and youth.
- The Green Revolution and White Revolution in India paved way for self-reliance in food and milk-production.
- Our performance in the fields of horticulture, fisheries and pulses has been exemplary.
- Today, India is at the first place in milk production and contributes 19% of World's total milk production. The income of dairy farmers has increased by more than 30% during the period from 2014 to 2018.

Steps taken by the government:

Doubling Farmers' income:

- Two corpus funds have also been constituted for the period from 2017 to 2020. Namely 'Micro Irrigation Fund' and 'Dairy Processing and Infrastructure Fund'.
- NITI Aayog has also constituted a Working Group to achieve the goal of doubling the income of farmers through new business models.
- As per the recommendations of Prof. M.S Swaminathan (Father of Green Revolution in India), MSP has been announced for different agricultural commodities at one and a half times of the cost price or more.
- Special attention is being given on increasing productivity, reduction in cost of farming and strengthening the post-harvest management and market structure. With these aims, Model Agricultural Produce and Livestock Marketing act 2017 and Model Contract Farming and Services Act 2018 have been enacted.
- National Agricultural Market Scheme has been launched to bring about transparency and improvement in the agricultural marketing sector.
- e-NAM platform facilitates online trading and also issuance of e-permits, e-payments etc. This platform has helped the government take a step forward towards 'One Nation-One Market'.

Shield against crop loss:

- “Pradhan Mantri Fasal Bima Yojana” has been launched to provide a safety shield to farmers against crop losses due to natural calamities. Along with the standing crops, the risks involved before sowing and after harvest have also been included in it. Also, 25% of the loss claims is being paid online, immediately.
- Contingency plans have been provided for all the districts of the country and by enhancing the relief amount, of farmers affected by drought and hail-storms, the interest of the farmers have been given priority.
- Measures have been taken to reduce damage to the fertile soil to the minimum level.
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Mechanisation of Agriculture:

- A new central scheme called “Agricultural Mechanisation Promotion” has been launched with the aim of decreasing the cost of farming, increasing the crop-yield and management of crop-residues. The focus is on in-place management of residues.
- Farmers are being provided 50% of the cost of machinery as financial assistance for the purchase of machinery on personal basis for the management of crop residues.
- Besides, financial assistance is also being provided to State Governments, Agricultural Science Centres, institutions affiliated to Indian Council of Agricultural Research, Central Government Institutions and Public Sector Undertakings for activities related to Information, Education and Communication (IEC).

Blue Revolution:

- Given the abundant capabilities and potential of fishery development, ‘Blue Revolution’ has been announced in the fisheries sector.
- Through Blue Revolution, the resolution to make India the world’s leading nation in the field of fishery development is being focused upon.
- This revolution focuses on increasing fish production through its multi-dimensional activities and aquaculture, inland and sea fishery resources.
- Under the Blue Revolution, a new scheme called “Deep-Sea-Fishing” has also been initiated.

Other measures:

- Organic farming is being promoted under the Paramparagat Krishi Vikas Yojana. The emphasis is on the maximum use of bio-fertilizers, bio-chemicals and bio-pesticides.
- More initiatives have been taken to strengthen the cooperatives.
- Emphasis is also on the integrated farming system. Special attention is given to multi-cropping system, cyclical farming and allied activities such as horticulture, livestock, fishery and bee-keeping.
- The government is also pushing for extension of micro irrigation facilities.
- In order to meet the requirement of edible oils in the country and enhance the production of oilseeds, activities of National Mission on Oilseeds and Oil Palm are underway on large scale.
- Efforts are being made to double the productivity of livestock and to add new dimensions to the White Revolution. Rashtriya Gokul Mission has been launched for conservation and promotion of native breeds of cow and buffalo.
- In order to link breeders of native bovine breeds and farmers, ‘e-pashudhan haat portal’ has been set up.
- A new export policy has been prepared to infuse competitive spirit in Indian agriculture. The interest of farmers has been protected by imposing duty on imports of oilseeds and pulses.
- Due to extensive research in agriculture, 795 new varieties of crops have been released. These varieties have the ability to withstand the effects of climate change.

- Krishi Vigyan Kendras are helping farmers on various issues related to agriculture through training and technological resources.
- For better coordination among agricultural scientists and farmers, programs such as 'Farmer First, Mera Gaon, Mera Gaurav and ARYA' have been started. Attracting and Retaining Youth in Agriculture (ARYA) scheme has proved to be very effective in making the farming an attractive occupation for educated rural youth.



Chapter 3: New Procurement Policy for Enhancing Farmers' Income

It is an annual exercise that the commission for Agricultural Costs and Prices announces the minimum support prices of two dozen of crops, prior to their sowing. Only four crops are being procured by the Government, at those announced prices.

- Wheat and paddy are procured by Food Corporation of India along with the State Agencies to maintain the buffer food stocks at the central level.
- The cotton is procured by Cotton Corporation of India and Sugarcane by the Sugar Mills of the State.
- By 1970, the country that was heavily dependent on food imports, at present, is the top exporter of paddy.
- In 2015-16, it exported 10.50 million tonnes of paddy and surpassed much ahead to the other rice exporting countries like Thailand, Vietnam, Pakistan, U.S.A. and Myanmar. The new high yielding varieties of wheat and paddy were developed by the research Institutes and Agricultural Universities.
- As Paddy and wheat, both require adequate quantity of water for irrigation, so the area under those crops escalated much higher in Punjab, Haryana and U.P. which had abundant water and particularly the ground water on which, 60 per cent of the irrigation was dependent.
- The Punjab and Haryana saw the staggering results in the output of these crops that is why these two states had been contributing about 80 percent in the total food stocks of the country.

