



State of Indian Agriculture

2017



Government of India
Ministry of Agriculture & Farmers Welfare
Department of Agriculture, Cooperation & Farmers Welfare
Directorate of Economics & Statistics
New Delhi

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सत्यमेव जयते

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PREFACE

The performance of agriculture and allied sector continues to be critical for India's growth story as it ensures food security to about 1.3 billion people, engages more than 50% of the workforce and makes a contribution of about 17% to the country's Gross Value Added (GVA). The sector, however, encounters a complex and often contradictory dynamics as evident in increasing agricultural production and a persistent agrarian distress in different parts of the country. Major issues responsible for this situation continue to be increasing soil fatigue, low productivity, frequent climatic variations, fragmentation of land holdings and inadequate marketing and other supporting infrastructure.

Against this background, the recent initiatives taken by the Government are an attempt to shift from the business-as-usual approach to farm profitability approach which goes beyond merely achieving the targeted production. The measures being taken by the Government are focused at improving net returns to the farmers by enabling them to realize higher yields at lower cost and benefit from better market prices. New and innovative techniques of farming are also being extensively promoted alongwith emphasis on better institutional and organizational support to farmers' welfare.

This edition of the 'State of Indian Agriculture' provides a comprehensive analysis of the recent performance of the agriculture and allied sectors in India and also analyze the major emerging challenges. The Report brings out development strategies being adopted by the Department of Agriculture, Cooperation & Farmers Welfare and all agriculture related Departments and Ministries. I would like to thank all the contributing Departments and organizations for their cooperation.

I would like to compliment Shri P.C. Bodh, Adviser and his team specifically Ms. Swati Singla, Assistant Economic Adviser, Ms. Nitika Pant, Former Assistant Director and Shri Ashutosh Sharma, Economic Officer, Directorate of Economics & Statistics for their endeavour in bringing out this voluminous work.

I am sure this Report will be appreciated by policy makers, academicians, research organizations, agri-business community and all other stakeholders.


(S.K. Pattanayak)

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Table of Abbreviations

AAGR	Average Annual Growth Rate
AAP	Annual Action Plan
AAV	Antyodaya Anna Yojana
ACABC	Agri-Clinics and Agri-Business Centres Scheme
ADRTC	Agricultural Development and Rural Transformation Centre
AE	Advance Estimates
AERC	Agro-Economic Research Centres
AERU	Agro-Economic Research Units
AFDP	Accelerated Fodder Development Programme
AFMA	Agriculture and Food Marketing Association
AGRISNET	Agriculture and Cooperation in the States and Union Territories
AIBP	Accelerated Irrigation Benefit Programme
AICRP	All India Coordinated Research Project
AICTE	All India Council for Technical Education
AKIS	Agriculture Knowledge Information System
AMI	Agriculture Marketing Infrastructure
APEDA	Agricultural and Processed Food Export Development Authority
APL	Above Poverty Line
APLMC	Agricultural Produce and Livestock Market Committee
APMC	Agricultural Produce Market Committee
APY	Area, Production and Yield
ARIMA	Auto Regressive Integrated Moving Average
ARYA	Attracting and Retaining Youth in Agriculture
ASEAN	Association of South East Asian Nations
ASI	Annual Survey of Industries
ATARIs	Agricultural Technology Application Research Institutes
ATICs	Agricultural Technology Information Centre
ATMA	Agricultural Technology Management Agency
AWSs	Automatic Weather Stations
BGREI	Bringing Green Revolution to Eastern India
BIMSTEC	Bay of Bengal Initiative for Multi-sectoral Economic & Technical Co-operation
BOT	Build, Operate and Transfer
BPL	Below Poverty Line
BRICS	Brazil, Russia, India, China and South Africa
BSDSM	Bhopal Sahakari Dugdha Sangh Maryadit
CA	Controlled Atmosphere
CACP	Commission for Agricultural Costs and Prices

CAD	Command Area Development
CADWM	Command Area Development and Water Management Program
CAGRs	Compound Annual Growth Rates
CAP	Cover and Plinth
CAZRI	Central Arid Zone Research Institutes
CBOs	Community Based Organizations
CCA	Culturable Command Area
CCE	Crops Cutting Experiment
CCEA	Cabinet Committee on Economic Affairs
CDB	Coconut Development Board
CDP	Crop Diversification Programme
CECA	Comprehensive Economic Cooperation Agreement
CEPA	Comprehensive Economic Partnership Agreement
CES-F&V	Crop Estimation Survey of Fruits & Vegetables
CFMTTI	Central farm Machinery Training & Testing Institute
CHAMAN	Coordinated Programme on Horticulture Assessment and Management using Geoinformatics
CIAE	Central Institute of Agricultural Engineering
CIGs	Commodity based Farmer Interest Group
CIH	Central Institute of Horticulture
CIPHET	Central Institute of Post harvest Engineering and Technology
CMP	Crisis Management Plan
CMVR	Central Motor Vehicles Rules
CoE	Centres of Excellence
CPAC	Country Programme Advisory Committee
CPC	Central Processing Centres
CPCB	Central Pollution Control Board
CPDOs	Central Poultry Development Organizations
CPI	Consumer Price Index
CPIS	Coconut Palm Insurance Scheme
CPMU	Central Project Monitoring Unit
CPO	Crude Palm Oil
CPPTC	Central Poultry Performance Testing Center
CPUE	Catch Per Unit Effort
CRIDA	Central Research Institute for Dryland Agriculture
CRP	Community Resource Persons
CRRRI	Central Rice Research Institute
CRS	Community Radio Stations
CS	Central Sector

CSC	Central Seed Committee
CSCB	Central Seed Certification Board
CSCs	Common Service Centres
CSO	Central Statistical Office
CSP	Country Strategic Programme
CSPCO	Cotton Seeds Price Control Order
CSS	Centrally Sponsored Schemes
CWC	Central Warehousing Corporation
CWWG	Crop Weather Watch Group
DAC&FW	Department of Agriculture, Cooperation and Farmers Welfare
DADF	Department of Animal Husbandry, Dairying and Fisheries
DAESI	Diploma in Agricultural Extension Services for Input Dealers
DARE	Department of Agricultural Research and Education
DASD	Directorate of Arecanut and Spices Development
DAY-NRLM	Antyodaya Yojana - National Rural Livelihoods Mission
DBT	Direct Benefits Transfer
DCCD	Directorate of Cashew and Cocoa Development
DCP	Decentralized Procurement
DDA	Doha Development Agenda
DEDS	Dairy Entrepreneurship Development Scheme
DEEs	Directorates of Extension Education
DES	Directorate of Economics & Statistics
DFPD	Department of Food and Public Distribution
DIDF	Dairy Processing and Infrastructure Development Fund
DIPP	Department of Industrial Policy and Promotion
DLMC	District Level Monitoring Committee
DMI	Directorate of Marketing & Inspection
DRR	Directorate of Rice Research
DSS	Decision Support System
DUS	Distinctiveness, Uniformity and Stability
EDEG	Entrepreneurship Development and Employment Generation
EDI	Electronic Data Interchange
EEIs	Extension Education Institutes
EFTA	European Free Trade Agreement
EIAs	End Implementing Agencies
ELISA	Enzyme-linked immunosorbent assay
e-NAM	Electronic_National Agriculture Market
ESVHD	Establishment and Strengthening of Existing Veterinary Hospitals and Dispensaries
FAO	Food and Agriculture Organization

FAPRI	Food and Agricultural Policy Research Institute
FAQ	Fair and Average Quality
FARMAP	Farm Analysis Package
FASAL	Forecasting Agricultural Output using Space Agro-meteorology and Land-based Observations
FCAC	Farmers Capacity Assessment & Certification
FCI	Food Corporation of India
FDI	Foreign Direct Investment
FFBs	Fresh Fruit Bunches
FFC	Fourteenth Finance Commission
FFDA	Fish Farmers Development Agency
FH	Fishing Harbors
FI	Field Investigator
FICCI	Federation of Indian Chambers of Commerce & Industry
FIGs	Farmer Interest Groups
FIMSUL	Fisheries Management for Sustainable Livelihoods
FLDs	Frontline Demonstrations
FMD	Foot and Mouth Disease
FMTTIs	Farm Machinery Training & Testing Institutes
FPCs	Farmers Producer Companies
FPOs	Farmer Producer Organizations
FRP	Fair and Remunerative Price
FTAs	Free Trade Agreements
FTF	Feed the Future
FYM	Farm Yard Manure
GAP	Good Agricultural Practices
GBY	Grameen Bhandaran Yojana
GCA	Gross Cropped Area
GCDT	Global Crop Diversity Trust
GCF	Gross Capital Formation
Gcs	Germ Cells
GEAC	Genetic Engineering Appraisal Committee
GEF	Global Environment Facility
GHGs	Green House Gases
GIS	Geographic Information System
GPS	Global Positioning System
GSVA	Gross State Value Added
GVA	Gross Value Added
HACCP	Hazard Analysis and Critical Control Points

HLC	High Level Committee
HMNEH	Horticulture Mission for North East and Himalayan States
HSS	High Speed Steel
IA	Implementing agency
IARI	Indian Agriculture Research Institute
IASRI	Indian Agricultural Statistics Research Institute
IBDC	Integrated Bee Keeping Development Centre
IBSA	India, Brazil and South Africa
ICAR	Indian Council of Agricultural Research
ICAR-CIAE	Central Institute of Agricultural Engineering
ICAR-CIBA	Central Institute of Brackishwater Aquaculture
ICAR-CIFA	Central Institute of Freshwater Aquaculture
ICAR-CIFE	Central Institute of Fisheries Education
ICAR-CIFT	Central Institute of Fisheries Technology
ICAR-CIPHET	Central Institute of Post harvest Engineering and Technology
ICAR-CIRCOT	Central Institute for Research on Cotton Technology
ICAR-CMFRI	Central Marine Fisheries Research Institute
ICAR-CRIDA	Central Research Institute for Dryland Agriculture
ICAR-NASF	National Agricultural Science Fund
ICDS	Integrated Child Development Scheme
ICT	Information and Communication Technology
IDDP	Intensive Dairy Development Programme
IDS	Integrated drying system
IEG	Institute of Economic Growth
IFS	Integrated Farming System
IGC	International Grains Council
IHR	Indian Himalayan Region
IOPR	Indian Institute of Oil Palm Research
IMCTs	Inter-Ministerial Central Teams
IMD	India Meteorological Department
INAPH	Information Network for Animal Productivity and Health
INM	Integrated nutrient management
INSIMP	Initiative for Nutritional Security through Intensive Millets Promotion
IOFS	Integrated Organic Farming System
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
IPOA-SHARKS	International Plan of Action for the Conservation and Management of Sharks
ISAM	Integrated Scheme for Agricultural Marketing

ISO	International Organization for Standardization
ISOPOM	Integrated Scheme of Oilseeds, Oil Palm and Maize
ISRO	Indian Space Research Organisation
ISS	Interest Subvention Scheme
ITDP	Integrated Tribal Development
IWMP	Integrated Watershed Management Programme
JAU	Junagarh Agricultural University
JLGs	Joint Liability Groups
KCC	Kisan Credit Card
KCCs	Kisan Call Centres
KVKs	Krishi Vigayan Kendras
KVV	Kisan Vikas Vriksha
kW/ha	KiloWatt Per Hectare
LCS	Land Custom Stations
LDCs	Least Developed Countries
LFCS	Live fish carrier system
LOC	Local Operating Cost
LPA	Long Period Average
MA	Modified Atmosphere
MAITRI	Multi Purpose AI Technician in Rural India
MBRT	Multi-Brand Retail Trading
MDA	Market Development Assistance
MEP	Minimum Export Price
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee ACT
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MI	Micro Irrigation
MIDH	Mission for Integrated Development of Horticulture
MIP	Market Intervention Price
MIS	Micro Irrigation System
MIS	Market Intervention Scheme
MKSP	Mahila Kisan Sashaktikaran Pariyojana
MMA	Macro Management of Agriculture
MNCFC	Mahalanobis National Crop Forecast Centre
MNI	Market yard(s) of National Importance
MoA&FW	Ministry of Agriculture & Farmer's Welfare
Modified NAIS	Modified National Agricultural Insurance Scheme
MoEFCC	Ministry of Environment, Forest and Climate Change
MoFPI	Ministry of Food Processing Industries

MoWR	Ministry of Water Resources
MOU	Memorandum of Understanding
MRIN	Marketing Research and Information Network
MRP	Maximum Retail Price
MSP	Minimum Support Price
MSP	Maximum Sale Price
MSY	Maximum Sustainable Yield
NABARD	National Bank for Agriculture and Rural Development
NABL	National Accreditation Board for Testing and Calibration Laboratories
NADP	National Agriculture Development Programme
NADRS	National Disease Reporting System
NAFED	National Agricultural Cooperative Marketing Federation of India Limited
NAIS	National Agricultural Insurance Scheme
NARES	National Agricultural Research and Education System
NARI	Nimbkar Agricultural Research Institute
NBB	National Bee Board
NBGC-IB	National Bovine Genomic Center for Indigenous Breeds
NBM	National Bamboo Mission
NBS	Nutrient Based Subsidy
NCAER	National Council of Applied Economic Research
NCAP	National Centre for Agricultural Policy and Research
NCCD	National Centre for Cold Chain Development
NCCF	National Cooperative Consumers' Federation of India Limited
NCIP	National Crop Insurance Programme
NCIWRD	National Commission on Integrated Water Resources Development
NCMC	National Crisis Management Committee
NDDDB	National Dairy Development Board
NDP-I	National Dairy Plan-Phase I
NDRF	National Disaster Response Fund
NDRI	National Dairy Research Institute
NE /Hilly/LW	North Eastern/ Hilly/ Left Wing
NeGP-A	National e-Governance Plan in Agriculture
NEHU	North Eastern Hill University
NEX	Nationally Executed
NFDB	National Fisheries Development Board
NFSA	National Food Security Act
NFSM	National Food Security Mission
NFSM-CC	National Food Security Mission - Commercial Crops

NFSM-RICE	National Food Security Mission on RICE
NGOs	Non-Government Organizations
NGS	Next generation sequencing
NHB	National Horticulture Board
NHM	National Horticulture Mission
NIAM	National Institute of Agricultural Marketing
NIC	National Informatics Centre
NIR	Near Infra-Red
NKBC	National Kamdhenu Breeding Centres
NLM	National Livestock Mission
NMAET	National Mission on Agricultural Extension and Technology
NMBP	National Mission on Bovine Productivity
NMFP	National Mission on Food Processing
NMOOP	National Mission on Oilseeds and Oil Palm
NMSA	National Mission for Sustainable Agriculture
NPBB	National Programme for Bovine Breeding
NPBBDD	National Programme for Bovine Breeding and Dairy Development
NPC	National Productivity Council
NPCA	National Plan for Conservation of Aquatic
NPDD	National Programme for Dairy Development
NPF	National Policy for Farmers
NPK	Nitrogen, Phosphorus and Potassium
NPMCR	National Policy for Management of Crop Residue
NPOF	National Project on Organic Farming
NRCC	National Research Centre for Citrus
NRDWP	National Rural Drinking Water Programme
NRLM	National Rural Livelihoods Mission
NRM	Natural Resources Management
NRPs	National Resource Persons
NRRP	National Rehabilitation and Resettlement Policy
NSAP	National Social Assistance Programmeme
NSC	National Seeds Corporation
NSR	National Seed Reserve
NTFP	Non-Timber Forest Produce
NUP	New Urea Policy
NWDPRA	National Watershed Development Project for Rain-fed Areas
NWR	Negotiable Warehouse Receipts
OECD	Organization for Economic Cooperation and Development

OFTs	On-Farm Trials
OPAE	Oil Palm Area Expansion (OPAE) programmes
OWS	Other Welfare Schemes
PACs	Project Appraisal Committees
PAT	Profit After Tax
PAU	Punjab Agriculture University
PCR	Polymerase Chain Reaction
PDA	Personal Digital Assistants
PDS	Public Distribution System
PGS	Participatory Guarantee System
PHET	Post Harvest Extension Technology
PHTM	Post Harvest Technology and Management
PKVY	Paramparagat Krishi Vikas Yojana
PLCs	Programmable Logic Controllers
PMAY-G	Pradhan Mantri Awaas Yojana - Gramin
PMFBY	Pradhan Mantri Fasal Bima Yojana
PMGSY	Pradhan Mantri Gram Sadak Yojana
PMJJBY	Pradhan Mantri Jivan Jyoti Bima Yojana
PMKSY	Pradhan Mantri Krishi Sinchayee Yojana
PMSBY	Pradhan Mantri Suraksha Bima Yojana
PPP	Public Private Partnership
PPP AID	Public Private Partnership in Agriculture Infrastructure Development
PPPs	Primary Processing Centres
PPR	Peste des Petits Ruminants
PPV&FR	Protection of Plant Varieties and Farmers' Rights
PRIs	Panchayati Raj Institutions
PROM	Phosphate Rich Organic Manure
PRRS	Porcine Reproductive and Respiratory Syndrome
PSL	Priority Sector Lending
PSS	Price Support Scheme
PSUs	Public Sector Undertakings
PTAs	Preferential trade agreements
RADAS	Reclamation and Development of Alkali & Acid Soils
RADP	Rainfed Area Development Programme
RCT	Resource Conservation Technologies
RFTA	Regional Free Trade Agreements
RIDF	Rural Infrastructure Development Fund
RKVY	Rashtriya Krishi Vikas Yojana

RPL	Recognizing of Prior Learning
RPS	Reclamation of Problem Soil
RS	Remote Sensing
RVP&FPR	River Valley Project & Flood Prone River
RWBCIS	Restructured Weather Based Crop Insurance Scheme
SAARC	South Asian Association for Regional Cooperation
SAC	Space Application Centre
SAFTA LDCs	South Asian Free Trade Area- Least Developed Countries
SAGF	Strengthening of Agmark Grading Facilities
SASA	State Agricultural Statistics Authorities
SAUs	state agricultural universities
SCCF	Special Climate Change Fund
SC-NEC	Sub-Committee of National Executive Committee
SD	Segmental Duplication
SDRF	State Disaster Response Fund
SFAC	Small Farmers Agri-Business Consortium
SHC	Soil Health Card
SHGs	Self Help Groups
SHM	Soil Health Management
SIA	State Implementing Agency
SIQ&CMP	Strengthening Infrastructure for Quality & Clean Milk Production
SLACC	Sustainable Livelihoods and Adaptation to Climate Change Project
SLCC	State Level Sanctioning Committee
SLCCCI	State Level Co-ordination Committee on Crop Insurance
SMAE	Sub-Mission on Agriculture Extension
SMAE	Sub-Mission on Agricultural Extension
SMAM	Sub-Mission on Agricultural Mechanization
SMART	Specific, Measurable, Achievable, Realistic and Time-bound
SMP	Skimmed Milk Powder
SMPP	Sub-Mission on Plant Protection and Plant Quarantine
SMSP	Sub-Mission on Seed and Planting Material
SNP	Single Nucleotide Polymorphism
SPS	Sanitary & Phytosanitary (SPS) Measures
SREP	Strategic Research and Extension Plan
SRLMs	State Rural Livelihoods Missions
SRR	Seed Replacement Rate
SRSWOR	Simple Random Sampling Without Replacement
SSM	Special Safeguard Mechanism

ST	Schedule Tribe
STEs	State Trading Enterprises
STRY	Skill Training of Rural Youth
SWC	State warehousing Corporations
T.E.	Triennium Ending
TBOs	Tree Borne Oilseeds
TCP	Technical Cooperation Programme
TCPF	Technical Cooperation Program Facility
TLS	Truthfully Labeled Seed
TNA	Training Need Assessment
TPDS	Targeted Public Distribution System
TSA	Technical Support Agencies
UPIS	Unified Package Insurance Scheme
UPWSRP	Uttar Pradesh Water Sector Restructuring Project
USDA	United States Department of Agriculture
VCA	Venture Capital Assistance
WBCIS	Weather Based Crop Insurance Scheme
WDPSCA	Watershed Development Project in Shifting Cultivation Areas
WDRA	Warehousing Development and Regulatory Authority
WFD	World Food Day
WFP	World Food Programme
WPI	Wholesale Price Index
WTO	World Trade Organization
YoY	Year on Year

Performance of Indian Agriculture

1.1 The performance of Indian agriculture seen in the overall perspective of domestic and global economic scenarios has been robust in 2017 and the agricultural outlook of the country looks brighter. The challenge before Indian agriculture today is that of having a tight policy and regulatory framework to plug loop-holes in the farm-input side and simultaneously address farm-produce side market imperfections so that the resources being spent on agricultural development add to the farmers' welfare and prosperity. This can put the country on a higher agricultural development trajectory that is sustainable in terms of three dimensions namely financial, ecological, and social. A paradigm shift in approach towards agricultural development is being affected through farmer centric policies rather than narrow agricultural output variable centric approach followed earlier. It was in view of this perception that farmers' welfare became focal point of agricultural development with the declaration of Ministry of Agriculture to be Ministry of Agriculture and Farmers Welfare; and the special policy drive to double farmers' income by the year 2022.

1.2 The Ministry took many steps in this direction. It include such steps as improvisation of the mission schemes going on since the Twelfth Five Year Plan, and introducing some new schemes during this period to correct land-use pattern, ensuring seed quality, protection of plant varieties, restoring soil health, schemes for drought-proofing, integrated nutrient management, customized mechanization, broad-basing agricultural credit, improving

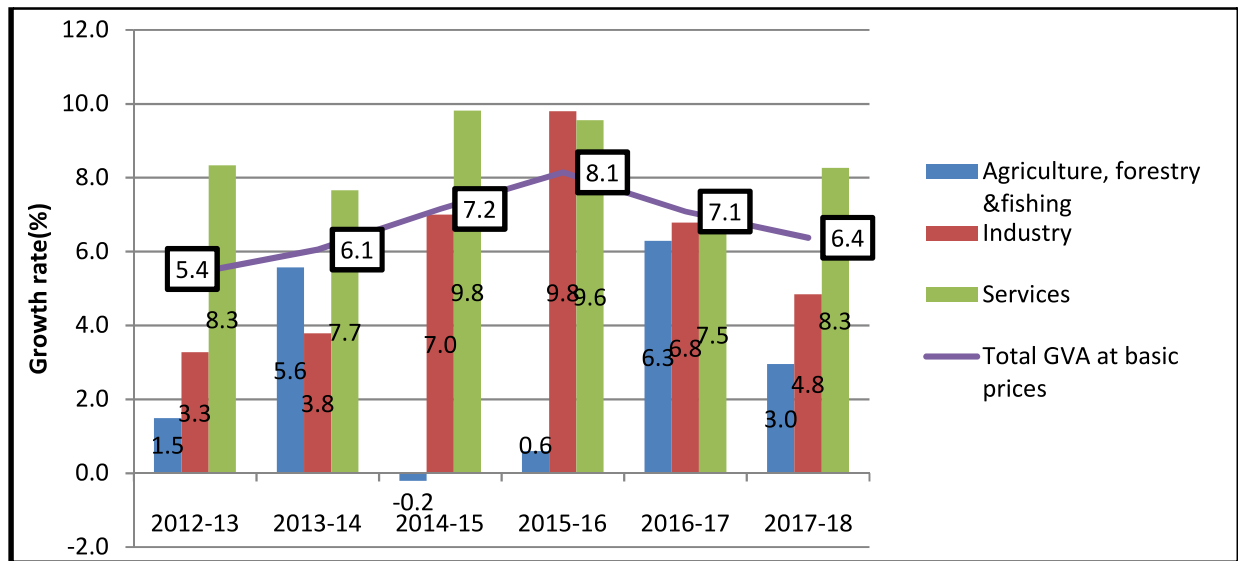
agricultural insurance schemes, etc.

1.3 This Report attempts to provide a comprehensive performance review of Indian agriculture and allied sector and suggest a possible way ahead. This chapter provides a snapshot of the developments made in the agriculture sub-sectors and briefly discusses the major policy changes undertaken in the recent years. The following chapters examine the performance of the major sub-sectors at length along with the issues involved and the way forward.

GROWTH OF THE AGRICULTURAL SECTOR

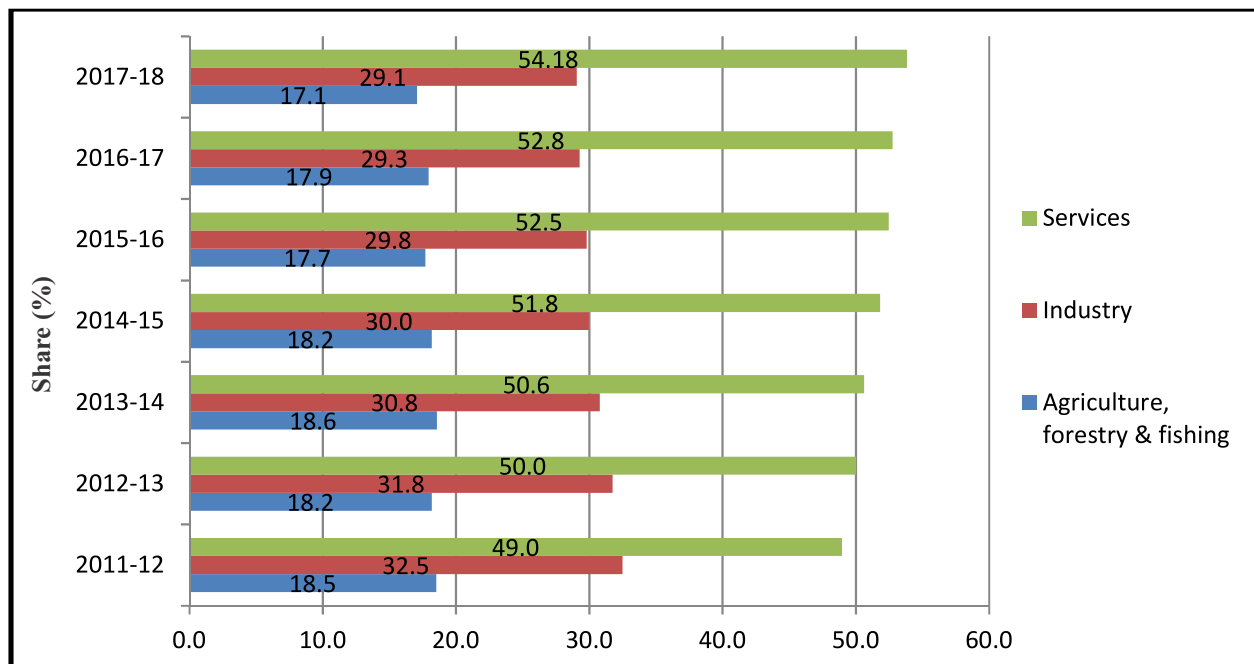
1.4 As per the new series estimates with base year 2011-12, agricultural growth in terms of GVA (Gross Value Added) at basic prices witnessed high volatility from 2012-13 onwards. After reaching a peak of 5.6 percent in 2013-14, the growth rate of GVA in agriculture saw a sharp fall of (-) 0.2 percent and 0.6 percent in 2014-15 and 2015-16 respectively. This low performance was mainly due to two consecutive deficient rainfall years. However, as a result of favourable monsoon and timely policy interventions, the trend in growth was reversed in 2016-17 with more output. As per the First revised estimates for 2016-17, the GVA in agriculture and allied sector is estimated to grow to Rs. 17.17 lakh crore in 2016-17 from Rs. 16.15 lakh crore in 2015-16, i.e., an increase of 6.3 percent. The rate of growth of GVA in agriculture, forestry and fishing and other sectors (at constant 2011-12 prices) and their respective share in total GVA (at current prices) are depicted in **Figures 1.1 and 1.2.**

Figure 1.1: Rate of Growth of GVA in Different Sectors at Constant 2011-12 prices



Source: Central Statistics Office

Figure 1.2: Sectoral Share in GVA at current prices (2011-12 series)



Source: Central Statistics Office

1.5 During 2017-18, as per the second advance estimates, the agriculture and allied sector is estimated to have grown by 3.0 percent as compared to the overall growth of 6.4 percent (Figure 1.1) in GVA. The low growth in the agriculture in 2017-18 is mainly on account of lower growth in production of

foodgrains, which (including fruits and vegetables) accounts for about 59.0 percent of GVA in 'agriculture, forestry and fishing' sector. Growth in foodgrains production was 0.9 percent in 2017-18 as compared to 9.4 percent in 2016-17, which was mainly due to low base year production. On the other

hand, livestock, forestry and fisheries sector, accounting for around 41.0 percent of GVA of the

agriculture and allied sector, are expected to register a combined growth of around 5.1 percent in 2017-18.

Box 1.1 : Doubling of Farmers' Income

The Hon'ble Prime Minister has set a target to double the farmers' income by 2022. To achieve this target a seven-point strategy has been advocated which includes:

- i. Special focus on irrigation with sufficient budget, with the aim of “Per Drop More Crop”.
- ii. Provision of quality seeds and nutrients based on soil health of each field.
- iii. Large investments in warehousing and cold chains to prevent post-harvest crop losses.
- iv. Promotion of value addition through food processing.
- v. Creation of a National Farm Market, removing distortions and e-platform across 585 Stations.
- vi. Introduction of a new crop insurance scheme to mitigate risks at affordable cost.
- vii. Promotion of ancillary activities like poultry, beekeeping and fisheries.

The DAC&FW has constituted an Inter-Ministerial Committee on 13.04.2016 under the Chairmanship of Additional Secretary (Policy), now CEO, National Rainfed Area Authority (NRAA) with members from all related departments and NITI Aayog to examine issues relating to doubling of farmers' income and recommend a strategy to achieve the same by the year 2022. The mandate of the Committee is as follows:

- i. to study the current income level of farmers/ agricultural labourers,
- ii. to measure the historical growth rate of the current income level,
- iii. to determine the needed growth rate to double the income of farmers/agricultural labourers by the year 2021-22,
- iv. to consider and recommend various strategies to be adopted to accomplish (iii) above,
- v. to recommend an institutional mechanism to review and monitor implementation to realise the goal, and
- vi. to examine any other related issue.

A series of meetings have been held between 14.03.2017 to 21.03.2017 with different stakeholders in order to facilitate focussed discussion with respect to doubling of farmers' income. Various Sub-Groups have since been constituted on the following aspects:-

- | | |
|-----------|---|
| Vol. I | March of Agriculture since independence and growth trends: analysis/examination of support infrastructure (Roads, Electricity, etc.). |
| Vol. II | Pace and direction of growth needed to double farmers' income by 2022. |
| Vol. III | Post production and marketing for remunerative value realisation by the farmers: fork to farm (reverse/inverse approach). |
| Vol. IV-A | Sustainability of agriculture. |
| Vol. IV-B | Specific strategies for sustainability. |
| Vol. V | Input management – Resource use efficiency/total factor productivity (TFP). |

- Vol. VI Production enhancement through productivity gains.
- Vol. VII Farm linked activities (for jobs & additional income).
- Vol. VIII Risk management in agriculture.
- Vol. IX Enablers – soft components.
- Vol. X Research and Development.
- Vol. XI Governance Issues.
- Vol. XII Supportive suggestions.

As a result of deliberations in DFI committee, the following steps have been taken:

a. **Institutional Framework Mechanism:** The Government has issued guidelines to all the States for setting up inter-ministerial/ departmental committees at State/District levels. The mandate of these committees is to achieve coordination and convergence among different activities relating to agriculture and also monitor welfare issues relating to farmers.

b. **Market Reforms:**

i. *Seven Point Agenda* (Based on Model APMC Act, 2003)-

- Setting up of markets in private sector,
- Direct marketing (direct purchase of produce from farmers by processors/exporters/ bulk buyers, etc. outside the market yard),
- Farmer-Consumer markets (direct sale by farmers to consumers) to be set up by a person other than a Market Committee,
- Contract Farming,
- E-Trading,
- Single point levy of market fee across the State,
- Single trading license across the State.

ii. *APLM Act:* Apart from e-NAM Govt. is persuading States to adopt market reforms with a view to provide farmers with alternate markets. To achieve this, a model act called Agriculture Produce and Livestock Marketing (Promotion & Facilitation) Act, 2017 has been shared with all States and UTs.

iii. *Contract Farming:* Government has constituted a committee for preparation of a model contract farming Act.

iv. The restructuring of Directorate of Marketing & Inspection (DMI) has been initiated.

c. **Road-map for Pulses Production:** DAC&FW has prepared a road-map for production of pulses to the tune of 24 million tonnes by 2017-18.

d. A dedicated micro-irrigation fund with initial corpus of Rs.5000 crores has been set up in NABARD to achieve per drop more crop.

e. Computerization and integration of all 63,000 functional PACS with core banking system to be supported through NABARD.

f. A dairy processing and infrastructure developing fund to be set up in NABARD with corpus of

Rs. 8000 crores over 3 years. Fund will initially start with corpus of Rs.2000 crores.

g. Under Blue Revolution scheme the fisheries production would be increased by 50% from 10 million tonnes in 2015-16 to 15 million tonnes by 2019-20.

h. Under Rashtriya Gokul Mission, indigenous breeds would be developed in focused and scientific manner.

i. The Ministry of Agriculture and Farmers Welfare with support from NITI Aayog is focusing on two other important reforms. These are:

(a) Adoption of Model Land Leasing Law by the States/UTs. A draft law has been shared by NITI Aayog.

(b) Liberalise current regulatory regime for felling and transit of trees grown on non-forest as well as private land. This will promote agro-forestry and diversify farmers' income basket, besides providing income security against vagaries of monsoon.

NABARD's Foundation day Seminar was held on 12th July, 2016 on doubling of farmers' income, subsequently, NABARD had been requested to organize Regional Conferences on Doubling of Farmers' Income, for preparing strategies and also to sensitize the State Governments. For this purpose, six Nodal States viz. Assam, Odisha, Uttar Pradesh, Rajasthan, Maharashtra and Karnataka were identified where the regional conferences may take place. The remaining States were attached to these nodal States. NABARD has organized the Regional Conferences in these Nodal States, giving invitation to the other attached States to attend the Conferences at the nodal States. Besides, 12 Agro-Economic Research Centre and 03 Agro-Economic Research Units were also invited by NABARD to these Regional Conferences.

DAC&FW has also written to all the State Governments to work on an appropriate strategy as the States have a primary role in working towards realisation of doubling of farmer's income. The strategy should take into account the status of end-to-end activities from production to post-production stages. Some of the States like Chhattisgarh and Madhya Pradesh, Rajasthan and Arunachal Pradesh have already devised suitable strategies in this regard. The Hon'ble Agriculture Minister has written to Hon'ble Chief Minister of the States/UTs to devise suitable strategies in this regard and share the same for making national level strategy.

State-wise Coordination Committees have also been set up by the Indian Council of Agriculture Research (ICAR) in 2016 to achieve the Government's objective of doubling the income of farmers by the year 2022. State agricultural experts have been included in these Committees. To expedite the work, these Committees have also submitted their reports, which have been made available to the State Governments. Based on these reports, ICAR and concerned States are working together to accelerate the work on ways to increase the income of the farmers. The main objectives of these Committees are to prepare a broad strategy document to double the income of the farmers.

REGIONAL VARIATIONS IN AGRICULTURAL GROWTH

1.6 The growth rate and respective share of agriculture and allied sector at the state-level presents a different picture from that at the national level, as per the latest available state-wise GVA estimates for 2016-17. While at the national level, the share of agriculture and allied sector continues to hover

around 18 percent (at current prices); a number of States are estimated to have a much larger share of agriculture in GSVA. As shown in **Table 1.1**, there are 8 States recording more than 20 percent share in the year 2016-17; while 16 States recorded less than 20 percent share of agriculture and allied sector in the GSVA¹.

Table 1.1: Share of Agriculture and Allied Activities in State GSVA during 2016-17 (at current prices)

Share of Agriculture and Allied Activities in GSVA	States
30% and above	Madhya Pradesh, Arunachal Pradesh, Andhra Pradesh
20 - 29 %	Punjab, Uttar Pradesh, Rajasthan, Bihar, Odisha
15 - 19%	Haryana, Meghalaya, Chattisgarh, Telangana, Gujarat, Jharkhand
Less than 15%	Himachal Pradesh, Kerala, Tamil Nadu, Karnataka, Maharashtra, Uttarakhand, Sikkim, Puducherry, Chandigarh and Delhi

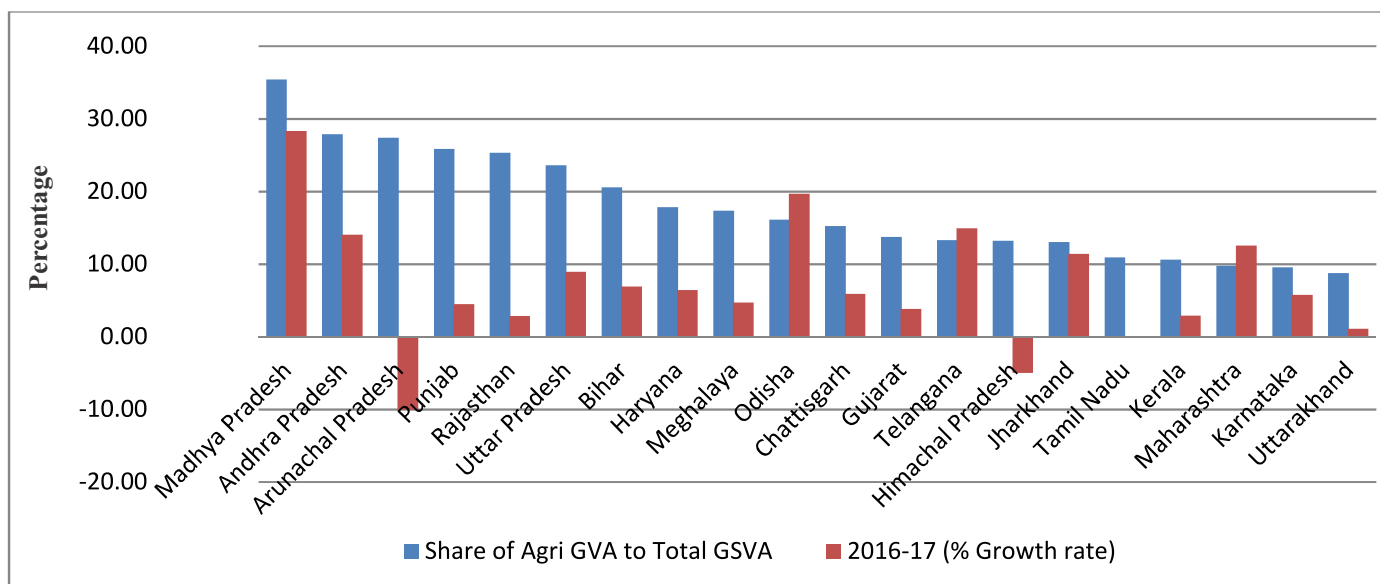
Source: Central Statistics Office

1.7 At the national level, the GVA from the agriculture and allied sector grew at the rate of 6.3 percent in 2016-17 (at constant 2011-12 prices), but the States of Madhya Pradesh, Odisha, Telangana, Andhra Pradesh, Maharashtra and Jharkhand registered double-digit growth during the same period (**Figure 1.3**). Almost 50 percent of the states were estimated to have experienced more than 5 percent growth in the agriculture and allied sector during 2016-17. The increase in devolution of funds to the State Governments by the successive Finance

Commissions has been instrumental in pushing agricultural growth rate at the State-level and also in reducing inter-state variation in agricultural performance. Under the new mechanism, State Government's dependence on tied funds from the Union Government have been reduced, thus a major share of transfer is through the non-discretionary funds which provides the required financial autonomy and flexibility to State Governments in Plan formulation.

¹GSVA estimates for 2016-17 are available for 24 States only

Figure 1.3: State-wise Growth and Share in Agriculture-GVA (2016-17)

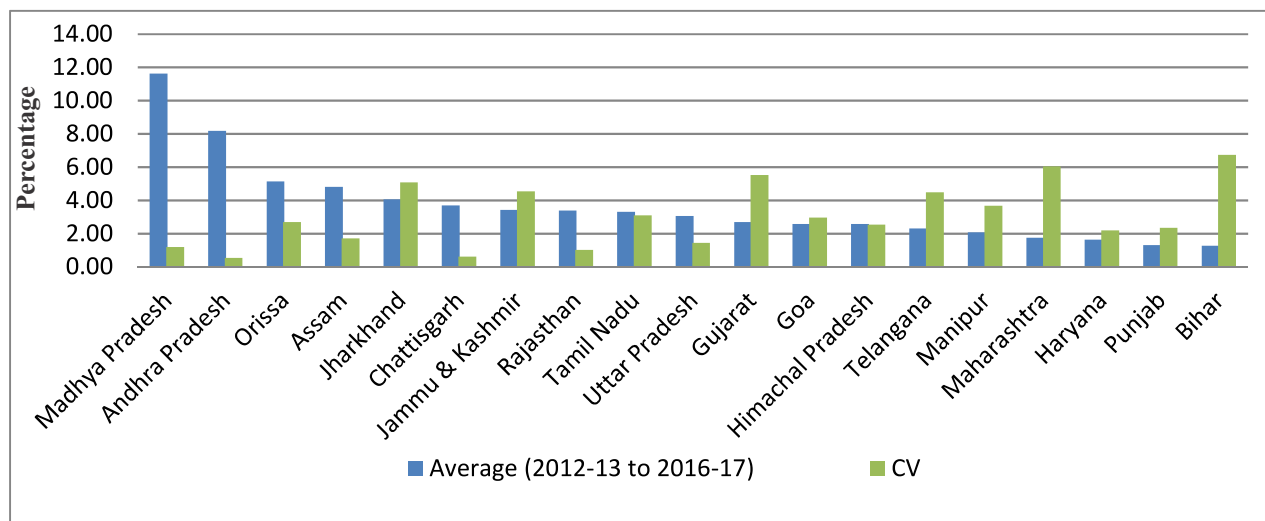


Source: Central Statistics Office

1.8 In addition to the wide variation in performance in agriculture sector at national and State-level, a general inter-state and inter-temporal variability in agricultural growth rate has been observed. For example, Madhya Pradesh, with the highest average agricultural growth of 11.62 percent between 2012-13 and 2016-17, has a relatively low coefficient of variation of 1.19 percent, whereas Bihar achieved an average growth of 1.28 percent during the same period, but with a high coefficient of variation (CV) of 6.74 percent (Figure 1.4). It is

noteworthy that, as compared to the all-India coefficient of variation of agricultural GVA of 1.08 percent between 2012-13 and 2016-17, the variation at the state-level was much higher. The large variations among States in the agricultural growth rate is partly attributed to the base effect and partly due to factors such as climatic variations, differences in the level of capital formation, access to institutions, pressure on natural resources, level of policy interventions, etc.

Figure 1.4: State-wise Average Growth rate and Coefficient of Variation (2012-13 to 2016-17)



Source: Central Statistics Office

Box 1.2: Task Force on Agricultural Development

The Governing Council (GC) of NITI Aayog at its first meeting held under the Chairmanship of the Hon'ble Prime Minister on 08th February, 2015 decided to constitute a Task Force on Agricultural Development at NITI Aayog to suggest measures to re-invigorate agriculture in the Country. The Governing Council also decided to constitute similar Task Forces in all the States and UTs. The NITI Aayog has been assigned the responsibility of coordinating with the States and UTs Task Forces and Central Ministries.

The Task Force on Agricultural Development was constituted on 16th March, 2015 under the Chairmanship of the Vice Chairman, NITI Aayog with the following primary objectives:

- ❖ Co-ordinate and develop synergy with the Central Ministries and State Govts. Task Forces
- ❖ Recommend strategies to re-invigorate Agriculture in all its aspects
- ❖ Formulate strategies for reforms, innovation and technology diffusion
- ❖ Identify successful experiments and programs from which all States and UTs may learn
- ❖ Suggest any other significant measures

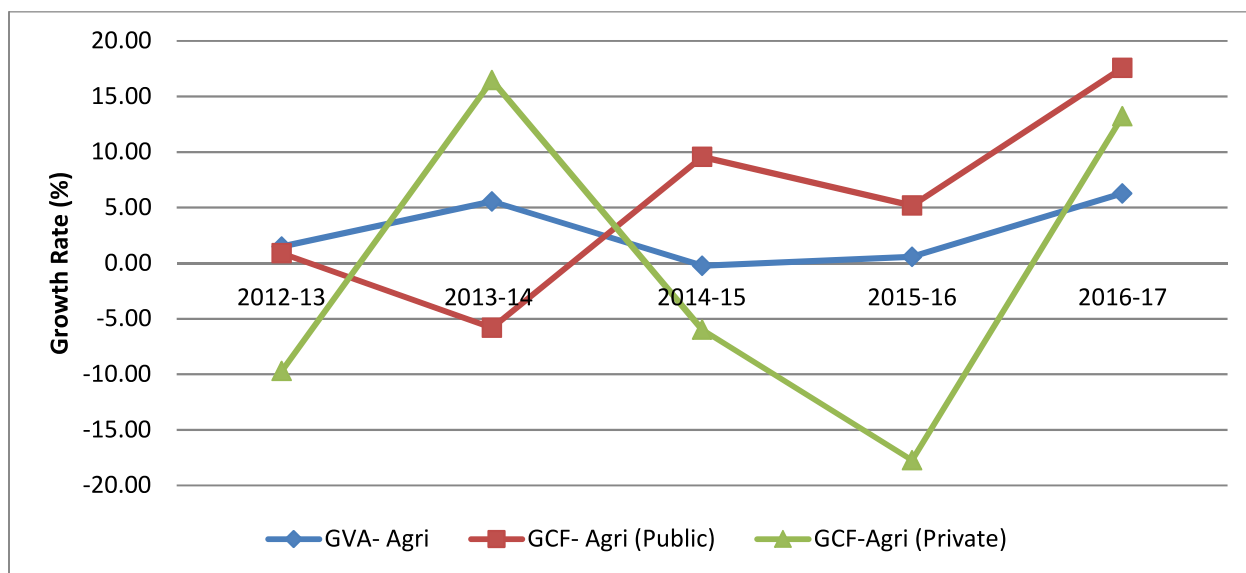
CAPITAL FORMATION IN AGRICULTURE

1.9 Gross Capital Formation (GCF), used as a measure of investment, refers to the aggregate of gross additions to the fixed assets (i.e. fixed capital formation) and change in stocks during the reference period. In case of agriculture, including livestock, fixed assets comprise machinery, farm equipment (including breeding stock, draught animals, dairy cattle, etc.), irrigation, land improvement, among others. Private GCF in agriculture (that is, farm households) accounts for a major share in total investment and public sector GCF is mainly on major and medium irrigation systems and its share has consistently decreased. As per the earlier estimates on GCF in agriculture and allied activities (GCF-Agri) with base year 2004-05, the GCF in the sector

was stagnant from 1980-81 to 1999-00 mainly due to a fall in the public GCF-Agri. However, the substantial increase in public sector GCF in agriculture during 2002-03 has also induced the private GCF which resulted in high growth in public and private GCF at 5.9 percent and 8.8 percent, respectively, during the 2000s.