New Crop Procurement Policy:

- The new crop procurement policy announced by the Central Government looks as a most prudent policy that would mitigate the uncertainty as well as the fear of volatile and unfavourable prices of those crops.
- In this new Procurement Policy, the government has envisaged the three alternatives.
 - In first, the additional crops would be procured by the Central Government with partnership of the concerned State Government.
 - In second case, the seller of those crops would be paid the balance of M.S.P and the market price by the government, but the farmers would have to register themselves with the regulated market of the area.
 - In the third option, the private traders can procure those products but those traders would have to pay the minimum support prices as announced by the Central Government.
- While analysing the probable impact of these three options, the first one looks as the most prudent and appropriate to enhance the confidence of the farmers because the Government either Central or State, would be responsible to pay the announced minimum support price. Definitely it would have a very favourable impact.
- 'Operation Green' is also now in place to address price volatility and thereby increase farm production.

Way forward:

- Now when the new policy of procurement is announced, some of the high value crops of daily use including vegetables and fruits must be included in the list of state procurement on the basis of the high yielding crops of that area.
- The diversification of crops with the growing of other crops along with the traditional crops would promote the level of employment, adequate and regular use of machinery, proper use of inputs including water and enhancing of income through new policy of assured marketing.
- It has been observed that a few agro-processing units are operating for value addition of agricultural products but availability of raw material is an issue. Such impediments can be removed by encouraging the contract

farming between agro-processing unit and the farmers with the prudent and suitable legal frame work in the state.

- The new procurement policy with the objective of assured marketing must boost the area under high value crops
- Yield of high value crops can be enhanced being the new crops.

The new procurement policy would prove much useful for enhancing the farm income, reducing the imports of pulses and oilseeds, saving of the foreign exchange and moreover for the best utilization of the limited sources for the best interest of the country.



Chapter 4: Institutional Credit for Agriculture

Availability of Credit is the Sine qua non for progress and growth of any sector, particularly agriculture, since most of those who are engaged in this sector belong to marginal and small farmer categories. Availability of timely and affordable credit facilitates the farmer to gain access to quality inputs and other support services. The strategy has, therefore, been to strengthen the role of institutional sources of credit to agriculture so as to replace informal sources of credit such as money lenders.

Investments in Agriculture:

- The increase in production in the country pre-supposes flow of investment, both public and private, for agriculture and allied activities.
- Besides production, such investments also help in increasing agricultural incomes, mitigating poverty and enhancing food security.
- In 2014-15, the private Gross Capital Formation in Agriculture (GCFA) accounted for 83% share, while that of public GCFA was 15%.
- Further, a push in public GCFA was seen to induce higher private GCFA.

Gross Capital Formation in Agriculture is the value of acquisition of new or existing fixed assets by Agriculture and allied sectors.

Role of institutional credit in private GCFA:

- As per AIDIS 2012-13, nearly 86% of the farm capital investment in India is undertaken with institutional/non-institutional sources of funds.
- While the farmers' dependence on borrowings for investment is more than 50% across all States, it is relatively higher and in excess of 90% in developed States like Andhra Pradesh, Kerala, Tamil Nadu, Punjab, Karnataka, Maharashtra and Madhya Pradesh.
- Further, at the all-India level, the share of such borrowings from institutional sources is estimated to be around 63%.
- However, it is also an accepted fact that in most of the States of the country, the marginal and small farmers are more dependent on the informal sources for meeting their credit needs.

Flow of Institutional Credit for Agriculture:

- India had adopted the multi-agency approach to provide rural credit, since nationalization in the late 1960s.
- A large number of formal agencies like the Co-operative Banks, Commercial Banks and the Regional Rural Banks were actively involved in providing bank credit for agriculture and its allied activities.
- Even Non-Banking Financial Institutions [NBFCs], Micro Finance Institutions [MFIs] and Self Help Groups [SHGs] were also involved in providing agricultural credit.

Agricultural Credit Flow vis-a-vis Gol targets:

- In 2004, the Gol had announced a Farm Credit Package for doubling credit to agriculture sector in three years: 2004-07.
- The concerted efforts of all banks resulted in credit flow to agriculture doubling in two years.
- In the subsequent annual budgets, Gol set targets for institutional credit to agriculture to ensure flow of adequate bank funds. Since then, all banks, put together, have been consistently surpassing the targets set by Gol in so far as credit flow to agricultural sector is concerned.

- Since March 2011, the agricultural credit flow has grown at a compound annual growth rate (CAGR) in excess of 14%!
- Quite a few of these investments go towards making permanent improvement in land quality, which will help in improving productivity of crops, which are financed out of ST Crop Loans.
- Further, States that have a high percentage of borrowing from institutional sources are also the States which account for a higher share in flow of agricultural credit.
- The long-term investments in agriculture have definitely contributed to production of various commercial and horticultural crops.

Widening Access to Agricultural Credit:

- There has been a steady and appreciable growth in terms of persons accessing institutional credit, across agencies, except Co-operative Banks.
- The Commercial Banks, as a group, have exhibited phenomenal growth in number of borrowers financed, with a CAGR of nearly 20%.
- Co-operative Banks, which had a greater number of agricultural loan accounts among all agencies until 2012-13, have witnessed a steady fall in their number of agricultural borrowers, while the RRBs have shown a growth of around 10%.
- The fragmentation of land has serious consequences in terms of owning and using modern technology and farm equipment, and also in provision of inputs including agricultural credit and extension as also marketing.
- Providing timely and affordable credit to this resource-constrained group is the key to attaining inclusive growth.
- The good news is that the share of small and marginal farmers in loan accounts as well as credit flow has improved. Loan amount per account has also seen improvement, across all categories of farm holdings. It means that there has been both widening (more people getting credit) and deepening (same people getting more credit) of institutional credit flow for agriculture, in recent years.

Progress so far:

- Over the last so many years, key indicators like agricultural land use, area under cultivation and production of various crops, production and use of agricultural inputs, all have shown an impressive growth, contributing to increase in production of food grains and flow of Institutional credit.
- However, while our Net Sown Area[NSA], which was about 123 million hectares [mha] in 1950-51, increased to around 140ha during 1970-71 after the Green Revolution campaign, the NSA has remained almost stable thereafter, as competing pressures on land did not allow any new land to be brought under cultivation.
- Our Gross Cropped Area (GCA) which was only 138 mha in the early 1950s steadily increased to about 185 mha by 1991, and has reached around 198 mha in the last few years. About 58 mha are multiple-cropped now, primarily due to availability of public or private irrigation.
- However, even if all irrigation sources are fully developed, almost half the cultivated land will remain unirrigated and will have to depend on the monsoons. Further increase in production will therefore, come from improved productivity.
- The productivity issues can be improved by ensuring better irrigation - through public or privately owned modes, better use of farm equipments, and timely availability and use of better seeds, fertilisers (bio or chemical) and other inputs.
- Availability and use of all these would depend a lot on availability of timely agricultural credit, extension services, better models of credit delivery and the like.

- In order to realise the Vision of Govt to double the farmers' income by 2022, many new initiatives have been taken up and are being implemented by the Govt. of India, RBI, NABARD and the various stakeholders in this regard.
 - The Kisan Credit Card [KCC] Scheme was envisaged to provide easy and hassle-free credit to the farmer. With the launch of RuPay, KCC has become more cost-effective.
 - Policy enablers in the form of interest subvention on crop loans and credit-linked capital subsidy schemes have also contributed in providing a fillip to agricultural financing by banks.
 - Financing to Self Help Groups and Joint Liability Groups [JLGs] are attempts to leverage on group collateral to provide credit to rural poor women and small and marginal farmers.
 - Volunteers of Farmers' Clubs are encouraged to form JLGs for accessing institutional credit.
- The Union Budget 2018-19 also provides special focus for marketing of agricultural produce through electronically-linked **Gram** in agricultural markets.
- Riding on the achievements thus far, the Budget also envisages enhanced flow of institutional credit for agriculture.

The Way Forward:

- Cooperative farming, collective farming, Farmer Producers Organizations [FPOs], JLGs, leasing out land or contract farming are some possible ways of aggregation, both for input supplies to reduce costs as also for marketing to ensure better prices.
- Recent amendments to the Priority Sector guidelines by the RBI - providing for specific sub-targets in flow of credit to Small Farmers/Marginal Farmers is also a welcome step.
- Financial products aimed at supporting more climate resilient and adaptive farming practices, is the need of the hour.
- Credit flow for agro processing Units, storage facilities, marketing infrastructure, etc., will facilitate in providing last-mile connect to enhance post-harvest value of agricultural produce.
- Simple insurance products that provides for hassle-free cover will also help improve resilience of the average Indian farmer and make agriculture a risk worth taking.
- A robust Negotiable Warehouse Receipt [NWR] system will enable farmers to monetize their produce early and avoid distress sale.

Higher investments in agricultural infrastructure from out of the dedicated Long Term Irrigation Fund [LTIF] and the Rural Infrastructure Development Fund [RIDF] will further boost credit flow to this sector, thereby ensuring realization of the mission to double

- The need is to further speed up the pace of change. That will help in realizing the desired outcomes faster, and in full measure.

Chapter 5: New Initiatives in Research and Extension

Research and extension are among the core activities identified for accelerating agricultural growth and prosperity of farmers. National Academy of Agricultural Sciences observed, 'Investment In agricultural research in India has been a Win-Win option as it was the largest Contributor to the agricultural total factor productivity, which in turn significantly contributed to reducing rural and urban Poverty.

- During 1980- 81 to 2006-07, the average internal rate of return to the investment in agricultural research was about 46%, which is comparable to that obtained internationally.
- After the globally acclaimed green revolution during 1960s, science-led synergistic extension approach led the agricultural sector towards white, blue, golden and pink revolutions.

Initiatives:

- To address the core concern of productivity in Indian farming, research efforts were focused on development of new varieties that give higher yield and show resistance/tolerance to pest and diseases.
 - ICAR has developed and released a total of 795 new crop varieties during last four years and 136 varieties of horticultural crops that could increase the yield upto 45%.
 - Specialized varieties, with specific attribute such as wheat variety HO CSW-18, is the first variety specifically bred for conservation agriculture.
 - Similarly, to boost up production of pulses, an extra- early (52-55 days) high-protein variety of Mung bean, called Virat, was released along with short duration (100 days) and iron rich variety of Lentil (Pusa Ageti Masoor).
- Considering the high cost of seeds of Bt cotton hybrids, eight GM Bt cotton varieties were developed for the first time in India for commercial cultivation.
 - These varieties are tolerant to devastating cotton bollworm and its seeds can be used by farmers for 2-3 years in contrast to Bt cotton hybrids in which costly seeds have to be purchased every year.
- Waging a war against malnutrition through agricultural research, an array of bio fortified varieties of field crops and horticultural crops have been developed.