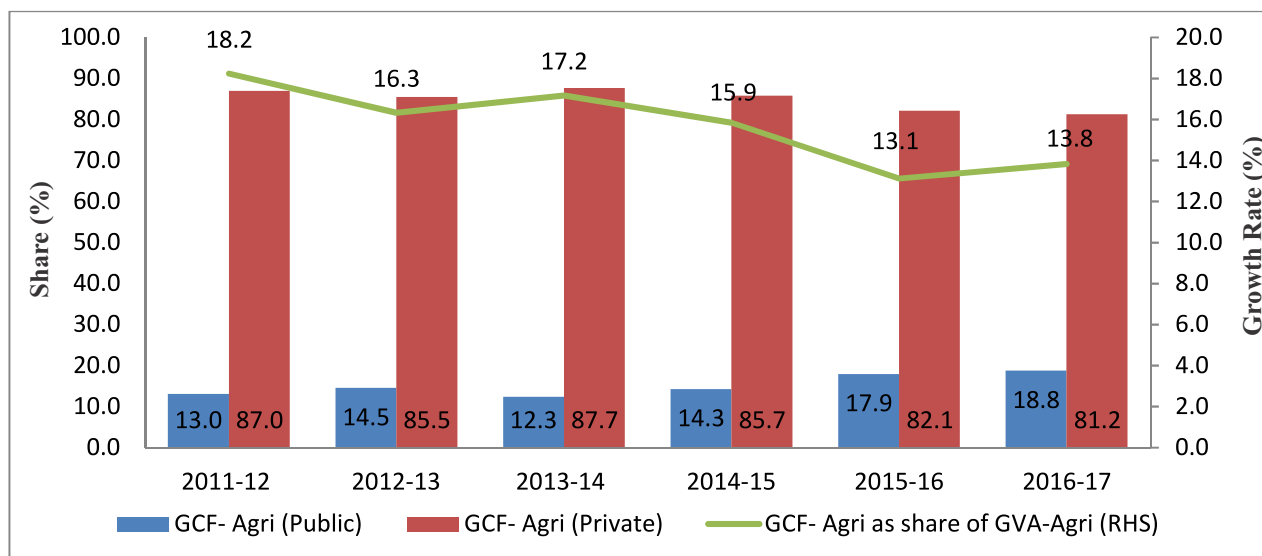
1.10 As per the new series estimates by CSO, with base year 2011-12, the rate of growth of GCF in agriculture, particularly private GCF, has shown a positive correlation with the agricultural output (**Figure 1.5 and 1.6**). Although the share of public sector GCF in total GCF in agriculture and allied sector continues to be less than 20 percent, its inducement effect on the private sector GCF makes it an important policy variable.

Figure 1.5: Trend in GVA in Agriculture and GCF (Public and Private) at constant 2011-12 prices



Source: Central Statistics Office

Figure 1.6: Share of Public and Private Sector in Agri-GCF (at current prices)



Source: Central Statistics Office

1.11 Under the revised series with base year 2011-12, the sector-wise rate of investment in agriculture and allied sector, measured as a ratio of GCF to GVA of the sector, is shown in the **Table 1.2**. Total GCF in

agriculture and allied sector has increased from Rs. 291989 crore in 2015-16 to Rs. 343476 crore in 2016-17. Agriculture and allied sector accounted for 7.71% of total GCF of the economy during 2016-17.

Table 1.2 Sector-wise share in GCF-Agri (based on 2011-12 series)**(Rs. Crore)**

Sector	GCF in Agriculture (at current prices)					
	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Public	35696	39743	40827	47319	52267	644102
Private	238175	233747	290009	284545	239721	79066
Total GCF in Agriculture	273870	273490	330836	331863	291989	343476
GCF in Agriculture to overall GCF (%)	8.54	7.73	9.04	8.17	7.00	7.71
GCF in Agriculture to GVA of Agriculture (%)	18.23	16.33	17.17	15.85	13.12	13.83

Source: Central Statistics Office

PRODUCTION PERFORMANCE

I) Foodgrains

1.12 Foodgrain production in the country increased from 217.28 million tonnes in 2006-07 to an all-time high of 275.11 million tonnes in 2016-17. Though monsoon rainfall deficiency continued during 2016-17 as well, the cumulative deficiency was only 3 percent, not as much as the rainfall deficit of 14 percent in 2015-16. The Government took such timely contingency measures as preparation of district-wise contingency plans, timely advisories and regular monitoring of seed and fertilizer

availability.

1.13 During the agricultural year 2017-18, total foodgrains production in the country is estimated at the record high of 279.51 million tonnes (as per 3rd Advance Estimates) which is higher by 4.40 million tonnes than the previous highest production level of 275.11 million tonnes in 2016-17. The production estimates for 2017-18 are also higher by 19.33 million tonnes than the previous five years' (2012-13 to 2016-17) average production of foodgrains. Production of major crops during last few years and the estimates for 2017-18 is given in **Table 1.3**.

Table 1.3: Production of Foodgrains and other major Crops**(Million Tonnes)**

Crop	Season	2006-07	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18*
Rice	Kharif	80.2	92.8	92.4	91.5	91.4	91.4	96.3	96.4
	Rabi	13.2	12.5	12.9	15.2	14.1	13.0	13.4	15.1
	Total	93.4	105.3	105.2	106.7	105.5	104.4	109.7	111.5
Wheat	Rabi	75.8	94.9	93.5	95.9	86.5	92.3	98.5	98.6
Coarse Cereals	Kharif	25.6	32.4	29.8	31.2	30.9	28.2	32.4	33.3
	Rabi	8.3	9.6	10.3	12.1	11.9	10.4	11.3	11.5
	Total	33.9	42.0	40.0	43.3	42.9	38.5	43.8	44.9
Total Cereals	Kharif	105.8	125.2	122.2	122.7	122.3	119.6	128.7	129.7
	Rabi	97.3	117.0	116.6	123.1	112.5	115.7	123.2	125.3
	Total	203.1	242.2	238.8	245.8	234.9	235.2	252.0	255.0
Pulses	Kharif	4.8	6.1	5.9	6.0	5.7	5.5	9.6	9.0
	Rabi	9.4	11.0	12.4	13.3	11.4	10.8	13.6	15.5
	Total	14.2	17.1	18.3	19.3	17.2	16.4	23.1	24.5
Foodgrains	Kharif	110.6	131.3	128.1	128.7	128.1	125.1	138.3	138.7
	Rabi	106.7	128.0	129.1	136.4	124.0	126.5	136.8	140.8
	Total	217.3	259.3	257.1	265.0	252.0	251.6	275.1	279.5
Oilseeds	Kharif	14.0	20.7	20.8	22.6	19.2	16.7	21.5	20.7
	Rabi	10.3	9.1	10.2	10.1	8.3	8.6	9.8	10.0
	Total	24.3	29.8	30.9	32.8	27.5	25.3	31.3	30.6
Sugarcane	Total	355.5	361.0	341.2	352.1	362.3	348.4	306.1	355.1
Cotton**	Total	22.6	35.2	34.2	35.9	33.5	30.0	32.6	34.9
Jute and Mesta#	Total	11.3	11.4	10.9	11.7	11.1	10.5	11.0	10.6

* 3rd Advance Estimates

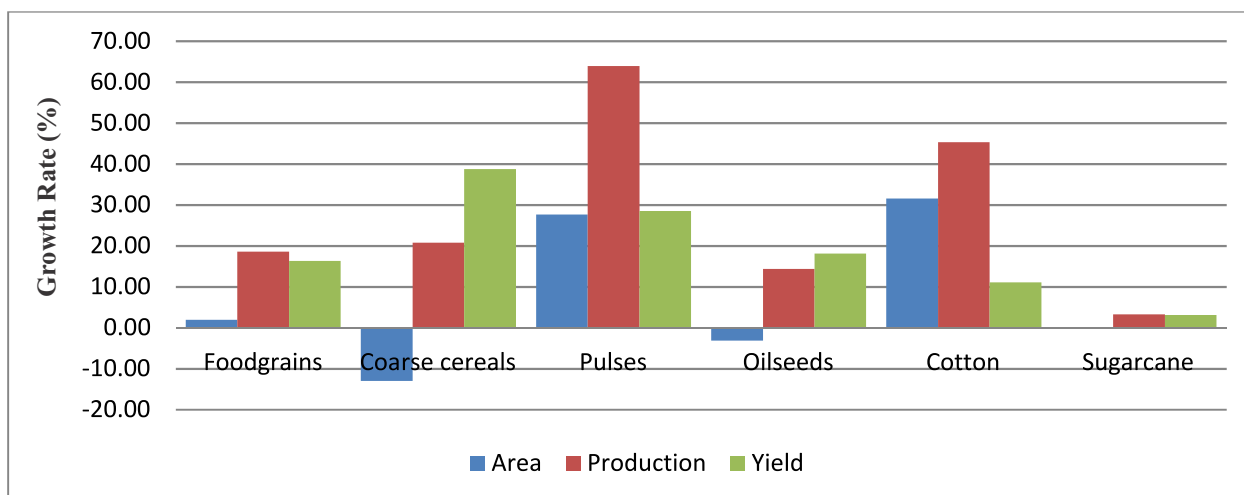
** Million bales of 170 kgs. each #Million bales of 180 kgs. each

Source: Directorate of Economics & Statistics, DAC&FW

1.14 Increase in agricultural production during the last decade [Triennium Ending (T.E.) 2007-08 to T.E. 2016-17] was largely a result of growth in productivity. However, in case of some crops such as maize, tur, gram, urad, moong, soybean and cotton, the growth in acreage was also substantial. Growth in acreage under pulses and cotton came at the expense of nutri cereals, particularly jowar and bajra. Overall acreage under nutri cereals declined from 28.75

million hectares in Triennium Ending (T.E.) 2007-08 to 25.00 million hectares in T.E. 2016-17, indicating a drop of about 13 percent. As crops normally grown in similar agro-climatic conditions, they usually compete with each other for acreage. The increase in area of more than 27 per cent of pulses and 31 per cent in case of cotton shows that farmers have exhibited an increasing preference for pulses and cotton over other crops, like nutri cereals (**Figure 1.7**).

Figure 1.7: Increase in Area, Production and Yield (T.E. 2007-08 to T.E. 2016-17)



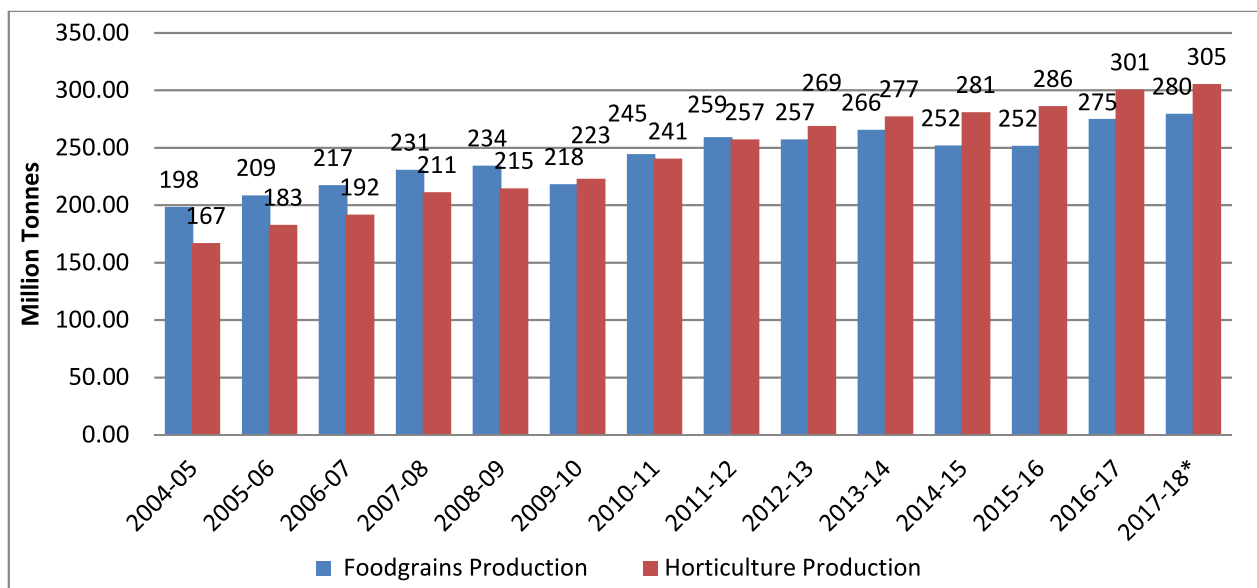
Source: Directorate of Economics and Statistics, DAC&FW

II) Horticulture

1.15 Horticultural crops form a significant part of the total agricultural produce in the country and is seen as a sub-sector of great potential towards realizing of Government's objective of doubling farmers' income by 2022. The sector appears to hold the key to India's challenges of meeting higher demand for production, income, employment and profits with least adverse effect on natural resources, and community welfare. During the period 2004-05 to 2016-17, horticultural output achieved a

compounded annual growth of about 5.0 percent as compared to around 3.0 percent growth in foodgrains production. This increase is due to increase in acreage and to a larger extent due to increase in productivity. The rate of increase in productivity in case of horticulture crops was about 34 percent between 2004-05 and 2016-17. As a result, India has maintained its second rank in the production of fruit and vegetables, next only to China. A comparative picture of horticulture and foodgrains production over the last few years is given in **Figure 1.8**.

Figure 1.8: Trend in Foodgrains and Horticulture Production



* Based on Third Advance Est. for Foodgrains and First Advance Estimates for Horticulture
Source: Directorate of Economics and Statistics, DAC&FW

1.16 The horticulture sector, however, suffers from high post-harvest losses, shortages of trained manpower for extension services to farmers, lack of quality planting material, bio-security concerns, absence of market linkages and resultant price fluctuations, changing quality consciousness, and increasing global competition. To meet these challenges there has to be focus on skill development, supporting high density plantations & canopy management in fruit crops, rejuvenation of senile orchards, quality planting material, new strategies on climate change & weather vagaries by promoting protected cultivation, micro irrigation, etc., and better post-harvest management.

III) Livestock and Fisheries

1.17 The development of livestock sector is vital for an inclusive and sustainable agriculture system. India enjoys a formidable position in the livestock sector, accounting for about half of the world's population of buffaloes and 1/6th of the goat population. However, such a large population presents both challenges and opportunities, wherein

existing productivity levels have to be sustained through proper application of modern science and technology, incentives and policies. Operation flood, one of the largest of its kind, has been hailed as a major success story of the dairy sector in India.

1.18 With the sustained growth in the production of milk and milk products, India has maintained its position of world's largest milk producer. During 2016-17, with an estimated production of 163.7 million tonnes India achieved its new high in terms of milk production. The per capita availability of milk of 355 grams per day in India is much more than the world average of 299 grams per day. The total meat production from cattle, buffalo, sheep, goat, pig and poultry has almost doubled from 4.0 million tonnes in 2007-08 to 7.4 million tonnes in 2016-17. Similar growth patterns have been observed in case of production of eggs and wool. The trend in all India production of milk, eggs, wool, meat and fish is given in **Table 1.4**.

Table 1.4: Production of Milk, Eggs, Wool, Meat and Fish- All India

Year	Milk	Eggs	Wool	Meat	Fish
	(Million Tonnes)	(Million Numbers)	(Million kg)	(Million Tonnes)	(Million Tonnes)
2004-05	92.5	45201	44.6	2.2	6.31
2005-06	97.1	46235	44.9	2.3	6.57
2006-07	102.6	50663	45.1	2.3	6.87
2007-08	107.9	53583	43.9	4	7.13
2008-09	111.2	55562	42.8	4.3	7.62
2009-10	116.4	60267	43.1	4.6	8
2010-11	121.8	63024	43	4.8	8.23
2011-12	127.9	66450	44.7	5.5	8.67
2012-13	132.4	69731	46.1	5.9	9.04
2013-14	137.7	74752	47.9	6.2	9.57
2014-15	146.3	78484	48.1	6.7	10.34
2015-16	155.5	82929	43.6	7	10.8
2016-17	163.7	88139	43.5	7.4	11.41

Note: Meat Production from Commercial Poultry farm is included from 2007-08.

Source: Department of Animal Husbandry, Dairying & Fisheries

1.19 With its hallmark of lesser vulnerability to climatic complexities and degrading natural resource base, livestock has proven a surer means of high returns to farmers vis-a-vis the crop sector. In view of this, Government is focusing on development of livestock, fisheries and social forestry sectors. With a view to enhance milk production and productivity of bovines and thereby enhancing farmers income, the Department of Animal Husbandry, Dairying & Fisheries is implementing three major schemes. These include: 1) Rashtriya Gokul Mission with three sub-components: a) National Programme for Bovine Breeding, b) Indigenous Breeds, and c) National Mission on Bovine Productivity); 2) National Dairy Plan-I; and 3) Breed Improvement institutes which includes a) Central Cattle Breeding Farms, b) Central Herd Registration Scheme, and c) Central Frozen Semen Production & Training Institutes. In addition, the Dairy Entrepreneurship Development Scheme (DEDS) is being implemented through National Bank for Agriculture and Rural Development (NABARD) under which back-ended subsidy (25% of the project cost for General Category and 33.33% for SC&ST beneficiaries) is provided for bankable projects through eligible financial institution, subject to the norms of the scheme. Further, a Centrally Sponsored Scheme namely, National Livestock Mission with a Sub Mission on Feed and Fodder Development is being implemented since 2014-15 with a component “Establishment of high capacity fodder block making units” thereby promoting conservation of fodder, and converting crop residues into fodder blocks.

1.20 In order to give a major thrust to conservation and development of indigenous breeds in a focused and scientific manner, funds under Rashtriya Gokul

Mission has been sanctioned for the establishment of 14 Gokul Grams in the country for the protection and development of indigenous cattle breeds. Animal Breeding Centers are being made sophisticated by providing the bulls of improved species with the assistance of more funds.

1.21 Fishery is one of the fast growing sectors in India which on the one hand provides nutrition and food security to a large population of the country, and on the other hand is a major source of income and employment to fishermen and fish farmers. India at present is the second largest fish producer in the world with an estimated production of 11.41 million tonnes in 2016-17. Besides, this sector provides employment and livelihood support to more than 15 million people in the country. The sector has also become a source of exports over the years. The country has earned foreign exchange of more than 5.78 billion US dollar (i.e., Rs. 37,871 crore) in 2016-17 through exports of fish and fishery products. In view of the vast resource potential and possibilities in the fisheries sector, all the schemes of fisheries sector have been merged into an umbrella scheme of Blue Revolution: Integrated Development and Management of Fisheries and is being implemented with an outlay of Rs. 3000 crore for five years. Blue Revolution is focusing to foster use of new and modern technology, training and capacity building of fishers and fish farmers, adoption of scientific methods and technologies, species diversification and proper fish health management, etc. The main aim of Government is to double the income of fishers and fish-farmers by 2022 through implementation of Blue Revolution.

1.22 It is well recognized that the high growth rate in agriculture and allied sector would not be achieved without stepping up capital investment. Therefore, a

provision of Rs. 10,000 crore has been made in the Union Budget 2018-19 for Fisheries and Aquacultures Infrastructure Development Fund and Animal Husbandry Infrastructure Development Fund. Through this, State Governments, Cooperatives and individual investors will get loans at cheap rates for fisheries and animal husbandry infrastructure. This will help in increasing the pace of construction of fish landing centres, cold storages, ice plants, transport facilities, processing units, and hatcheries, etc.

LAND USE PATTERN

1.23 The relationship between the size of land holding and farm productivity is a complex one. While some studies show that smallholdings exhibit a higher productivity than larger ones others contend that the small size of the holdings results in lower per capita productivity. However, one thing is certain that the process of fragmentation of land holdings is showing no sign of reversal and the incidence of poverty is much higher on the marginal and small operational holders. Data from the latest Agricultural Census 2010-11, shows that around 85 percent of the operational holdings in the country are small and marginal, i.e., holdings of less than 2 hectares each.² The number of marginal and small holdings has increased to 92.83 million and 24.78 million in 2010-11 from 75.41 million and 22.70 million respectively in 2000-01. Semi-medium holdings increased by 0.7 percent, while the number of medium holdings dropped by 3 percent and the number of large holdings declined by almost 11 percent. The area under small and marginal holdings has also shown a similar pattern. While the share of marginal and small holdings has increased from 41 percent in 2000-01 to

about 45 percent 2010-11, both medium and large holdings witnessed a gradual decline in area over the years. Due to this continued process of fragmentation of holdings in India, the average size of land holding in India has come down from 1.33 hectare in 2001-01 to 1.15 hectare in 2010-11.

1.24 The predominance of marginal and small land holding is, however, not a phenomenon unique to India. As per Food and Agriculture Organization (FAO) estimates based on sample from 111 countries, farms of less than 2 hectare accounts for about 84 percent of all farms worldwide and control 12 percent of all agricultural land; whereas only 1 percent of all farms in the world are larger than 50 hectares which cover about 65 percent of the world's agricultural land. Moreover, the estimates suggest that the farm sizes have got smaller in the 2000s worldwide than they were in the 1960s, largely reflecting the decrease in farm size in the low-and middle-income countries, where the majority of the world's farms are located. By contrast, average farm size in the high-income country group has increased.

1.25 Therefore, it is vital to focus on factors which inhibit the productivity of small and marginal farmers, rather than attempting to reverse the trend of land fragmentation. The process may involve diversification of activities undertaken by the small and marginal farmers, creation of off-farm opportunities to supplement farm income, improving market linkages and timely availability of institutional credit, better extension services, etc. In addition, there is a need to focus on aggregation of small and marginal farmers into groups for overcoming market imperfections and for realising

²As per the classification followed in the Agricultural Census, marginal holdings covers holdings with less than 1 hectare; small holdings from 1 to 2 hectare; semi-medium with 2 to 4 hectare; medium with 4 to 10 hectare; and large holdings with area of 10 hectares and above.

better prices for their produce.

1.26 The restricted land leasing laws is another major issue inhibiting the performance of agricultural sector in India. Under the existing framework, agricultural land leasing is either legally banned or imposed with many restrictions, which has led to informal, insecure and inefficient tenancy in India. This informal nature of tenancy subjects the tenants to inefficient and insecure position, as they do not have legal sanctity and access to institutional credit, insurance and other support services. In addition, restrictions on land leasing have reduced the occupational mobility of many landowners who have interest and ability to take up employment outside agriculture and yet are forced to stay in agriculture due to the fear of losing land if they lease out and migrate (NITI Aayog, 2016). Against this background an Expert Committee was setup by the

government under the chairmanship of Dr. T. Haque to review the existing agricultural tenancy laws of various states and suggest appropriate amendments keeping in view the need to legalize and liberalize land leasing for much needed agricultural efficiency, equity, occupational diversification and rapid rural transformation. The committee, with due deliberations with the state governments and other stakeholders, proposed a Model Land Leasing Act (**Box 1.3**). The recent initiatives by the Government have taken this inefficiency of existing tenancy laws under consideration while determining the intended beneficiaries of the schemes/ programmes. For example, under the Pradhan Mantri Fasal Bima Yojana (PMFBY) all farmers, including sharecroppers and tenant farmers growing the notified crops in the notified areas are eligible to avail the benefits of the Scheme.

Box 1.3: Model Land Leasing Act

Key Features of the proposed Model Land Leasing Act are as under.

- i) Legalize land leasing to promote agricultural efficiency, equity and poverty reduction. This will also help in much needed productivity improvement in agriculture as well as occupational mobility of the people and rapid rural change.
- ii) Legalize land leasing in all areas to ensure complete security of land ownership right for land owners and security of tenure for tenants for the agreed lease period.
- iii) Allow automatic resumption of land after the agreed lease period without requiring any minimum area of land to be left with the tenant even after termination of tenancy, as laws of some states require;
- iv) Allow the terms and conditions of lease to be determined mutually by the land owner and the tenant without any fear on the part of the landowner of losing land right or undue expectation on the part of the tenant of acquiring occupancy right for continuous possession of leased land for any fixed period.
- v) Facilitate all tenants including share croppers to access insurance, bank credit and bank credit against pledging of expected output.
- vi) Incentivize tenants to make investment in land improvement and also entitle them to get back the unused value of investment at the time of termination of tenancy

REJUVENATING SOIL HEALTH

1.27 The grave soil health threat that India faces with 37 percent of its total geographical land area struck by soil contamination, caused by a long list of agricultural and non-agricultural factors, has nudged the Union Government and the State Governments to take innovative developmental steps to restore soil vitality. Government launched the ambitious Soil Health Card (SHC) Scheme, under which the soil of every operational holding is being tested and a SHC issued. SHC provides information to farmers on nutrient status of their soil along with recommendation on appropriate dosage of nutrients to be applied for improving soil health and its fertility. For this purpose, a wide network of soil testing labs has been established. The scheme also provides for reissue of the SHCs every third year. It involves the use of digital technology to help farmers track their soil samples and testing results. Soil status has to be assessed regularly in a cycle of every 2 years and in all 253 lakh soil samples are to be collected and tested to generate 12 crore SHCs for distribution to the farmers.

1.28 During 2016-17, a sum of Rs. 133.6 crore was released under the scheme and so far (upto August, 2017) Rs. 33.03 has been released under various components in 2017-18. As regards the physical achievements, as on 29-08-2017, against the target of 253 lakh soil samples, 100 percent soil samples have been collected and tested under Cycle-1 of the scheme. Against the target of 1,198 lakh soil health cards, 908.98 lakh (i.e. 76%) cards have been distributed to farmers. In the 2nd cycle of the Scheme started from 1st May 2017, against the target of 130.65 lakh soil sample collection for the year 2017-18, 73.65 lakh samples have been collected and 18.76 lakh samples tested. Against the target of 689.41 lakh

soil health cards, 23.19 lakh cards have been distributed to farmers. Moreover, as per the estimates of National Productivity Council (NPC) about 84 percent of farmers have been benefitted in reducing the cost of cultivation and improving productivity of crops through the nutrients recommendations suggested in soil health card in 2016.

1.29 In order to have a wider outreach of SHC scheme, States are being encouraged to give wider publicity and organize media campaign to increase awareness among farmers. Moreover, steps like linking of Aadhar number of farmers in registration of soil samples and on SHCs, establishment of new testing labs/ mini labs in a time bound manner, setting up of village level soil testing projects in SAGY villages & others, involving KVKs/SAU/Science College labs in implementation process of SHC, etc., will ensure timely completion of the Scheme.

UPGRADING WATER USE EFFICIENCY TO TACKLE DROUGHT

1.30 India accounts for just 4 percent of world's freshwater resources. The problem of limited availability of water is exacerbated by its uneven distribution and increasing climatic complexities. On the demand side, pressures from population growth, urbanization and industrialization has led to competing use of water for various purposes. Agricultural sector, in particular, uses about 80 percent of available water resources but the increasing demand from other sectors is estimated to reduce the availability for agricultural use to 68 percent by 2050. It is, therefore, not just important but essential to utilize available water resources effectively both in agriculture and other sectors. The policy focus has been accordingly shifted towards increasing water-use efficiency by using precision irrigation techniques, like micro irrigation which

includes drip and sprinkler systems, and pressurized irrigation network system. Studies have shown that about 50 percent of water conservation can be done through the use of drip and sprinkler systems.

1.31 To give a major impetus to precision irrigation in the country, Government has approved Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) for a period of 5 years, i.e., from 2015-16 to 2019-20. The PMKSY has been made operational in the country from 1st July, 2015. Target of 10 Million ha for Micro Irrigation has been set under PMKSY for the period 2015-16 to 2019-20. Since 2015-16, an area of about 9.7 lakh ha and 6.34 lakh ha has been covered under drip irrigation and sprinkler irrigation, respectively, upto August 2017. Besides, micro irrigation is being promoted under Command Area Development and Water Management Programme (CADWM) Scheme of 'Har Khet Ko Pani' component of PMKSY. Under PMKSY- Accelerated Irrigation Benefit Programme (AIBP), 99 prioritized projects along with Command Area Development (CAD) works have been taken up from 2016-17 for completion in Mission mode. Minimum 10 percent of the total Culturable Command Area (CCA) of these projects is targeted for coverage under Micro Irrigation.

1.32 During the agricultural year 2014-15 and 2015-16, large parts of the country were affected by drought, causing widespread hardships to the affected population since the calamity encompassed major agricultural states in the country. Despite a good coverage of rainfall in the country, southern states faced a severe drought during 2016-17.

1.33 Keeping in view the increasing frequency of drought like situation in various parts of the country, several drought relief and response measures have been prepared for immediate implementation

following the declaration of drought. These measures involve sector specific planning and inter-departmental coordination. Under the existing Crisis Management Plan, District Agriculture Contingency Plans and financial assistance under State Disaster Response Fund/National Disaster Response Fund, prompt and planned measures by the Government have proven to be effective in reducing the hardships to the farmers. However, in addition to these short term relief oriented measures, various other measures are also required to attain the objective of drought proofing, which may inter-alia involve adaptation to climate change, restoration of ecological balance through adoption of sustainable agronomic and conservation practices, optimal cropping patterns and choices.

1.34 Drought proofing measures are being taken as a part of regular development programmes, like, Pradhan Mantri Krishi Sinchayee Yojna, National Rain fed Area Development Programme, National Rural Drinking Water Programme, Mahatma Gandhi National Rural Employment Guarantee Scheme, etc. Identification of most vulnerable districts in the country and then preparing district-wise action plan is important for achieving the objective of drought proofing. Towards this end, Mahalanobis National Crop Forecasting Centre (MNCFC) has identified 150 districts which have been most drought affected regions in the last 15 years. DAC&FW has accordingly embarked upon a mission to prepare District-wise Action Plan by incorporating measurable parameters, like increase in area under irrigation, increase in water table because of watershed activities, impact of NRLM on livelihood/alternate income generation, penetration of crop insurance, steps taken for diversification of cropping pattern in semi-arid districts and districts

which are always under acute water stress and frequently face drought. Out of about 150 drought prone districts, 24 chronic drought districts are in three states, namely, Karnataka (16), Andhra Pradesh (4) and Rajasthan (4), which were affected by more than 10 drought events during last 15 years. These districts have been identified for coverage under District Drought Proofing Plans. MOU has also been signed with ICAR-CRIDA to facilitate the process of preparation of above plans in close consultation with state and district level officers. The Plan would be essentially prepared by district and state level officials of different sectors such as agriculture, horticulture, animal husbandry, irrigation (surface and ground water sources), rural development, etc., in a collaborative way for each district separately. CRIDA would also organise capacity building programs for the staff of line departments at state level in preparation of these plans, review and finalize plans prepared by the line departments. States are expected to identify the priority of programmes/interventions to be taken up, participate in the capacity building programs/meetings, etc., for finalization of plans.

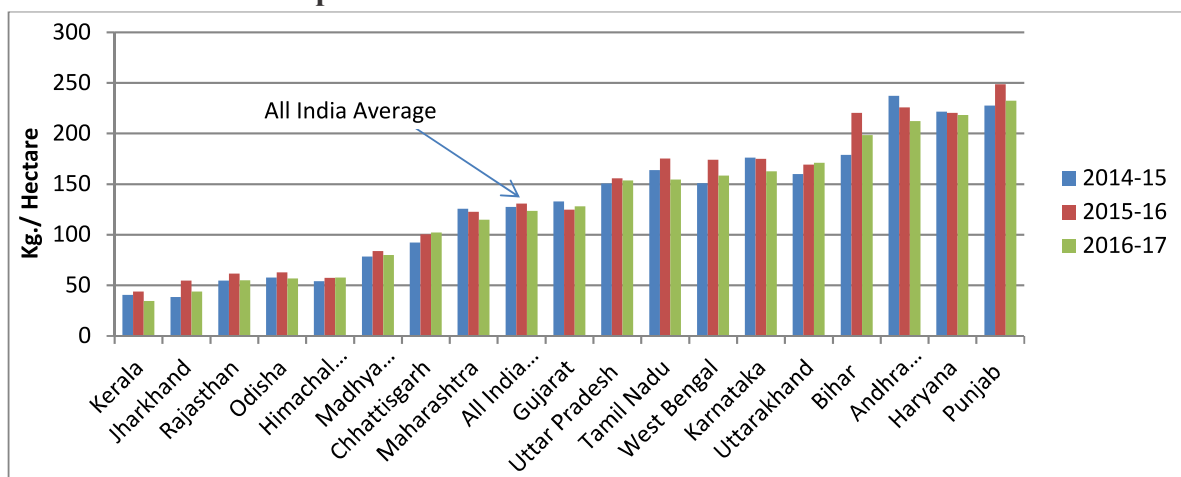
INTEGRATED NUTRIENT MANAGEMENT

1.35 Deteriorating soil health is one of the major

concerns policymakers throughout the world are grappling with. To arrest the decline in soil health, what is required to be ensured is timely and appropriate mix of nutrients for maintaining soil's carrying capacity while realizing the maximum potential of land to meet the ever increasing food demand. In particular, the optimal usage of primary, secondary and micro nutrients is essential for enhancing soil productivity.

1.36 In the national quest for achieving self-sufficiency in foodgrains, use of chemical fertilizers rose from less than 2 million tonnes during the pre-Green Revolution period in 1966-67 to the level of about 26 million tonnes in 2016-17. The all-India average consumption of fertilizers per hectare also increased substantially over the years but was accompanied by wide inter-state variability. For instance, major foodgrain producing states like Punjab, Haryana, Andhra Pradesh and Telangana are having per hectare consumption of over 200 kg., while states like Jharkhand, Odisha, Assam, Kerala, Madhya Pradesh, Chhattisgarh and Rajasthan were reported to have less than 100 kg per hectare fertilizer consumption in 2016-17 (**Figure 1.9**).

Figure 1.9: State-wise Consumption of Fertilizers

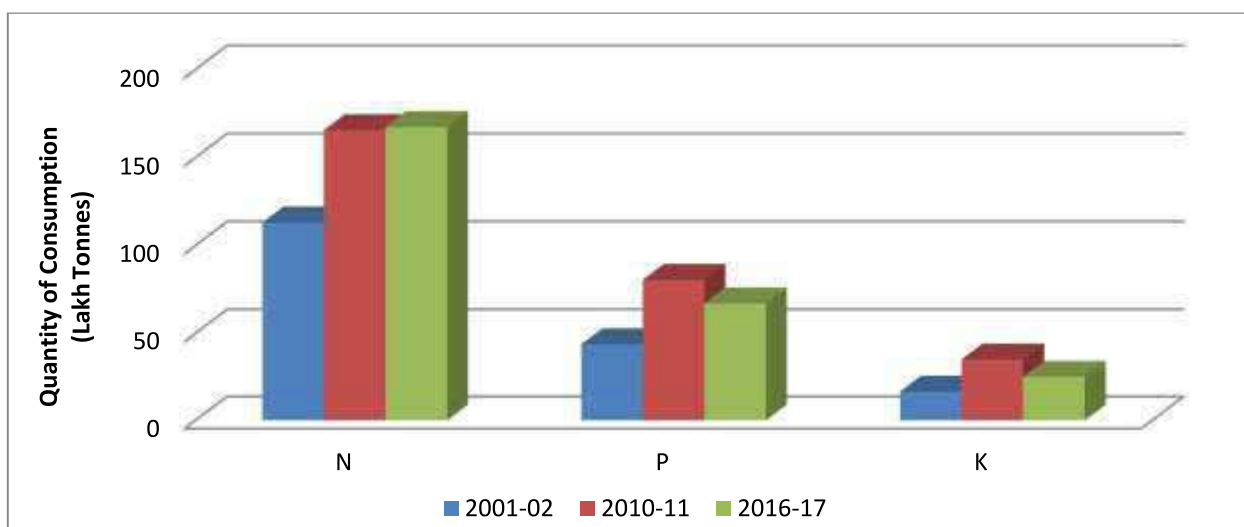


Source: Department of Agriculture, Cooperation & Farmers Welfare

1.37 Government introduced Nutrient Based Subsidy (NBS) Policy from April 2010 to ensure balanced use of fertilizers. Under the policy, a fixed rate of subsidy is announced on nutrients. Barring Urea, which is kept under statutory control, NBS policy covered P and K fertilizers in which the maximum retail price (MRP) of fertilizers is fixed by the fertilizer companies based on the prices prevailing in the international markets and a fixed amount of subsidy is provided on each grade of P & K depending upon its nutrient content. As a result, the prices of P and K fertilizers have increased in line with the movement in international prices of these

products and raw materials. This has led to a wide disparity in the prices of urea and other fertilizers which distorted the consumption pattern of NPK fertilizers. As may be seen from **Figure 1.10**, the consumption of P and K fertilizers has come down during the period 2010-11 to 2016-17, while consumption of N has increased, thus creating an imbalance in the optimal NPK ratio suggested for maintaining soil productivity. It may, therefore, be inferred that while the NBS Policy may have reduced the injudicious use, it has actually worsened the nutrient balance, as farmers have reduced the use of P and K, which are essential to soil and plant health.

Figure 1.10: Consumption of Fertilizers in terms of Nutrients



Source: Department of Agriculture, Cooperation & Farmers Welfare

1.38 Against this backdrop, Government is taking several steps for promotion of balanced use of fertilizers, including micro-nutrients by setting up and strengthening of soil testing laboratories, providing training and demonstrations to farmers for balanced fertilizer applications. At present, there are 1,414 Soil Testing Laboratories with analyzing capacity of 195.27 lakh samples per annum. Moreover, to preserve the soil health and to check the diversion of subsidized fertilizers in other uses,

Government has initiated a transition towards the total production and import of subsidized urea as neem-coated urea, and a gradual shift from an optional approach to a mandatory approach. Government has also been taking measures to promote the balanced use of fertilizers by introducing the SHC Scheme and, promoting customized fertilizers, quality fertilizers, etc. Soil Health Card portal- a single national database on soil health- is also being built for registration of soil samples,

recording test results of soil samples, generation of Soil Health Card (SHC) along with fertilizer recommendation and storehouse of data for use in research and planning.

1.39 Government is also promoting judicious use of chemical fertilizers in conjunction with organic manures and bio-fertilizers to maintain soil health and productivity. The main advantages of these organic fertilizers are that they are not just eco-friendly and provide nutrients for maintaining soil fertility, but also improve soil's physical & biological health. These fertilizers are largely produced on-farm by the farmers. On-farm organic inputs are estimated to bring down cost of production per unit area by about 13 percent as compared to inorganic fertilizers. However, if organic inputs from outside the farm are purchased and utilized, the cost of production increases by about 15-20 percent depending on the nature of inputs used. In view of this, Integrated Organic Farming System (IOFS) models being developed under National Project on Organic farming (NPOF) which promises to meet 70-80 percent of organic inputs within the farm thus reducing the market input cost considerably. The use of organic manure is being actively promoted through the dedicated scheme of Paramparagat Krishi Vikas Yojana (PKVY) under National Mission for Sustainable Agriculture (NMSA) The Scheme provides financial assistance for cluster formation, mobilization of farmers, PGS (Participatory Guarantee System) certification and quality control, residue analysis of samples in NABL (National Accreditation Board for Testing and Calibration Laboratories), conversion of land to organic farming, establishment of production units (Pachagavya/Beejamruth/Jeevamruth), green manuring/biological nitrogen harvest planting, botanical

abstracts production units, liquid biofertilizers, liquid biopesticides, Phosphate Rich Organic Manure (PROM), establishment of vermi-compost unit, supply of improved agricultural implements, transportation of organic products, packaging, labelling and branding of organic products, etc.

CUSTOMIZED MECHANIZATION

1.40 The relentless development efforts on farm management by extension services has increased use of machines in agricultural operations. But the focus now needed is on customized mechanization with matching skill sets and taking note of the gender dimension. For example, in 1960-61, about 92.30 percent farm power was coming from animal sources, in 2014-15 the contribution of animal sources of power reduced to about 9.46 percent and that of mechanical and electrical sources of power increased from 7.70 percent in 1960-61 to about 90.54 percent in 2014-15. The degree of farm mechanisation, expressed as a ratio of mechanical power to cultivable unit area, has, however, not shown any major improvement over the last few decades. During the period from 1973-74 to 2013-14, degree of farm mechanization has increased from 0.48 kW/ha to 1.84 kW/ha which has increased to 2.02 kW/ha during 2014-15 to 2016-17.

1.41 The process of agricultural mechanization in India is constrained by increasing fragmentation of land holdings which makes individual ownership of agricultural machinery difficult; domination of small and marginal farmers with limited capital availability, lack of finances; skill barriers to provide adequate support to modern technology; increasing environmental considerations, etc. In future, it is, therefore, necessary to establish a link between the possibility of sustainable development of agricultural mechanisation without neglecting the

lack of energy and environmental degradation due to low availability of fossil fuels and its high cost. Moreover, innovative solutions like customized farm machinery and equipment for different regions to cater to the needs of minimum tillage as well as inter-cultivation practices are important for tackling the emerging challenges in promoting farm mechanization. Financing of agricultural machinery is yet another area of concern. At present, only the tractor segment has access to long-term institutional credit; it has to be gradually extended to other categories of farm machinery to cater to the changing needs of farmers.

1.42 With a view to promote agricultural mechanisation among small and marginal farmers and in the areas where the level of mechanisation is very low, Government has started the Sub-Mission on Agricultural Mechanisation in the year 2014-15. The scheme not only includes the traditional component of training, testing, demonstration of agricultural machinery and procurement subsidy but also includes Farm Machinery Banks for Custom Hiring, Hi-Tech High Productive Equipments Centres on custom hiring model, and farm mechanisation in selected villages for enhancing productivity and creating ownership of appropriate farm equipments among small & marginal farmers. In addition, farm mechanisation is being promoted through various other schemes and programmes of the Ministry such as RKVY, NFSM, NHM, NMOOP, etc.

LIBERATING AGRICULTURAL CREDIT FROM SYSTEMIC SHORTCOMINGS

1.43 The availability and accessibility to adequate, timely and low cost credit is crucial for sustainable and profitable farming systems. Policy measures over the years have focused on improving the

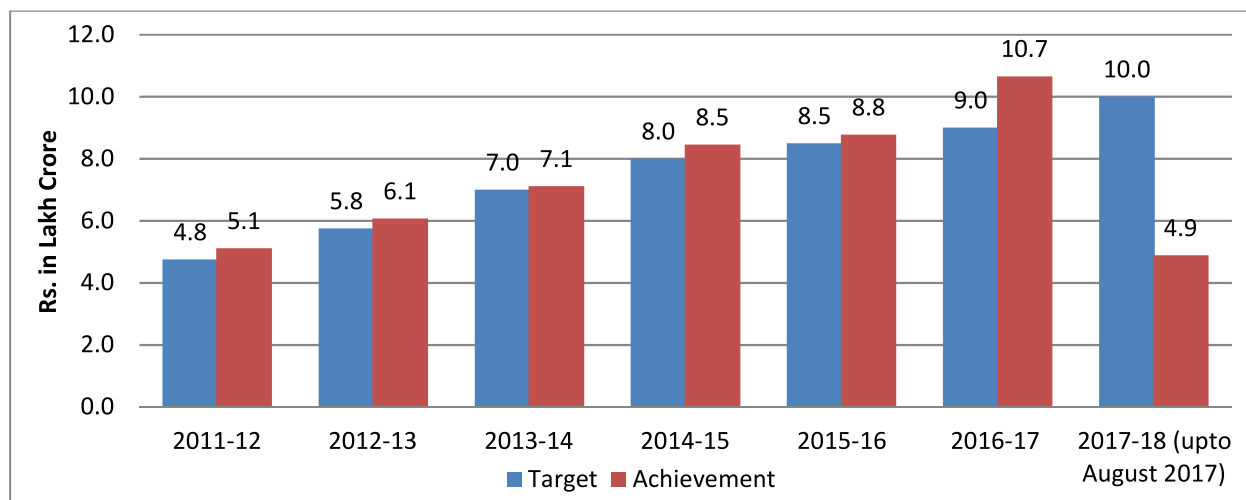
accessibility to the institutional sources of credit for protecting the farmers from the exploitative, illegal, money lenders' trap of usurious rates of interest. The small and marginal farmers, in particular, often face serious difficulties in accessing low cost institutional credit, which in turn hinders their ability to adopt modern technology and improved agricultural practices required for increasing agricultural production and productivity. As per the 'Situation Assessment Survey of Agricultural Households 2013', the proportion of agricultural households having access to credit from institutional sources is about 60 percent, which includes sources like Government (2.1 percent), Co-operative society (14.8 percent) and banks (42.9 percent). According to the Survey, institutional loans are so skewed against the farmers with small land holdings, that the lowest size of land holdings (less than 0.01 hectare) were estimated to have only 15 percent of outstanding loans from institutional source vis-a-vis about 79 percent in case of highest size of land holding (more than 10 hectare). The probable causes for this low percentage of small and marginal farmer in the total accessed credit may be many, which require an in-depth study. This also should be seen in the light of the fact that the majority of farmers in distress are in the small and marginal farmers category.