Improved Livestock for Livelihood security:

Livestock (including poultry and fisheries) play a central role in livelihood of farmers by assuring additional income with low investment, and also an 'insurance' against climatic distress. Hence, breeds of popular livestock species were developed through systematic research mainly for higher production.

- 4 backyard poultry varieties were developed and released having more than double the egg production as compared to native/local breeds (50-70 eggs/annum).
- "Jharsim" poultry bird released for Jharkhand and Bihar has a capacity of producing 120-130 eggs per annum; 'Narmada Nidhi' for Madhya Pradesh (180 eggs/annum), 'Kamrupa' (118- 130 eggs/annum) for Assam and 'Himsamridhi' for Himachal Pradesh (140-150 eggs/annum) are other poultry varieties showing promise in their respective region.
- A new advanced breed of sheep 'Abhishan' has been developed for dry areas of the country which has shown the promise of raising the income of sheep farmers.
- Nine improved cross bred varieties of pig were developed and released for north-east and south region where pig farming is popular and a remunerative enterprise for farmers.
- To improve livestock health, an ambitious research program to develop indigenous vaccines and diagnostic kits was launched in ICAR institutes.

- Vaccines developed against sheep pox, equine influenza, classical swine fever and Johne's disease have been found effective against respective diseases.
- Diagnostic kits developed for Japanese Encephalitis, Brucellosis, FMD and Avian influenza are performing with equal accuracy as that of their imported counterparts, but at a much lower cost.
- In fisheries sector, the technology of marine cage culture of high-value fishes is proving a game-changer technology in coastal regions.
- Research has also propelled India into an era of new-generation fishing vessels that are fuel-efficient, multi-purpose and cost-effective. State-of-art fishing vessel has been commissioned and is being used for trawling, gill-netting and long-lining, Innovative fishing crafts and gears have been developed to increase efficiency and output.
- Green mussel and green algae extract for pain and arthritis; seaweed anti diabetic extract for type-2 diabetes; seaweed anti-obesity extract to combat obesity/dyslipidaemia; and seaweed nutraceutical drink for enhancing micronutrients level are some of the popular green remedies gaining ground in pharma sector.

Integrated Farming for Improved Income:

IFS involves synergic blending of crops, horticulture, dairy, fisheries, poultry etc. to optimize use of by-products, residues and wastes generated in each system in compatible and sustainable manner.

- Integrated farming system (IFS) approach has become a core research activity due to its potential to increase farmers' income and site-specific employment to small land holders
- It cuts-down cultivation cost through multiple use of resources and provides desired resilience to climate change scenario.
- Integrated rice- fish-poultry farming system and rice-fish-vegetable model have successfully increased net income of farmers in southern and east region respectively.
- Scientists have also developed a unique system where farmers can grow three different vegetables on the same piece of land at a time. Called 'three tier' system, this intervention has made a big impact in and around Vaishali district of Bihar, and is gaining popularity in north Bengal and north-east region.
- Development of agri-voltaic system for fields is a breakthrough research, where electricity is generated by installing solar PV modules in fields and crops are cultivated in inter space area.
 - Rain water is also harvested from top surface of PV modules.
 - Annual income from PV generated electricity is estimated as Rs. 7 lakh per hectare in addition to income from field crops.
 - Rainwater harvested from PV modules can be used as supplemental irrigation to crops.

Conclusion:

- A unique "FARMER first' scheme is an enriching Farmers-scientists interface through which scientists are working with more than 48,000 farm families to increase their income.
- An effective alliance between agricultural research and extension is paving way for higher agricultural growth and prosperity of farmers.
- On-farm trials and front-line demonstrations of latest technologies are Convincing farmers to adopt new package of practices in their fields.
- Analysis of soil nutrient status and water samples at field level is helping farmers to achieve nutrient efficiency and water use efficiency.
- However, a strong extension support is imperative to disseminate emerging technologies at grass root level for quick adoption and practice.

- The interface between research and technology transfer is indeed very critical for converting research outputs into farming outcomes.

TID-BITS

ICAR-Driver of Agricultural Research and Extension in India

- The Indian Council of Agricultural Research (ICAR) was established in 1929.
- It is dedicatedly serving the nation as an apex body of agricultural research, education and extension under Ministry of Agriculture and Farmers' Welfar.
- ICAR has successfully harnessed the power of science, technology and innovation for food security, farmer's prosperity and has catalysed sustainable growth in agriculture sector.
- Scientific interventions developed by ICAR have enabled the country to increase the production of food grains, horticultural crops, fish, milk and eggs.
- With 101 national level research institutes, national research centres, national bureau, directorates/ project directorates; 60 All India Co-ordinated Research Projects; 19 Network Projects; and 71 Agricultural Universities spread across the country, ICAR is one of the largest national agricultural systems in the world.
- Mandate of ICAR is comprehensive and vast, dealing with agriculture and food spanning across crops, natural resources, livestock and fisheries.
- Indian farmers, livestock owners, fishers and village-based entrepreneurs are its main client and benefactor, hence, ICAR has adopted the 'farmer first' approach which is part of its motto also.
- On the extension front, ICAR operates an innovative and robust system through its 692 Krishi Vigyan Kendras (Farm Science Centres) located in every nook and corner of the country.
 - KVKs provide last mile Connectivity to farmers and minimize the time lag between technology generation and adoption.
- With Concerted and dedicated efforts, ICAR has evolved a number of innovative pathways for disseminating breakthroughs in technology to farmers and agripreneurs.
- ICAR is leading the nation towards attaining sustainable food, nutritional and livelihood security through agriculture research and extension.