1.44 In light of this, the thrust of the policy measures has been to progressively increase the allocation towards institutional credit for agriculture sector, with a focus on small and marginal farmers. Between 2004-05 and 2016-17, agricultural credit disbursement registered a compounded annual growth rate of about 25 percent, which had consistently exceeded the credit allocation targets. During 2016-17, against a target of Rs. 9 lakh crore, about Rs. 10.65 lakh crore agricultural credit was

disbursed through commercial banks (75%), cooperative banks (13%) and regional rural banks (12%). For the year 2017-18, government has fixed an ambitious target of Rs. 10 lakh crore against which

about 4.88 lakh crore has been disbursed till August 2017, i.e., about 49 percent (**Figure 1.11**).

Figure 1.11: Year-wise Targets and Achievements of Institutional Agricultural Credit



* Achievement relates to April-August, 2017.

Source: Department of Agriculture and Farmers Welfare

1.45 Government is implementing the Interest Subvention Scheme (ISS) since 2006-07, with a view to incentivize farmers towards institutional sources of agricultural finance. Under the Scheme, as approved by the Cabinet for implementation in 2017-18, Central Government will provide interest subvention of 5 percent per annum to all prompt payee farmers for short term crop loan upto one year for loan upto Rs. 3 lakhs borrowed by them during the year 2017-18. Farmers will thus have to effectively pay only 4 percent as interest. In case farmers do not repay the short term crop loan in time they would be eligible for interest subvention of 2 percent as against 5 percent available above. Moreover, in order to give major relief to small and marginal farmers who would have to borrow at 9 percent for the post harvest storage of their produce, the Central Government has approved an interest subvention of 2 percent i.e. an effective interest rate of 7% for loans upto 6 months.

In addition, measures like Kisan Credit Card (KCC), enhancement of collateral free farm loan, revival package of Short-term Rural Cooperative Credit Structure, promotion of Joint Liability Groups (JLGs) to bring small, marginal, tenant farmers, oral lessees into the fold of institutional credit, etc., are being undertaken to ensure that all eligible farmers are provided with hassle-free and timely credit for their agricultural operations.

1.46 Taking note of the enormity of funds flowing to agricultural credit as discussed above, and the current pattern of credit facility penetration and distribution among the farmers possessing large, medium and small size land holdings, it is important to focus on precision guided credit instruments while targeting small and marginal farmers in terms of more share in the total flow of funds in the institutional credit so as to shield them from the moneylenders exploitation. What is utmost important is to effect a major change

in the banking and financial institutional mindset and a new code, informed by social policy institutions and monitored by authorities in banking sector is developed. Alongwith this, the banking and financial institutions should be activated in taking due care of all three segments of credit cycle: deposit mobilization, stress on lending vigorously, and prompt recovery.

FARM INSURANCE

1.47 The concerns about increasing vulnerability to climate change and limited coverage under the existing insurance schemes led the government to restructure the agricultural insurance schemes in accordance with the changing requirements and risk structure. Accordingly, the ambitious Pradhan Mantri Fasal Bima Yojana (PMFBY) was launched in kharif 2016 to provide a comprehensive crop insurance coverage from pre-sowing to post harvest losses against non-preventable natural risks. As against the prevailing high premium rates, the rate of premium for farmers under PMFBY has been reduced for all food and oilseeds crops and kept at a maximum of 1.5 percent for rabi, 2 percent for kharif, and 5 percent for annual horticultural and commercial crops. The balance of actuarial premium is shared by the Central and State Governments on 50:50 basis. The scheme has been made voluntary for States and available in areas and crops that are notified by the State Governments. Further, the scheme is compulsory for loanee farmers and voluntary for non-loanee farmers.

1.48 Since its inception, the PMFBY, with its simplified provisions and reduced premium rate, has resulted in both increased awareness among farmers and increase in coverage of area and crops. In terms of coverage, about 28 percent of Gross Cropped Area (GCA) has been covered in 2016-17, as compared to

22 percent in 2014-15. Moreover, a total of 5.74 crore farmers were covered in 2016-17, including 1.35 crore non-loanees. In terms of area insured, about 518 lakh ha. was insured which is 56.56 lakh ha. more than in the previous year, i.e., an increase of 10.78 percent.

1.49 One of the major reasons for the delay in settlement of claims under the erstwhile crop insurance schemes was the non-adoption of improved technology. In light of this under PMFBY, the States are required to give Crop Cutting Experiment (CCE) data to insurance companies within one month of harvest and the companies have to settle the claims within three weeks of receiving the CCE data. In order to eliminate the delay in claim settlement arising due to estimation of yield data and to promote transparency, it has been made mandatory to use smartphones/CCE Agri App for capture/transmission of yield data to the crop insurance portal. Due to this innovation, subsequent to harvest of kharif crops between November to December 2016, CCE data could be obtained from end December onwards and by January-end settlement of claims had been initiated. Other policy measures taken to expedite the claims settlement process is as under:

- a) A Central Crop Insurance Portal has been developed for integrating farmers and other stakeholders and for facilitating online registration of farmers
- b) All possible farmer friendly administrative initiatives and technology have been put in place to increase the coverage of non-loanee farmers including sharecroppers. For example Common Service Centres (CSC) have been engaged to facilitate enrolment of non-loanee farmers from kharif 2017.
- c) Approximately 12 lakh farmers have

registered online for crop insurance during kharif2017.

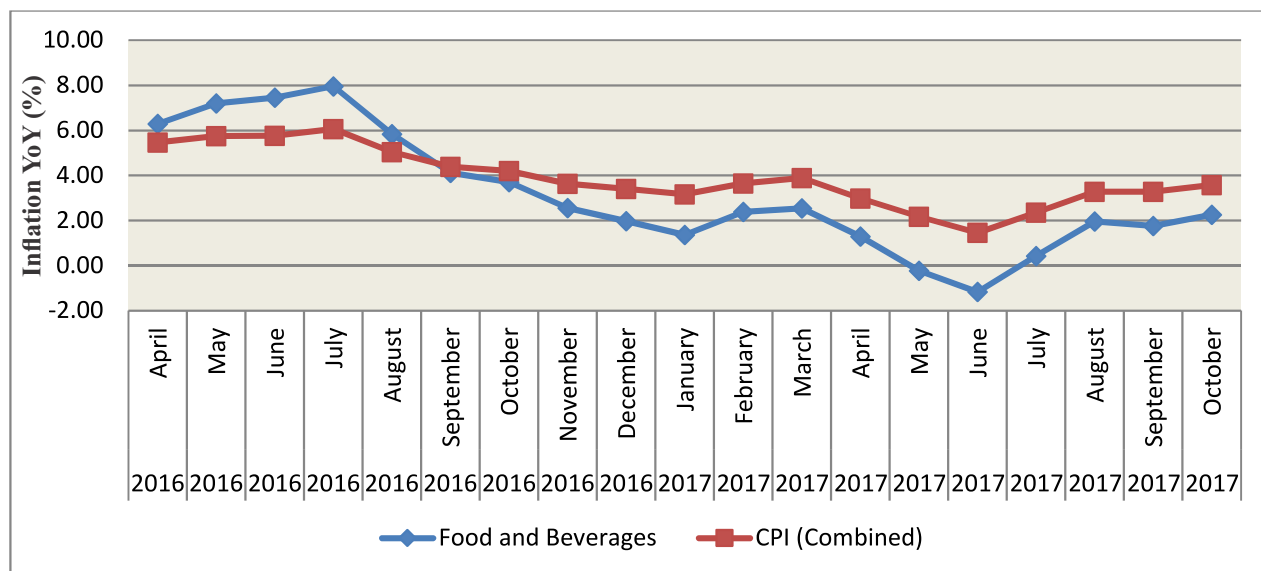
- d) Direct Benefit Transfer (DBT) has been initiated to facilitate transmission of claims amount directly to the farmers account.
- e) Provision has been made for use of advanced technology such as drone, remote sensing etc. for promoting transparency and immediate settlement of insurance claims.

STABILISING FOOD PRICES

1.50 Inflation based on both Consumer Price Index (CPI) and Wholesale Price Index (WPI) remained

low during the last few years. During 2016-17, while overall CPI inflation (Base: 2012=100) averaged 4.54 percent, inflation in case of food and beverages averaged 4.45 percent. The price of food items remained elevated during the first half of 2016-17, but declined sharply in the second half (till December) mainly reflecting the impact of demonetization on food prices through subdued demand (Figure 1.12). During 2017-18, food prices remained muted in the first quarter before starting their upward trend from July onwards on account of high prices of fruits and vegetables.

Figure 1.12: Month-wise Trend in Food Inflation based on CPI



Source : Central Statistics Office

1.51 The retail prices of pulses, in particular, which reached alarming levels in late 2015, witnessed a sustained fall since October 2016 on account of agricultural policies of higher MSPs and bonuses resulting in bumper production. The domestic production of pulses during 2016-17 was 22.95 million tonnes and is targeted at 22.90 million tonnes for 2017-18. In order to prevent distress selling, Government has procured 20 lakh tonnes of pulses by ensuring minimum support price or market rates,

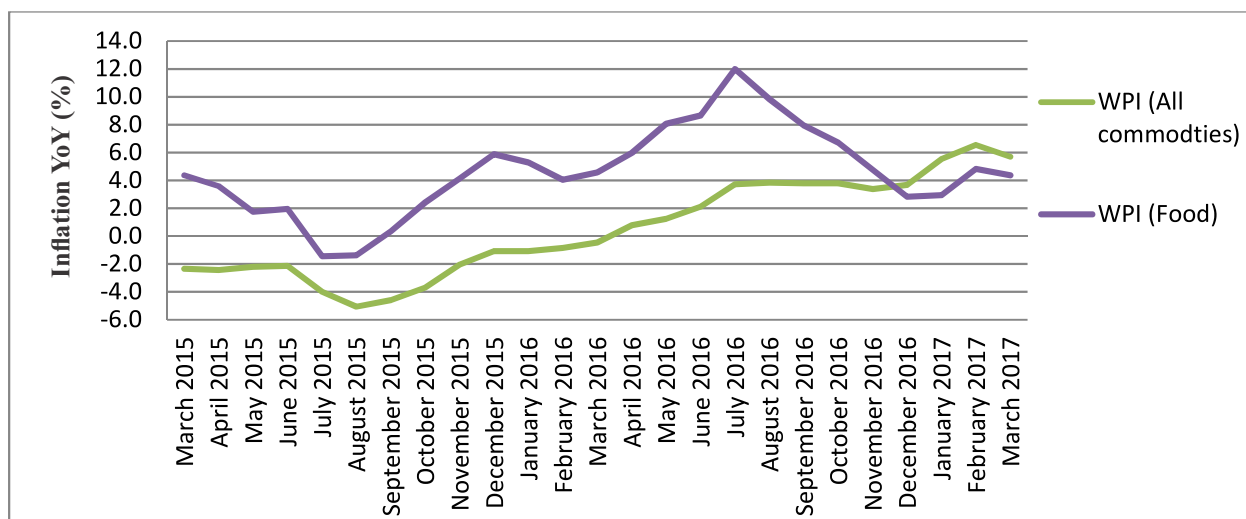
whichever is higher, directly from the farmers and this has been the highest ever procurement of pulses. The measures being taken by the government to augment the supply of pulses in the country will play a major role in reducing the import dependence and work towards nutritional security. The integration with global supply chain is also likely to help our farmers in adopting good agricultural practices and better productivity.

1.52 On account of increase in production of pulses, Government has recently removed ban on export of all types of pulses to ensure that farmers will have more choices in marketing their produce and get better remuneration. The measure is aimed at helping the farmers to dispose off their products at remunerative prices and encourage them to expand the area of sowing. Moreover, the export of pulses would provide an alternative market for the surplus production of pulses and will help the exporters to regain their markets.

1.53 The inflation based on Wholesale Price Index (WPI) with Base Year 2004-05=100, averaged 3.7

percent in 2016-17 as compared to (-) 2.5 percent in 2015-16, while the rate of food inflation (including food articles and manufactured food products) averaged 6.5 percent in 2016-17 as against 2.6 percent in 2015-16 (**Figure 1.13**). Food prices, in particular, gained momentum since March 2016 and reached the double digit level of 12 percent in July 2016, mainly due to increase in prices of pulses, fruits and vegetables, sugar, cereals, eggs, meat and fish, etc. However, prices witnessed a downward trend since July, 2016 mainly on account of fall in prices of fruits and vegetables, pulses, condiments and spices, etc.

Figure 1.13: Month-wise Trend in Food Inflation based on WPI



Source: Office of Economic Adviser, DIPP

MAKING MARKETING A WIN-WIN GAME

1.54 It is well recognized that to address the demands for marketing of increased and diversified agricultural marketable surplus, there is a need to strengthen the network of regulated markets in the country and augment it with alternative marketing channels. Government, therefore, advocates development of adequate number of markets equipped with modern infrastructure, with increased

private sector participation and development of other marketing channels, like direct marketing and contract farming, etc., to ensure profitable returns to farmers for their produce.

1.55 To meet the emerging agricultural marketing challenges, Government has formulated the 'Agricultural Produce Market Committee (APMC) Act 2017' which primarily includes: establishment of

private market yards/ private markets managed by a person other than a market committee; direct marketing or direct purchase of agricultural produce from farmers; consumers'/farmers' market to facilitate direct sale of agricultural produce to consumers; promote and permit e-trading; single point levy of market fee; single registration/license for trade/transaction in more than one market; removal of provisions of essentiality of shop in market premises; excluding fruits and vegetables from APMC Act, etc. The Model APMC Act 2017, after incorporating inputs from all the stakeholders, has been sent to the State Governments for effective implementation. Government has also approved the implementation of National Agriculture Market (e-NAM) Scheme aimed to provide an online trading portal to farmers and enable them to have an access to transparent sale transactions and price discovery. The main objective of the scheme is to give access to farmers about prices of various markets at one place so that the farmers can sell their yield under a transparent system to a buyer who offers the best price. Under this scheme Rs. 30 lakh is sanctioned to each market to build essential infrastructure. The fund was increased to Rs. 75 lakh during budget 2017-18. Under the scheme, a total of 585 regulated wholesale markets across the States are to be integrated to the portal by March, 2018. A total of 585 mandis of 16 States and 2 UTs that have to be

integrated with e-NAM include, Andhra Pradesh-22, Chandigarh-01, Chhattisgarh-14, Gujarat-79, Haryana-54, Himachal Pradesh-19, Jharkhand-19, Madhya Pradesh-58, Maharashtra-60, Odisha-10, Pudducherry-02, Punjab-19, Rajasthan-25, Tamil Nadu-23, Telangana-47, Uttar Pradesh-100, Uttarakhand-16 and West Bengal-17. Besides this other major policy decision like formulation of a model contract farming law will help in providing marketing infrastructure, developing marketing skills and in reducing risks associated with diversity in production.

1.56 Moreover, several demand driven Schemes are being implemented to develop an efficient agricultural marketing network in the country. These include Integrated Scheme for Agricultural Marketing and other capital investment schemes, like MIDH and RKVY. Besides, NABARD is also promoting development of various types of marketing infrastructures including warehouses, cold storages, etc., under RIDF/WIF. For setting up of integrated cold chain and preservation infrastructure facilities for horticulture and non-horticulture produce without any break from the farm gate to the consumer, the Ministry of Food Processing Industries is implementing a Central Sector Scheme of Cold Chain, Value Addition and Preservation Infrastructure.

Box 1.4: Agricultural Marketing and Farmer Friendly Reforms Index

NITI Aayog has launched “Agricultural Marketing and Farmer Friendly Reforms Index” to rank States and UTs based on the implementation of seven provisions proposed under model APMC Act, joining e-NAM initiative, special treatment to fruits and vegetables for marketing and level of taxes in mandis. These indicators reveal ease of doing agri-business as well as opportunities for farmers to benefit from modern trade and commerce and have wider option for sale of her/his produce. These indicators also represent competitiveness, efficiency and transparency in agriculture markets. The second area of reforms included in the index is relaxation in restrictions related to lease in and lease out agricultural land and change in law to recognize tenant and safeguard land owners liberalization. The third area included in the index represent freedom given to farmers for felling and transit of trees grown on private land. This represents opportunity to diversify farm business.

The Index has a score which can have minimum value “0” implying no reforms and maximum value “100” implying complete reforms in the selected areas. States and UTs have been ranked in terms of the score of the index.

The State of Maharashtra achieved first rank in implementation of various reforms. The State has implemented most of the marketing reforms and it offers best environment for doing agri-business among all the States and UTs. Gujarat ranks second with a score of 71.50 out of 100, closely followed by Rajasthan and Madhya Pradesh. Almost two third States could not reach even half-way mark of reforms score. Major States like U.P., Punjab, West Bengal, Assam, Jharkhand, Tamil Nadu and J&K are in this group.

CASHING UPON GLOBAL TRADE OPPORTUNITIES

1.57 India enjoys a significant position in global agricultural trade. Over the years, India has developed export competitiveness in certain specialized agricultural products, like basmati rice, guar gum and castor. During the year 2016-17, while the value of agricultural exports has increased to Rs. 2.27 lakh crore as compared to Rs. 2.15 lakh crore in 2015-16, the share of agricultural exports in overall exports has marginally come down to 12.30 percent from 12.55 percent in 2015-16. The increase in agricultural exports during the period was mainly due to increased exports of marine products, spices, groundnut, oil meals and fruits and vegetables. The overall trend in agricultural exports, however, has not

been encouraging particularly from 2013-14 onwards, which recorded the highest ever agriculture exports of about Rs. 2.62 lakh crore. The major external factors behind low agricultural export earnings are fall in international prices and loss of competitiveness due to currency movements. Moreover, policy restrictions on exports of certain agricultural commodities are often held responsible to limit the incentives for farmers to produce such crops. Against this background, the recent decision by the government to remove the ban on exports of all pulses is considered as an important step to realize better returns for their produce.

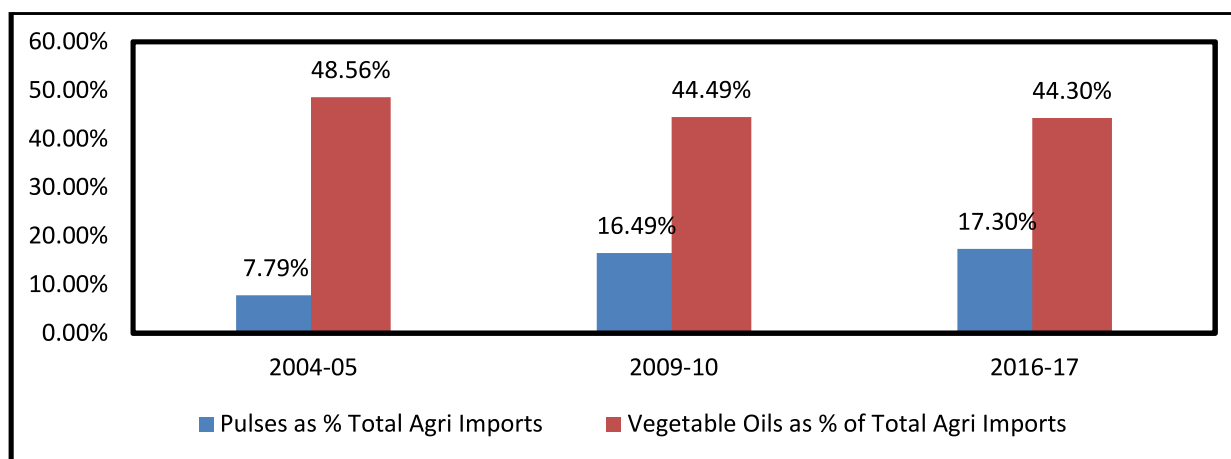
1.58 While the performance on export front has not been satisfactory, imports of agricultural products

have witnessed a significant jump from 2013-14 onwards. The value of agricultural imports has almost doubled since 2013-14 and as a result trade surplus in case of agricultural products has come down by a significant extent during the last few years. The value of total agricultural import has increased from Rs. 1.40 lakh crore in 2015-16 to Rs. 1.65 lakh crore in 2016-17, registering a growth of nearly 17 percent. Increase in value of agricultural imports was primarily on account of increase in import of wheat, vegetable oils, cotton, pulses and sugar. Share of agricultural imports in the total imports has also increased from 5.63 percent in 2015-16 to 6.39 percent in 2016-17.

1.59 One intriguing feature of India's agricultural trade is that while the export basket and destination

have diversified over the years, India's dependence on edible oils and pulses continues to play a major role in deciding the import basket. The share of edible oils and pulses in overall imports is shown in **Figure 1.14**. With the concerted efforts of the government, production of pulses has reached to its all time high of 22.95 million tonnes in 2016-17 which will reduce the demand for imported pulses. The increase in production, however, resulted in lower prices of pulses, which in the absence of adequate procurement measures by the government, may reduce the incentive to cultivate the crop in next season; thus creating a cobweb effect. It is thus imperative to strengthen the procurement mechanism of pulses in the country so as to incentivize farmers to sustain the production of pulses to meet the increasing demand.

Figure 1.14: Share of Edible Oils and Pulses in Agricultural Imports



Source: Department of Commerce

1.60 In case of edible oils, as against the total domestic production of about 11 million tonnes in 2016, the domestic requirement was about 24 million tonnes. Thus, setting a challenge of fully bridging the gap of about 13 million tonnes through imports in 2016-17. Palm oil, in particular, contributes 70

percent of vegetable oil import and is one of the cheapest oil due to high productivity per hectare of oil palm. In order to promote production of oil palm in the country, Government is implementing several programmes since 1986-87 and National Mission on Oilseeds and Oil Palm (NMOOP) from 2014-15.

Government has recently relaxed the land ceiling limit for oil palm cultivation under NMOOP for providing assistance to more than 25 hectare area also under NMOOP to attract corporate bodies towards oil palm and derive maximum benefit of 100 percent FDI. Moreover, norms of assistance have been revised under Mini Mission of NMOOP for planting materials, maintenance cost, inter-cropping cost and bore-well to make oil palm plantations attractive. These measures are aimed at reducing the burden on exchequer by increasing domestic availability of edible oils.

EMPLOYMENT IN AGRICULTURE

1.61 As per the decadal Population Census conducted by the Registrar General of India, the share of agricultural workers in the total workforce of the country has come down from 69.9 percent in 1951 to 54.6 per cent in 2011. During the same period, the share of agriculture in total GDP has witnessed a sharp decline from 51.9 percent to 14.4 percent. Although this shift in workforce from agriculture (primary) sector to secondary and tertiary sectors is a normal phenomenon of the development process, what is atypical of India is that the fall in employment share was not commensurate with declining GDP share. A cross country comparison of share in employment and Gross Value Added is given in **Table 1.5 and 1.6**. The slow pace of structural transformation in India can be largely attributed to lack of non-farm employment opportunities in rural areas to absorb a larger proportion of the workforce from agriculture and lower skill-sets of agrarian

workforce. The resultant high level of dependence on agriculture makes the sector more vulnerable to any shock in agricultural production as it impacts incomes and expenditure of a majority of population and has a direct impact on poverty. It is, therefore, important to focus on skill development of agricultural workforce and creation of 'non-farm' and 'near-farm' employment opportunities, viz., post-harvest management, food processing, logistics and modern retail which will not only help move people from farm jobs to near-farm jobs but also enable farmers to realize better prices for their produce, bring down price volatility and enable consumers to gain through better quality products at lower prices.

1.62 Some of the measures taken by the Government to ease the pressure on agriculture, through development of secondary and tertiary sectors, include: Make in India initiative to promote manufacturing; Startup India initiative to build a strong eco-system for nurturing innovation and startups in the country; building of industrial corridors along the dedicated freight corridors; and significant change in FDI policy. Furthermore, with a view to improve the employability of workforce, various skill development measures are being taken under the Skill India Initiative and its various components such as Pradhan Mantri Kaushal Vikas Yojana (PMKVY), National Skill Development Mission, National Policy for Skill Development and Entrepreneurship, and Skill Loan Scheme.

Table 1.5 Employment in agriculture (% of Total Employment)

Country	1981	1991	2001	2011
Brazil	29.3	na	20.6	15.7
China	68.1	59.7	50	34.8
Egypt, Arab Rep.	40.3	31.3	28.5	29.2
India	60.5	59	58.2	54.6
Pakistan	52.6	47.4	48.4	45.1
Russian Federation	na	14.2	12	7.7
United States	3.5	2.9	2.4	1.6

Source: World Bank

Table 1.6 Share of different sectors in Value Added (% of GDP)

		1960	1978	1988	1990	2000	2010	2014	2015
Bangladesh	Agriculture	61	57	46	28	26	18	16	16
	Industry	8	13	14	24	25	26	28	28
	Services	31	30	40	48	49	56	56	56
Brazil	Agriculture	16	11	9	8	6	5	5	5
	Industry	35	37	18	39	28	27	24	23
	Services	49	52	73	53	67	68	71	72
China	Agriculture	-	-	32	27	15	10	9	9
	Industry	-	-	46	42	46	46	43	41
	Services	-	-	21	31	39	44	48	50
Egypt.	Agriculture	30	29	21	19	17	14	11	11
	Industry	24	30	25	29	33	38	39	36
	Services	46	41	54	52	50	49	50	52
France	Agriculture	10	5	4	3	3	2	2	2
	Industry	38	37	37	29	23	20	20	20
	Services	52	58	59	67	74	79	79	79
India	Agriculture	50	40	32	31	23	18	17	17
	Industry	20	26	30	27	26	27	30	30
	Services	30	34	38	42	50	55	53	53
Pakistan	Agriculture	46	32	26	26	26	24	25	25
	Industry	16	24	24	25	23	21	21	20
	Services	38	44	49	49	51	55	54	55
Russian Federation	Agriculture	21	17	-	17	6	4	4	5
	Industry	62	62	-	48	38	35	32	33
	Services	17	21	-	35	56	61	64	63

Sri Lanka	Agriculture	34	35	26	26	20	13	9	9
	Industry	22	31	27	26	27	29	31	31
	Services	44	34	47	48	53	58	61	61
South Africa	Agriculture	12	8	6	5	3	3	2	2
	Industry	40	45	45	40	32	30	30	29
	Services	48	47	49	55	65	67	68	69
U.K.	Agriculture	4	2	2	2	1	1	1	1
	Industry	43	36	42	35	27	21	20	19
	Services	53	62	56	63	72	79	79	80
U.S.	Agriculture	4	3	2	2	1	1	1	..
	Industry	38	34	33	28	23	20	21	..
	Services	58	63	65	70	75	79	78	..

Source: World Bank

1.63 The availability of timely and reliable employment statistics assumes significant importance for focused policy interventions. At present Employment-Unemployment Surveys are conducted annually by the Labour Bureau and every five years by the NSSO. In addition, under the Population Census conducted by the Registrar General of India every ten years, total workers are enumerated on the basis of economic activity. There is, however, a need for more frequent and regular estimates on employment and unemployment patterns in the country to assess the efficacy and impact of various interventions by the government at

the centre and state level. To address this issue, the nation-wide Periodic Labour Force Survey (PLFS) has been launched by NSSO from April, 2017 with the objective to measure quarterly changes of key labour force indicators (such as Labour Force Participation Rate (LFPR), Worker Population Ratio (WPR) & Unemployment Rate (UR)) in urban areas as well as to generate the annual estimates of different labour force indicators both in rural and urban areas. For measuring the labour force indicators, both Current Weekly Status (CWS) and Usual Activity Status (US) approach are followed.

Box 1.5: Women in Agriculture

“Gender Mainstreaming’ is one of the important pillars of the National Policy for Farmers’ formulated in 2007. The role of women has increased in all fields of agricultural development from production, post-harvest operations, livestock, horticulture, fisheries etc. This has been a result, also, of increasing migration of men to urban areas and has been termed as *Feminisation of Agricultural Sector*. Globally, there is evidence to show that women have a decisive role in ensuring food security and preserving local agro-biodiversity. Rural women are responsible for the integrated management and use of diverse natural resources to meet the daily household needs. This necessitates that women farmers have access to resources like land, water, credit, water, seeds and markets.

Addressing this issue, the National Gender Resource Centre in Agriculture (NGRCA) and Gender Budgeting Cell (GBC) have been constituted by the Department of Agriculture, Cooperation & Farmers Welfare. Mainstreaming of women in agriculture is addressed by these steps in the following ways:

- i) Earmarking 30% of funds for women under various major schemes/programmes and development interventions;
- iii) Women farmers are to be involved in different decision making bodies at district and block level such as Agriculture Technology Management Agency (ATMA) Governing Board and ATMA Management Committee at district level;
- iv) Women are represented in Farmers Advisory Committees (FACs) set up at block/ district and state level;
- v) More women are involved as 'Farmer Friends 'under the newly introduced mechanism for extension delivery below the block level through a 'Farmer Friend';
- vi) Farm Women's Food Security Groups (FSGs) @ at least 2 per block to be formed annually for ensuring household food and nutritional security providing assistance of Rs. 10,000/ per group.
- vii) Self Help Groups for credit among women are promoted
- viii) Recognising the critical role of women in agriculture, the Ministry of Agriculture and Farmers Welfare has declared 15th October of every year as Women Farmer's Day.

Realizing that it is 'gender' that differentiates the roles, responsibilities, resources, constraints and opportunities of women and men in agriculture, precise gender information is essential and would help in overcoming gender based prejudices and articulating gender perspectives in development activities. Further, this may not only enhance the production and productivity of agricultural sector and improve overall national food security but would also smoothen the transition of women from being beneficiaries of the Government policies to their active participation in shaping the empowerment.

IMPACT OF GST ON INDIAN AGRICULTURE

1.64 Government introduced a new tax regime, namely Goods and Services Tax (GST) with effect from 1st July 2017, which seeks to replace all the extant central and state indirect taxes and introduce a single tax on goods and services. The GST, unlike the earlier system, will allow the supplier at each stage to set-off the taxes paid at previous levels in the supply chain. It is essentially a tax on value added at each stage. The final consumer will thus bear only the GST charged by the last dealer in the supply chain, with set-off benefits at all the previous stages.

1.65 The impact of GST on the Indian economy is largely expected to be comprehensive and transparent. This can be specifically seen in the agricultural sector, wherein due to the presence of variegated state agricultural taxation policies, any central pricing mechanism could not be fully effective. But with the introduction of the GST regime, uniformity across centre and the states, thus achieved, would make any such policies for commodities effective. Moreover, the principle that GST rate would be more or less at par with the earlier indirect tax regime makes the implementation all the

more conducive. The change in tax rates on major agricultural commodities, products and inputs with the implementation of GST is given in **Table 1.7**.

1.66 It is important to note that the main agricultural outputs are placed in the zero tax slab which would benefit the small and marginal farmers the most. Also, the rates in the food segment are fixed

such that there is no negative impact on inflation. However, the high GST rate for packaged food may negatively impact linkages between farmers and food processing industry, but a right policy mix for boost in the industry (uniform tax rate) may counter this negative impact by making the entire process smooth, transparent and less time consuming.

Table 1.7: Changes in tax rate on agricultural commodities and inputs

Category	Earlier Tax Rate	Tax Rate Under GST
Fertilizers	0-8%	5%
Pesticides	12% excise and 4-5% VAT in some states	18%
Drip and sprinkler irrigation equipment	5% VAT	12% (initially placed under 18% slab)
Packaged food preserved vegetables, jams, jellies, sauce etc.	5%	18%
Tractors (except road tractors)	18.5%	12%
Butter, Ghee, Cheese	6%	12%
Dried nuts like almonds, hazelnuts	6%	12%

Source: Department of Revenue

1.67 Overall the GST regime would result in a unified market at national level. This is likely to facilitate and strengthen the Scheme on National Agricultural Market (NAM), aimed at an integrated system of market of agriculture produce at the national level, allowing free flow of agricultural commodities across states. This would improve marketing efficiency, facilitate development of virtual markets through warehouses and reduce overhead marketing cost. The reduced effective cost of production would also give a boost to the agricultural exports of the economy. Furthermore, agricultural commodities are perishable in nature in varying degrees; therefore, trade is influenced by the

time required for transportation. The simple uniform tax regime is likely to improve the transportation time, and curtail food wastage and have a substantial positive impact on the agricultural sector.

1.68 Moreover, to make a smooth transition to the GST regime in agriculture sector, a GST Cell under the Chairmanship of Adviser (Trade), Ministry of Agriculture & Farmers' Welfare has been formed to receive grievances from farmers and others, examine the complaints, grievances, proposals and resolve them immediately by coordinating with the Department of Revenue.

Agricultural Production and Programmes

2.1 Indian Agriculture during 2016-17 saw new heights in the production of foodgrains, horticultural and dairy products with impressive contribution by rice, wheat, pulses, sugar, egg and poultry. The trend is expected to continue through 2017-18. The new initiatives that have made positive impact on the area, yield and productivity of foodgrains, pulses, horticultural and the livestock items are NFSM, BGREI, crop diversification, support to cold chain development and RKVY. In this achievement, among other things, innovative management solutions and application of science and technology to crops have played a crucial role.

AGRICULTURAL PERFORMANCE

2.2 Foodgrain production in the country is estimated to have reached its all time high of 279.51 million tonnes in 2017-18. The increase in production of 4.40 million tonnes over the previous record production of 275.11 million tonnes achieved during 2016-17 was mainly on account of good rainfall conditions during monsoon 2017 and various policy initiatives undertaken by the government. This revival in agricultural production in 2016-17 and 2017-18 after the two consequent deficient rainfall years (2014-15 and 2015-16) is considered to be an important development towards achieving the ambitious goal of doubling farmers' income by 2022. The crop-wise performance is discussed in the following sections.

Rice

2.3 Rice production in India has reached the new high of 111.52 million tonnes (3rd advance estimate)

during 2017-18, surpassing even the target of 108.50 million tonnes. As compared to 2016-17, production is estimated to be higher by 1.82 million tonnes in 2017-18 and is also higher than the last five years' average production of 106.29 million tonnes. The increased production of rice is a result of various price and technological interventions by the Government, viz., introduction of better crop varieties, intensive application of inputs, irrigation, adequate price support and timely procurement by the Government.

2.4 The productivity in rice has also witnessed an increase from 2,494 kg per hectare during 2016-17 to 2,539 kg per hectare in 2017-18. Over the years, rice productivity in the country has shown an upward trend, i.e., rising from 1,984 kg per hectare in 2004-05 to the all time high level of 2,539 kg per hectare in 2017-18. Although at the state-level, yield differentials continue to be significant with Punjab as the front runner, the other states are gradually catching up. Various crop development schemes/programmes are being implemented by the Government to increase production and productivity of rice. Important among these are: National Food Security Mission on Rice (NFSM-Rice), Rashtriya Krishi Vikas Yojana (RKVY), Pradhan Mantri Krishi Sinchai Yojana, Bringing Green Revolution to Eastern India (BGREI) as a sub-scheme of RKVY, etc. The NFSM-Rice is being implemented in 194 districts of 25 states i.e., Andhra Pradesh (5), Arunachal Pradesh (10), Assam (13), Bihar (15), Chhattisgarh (13), Gujarat (2), Himachal Pradesh (2), Jammu & Kashmir (8), Jharkhand (4), Karnataka

(7), Kerala (1), Madhya Pradesh (8), Maharashtra (8), Manipur (9), Meghalaya (7), Mizoram (6), Nagaland (11), Odisha (8), Sikkim (2), Tamil Nadu (8), Telangana (4), Tripura (8), Uttar Pradesh (23), Uttarakhand (5), and West Bengal (7).

2.5 With a view to improve the productivity of rice, ICAR is conducting basic and strategic research related to different aspects of crop improvement, crop production and crop protection through Central Rice Research Institute (CRRI), Cuttack and All India Coordinated Research Project (AICRP) on Rice coordinated by Directorate of Rice Research (DRR), Hyderabad. Through these research initiatives of ICAR, improved rice varieties and hybrids are being developed with higher yield, stress tolerance, good cooking qualities. Special emphasis has also been given to develop climate resilient rice varieties to mitigate the adverse effect of climate change on rice production in the years to come and also on sustainable agricultural practices to bring down the cost of cultivation.

2.6 Some technically innovative and economically viable interventions evolved by research institutions include direct seeded rice (DSR) in rain-fed upland and lowland irrigated areas, transplanted rice cultivation (TRC) in rain-fed lowland and irrigated areas, alternate wetting and drying (AWD) in irrigated areas with good water management practices, system of rice intensification (SRI) in levelled and well-drained soil with assured sources of irrigation, integrated crop management through seed treatment, low seed rate, seedlings age and number per hill, wider spacing, need based nutrient application, weed management, intermittent irrigation, integrated pest management (IPM) and promotion of new varieties.

Wheat

2.7 During the decade of 2007-08 to 2017-18, a

significant increase in production of wheat from 78.57 million tonnes to 98.61 million tonnes was witnessed. This became possible mainly due to the improvement in productivity from 2802 kg/hectare to 3318 kg/hectare during this period. The acreage under wheat crops increased by only about 1.68 million hectare during this decade. This increase in wheat production and productivity was made possible through adoption of newer varieties, increase in area under assured irrigation facilities, better seed treatment, timely rust management and timely sowing of crop to escape terminal heat stress.

2.8 Under the ongoing schemes, like National Food Security Mission (NFSM) and Rashtriya Krishi Vikas Yojana (RKVY) various interventions are being made for improving wheat production and productivity in the country. These include: demonstrations of improved production technologies, including climate resilient varieties; seed distribution of newer varieties; farm machinery & implements; water efficient devices (sprinkler, rain gun, water carrying pipes); plant protection chemicals; micro nutrients and soil ameliorants, etc. The NFSM-Wheat is being implemented in 126 districts of 11 states i.e. Bihar (10), Gujarat (5), Haryana (7), Himachal Pradesh (11), Jammu & Kashmir (8), Madhya Pradesh (16), Maharashtra (3), Punjab (12), Rajasthan (14), Uttar Pradesh (31), and Uttarakhand (9).

2.9 In order to sustain the present level of wheat productivity and production in the country, certain key areas such as increased seed replacement rate (SRR) along with varietal replacement with rust resistant ones and resistance to different biotic and abiotic stresses including multi stress tolerant cultivars need to be addressed on priority basis. Towards this end, various technological interventions are being practiced, such as maintaining optimum

sowing time, line sowing, avoiding terminal heat stress, avoiding early sowing in mid hills to break green bridge to contain rusts, cultivating rust resistant varieties like DPW-621-50, PBW-550, DBW-17, HD-1105, etc., in plains of North Western Plains Zone and testing & popularizing rust resistant varieties like HS-375 & VL-832 in higher hills in summer season cultivation, adoption of Resource Conservation Technologies (RCT) including Zero tillage, laser land leveller, revising rust epidemiology in higher hills, adequate spacing between rows so as to augment yield and integrated pest & nutrient management.

Nutri Cereals

2.10 Nutri cereals, including barley, jowar, bajra, ragi, maize and other small millets (kodo, kutiki, sanwa, and foxtail), are known for their nutrient-rich content and characteristics like drought tolerance, photo-insensitivity and resilient to climate change. The area, production and yield trends in case of nutri cereals segment during 2007-08 to 2017-18 highlight the success of the crop development strategy in India, wherein despite a decline in area under cultivation for these crops, production increased due to increase in yield. The area under nutri cereals declined from 28.48 million ha in 2007-08 to 25.00 million ha in 2016-17 which has further come down to 23.98 million ha in 2017-18. However, the productivity of nutri cereals has increased significantly from 1,431 kg per hectare in 2007-08 to 1,750 kg per hectare in 2016-17 and further to 1,871 kg per hectare in 2017-18. The increase in productivity was observed in almost all the major nutri cereals producing states resulting in an increase in the total production of nutri cereals from 40.75 million tonnes in 2007-08 to its estimated record production of 44.87 million tonnes in 2017-18 (3rd Advance Estimates).

2.11 Despite the considerable improvement in

production and productivity of cereals, various factors impede the production of nutri cereals in India. These include; cultivation in rainfed areas, non-availability of high yielding varieties, non-adoption of the recommended doses of inputs due to risk under the rainfed agro-climatic conditions, lack of assured procurement under MSP, poor irrigation facilities, etc. In order to promote cultivation of nutri cereals in the country, the Government of India is implementing since 2014-15, a Centrally Sponsored Scheme “National Food Security Mission NFSM-Coarse Cereals”. The erstwhile “Initiative for Nutritional Security through Intensive Millets Promotion (INSIMP)” a sub-scheme of Rashtriya Krishi Vikas Yojana (RKVY) has been subsumed under NFSM-Coarse Cereals from 2014-15. The NFSM-Coarse Cereals is presently being implemented in 265 districts of 28 states, i.e., Andhra Pradesh (6), Arunachal Pradesh (17), Assam (4), Bihar (11), Chhattisgarh (9), Gujarat (8), Haryana (5), Himachal Pradesh (12), Jammu & Kashmir (22), Jharkhand (11), Karnataka (11), Kerala (1), Madhya Pradesh (16), Maharashtra (8), Manipur (9), Meghalaya (11), Mizoram (8), Nagaland (11), Odisha (6), Punjab (3), Rajasthan (12), Sikkim (4) Tamil Nadu (10), Telangana (6), Tripura (8), Uttar Pradesh (20) Uttarakhand (13), and West Bengal (3).

2.12 Under NFSM-Coarse Cereals various interventions, like cluster demonstrations of improved technologies for sole crop and intercropping and distribution of quality seeds, are being promoted to enhance production and productivity of Nutri Cereals in the country.

Pulses

2.13 Pulses are an important commodity group of crops that provide high quality protein complementing cereal proteins. The potential of pulses to help address future global security, nutrition and environmental

sustainability needs has also been acknowledged through the UN declaration of year 2016 as International Year of Pulses. India is the leading producer of pulses in the world and accounts for about 33 percent of the world production and about 39 per cent of the area under cultivation. The important pulse crops are chickpea with a share of 41 percent, pigeon pea with 21 percent, Urad with 13 percent and Moong with 9 percent share. The major pulse producing states are Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh, Karnataka and Andhra Pradesh together accounting for about 80 percent of total production during 2017-18.

2.14 As a result of significant increase in the area coverage and productivity of all major pulses, total production of pulses is estimated to reach 24.51 million tonnes during 2017-18 (3rd advance estimate), which is even higher than the previous record production of 23.13 million tonnes achieved during 2016-17. Over the last decade, pulse production has shown a significant jump from 14.76 million tonnes in 2007-08 to reach its record high of 24.51 million tonnes in 2017-18. The increase in the total production of pulses has been on account of improvements in the production levels of Gram, Tur, Urad and Moong. Productivity of pulses has also increased from 625 kg per hectare in 2007-08 to 835 kg per hectare in 2017-18. A major increase in the productivity of pulses was noticed in States of Chhattisgarh, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh.

2.15 The cultivation of pulses builds-up a mechanism to fix atmospheric nitrogen in their root nodules and thus meet their nitrogen requirements to a great extent. It also help in improving soil fertility and physical structure, fit in mixed/inter-cropping system, crop rotations and dry farming and provide green pods for vegetable and nutritious fodder for

cattle as well. However, pulse cultivation in India is mostly concentrated in the rainfed area (around 80% of the area), on marginal lands, on low fertile soil by resource poor farmers. Moreover, low Seed Replacement Rate (SRR), high susceptibility to pests especially pod borer, inadequate market linkages, etc., are the primary reasons for low yield of pulses. With a view to minimize this problem and ensure protective irrigation at the critical stage of plant development, sprinkler set, mobile rain gun, pump set, etc. are being distributed to farmers for efficient use of water from Dug well, Pond and Polythene lining pond.

2.16 The Government of India gives priority to increasing the production of pulses. Around 50 percent of the budget under the National Food Security Mission (NFSM) is allocated for pulses. Under NFSM, 638 districts of 29 states, including all the districts of the North Eastern and hill states, are covered for promoting the cultivation of pulses.

Oilseeds Production

2.17 India produces a wide range of oilseed crops in different agro-climatic regions of the country. Major oilseeds grown are: groundnut, rapeseeds and mustard, soybean, sunflower, sesame, safflower, niger and non-edible oilseeds like castor and linseed. Oilseeds are mostly cultivated under the rain-fed conditions and are important for the livelihood of small and marginal farmers in arid and semi-arid regions of the country.

2.18 During the agricultural year 2017-18, as against the target of 35.50 million tonnes, oilseeds production is estimated at 30.63 million tonnes (3rd Advance Estimates). Of this, edible oil accounts for production of 10.52 million tonnes which is less than the actual production of 10.75 million tonnes of 2016-17. With the increase in population and

disposable income, the domestic consumption of edible oils has also increased substantially over the years and touched 23.55 million tonnes in 2016-17 and is likely to increase even further. Thus, although the growth in production of oilseeds in the country has increased over the years it has not been able to keep pace with the growth in consumption and a large part of the gap is being met through imports. About 14 million tonnes of edible oils was imported during 2016-17, which include largest share of palm oil and palmolein (78%) followed by soybean (10%) and sunflower oil (9%). During 2017-18, it is estimated that about 15.36 million tonnes of vegetable oils have been imported to cater to the domestic requirements.

2.19 In order to give a major impetus to oilseed production in the country, Government is implementing National Mission on Oilseeds and Oil Palm(NMOOP) since 1st April, 2014 by restructuring the existing CSS scheme of Integrated Scheme of Oilseeds, Oil Palm and Maize(ISOPOM), tree borne oilseeds(TBOs) and Oil Palm Area Expansion

(OPAE) programmes. Under the scheme, to encourage farmers for cultivating oilseeds, incentives are given on production and distribution of seeds, supply of seed minikits, transfer of improved production technologies through block demonstrations, front line demonstrations, farmers training, supply of other inputs such as improved farm implements, sprinkler sets, water carrying pipes, supply of seed storage bins, seed treatment drums, bio-pesticides, micronutrients, bio-fertilizers, plant protection chemicals including bio agents, etc. An outlay of Rs. 500.00 crore has been allocated under NMOOP in year 2016-17. During 2017-18, NMOOP programme is under implementation in 28 states comprising of three Mini Missions, i.e, Mini Mission-I (Oilseeds) in 27 states, Mini Mission-II (Oil palm) in 13 states and Mini Mission-III (Tree Borne Oilseeds) in 10 states involving 5 Central seed producing agencies and need based R&D through 7 R&D institutions with Budgetary Estimate (BE) of Rs.403 crore.

Box 2.1: Oil Palm Cultivation in India

Oil Palm (*Elaeis guineensis*), originated from West Africa, is comparatively a new crop in India and has highest vegetable oil yielding capability per hectare. It produces two distinct oils, i.e., palm oil and palm kernel oil, which are used for culinary as well as industrial purposes. Palm oil is derived from the fleshy mesocarp of the fruit, which contains about 45-55 percent of oil. Palm kernel oil, obtained from the kernel of oil palm, is the source of lauric oils. With quality planting material, irrigation and proper management, there is potential of 20-25 MT fresh fruit bunches (FFBs) per ha after attaining the age of 8-9 years. In comparative terms yield of palm oil is 5 times the yield of edible oil obtainable from traditional oilseeds. An area of 19.33 lakh ha has been identified suitable for oil palm cultivation in the country including 2.18 lakh ha area in North Eastern States. Palm oil has good acceptance as a cooking medium because of its price advantage. It is also used as raw material for manufacturing oleo chemicals used in making soaps, candles, plasticizers, etc.

Oil Palm Development Programme was started in India during 1991-92 and continued till 2002-03, mainly for area expansion under oil palm in selected states. Subsequently, in order to increase the production & productivity of oilseeds and oil palm cultivation, Integrated Schemes of Oilseeds, Pulses, Oil Palm and Maize (ISOPOM) was implemented from 2004-05 to 2013-14 in 10 states of the country. Besides, area

expansion of oil palm was also supported through Oil Palm Area Expansion (OPAE) programme under RKVY from 2011-12 to 2013-14.

Mini Mission-II of National Mission on Oilseeds and Oil Palm (NMOOP), launched during the 12th Five Year Plan, is dedicated to oil palm area expansion and is currently being implemented in 12 states, viz., Andhra Pradesh, Telangana, Chhattisgarh, Tamil Nadu, Kerala, Gujarat, Karnataka, Odisha, Mizoram, Nagaland, Assam and Arunachal Pradesh w.e.f. 01.04.2014. Under the Mission, financial assistance is being provided to the farmers @ 85% cost of the planting material and @ 50% cost of the other components, like maintenance cost of new plantations for four years, installation of drip-irrigation systems, diesel/electric pump-sets, bore-well/water harvesting structures/ponds, inputs for inter-cropping in oil palm (during gestation period), construction of vermi-compost units and purchasing of machinery & tools etc. in the country w.e.f. 2014-15, with three Mini Missions (MM) of which MM-II is on oil palm.

Expenditure under MM-II is being shared in the ratio of 60:40 between the Central and the State Governments in case of general states and 90:10 in case of NE states from the year 2015-16. 100% support is being provided to Indian Institute of Oil Palm Research (IIOPR), Pedavegi, Andhra Pradesh for Research & Development on oil palm.

All these developmental efforts have resulted in area expansion under oil palm from 8585 ha in 1991-92 to 3.00 lakh ha by the end of 2015-16. Similarly, the Fresh Fruit Bunches (FFBs) production and Crude Palm Oil (CPO) have increased from 21,233 MT and 1,134 MT respectively (1992-93) to 12.83 lakh and 2.17 lakh MT respectively during the year 2015-16. At present, Andhra Pradesh, Karnataka, Tamil Nadu, Mizoram and Odisha are major oil palm growing states.

Major Constraints in Oil Palm cultivation

- Production involves a long gestation period and restricts income flow to farmers for at least 4-5 years.
- Fluctuation in prices of CPO in the international market and price of FFBs.
- Erratic monsoon resulting in water stress.
- Competition with other economically viable crops such as rubber, arecanut, sugarcane, banana, coconut etc.
- Variation in import duty on edible oils.
- Non-availability or shortage of power and limited availability of new electric connections.

Strategy for oil palm development under Mini Mission-II of NMOOP

- Augmenting availability of planting materials by establishment of new seed garden in the country.
- Support for maintenance of new plantations and inputs for inter-cropping in oil palm field during gestation period.
- Enhancing irrigation through Drip, Pump set, bore well, water harvesting structure and ponds etc.
- Support for establishment of new oil palm processing units for NE /Hilly/LW states.
- Support for construction of roads from farmer's field to FFBs collection/ processing centre for hilly areas.
- Demonstration of oil palm in farmer's fields.
- Capacity building of field functionaries/extension workers & farmers /input dealers.
- Support for need based Research on project basis.

Sugarcane

2.20 India is the second largest producer of sugarcane after Brazil, and contributes about 19 percent of the world production. Sugarcane is one of the important cash crops of the country and is grown across an area of 4.77 million ha (3rd Advance Estimates for 2017-18) with a 55 percent and 45 percent geographical distribution between the sub-tropical and tropical India. The area sown under sugarcane depends on farmers' preference, shift of area to other competing crops, agro-climatic conditions, inter-crop profitability, irrigation facilities, resource availability with farmers and timely payment of cane dues to farmers by the mills, etc.

2.21 Sugarcane production is estimated at 355.10 million tonnes during 2017-18 (3rd advance estimate) which shows a significant increase of 49.03 million tonnes over 2016-17. The production of sugarcane during 2017-18 is also higher by 13.06 million tonnes than the average sugarcane production of 342.04 million tonnes of the last five years. Yield of sugarcane has also increased to 74.37 tonnes per hectare during 2017-18 as compared to 69.00 tonnes per hectare during 2016-17. This revival in sugarcane production, after two back-to-back droughts in major sugarcane growing areas during 2014-15 and 2015-16, is considered as a major development in the sugar industry.

2.22 With a view to enhance area coverage and production of Sugarcane in the country, Government is implementing Sugarcane Development Programme under National Food Security Mission - Commercial Crops (NFSM-CC) in 13 major sugarcane growing states of the country, viz., Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Punjab, Telangana, Tamil Nadu, Uttarakhand and Uttar

Pradesh. The states can also support Sugarcane Development Programme under Rashtriya Krishi Vikas Yojana (RKVY) with the approval of State Level Sanctioning Committee (SLCC).

2.23 The technologies developed for increasing sugarcane cultivation, as developed by ICAR and other similar organizations, are disseminated among farmers through frontline demonstrations, Krishi Vigyan Kendras (KVKs), organizing training programmes, Kisan Melas, awareness campaigns, etc.

Cotton

2.24 India is the largest producer and second largest exporter of cotton in the world. Major cotton producing states in the country are: Gujarat, Maharashtra, Telangana, Madhya Pradesh, Karnataka, Andhra Pradesh, Haryana, Rajasthan, Punjab and Tamil Nadu.

2.25 Cotton production has increased more than two times in a decade and reached its peak of 359.02 lakh bales during 2013-14 as compared to 164.29 lakh bales in 2004-05. As per the Third Advance Estimates for 2017-18, production of cotton is estimated at 348.62 lakh bales. The area under cotton cultivation has increased from 119.60 lakh ha in 2013-14 to 124.48 lakh ha in 2017-18. Productivity of cotton has increased marginally in 2016-17 to 512 kg/ha as compared to 510 kg/ha in 2013-14. However, during 2017-18 it is estimated to decline to 476 kg/ha as per Third Advance Estimate. During 2016-17, out of the 108 lakh ha area planted under cotton about 80 percent is estimated to be under Bt Cotton (86.39 lakh hectare) and 20 percent (21.61 lakh hectare) under Non Bt. Cotton. State-wise details of area coverage under Bt Cotton & Non Bt Cotton during 2016-17 is given in the **Table 2.1** below.

Table 2.1: Area under Bt Cotton during 2016-17

(Area in Lakh hectare)

Major Cotton Growing State	Bt Cotton	Non Bt Cotton	Total
Andhra Pradesh	4.38	0.33	4.71
Gujarat	19.24	4.81	24.05
Haryana	3.77	1.93	5.70
Karnataka	2.95	1.71	4.66
Madhya Pradesh	5.39	0.60	5.99
Maharashtra	32.30	5.70	38.00
Odisha	-	1.36	1.36
Punjab	2.43	0.42	2.85
Rajasthan	2.87	1.84	4.71
Tamil Nadu	0.79	0.58	1.37
Telangana	12.27	1.83	14.10
Others	-	0.50	0.50
All India	86.39	21.61	108.00

Source : Department of Agriculture, Cooperation & Farmers Welfare

2.26 During 2016-17, incidence of Pink Bollworm infestation were reported in some pockets of cotton growing states especially, Andhra Pradesh, Gujarat, Karnataka, Maharashtra and Tamil Nadu. Government has undertaken several measures to check the infestation caused by pink bollworm, viz., conducting frontline demonstration at farmers' field on modern production and protection technologies including Integrated Pest Management (IPM) by major cotton producing states and ICAR institutes/SAUs, training on latest production and protection technologies including management of pests, etc. Besides this States also take steps for Crop Pest Surveillance, Online Pest Monitoring System, issuing Advisory from time to time for management of pests including pink bollworm in cotton.

Jute

2.27 India is the largest producer of raw jute in the world with more than 50 percent share in the global production. During 2017-18, jute production is estimated to reach 101.41 lakh bales from 98.32 lakh bales in 2016-17. Production of jute is majorly concentrated in West Bengal, Bihar, Assam and

Odisha, which together accounts for over 90 percent of total production in 2017-18. The share of West Bengal in the total production and area was 77.16 percent and 73.8 percent respectively in 2017-18. The area under jute cultivation was 7.06 and 7.04 lakh ha during 2016-17 and 2017-18 respectively as per the Third Advance Estimates.

2.28 One of the major constraints being faced by the jute cultivators in India is the availability of quality seed as only 35-40 percent of total seed produced in the country is certified and the remaining is sold as Truthfully Labeled Seed (TLS). As a result, farmers still cultivate old varieties and use traditional cultivation practices which adversely impact the crop yield. Towards this end, new varieties of jute viz., JRO-204, JBO-2003, JRS-517, JRC-532 and JRO-2407 are being promoted by providing support for seeds production under National Food Security Mission (NFSM)-Commercial Crops. National Seeds Corporation Limited has entered into agreement for promotion of new varieties of jute seeds in the jute growing states.

Commodity Outlook

2.29 The Department of Agriculture, Cooperation and Farmers Welfare has commissioned the National Council of Applied Economic Research (NCAER) to provide analytical data for better understanding of emerging agricultural scenarios both in the short term

of one or two quarters and in the medium to long term. The medium term production projections of major agricultural commodities by the NCAER and other international organizations are given in **Table 2.2**. These reports are available on the website of the NCAER at <http://www.ncaer.org/publication.php>.

Table 2.2: Average Annual Growth Rate of Production of Selected Food Commodities in India by various agencies

Crops	Actual Growth Rate	FAO/OECD	USDA	FAPRI	IGC	NCAER	
						India stand-alone Cosimo Model	Econometric Model
	2004-2015	2015-24	2016-25	2015-21	2016-21	2016-25	2016-24
Wheat	3.21	1.4	1.78	1.3	2.05	1.69	0.96-1.73
Rice	1.52	1.76	1.19	NA	176	1.88	2.46-2.75
Nutri grains	-0.93	2.70	2.16	0.49	1.27	1.78	-0.41-3.30
Pulses	3.19						2.74-3.21
Total oilseeds	0.81	2.21	3.72	1.47	2.66		3.47-4.29
Vegetable oil	-0.93	2.05	4.20	1.48	NA	1.88	
Sugar	2.64	0.32	NA	3.24	NA	3.31	
Egg	4.44					3.66	
Milk	1.9					2.15	
Poultry	5.39					3.12	

Source : National Council of Applied Economic Research

SPECIAL INITIATIVES FOR ENHANCING AGRICULTURAL PRODUCTION

2.30 Ministry of Agriculture and Farmers' Welfare took several initiatives towards raising agricultural production to its potential level to meet the challenges of food security. The major initiatives are mentioned in the following sections.

Bringing Green Revolution to Eastern India (BGREI)

2.31 BGREI is under operation in seven states of Assam, Bihar, Chhattisgarh, Jharkhand, Odisha, Eastern Uttar Pradesh and West Bengal since 2010-

11 with an objective to increase the productivity of rice based cropping system by intensive cultivation through promotion of recommended agricultural technology as per package agro climatic sub region. Intervention under this programme include: (i) Block demonstrations of rice and wheat in cluster mode; (ii) asset building activities such as construction of shallow tube wells, Dug wells / Bore wells etc. (iii) need based site specific activities for facilitating petty works such as constructing renovation of irrigation channels/electricity for agricultural purposes and (iv) Marketing support are also included.

2.32 Keeping in view the experience gained during the implementation of the programme from the last five years and also the requests of the implementing States, it was decided to modify the programme in accordance with the National Food Security Mission-Rice. Accordingly, from the year 2015-16, the programme has been modified by including a few more interventions like seed distribution of rice & wheat, seed production incentive for newer varieties/hybrids of rice & wheat, micro-nutrients, soil ameliorants and plant protection chemicals, machines like laser land levelers, etc. and cropping system based trainings for farmers, which were not covered so far.

2.33 The programme has been implemented in BGREI states on 100 percent central assistance till 2014-15. An amount of Rs. 400 crore was allocated for the programme for the years 2010-11 & 2011-12 and it was enhanced to Rs 1000 crore during 2012-

13. The same amount was allocated for the years 2013-14 and 2014-15.

2.34 From the year 2015-16, the programme is implemented on 60:40 sharing basis between GOI and states in all states except Assam where it is being implemented on 90:10 sharing basis. An amount of Rs. 500 crore and Rs. 630 crore as central share has been earmarked for implementation of the programme during 2015-16 and 2016-17, respectively. An amount of Rs. 450.00 crore as central share has been earmarked for implementation of the programme during 2017-18.

Impact of BGREI

2.35 The production of rice has increased in seven Eastern States from 456.5 lakh tonnes during 2009-10 to 569.60 lakh tonnes during 2017-18 (3rd Advance estimate) after implementation of BGREI and NFSM (Table 2.3).

Table No. 2.3: Production of Rice in BGREI States

Sl. No.	State	Production of Rice (Lakh Tonnes)	
		2009-10	2017-18 (3 rd advance estimates)
1	Assam	43.36	51.64
2	Bihar	35.99	78.25
3	Chhattisgarh	41.10	47.26
4	Jharkhand	15.38	40.78
5	Odisha	69.18	65.29
6	Uttar Pradesh	108.07	132.71
7	West Bengal	143.41	153.68
Total of Seven States		456.49	569.60
% Share to All India		51.24	51.08
All India		890.83	1115.19

Source : Department of Agriculture, Cooperation & Farmers Welfare

Crop Diversification Programme (CDP)

2.36 Crop Diversification Programme is being implemented in Original Green Revolution States viz: Punjab, Haryana and Western Uttar Pradesh as a sub scheme of RKVY since 2013-14 to divert the area of water guzzling paddy to alternate crops like pulses, oilseeds, maize, cotton and agro forestry with the objective of tackling the problem of declining soil fertility and depleting water table in these states. Alternate crop demonstrations, farm mechanization & value addition, site specific activities and awareness campaign/trainings are major interventions of the programme.

2.37 Crop Diversification Programme has been extended to 10 tobacco growing states of Andhra Pradesh, Bihar, Gujarat, Karnataka, Maharashtra, Odisha, Tamil Nadu, Telangana, Uttar Pradesh and West Bengal to encourage tobacco growing farmers to shift to alternate crops/cropping system w.e.f. 2015-16. An amount of Rs. 500.00 crore & Rs. 250.00 crore has been allocated for CDP in Original Green Revolution States (Punjab, Haryana and Western Uttar Pradesh) during year 2013-14 & 2014-15 on 100% GOI assistance. However, from the year 2015-16, the programme is being implemented on 60:40 sharing basis between GOI and State Governments. During 2015-16, financial allocation of Rs. 150.00 crore as a central share (Rs. 125.00 crore for CDP in Original Green Revolution States and Rs. 25.00 crore for replacing tobacco farming with alternate crops/cropping system) have been allocated. During 2016-17, an amount of Rs. 180.00 crore as a central share (Rs. 150.00 crore for CDP in Original Green Revolution States and Rs. 30.00 crore for replacing tobacco farming with alternate crops/cropping system) have been earmarked.

KRISHI KARMAN AWARDS

2.38 Krishi Karman Awards were instituted in 2010-11 for recognizing the meritorious efforts of the States in foodgrains production. Till 2012-13, the awards were given to the best performing States in two broad sets one for total foodgrains production and the other for individual foodgrains crops of Rice, Wheat, Pulses and Nutri Cereals. There were three awards for total foodgrains production, **Category-I** for States where total foodgrains production exceeded 10 million tonnes, **Category-II** for States where total foodgrains production was in between 1 and 10 million tonnes and **Category-III** for States with total foodgrains production less than 1 million tonne. Each award winning State is given a trophy, a citation and a cash award of Rs. 2 crore. For individual crops of rice, wheat, pulses and nutri cereals, each award winning State got a trophy, a citation and a cash award of Rs. 1 crore. During 2013-14, oilseed crops were also included under individual crop category. The award amount was also increased from Rs. 2.00 crore to Rs. 5.00 crore for total foodgrains (category-I, II & III) and from Rs. 1.00 crore to Rs. 2.00 crore for individual crops including oilseeds crop. The amount for Commendation Award was increased from Rs. 25 lakh to Rs. 1.00 crore. Moreover, many Krishi Karman Awards have been given to progressive farmers for corresponding crops by the Agriculture Ministers of the respective States. These awards are given to two farmers in each state, one male and one female. Each award carries an amount of Rs. 2 lakh along with a Prashahsti Patra.

2.39 The following awards were presented for the year 2015-16 by the Hon'ble Prime Minister of India:

(A) Krishi Karman Awards, 2015-16**Total Foodgrains Production**

Category-I (> 10 million tonnes)	Tamil Nadu
Category-II (1 to 10 million tonnes)	Himachal Pradesh
Category-III (< 1 million tonnes)	Tripura

Individual Crops

Rice	Punjab
Wheat	Madhya Pradesh
Pulses	West Bengal
Nutri Cereals	Bihar
Oilseeds	Assam

(B) Commendations Awards**Total Foodgrains**

Category-III	Meghalaya
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(C) Agriculture Minister's Krishi Karman Awards for Progressive Farmers

State	Award Recipient	Crop
Tamil Nadu	Shri Thiru S. Samynathan	Black Gram
	Smt. Thirumathi R. Rasathi	Paddy
Himachal Pradesh	Shri Ajit Singh	Wheat
	Smt. Vijay Laxmi	Wheat
Tripura	Shri Rakhil Acharya	Paddy
	Smt. Aparna Deb	Hybrid Paddy
Punjab	Shri Raj Mohan Singh Kaleka	Rice
	Ms Gurpreet Kaur	Paddy
Madhya Pradesh	Shri Naresh Patel	Wheat
	Smt. Aruna Joshi	Wheat
West Bengal	Shri Mohan Gorai	Lentil
	Smt. Jayanti Rani Daulai	Moong
Bihar	Shri Anil Kumar	Maize
	Smt. Neelam Kumari	Maize
Assam	Shri Binay Lekhak	Rapeseed and Mustard
	Smt. Hemakanti Payeng	Toria (Oilseeds)

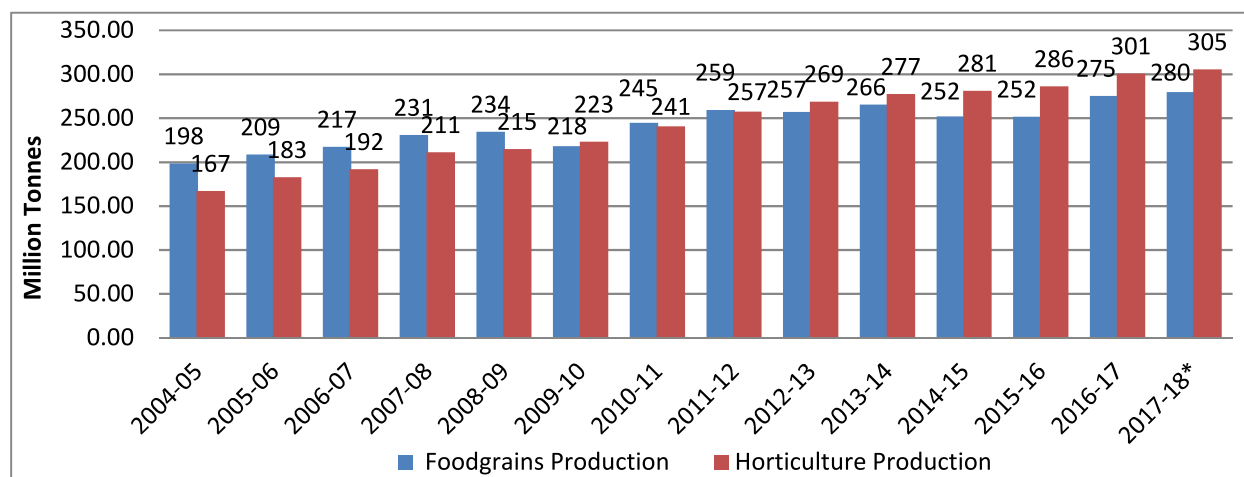
Source: Department of Agriculture, Cooperation & Farmers Welfare

HORTICULTURE PERFORMANCE

2.40 In response to the changing dietary patterns, the composition of agricultural production has diversified over the years. As a result, the horticulture and livestock sectors have emerged as major drivers of growth in the agricultural and allied sectors. On the production and productivity fronts, the horticulture sector outperformed conventional food crops. During the period 2004-05 to 2016-17, horticultural output achieved a compounded annual growth of

about 5.0 percent as compared to around 3.0 percent growth in foodgrains production. This increase in production has come from an increase in acreage and even larger increase in productivity. As a result, India has maintained its second rank in the global production of fruits and vegetables, next only to China. A comparative picture of horticulture and foodgrains production over the last few years is given in **Figure 2.1**.

Figure: 2.1 Growth Trend in Foodgrain and Horticulture Production

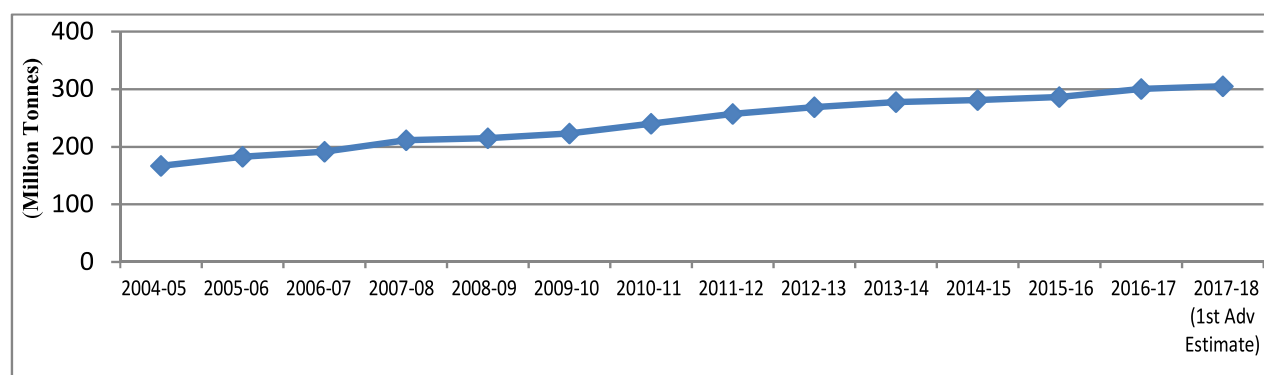


* 3rd Advance Estimates for Foodgrains and 1st Advance Estimates for Horticulture
Source: Department of Agriculture, Cooperation and Farmers Welfare

2.41 The trend in horticultural production growth over the last 12 years is depicted in **Figure 2.2** and the

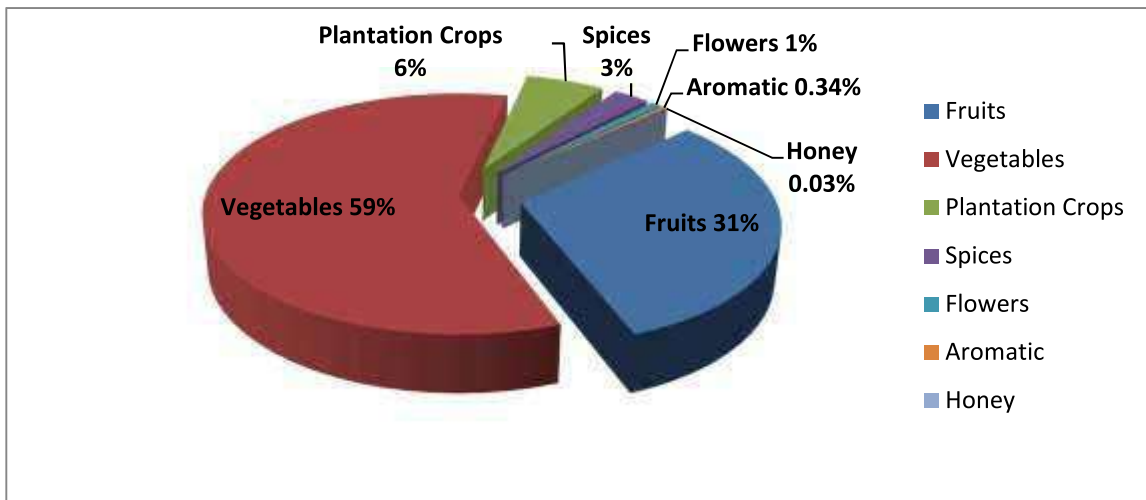
share of different commodities in horticulture production during 2017-18 is given in **Figure 2.3**.

Figure 2.2: Growth Trend in Horticulture Production



Source: Department of Agriculture, Cooperation & Farmers Welfare

Figure 2.3: Share of Different Commodity Groups in Horticulture Production



Source: Department of Agriculture, Cooperation and Farmers Welfare

Fruits

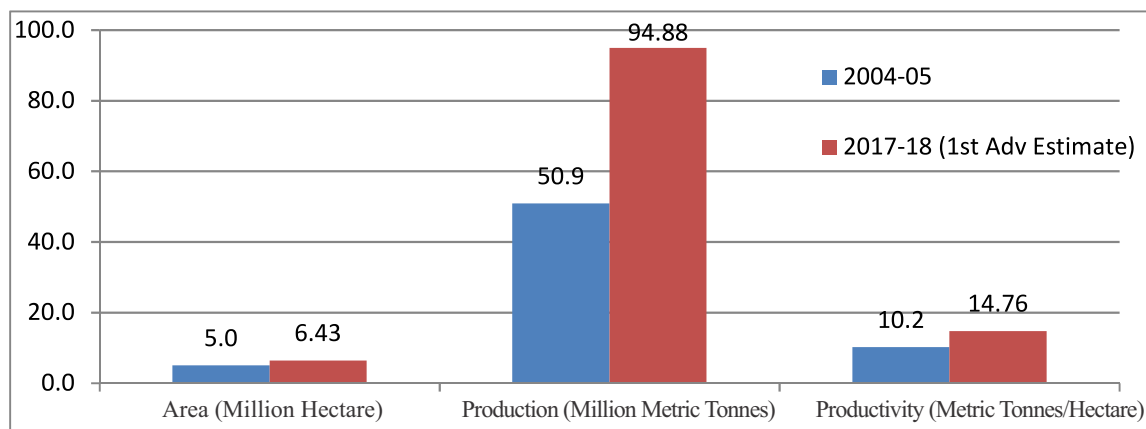
2.42 With a production of 94.8 million tonnes, fruits account for about 31 percent of total production of horticulture crops. The area under fruit crops cultivation during 2016-17 was 6.4 million ha, which is 25.8 percent of total area under horticulture cultivation in India. The area under fruit crops cultivation has increased from 5.0 million ha in 2004-05 to 6.42 million ha in 2017-18, with a corresponding increase in production from 50.9 to 94.8 million tonnes. A large variety of fruits, such as banana, mango, citrus, papaya, guava, grape, sapota, pomegranate, pineapple, aonla, litchi, pear, plum and walnut are grown in India. India accounts for about 13 percent of the total world production of fruits and leads in the production of mango, banana, papaya, sapota, pomegranate, acid lime and aonla.

2.43 During 2017-18, Andhra Pradesh stood first in terms of fruit production with a 14.6 percent share

in total production followed by Maharashtra with 11.47 percent, Uttar Pradesh with 11.09 percent, and Gujarat with 9.51 percent and Karnataka with 7.97 percent shares. These states together contributed about 55 percent of the total fruit production in the country. Banana is the most cultivated fruit accounting for 31.82 percent of total production, followed by mango at 21.83 percent, citrus at 12.34 percent, papaya at 6.43 percent, guava at 4.13 percent, grapes at 3.13 percent, apple at 2.39 percent share in the country. In case of Himachal Pradesh and Jammu and Kashmir, the value of output from apples, plums, pears and stone fruits exceeds the value of output from cereal crops.

2.44 The area under cultivation, production and productivity of fruit crops have registered significant increase during the last few years, as depicted in **Figure 2.4.**

Figure: 2.4 Area, Production and Productivity of Fruits



Source: Department of Agriculture, Cooperation and Farmers Welfare

Box 2.2: Fruit Sector

- India is the second largest producer of fruits in the world and is the leader in producing fruits like mango, banana, pomegranate, sapota, acid lime and aonla.
- India's fruit productivity is higher than that of China, though China is the largest fruit producing country.
- Special efforts are being made to improve the productivity of fruit crops by enhancing the supply of quality planting material from accredited nurseries and improved package of practices.
- The per capita availability of fruit is 200.6 gm/person/day and has been helping in supplementing nourishment.

Vegetables

2.45 Vegetables occupied an area of 10.2 million ha during 2017-18 with a total production of 180.68 million tonnes having average productivity of 17.76 tonnes per hectare. Vegetable production almost doubled between 2001-02 and 2017-18.

2.46 The major vegetable crops grown in the country are potato, tomato, onion, brinjal, cabbage, cauliflower, peas, okra, chillies, beans, melons, etc. Uttar Pradesh has been maintaining the lead position in vegetable production in the country, contributing about 15.62 percent to total production, while West

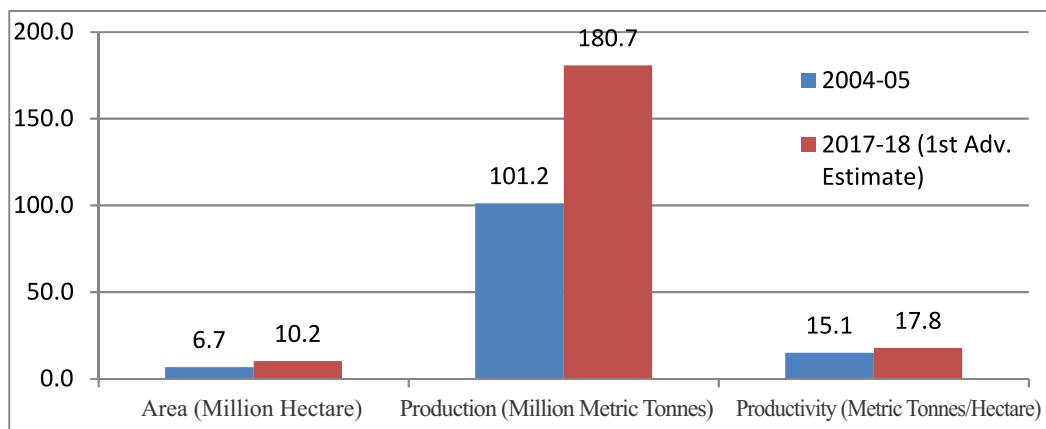
Bengal is producing 14.33 percent of vegetables in the country. Other leading vegetable producing states are Madhya Pradesh with 10.08 percent share, Bihar with 8.04 percent share, Gujarat with a 7.36 percent share, Maharashtra with 5.01 percent share, and Odisha with a 4.85 percent share each. Amongst vegetables, potato is the most cultivated vegetable accounting for 27.31 percent of the total production of vegetables in the country, followed by tomato (12.36 percent), onion (11.84 percent), brinjal (6.98 percent), cabbage (4.97 percent), cauliflower (4.87 percent), peas (3.00 percent).

Box 2.3: Vegetable Sector

- Productivity of vegetables in India continues to be low compared to world average productivity.
- Special emphasis is being given for vegetable seed production and production of disease free vegetable seedlings for hybrid cultivars under Mission for Integrated Development of Horticulture (MIDH).
- Per capita availability of vegetables is 378.13 gm/ person/day

2.47 Details of the area, production and productivity of vegetables during the last decade are depicted in **Figure 2.5** below:

Figure: 2.5 Growth in Area, Production and Productivity of Vegetables



Source: Department of Agriculture, Cooperation and Farmers Welfare

2.48 India is the second largest producer of vegetables after China and is a leader in the production of vegetables like peas and okra. Besides, India occupies the second position in terms of production of brinjal, cabbage, cauliflower and onion and the third position in the production of potato and tomato in the world.

Spices

2.49 A wide variety of spices, like black pepper, chillies, ginger, turmeric, garlic, cardamom and a variety of tree and seed spices are being produced in India, and India is the largest producer and exporter of spices in the world. The major spice producing

states are Rajasthan (17.13 percent), Andhra Pradesh (13.54 percent), Madhya Pradesh (13.27 percent), Gujarat (10.69 percent), and Karnataka (6.16 percent). Spice production in India is currently estimated at 8.16 million tonnes from an area of about 3.69 million ha.

2.50 The production of spices in the country has registered a substantial increase over the last nine years. Chilli is the major spice crop, accounting for about 25.8 percent of total spice production in the country. Garlic accounts for a 20.85 percent share in production, while turmeric and ginger accounts for 13% share in production.

Box 2.4: Spices Sector

- Spices are low volume high value crops which have the potential to provide better remuneration to farmers.
- The productivity of spices continues to be low compared to world average productivity.
- Prices in the domestic market change as a result of fluctuations in International Market

Flowers

2.51 During 2017-18, floriculture covered an area of 0.31 million ha, with total production of 1.81 million tonnes of loose flowers and 0.70 million tonnes of cut flowers (1st Advance Estimates). This sector offers opportunities for generating income and employment, especially for women. Noticeable advancements have been made in recent years in flower production, particularly, in the production of cut flowers, which have potential in terms of exports.

The main cut flowers being grown are roses, orchids, gladiolus, carnation, gerbera, anthurium and liliun.

2.52 The important flower growing states are West Bengal, Uttar Pradesh, Chhattisgarh, Karnataka, Jharkhand, Maharashtra, Assam, Himachal Pradesh and Uttrakhand. A major part of the area under flower cultivation is devoted to the production of marigold, jasmine, roses, chrysanthemum, tuberose, etc. The area under cut flower cultivation has increased significantly in the recent years.

Box 2.5: Floriculture Sector

- Flowers and foliage are being used increasingly in domestic and international markets.
- The quality and price of flowers assumes importance, particularly in tapping the international market.
- Under MIDH, special emphasis is being placed on production of flowers under protected cultivation.

Plantation Crops

2.53 The leading plantation crops being grown in India are coconut, cashew, areca nut and cocoa, which are mainly grown on the fields of small and marginal farmers. The total production of plantation crops during 2017-18 has been 18.5 million tonnes from an area of 3.5 million ha (1st Advance Estimates). Coconut accounts for the largest share amongst plantation crops in terms of production, followed by cashew nut and areca nut. The major plantation crops producing states are Kerala with

29.66 percent share, Karnataka with 28.80 percent, Tamil Nadu with 25.81 percent share and Andhra Pradesh with 5.89 percent share, which together contribute to about 90 percent of all India production.

Medicinal and Aromatic Plants

2.54 India is considered a treasure house of valuable medicinal and aromatic plants, which provide raw materials for the formulation of indigenous medicines apart from exports. Over the years, there has been an appreciable increase in the area under medicinal plant cultivation and

production of medicinal and aromatic plants. During 2017-18, about 0.6 million hectare was covered under medicinal and aromatic plants with a total production of 1.04 million tonnes (1st Advance Estimate).

Growth in Horticulture Exports

2.55 Commensurate with increased horticulture production, there has been a significant improvement in terms of export earnings in the horticulture sector as shown in **Table 2.4** below.

Table 2.4: Value of Exports of Horticulture Commodities

Sl. No.	Commodity	Value (Rs in crore)	
		2004-05	2016-17
1.	Fresh fruits and vegetables	1725.25	10369.95
2.	Floriculture products	222.92	548.70
3.	Spices	1883.18	19442.05
4.	Cashew	2477.18	303.30

Source: Directorate General of Commercial Intelligence and Statistics (DGCIS)

2.56 The Department of Agriculture, Cooperation and Farmers Welfare is working closely with the Agricultural and Processed Food Export Development Authority (APEDA) under the Ministry of Commerce & Industry and the state governments to ensure that infrastructure and institutional support is available for exports so that farmers can leverage export markets for higher incomes. Out of the 60 agri-export zones identified in the country, 52 focus on horticultural crops.

Support for Horticulture Development

2.57 The major planned activities taken up under the Mission for Integrated Development of Horticulture (MIDH) scheme included programmes for production of planting material, area expansion including high density planting, rejuvenation of old and senile orchards, protected cultivation, creation of water resources and promotion of INM and IPM, which are basically aimed at productivity improvement. Organic farming and good agricultural practices (GAP) are promoted to enable chemical

residue free horticulture produce, besides addressing environmental concerns of soil and land degradation. Horticulture mechanization is promoted to bring in efficiency in horticulture production and harvesting operations. Production and productivity improvement programmes are complemented by the creation of infrastructure facilities for post harvest management, processing and marketing. Investments in horticulture have been steadily increasing, from Rs. 5,025 crore in the 10th Plan to Rs. 16,840 crore in the 12th Plan, keeping pace with increased demand in the sector.

Physical Achievement under Mission for Integrated Development of Horticulture (MIDH) up to 2017-18

- Area under horticulture increased from 18.7 lakh ha in 2005-06 to 36.11 lakh ha in 2017-18 under MIDH, as more farmers are venturing into horticulture in their quest for diversification.
- 4537 nurseries have been established for production of quality planting material for supply to beneficiaries.

- Over 6.57 lakh ha of old and senile orchards have been rejuvenated.
- An area of 17.09 lakh ha has been covered under Integrated Pest/Nutrient Management.
- About 2.29 lakh ha were covered under protected cultivation for improving productivity.
- 2.72 lakh ha have been brought under organic farming practices.
- 96065 water harvesting structures have been created for life saving irrigation to horticulture crops.
- 10.99 lakh bee colonies with hives have been distributed for maximizing agriculture productivity.
- 2.91 lakh horticultural including plant protection equipments have been distributed to improve farm efficiency.
- In all, 25 Centre of Excellence have been established through Indo – Israel and Indo-Dutch collaboration.
- Over 21.69 lakh farmers have been trained so far on improved horticultural practices.
- 78850 post harvest management facilities including cold chain infrastructures have been set up to complement the production and productivity improvement programme.
- 4065 Market Infrastructures have been established.

Towards Sustainable and Inclusive Growth in Horticulture

2.58 The major challenge for horticulture is to sustain this growth in a manner which ensures a higher income for the primary producer through better institutional support mechanisms such as infrastructure and technology support for the entire value chain – from pre-planting to post harvest management. While the ICAR system, with its research institutions, national research centers and state agricultural universities have addressed issues relating to soil health, planting material and new and adaptive varieties, the major challenge for the DAC&FW is to assure higher returns for the farmer by ensuring that what is produced is not lost in transit on account of poor handling or perishability and that the farmer is part of the value chain.

Institutional Support and Market Linkages

2.59 Several initiatives of the DAC&FW have the potential to impact farmers' incomes in a positive manner. These include support for Farmer Interest Groups (FIGs) and Farmer Producer Organizations (FPOs) for better integration with markets and input suppliers and a Public Private Partnership in Agriculture Infrastructure Development (PPP AID) for intensive agricultural development initiated during 2011-12. During 2013-14, this has been further strengthened by way of providing matching equity upto Rs. 10 lakhs per FPO and the formation of a Credit Guarantee Fund operated by SFAC.

Box 2.6: Major Milestones Achieved under NBB, DASD, DCCD, CIP and MI under PMKSY [2014-15 and 2015-16 (till December 2016)]

National Bee Board (NBB)

- An amount of Rs. 7.15 crore released to National Bee Board (NBB) during last two years (2014-15 & 2015-16) in comparison to an amount of Rs. 5.94 crore released during last three years (2011-12 to 2013-14);
- An amount of Rs. 12.00 crore has been approved for National Bee Board (NBB) for the year 2016-17;
- 9834 farmers/ beekeepers have been trained in scientific beekeeping during 2014-15 & 2015-16;
- 6361 beekeepers/ beekeeping & honey societies/ firms/ companies *etc.* with 10.62 lakhs colonies have been registered (as on 30th November, 2016);
- A “Trainees' Guide- Manual on Scientific Beekeeping” was published in Hindi and was released by the Hon'ble Minister for Agriculture and Farmers Welfare on 16 December, 2015.
- Projects for Integrated Development of Scientific Beekeeping programme, including one at Vidarbha, Maharashtra and one at Lalitpur, Uttar Pradesh, have been approved/implemented/under implementation.
- Designed technical standards for good grade plastic containers for storing honey.
- A pilot project/sub-scheme for financial assistance of Rs. 10.04 Crore (GOI Share), proposed by NBB for Integrated Development of Scientific Beekeeping on Cluster/Area/District development approach for enhancing the crop productivity & income of farmers/beekeepers and generating employment in rural areas has been approved under RKVY Scheme during 2016-17 for its implementation in 16 Districts of 8 States, viz., Assam, Bihar, Gujarat, Karnataka, Maharashtra, Himachal Pradesh, Rajasthan and Uttar Pradesh (2 Districts in each).
- Regarding development of one District, in each State, as a role model (IBDC), in first phase 12-15 States have been identified
- 3 centres (IBDCs) viz., Haryana, Bihar (Rajendra Agricultural University), Delhi (Indian Agriculture Research Institute, Pusa), have already been commissioned.

Directorate of Arecanut and Spices Development (DASD), Calicut

- 31.64 lakh of planting material of tree spices and black pepper and 823.35 tonnes of planting material of ginger, turmeric, chilly and seed spices produced.
- Deployed micro rhizome technology to create large scale disease free planting material for ginger and turmeric in Kerala, Tamil Nadu and the North Eastern states.

Directorate of Cashew and Cocoa Development (DCCD), Cochin

- Cashew was planted in an additional area of 4756 hectares

- Cashew has been replanted in an area of 2,200 hectares
- Cashew has been rejuvenated in 625 hectares
- Cocoa was planted in an additional area of 4108 hectares
- 35 nurseries have been accredited.
- 100 units of cashew/cocoa were demonstrated under Front Line Technology Programme
- 3700 farmers were trained on latest production technologies of cashew/cocoa

National Mission on Saffron

- 1,928 hectares of saffron area were rejuvenated or replanted.
- 650 hectares were developed for producing planting material.
- 137 tube wells were dug under the irrigation system.
- 300 farmers were trained; 200 demonstrations were organized in Jammu and Kashmir.
- A saffron park is being constructed at Pulwama in Jammu and Kashmir for processing and value addition of saffron.