Chapter 6: Micro-Irrigation for Agricultural Growth

India accommodates more than 17% of world's population, but the country has only 4% water resources and 2.5% land resources of the world. There is a huge demand-supply gap to meet the water requirements of various sectors. The highest water demand is from irrigation, a critical input for agriculture production and its current demand in the country is around 80%. Since the demand from agriculture sector and other sectors are ever increasing and it is difficult to identify additional sources of water. Demand management is the most appropriate strategy to manage the scarce resources and according to National Water Policy (2012) by Ministry of Water Resources.

Micro Irrigation:

- Micro irrigation is an innovative water saving technology in which water is directly supplied to the crops with very less conveyance and evaporation losses.
- Micro-irrigation is considered as a prudent irrigation technology promoted nationally and internationally to achieve higher cropping intensity and irrigation intensity through more focussed application of water to crops.
- Different types of systems are drip irrigation, sprinkler irrigation, micro Sprinkler, porous pipe system, rain gun etc., where drip irrigation and sprinkler irrigation dominate among all these systems.
- The major crops cultivated under drip irrigation are sugarcane, banana, Cotton, lemon, grapes, oranges, mangoes and wide variety of vegetables.
- Sprinkler irrigation is mainly used for groundnut, wheat, millet, sorghum, mustard etc.

Benefits of Micro Irrigation:

The major advantage of this technology compared to traditional surface flooding method is that micro irrigation reduces non-beneficial evaporation and non-recoverable percolation of water. The other benefits are:

- Increase In water use efficiency:** Micro irrigation helps in significant reduction of water conveyance losses, runoff, evaporation losses, and seepage & deep percolation losses. This ensures higher water use efficiency up to 50-90%.
- Energy Efficiency:** Micro irrigation requires minimum pressure and low flow rate only. Hence, this ensures energy consumption savings. Since this system requires very low pressure, off-grid farmers can use solar pumps or diesel pumps.
- Fertilizer Use Efficiency:** Proper mixing of fertilizers and water, control of optimum dosage and direct application of fertilizers to the root zone result in the saving in fertilizer consumption.
- Productivity increase:** The crop yield (quantity and quality) is increased and the enhancement in productivity is estimated for fruits / crops and vegetables. This ensures good economic return for the better yields.
- Irrigation cost saving:** This technology reduces the overall cost of irrigation due to decrease in labour requirement for irrigation, weeding and fertilizer.
- New crop Introduction:** Farmers can judiciously add more new crops due to improved water scenario. Farmers have tried Intercropping and crop rotation.
- Increase in farmers' income:** More focussed and judicious use of water & nutrients result in good quality produce and increase in farmers' income. Moreover, the reduction in spacing between the plants can accommodate more number of plants.
- Other benefits:** There are many other benefits of micro irrigation adoption.
 - Mixing of nutrients & water is possible in the drip irrigation system itself and the solution can be directly supplied to the root zone of the plants. Water and fertilizer application efficiency are improved significantly.
 - This has a long term impact to regain land fertility and ultimately increase in land productivity.

- Farmers are motivated to use this technology due to various reasons. Pre-monsoon cultivation and early harvest are possible. Hence, the crop will not be affected even if the monsoon withdraws early or an insufficient monsoon.
- Micro irrigation leads to substantial increase in farm income, larger area of cultivation, low cost of cultivation especially irrigation cost and weeding cost, increased yield of produce, enhanced quality of crops with optimum water use efficiency.
- It is possible to control water application rate and fertilizer application dosage.
- Farmers can judiciously adopt the cropping pattern and crop intensity due to improved water availability situation.
- High valued cash crops can be cultivated easily.

Technology Promotion

- Micro-irrigation is suitably applied to irrigated agriculture of water scarce regions of developing countries.
- Government has initiated micro irrigation in the Tenth Five Year Plan (2002-2007), since then, keen initiatives are being taken by the Government, to promote and propagate this new technology.
- Micro-irrigation has been given special importance In Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) with the aim of extending irrigation cover ('Har Khet Ko Pani') and Improving water use efficiency ('Per Drop More Crop') to improve various water development and management activities.
- Gujarat is one of the high performing states In India and this State has established 'Gujarat Green Revolution Company (GGRC) Limited' in 2005 for successful implementation of Government schemes for micro-irrigation.
- Small and marginal farmers in India are entitled to get a subsidy up to 55% of the total cost of the system and the same for other farmers up to 45%.
- Tribal farmers and farmers from dark zone areas are given additional benefits. Region wise benefits are also available.
- Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), considers micro irrigation as its integral part due to enhanced water productivity and water use efficiency through its proximity and focussed water application.

Effective Implementation of Technology:

- Some reports state that micro Irrigation programme Implementation is facing some problems. Energy crisis due to power outages and unscheduled interruptions across rural and urban India.
 - This problem may be solved by integrated drip irrigation with solar panel system which is considered as the best option for off-grid farmers.
- Most of the adopters are wealthier farmers and poor farmers cannot afford it.
 - This problem is resolved by inventing low cost systems by different agencies.
- The major disadvantage of solar panel enabled micro irrigation system is that farmers have to schedule irrigation during sunshine hours only, which otherwise they would be using the time for other productive works.
 - However, this problem may be solved by constructing large storage tanks and connecting with the system.
 - Also, some of the grid connected farmers are getting electricity alternatively one week during day time and the following week during night time.