Central Institute of Horticulture (CIH), Medziphema, Nagaland

- CIH was established in 2006 for the holistic development of horticulture sector in the North East Region
- CIH conducted 3 numbers of Certificate course in the year 2015-16 and 02 numbers of courses in 2016-17 on Modern Nursery Management Practices of Horticulture crops, Protected cultivation, Post Harvest Management and Organic farming with 85 trainees from 5 states of North Eastern States
- CIH conducted 308 farmers training with 19356 farmers and 65 trainings of trainers with 2445 participants from NE Region from 2006 to 2016
- The mandate of accreditation of nurseries in NE region has been assigned to CIH and 16 nurseries have been accredited from NE Region so far
- Mother blocks have been developed in the CIH farm with a target of quality planting material of Citrus, Jackfruit, Mango, Cashew and Guava *etc*
- Demonstrations of identified technologies for north east region have also been laid out in farmer's field and CIH farm also
- Capacity building programmes on horticultural aspects are being conducted with the coordination of state governments

Support for Cold Chain Development

2.60 In order to address the issues concerning the holistic development of the cold chain sector in the country, the National Centre for Cold Chain Development (NCCD) was established with an initial corpus of Rs 25 crore from the Government in 2011-12 in PPP mode. The NCCD particularly addresses issues relating to cold chain management including standards, protocols and Human Resource Development. The General Council of NCCD is headed by the Secretary of the DAC&FW, its members include representatives of growers' associations, FPCs, cooperatives and corporates engaged in the sector, including equipment suppliers, logistics companies, industry bodies, Resource institutions, regulatory and development agencies, apex intuitions, PSUs, State Governments and the

Ministry of Food Processing Industries (MoFPI). NCCD had established four technical committees: (i) Technical Specification, Standards, Test Laboratory and Product Certification Committee, (ii) Training, HRD and R&D Committee, (iii) Committee on Application of Non Conventional Energy sources in cold chain infrastructures, and (iv) Committee on Supply Chain and Logistics for Post Harvest Management and Marketing. NCCD has published Guidelines of Minimum System Standard for implementation in cold chain. NCCD is already working on capacity building for various components of the cold chain within and outside the country. Under MIDH, assistance for modernization of existing cold storage systems through upgradation of refrigeration and installation is being provided.

Box 2.7: Cold Chain

- The Government's focus on cold chains is manifested in the addition of over 34 million MT of cold storage capacity, by MIDH, APEDA, MoFPI and Department of Animal Husbandry, Dairying and Fisheries.
- Cold chain is emerging as a promising sector for private investments.

Major Challenges

2.61 The major challenges before horticultural development are as follows:

- a) Lack of quality planting material of improved high yielding varieties is a major concern.
- b) Reducing post-harvest losses of perishable commodities, particularly fruits and vegetables
- c) Lack of availability of trained manpower at the field level for providing extension services to farmers
- d) Creation of an effective supply chain by empowering producers of horticulture

commodities is yet another major challenge

The Way Forward

2.62 Potential ways to address the challenges for Horticulture:

- a) Horticulture development is being continued during Twelfth Five Year Plan under the umbrella of the MIDH by subsuming the existing schemes of NHM, HMNEH, NHB, Coconut Development Board (CDB), Central Institute of Horticulture (CIH) and National Bamboo Mission (NBM).
- b) Addressing the production and productivity

- by supply of quality planting material, Post Harvest Management, Rejuvenation of old and senile orchards, creation of Market infrastructure, creation of water resources continue to be a high priority area for horticulture development during the Twelfth Five Year Plan. In this context, special emphasis is being placed on the establishment of hi-tech nurseries having provisions for mother or scion blocks of improved varieties, good quality rootstock banks and hi-tech greenhouses. Besides, planting material will be channelized through accredited nurseries. The National Horticulture Board has taken up the task of accrediting the nurseries in India and CIH has taken up task of accrediting the nurseries in NE region.
- c) Establishment of crop based Centres of Excellence (CoE) will be encouraged in each state, so that they can serve as hubs for the supply of planting material and dissemination of technology to farmers. So far, 27 CoEs have been approved through Indo-Israel and 3 CoEs have been approved under Indo-Dutch collaboration. More are in the pipeline in collaboration with other countries.
 - d) Area expansion programmes have been linked to the availability of quality planting material through accredited nurseries and tissue culture units. Importance will be given for covering more area under F1 vegetable hybrids and export oriented varieties of ginger, turmeric and chillies.
 - e) High density planting and tree canopy management of orchards, right from the establishment stage, is being focused on to derive better yield. Besides, an integrated approach is being encouraged for taking up drip irrigation or mulching and other support systems required for cultivation of fruit and plantation crops.
 - f) Rejuvenation of old and unproductive orchards continue to be a focus area for enhancing productivity, profitability and sustainability.
 - g) A major thrust is on protected cultivation, particularly of high value crops, in green houses, shade net houses, polyhouses etc.
 - h) Creation of infrastructure for post-harvest management and value addition also continue to be a high priority area with a focus on creating cold chain networks.
 - i) Setting up of market infrastructure linked with reforms in the APMC Act, for permitting direct marketing of horticulture produce.
 - j) Mobilization of farmers into producer groups and organizations is another priority area which aims at strengthening their negotiating power. These could also function as viable farmer groups involved in the production and marketing of horticulture produce.
 - k) Human resource development is being emphasised for capacity building of farmers, horticulture entrepreneurs, supervisors and field functionaries.
 - l) All States have been given targets to impart trainings under “Skill Development” during 2016-17 and onwards.
 - m) All states have been directed to use HORTNET and DBT for complying with the

directives of DBT Mission of the Cabinet Secretariat.

RASHTRIYA KRISHI VIKAS YOJANA (RKVY)

2.63 Rashtriya Krishi Vikas Yojana (RKVY) was launched in 2007-08 in which funds are provided as a 100% grants to the states to choose projects specifically tailored to their conditions for enhancing growth in agriculture and allied sectors. The approved outlay of the scheme for the Financial year 2017-18 to 2019-20 is Rs. 15722 crore as against

Rs.63246 crore for XIIth Plan Period.

2.64 States have approved a total of 1,070 projects in various sectors of agriculture such as crop development, horticulture, animal husbandry, fisheries, agriculture mechanization, natural resource management, micro/minor irrigation etc. for implementation under RKVY during 2015-16. Activity wise share in value of projects approved by states during 2015-16 are shown in the **Table 2.5**.

Table 2.5: Sector-wise list of projects Approved during 2015-16

(Rs. in crore)

Sl. No	Name of the Sector	Number of project	Amount of projects	% share
1.	Crop Development	93	1047.04	17.69
2.	Horticulture	137	546.06	9.23
3.	Sericulture	35	70.75	1.2
4.	Animal Husbandry	123	805.08	13.6
5.	Innovative Programmes/ Training / Capacity Building/ Others	73	240.3	4.06
6.	Fisheries	92	211.94	3.58
7.	Cooperatives and Cooperation	12	68.65	1.16
8.	Integrated Pest Management	18	22.04	0.37
9.	Seed	52	339.14	5.73
10.	Fertilizers and INM	16	91.68	1.55
11.	Agriculture Mechanization	49	589.19	9.95
12.	Extension	41	347.2	5.87
13.	Marketing and Post Harvest Management	34	217.74	3.68
14.	Non Farm Activities	11	28.52	0.48
15.	Information Technology	6	17.44	0.29
16.	Research (Agri/Horti/Animal Husbandry etc.)	118	217.99	3.68
17.	Natural Resource Management	57	327.7	5.54
18.	Micro/Minor Irrigation	40	420.95	7.11
19.	Organic Farming / Bio Fertilizer	19	66.31	1.12
20.	Dairy Development	44	242.9	4.1
		1070	5918.62	100%

Source : Department of Agriculture, Cooperation & Farmers Welfare

2.65 The scheme is being implemented on 90:10 sharing basis between the centre and the States in 8 North Eastern States and three Himalayan States and in the ratio of 60:40 in all other States from 2015-16 against 100% funding by the centre till 2014-15. The central share of allocation for implementation of the scheme was Rs 3550 crore (RE) in 2016-17 and Rs. 4750 crore in 2017-18 at BE stage.

2.66 Several sub-schemes have been introduced

under RKVY since 2010-11 for promoting programmes of national priorities. During 2016-17, the following special Programmes /schemes are being implemented as sub-schemes of RKVY with a total allocation of Rs.1092.26 crore, which have very focused objectives and are under implementation in States best suitable for these. Details of these programmes and their allocation for 2016-17 are at **Table 2.6.**

Table 2.6: Sub-Schemes of RKVY (2016-17)

S. No	Sub-Scheme	Allocation (Rs. in crore)
I.	Bringing Green Revolution to Eastern India (BGREI)	630
II.	Crop Diversification Programme in original green revolution States(CDP)	180
III.	Reclamation of Problem Soil (RPS)	50
IV.	Rice Fallow Areas in Eastern India for Pulses and Oil Seeds	50
V.	Footh and Mouth Disease control Programme (FMD)	100.65
VI.	Integrated Development of Scientific Beekeeping	10.04
VII.	Accelerated Fodder Development Programme (AFDP)	22.2
VIII.	Saffron Mission-Economic Revival of J&K Saffron	49.37
	Total	1092.26

Source : Department of Agriculture, Cooperation & Farmers Welfare

2.67 Statement on state-wise allocation and release of funds, including sub-schemes, under RKVY during the last three years are given in **Annexure 2.1.** Details of all projects taken up by the states under RKVY, including their progress, outcomes, along with actual achievements since inception of the scheme in 2007-08 can be accessed at www.rkvy.nic.in.

INNOVATIVE SUCCESS STORIES UNDER RKVY

2.68 RKVY has been witnessing a wider spectrum of interventions which effectively caters to diverse needs and requirements of the States. A few of the interventions taken up by the states under the scheme are elaborated under:

Pandal Cultivation of Vegetables in Telangana

Background & Objectives

2.69 The diversity in terms of soil, climate, agro-ecological regions throughout India makes it conducive to the growth of wide variety of horticulture crops, providing livelihood to many and creating substantial employment opportunities for the rural population. India is next only to China in vegetable production. More than 40 kinds of vegetables are grown in different agro-climatic situation of the country. Telangana is exemplary in this context, where the horticulture sector has been identified as one of the growth engines for increasing overall agriculture growth.

2.70 Telangana took up a major programme under Rashtriya Krishi Vikas Yojana (RKVY) to boost production of the major horticulture crops across the State. The intervention comprised of construction of permanent *pandals* and trellises for protected cultivation of horticulture crops through a cluster approach, duly considering local agro-climatic conditions/needs/crops/priorities, and providing market linkages for ensuring remunerative prices to the farmers. Boosting the horticulture sector would not only ensure additional income to farmers but also meet the demands of changing nutritional requirements of the people.

Intervention

2.71 The major vegetables grown in the state are tomato, onion, tapioca, brinjal and okra. In general, such vegetables need proper support for their growth and development. *Pandals*/trellises are special structures used for twining vegetables. The weak climbers utilize this support, which protects the produce from soiling and increases exposure to sunlight and aeration, thereby increasing the number

of flower buds, ultimately resulting in higher quantity of fruits of superior size and quality.

Outcome

2.72 A. Malla Reddy, a farmer of Ibrahimnagar village, Medak District in Telangana, with the adoption of permanent *pandal* system has observed a substantial increase in his income. He has constructed a Permanent *Pandal* over an area of 0.60 hectares, wherein, he received a subsidy of Rs. 1,50,000. He has, thereby, been able to achieve a yield between 8 to 20 tons per hectare. From this land, he has been able to gain an additional income with *Pandal* of about Rs. 1,70,000 with the construction of *Pandal*.

Success Story on King Chili Cultivation as an alternative to Opium in Arunachal Pradesh

Background & Objective

2.73 Opium is being cultivated since time immemorial in Arunachal Pradesh. More than half of the state especially eastern part still cultivates opium for household use. Consumption of opium is a part of social, traditional, and cultural occasions And for a very long time, State Agriculture Department has been planning to replace this crop with equally potential cash crop on long term basis without touching the local sentiment to give up the opium cultivation abruptly.



2.74 King chilli (*Capsicum chinense* Jacq) popularly known as Raja Mircha, is a popular indigenous crop cultivated by all indigenous Tribes of Arunachal Pradesh for its pungency and medicinal food value. Considering the potential and adaptability of King chili cultivation in the agro-climate and agro-economic condition of Arunachal Pradesh, commercial cultivation of king chili as an alternative to drudgery opium cultivation was taken up in the state as an intervention under Rastriya Krishi Vikas Yojana(RKVY).

Intervention

2.75 Due to the efforts of the State Government the uneducated rural youths have today accepted and adopted this project and are making profits and even exporting their produce. One such Agri-preneur, Mr. Chow Amat Namchoom, Graduate from St. Edmund's College under North Eastern Hill University(NEHU), Shillong, has taken up King chili cultivation. He is a registered Exporter of Species under the SPICES BOARD, Ministry of commerce and Industry, GOI bearing Reg.No.M1941 and exports his products as M/s ARUNACHAL SPICES.

Outcome

2.76 So far Mr. Namchoom has supplied his product to various companies in Kolkata and USA. Apart from self cultivation he purchases produce from nearby adjoining area, process, packs and supplies to various domestic and international markets. He purchases King chili at Rs.120 – 170/kg and sells dried chili at an average cost of Rs. 1550-1875/kg. Today he is not only self employed but a employer undertaking King chili cultivation as an alternative to opium cultivation in the area.

Center of Excellence for Precision Farming Training, Maddur, Mandya District in Karnataka Background & Objective

2.77 The increase in production and productivity of

horticulture crops largely depends on knowledge of judicious application of inputs and precise farming technologies by the farmers to harness the good crop and better returns. With this in view, Department of Horticulture, Government of Karnataka has initiated the project called Establishment of Center of Excellence for Precision Farming Training in 25 acres of Maddur Horticulture Farm, Mandya district. The center caters to the needs of training for farmers, department officers and entrepreneurs in precision horticulture under the assistance of RKVY programme.

Intervention

2.78 A hi-tech training centre, in an area of 1500 square meters is built up for hands on training programmes in precision farming techniques in fruits, vegetables and flower crops. So far 450 farmers, farm-women and entrepreneurs have been trained both in open and protected cultivation. The centre encourages the farming community to adopt the precision farming technologies in various horticulture crops under both open and protected conditions.

Outcome

2.79 Around 15 to 20 percent of the farmers have adopted the precision farming technologies in Mandya, Chamarajanagar, Mysore and Ramanagar districts of Chamrajangar. Sri Sadashivamurty, Chamarajanagar District, Karnataka has been trained on construction of naturally ventilated polyhouse and cultivation of green capsicum with all the precision farming technologies under protected cultivation. He is a progressive farmer cultivating horticulture crops like banana, chilli and turmeric in open conditions with advanced technologies since 10 years.

2.80 He could notice less challenges and more profit

in polyhouse cultivation after training in protected cultivation of vegetable at COEPF Maddur. With this knowledge he started cultivation of green capsicum varieties- Indira and Starlet by investing on green house with bank loan. He has also been given a subsidy of Rs. 17.00 lakhs from the Department of Horticulture, Gundlepete, Chamrajangar under the Project Protected Cultivation of Flowers and Vegetables of RKVY scheme during 2015-16.

2.81 He could harvest 45 tones of green capsicum fetching an average rate of Rs. 20 per kg. Thus, harnessing a net profit of Rs. 6.00 lakhs from one acre in 8 months crop duration. His success has influenced and encouraged the fellow farmers of the district to use precision farming technologies for production of horticulture crops.

Fodder Development by Hydroponics in Tamil Nadu

Background & Objective

2.82 The word hydroponics is derived from the Greek word “water working”. It is a technology of sprouting grains or growing plants without soil, but only with water or nutrient rich solution. Tamilnadu has adopted the technology for growing fodder by hydroponic technology for feeding animals. The advantages of hydroponic fodder production are;

1. Requires less water
2. Requires less land
3. Very short growth period
4. High Nutritious fodder
5. Round the year production

2.83 This technology was adopted at ILFC – MVC of TANUVAS under NADP scheme on “Water conserving hydroponic green forage production to augment livestock productivity” during the year

2014 – 15. Different seeds such as yellow maize, horse gram, sun hemp, foxtail millet, jowar, bajra, cow pea, sanwa millet etc were utilized for fodder production . Among them the seeds that showed higher biomass yield when compared to others were used to conduct feeding trials to study the impact of hydroponically grown fodder on the milk yield of cattle and growth performance of calves. From the study it was concluded that hydroponic maize fodder can be used as an alternative to conventional green fodder in cattle without affecting its milk yield and hydroponic horse gram and sun hemp fodder can be used as an alternate to conventional green fodder in calves.

Intervention

2.84 The hydroponic unit at ILFC-MVC acted as a model unit for hydroponic fodder production technology. It attracted more than 100 livestock farmers throughout Tamil Nadu to make visit and to enhance their knowledge on hydroponic fodder production technology. It also encouraged many livestock farmers to opt hydroponic fodder production method as an alternative fodder production method for their livestock

Outcome

2.85 Through the use of this technology, the challenge of fodder scarcity in the country can be better addressed. Like in the case of Tamil Nadu, where a farmer named M. Nithyanatham has purchased a low cost hydroponic machine for his farm and his farm has been serving as a training and demonstration center for animal husbandry, hygienic milk production, hydroponic fodder production etc. This center also plays a role as Farmer-led Extension. It was supported from ATMA, Thiruvallur as a Training-cum Demonstration Center.

Bhopal Dairy Plant Automation

Background and Objective

2.86 Bhopal Sahakari Dugdha Sangh Maryadit (BSDSM) is affiliated to Madhya Pradesh State Cooperative Dairy Federation Limited. Since its establishment, it has worked as a bridge between rural milk producers and urban consumers. During 2015-16 BSDSM had 2389 functional primary milk cooperative societies with total membership of 95923 and 4.23 lakh Kg milk was procured through them. During the year the turnover of milk union was Rs. 723 Crore. BSDSM had received grant of Rs 9.5 Crore under Rashtriya Krishi Vikas Yojana (RKVY) for Upgradation and Automation of Bhopal Dairy Plant.

The Milk Process

2.87 Every day raw milk is delivered from the dairy cooperative societies to the main dairy plant for processing and product making, and then further marketed to the urban consumers. At each stage of the process critical information, must be tracked and recorded. Automated data collection has significantly increased the control mechanism for the day-to-day operation of the dairy. The previous dairy systems were not automated and the PLCs were not connected which led to unnecessary waste. Also, these processes were time-consuming and in-efficient.

2.88 Bhopal dairy plant is the first dairy in the Madhya Pradesh to be computerized with the existing facility and equipments. Dairy Automation Pvt. Ltd. has successfully introduced full scale automation of all critical process like Milk reception, Chilling, Storage in raw milk silos, operation of pasteurizer, separator, homogenizer, milk dispatch to Packing section and Tanker, batch formation and Cleaning in Place (CIP) with modernization of

equipment.

Outcomes

1. Optimum utilization of critical resources like water, electricity, refrigeration, steam and manpower
2. Strict process monitoring at all levels
3. Reduction in loss of milk while processing
4. Timely maintenance of equipment
5. Strict adherence to ISO and HACCP norms

White Onion Cultivation in PPP-IAD Project 2013-14 – Success Story (Jain Irrigation Systems Ltd, Jalgaon)

Background & Objectives

2.89 White onion offers great potential for processing and the activity is prevalent in Jalgaon, Dhule, Nandurbar districts of Khandesh & Amravati, Akola, Buldhana districts of Vidarbha. Initially onions were procured from open market. Jain Irrigation Systems Ltd (JISL) has established a state of art onion & vegetable dehydration factory in Jalgaon & process white onions & other vegetables after a continuous & rigorous research, developments & field trials & introduced it with growers in the region through contact farming.

2.90 The aim was to increase farm productivity, reduce cost of production and minimize losses in supply chain and help in the capacity building of the farmer with an integrated approach to develop sustainable agriculture.

Outcome

2.91 Through the establishment of this unit, 19.645 MT seed was supplied to the selected 2208 farmers over an area of 1957.9 ha, wherein 82 percent of the total area cultivated was sown directly by planter and the cost of cultivation reduced by Rs. 7000 to 8000 per acre due to mechanization. Also, 85 percent of the

total area cultivated in this project was under Micro Irrigation System (MIS), and Jain Good Agricultural Practice (food safety, traceability & quality management system) was implemented for the entire white onion cultivated area. The entire produce in this project was procured directly by the company through its Jalgaon centre.

2.92 The financial assistance provided through Public Private Partnership for Integrated Agricultural Development project helped many small & marginal farmer to buy the planter and created an opportunity to develop village level agri. Entrepreneur.

Statement showing Allocation and Release of funds under RKVY

(Rs. in Crore)

Sl.	Name of the city	2015-16		2016-17		2017-18
		Allocation	Release	Allocation	Release	Allocation
1	Andhra Pradesh	197.79	192.66	228.35	222.59	208.61
2	Arunachal Pradesh	31.55	31.55	23.82	11.92	41.51
3	Assam	128.07	94.10	279.75	210.45	279.71
4	Bihar	164.86	111.20	258.22	90.61	175.69
5	Chhatisgarh	150.11	145.07	200.30	193.04	161.08
6	Goa	43.40	21.70	20.69	10.35	17.77
7	Gujarat	182.09	174.55	315.27	155.31	212.98
8	Haryana	143.10	141.54	152.40	126.85	118.16
9	Himachal Pradesh	28.30	28.30	52.76	52.76	22.94
10	Jammu & Kashmir	74.72	37.36	88.90	38.49	29.52
11	Jharkhand	87.68	78.32	155.27	72.72	124.67
12	Karnataka	359.94	346.93	247.04	242.31	241.73
13	Kerala	91.86	90.48	157.71	92.76	128.44
14	Madhya Pradesh	264.57	264.09	454.89	293.49	226.23
15	Maharashtra	438.11	438.00	396.29	250.91	411.35
16	Manipur	20.46	20.46	29.77	12.83	16.88
17	Meghalaya	16.52	8.26	20.19	10.63	20.31
18	Mizoram	16.61	19.39	25.95	20.58	10.40
19	Nagaland	25.25	25.25	36.94	34.94	57.34
20	Orissa	299.67	292.36	342.59	334.91	278.99
21	Punjab	215.94	107.97	260.50	95.81	280.52
22	Rajasthan	342.47	325.97	262.28	261.98	232.64
23	Sikkim	24.35	4.07	14.71	14.40	5.97
24	Tamil Nadu	259.94	259.74	147.39	204.87	224.14
25	Telangana	142.30	135.91	427.85	256.9	127.68
26	Tripura	21.54	21.54	34.41	934.41	39.55
27	Uttar Pradesh	358.16	177.41	321.98	201.89	435.68
28	Uttarakhand	40.03	36.20	46.87	46.57	84.13
29	West Bengal	285.26	284.56	352.47	280.78	298.60
	Total States	4454.65	3914.94	5355.56	3876.15	4513.23
30	A & N Islands	4.70	2.35	4.69	2.35	5.97
31	Chandigarh	0.31	0.00	0.33		0.15
32	D& N Haveli	5.43	0.00	5.42		2.86
33	Daman & Diu	0.94	0.00	0.94		0.45
34	Delhi	1.50	0.00	1.50		3.31
35	Lakshadweep	0.63	0.00	0.63		0.30
36	Pudducherry	1.51	0.76	1.51		2.66
	Total UTs	15.02	3.11	15.02	2.35	15.70
	Grand Total	4469.67	3918.05	5370.58	3878.50	4528.93

Agricultural Prices, Marketing and International Trade

3.1 The performance of farming households in achieving higher welfare and prosperity depends on how they perform in producing maximum output at the lowest possible cost, and getting maximum prices for their basket of produce with the least wastage, less transportation cost and mandi fees. This is possible when agricultural marketing system is well developed and the adequate institutional support is provided by the Government to check the risk of market imperfections and volatility both in farm inputs and output business & industry. At present India's agricultural market is beset with numerous adverse conditions and systemic shortcomings despite important policy measures taken in the past.

3.2 This chapter discusses the major developments in agricultural prices, marketing, international trade and other related issues dealt by various international fora and suggest a possible way forward.

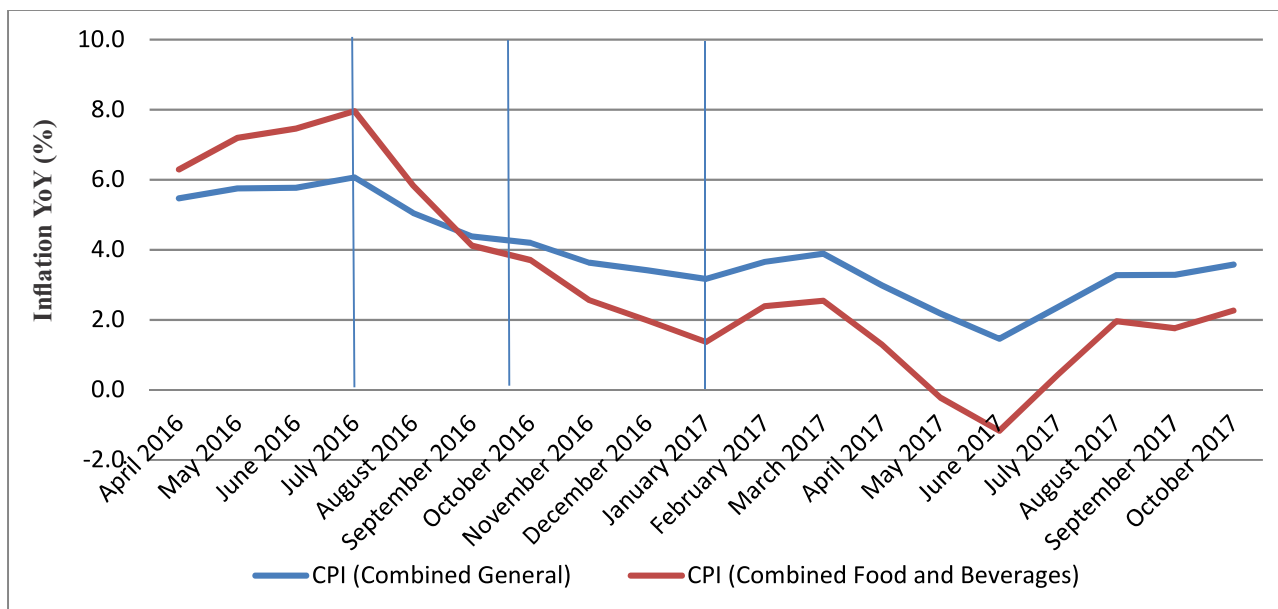
AGRICULTURAL PRICES

3.3 The rate of food inflation, as measured by the Consumer Price Index (Base: 2012=100), averaged 4.5 percent during 2016-17 as compared to 5.1 percent in 2015-16. An analysis of the monthly inflation suggests that the food inflation has broadly gone through four phases during 2016-17 (**Figure 3.1**). In the first phase (April-July), the price of food

items remained high and as a result food inflation hovered around 7.2 percent and reached the peak of 8.0 percent in July 2016. In the second phase (July-October), food prices eased steadily and CPI food inflation averaged 4.6 percent as compared to the overall CPI inflation of 4.0 percent. In phase three (November-January), prices of food items declined more sharply which resulted in all time low CPI food inflation of 1.4 percent, primarily reflecting the impact of demonetization on food prices through subdued demand. In the last phase, i.e., after January 2017, prices of food items again started moving upwards. The volatility witnessed in the food inflation during 2016-17 may be largely attributed to the variation in the prices of perishable commodities, including fruits and vegetables due to certain seasonal factors and partly due to the impact of demonetization announced on 8th November 2016. The study on spatial and temporal dynamics of food prices post-demonetisation done by the Reserve Bank of India¹ suggests that within the food group, the decline in vegetable prices was particularly large and seen across all States in both wholesale and retail markets. During 2017-18, food prices remained muted in the first quarter before starting their upward trend from July onwards on account of high prices of fruits and vegetables.

¹ RBI Monetary Policy Report, April 2017

Figure: 3.1 Month-wise Inflationary Trend (based on CPI)

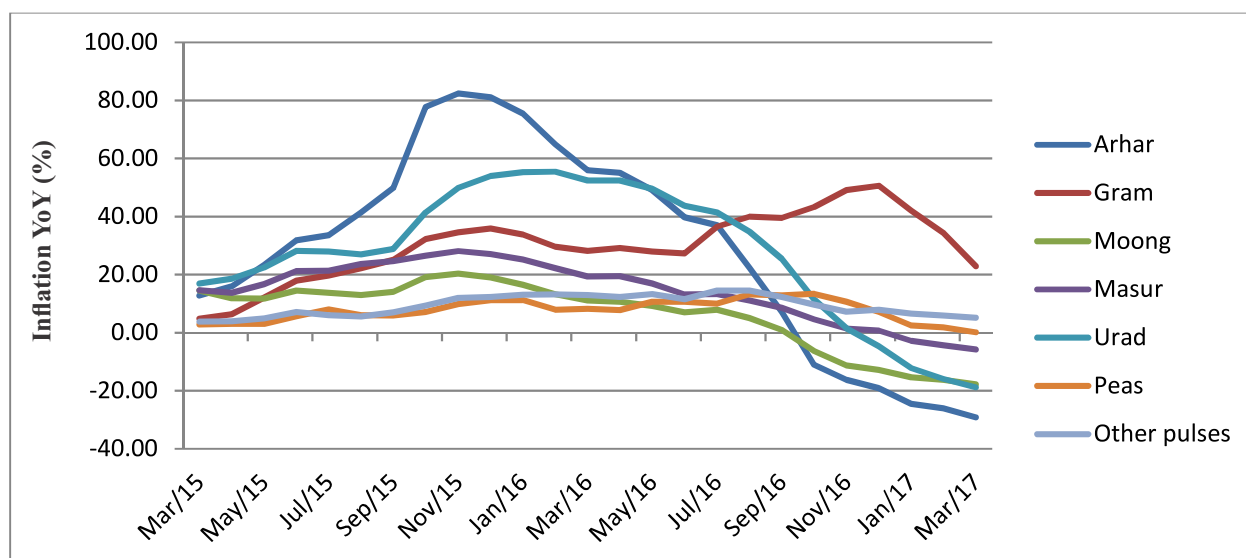


Source : Central Statistics Office

3.4 The increase in food prices witnessed in 2015-16, which was mainly triggered by the increased prices of pulses, was largely contained in 2016-17 due to favourable monsoon and astute supply management policies of the government, including incentivising pulses production through increase in MSP and announcement of bonus on major pulses and oilseeds, increase in buffer stock limit of pulses, export ban on pulses, increased state

procurement, etc. As a consequence of increase in supply of pulses, the prices of all the major pulses remained subdued except gram, particularly, in the second half of 2016-17. This has also contributed in bringing down the level of headline CPI inflation to its record low of 3.2 percent in January 2017. **Figure 3.2** depicts the recent trend in CPI inflation in case of major pulse crops.

Figure 3.2: Inflation (CPI) for major Pulse crops

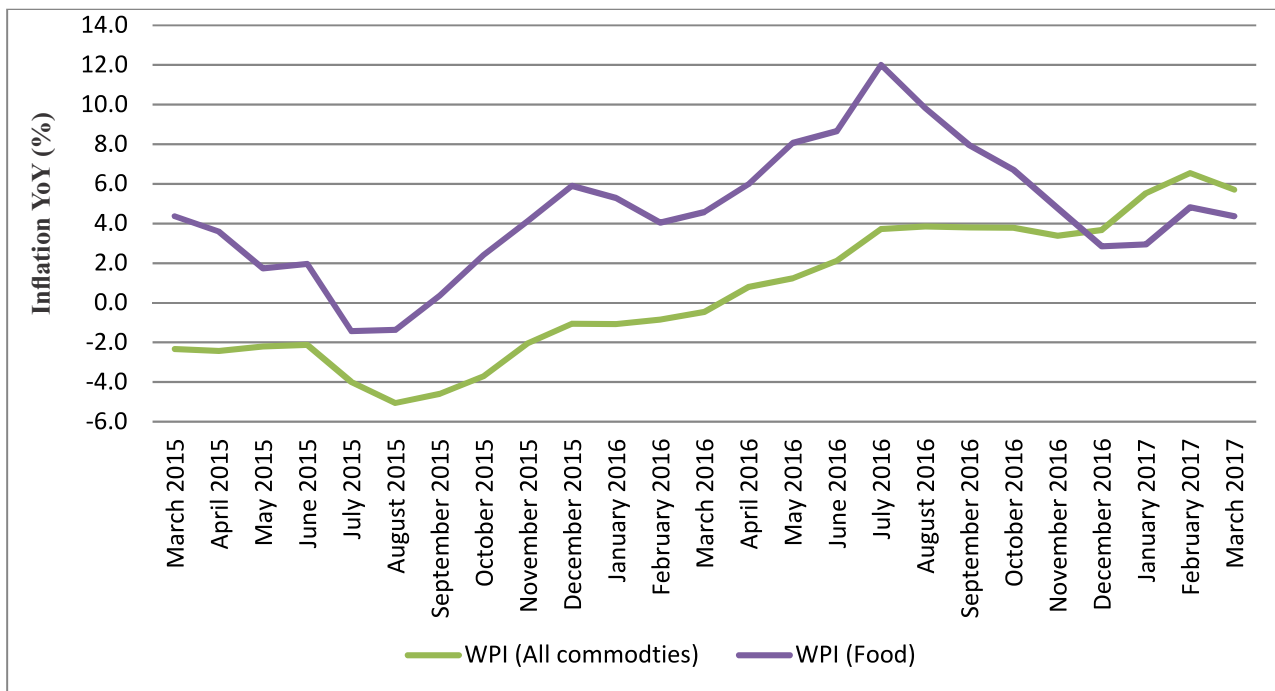


Source : Central Statistics Office

3.5 At the wholesale level, while the overall inflation as calculated by the Wholesale Price Index (WPI) with Base Year 2004-05=100, averaged 3.7 percent in 2016-17 as compared to (-) 2.5 percent in 2015-16, the rate of food inflation (including food articles and manufactured food products) averaged 6.5 percent in 2016-17 against 2.6 percent in 2015-16. The increase in WPI inflation in 2016-17, among other things, can be explained through the low base effect. The deflationary trend in the WPI witnessed since October 2014 gradually subsided by the mid of

2015 and WPI entered into positive trajectory since March 2016 (Figure 3.3). The food prices, in particular, gained momentum since March 2016 and reached the double digit level of 12 percent in July 2016, mainly due to increase in prices of pulses, fruits and vegetables, sugar, cereals, eggs, meat and fish, etc., However, prices witnessed a downward trend since July, 2016 mainly on account of fall in prices of fruits and vegetables, pulses, condiments and spices, etc.

Figure: 3.3 Month-wise Inflationary Trend (WPI) for Food and All Commodities

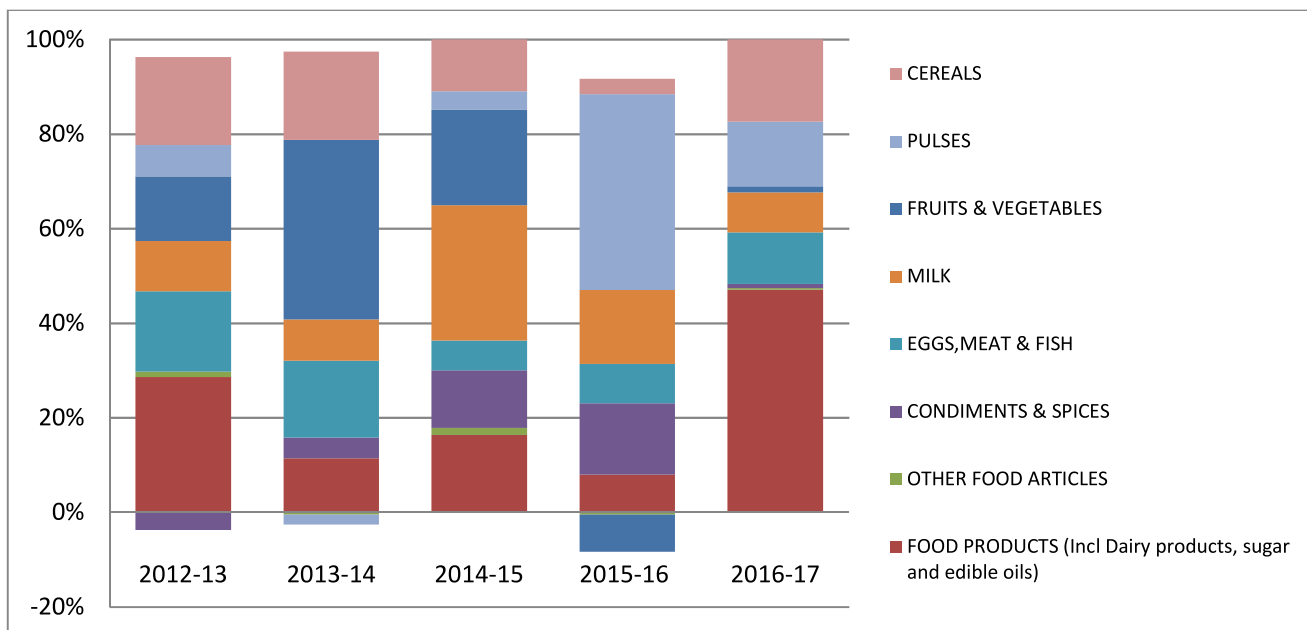


Source : Office of Economic Adviser, DIPP

3.6 The analysis of drivers of food inflation during the year 2016-17 (Figure 3.4) shows that the food products, viz., sugar, edible oils, grain mill products, dairy products, bakery products, etc., emerged as a significant contributor to food inflation with a share of about 47 percent. The other major components of food inflation were cereals, pulses,

eggs, meat and fish, and milk. The cyclical nature of sugar production in India, which resulted in two consecutive years of low production, i.e., 2015-16 and 2016-17, after reaching its all time high in 2014-15, has led to inflationary pressures in case of sugar. This along with high cereal and pulses inflation exerted greater influence on overall food inflation.

Figure: 3.4 Year-wise Drivers of Food Inflation (WPI)



Source : Office of Economic Adviser, DIPP

The Way Forward

3.7 The price and non-price interventions undertaken since 2015 by the government have yielded significant results in controlling the food inflation spiral. The price of pulses, in particular, was largely contained from second half of 2016-17 on account of increased production and other administrative measures taken by the government. The introduction of Pusa-16, an improved and short-duration variety of arhar, and other technological interventions are other important steps towards long-term solution for increasing self sufficiency in case of pulses. Furthermore, to tame the inflationary pressures in case of sugar and edible oils, which contributed significantly to food inflation in 2016-17, government has resorted to several measures, viz., imposition of stockholding limits, discouraging exports, and reduction in import duty on certain edible oils. These measures are likely to exert greater influence in containing the food price inflation in 2017-18. One factor that played a major role in low food inflation witnessed during 2016-17 was the

demonetization decision announced by the government in November 2016. The prices of perishable commodities, in particular, witnessed a sharp fall during November 2016 to January 2017 on account of lower spending by the consumers.

3.8 Keeping in view the seasonal variations in prices of the horticulture produce, it is imperative to build efficient supply chain, with focus on improvement in cold storage infrastructure, processing facilities including creation of infrastructure for logistics, buffer stocking of onion in the dehydrated form, canning of fruits and freezing of vegetables, etc. In this regard, some of the recent measures by the government to reform the agriculture marketing system in the country, including, *inter-alia*, creation of National Agriculture Market (e-NAM), 100 percent FDI through automatic route in marketing of food products produced and manufactured in India, setting up of mega food parks, etc., will reap benefits to farmers in facilitating better price discovery, better marketing of agricultural produce, reducing

wastages, etc. and thereby reducing volatility in food prices.

AGRICULTURAL PRICE POLICY AND MINIMUM SUPPORT PRICE

3.9 Agriculture Price Policy in India aims to ensure remunerative prices for agricultural commodities to farmers, encourage higher investment in agriculture, incentivize production and evolve a balanced and integrated price structure, while safeguarding the interests of consumers by making supplies available at reasonable prices. The instruments of agricultural price policy includes a system of Minimum Support Prices (MSP) backed by procurement of grains to ensure remunerative returns to farmers; open market operations by the government to minimize the short-run and year to year price fluctuations; and to distribute foodgrains at subsidized prices through Public Distribution System (PDS).

3.10 The Government fixes the Minimum Support Price (MSP) for both kharif & rabi commodities based on the recommendations of the Commission for Agricultural Costs and Prices (CACP) and taking into account the views of State Governments, concerned Central Ministries and Departments. The MSP fixed by the Government provide adequate returns over all India weighted average of all paid out costs including family labour (A2+FL) as estimated by the CACP. Although, the Government offers to procure crops at MSP, farmers are free to sell their produce to the Government procurement agencies at MSP or in the open market as is advantageous to them.

3.11 The CACP recommends MSP for 22 major agricultural crops and Fair and Remunerative Price (FRP) for sugarcane. Apart from sugarcane, for which the FRP is declared by the Department of Food & Public Distribution, the 22 crops covered under MSP are paddy, jowar, bajra, maize, ragi, arhar (tur), moong, urad, groundnut-in-shell, soybean, sunflower, sesame, niger seed, cotton, wheat, barley, gram, masur (lentil), rapeseed/mustard seed, safflower, jute and copra. In addition, the MSP for toria and de-husked coconut is fixed by the Department of Agriculture Cooperation and Farmers Welfare (DAC&FW) on the basis of the MSPs of rapeseed/mustard seed and copra, respectively. The important factors which CACP considers while formulating its recommendations on price policy, *inter alia*, include cost of cultivation, trends in market prices (domestic and international), the demand and supply situation, inter-crop price parity, terms of trade between agriculture and non-agriculture, effects on general price level, effects on cost of living, etc.

3.12 Government has progressively increased the MSP of both rabi and kharif crops. The crop-wise MSPs announced for 2016-17 kharif and rabi seasons and kharif 2017-18 season is given in **Table 3.1**. With a view to incentivise cultivation of pulses and oilseeds, Government has announced a bonus of Rs. 200/- per quintal for Arhar (Tur), Urad, Moong, Groundnut-in-shell and Soyabean and a bonus of Rs 100/- per quintal for Sunflowerseed, Sesamum and Nigerseed. This bonus is payable over and above the approved MSP.

Table 3.1: Minimum Support Prices (According to Crop Year)

Sl. No.	Commodity	Variety	2015-16	2016-17	(#) increase in MSP 2016-17 over 2015-16	2017-18	(#) increase in MSP 2017-18 over 2016-17	2018-19	(#) increase in MSP 2018-19 over 2017-18
	Kharif Crops								
1	Paddy	Common	1410	1470	60(4.3)	1550	80(5.4)		
		Grade 'A'	1450	1510	60(4.1)	1590	80(5.3)		
2	Jowar	Hybrid	1570	1625	55(3.5)	1700	75(4.6)		
		Maldandi	1590	1650	60(3.8)	1725	75(4.5)		
3	Bajra		1275	1330	55(4.3)	1425	95(7.1)		
4	Maize		1325	1365	40(3.0)	1425	60(4.3)		
5	Ragi		1650	1725	75(4.5)	1900	175(10.1)		
6	Arhar (tur)		4625^	5050^^	425(9.2)	5450^	400(7.9)		
7	Moong		4850^	5225^^	375(7.7)	5575^	350(6.7)		
8	Urad		4625^	5000^^	375(8.1)	5400^	400(8)		
9	Cotton	Medium Staple	3800	3860	60(1.6)	4020	160(4.1)		
		Long Staple	4100	4160	60(1.5)	4320	160(3.8)		
10	Groundnut in shell		4030	4220*	190(4.7)	4450^	230(5.5)		
11	Sunflower seed		3800	3950*	150(3.9)	4100*	150(3.8)		
12	Soyabean		2600	2775*	175(6.7)	3050^	275(9.9)		
13	Sesamum		4700	5000^	300(6.4)	5300*	300(6)		
14	Nigerseed		3650	3825*	175(4.8)	4050*	225(5.9)		
	Rabi crops					-			
15	Wheat		1525	1625	100(6.6)				
16	Barley		1225	1325	100(8.2)	-			
17	Gram		3500**	4000^	500(14.3)	-			
18	Masur (lentil)		3400**	3950@	550(16.2)	-			
19	Rapeseed/mustard		3350	3700*	350(10.4)	-			
20	Safflower		3300	3700*	400(12.1)	-			
21	Toria		3290	3560	270(8.2)	-			
	Other Crops								
22	Copra (Calender Year)	Milling	5550	5950	400(7.2)	6500	550(9.2)	7511	1011(15.6)
		Ball	5830	6240	410(7.0)	6785	545(8.7)	7750	965(14.2)
23	De-Husked Coconut (Calender Year)		1500	1600	100(6.7)	1760	160(10)	2030	270(15.3)
24	Jute		2700	3200	500(18.5)	3500	300(9.3)	3700	200(5.7)
25	Sugarcane \$		230	230	-	255	25(10.9)		

Source: Directorate of Economics & Statistics

Figures in brackets indicate percentage increase. \$ Fair and remunerative price. * Including Bonus of Rs. 100 per quintal. ** Including Bonus of Rs. 75 per quintal. ^Including Bonus of Rs. 200 per quintal. ^^Including Bonus of Rs. 425 per quintal. @ Including Bonus of Rs. 150 per quintal.