Conclusion:

Total water demand from agriculture sector is around 80%, any effort for saving irrigation water will contribute to water use efficiency. Various research studies show that micro-irrigation is economically viable. In addition to this, use of solar panels for working of pumps will be more helpful to farmers. More focussed and judicious use of water will

result in increase in farmers' income. Hence, micro-irrigation has been considered as an innovative technology to accelerate sustainable agricultural growth.



Chapter 7: Streamlining Storage and Marketing

The Government is focussing on efficient functioning of agriculture sector both in terms of its productivity and marketing. While productivity, storage and transportation are supply side factors, markets provide an intermediate link between producers and final consumers. Efficient functioning of market provides welfare of producers as well as consumers. Better storage and transportation facilities for agricultural products can add to the productivity of farm resources thus making domestic agricultural sector more competitive in international markets. The challenges posed by present and future global food supply will continue to push the agro & food sector towards technological innovations and interventions. At the same time, new technological developments in agro-sector also pose new challenges. Therefore, the focus is mainly on technological developments in agriculture sector, which in turn are assessed within the context of social, economic and political developments around the globe.

- Storage and proper transportation is the most important aspect of food Supply chain that ensures food security and round-the-year quality food supply of a country.
- According to World Bank Report, the food grains and perishables which are wasted due to improper storage could be sufficient to feed the one-third of world's poor population.
- Storage conditions, environmental factors, gas composition, management practices etc. affect the shelf life and quality of agricultural produce to a great extent.

Strengthening Cold Storage/Warehousing:

- Cold storage technology is an integral part of post-harvest management of many fruits, vegetables and processed products.
- Timely storage of perishable commodities in required temperature makes their supply continuous.
- Lack of cold storage space, is one of the major reasons behind higher post-harvest losses of fruits and vegetables in India which reach up to 25 to 40 % of the total production on an annual basis.
- Shortage of adequate storage space with associated infrastructure and transportation facilities, are very common at the time of harvest for many edible commodities.
- At present, 6227 cold stores are available in India with a storage capacity up to 3000 million tonnes
- Government has invested Rs 45,000 crore for creation of warehousing facilities across the country between 2018 and 2020.
- Two prominent changes that have created a significant growth prospects in warehousing are the implementation of GST in India and creating a unified taxation, and the rapid growth of e-commerce necessitating building of large scale warehousing across various locations.

Agricultural Marketing in India:

- Agricultural Marketing is a process that starts with a decision to produce a saleable farm commodity, and involves all aspects of market system (functional and institutional), based on technical and economic considerations. It includes pre and post-harvest operations, assembling, grading, storage, transportation and distribution or marketing.
- Besides the physical and facilitating functions of transferring the goods from producers to consumers, the marketing system also performs the function of discovering the prices at different stages of marketing and transmitting the price signals in the marketing chain.

Agriculture Marketing in India promotes the efficient use of resources in the production and distribution systems. Therefore, agricultural market policies are treated as an integral part of development policies and their functioning has remained an important part of public policy in India.

Government Initiatives for improving Agricultural Marketing:

- Policy interventions in agricultural markets in India till the mid-1960s was mainly meant to facilitate the smooth functioning of markets and to check on hoarding activities that were considered unfriendly to producers and/or consumers.
- Consequently, the country has adopted a package of direct and indirect interventions in agricultural markets and prices.
- Initially targeted at procuring and distributing wheat and paddy, it has gradually expanded to cover a number of other crops/products and aspects of domestic trade in agriculture.
- The present policy framework for intervention in agricultural markets and prices can be broadly grouped under three categories— Regulatory measures; Market infrastructure and institutions; and Agricultural price policy.
- Regulatory measures include development and regulation of wholesale markets in India; and, adoption of legal instruments for regulation Of agriculture marketing and trade.

Agriculture Produce Marketing Committee Regulation (APMC) Act:

- All the wholesale markets for agricultural produce that have adopted the Agricultural Produce Market Regulation Act (APMRA) are termed as "regulated markets".
- All the states of India have enacted APMC Act except for Kerala, J&K and Manipur.
- The Act mandates that the sale or purchase of agricultural commodities, notified under the Act, is to be carried out in specified market areas, yards or sub-yards.
- These markets are required to have the proper infrastructure for sale of farmers' produce.
- Prices in regulated markets are to be determined by open auction, conducted in a transparent manner in the presence of an official of the market committee.
- Market charges for various agencies, such as commissions for commission agents, statutory charges such as market fees and taxes and produce- handling charges, such as for cleaning of produce, loading and unloading, are clearly defined, and no other deduction can be made from the sale proceeds of farmers.

The Advantages of APMC Act:

- Removal of several malpractices and imperfections from agricultural markets.
- Creation of transparent marketing conditions.
- Ensuring a fair price to the farmers to sell their produce.
- With improving the market functioning, the Act also has created an environment that has freed producers/sellers from exploitation by traders and mercantile capital and in turn has enhanced the income of farmers.
- As per the needs of the prevailing situations, the Inter-Ministerial Task Force on Agricultural Marketing Reforms (2002) recommended that the APMC Acts be amended to allow for direct marketing and the establishment of agricultural markets in the private and cooperative sectors.
 - The rationale behind direct marketing is that farmers should have the option to sell their produce directly to agri-business firms, such as processors or bulk buyers, at a lower transaction cost and in the quality/form required by the buyers.
 - On the recommendation of the committee, the government had come up with a Model APMC Act in 2003.