3.13 Though the price intervention mechanism of the government, through announcing of Minimum Support Prices before the sowing season, plays an important role in agricultural policy, inadequate procurement infrastructure not just limits the effectiveness of such mechanism but also distorts the cropping pattern in favour of few crops. In the wake of these imbalances, government has lately stressed on the need for enhancing procurement mechanisms with special focus on eastern belts of the country. Owing to the changing dietary patterns and demand supply mismatch in case of pulses and oilseeds, there is a growing emphasis towards building a credible procurement mechanism for pulses and oilseeds. NITI Aayog has also stressed on the need for reorientation of the existing agricultural price policy through setting up of “Price Deficiency Payment”

mechanism wherein subsidy could be provided on targeted produce in case the market price falls below a pre-specified assured threshold. This approach would help prevent unwanted stocks with the Government and provide price incentives to producers in all the regions and all the crops, for which MSP is announced. In the wake of the surge in retail prices of pulses in later half of 2015-16 and to suggest a mechanism to strengthen the procurement infrastructure in the country, Government has set up a committee under the chairmanship of the Chief Economic Adviser, Ministry of Finance. Main recommendations of the Committee's report titled 'Incentivising Pulses Production through Minimum Support Price (MSP) and Related Policies' are discussed in **Box 3.1** below.

Box 3.1 Main recommendations of CEA Committee Report on MSP of Pulses

Government constituted a Committee headed by Dr. Arvind Subramanian, Chief Economic Adviser, to review the Minimum Support Prices (MSPs) and related policies to incentivize the cultivation of pulses. The Committee submitted its report in September 2016 with the following major recommendations.

- i) MSP should be increased to Rs. 70/kg in 2018 when short duration kharif tur is ready for sale.
- ii) Efforts should be made to give production subsidies to farmers for growing pulses in irrigated area of about Rs. 10-15 per kg to be given via DBT.
- iii) CACP should review its MSP-setting framework to incorporate risk and social externalities, which can be effective in determination of MSPs.
- iv) To increase procurement, the government should allocate an additional Rs. 10000 crore to procurement agencies such as Food Corporation of India, and state co-operatives among others.
- v) State government should be encouraged to delist pulses from their Agricultural Produce Market Committee Acts, so that produce may be traded outside of the state-owned mandis.
- vi) The government should aim to create a new institution as PPP arrangement for pulses, that would be owned by the government, public sector institutions and private players but operated by a board on a day to day basis to procure, stock and dispose pulses.

PRICE SUPPORT SCHEME (PSS)

3.14 The DAC&FW implements Price Support Scheme (PSS) for procurement of 16 commodities of oil seeds, pulses and cotton through Central nodal agencies, viz., NAFED, SFAC, CWC, NCCF and FCI. This scheme is implemented at the request of the concerned State Government which agrees to exempt the procured commodities from levy of mandi tax and assist central nodal agencies in logistic arrangements, including gunny bags, working capital for state agencies, creation of revolving fund for PSS operations, etc., as required under the scheme guidelines. The procurement of these commodities are undertaken by Central agencies at Minimum Support Price (MSP) announced by the Government as and when prices fall below the MSP and compliance of State Govt. to PSS guidelines.

Produce of Fair Average Quality (FAQ) alone is procured under the Price Support Scheme (PSS). Losses, if any, incurred by Central agency in undertaking PSS operations, are fully reimbursed by the Central Government. Profit, if any, earned in undertaking PSS operations is credited to the Central Government Accounts. The DAC&FW provides working capital to the Central agencies in the form of Government Guarantee for procurement under PSS. A standing Government Guarantee of Rs. 2500 crore is available with NAFED and Rs. 150 crore to SFAC. Over and above this, DAC&FW also provides letter of comfort for providing short term loan to the Central agencies. The details of procurement made for oilseeds & pulses by NAFED and SFAC during 2015-16 and 2016-17 are as under (Table 3.2 and 3.3).

Table 3.2: Procurement by NAFED

S. No	Year / Season	Commodity	Procured Quantity (in MTs)	Minimum Support Price (MSP) for FAQ (in Rs. Per Qtl)	Procurement Value (in lakh Rs.)
1	2014-15	Mustard Seed R-2014	1714.821	3050	558.77
		Groundnut Pods R-2014	6229.805	4000	2750.74
		Sunflower Seed R-2014	4153.213	3700	1659.52
		Gram R-2014	313881.049	3100	104960.23
				Total	109929.26
2	2015-16	Sunflower Seed R-2015	4237.684	3750	1711.88
3	2016-17	Sunflower Seed R-2016	4949.312	3800	1881.00
		Milling Copra 2016	4488.943	5950	2671.00
		Ball Copra 2016	1835.459	6240	1145.00
		Soyabean K-2016	163.810	2775	45.00
		Groundnut Pods K-2016	210731.162	4220	88929.00
		Moong K-2016	8267.578	5225	4320.00
				Total	98991.00

Table 3.3: Procurement by SFAC

S. No	Year / Season	Commodity	Procured Quantity (in MTs)	Minimum Support Price (MSP) for FAQ (in Rs. Per Qtl)	Procurement Value (in lakh Rs.)
1	2014-15	Gram R-2014	50285.00	3100	15588.00
2	2016-17	Moong K-2016	1227.93	5225	641.59

MARKET INTERVENTION SCHEME (MIS)

3.15 The DAC&FW also implements the Market Intervention Scheme (MIS) for procurement of horticultural commodities which are perishable in nature and are not covered under the PSS. The objective of intervention is to protect the growers of these commodities from making distress sale in the event of a bumper crop during the peak arrival period when the prices tend to fall below economic levels and below cost of production. The condition is that there should be either at least a 10 percent increase in production or a 10 percent decrease in the ruling market prices over the previous normal year. The Scheme is implemented at the request of a State/ UT government which is ready to bear 50 percent of the loss (25 percent in case of North-Eastern States), if

any, incurred on its implementation. The extent of total amount of loss to be shared on a 50:50 basis between the Central Government and the State Government is restricted to 25 percent of the total procurement value which includes cost of the commodity procured plus permitted overhead expenses. Under the Scheme, in accordance with MIS guidelines, a pre-determined quantity at the fixed Market Intervention Price (MIP) is procured by the agencies designated by the state government for a fixed period or till the prices are stabilized above the MIP whichever is earlier. The area of operation is restricted to the concerned state only. The details of MIS implemented during 2014-15, 2015-16 and 2016-17 are as under (Table 3.4):-

Table 3.4: MIS implemented during 2014-15 to 2016-17

S.No.	Year	Commodity	Market Intervention Price (MIP) (Rs. per MT)	State	Sanctioned Qty (in MTs.)
1	2014-15 01.05.2014 to 16.06.2014	Chilli	42,000/-	Mizoram	2,850
2	2014-15 15.08.2014 to 15.10.2014	'C' Grade Apple	6,500/-	Himachal Pradesh	27,000
3	2014-15 25.11.2014 to 25.12.2014	Ginger	9,050/-	Nagaland	32,000
4	2015-16 20.05.2015 to 20.06.2015	Potato	4,250/-	Uttar Pradesh	1,00,000

5	2015-16 15.12.2015 to 14.03.2016	Oil Palm FFB	7,888/-	Andhra Pradesh	1,14,963
6	2016-17 01.09.2016 to 30.09.2016	Grapes	42,000/-	Mizoram	3,800
7	2016-17 01.11.2016 to 30.11.2016	Onion	6,240/-	Karnataka	1,00,000
8	2016-17 01.12.2016 to 30.12.2016	Onion	7,070/-	Telangana	5,000
9	2016-17 07.12.2016 to 14.02.2017	Arecanut	Chali - 2,51,000/- Red - 2,70,000/-	Karnataka	
10	2016-17 14.12.2016 to 12.01.2017	Palm-Oil	7,650/-	Tamil Nadu	1,000
11	2016-17 7.02.2017 to 18.03.2017	Ginger	8,750/-	Arunachal Pradesh	12,675

Source : Department of Agriculture, Cooperation & Farmers Welfare

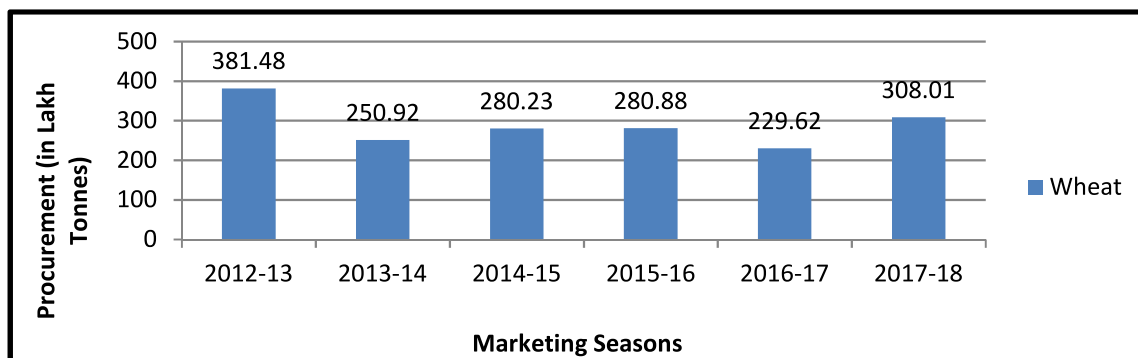
PROCUREMENT OF FOODGRAINS

3.16 The Central Government extends price support to paddy, nutri grains and wheat through the FCI and State Agencies. All the foodgrains conforming to the prescribed specifications offered for sale at specified centers are bought by the public procurement agencies at the Minimum Support Price (MSP). The farmers have the option to sell their produce to FCI/State Agencies at MSP or in the open market as is advantageous to them. Foodgrains procured by the State Governments and their agencies are ultimately taken over by the FCI for distribution throughout the country.

3.17 The objective of foodgrains procurement by Government agencies is to ensure that farmers get remunerative prices for their produce and do not have to resort to distress sale. It also aims to service the commitments of the Government under National Food Security Act (NFSA) and other welfare schemes of the Government, viz., Mid Day Meal Scheme, Integrated Child Development Scheme (ICDS), so that subsidised foodgrains are supplied to the poor and needy, and to build up buffer stocks of foodgrains to ensure foodgrain security.

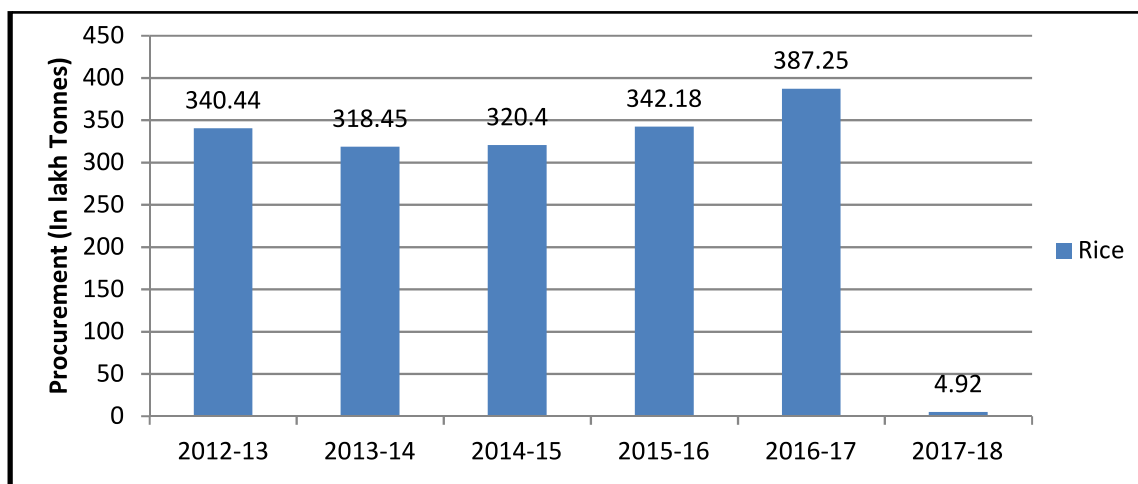
3.18 The Government procurement of wheat and paddy/rice during the last few years are at **Figure 3.5 and 3.6.**

Fig. 3.5: Procurement of Wheat (upto September 2017)



Source : Department of Food and Public Distribution

Fig. 3.6: Procurement of Rice (upto September 2017)



Source : Department of Food and Public Distribution

3.19 The Government has accepted the recommendation of High Level Committee (HLC) constituted under the Chairmanship of Shri Shanta Kumar, M.P., that FCI should focus more in the Eastern States of India, where there are frequent complaints of distress sale of paddy and where the present procurement system is ineffective. Accordingly, State-wise Five-year Action Plans has been drawn by FCI for U.P. (with focus on Eastern U.P.), Bihar, Jharkhand, West Bengal & Assam, where concerns exist about distress sale of paddy (procurement is already robust in Chhattisgarh & Odisha).

3.20 So far as nutri grains is concerned, State Government/agencies procure the nutri grains at MSP on behalf of FCI/Government of India after obtaining prior approval of procurement plan as per laid down policy guidelines of Department of Food and Public Distribution (DFPD). This is subject to the condition that the procured nutri grains are planned to be distributed under NFSA or Other Welfare Schemes (OWS) by the State. The financial liabilities of DFPD with regard to procurement of nutri grains under central pool will be limited to the extent of quantity utilized for the respective State's NFSA or OWS and requirement of the nutri grains stocks for

FCI. In case of any requirement raised by FCI for nutri grains as per approved plan, State will deliver the same to them. In case, there is a demand for nutri grains in some other States, FCI moves the required quantity to that State, based on allocation issued by the DFPD. Any excess quantity apart from distribution under NFSA/OWS and FCI's requirement is not allowed under central pool.

STORAGE OF FOODGRAINS

3.21 The total storage capacity available with FCI as on 31.03.2017 was 352.71.63 lakh MT. However, total storage capacity available with FCI and State agencies for storage of Central Pool Stocks was 772.93 lakh MT.

3.22 Due to the increased procurement of foodgrains and in order to reduce the storage in Cover and Plinth (CAP), the Government formulated a Scheme for construction of storage godowns through private entrepreneurs, Central Warehousing Corporation (CWC) and State warehousing Corporations (SWCs). Assessment of additional storage needs under the Scheme is based on the overall procurement/consumption and the storage space already available. For the consuming areas, storage capacity is to be created to meet four month's requirement of PDS and Other welfare Schemes in a State. For the procurement areas, the highest stock levels in the last three years are considered to decide the storage capacity required. Later this Scheme was extended to Decentralized Procuring (DCP) State in 2009. FCI has sanctioned a total storage capacity of 150.94 lakh MT out of which a capacity of about 114.75 lakh MT has been sanctioned to the private entrepreneurs (as on 30.09.2016). CWC and SWCs have been sanctioned 7.17 lakh MT and 29.02 lakh

MT respectively. At present about 135.80 lakh MT has been completed out of which 126.92 lakh MT has been taken over. All possible efforts are being made to eliminate the lag between constructed and taken over capacity. A capacity of about 10.50 lakh MT is under construction.

Warehousing development and Regulatory Authority (WDRA)

3.23 The Warehousing Development and Regulatory Authority (WDRA) has been set up by the Government of India under the Warehousing (Development and Regulation) Act, 2007 with the objective of developing and regulating warehousing, including registration and accreditation of the warehousing intending to issue negotiable Warehouse Receipts (NWRs) in the country. The authority has so far notified 123 agriculture commodities and 26 horticulture commodities for the purpose of negotiable warehouse receipts (NWRs) including cereals, pulses, oil seeds, spices, rubber, tobacco and coffee. In total 1437 warehouse of CWC, SWCs, private and Project Appraisal Committees (PACs) have been registered with the WDRA till 31.04.2017. In order to create an effective regulatory framework in warehousing sector, and for improving the effectiveness of NWRs, a transformation plan for WDRA was conceptualized in the year 2014 and its implementation is going on.

Allocation of foodgrains under TPDS

3.24 With a view to make receipt of foodgrains under Targeted Public Distribution System (TPDS) a legal right, Government of India enacted the National Food Security Act (NFSA), 2013 which came into force w.e.f. 10th September, 2013. The Act provides for coverage of upto 75% of the rural population and

upto 50% of the urban population for receiving subsidized foodgrains under TPDS, thus covering about two-third of the total population. The eligible beneficiaries identified by the States/UTs are entitled to receive 5 kgs of foodgrains per person per month at subsidized prices of Rs.3/2/1 per kg for rice/ wheat/ nutri grains respectively. The existing Antyodaya Anna Yojana (AAY) households, which constitute the poorest of the poor, receive 35 kgs of foodgrains per household per month. NFSA 2013 has been implemented in all the 36 States/UTs and they are receiving monthly allocation of foodgrains under NFSA, with Kerala and Tamil Nadu implemented the NFSA 2013 w.e.f. 01.11.2016.

3.25 Prior to the implementation of NFSA, State/UTs were receiving foodgrains under erstwhile TPDS, which was based on March, 2000 population estimates of Registrar General of India and 1993-94 poverty estimates of erstwhile Planning Commission, under which foodgrains (including additional allocations) were provided @35 kg per family per month for AAY and BPL families and @ 10-35 kg per family per month for APL families.

3.26 During 2016-17 (upto November 2016), Government of India has made a provisional allocation of 512.59 lakh tons for States/UTs under NFSA and 29.27 lakh tons of foodgrains has been allocated for non-NFSA States/UTs. Further, an

additional quantity of 1.87 lakh tones of additional foodgrains have also been allocated for BPL and APL families for the States of Nagaland, Tamil Nadu and Kerala as Nagaland implemented NFSA w.e.f. August, 2016 and Tamil Nadu & Kerala implemented NFSA w.e.f. from 01.11.2016. In addition, 28.97 lakh tones of foodgrains have been allocated to the States/UTs for festivals, natural calamities etc.

3.27 Government has also allocated a quantity of 55.29 lakh tons of foodgrains for Other Welfare schemes (OWS) such as Mid-Day-Meal Scheme, wheat Based Nutrition Programme under ICDS, Welfare Institutions Scheme, SC/ST/OBC Hostel, Annapurna Scheme, etc. The total release of foodgrains during the year has been 627.99 lakh tons (upto November 2016).

3.28 For better foodgrain management, the Government has also revised the foodgrain stocking norms (previously called Buffer Norms) for the Central pool with effect from 22.01.2015. The Foodgrain Stocking Norms for central pool has recently been modified slightly for the period from November, 2016 to June, 2017 in view of shortage of wheat in the central pool.

3.29 The modified foodgrain stocking norms from November, 2016 to June, 2017 are as under **(Table3.5):-**

Table 3.5: Foodgrain stocking norms

(in million tonnes)

As on	Operational stocks		Strategic Reserve		Total
	Rice	Wheat	Rice	Wheat	
1 st April	11.5	4.46	3.00	2.00	21.04
1 st July	811.5	24.58	2.00	3.00	41.12
1 st Oct (w.e.f Nov, 16)	48.25	17.52	3.00	2.00	30.77
1 st Jan	5.61	10.80	3.00	2.00	21.41

Source : Department of Food & Public Distribution

3.30 With effect from 01.07.2017, the foodgrain stocking norms for the central pool will be restored

as given in **Table 3.6:-**

Table 3.6: Foodgrain stocking norms for the central pool

(in million tonnes)

As on	Operational stocks		Strategic Reserve		Total
	Rice	Wheat	Rice	Wheat	
1 st April	11.58	4.46	2.00	3.00	21.04
1 st July	11.54	24.58	2.00	3.00	41.12
1 st Oct	8.25	17.52	2.00	3.00	30.77
1 st Jan	5.61	10.80	2.00	3.00	21.41

Source : Department of Agriculture, Cooperation & Farmers Welfare

Export of Rice and Wheat

3.31 Free export of non-basmati rice and wheat has been allowed to private parties out of privately held stocks through Electronic Data Interchange (EDI) enabled ports w.e.f. 09.09.2011. State Trading Enterprises (STEs) including National Cooperative Consumers' Federation of India Limited (NCCF) and National Agricultural Cooperative Marketing Federation of India Limited (NAFED) have also been permitted to participate in the export along with private parties. Exports have also been allowed through the Land Custom Stations (LCS) on Indo-Bangladesh and Indo-Nepal border w.e.f. 23.02.2012. There has been no export or import of wheat and rice from central pool stock on commercial ground. However, a quantity of 20,000 metric tonnes has been exported to Egypt at concessional rate on diplomatic ground.

AGRICULTURAL MARKETING

3.32 Development of agricultural marketing infrastructure is the foremost requirement for the growth of a comprehensive and integrated agricultural marketing system in the country. For this purpose, DAC&FW has been implementing demand-driven plan schemes for providing assistance to entrepreneurs in the form of back-ended

credit linked subsidy. The Integrated Scheme for Agricultural Marketing (ISAM), which includes Agriculture Marketing Infrastructure (AMI), is being implemented by the Directorate of Marketing and Inspection (DMI), DAC&FW which provides assistance for the creation of agri-marketing infrastructure, including storage capacities between 25 MT to 30,000 MT. The five major sub-schemes under ISAM are (i) Marketing Research and Information Network (MRIN) (ii) Strengthening of Agmark Grading Facilities (SAGF) (iii) Training, Research and Consultancy through Choudhary Charan Singh National Institute of Agricultural Marketing (NIAM) (iv) Agri-business Development through Venture Capital Assistance (VCA) and Project Development Facility (v) National Agriculture Market (e-NAM). The first two sub-schemes are being implemented by Directorate of Marketing & Inspection (DMI), the third sub-scheme by CCS National Institute of Agriculture Marketing (NIAM), Jaipur, while the fourth and fifth sub-schemes are being implemented by Small Farmers Agri-Business Consortium (SFAC), New Delhi.

3.33 The AMI sub-scheme has two components, namely i) Storage Infrastructure and ii) Marketing Infrastructure other than Storage. The main

objectives of the AMI schemes are to develop agricultural marketing infrastructure for effectively managing marketable surplus of agricultural commodities including horticulture and of allied sectors including dairy, poultry, fishery, livestock and minor forest produce; promoting innovative and latest technologies and competitive alternative agricultural marketing infrastructure by encouraging private and cooperative sector investments; direct marketing; creation of scientific storage capacity; integrated value chains (confined upto primary processing stage only) and to provide Infrastructure facilities for grading, standardization and quality certification of agricultural produce. In addition, the Scheme aims to create general awareness and provide training to farmers, entrepreneurs, market functionaries and other stakeholders on various aspects of agricultural marketing including grading, standardization and quality certification.

3.34 The State agency projects of those States/Union Territories that have amended their respective APMC Acts w.r.t. (i) direct marketing, (ii) contract farming, and (iii) agricultural produce markets in private and cooperative sectors, will be eligible for assistance under the sub-scheme. Notwithstanding the reform status, state agencies in all States/ UTs will be eligible to avail assistance for storage infrastructure projects. However, projects promoted by private entrepreneurs other than State agencies are eligible to avail assistance under the sub-scheme, irrespective of the reforms undertaken by the State Government/UTs in their respective APMC Acts.

3.35 The assistance under the sub-scheme is available to individuals, group of farmers / growers,

registered Farmer Producer Organisations (FPOs), partnership/ proprietary firms, companies, corporations, Non-Government Organizations (NGOs), Self Help Groups (SHGs), cooperatives, Cooperative Marketing Federations, Autonomous Bodies of the Government, Local Bodies (excluding Municipal Corporations for storage infrastructure projects), Panchayats, State agencies including State Government Departments and autonomous organization / State owned corporations such as Agricultural Produce Market Committees & Marketing Boards, State Warehousing Corporations, State Civil Supplies Corporations, etc.

3.36 The storage component of the AMI sub-scheme (erstwhile Grameen Bhandaran Yojana (GBY) has been under implementation since April 2001. The Scheme is a back ended capital subsidy scheme in which rate of subsidy varies from 25 percent to 33.33 percent based on the category of eligible beneficiary and provided on capital cost of the project. Likewise, subsidy is also provided at the rate of 25 percent to eligible beneficiaries from the general category upto a ceiling of Rs. 4 crore and at the rate of 33.33 percent to special categories and special areas upto a ceiling of Rs. 5 crore for agri-marketing infrastructure (other than storage infrastructure, such as general or commodity-specific infrastructure for marketing of agricultural commodities) and for strengthening and modernizing existing agricultural markets including wholesale, rural and periodic markets. Since inception in 2004 and until September 2016, 18,218 agri-marketing infrastructure projects other than storage have been sanctioned, and a subsidy of Rs 1,601.89 crore has been released. Largely, the

Scheme has been very successful, and the off-take in previous years has been so much that the funds allocated in 2014-15 under the general category were exhausted midway and the Scheme had to be temporarily stopped for new projects for general category promoters on 5th August 2014.

3.37 Ch. Charan Singh National Institute of Agricultural Marketing (NIAM) is an Institute of excellence set up by the Government of India in August 1988 with aim to enhance the efficiency and effectiveness of agricultural marketing systems that is inclusive and empowers the primary producer by building capacity of various stakeholders through teaching, training applied research, policy advocacy and consultancy services. The Institute since inception has been continuously engaged in cutting edge applied research and knowledge dissemination for strengthening the agricultural marketing system and activities to enable primary producers, particularly small and marginal farmers to enhance their income by realizing better price.

3.38 In order to encourage desired changes at the ground, the Institute has aligned its activities with the concept of *Kisan Vikas Vriksha* of Ministry of Agriculture and Farmers Welfare, like promoting National Agricultural Market, development of integrated value chains mainly for horticulture and organic crops and developing marketing strategies particularly for NER States.

3.39 As a National Level Agency for MIDH, NIAM has undertaken a study for developing marketing strategies for northeastern states namely Meghalaya,

Assam and Tripura. A similar plan has already been completed for Sikkim State. Value chains approach is also being followed by the Institute for enhancing farmers participation in horticulture value chains.

3.40 The Institute has developed certificate course for management of Farmer Producer Organizations (FPOs) to help them implement their business plans and bring sustainability to their operations. As part of its commitment for development in northeastern region, *Meghalamp* is being implemented which aims at exposing community market owners from Meghalaya to various models of operation and management of markets.

3.41 NIAM is evolving as a key organization in the field of agricultural marketing for South-East Asian and African countries. NIAM is proposed to be the Nodal Resource Center for conducting trainings, workshop/conferences and consultancy for SAARC nations, Feed the Future (FTF) programme of United State Agency for International Development and members of Agriculture and Food Marketing Association for Asia Pacific (AFMA). NIAM also offers two years PGDBM approved by the All India Council for Technical Education (AICTE). The programme with 100 percent placement is one of the most sought after programme by the Industry. The Institute is in the process of getting the programme accredited by National Board of Accreditation so that successful candidates may be awarded with Masters Degree and their acceptability gets enhanced in industry and academics.

Box 3.2: Marketing Research Information Network

The role of Marketing Research and Information Network (MRIN) scheme is to ensure better price realization to farmers by providing market information on prices and arrivals of agricultural commodities in the wholesale markets. The availability and dissemination of complete and credible marketing information is the key to achieve both operational and pricing efficiency in the marketing system. Under MRIN, an E-Governance Portal has been developed for connecting the farmers to their markets. For this purpose, it is considered advantageous to have a network down to the mandi level to begin with, which can be progressively extended to villages and household level. Presently, electronic connectivity is provided to 3297 markets in 36 States/UTs and more than 2758 mandis reporting on daily basis to AGMARKNET portal. This is one of the largest Market Information System in the world and having richest data base available. Daily prices and arrivals of more than 300 commodities and 2000 varieties are reported on the portal.

Objectives of MRIN

- To establish a nation-wide information network for speedy collection and dissemination of market information.
- To facilitate collection and dissemination of information for better price realization by the farmers.
- To sensitize and orient farmers to respond to new challenges in agricultural marketing by using Information and Communication Technology (ICT).
- To improve efficiency in agricultural marketing through regular training and extension for reaching region-specific farmers in their own language.
- Linking of all important agricultural markets of the country.

Assistance under the Scheme:

- Free supply of computer to the important markets.
- Financial support for organizing training, research, awareness and sensitization campaign to State Govt. organizations.
- Provision of financial incentive @ Rs 1000/- per month to the data reporting officer/Nodal officer for uploading data in the portal for more than 20 days in a month.

Towards Profit-Enabling Marketing Regulations

3.42 An overarching concern regarding enabling farmers to profit is regulation of the entire gamut of farm inputs and farm produce business and industry dealing with financing, sales, purchase, storage, transportation and distribution of agricultural inputs and produce. The regulating framework consist of: a) regulatory measure; b) market infrastructure and institutions; and c) agriculture price policy. In the present policy priority of doubling of farmers income and enabling them to attain higher level of welfare and prosperity, this aspect of policy gains immense importance.

3.43 One of the most overlooked aspect of agricultural development policy is the need for strict marketing regulation in the process of allocating more and more capital resources under the multitude of new agricultural development schemes for farm inputs availability, development of agricultural marketing and storage, and providing price support for better farming. This has kept the farmers deprived of their opportunities for better prices for their produce and minimization of cost of their produce. Thus, setting the regulatory system right can prove to be a game changer in enabling farmers to gain maximum benefits from the massive developmental resources being mobilized with them.

Farm Inputs Market Regulation

3.44 The issue of dependence on old regulatory legislations with regard to effective regulation of quality, quantity, safety and pricing of fertilizers, insecticide, pesticides on the one hand and quality, quantity and pricing regulation in the case of seeds and plants other agricultural and horticultural inputs needs to be addressed at the earliest especially in view of the emerging agricultural challenges. This

would go a long way in not only ensuring cultivation at the optimal costs, but also preventing deaths of farmers while handling insecticides, pesticides and fertilizers. Secondly, it would disciplined the business and industry to follow the best practices in manufacturing, packaging, and providing effective usage precautions to prevent incidents.

Agricultural Produce Market Regulation

3.45 For addressing the issues related to the regulatory framework for agricultural markets, it is important to understand deficiency in the existing system on the basis of empirical findings.

Deficiencies in the Existing System

3.46 With the growth of economy, as the number of agriculture produce and quantity of production increased, bottlenecks developed leading to obstruction in the movement of produce. The markets began to be more opportunistic trading platforms under the control of a few with restrictive characteristics depriving the farmers of due prices for their produce. These practices obstruct free flow of agricultural produce; and direct interface between farmers and the processors, exporters/bulk buyers/end users, leading to the rise of intermediaries who may or may not be adding any value along the value system. There arose multiple handling of agri-produce and multiple levels of mandi charges, which ended up escalating the prices for consumers without commensurate benefit to farmers, and diversion of revenue generated from the market fee to purposes other than the development of the market.

3.47 **Measures for Regulation of Agricultural Markets:** The Agricultural Produce Market Committee (APMC) Act requires that farm produce be sold only at regulated markets through registered

intermediaries. Although the APMC Acts have improved agricultural markets in several respects and considerably diluted mercantile power in them, over time the balance of power in transactions has moved back in favour of middlemen and the trading class. Traders who operate in the APMC Markets are severely screened through licensing. This creates barriers to entry for new participants in the supply chains, and thus, limiting option for producers in the markets, defeating the purpose of regulation. All these led to suppressing agriculture produce prices under the influence of strong associations, and formation of collisions among traders. These handicaps have not only had contrary effect but also close the possibility of development of private agriculture markets. Reforms in APMC Act are a foot to all these issues so that the original objectives of making APMC instrumental in removing shortcomings of the agriculture marketing and also encouraging competing private sector markets. There is a need to revamp the APMC to allow and encourage private sector players and cooperatives to create and improve much needed facilities in the agricultural marketing system. Along with this, the rural periodic markets are the main access point for the small and marginal farmers they should be upgraded with technology as well as linked with basic amenities like link road to increase the connectivity for the farmers.

3.48 The Essential Commodities Act (ECA) allows central and state governments to place restrictions on the storage and movement of commodities deemed essential by governments. Notwithstanding moves to deregulate, fragmented market players continue to dominate the industry. The transportation, marketing and distribution of

agri-food commodities did not develop in a scientific manner, linked or directly linked to demand from growing markets and the demand for what was earlier an essential commodity has also undergone changes.

3.49 A series of legal instruments for regulating the functioning of markets and trade activities, include measures for regulation of supply, demand and prices, maintenance of quality, standardisation of grades and packaging, protection of consumers, regulation of warehousing and storage practices and institutionalisation of marketing practices. These sometimes adversely affect the marketing efficiency as are looked by different Departments and there is a lack of coordination between the same.

Empirical Findings

3.50 Agricultural marketing in India is carried out mainly through four channels: a) marketing channels to consumers directly; b) private wholesalers and retailers; c) public agencies and cooperatives; d) processors, which overlaps the channels mentioned in (b) and (c).

3.51 Studies indicate that the length of these marketing channels is increasing due to increasing demand for value-added services. This creates the possibilities of localised monopolies and oligopolies due to infrastructural bottlenecks and larger geographical spread of the markets. Bringing the producers and the consumers closer to each other through a modern supply chain can ensure several advantages. By reducing the trader's margin, the farmer's market opportunity and profit can be improved. Empirical data suggests that higher prices and assured sales make it attractive for the farmers to enter emerging channels of marketing like contract farming, the Market Intervention Scheme, e-Trading

in the spot and the futures market, establishment of derivative exchanges and the ITC e-Choupal. But since farmers are located in underdeveloped rural India with poor transport and communication connectivity with urban and modern societies, information asymmetry becomes a major hurdle. Lack of transport and communication not only among the farmers and traders; but also among the large, small and marginal farmers, keep the farmers out of these channels. Direct marketing and trader-based channels with no organized marketing bodies provide small and marginal farmers relatively more benefits than the emerging channels in the country.

3.52 Moreover, after the reforms of 1990s, the agricultural sector has witnessed a decline in public investment, which has resulted in retrogression in availability of institutional credit to the small and marginal farmers, decreasing their total factor productivity. All this necessitate making availability of institutional credit essential for creation of such marketing activities as cleaning, grading and packaging facilities, construction of storage structures, establishment of cold stores, etc.

Recent Reforms in Agriculture Marketing

3.53 Agriculture Sector needs competitive and well-functioning markets which provide alternative choices to the farmers to sell their produce. Reforms in agricultural marketing were therefore, initiated to ease restrictive and monopolistic policies of State Governments, reduce the intermediaries in supply chain and enhance the private sector investment in post harvest marketing infrastructure development so as to reduce the wastages and thereby strengthen the supply side and also to benefit farmers through access to global markets.

3.54 The DAC&FW has prepared “The Agricultural Produce and Livestock Marketing (Promotion and Facilitation) Act, 2017” as a Model APLM Act, which provides for progressive agricultural marketing reforms. Act was released in April, 2017 for adoption by the States. The salient features of the Model APLM Act, 2017 are as under.

- (i) Abolition of fragmentation of market within the State/UT by removing the concept of notified market area in so far as enforcement of regulation by Agricultural Produce and Livestock Market Committee (APLMC) is concerned (State/UT level single market).
- (ii) Full democratization of Market Committee and State/UT Marketing Board.
- (iii) Disintermediation of food supply chain by integration of farmers with processors, exporters, bulk retailers and consumers
- (iv) Clear demarcation of the powers and functions between Director of Agricultural Marketing and Managing Director of State/UT Agricultural Marketing Board with the objective that the former will have to largely carry out regulatory functions, while the latter will be mandated with developmental responsibilities under the Act.
- (v) Creation of a conducive environment for setting up and operating private wholesale market yards and farmer consumer market yards, so as to enhance competition among different markets and market players for the farmer's produce, to the advantage of the latter.
- (vi) Promotion of direct interface between farmers and processors/ exporters/ bulkbuyers/ end users so as to reduce the

price spread bringing advantage to both the producers & the consumers.

- (vii) Enabling declaration of warehouses/ silos/ cold storages and other structures/ space as market sub-yard to provide better market access/ linkages to the farmers.
- (viii) Giving freedom to the agriculturalists to sell their produce to the buyers and at the place & time of their choice, to whom so ever and wherever they get better prices.
- (ix) Promotion of e-trading to enhance transparency in trade operations and integration of markets across geographies.
- (x) Provisions for single point levy of market fee across the State and unified single trading licence to realise cost-effective transactions.
- (xi) Promotion of national market for agriculture produce through provisioning of inter- state trading licence, grading and standardization and quality certification.
- (xii) Rationalization of market fee & commission charges.
- (xiii) Provision for Special Commodity Market yard(s) and Market yard(s) of National Importance (MNI).
- (xiv) Providing a level playing field to the licensees of private market yard, private market sub-yard, electronic trading and direct marketing vis-à-vis the APLMCs and removing the conflict of interest that the latter are likely to practise, if both development and regulatory functions are centered in the same authority.

3.55 All the State governments have been requested to adopt the Model Act, 2017 and to make concerted efforts for successful implementation of the scheme in order to achieve the objectives for

optimizing benefits to the farmers.

3.56 Government has also launched the **National Agriculture Market (e-NAM)** on 14.04.2016 as a pan-India electronic trading portal with a view to network the existing APMC and other market yards to create a unified national market for agricultural commodities. e- NAM creates a national network of physical mandis which can be accessed online. The main objectives of the e-NAM Scheme are to: i) liberalize agri-marketing sector by creation of a unified National Agriculture Market; ii) increase access of farmers to markets beyond the closest APMC market by the provision of inter mandi trade as well as making available prices in all the mandis in the vicinity; iii) enhance competition among traders for better price discovery by farmers; iv) promote digital operations to bring in transparency; and v) real time data for improved reporting on arrivals and prices in integrated markets bringing in information symmetry for informed decision by farmer as well as traders.

3.57 Central Assistance is being provided under e-NAM for the following components:

- (i) e-NAM software provided to States/ Uts.
- (ii) One time grant up to Rs 30.00 Lakh per market based on their DPR for purchase of hardware, internet connection, assaying equipments and related infrastructure to make the market ready for integration with e-NAM platform. The costs over and above this are to be borne by the respective States/UTs.
- (iii) The central assistance was enhanced to Rs 75 lakhs per mandi in Union Budget 2017. This is under the process of financial approvals which should be completed shortly. The additional assistance would be for setting up

packing, grading and sorting units and composting unit.

- (iv) A mandi analyst (IT expert) for one year through the Strategic Partner to provide hand holding to stakeholders during the initial stages.
- (v) A State Coordinator is also deputed by Strategic Partner for each of the integrated States to oversee all integrated mandis across the State and liaison with HQ.

3.58 With a view to integrate farmers with bulk purchasers including exporters, agro- industries etc. for better price realization through mitigation of market and price risks to the farmers and ensuring smooth agro raw material supply to the agro industries, Union Finance Minister in the budget for 2017-18 announced preparation of a “Model Contract Farming Act” and circulation of the same to the States for its adoption.

Progress under e-NAM

3.59 As of October, 2017, 455 mandis of 13 States have been integrated with e-NAM and Rs. 134.065 crore have been released under the scheme (States-124.465 crore, Small Farmers Agribusiness Consortium (SFAC) - 5.00 crore and Strategic Partner-4.60 crore). To facilitate assaying of commodities for trading on e-NAM, common tradable parameters have been developed for 90 commodities, including bamboo. State-wise list of mandis integrated with e-NAM is as under (**Table 3.7**). Thirteen states have so far either de-notified fruits and vegetables or exempted/reduced market fee on fruits and vegetables. In respect of other reforms, 18 States have carried out reforms in respect of direct marketing, contract farming and setting up of private markets in their APMC Acts. In order to pursue the reforms with the

States particularly in three areas mandatory for NAM, DMI (Directorate of Marketing and Inspection) has been asked to initiate the process of preparing Model template so as to guide the States in uniform manner.

The Way Forward

3.60 For States which have already integrated with e-NAM the following changes are recommended for effective implementation of the Scheme.

- a) Infrastructure framework for implementation of e-NAM scheme needs to be strengthened. This includes internet connectivity, adequate number of computers, integrated digital weigh bridges/weighing scales, etc.
- b) Quality assaying laboratories need to be strengthened since this is the corner stone for inter mandi trade to be done in the true spirit. Assaying (evidence) based trading will justify differential prices for different lots making the farmer aware of the importance of grading and improved quality of produce brought to the mandis to get remunerative prices as well as prevent them from being hoodwinked into the advice from commission agents/traders.
- c) There should be 100% online bidding of commodities arriving in the mandis.
- d) States to provide sufficient number of trained manpower at all places of transactions such as arrival gate, yard, assaying lab, auction hall & exit gate to run the e-NAM operations smoothly.
- e) For online payment gateway it is compulsory to have the correct database (ID, Account number). This assumes greater importance in view of the need to promote digital transactions for which a target of 104 cr. transactions have been given to mandis across

Table 3.7: Progress under e-NAM

S.No.	State	No. of Mandis
1	Andhra Pradesh	22
2	Chhattisgarh	14
3	Gujarat	40
4	Haryana	54
5	Himachal Pradesh	19
6	Jharkhand	19
7	Madhya Pradesh	58
8	Rajasthan	25
9	Telangana	44
10	Maharashtra	45
11	Uttar Pradesh	100
12	Uttarakhand	5
13	Odisha	10
Total		455

Notes: i) 15 mandis of Tamil Nadu are currently under integration.
ii) Proposal for 35 mandis has been received from Punjab and is being examined, and iii) Preliminary proposal for 6 mandis has been received from Kerala. DPR is awaited

Source : Department of Agriculture, Cooperation & Farmers Welfare

the country.

- f) Inter-mandi and inter-State trading has not started except in Telangana and Chhattisgarh and on pilot basis in UP and Haryana. This has to be stepped up gradually in order to realize the objectives of e-NAM Scheme.
- g) Storage structures should be made available within the mandi yard so that the farmer can safely keep unsold produce till an opportune time and hence reduce distress sale.
- h) States should come forward and adopt new Model APLM Act, 2017 for effective implementation of marketing reforms.

INTERNATIONAL COOPERATION IN AGRICULTURE SECTOR

3.61 International cooperation in agriculture

sector aims at fostering mutually beneficial partnerships with other countries in multilateral as well as bilateral format. The DAC&FW is the nodal contact point in the Government of India for the Food and Agriculture Organization (FAO) and the World Food Programme (WFP). Bilaterally, with countries of strategic interest, Memorandum of Understanding (MoUs), agreements, protocols and work plans are signed and implemented for furthering cooperation in the agriculture and allied sector.

3.62 The benefits that accrue to the sector from such agreements and MoUs are in the nature of capacity building, knowledge exchange through visits of scientists and technicians, exchange of genetic resources, etc., that aid in the development of appropriate technologies and farm practices for

enhancing agricultural productivity at farmers' fields. Such cooperation also facilitates the creation of opportunities for trade in agricultural commodities and serves our strategic interests.

Multilateral Cooperation

3.63 Food & Agriculture Organization (FAO):

India is a founder member of the FAO and has been taking part in all its activities. India makes payment of the annual membership contribution to FAO, and has paid the contribution to FAO for the year 2017. India has been availing services from the FAO from time to time in the form of training, consultancy services, equipments and material in the field of agriculture and allied sectors under its Technical Cooperation Programme (TCP) . The major projects which are currently under implementation with FAO assistance are as under:

- (i) **Development of Extension and Outreach organizational and managerial capacities by state and public institutions in Mizoram:** This project was signed on 22nd June, 2015 for a period of two years with the FAO assistance of US \$ 496,000. Project will contribute to the State of Mizoram's development plans by supporting Departments to improve their outreach and extension support using current key production constraints, especially in the areas of managing pig disease - Porcine Reproductive & Respiratory Syndrome (PRRS), sustainable cropping on sloping areas and community forest policy, to develop new and innovative solutions to service delivery.
- (ii) **Global Environment Facility (GEF) Formulation in India:** This project was

signed on 26th June, 2015 for a period of 18 months with the FAO assistance of US \$ 110,787. Under this project, a GEF proposal covering four focal areas: i) Climate Change Mitigation/Programme; ii) Biodiversity/ Programme; iii) Land degradation/Entire Focal Area; and iv) Special Climate Change fund for Adaptation is being prepared by FAO India.

- (iii) **Strengthening National Forest Inventory and Monitoring Protocols and Capacities in India :** This project was signed on 1st May, 2016 for a period of 18 months with the FAO assistance of US \$ 397,000. Under this project, Government, Industry and relevant stakeholders actively promote environmentally sustainable development; and resilience of communities is enhanced in the face of challenges posed by climate change, disaster risk and natural resource depletion.
- (iv) **Technical Cooperation Program Facility (TCPF): Strengthening institutional capacities for sustainable mountain development in the Indian Himalayan Region :** This project was signed on 11th July, 2016 for a duration of 2 years with the FAO assistance of US \$ 99,955. Project will contribute to enhanced institutional capacities for sustainable mountain development in the Indian Himalayan Region (IHR), with a focus on agriculture and allied sectors through targeted support for institutional development and policy advocacy. The initiative will further contribute to informed and evidence-based decision and policy making on mountain

agriculture and allied sectors (including animal husbandry, fisheries, forestry, biodiversity, land degradation and climate change).