Model APMC Act, 2003:

- Under the model APMC Act, the private sector and cooperatives can be licensed to set up markets.

- This act also has provision for contract farming and direct marketing by the private players.
- Except for few states, all the States and UTs have either fully or partly adopted the model APMC Act.
- As a result of model act, the proportion of private trade and contract farming had increased manifold in some part of the country which benefited the both private sector as well as farmers.

E-NAM-An Electronic Portal for Agriculture Marketing:

- National Agriculture Market or e-NAM is an electronic trading portal which networks the existing Agricultural Produce Market Committees (APMC) mandis to create a unified national market for agricultural commodities.
- Small Farmers Agri-business Consortium (SFAC) is the leading agency for implementation of e-NAM under the guidance of Ministry of Agriculture and Farmers' Welfare.

Paramparagat Krishi Vikas Yojana (PKVY):

- The Paramparagat Krishi Vikas Yojana (PKVY) was launched in April, 2015 as an elaborated component of Soil Health Management (SHM) under the Centrally Sponsored Scheme, National Mission on Sustainable Agriculture (NMSA).
- PKVY aims at supporting and promoting organic farming through adoption of organic village by cluster approach and PGS (Participatory Guarantee System) certification.
- This scheme encourages the farmers to adopt eco-friendly concept of cultivation and reduce their dependence on fertilizers and agricultural chemicals.
- Funding pattern under the scheme is in the ratio of 60:40 by the Central and State Governments respectively.
- In case of North Eastern and Himalayan States, Central Assistance is provided in the ratio of 90:10 (Centre: State), for Union Territories, the central assistance is 100%.
- The scheme envisages the promotion of commercial organic production through certified organic farming which provides more income to the farmers.
- The cultivated produce under organic farming will be pesticide free and will contribute to improve the consumer's health.
- It will raise farmer's income and create potential market for traders and also motivate the farmers for natural resource mobilization for input production.
- It will increase domestic production and certification of organic produce by involving farmers.

Conclusion:

The electronic National Agriculture Market initiative has so far linked 585 regulated mandis. Further, a Model APMC Act 2017 has been circulated to all the states for improving marketing system in the agriculture sector. Paramparagat Krishi Vikas Yojana motivates the farmers to take up organic farming. A Model Act for promoting contract farming is also being worked out. The main purpose of implementation of these schemes is to give extensive strategic growth in agriculture sector for doubling the farmers' income by 2022.

Chapter 8 - Boosting Agriculture through Agri-Business

Government has initiated a number of measures not only to augment the income of farmers, but also to put agriculture on sound footing in the country. Farmers and other stakeholders involved in agri-business activities need to be made aware about these initiatives. Further, effective convergence in between and among various programmes may also be operationalized in a time bound manner. Among others, two important programmes are Mahatma Gandhi National Employment Guarantee Scheme and National Rural Livelihood Mission so that efforts of different programmes are optimized.

Agri-business:

- Agribusiness sector involves four different sub-sectors.
- These are: i) Agricultural inputs; ii) Agricultural production; iii) Agro-processing; and iv) Marketing and Trade.
- Put above four together, it may be said that agribusiness covers crop production, distribution, agrichemicals, fodder, breeding, farm equipments, seed supply, raw and processed commodities of food and fibre, storage, transportation, packing, soil testing, marketing, retail sales, and more.

Government efforts to Promote Agri-business;

Following efforts have been made by the Government to promote agribusiness in the country in order to fulfill the goal of doubling income of farmers.

- i) The Indian Council of Agricultural Research (ICAR) has taken a lead to initiate a network of 25 Agri-business Incubation (ABI) centers in different states of the country under the National Agriculture Innovation Fund (NAIF) Scheme. These ABIs act as an effective platform for fostering the growth of sustainable business endeavour and nurturing the techno-entrepreneurs.
 - The ABI centers provide a wide range of services such as research support; business planning; office space; access to information and communication technologies; and advice on management, marketing, technical, legal, and financial issues.
 - Following are the technologies available for the Start-Ups, Entrepreneurs and Innovators:
 - a. 1. Eco-friendly preparation of absorbent cotton for medical & hygiene products, which are Antimicrobial and provide UV protection.
 - b. 2. Water repellency Nano-finishing Technologies for Cotton Textiles.
 - c. 3. Cotton rich blends for functional textile applications.
 - d. 4. Innovative Finishing processes for garments & home textiles: Mosquito repellent, pesticide protection cloths & denim.
 - e. 5. Software module for non-metameric color matching in textiles.
 - f. 6. Central Institute for Research on Cotton Technology (CIRCOT) Calibration Cotton for global outreach.
 - g. 7. Sustainable business model for cotton at village level:
 - i.
 - h. 8. Microbial Degossypolisation of cottonseed meal for poultry, fish & piggery sectors
 - i. 9. Enhancing farmers and other stakeholders income by Cotton value chain through startup & entrepreneurship development.
 - j. 10. Cotton Trading based on Quality Parameters for better price & remuneration to Farmers.
- ii) Realising the importance of agri-business and motivating youth towards agriculture, a programme entitled "Attracting and Retaining Youth in Agriculture" (ARYA) was started
- iii) In order to give more focus on the engagement Of youth in agricultural activities, another Student Rural programme named as Entrepreneurship Awareness Development Yojana (READY) programme was started in 2015-16. Student READY is an essential course module for the award of degree at Bachelors level to

ensure hands on training and practical experience depending on the requirements of respective discipline in agricultural Universities.

- iv) Several concrete initiatives have been started by the Government to link the farmers with the markets with the purpose to help the farmers in trading of their food grain.
- v) Mega Food Park and Cold Chain schemes for setting up of food processing infrastructure have been in operation since 2008. Now under 'Pradhan Mantri Kisan Sampada Yojana (PMKSY) promotion, modernisation and capacity enhancement of food processing industries in the country has been initiated. It has seven planks namely (i) Mega Food Parks (ii) Integrated Cold Chain and Value Addition Infrastructure (iii) Infrastructure for Agro-processing Clusters (iv) Creation of Backward and Forward Linkages (v) Creation/ Expansion of Food Processing & Preservation Capacities, (vi) Food Safety and Quality Assurance Infrastructure and (vii) Human Resources and Institutions.

Conclusion:

It is clear from above that Government has initiated a number of measures not only to augment the income of farmers, but also to put agriculture on a sound footing in the country. Farmers and other stakeholders involved in agri-business activities need to be made aware about these initiatives. Further, effective convergence between and among various programmes may also be operationalised in a time bound manner. Proper leadership at grassroots level with adequate trained manpower is also required.

TID BITS:

- A rural toilet pan is the central design theme of Sanitation Park set up within the campus of the Collectorate of Siwan district in Bihar.
- Seeing it on regular basis by passersby and those who visit the park from other villages would help them associate the toilet pan as a tool for hygiene and sanitation and not something that is unclean and impure.
- People who visit the park look at toilet pan in a positive way.
- The DDC has also informed that at special events held in the district, guests are given toilet pan shaped potted plants, and people have taken it positively.

Chapter 9: Irrigation: Key Inputs for Agriculture

Increase in agricultural production and productivity depends a lot on the availability of water, and so irrigation plays an important role in this regard. It has been corroborated by various studies that irrigation facility makes significant difference in crop output. According to the Food and Agriculture Organization of the United Nations (FAO), the highest yields that can be obtained from irrigation are more than double the highest yields that can be obtained from rainfed agriculture. Irrigation significantly increases crop output for various reasons.

- Irrigation facility encourages the farmers to use better varieties and other bio-chemical technologies which obviously lead to increased productivity.
- The cropping pattern followed in the irrigated area is superior to that of un-irrigated area and therefore, the output of crop is invariably higher under irrigated land.
- Irrigation facility allows the farmers to use the land more intensively throughout the year with higher level of cropping intensity, which is not possible under un-irrigated land.
- The risk in getting the assured output from the crops cultivated due to moisture stress is very high under un-irrigated land while it is much less in irrigated land. Importantly, given the highly inelastic supply of land and reduced net sown area, the future growth of agriculture will have to heavily rely on irrigation facility as it allows for multiple cropping on the same piece of land.

Challenges:

- India is a water-stressed country where more than 50% of agriculture depends on rainfall.
- But for most parts of India, the rainy season is restricted to only four months of monsoon.
- Even during monsoon, insufficient or irregular rain is not uncommon.
- This high variability and inadequacy of rainfall makes irrigation a decisive factor for Indian agriculture.

To address the challenges, the Government has recently taken several steps to provide improved access to irrigation and to enhance water efficiency, primarily through an umbrella scheme—Pradhan Mantri Krishi Sinchayee Yojana (PMKSY).

- PMKSY has been operationalized from 1st July, 2015 with the objective of enhancing irrigation coverage and improving the delivery system at farm level.
- The major objective of the PMKSY is to achieve convergence of investments in irrigation at the field level, expand cultivable area under assured irrigation, improve on-farm water use efficiency to reduce wastage of water, enhance the adoption of precision-irrigation and other water saving technologies, enhance recharge of aquifers and introduce sustainable water conservation practices by exploring the feasibility of reusing treated municipal based water for peri-urban agriculture and attract greater private investment in precision irrigation system, thus bringing much desired rural prosperity
- PMKSY has four components:
 - l. a. Accelerated Irrigation Benefit Programme (AIBP) & Command Area Development & Water Management (CADWM): To focus on faster completion of on-going Major and Medium Irrigation including National Projects.
 - m. b. Har Khet Ko Pani (HKKP): Creation of new water sources through minor irrigation (both surface and ground water); repair, restoration and renovation of traditional water bodies; command area development; strengthening and creation of distribution network from sources to the farm etc.
 - n. c. Per Drop More Crop (PDMC): Precision irrigation systems, efficient water conveyance & application, micro level storage structures, topping up of input cost beyond Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) permissible limits, secondary storage, water lifting devices, extension activities, coordination & management etc.

- o. d. Watershed Development (WD): Ridge area treatment, drainage line treatment, soil and moisture conservation, rainwater harvesting and other watershed interventions.

Maharashtra benefits most under the programme with selection 26 of its irrigation projects, to be completed on priority basis. The impact of irrigation development on crop output cannot take place instantaneously because of the time lag involved for making adjustments to the factors of production. However, this is a well-documented fact that irrigation is one of the critical inputs to improve productivity in agriculture sector along with seeds, fertilizers, credit and mechanization. So, irrigation and water use efficiency schemes discussed above are bound to reflect in increased crop production.