- (v) **Technical Cooperation Program Facility (TCPF): Promoting Nutrition Education and Communication in India:** This project was signed on 1st August, 2016 for a period of 17 months with the FAO assistance of US \$ 99,821. The project aims to demonstrate the application of a communication intervention to improve behaviours at the intersection of agriculture and nutrition in India.
- (vi) **Technical Cooperation Program Facility (TCPF): Supporting Project Preparation of FAO India GEF 6 Full Scale Project:** This project was signed on 1st August, 2016 for a period of 17 months with the FAO assistance of US \$ 49,951. Project will support a range of project preparation activities to design the Full Size Global Environment Facility (GEF) 6 Project (USD 36.9 million) Green-Agriculture: Transforming Indian agriculture for global environmental benefits and the conservation of critical biodiversity and forest landscapes, which aims to catalyze transformative change for India's agricultural sector to support achievement of national and global environmental benefits and conserve critical biodiversity and forest landscapes. The project will be implemented at the National level and in five states, viz., Rajasthan, Madhya Pradesh, Odisha, Uttarakhand, and Mizoram.
- (vii) **Strengthening Agricultural Market**

Information Systems in India using innovative methods and digital technology

(Baby Project): This project was signed on 14th September, 2015 for a period of 21 months with the FAO assistance of US \$ 884,374. The project supports national efforts to produce quality statistics and data on crop production forecasts, market food prices and stocks for the four AMIS commodities (maize, rice, soybeans and wheat), by incorporating international best practices and experiences.

- (viii) **Programme Support to Nationally Executed (NEX) Land and Water Programme in India:** This project was signed on 1st January, 2004 with the FAO assistance of US \$ 4,652,611. The objectives of the project is to ensure high quality results and impact of the Andhra Pradesh Land and Water Management Programme, in accordance with FAO's role and responsibilities vis-à-vis the three NEX projects; to facilitate synergy between these projects and other normative activities of the Organization and to promote further programme development in this area in India. The project was expired on 31st December, 2016.
- (ix) **Green-Agriculture: Transforming Indian agriculture for global environmental benefits:** This project was signed on 16th August, 2016 for a period of 16 months with the FAO assistance of US \$ 300,000. The objective of the project is to support the preparation of the full project document which will consist of relevant baseline data and information collected during the preparation period, workshop reports, consultant's analysis

and cost/efficient proposals, financing plan, risk analysis and mitigation measures and realistic targets and indicators.

(x) **Technical Assistance to Farmer Water School Programme and Agricultural Activities under the Uttar Pradesh Water Sector Restructuring Project (UPWSRP)**

Phase II: This project was signed on 9th March, 2016 with the FAO assistance of US \$ 1,847,539. The objective of the project is to strengthen the institutional and policy framework for integrated water resources management for the entire State and to increase agricultural productivity and water productivity by supporting farmers in targeted irrigation areas. The project is going to be expired on 30th October, 2020.

(xi) **Incorporating International Best Practices in the Preparation of Agricultural Outlook and Situation Analysis Reports for India -**

Phase II: This project was signed on 3rd March, 2014 for a period of 26 months with the FAO assistance of US \$ 461,139. The project is designed for supplementary funding to MoA&FW project for carrying out critical tasks that will lead to better availability of information for policy makers.

3.64 **World Food Programme (WFP):** The World Food Programme (WFP) was set up in 1963 jointly by the United Nations General Assembly and Food & Agriculture Organization (UN/FAO). India is the member of WFP since its inception. It seeks to provide emergency feeding in places facing acute food insecurity due to natural calamities and man-made causes. Present share of Government of India (GOI) for a biennium is US \$ 1.92 million towards

WFP Pledge Contribution which is used by them to support WFP India Country Programme. India has made full payment to UNWFP for biennium 2015-2016. Besides, GoI makes an annual payment of Rs. 30 lakh to UNWFP 'Country Office towards their Local Operating Cost (LOC).

3.65 Contribution for the year 2016 has been released as requested by WFP. Government of India (GoI) has recently decided that the amount of US \$ 1.92 million (Biennium) towards GoI's pledge contribution to UNWFP will remain the same for the year 2017 as well.

3.66 A Country Strategic Programme (CSP) 2015-2018 has been signed between WFP and GoI and meeting of the Country Programme Advisory Committee (CPAC) of WFP India was held on 18th April, 2016 to discuss CSP 2015-18 and Annual Work Plan thereof. Recently a 'Letter of Intent' has also been signed for establishment of Center of Excellence under strategic outcome of CSP 2015-2018.

3.67 **World Food Day (WFD):** World Food Day (WFD) was celebrated throughout the Country on 16th October, 2016 to commemorate the founding day of the FAO and to create public awareness about the plight of the hungry and malnourished people and to take concrete action to tackle and overcome the menace of hunger. This year's theme of WFD was **“Climate is changing. Food and Agriculture must too”**.

Bilateral Cooperation

MoUs or Agreements or Work Plans

3.68 Although India has made significant agricultural and technological advancements to gain self-sufficiency in foodgrain production and to

become one of the biggest international agricultural producers and exporters; there are challenges of growing population, rapid urbanization, climate change, etc., necessitating adoption of innovative measures for sustaining food security. While India has a lot to share from its experience and expertise in the field of agriculture and allied activities, there is much to learn from other countries as well.

3.69 During 2016, DAC&FW has signed 5 MoU/MoC/Agreements with corresponding Ministry of Armenia on 19.02.2016, Madagascar on 29.02.2016, Lithuania on 19.07.2016, Japan on 11.11.2016 and Kyrgyzstan on 20.12.2016. In addition to these, an Memorandum of Understanding (MoU) between India-Taipei Association in Taipei and Taipei Economic and Cultural Centre in India was signed on 12.09.2016 and an MoU between Government of India and the Global Crop Diversity Trust (GCDT), Bonn, Germany was signed on 07.11.2016. With a view to develop better understanding on issues of mutual interest, a one day workshop was organized on 26th April 2016 at New Delhi, with participation of experts and officials from USDA, in which issues relating to four areas: crop insurance; global agriculture situations and trends; US farm bill and issues under WTO, were discussed.

Strategic Groups

3.70 India is a member of multilateral groupings such as **G-20** – a forum for global cooperation on international economic and financial issues; **IBSA** (India, Brazil and South Africa); **BRICS** (Brazil, Russia, India, China and South Africa); **SAARC** (South Asian Association for Regional Cooperation); **BIMSTEC** (Bay of Bengal Initiative for Multi-sectoral Economic & Technical Co-operation) etc.

International Events

3.71 **BRICS:** The Department successfully organized the 6th meeting of Agriculture Ministers of the BRICS countries on 23rd September, 2016 in New Delhi. A joint declaration on the way ahead for our future initiatives and continued cooperation was adopted unanimously. The declaration envisages BRICS as an important platform for developing, testing and sharing models of sustainable agriculture technology in the face of climate change; the importance of deploying ICT in agriculture for giving farmers access to inputs, technology and financial services; promotion of agriculture sustainability as a key component of the 2030 agenda for sustainable development; the need to prioritize and strengthen support for small farmers; improved water management given the dependence of agriculture on water and giving protection and preservation of cultivable land. The declaration also aims to promote production of pulses in the BRICS countries given the crops' beneficial influence on soil fertility and in ameliorating malnutrition.

3.72 **India-Africa Agribusiness Forum:** Ministry of Agriculture & Farmers Welfare, in collaboration with FICCI, successfully organized the India-Africa Agribusiness Forum at New Delhi on 10-11th February, 2016 in which several Ministers, Government officials and company representatives participated.

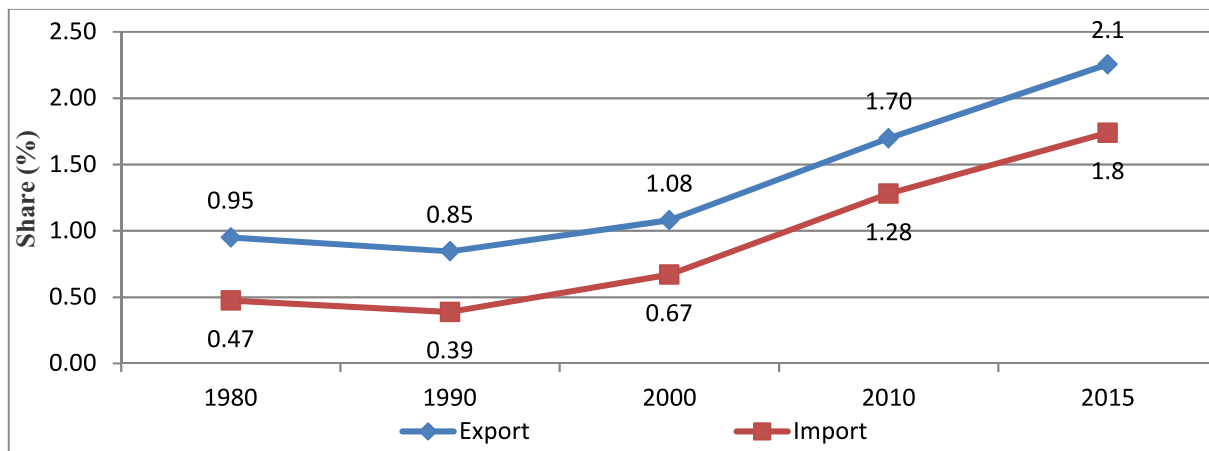
INDIA'S AGRICULTURE TRADE

3.73 India ranks among the leading producers of agricultural products in the world. From a net importer of foodgrains in 1950's, India has emerged as a significant exporter of agricultural commodities. As per the WTO's Trade Statistics, India's share in

agricultural exports and imports in the world in 2016 was 2.1 percent and 1.8 percent, respectively (Figure 3.7). India has developed export competitiveness in certain specialized agricultural products like basmati rice, guar gum and castor.

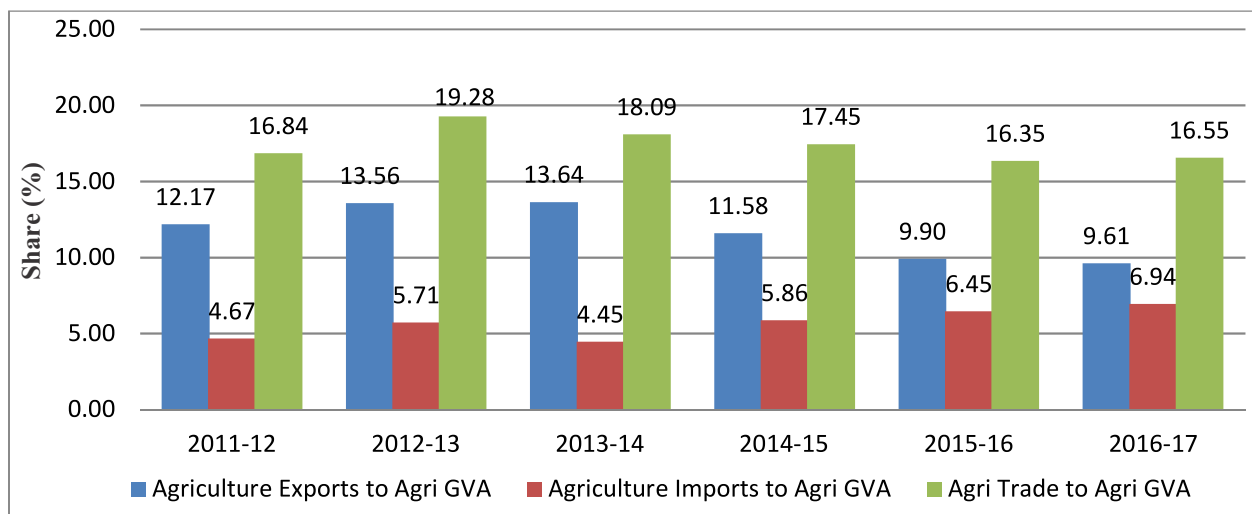
Agricultural trade as a percentage of agriculture Gross Value Added (GVA) has been more than 15 percent and witnessed an increase during the year 2016-17 (Figure 3.8).

Figure 3.7: India's Share in Global Agri Exports and Imports



Source: International Trade Statistics, WTO

Figure 3.8: Agriculture Trade as Percentage of Agriculture & Allied GVA



Source: D/o Commerce for Export and Import and CSO for Agriculture GVA.

Agricultural Exports and Imports

3.74 The value of agricultural exports has increased from Rs. 215,396 crore in 2015-16 to Rs. 2,27,880 crore in 2016-17, registering a growth of about 6 percent. Increase in agricultural exports during 2016-17 was mainly due to the exports of marine products, spices, groundnut, oil meals and

fruits and vegetables. However, the share of agricultural exports in total exports of the country has marginally come down from 12.55 percent in 2015-16 to 12.30 percent in 2016-17.

3.75 India's top 10 agricultural export commodities in terms of quantity and value for the last few years are given in **Table 3.8**.

Table 3.8: India's top 10 Agricultural Export Commodities

(Quantity: '000 tonnes Value in Rs. Crore)

S. No.	Commodity	2013-14		2014-15		2015-16		2016-17 (P)	
		Qty	Value	Qty	Value	Qty	Value	Qty	Value
1	Marine Products	100	306	123	336	978	312	119	397
2	Buffalo Meat	136	264	150	292	131	266	133	263
3	Rice Basmati	375	292	369	275	404	227	400	216
4	Spices	897	151	939	148	832	166	101	194
5	Rice (other than Basmati)	714	177	830	204	646	154	682	171
6	Cotton Raw incld. Waste	194	223	114	116	134	128	100	109
7	Sugar	247	717	195	532	384	982	254	867
8	Fresh vegetables	229	538	208	466	210	523	339	577
9	Coffee	254	479	464	497	256	512	290	566
10	Groundnut	510	318	788	467	543	407	727	545

Source: DGCIS, Kolkata (D/o Commerce)

3.76 The value of agricultural imports witnessed an upward trend during the last few years. Total agricultural imports have increased from Rs. 1,40,289 crore in 2015-16 to Rs. 1,64,711 crore in 2016-17, registering a growth of nearly 17 percent. Increase in value of agricultural imports during this period was primarily on account of imports of wheat, vegetable oils, cotton, pulses and sugar. Share of

agricultural imports in the total imports has also increased from 5.63 percent in 2015-16 to 6.39 percent in 2016-17.

3.77 India's top 10 agriculture commodities imported during the last few years are reported in **Table 3.9**.

Table 3.9: India's top 10 Agricultural Import Commodities

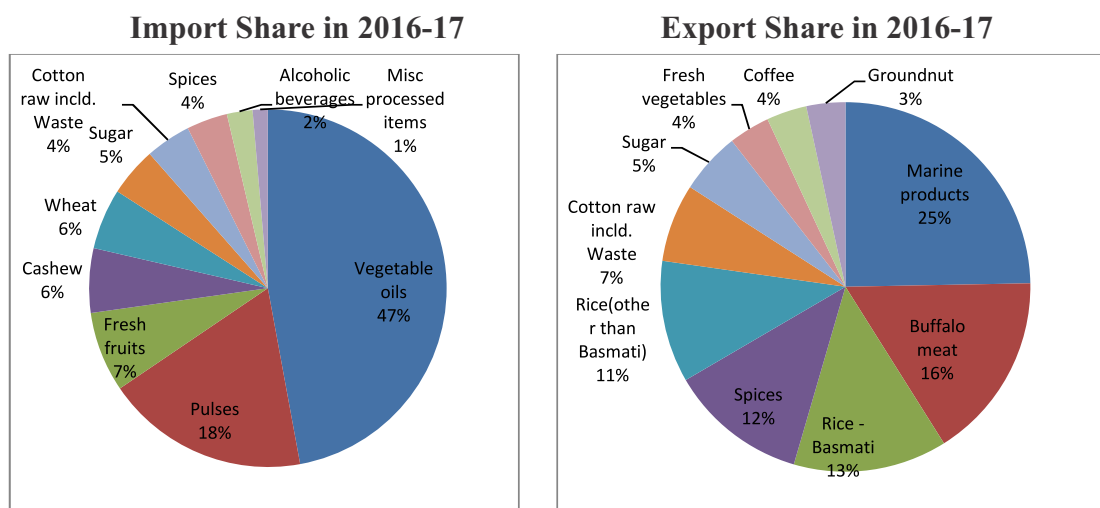
(Qty: '000 tonnes Value in Rs. crore)

S. No.	Commodity	2013-14		2014-15		2015-16		2016-17 (P)	
		Qty	Value	Qty	Value	Qty	Value	Qty	Value
1	Vegetable Oils	7943	44038	12732	64890	15642	68677	14010	73048
2	Pulses	3178	11037	4585	17063	5798	25619	6609	28524
3	Fresh fruits	769	7716	901	9567	840	11072	1041	11251
4	Cashew	776	4668	933	6600	962	8701	774	9027
5	Wheat	11	27	29	61	518	873	5749	8509
6	Sugar	881	2287	1539	3668	1943	4038	2146	6869
7	Cotton Raw incld. Waste	181	2376	289	3102	232	2566	499	6338
8	Spices	156	3452	163	4393	193	5400	242	5760
9	Alcoholic	-	2076	-	2509	-	2936	-	3591
10	Misc processed	-	1474	-	1785	-	1811	0	2124

Source: DGCIS, Kolkata (D/o Commerce)

3.78 Share of top 10 exported and imported agri- commodities during 2016-17 is as follows (Figure 3.9):

Fig.: 3.9: Share of top Exported and Imported Commodities in 2016-17



Source: DGCIS, Kolkata (D/o Commerce)

Foreign Trade Policy

Cereals

3.79 The export of cereals is currently free and imports are allowed through FCI subject to some conditions. Import duty on wheat has been increased from 10 percent to 20 percent and on peas from 0 percent to 50 percent respectively vide Custom Notification dated 8.11.2017. Rice from India is traded in two varieties- Basmati and non Basmati. Wheat is traded as Duram and other Wheat.

Sugar & Cotton

3.80 In case of sugar and cotton, the exports are free without any quantitative restrictions. Import duty of 40% is levied on sugar while duty free import is allowed for cotton. Export duty of 20 percent has been imposed on sugar w.e.f. 16th June 2016 to check the price and enhance availability in domestic market. Import duty on sugar was increased from 40 percent to 50 percent vide Customs Notification dated 10th July, 2017.

Oilseeds & Oil

3.81 Import duty on crude palm oil has been raised from 15 percent to 30 percent, on refined palm oil from 25 percent to 40 percent, on crude sunflower oil from 12.5 percent to 25 percent, on refined sunflower oil from 20 percent to 35 percent, on crude soya bean oil from 17.5% to 30%, on refined soya bean oil from 20 percent to 35 percent, crude rapeseed oil including canola oil (Low erucic and rapeseed oil), mustard oil and colza oil from 12.5 percent to 25 percent and on refined rapeseed oil including canola oil (Low erucic acid and rapeseed oil), mustard oil and colza oil from 20 percent to 35 percent vide Custom Notification dated 17.11.2017. Import duty on soya bean seed has also been raised from 30 percent to 45 percent vide Customs Notification dated 17.11.2017.

Pulses

3.82 Pulses export is prohibited except for chick pea (Kabuli chana) and organic pulses including lentils upto 10,000 MT per annum. Import of all pulses is duty free. Quantitative ceiling of 2 lakh tons/year on arhar and 3 lakh tons/ year on moong & urad have been imposed on 5th August, 2017 and 21st August, 2017 respectively.

Trade Policy as an instrument of Price Stabilization

3.83 Trade policy has been amended from time to time for various agricultural commodities in response to domestic availability and price situation. In view of domestic shortage and price volatility, import duty on wheat was brought down to zero in September 2006 and export was banned in October 2007. Similarly, to manage shortage in domestic markets, import duty on rice was brought down to zero in March 2007 and export was banned in April 2008. In September 2011, export restrictions on wheat and rice were removed in view of the stable prices and improved stocks. Also, import duty on rice has been restored to the statutory level in 2011 in view of sufficient domestic availability.

3.84 In June 2006, import duty on pulses was brought down to zero and export of pulses was banned to augment domestic availability. Later in 2007, export of chick pea (Kabuli Chana) was permitted considering that India is the largest producer of this commodity. In 2011, export up to 10,000 MT of organic pulses including lentils per annum was also permitted.

3.85 Exports of edible oils were banned in March 2008 and import duty was brought down to zero on crude and 7.5 percent on refined edible oils in April 2008 as a price stabilization measure. Later, certain

relaxations were made for export of edible oils in consumer packs. In year 2013, when prices of coconut fell below MSP, restriction on export of coconut oil was removed to facilitate exports. Further, export of edible oils has been allowed in consumer packs of 5 kg subject to a Minimum Export Price of US\$ 900 per MT. The MEP is reviewed from time to time by an Inter-Ministerial Committee.

3.86 Cotton exports used to be subject to quantitative restrictions till September 2011. With sufficient availability to meet domestic demand and stable prices, export of cotton have been made free since October 2011, except for a brief period from 5th to 12th March 2012 when export of cotton was restricted. The requirement of prior registration with Directorate General of Foreign Trade (DGFT) for export of cotton has been dispensed with on 8 December, 2014.

3.87 Policy on export of onion has seen frequent changes in past. Exports have been regulated through MEP or outright ban. Recently, in April 2015, the MEP on onion was introduced again in view of high domestic prices, but was removed on 24 December 2015. The requirement of canalization of onion exports through state trading enterprises was also done way with in March 2014.

3.88 Policy of export of potato has also seen some changes in respect of domestic production where export has been regulated through MEP.

Trade Policy as an instrument of growth

3.89 Export of agricultural commodities has helped producers to take advantage of wider international market which in turn has incentivized their domestic production. Crops exported in significant quantities such as cotton, soybean and maize have seen

significant increase in area coverage and growth rate of production. Compound annual growth rate of cotton, maize and soybean during 2005-06 to 2016-2017 has been 4.5 percent, 5.3 percent and 4.3 percent respectively compared to overall growth of foodgrains of 2.5 percent during the same period.

3.90 Niche products such as Basmati rice and organic pulses (10000 MT/annum) have been allowed to be exported even in the event of ban on export of mass consumption produce such as non-Basmati rice and pulses. A decision has been taken by Government to allow export of certain processed products such as cereal flour and milk products (except SMP) even in the event of ban on export of their primary products in the face of domestic shortages. Export of edible oils in consumer packs of 5 kg subject to MEP of US\$ 900 per MT is also permitted.

Regional Free Trade Agreements (RFTA)

3.91 India has been negotiating Free Trade Agreements (FTAs) including liberalized trade in agricultural goods to increase its trade. The main developments during the period under review have been:

- (i) Negotiations on Preferential Trade Agreements (PTAs) and FTAs continued to mark progress with European Union, EFTA (Switzerland, Norway, Iceland and Liechtenstein). MERCOSUR (Brazil, Argentina, Paraguay, Uruguay), Chile, Israel, Indonesia, Australia, New Zealand and Thailand.
- (ii) Trade in Goods Agreement between India and ASEAN (Brunei, Indonesia, Malaysia, Philippines, Singapore, Thailand, Cambodia, Lao PDR, Myanmar and Vietnam) was signed on 13th August 2009. This FTA became

effective from 1st January 2010. India-South Korea Partnership Agreement (CEPA) was concluded on 7th August 2009 and came into force w.e.f. 1st January, 2010.

- (iii) Trade in goods agreements under India-Malaysia CECA and India- Japan CEPA were concluded during **2010-11** and have become effective from 1st July 2011 and 1st August 2011 respectively.
- (iv) More tariff concession has been provided to SAFTA LDCs (Bangladesh, Nepal, Bhutan, Afghanistan and Maldives) and Non-LDCs (Sri Lanka and Pakistan). Tariff on all agricultural products has been reduced to zero for SAFTA LDCs. Bangladesh is major beneficiary of this liberalization.

3.92 Impact of FTA- After implementation of the India-ASEAN FTA, India's export to ASEAN of garlic, onions, turmeric, wheat & meslin, cane sugar, groundnuts, oilcake/ oilcake meal of soyabean, oilcake/ oilcake meal of rape/colza seed, millets (sorghum, bajra), etc., have registered an increase. On the other hand, high growth of import from Indonesia are noticed in black pepper, refined palm oil, maize etc. and from Malaysia in crude palm oil, cotton, from Thailand in dog & cat food, other fresh fruit, from Vietnam in cashew kernel (whole), black pepper, anise seeds, starches, from Myanmar in chickpeas, red beans and kidney beans. However, no significant import under FTA has been noticed from Philippines and Cambodia.

World Trade Organization (WTO) Negotiations

3.93 WTO Ministerial Conference- The 10th WTO Ministerial Conference was held in Nairobi from 15th to 19th December, 2015. The 'Nairobi Package' contains a series of six ministerial decisions made

under the Doha Agenda, including the decisions pertaining to agriculture and cotton as given below.

- (I) The developing members' countries will have the right to an agriculture Special Safeguard Mechanism (SSM), as envisaged under the Hong Kong Ministerial Declaration, to apply tariffs beyond the bound tariff rates on agricultural products on the grounds of food security, farmers' livelihoods and rural development in cases of import sugars or price declines. It was decided that the issue of SSM would be further discussed in the WTO Committee on Agriculture in special session.
- (ii) In view of the reluctance of developed countries to agree to continue the Doha Development Agenda post-Nairobi, India negotiated and secured a re-affirmative Ministerial Decision on Public Stockholding for Food Security purposes honoring the Bali Ministerial and General Council Decisions. The decision commits members to engage constructively in finding a permanent solution to this issue. These negotiations will be held in the Committee on Agriculture in special session, in dedicated sessions and in an accelerated time-frame, distinct from the agriculture negotiations under the Doha Development Agenda (DDA).
- (iii) All member countries have to eliminate export subsidies within a given timeframe. Developed country members have to immediately eliminate their remaining scheduled export subsidy entitlements as of the date of adoption of this decision. Developing countries have to eliminate such subsidies by the end of 2018, but will

continue to benefit under the reduction commitments of the other subsidies as described in the Agreement on Agriculture for an extended period. Under this Decision, developing members will keep the flexibility to cover marketing and transport costs for agriculture exports until the end of 2023.

- (iv) Developed country members, and developing country members declaring themselves in a position to do so, shall under their respective preferential trade agreements grant duty-free and quota-free market access for cotton produced and exported by least developed countries (LDCs) from 1st January 2016

3.94 WTO decision on public stockholding for food security: General Council of WTO had passed a decision on 27th November, 2014 that the WTO Members would not challenge the public stockholding programmes of developing country members for food security purposes until a permanent solution regarding this issue was agreed to and adopted.

3.95 This strengthens the safeguard available for continuing the Minimum Support Price policy and will ensure that India's food security operations are not constrained due to WTO rules.

FOREIGN DIRECT INVESTMENT (FDI) POLICY IN AGRICULTURE

3.96 FDI policy aims at attracting investments in technology, machinery, equipments, seeds/planting material, warehousing and cold storages and other infrastructure logistics. It complements public and private investments necessary to bring knowledge, technologies and services to farmers. 100% FDI has been allowed in development and production of seeds and planting material, floriculture, horticulture and cultivation of vegetables and mushrooms under

controlled conditions. Also, 100% FDI is allowed in animal husbandry (including breeding of dogs), pisciculture, aquaculture and services related to agro and allied sectors. Similarly, 100% FDI is allowed in the tea sector. From April 2000 to September 2017, FDI inflows of Rs. 12,743 crore have been received in agriculture sector (i.e. agriculture services including agriculture machinery). The investments were made in development and production of seed and planting material, horticulture and nursery services, agriculture machinery, plant protection services, cattle breeding and livestock rearing, cold storage and warehousing.

3.97 Besides, policy for FDI in Multi-Brand Retail Trading (MBRT) provides that at least 50% of the first tranche of US \$ 100 million shall be invested in back-end infrastructure which includes construction of warehousing and cold storages.

CHALLENGES

3.98 Stable Price Environment for Domestic Growers: Trade policy should also aim at providing a stable price environment to reduce the vulnerability of domestic producers and consumers. This is with particular reference to massive imports of edible oils and pulses to meet the gap between domestic demand and production.

- (a) **Edible oils:** India's self-sufficiency in terms of domestic production has come down from 94 percent in 1994-95 to about 43 percent in 2016-17. With increasing share of imports, domestic prices of various oils are impacted due to volatility in international prices, particularly that of palm oil. This has increased the vulnerability of domestic producers and consumers. One instrument of promoting domestic production is calibration of the import duty structure wherein the rate

of import duty varies in counter-cyclical manner with international prices. This measure would help in stabilizing prices of edible oils at reasonable levels and thereby incentivize better technology adoption by oil seed growers, and thereby reduce our dependence on massive edible oil imports. This would contribute towards enhancing food security in edible oil sector.

- (b) **Pulses:** Import of pulses has been increasing over the years and now constitutes around 20 percent of domestic demand. There were incidents in the last few years, when imported prices of urad, tur and gram were below MSP, bringing down domestic prices of these commodities below remunerative price. It is therefore, important, to ensure import price does not go below to the MSP of pulses.

3.99 Quality Issues and Sanitary & Phytosanitary (SPS) Measures: Applying hygiene and safety standards for both domestic consumption and exports is becoming increasingly important. With the Food Safety and Standards Authority of India (FSSAI) coming into being and food sanitary measures applied for international quality and competitive pricing will determine the course of trade.

THE WAY FORWARD

3.100 Consistent Trade Policy for Agricultural Growth: A stable trade policy for over the years has benefited the agriculture sector which is reflected in fast growing exports and positive trade balance. The trade policy would continue to focus on adequately incentivizing farmers to invest more in productivity increasing techniques, which will not only help the agriculture sector to realise its true potential but also

assist in meeting the domestic demand. Policy would need to be formulated in such a manner so that we may be able to reduce our huge import bills of vegetable edible oils and pulses.

3.101 In India, import policy for agriculture is often considered as a price support and price stabilization tool. Increase in tariffs is recommended for agricultural products in response to decline in prices on an ad hoc basis. In this context, it is felt that import duties may be imposed on agriculture imports in such a manner that landed cost of the imported products does not go below the prevailing Minimum Support Prices (MSP) of that product. To ensure parity between landed cost of imported commodity and domestic price policy, a cess over and above the applied duty may be levied for all agriculture imports, after carefully examining international benchmark prices and the prevailing MSP for respective items. This would help in maintaining a stable price regime of agri-products without compromising the interest of our farmers.

3.102 Product Development: Apart from Basmati rice, there are a number of agricultural products which have the potential to command better price in international market. For instance, among rice varieties Sona Masoori, Mohan Bhog, Ponni Sambha and Matta; among wheat varieties, MP (Duram) wheat; among onions, Krishnapuram, Bangalore Rose and Nasik varieties; among mangoes, Alfonso and Begun Palli (this is only an illustrative list). A large number of agricultural products have already been registered as GI products but no further attempt has been made to promote and market them. To begin with, these products can have distinct HS Code (at eight digit) and separate schemes for their promotion/marketing can be formulated.

Natural Resource Management

4.1 Natural resource management is the key to India's agricultural development, growth and sustainability challenges, and lies in the fore-front of national and international concerns for evolving better policy initiatives and developmental approaches to ensure judicious use of land, water and forests to produce enough to meet the present demand for food while saving enough for future generations. The nation's strength, be it social, economic or political, depends mostly on the available resources and their proper utilization. India has rich endowment of resources and an integrated effort is being made by the Government to make the best use of the available resource potential to meet the demands of growing population and also provide opportunities for employment and livelihood. Land and water are our basic resources and most of our resources for sustenance, viz., fuel, fodder, clothing and shelter come from the land. Land has many physical forms like mountains, hills, plains, lowlands and valleys and supports many kinds of vegetation. India has significantly large tract of cultivable/arable land which plays a crucial role in the country's socio-economic development. India ranks seventh in terms of geographical area and second in terms of population in the world, resulting into the arable land-man ratio not as favorable as in countries like Australia, Canada, Argentina, USA, Chile, Denmark and Mexico. Conversely, the land-man ratio is more favorable in India than Japan, Netherlands, Egypt, United Kingdom, Israel and China.

4.2 India's geographical features are diverse and complex. There are mountains, hills, plateaus and

plains which produce varied human developmental response to the use of land resources. This leaves mere 181.89 million ha as cultivable land while the rest goes to areas under tree crops and groves, culturable wasteland, forests and fallow lands. Moreover, soils, topography, moisture and temperature determine the limits of cultivability and the quality of arable land is determined by these factors. Besides, out of the total geographical area,

Box 4.1: Land Use in India

- Reporting area for land utilization: 307.8 mha
- Forest area: 71.8 mha (23.32%)
- Non-agricultural uses: 26.9 mha (8.73%)
- Barren & uncultivable: 17.0 mha (5.52%)
- Permanent pastures: 10.3 mha (3.33%)
- Miscellaneous tree crops: 3.1 mha (1.01%)
- Culturable waste: 12.5 mha (4.05%),
- Fallow land: 26.2 mha (8.51%),
- Net area Sown: 140.1 mha (45.52%)
- Agricultural land: 181.9 mha (59.09%)

Source: Directorate of Economics & Statistics

about 120 million ha suffer from various kind of land degradation, largely caused by soil erosion, salinity, alkalinity, acidity, water logging, etc. The most serious threat to the soil is posed by deforestation. Heavy rainfall during monsoon damages the soils. Steep slopes cause rapid runoff leading to soil erosion especially on the southern slopes of the Himalayas and western slopes of the Western Ghats. Diversion of agricultural land for non agricultural uses is another problem by which the amount of land available for agriculture is steadily declining. In other words, there is a tough competition between agriculture, urban and

industrial development. Besides all those factors, the net sown area, now nearly 140 million ha, has been stagnant for last three to four decades, and likely to be so due to competing demands for land.

4.3 It has been well documented that water is an essential input influencing the scale and pattern of agricultural growth. Water resources are also under pressure due to ever-increasing demand for irrigation, drinking water and industrial and other uses. Irrigation potential in the country is required to be tapped to about 140 million ha of net area sown, vis-à-vis the present coverage of 68.4 million ha (48.8%) of the net area sown irrigated. A large part of agriculture- 71.7 million ha (51.2%) continue to be rainfed. Therefore, investment for irrigation sector needs to be given priority.

LAND USE

4.4 Land use pattern is crucial to the determination of how effectively land is put to use as means of livelihood for a vast section of our population. The challenge before the planners is to bring the maximum of 328.73 million ha of the country's land area under productive use while maintaining the carrying capacity. Land use is a dynamic process. It changes over time due to number of factors, including increasing population, changes in cropping system and technology. As various sectors of the economy develop, there has got to be a shift in the pattern of land use. Besides, land users in India are often constrained by their ability to invest in land improvement due to several reasons. The main reasons are: (i) non – availability of capital and land users inability to reap full economic benefits; (ii) inadequate technical and managerial knowledge; and, (iii) inadequate return on investment to meet the

cost of borrowing. Since the responsibility of preventing overexploitation of land resources cannot be left entirely on individuals, the need for framing policies to incentivize the farming community to reverse the processes of degradation is being realized.

4.5 On the front of land use statistics, out of the total geographical area of 328.73 million ha, land utilization statistics are available for 307.82 million ha only. The balance 20.91 million ha remains unsurveyed or inaccessible. As per the latest available Land Use Statistics for 2014-15, out of total reported area of land utilization in the country, about 140.13 million ha under net sown area, 3.10 million ha under miscellaneous tree crops and grooves, 12.47 million ha as culturable wasteland and 26.18 million ha as fallow land. Similarly, area under non-agricultural uses is about 26.88 million ha.

4.6 Over the years, there has been a gradual increase in area under non-agricultural uses. During the period 2005-06 to 2014-15, area under non-agricultural uses has increased by 1.89 million ha accounting for 8.7 percent. During the same period cultivable land has marginally declined by 0.8 million ha i.e. 0.4 percent and net sown area has stagnated at around 140 million ha. As a normal process of urbanization and development, area under non-agricultural uses is bound to increase. However, the area under agriculture has not declined much as Government has been taking various measures to bring degraded/culturable wasteland under cultivation. The net sown area increased by about 18 percent from 119 million ha in 1950-51 to 140 million ha in 2014-15 whereas the cropping intensity has increased from 111 percent to 142 percent during the same period.

4.7 But what is applaudable is the increase in the area under forest from the deplorable 14 percent in 1950-51 to 23.3 percent. Though after the substantial restoration during 1950-51 to 1990-91, the increase in forest cover has sectioned to reach 69.84 percent in 2000-01 being just 2 percent during 2000-01 to 2014-15. More afforestation plan and curbing deforestation can improve the situation.

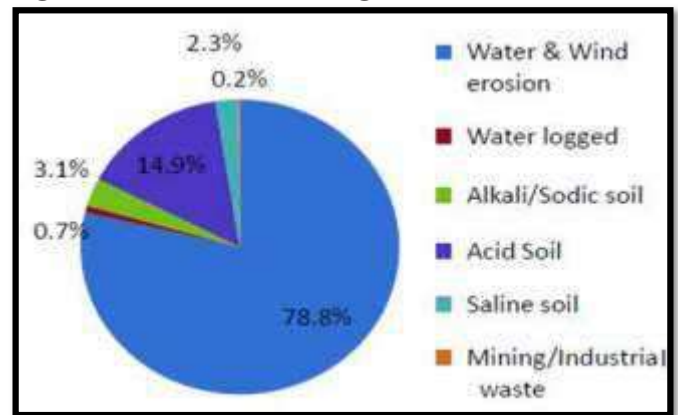
CHALLENGES

4.8 **Land Degradation:** Interestingly whereas it takes nature thousands of years to generate soil, its own agents of erosion cause depletion of one millimeter of top soil every year. The erosion led degradation of soil occurs in many forms which are required to be scientifically studied. Soil erosion and its formation simultaneously occur as natural process, and about one millimeter of top soil is being lost annually in the country due to erosion, causing land degradation in upper reaches of the river system and increasing soil fertility when deposited at various locations of river systems.

4.9 Land degradation takes place in many forms and is prevalent throughout the country. Sometimes, it exists in combination with one or other problems. In the absence of comprehensive and periodic scientific surveys, estimates are made on the basis of localized surveys and studies. In 2010, according to Indian Council of Agricultural Research harmonized land degradation data, of the total geographical area of 328.73 million ha, about 120.40 million ha (37%) was affected by various kind of land degradation (**Figure 4.1**). This includes water and wind erosion (94.87 million ha), water logging (0.91 million ha), soil alkalinity/sodicity (3.71 million ha), soil acidity

(17.93 million ha), soil salinity (2.73 million ha) and mining and industrial waste (0.26 million ha).

Figure 4.1 : Forms of Land Degradation



Source: ICAR

4.10 Accumulation of heavy metals and metalloids, through emissions from the rapidly expanding industrial areas, mine tailings, disposal of high metal wastes, leaded gasoline, paints, application of fertilizers, animal manures, sewage sludge, pesticides, wastewater irrigation, coal combustion residues, spillage of petrochemicals and atmospheric deposition etc – cause soil degradation. Heavy metals constitute an ill-defined group of inorganic chemical hazards, and the most commonly found heavy metals at contaminated sites are lead (Pb), chromium (Cr), arsenic (As), zinc (Zn), cadmium (Cd), copper (Cu), mercury (Hg), and nickel (Ni). Soils function as the major sinks for heavy metals released into the environment by aforementioned anthropogenic activities and unlike organic contaminants, which are oxidized to carbon by microbial action, most metals do not undergo microbial or chemical degradation, and their total concentration in soils persists for a long time after their introduction. The presence of toxic metals in soil can severely inhibit the biodegradation of organic contaminants too. Heavy metal

contamination of soil may pose risks and hazards to humans and the ecosystem through direct ingestion or contact with contaminated soil, thus entering into food chain (soil-plant-human or soil-plant-animal-human), drinking of contaminated ground water, reduction in food quality (safety and marketability) via phytotoxicity and reduction in land usability for agricultural production in turn causing food insecurity.

4.11 Land fragmentation: The process that turn land into small or incomplete part or piece broken off / separated from the whole to which it originally belongs is defined as fragmentation. Increasing human and animal population has reduced availability of land over the decades. Per capita availability of land has declined from 0.91 ha in 1951 to 0.27 ha in 2011 and is feared to further slide down to 0.20 ha in 2035. As far as agricultural land is concerned, per capita availability of land has declined from 0.53 ha in 1951 to 0.15 ha in 2011 and is likely to decline further. Problems associated with land fragmentation are distance between parcels and the farmstead; increase in boundary lines; reduction in size and irregular shape of parcels; and lack of access. These problems compound when parcels are spatially dispersed, and the cost of travel time and costs of moving labour, machines, etc., from one parcel to another make farming cost intensive. In addition, land fragmentation necessitates a complicated boundary network among parcels of hedges, stone walls, ditches, etc, causing land wastage. On tiny parcels, the use of modern machinery is difficult or impossible and an excessive amount of manual work may be required along corners and boundaries. If a parcel has an irregular shape, proper cultivation is not possible. As

a result, productivity decreases and farmer income declines. Besides, as there is no network of farm roads, land owners do not allow neighbouring landowners to cultivate overlapping areas between fields; as a result some land remains uncultivated. Thus, this situation demands agricultural commercialization via enabling formation of large/medium size farming units to attain economies of scale. This in turn is possible by facilitating various forms of group and contract farming.

4.12 Diversion of agricultural land: Agricultural land diversion estimates for the period 1980-81 and 1990-91 indicates that annual average increase in non-agricultural use was 0.16 million ha., during 1991-92 to 2000-2001, it rose to 0.23 million ha, but dropped to 0.21 during most recent period (2001-02 to 2012-13). With a view to conserve top soil and to prevent soil erosion and land degradation, Government of India has been implementing various programmes across the country. Parts of the degraded lands developed under these programmes have been put to cultivation, arresting the decline; net area sown has remained unchanged around 140 million ha. in last two decades.

4.13 Land Holdings: There was a decline in the average size of operational land holdings in India, reflecting the immense population pressure on the limited land resource available for cultivation as per Agriculture Census, during 2000-01 and 2010-11. The average size of operational land holdings (**Table 4.1**) have declined from 1.33 ha in 2000-01 to 1.15 ha in 2010-11. This decline in average holding size was due to declining trends in large and semi-medium holding categories both in number of holdings and area, and an increasing trend in marginal and small

holding categories in both number of holdings and area. Landholding size determines investment in agriculture, its productivity, farm mechanization and sustainability of farm incomes itself. Land holdings in the marginal category (less than 1 ha) constitute 67

percent of the operational holdings in the country (2010-11). In terms of area operated, the share of marginal holdings has increased to 22 percent (2010-11) from 19 percent (2000-01).

Table 4.1 Number and Area of Operational Holdings by Size Group

No. of Holdings: ('000 Number)
Area Operated: ('000 Ha)
Average size: (Ha)

Category of Holdings	Number of Holdings			Area			Average Size of Holdings		
	2000-01*	2000-06*	2010-11	2000-01*	2005-06*	2010-11	2000-01*	2005-06*	2010-11
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Marginal (Less than 1 ha)	75408 (62.90%)	83694 (64.80%)	92826 (67.10%)	29814 (18.70%)	32026 (20.20%)	35908 (22.50%)	0.4	0.38	0.39
Small (1.0 to 2.0 ha)	22695 (18.90%)	23930 (18.50%)	24779 (17.90%)	32139 (20.20%)	33101 (20.90%)	35244 (22.10%)	1.42	1.38	1.42
Semi-Medium (2.0 to 4.0 ha)	14021 (11.70%)	14127 (10.90%)	13896 (10.00%)	38193 (24.00%)	37898 (23.90%)	37705 (23.60%)	2.72	2.68	2.71
Medium (4.0 to 10.0 ha)	6577 (5.50%)	6375 (4.90%)	5875 (4.20%)	38217 (24.00%)	36583 (23.10%)	33828 (21.20%)	5.81	5.74	5.76
Large (10.0 ha and above)	1230 (1.00%)	1096 (0.80%)	973 (0.70%)	21072 (13.20%)	18715 (11.80%)	16907 (10.60%)	17.12	17.08	17.38
All Holdings	119931	129222	138348	159436	158323	159592	1.33	1.23	1.15
	(100)	(100)	(100)	(100)	(100)	(100)			

*-Excluding Jharkhand

Source: Department of Agriculture, Cooperation & Farmers Welfare (Agriculture Census 2010-11, Phase-II).

Note: Figures in parentheses indicate percentage share in total.

4.14 Similarly, the share of operated area under small farm holdings (1 to 2 ha) increased from 20 percent to 22 percent during the same period. Small and marginal holdings together, constitute 85 percent in terms of number of operational holdings and 44.6 percent of the operated area in the country.

POLICIES & PROGRAMMES

4.15 National Policy for Management of Crop

Residue (NPMCR): In India, harvesting of various crops generate large volume of residues both 'on' and 'off' farm. A large portion of crop residue is burnt 'on farm' in order to clean the field for sowing the next crop as time gap between harvesting of kharif crops and sowing of rabi crops is very limited. Burning crop residues not only causes air pollution but also damages soil and the available nutrients, besides

creating human health problems. In view of this, the 'National Policy for Management of Crop Residue, 2014 (NPMCR-2014)' was formulated by the Ministry of Agriculture & Farmer's Welfare and circulated to all States for implementation to ensure prevention of crop residue burning by incentivizing purchase of modern machinery to minimize crop residue left over in the field and to facilitate multiple uses of crop residue and by the formulation of fodder pellets briquettes. As agriculture is a State subject, various States are implementing NPMCR-2014 as per their policy and priority. This reality of current policy to leave the implementation of over a sensitive legislation dealing with such matters at the mercy of regional perception leads to the emergency level smog pollution mainly due to stubble burning. What becomes apparent was that farmers pushed to meet their sowing timeliness would not budge from burning the residue if expeditious and win-win solutions are not offered. Thus innovative and financially viable legal solutions are required to be sought.

4.16 National Policy for Farmers, 2007 (NPF 2007) states that 'Prime farmland must be conserved for agriculture except under exceptional circumstances, provided that the agencies that are provided with agricultural land for non-agricultural projects should compensate for treatment and full development of equivalent degraded/wastelands elsewhere. So far as non-agricultural purposes is concerned, as far as possible, land with low biological potential for farming would be earmarked and allocated'. State governments have been advised to 'earmark lands with low biological potential such as uncultivable land, land affected by salinity, acidity, etc., for non-agricultural development activities, including industrial and construction activities.'

4.17 As per **National Rehabilitation and**

Resettlement Policy, 2007 (NRRP, 2007), 'only the minimum area of land commensurate with the purpose of a project may be acquired. Also, as far as possible, projects may be set up on wasteland, degraded land or un-irrigated land. Acquisition of agricultural land for non-agricultural use in the project may be kept to the minimum; multi-cropped land may be avoided to the extent possible for such purposes and acquisition of irrigated land, if unavoidable, may be kept to the minimum.

4.18 In addition, **The Right to Fair Compensation, Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013** encompasses proper rehabilitation & resettlement, fair compensation and some extent of restriction in diversion of agricultural land.

4.19 Ministry of Agriculture & Farmer's Welfare (MoA&FW) with the objective of developing degraded land, had implemented various programmes, namely, the National Watershed Development Project for Rain-fed Areas (NWDPA), Soil Conservation in the Catchments of River Valley Project & Flood Prone River (RVP&FPR), Reclamation and Development of Alkali & Acid Soils (RADAS) through Macro Management of Agriculture (MMA) and Special Central Assistance to State Plan Programme of Watershed Development Project in Shifting Cultivation Areas (WDPSA). As per the decision of the erstwhile Planning Commission, these programmes were discontinued from 1st April 2013. Similarly, Department of Land Resources, Ministry of Rural Development has been implementing an area development programme, i.e., Integrated Watershed Management Programme (IWMP) for development of rainfed/degraded areas. The IWMP has been merged with Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) as PMKSY-Watershed

in 2015-16. Under these programmes since inception till end of Eleventh Five Year Plan, an area of about 81.70 million ha of degraded lands has been developed.

4.20 Contract farming: Contract farming, taking various forms of contract between the farmers and farm produce buyers to reach a win-win situation in terms of better price, assured demand and input/investment support for farms and assured supply of high quality produce has become popular in the recent years. It has been in use for agricultural production for decades, but its popularity has increased in recent years. The use of contracts has become attractive to farmers because this arrangement can offer both an assured market and access to production support. Another major strength of this management solution is found in its effectiveness in the delivery of technology and inputs services, as compared to extension services of the Government. Contract farming maximises economies of scale and is viewed as an effective approach for solving market access and input supply problems faced by small farmers.

4.21 The implementation of the contract farming model, however, faces the serious problem in absence of a legal framework, which exposes the two parties, i.e., the farmers and lessee, to risks of becoming prey to fraudulent conduct by one another. A legal framework is required to prevent farmers from selling land under lease or under input investment contract or the lessee wriggling out of the promised price or quantity of produce or purchase of the produce completely. In this regard, Government in the Union Budget 2017-18, announced that a model law on contract farming would be prepared and circulated among the States for adoption.

4.22 Soil and its Survey: Nature of soil is key to

human and animal health. Good soil health, defined as the capacity to function within ecosystem and land use boundaries to sustain biological productivity, is precondition to environmental quality and promotes plant and animal health. Areas of major concern are the excessive use of chemical fertilizers, particularly in the north-western part of the country, coupled with imbalanced nutrient application, non-judicious use of pesticides, intensive cropping system, decline in soil biodiversity and depletion of organic matter. To counter these problems, policy emphasis is required on promoting soil test-based balanced and judicious use of chemical fertilizers in conjunction with organic sources of nutrients. Intensive agriculture without realizing the necessity of soil testing is leading to a widespread deficiency of micronutrients, such as deficiency of zinc, iron, manganese and boron, and needs to be addressed at the earliest.

4.23 Reclamation of Problem Soils: As per ICAR-2010 estimates, the area under problem soils is about 24.3 million ha, comprising alkali soil (3.7 million ha.), saline soil (2.73 million ha.) and acid soil (17.93 million ha.). With a view to enhance productive potential of problem soil (Alkali/Saline & Acid), DAC&FW has launched 'Reclamation of Problem Soils' as a sub-Scheme under Rashtriya Krishi Vikas Yojana (RKVY) on pilot basis in 15 States having higher extent of problem soils during 2016-17 with central allocation of Rs. 50.0 crore.

4.24 Watershed Development Programme: To address the issue of land degradation, Department of Land Resources, Ministry of Rural Development had been implementing an area development programme, i.e, Integrated Watershed Management Programme (IWMP) w.e.f. 26.02.2009 for development of rainfed / degraded areas. The major activities taken up under IWMP, inter alia, include

ridge area treatment, drainage line treatment, soil and moisture conservation, rain water harvesting, nursery raising, afforestation, horticulture, pasture development, livelihood for assetless persons, etc. The IWMP has been amalgamated as the Watershed Development component of the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) during 2015-16.

THE WAY FORWARD

4.25 Possible initiatives to address these issues have been listed below.

a) Incentivize Conservation of Agriculture

Conservation of agriculture can be ensured by incentivizing sustainable farm operations through reliable power connectivity, timely availability of quality inputs, low premium on crop insurance, etc.

b) Land Use Policy

For proper management of natural resources and to ensure sustainable agricultural growth in the country, there is need for a clear land use policy. As per the Seventh Schedule of the Constitution of India, land and water fall under the purview of State Governments, and it is for States to bring about suitable legislation for regulating conversion of agricultural land into non-agricultural purposes. Land use planning should be integrated with all developmental programmes, especially with the MNREGA, for holistic rural development, natural resource management and eco-restoration.

c) Land Reform

Considering the skewed ownership pattern of land, it is necessary to strengthen the implementation of laws relating to land reforms, with particular reference to tenancy laws, leasing, facilitation of contract farming,

distribution of ceiling-surplus land and wasteland, providing adequate access to common property and wasteland resources and consolidation of holdings.

d) Control on Fragmentation of Land

Land fragmentation leads to reduction in landholding size, and makes it uneconomical for optimal farm operations, application of science and technology and mechanization. Besides, fragmentation necessitates too many field boundaries and bunds, and leads to wastage of land. Therefore, laws ensuring reforms in land tenancy rules and automatic land rights inheritance need to be legislated to encourage sharecropping and contract farming and to render physical boundaries and fencing irrelevant.

e) Land Utilization Data and Its Computerization

The net area sown has been hovering around 140 million ha for the last two decades. However, it may be even lower as in villages farmers build houses and put agricultural land to other uses without recording such changes in land use. In this context, a land use survey need to be looked at for any methodological change to improve the assessment, and for completing the inventory of land resources in each state for ensuring resource allocation on the basis of a more reliable database. A “soil-to-satellite” approach needs to be promoted, along with digitizing land records to make accurate and transparent information on land and land use easily available.

f) Policy on Diversion of Land and Land Tenancy

Productive agricultural land should not be diverted to industrial or urbanization activities. In case of extreme national need, it should be stipulated that industries provided with agricultural or other land for development projects compensate for the treatment and full development of the equivalent degraded land or wasteland elsewhere.

Each state should promulgate land tenancy legislation or policy, so that tenants instead of landowners can benefit from the various subsidy and crop insurance programmes and, therefore, tenant's land is put to crop production.

g) Contract Farming and Public Private Partnership

Partnership Contract or leased farming is seen as a proven path around all the issues that impede Indian farming. It is expected that contract farming will tap fully the agricultural development potential through modern farming techniques and ensure profitability and ecological sustainability. The reason is that it solves all agricultural management issues, viz., lack of capital; unavailability of technology and technological knowhow; and problems of imperfect farm input markets and agricultural output markets. Seen in this perspective, public private partnership (PPP) is one ideal modality for land and watershed development activities. The government has the funds and policy commitment to enable these activities, and private sector agencies and NGOs have the managerial/corporate experience, manpower and technology to execute these activities. All that is required is an enabling framework that puts government and private sector players in

agriculture and natural resource management on one platform.

h) Revisiting of various Succession Acts

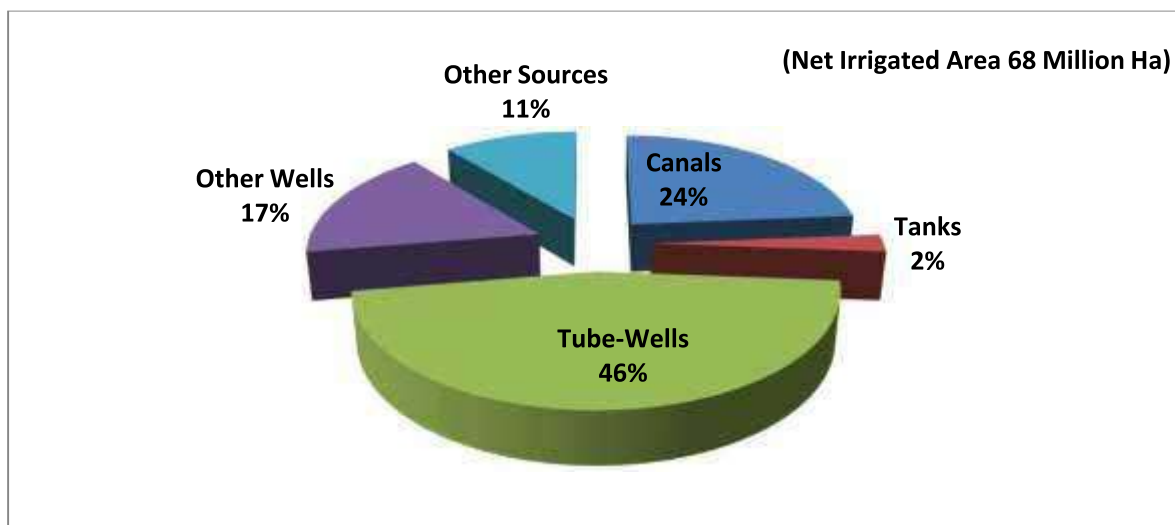
Multiple succession Acts need to be revised, and a common succession Act needs to be put in place for smooth inheritance. It is necessary to ensure that land rights go to the inheritors but land fragmentation is avoided.

WATER RESOURCES

4.26 India has only 4 percent of the world renewable water resources. The average annual precipitation in India is estimated to be 4,000 BCM (billion cubic meters), out of which the average precipitation during monsoon (June-September) is estimated at 3,000 BCM. The average annual run off in the rivers is estimated to be 1,869 BCM. Out of the above, the estimated utilizable surface water resource is 690 BCM. Apart from the above, the total utilizable groundwater resource is 431 BCM. As such, the total annual utilizable water resource in the country is estimated to be 1,121 BCM.

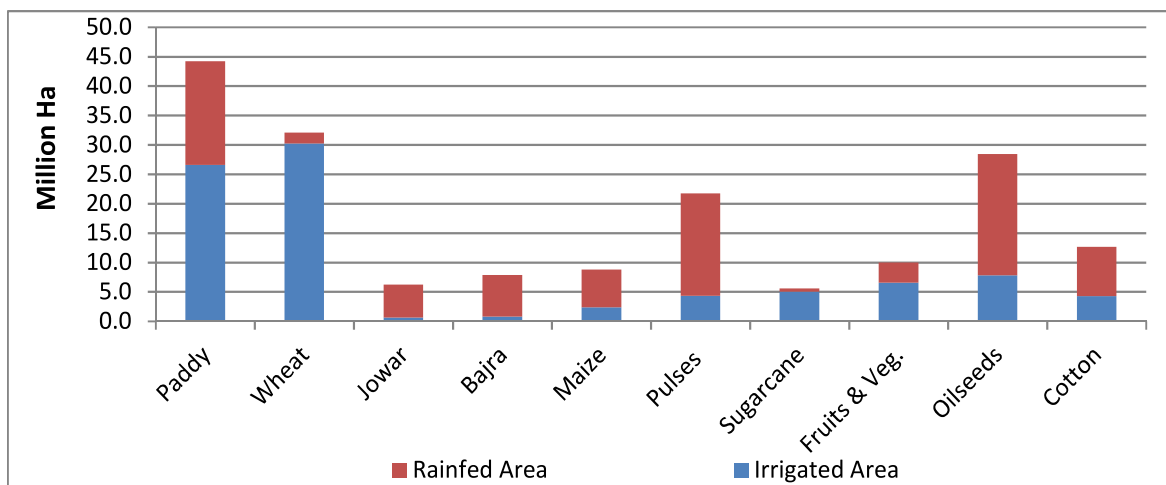
4.27 A large number of dams, barrages, hydro power structures, canal networks, etc., were built all over the country during the successive Plan periods. A cumulative storage capacity of about 225 BCM from major and medium irrigation projects has made it possible to provide assured irrigation in command areas, extend the supply of drinking water to remote areas and ensure water supply to hydro and thermal power plants and to meet other requirements. Added to this is the minor irrigation potential of about 100 BCM, created through check dams, small structures, ponds, etc. Finally, groundwater potential of about 243 BCM was available. All this has made it possible to irrigate about 68.38 million ha (2014-15) of the 140.1 million ha of net sown area (**Figure 4.2 and 4.3**).

Figure 4.2: Various Sources of Irrigation in 2014-15



Source: Land Use Statistics (2014-15), Directorate of Economics & Statistics

Figure 4.3: Irrigated and Rainfed Area under major crops



Source: Land Use Statistics (2014-15), Directorate of Economics & Statistics

ISSUES & CHALLENGES

Regional Imbalance in Rainfall

4.28 There is a huge temporal and spatial variation in rainfall and water availability in the country. Most of the water is available during the monsoon, and in a few spells of intense rainfall, resulting in floods in major rivers. While the average annual rainfall of the country is about 1170 mm, average rainfall in the North East Region is as high as 10000 mm per year, but some parts of Western Rajasthan receive annual

rainfall of about 100 mm only. Estimates show that whereas the lower rainfall zone (less than 750 mm annual rainfall) accounts for 33 percent of the net sown area, the medium rainfall zone (750-1125mm) accounts for 35 percent of the net sown area, the high rainfall zone (1125 to 2000 mm) covers 24 percent of the net sown area and the very high rainfall zone (more than 2000 mm) accounts for the remaining 8 percent of the net sown area. The basin-wise availability of water is quite varied- the Ganga-

Brahmaputra river basin contributes more than 50 percent of the total annual water availability, and the Southern and Western basins contribute about 15 percent each.

Sub-optimal utilization of created facilities

4.29 Despite sixty-nine years of concerted efforts to tap the irrigation potential, the gap between the potential tapped and the potential possible is not only large, but widening. The major causes for these gaps are poor maintenance of the canal system, lack of participatory management, changing land use pattern, deviation from the designated cropping pattern, soil degradation and delay in the development of the command area. Whereas the potential created for irrigation is 112 million ha, the gross irrigated area is merely 93 million ha the gap of 19 million ha is staggering.

Poor Irrigation Efficiency

4.30 As per the Report of the Task Force on Irrigation (2009) constituted by the then Planning Commission, for a gross irrigated area of about 91 mha, the water use is 634 BCM, which gives a delta of 0.68 m per ha of gross irrigated area. The average annual rainfall is 1170 mm (1.17m). Taking 70 percent of the rainfall as effective for crop consumptive use, the gross water use is about 1.45 m (4.8 feet) per ha of the gross irrigated area. This is very high compared to water use in irrigation systems in developed countries, such as the USA, where water allocation is about 90 cm. This overuse in the country reflects low irrigation efficiency, of about 25 percent to 35 percent in most irrigation systems, with efficiency of 40 percent to 45 percent in a few exceptional cases.

Ground Water Policy

4.31 Groundwater has rapidly emerged to occupy a dominant place in India's agriculture and food security. It has become the main source of growth in irrigated area, and it now accounts for over 60 percent of the irrigated area. About 70 percent of the paddy and wheat production in the country is from irrigated areas. Heavy subsidies in electricity consumed for agriculture have tended to encourage wasteful use of energy and water. This has also encouraged farmers to overdraw water from deep aquifers, causing substantial depletion of the water table and deterioration of water quality in many cases. There has been unprecedented crop diversification, due to unregulated groundwater development. The preference for water-intensive crops like rice, sugarcane, banana, cotton, etc., is high in regions known only for groundwater availability. It is to be clearly understood that despite huge groundwater potential for agricultural growth, the country is heading towards an irrigation crisis.

Ultimate Irrigation Potential

4.32 In the total 329 million ha (mha) of geographical area of the country, the total cropped area is about 198.4 mha, out of which net sown area is only about 140.1 mha. Only about 68.3 mha, i.e., 48.8 percent of the net sown area, is reported as irrigated. There is a need to bring more cropped area under assured irrigation to increase agriculture productivity and production. The ultimate irrigation potential (Table 4.2) of the country is estimated at about 140 mha, with about 76 mha from surface water sources and about 64 million ha from groundwater sources. High priority needs to be accorded to balance the use of irrigation potential.

Table 4.2: Ultimate Irrigation Potential

S.No.	Sector	Potential(mha)
1	Major & Medium Irrigation	58.47
2	Minor Irrigation	81.43
	a. Surface Water	17.38
	b. Ground Water	64.05
Total		139.9

Source: Ministry of Water Resources

Competing Demand

4.33 The demand for water for various purposes is increasing due to population growth, urbanization and industrialization. Presently, the agriculture sector uses about 83 percent of available water resources, but as per the estimates, demand from

other sectors may reduce the availability for agricultural use to 68 percent by 2050. The Standing Sub-Committee report on the "Assessment of Availability and Requirement of Water" and the NCIWRD assessed the water requirement for various sectors by 2050 (Table 4.3).

Table 4.3: Water Demand in India

Water Demand (BCM)				
Sector	Standing Sub-Committee of MoWR		NCIWRD	
	2025	2050	2025	2050
Irrigation	910	1072	611	807
Drinking Water	73	102	62	111
Industry	23	63	67	81
Energy	15	130	33	70
Others	72	80	70	111
Total	1093	1447	843	1180

Waterlogging and Soil Salinity

4.34 Overuse of surface water leads to drainage problems, which in turn leads to water logging in some areas. Waterlogging, however, is mostly associated with unlined or poorly maintained canal irrigation systems.

Impact of Climate Change

4.35 Although a precise quantitative assessment

of the impact of climate change on water resources is yet to be made, various reports indicate that climate change could result in further intensification of temporal and spatial variation in the availability of water and extreme weather events of flood and drought. Temperature drives the hydrologic cycle and influences hydrological processes in a direct or indirect way. A warmer climate may lead to intensification of the hydrological cycle, resulting in

higher rates of evaporation and increase of liquid precipitation. What is more detrimental could be the phased changes in the hydrological cycle, affecting spatial and temporal distribution of runoff, soil moisture, groundwater reserves, etc. It may increase the frequency of floods and droughts. With the rise in sea levels, it can have a distinct effect on estuarine ecology, thereby affecting river behaviour in myriad ways, in addition to hydrological changes. Altogether, it can have an influence, both hydrologically and ecologically, on river basins as a whole. Its impact is further compounded by surging population, increasing industrialization and associated demands on freshwater.

PROGRAMMES & SCHEMES

Pradhan Mantri Krishi Sinchai Yojana

4.36 Towards the motto of '*Har Khet ko Pani*' and '*Per Drop More Crop*', an ambitious irrigation development plan was drawn with the objective of boosting irrigation in a short span of five years, during 2015-16 to 2019 under Pradhan Mantri Krishi Yojana with a massive outlay of Rs. 50,000 crore. The PMKSY has the following major components:

1. **Accelerated Irrigation Benefit Programme (AIBP) & Command Area Development & Water Management (CADWM):** To focus on faster completion of ongoing major and medium irrigation, including national projects. This component is implemented by Ministry of Water Resources, River Development and Ganga Rejuvenation.
2. **PMKSY (*Har Khet ko Pani*):** Source augmentation, distribution, ground water development, lift irrigation, diversion of water from water plenty to water scarce areas, supplementing

rain water harvesting beyond IWMP & MGNREGA, repair, restoration, renovation of traditional water bodies. This component is implemented by Ministry of Water Resources, River Development and Ganga Rejuvenation.

3. **PMKSY(Per Drop More Crop):** Micro level storage structures, efficient water conveyance & application, precision irrigation systems, topping up of input cost beyond MGNREGA permissible limits, secondary storage, water lifting devices, extension activities, coordination & management. This component is implemented by Dept. of Agriculture & Cooperation, M/o Agriculture & Farmers Welfare.

4. **PMKSY (Watershed):** Ridge area treatment, drainage line treatment, soil and moisture conservation, water harvesting structure, livelihood support activities and other watershed works. This component is implemented by Dept. of Land Resources, M/o Rural Development.

4.37 This Scheme envisages the following objectives and deliverables:

- i. The PMKSY envisages an end-to-end solution in the irrigation supply chain, viz., water sources, distribution network, efficient farm level application and extension services on new technologies and information.
- ii. It will focus on improving water use efficiency to reduce wastage and increase availability both in duration and to extend and bridge the gap between irrigation potential created and its utilization. Special emphasis will be on creating protective irrigation by harnessing rainwater at the micro level, through “Jal Sanchay” and “Jal

Sinchan”.

- iii The Scheme is meant for implementation in area development mode, adopting “decentralized State-level planning and projectized execution” and allowing states to draw up their own irrigation development plans. Through these comprehensive irrigation plans at the subdistrict, district and state level, it will serve as a platform for convergence of investments in irrigation.
- iv The PMKSY will serve as an important tool for adaptation to climate change in the agriculture sector. Efficient use of water will avoid anaerobic conditions in the soil and thereby reduce GHG emission.

4.38 With the objective of completing 99 major and medium irrigation projects with a projected potential of providing irrigation for an area of 76.03 lakh ha, by December, 2019, in a mission mode, a National Steering Committee under the chairmanship of Hon'ble Prime Minister and National Executive under the chairmanship of Vice-Chairman of NITI Aayog have been set-up. To ensure time bound completion an innovative funding mechanism through NABARD and overall coordination of all the components of the scheme were envisaged.

4.39 Expeditious steps toward release of funds by the participating Ministries/ Departments, bringing more area under Per Drop More Crop component, and strengthening the Management Information System (MIS) are being taken by the DAC&FW. During 2017-18, an amount of Rs. 1610.00 crore and Rs. 594.90 crore has been released as on 31st December, 2017 to states for micro-irrigation and for

other interventions respectively under Per Drop More Crop component. An area of about 4.97 lakh ha has been covered under Micro Irrigation and constructed 39808 water harvesting structure till 31st December, 2017.

THE WAY FORWARD

4.40 It is vital to employ scientific and systematic problem identification approach so as to understand water requirement, constraints involved and the solutions in a specific region.

Conveyance Loss

4.41 The operation and maintenance of irrigation systems is poor, the water channels are not properly lined and, therefore, water loss from canals is very high. Almost half of this loss is found in field channels. Improvement in canal operating systems is the requirement of the day.

Application Losses

4.42 In view of increasing scarcity of water for irrigation, the policymakers need to focus on the modern irrigation infrastructure and management for raising water use efficiency rather than conventional flow irrigation practice. It is widely known from water resource use experience in agriculture that better irrigation practices can save water use in different crops in the range of 16 percent to 69 percent, raising yield in the range of 10 percent to 50 percent. This would require the use of pressurized irrigation means of micro irrigation, drip irrigation, sprinkler irrigation. Emphasis on making available pressurized irrigation devices of drippers, micro-sprinklers, mini-sprinklers, micro-jets, misters, fan-jets, micro-sprayers and foggers is required in the irrigation development policy. That so far, only about 5 million ha area has been provided with irrigation

under micro irrigation mode, including drip and sprinkler irrigation, it underscores the need for more emphasis on water loss preventing irrigation infrastructure and management. The use of more efficient irrigation techniques may involve higher operation and maintenance cost, but in view of larger issue of scarcity of water and the declining health of soil, it is well justified.

Over-Exploitation of Ground Water

4.43 The consequences of continuous excess extraction of ground water in the Green Revolution heartland States have resulted in the near irreversible ecological impact of receding ground water levels. The envisaged approach for tackling this problem lies in an integrated development of ground water resources in these regions. What is required is adopting a multi-pronged strategy focusing on artificial recharge, rainwater harvesting, balanced use of both surface water and ground water, better managing poor quality ground water, conserving water by resorting to water use efficiency raising irrigation methods and regulating ground water development through a participatory management.

Secondary Storage

4.44 Considering Indian weather and rain pattern which is marked by monsoon deluge and the resultant abundance of water in the water reservoir network while irrigation water consumption demand is at the lowest ebb in this season—it is important to ensure storing water in the secondary storages along the tail end of canal systems to make water available to the disadvantaged farmers.

In-situ Moisture Conservation and Rainwater Harvesting

4.45 The vision behind in-situ moisture

conservation and rain water harvesting is to strike a balance between the pressure of irrigation water demand and sustainability of the water resources in meeting this demand in the long run without threatening the future generations. In-situ moisture conservation efforts are required to be made by impounding water in surface structure, adopting less water depleting techniques of farming such as zero tilling, inter-row cultivation, contour farming and watershed approach.

Irrigation Development in North-East Region

4.46 So far as North-Eastern India is concerned, with abundance of ground water resources, estimated to be underutilized to the extent of 58-82 percent, and its present cropping pattern and land use nature, an effort is required to develop ground water irrigation infrastructure to tap ground water resources with assured power supply and also bring in suitable cropping pattern with potential of higher farm production and income.

On-farm Water Management

4.47 There is an immense scope for bringing down wasteful use of water and enhancing agricultural productivity by employing on-farm water management solutions. Farm management studies by ICAR suggests that there is great scope for economizing water use, increasing crop productivity and improving water use efficiency through transfer of available irrigation and other agro-technology to farmers in irrigation commands.

Controlling Water logging and Soil Salinity

4.48 The problem of water logging and soil salinity need to be addressed by providing for lined canals, drainage development either through surface, sub-surface, bio-drainage, or through a combined

approach supported by appropriate agronomic measures.

Water Pricing

4.49 Pricing of water as a mechanism for ensuring its optimal use is an important policy issue. When made available at no or nominal charges, farmers end up using water extravagantly resulting into fast depletion of ground water or causing water logging when it is surface water source. Thus there is a strong case for not only charging for water, but also the use of volumetric system for measuring supply and precise pricing of water.

Recycling of Water

4.50 One important area of water resource management for meeting its increasing demand is the reuse and recycling of water. The importance of better management on this account lies in controlling water and soil pollution due to abundance of waste water and adding to the availability of water.

Emphasis on Awareness Generation & Training

4.51 As integral part of water resource development and management with the focus on optimal utilization of scarce water, there should be an effective system for awareness generation training for making farmers aware of scientific use of irrigation water at critical stages of the growth of the crops depending on the soil and environmental conditions.

Coordination & Convergence Mechanism

4.52 In the conditions of scarcity, scanty rains and large number of farm holdings spread over different terrains away from resources, efficient management of water is the key to economical and sustainable use of water. Water management, therefore, has to be

ensured with the participation of the farmers, and the functionaries and officials of departments related to agriculture and farm management and water resources.

Water Pollution

4.53 Taking cognizance of the report of Central Pollution Control Board (CPCB) that there are around 302 polluted river stretches in the country during 2009-12, the Ministry of Environment, Forest and Climate Change (MoEFCC) is working on several planks of water quality improvement plans. These include: (i) sewerage works to capture the raw sewage flowing into the rivers through open drains and diverting them for treatment; (ii) sewage treatment plant for treating the diverted sewage; (iii) low-cost sanitation works to prevent open defecation on river banks; (iv) electric and improved wood-based crematoria to conserve the use of wood and help in ensuring the proper cremation of bodies brought to burning ghats; and (v) river front development, such as improvement of bathing ghats, etc. In addition to this, other issues of water pollution prevention are being addressed by the Ministry of Urban Development as well as the Ministry of Water Resources, River Development & Ganga Rejuvenation with regard to pollution abatement/sewerage works; and by National Plan for Conservation of Aquatic Eco-Systems (NPCA) regarding conservation of lakes and wetlands.

4.54 The menace of ever increasing pollution loads in river and other water bodies is required to be checked through measures, like reuse of treated sewage water for agriculture and horticulture purposes; use of sewerage sludge as manure and soil conditioner; use of water saving, efficient irrigation

technologies; educating farmers to adopt diversification of crops for saving agricultural water conservation; and educating farmers to make optimal use of pesticides and fertilizers.

CLIMATE CHANGE

4.55 Climate Change, as evident from change in global temperature, precipitation, etc., has potential of altering the distribution and quality of natural resources. It is primarily caused by building up of Green House Gases (GHGs) in the atmosphere, which in turn is a result of such factors as use of fossil fuel and change of land use pattern. Global warming is a specific manifestation of climate change in terms of rise in average temperature of air near the earth surface. In this context, observations of Intergovernmental Panel on Climate Change (IPCC) indicate that adverse impact of climate change due to rising temperatures and extreme weather events on food production system could impact agricultural growth. Consistent warming and more frequent extreme weather events are being observed across India, in

view of which several areas, such as coastal areas, Indo- Gangetic Plains and the drought and flood prone areas have been identified as risk prone due to impact of climate change.

4.56 Considering that agriculture itself is a source of Green House Gases, institutional endeavors like quantification of GHGs from Agriculture, vigorous research and development programme for identifying methods of mitigations and reduction consistent with the goals of achieving greater resilience in production systems, food security are being undertaken.

DROUGHT MANAGEMENT

4.57 During the monsoon season of 2016-17, cumulative rainfall was deficient by 3 percent. As per the India Meteorological Department (IMD) report, there was deficit rainfall in 11 States/UTs for the period 1 June 2016 to 30 September, 2016 as shown in **Table 4.4**.

Table 4.4: States with Deficiency in Rainfall

Sl. No.	State/UT	% Departure from Normal
1	Assam	(-22%)
2	Meghalaya	(-48%)
3	Nagaland	(-27%)
4	Tripura	(-20%)
5	Haryana	(-28%)
6	Chandigarh (UT)	(-46%)
7	Punjab	(-28%)
8	Himachal Pradesh	(-24%)
9	Gujarat	(-20%)
10	Kerala	(-34%)
11	Lakshadweep (UT)	(-25%)

Source : India Meteorological Department

4.58 The DAC&FW is mandated for coordination of relief efforts necessitated by drought. State Governments are primarily responsible for taking necessary steps in the wake of natural calamities and are empowered to initiate immediate relief measures to address the situation arising out of drought. Government of India supplements the efforts of State Governments with financial assistance. For undertaking relief measures, funds are available with the State Government in the form of State Disaster

Response Fund (SDRF). Additional financial assistance, over and above SDRF, is considered from National Disaster Response Fund (NDRF) for natural calamities of severe nature and is approved on the basis of Memorandum received from State Government in accordance with established procedure, keeping in view the items and norms in vogue for assistance. Details of amount sanctioned from NDRF to various States during 2015-16 and 2016-17 (Table 4.5) is given below.

Table 4.5: Assistance sought and approved from National Disaster Response Fund (NDRF) for Natural Calamities (Drought & Hailstorm) in the States.

(Rs. in crore)

Sl. No.	State	Calamity	Amount approved
During 2015-16			
1.	Karnataka	Drought Drought-R	1540.20 723.23
2.	Chhattisgarh	Drought	1276.25
3.	Madhya Pradesh	Drought	2032.68
4.	Maharashtra	Drought-K Drought-K (Supplementary) Drought-R	3049.36 589.47 679.54
5.	Odisha	Drought	815.00
6.	Telangana	Drought	791.21
7.	Uttar Pradesh	Drought Drought-R	1304.52 622.76
8.	Andhra Pradesh	Drought	433.77
9.	Jharkhand	Drought	336.94
10.	Rajasthan	Drought Hailstorm	1193.41 79.18
11.	Uttarakhand	Drought-R	70.22
Total:			15537.74
During 2016-17			
1.	Karnataka	Drought	#
2.	Andhra Pradesh	Drought	
3.	Kerala	Drought	

Source : Department of Agriculture Cooperation & Farmers Welfare

R:Rabi, **K:** Kharif

.# under process and finalization.

@:Inter Ministerial Central Team(IMCT) constituted on 3.11.2016, Memorandum awaited from the State Govt.

4.59 During the year 2017-18 (as on December 2017), Chhattisgarh, Madhya Pradesh and Rajasthan have declared drought and submitted Memorandum seeking financial assistance from National Disaster Response Fund (NDRF). Inter-Ministerial Central Teams (IMCTs) constituted for Chhattisgarh and Madhya Pradesh have visited these States to assess the loss/damage to crops etc. and recommended appropriate financial assistance from NDRF. The Sub-Committee of National Executive Committee (SC-NEC) considered both the reports and recommendations and forwarded the same to Ministry of Home Affairs for placing them before the High Level Committee (HLC) for consideration. The memoranda received from the State Government of Rajasthan and Maharashtra for drought during kharif 2017 and pest attack, respectively, are under consideration of the Government.

4.60 A Crisis Management Plan (CMP) for drought has been in place and is available at the website of DAC&FW. CMP refers to the actionable programme, which is pressed into action in the event of a crisis situation to minimize and to mitigate the impact of drought situation. CMP is updated annually in consultation with all stakeholder Ministries/Departments.

4.61 A Manual for Drought Management was published in the year 2009 by the Department. This Manual for Drought Management suggests a system for drought management policy and programmes to be followed by the Government of India and State Governments. It focuses on the general/ common elements of drought management at the national level, while allowing the States to include their specific schemes and interventions and incorporates

drought forecasting, monitoring, response and mitigation as a continuum of activities. The objective of this Manual is to serve as a handbook for all the decision-makers and administrators. The Manual provides relevant guidelines so that States benefit from them and pursue the most efficient and practical course of action. Since the Manual was published in 2009 and several new developments have taken place since then and also to promote use of modern technology, the Manual for Drought Management is being revised through a consultative process involving the concerned Central Ministries, State Governments, various scientific, technical and research organizations.

4.62 Central Research Institute for Dryland Agriculture (CRIDA), under ICAR, has developed detailed District-wise contingency plans to provide a broad advisory to farmers at the district level, prescribing alternate strategies in the event of climate variability, by factoring in crops/livestock/aquaculture practices/pattern, soil characteristics, infrastructural facilities, etc. These plans have been developed based on certain simulated models for different weather conditions, like occurrence of flood, drought, cyclone, cold wave/frost, etc. CRIDA has so far prepared Contingency Plans for 623 districts in the country.

4.63 The Control Room of the DAC&FW collects information on rainfall, reservoir position & sowing status, etc., to monitor drought situation and liaises with the Central Ministries/Department and the States. In case of severe drought situation in the country, the National Crisis Management Committee (NCMC) under the Chairmanship of Cabinet Secretary also reviews the situation and takes

necessary decisions to mitigate the drought situation.

4.64 Availability of seeds and other inputs is being monitored and reviewed on a regular basis in the weekly Crop Weather Watch Group (CWWG) meeting being held in the Department. Weekly video conference with States is also being held to get first-hand information about States preparedness and to advise States appropriately whenever needed.

4.65 States have been advised to keep aside about 5 percent to 10 percent of fund allocated under Rashtriya Krishi Vikas Yojana (RKVY) for undertaking appropriate interventions, if the situation so warrants, to minimize the advance impact of an aberrant monsoon on the agriculture sector. The Central Government implements Centrally Sponsored Schemes(CSS)/Central Sector (CS) Schemes such as Pradhan Mantri Krishi Sinchai Yojana (PMKSY), the Rainfed Area Development Programme (RADP), National Rural Drinking Water Programme (NRDWP), etc., which contribute towards drought proofing . Twenty five percent of total outlay for all CSS Schemes (except for schemes, which emanate from a legislation, e.g., MGNREGA), can be used as flexi funds to enable mitigation/restoration activities in cases of natural calamities. In addition several activities can be undertaken using Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) funds and Fourteenth Finance Commission (FFC) grants to rural and urban local bodies for mitigating the impact of drought.

4.66 The Ministry of Drinking Water and Sanitation is implementing National Rural Drinking Water Programme (NRDWP) which includes components such as Coverage, Quality, Operation &

Maintenance, Sustainability, Support, Water Quality Monitoring and Surveillance.

4.67 The Pradhan Mantri Krishi Sinchai Yojana (PMKSY) launched on 1st July, 2015 with the motto of 'Har Khet Ko Paani' , adopts State level planning and execution of District Irrigation Plans and State Irrigation Plans. This will go a long way in drought proofing.

4.68 Rainfed areas in the country are more susceptible to drought. Rainfed Area Development (RAD) programme is being implemented by the Ministry of Agriculture & Farmers' Welfare to focus on Integrated Farming System (IFS) for enhancing productivity and minimizing risk associated with climate variabilities. Under NMSA, cropping system are sought to be integrated with allied activities like horticulture, livestock, fisheries, agro-forestry, apiculture, etc., to enable farmers to maximize farm returns, diversify the sources of income in the event of crop damage due to drought, etc.

4.69 An important measure of drought mitigation is the supply of electricity to help farmers with irrigation of crops. The Ministry of Power oversees rural electrification and pumpset energisation to assist irrigation through pumpsets and also to run drinking water supply schemes under drought conditions.

4.70 Public works being executed under MGNREGA have helped in mitigating the suffering of affected population through water conservation and water harvesting, watershed management, micro and minor irrigation works, renovation of traditional water bodies, afforestation, tree plantation, horticulture works and land development works.

Para 4(1) of Schedule in the MGNREG Act lists about 100 public works relating to Natural Resources Management (NRM) that are permissible under the Scheme which are helpful in preventing or ameliorating drought or drought like situation. The central government has laid great emphasis on creation of farm ponds for conservation of water under MGNREGA as an important mitigating measure for drought.

4.71 To mitigate the adverse impact of drought, State Governments are advised to initiate advance remedial action, like constructing water harvesting

structures under MGNREGA and other such schemes, promoting agronomic practices for moisture conservation, promoting cultivation of less water consuming crops and restoring irrigation infrastructure by desilting canals, energizing tube-wells, replacing/repairing faulty pumps, to carry out periodic assessment of preparation for kharif crops, particularly contingency crops and also investment made in water conservation structure under various schemes, like Integrated Watershed Management Programme (IWMP) to verify their utility in harvesting the rainfall.

Farm Inputs and Management

5.1 Farm inputs determine the fate of farmers even in a normal monsoon year. These inputs, including seeds, fertilizers, pesticides, machines and appliances, availability of credit, etc., in turn depend on the business and industry dealing with the production and sales of these products and related services. The quality, quantity and prices related information about these inputs determine the costs of production of the agricultural produce. The challenging task before the farmer is to get the best seeds at the lowest prices with the guarantee of quality, quantity and prices being true to the claim. The same is true of other inputs. The problem here is that despite the best possible development schemes to ensure their availability at subsidised rates and at the right time, farmers often fail to get quality farm inputs at affordable prices. Against this background, policy focus has to be towards tightening regulating framework to ensure that the business and industry deliver the quality inputs and should also strengthen their extension services to make farmers aware of farm inputs quality, quantity and prices.

SEEDS

5.2 Seeds are the essential and the most critical input for agricultural production. Government policy and developmental schemes take due cognizance of the fact that the availability of quality seeds, which is

estimated to contribute in the productivity of other inputs between 20- 25 per cent.

5.3 The Indian Seed programme recognizes three generation of seeds, namely breeder, foundation and certified seeds. The programme entails the participation of both Central and State governments, the Indian Council of Agricultural Research (ICAR), State Agricultural Universities (SAUs) and public sector, co-operative sector and private sector institutions. The Central Seed Committee (CSC) and Central Seed Certification Board (CSCB) are apex agencies set up under the Seed Act (1966) to ensure the production of certified and quality seeds in the country. Lately, the private sector has started to play a significant role in the production and distribution of quality seeds which together with the public sector (organized sector) account for about 30-35 per cent of the total seeds distributed in the country. Rest is accounted by the unorganized sector comprising mainly farm-saved seeds.

5.4 The details of production of breeder, foundation and certified/quality seeds as well as production of certified seeds from 2005-06 onwards is given in **Table 5.1**.

Table 5.1: Production of Seed

Year	Production/Availability of Seed (Metric Tonnes)		
	Breeder Seed	Foundation Seed	Certified / Quality Seed
2005-06	6823	74800	1405000
2006-07	7382	79654	1481800
2007-08	9196	85254	1943100
2008-09	9441	96274	2503500
2009-10	10683	114638	2797200
2010-11	11921	180640	3213592
2011-12	12338	222681	3536200
2012-13	11020	161700	3285800
2013-14	8229	174307	3473130
2014-15	8621	157616	3517664
2015-16	9036	149542	3435248
2016-17	11071	220907	3802904
2017-18 (Target)	11233	195415	4194111

Source: Department of Agriculture, Cooperation & Farmers Welfare

5.5 The release of newly evolved varieties of seeds assumes significant importance in selection according to suitability of seeds based on different agro-climatic regions. During 2016-17, 96 new varieties of agricultural crops were notified. At present, 5246 varieties of different crops stand notified under Section 5 of the Seeds Act, which relates to notification of newly released seeds.

5.6 Strict procedures are followed for the maintenance of seed quality which includes seed certification, seed testing, seed labeling and seed law enforcement. Seed Certification is done by the State Seed Certification Agencies, numbering 25 at present. Seed testing is carried out by seed analysts

who are experts in seed technology. Currently, 124 Seed Testing Laboratories are functioning and testing more than 6 lakh seed samples in the country. In last five years, 82 Seed Testing Laboratories were strengthened and further strengthening has been proposed. Seeds being sold in the market are compulsorily required to be labelled as prescribed under the Seeds Act, 1966. During random inspection, if any seed is found to be sub-standard, or any seed dealer is found to be in contravention of the provisions of the Seeds Act or Seeds Rules, legal proceedings can be initiated against such seed dealers or distributors.

5.7 The increased demand and production of hybrid seeds in the country is the result of higher yield. Hence greater emphasis should be laid on

hybrid seeds. The crop-wise requirement and availability of hybrid seeds during each of the last five years as reported by the States is shown in **Table 5.2**.

Table 5.2: Requirement and Availability of Certified/Quality Seeds of Hybrids ('000 tonnes)

S.No.	Crop	2012-13		2013-14		2014-15		2015-16		2016-17	
		Req.	Av.	Req.	Av.	Req.	Av.	Req.	Av.	Req.	Av.
1	Paddy	31.6	31.4	42.8	34.2	15.1	19.5	38.5	61.4	19.21	22.09
2	Maize	97	103.5	94	96.6	93.5	106.9	101.6	120.5	100.19	125.29
3	Jowar	13.3	14	7.9	10.2	15.6	19	17.7	20	13.25	19.57
4	Bajra	24	27.1	23.6	33.2	21	24.8	24.1	26.6	19.64	24.98
5	Arhar	0	0	0	0	0.1	0.1	0.1	0	0	0
6	Sunflower	6.4	6.6	4.9	5.4	2.9	3	4.4	4.6	6.1	6.26
7	Safflower	0	0	0	0	0	0	0	0	0	0
8	Castor	4	4.3	3.4	4.3	7.1	8.4	6	6.1	4.91	5.78
9	Cotton	22.4	25.4	5.9	17.9	17.9	21.7	18.7	19.8		
	TOTAL	198.7	212.3	192.5	201.8	173.2	203.4	211.2	259.1	181.68	223.69

Req: Requirement

Av. Availability

Source: Department of Agriculture, Cooperation & Farmers Welfare

Export of Seeds

5.8 India has opened up new opportunities for export of seeds of several varieties of crops. At present, India's share of global seed market is less than 2 per cent. However, the National Seed Policy envisages a 10 per cent share of global market in the coming decade. In view of this, the need was felt for a single window system for providing clearance to export of seeds. For the same, the DAC&FW is developing a strategy for further streamlining the process of seeds export. The strategy will cover identification of crops/varieties with the potential for export of seeds, present difficulties in export of seeds, suggestions for overcoming such bottlenecks, etc. During 2016-17, the EXIM Committee recommended 118 export proposals and 76 import proposals for the export/import of seeds and planting materials.

Seed Banks

5.9 State governments are giving thrust to the creation of seed banks to resort to in emergency situations during unforeseen, unknown situations and natural calamities of different magnitude and type, viz., flood, drought, cyclones, etc. To meet these objectives, States have been advised to prepare a long-term Seed Rolling Plan that envisages the identification of the right varieties of seed for the seed chain and of the agencies responsible for the production of seeds at every level. The Plan should take into account the nature of the crop cultivated, existing and desired Seed Replacement Ratio (33% for self pollinated crops, 50% for cross pollinated crops and 100% for hybrid crops). With effect from 2014-15, the Seed Bank Programme has been re-structured as the National Seed Reserve for implementation till 2021-22. The basic objectives of

the Programme remain the same as above. The National Seed Reserve (NSR) programme is implemented by 22 implementing agencies in the country, namely, National Seeds Corporation (NSC), State Seeds Corporations and State Department of Agriculture of Tamil Nadu, Himachal Pradesh, Jammu & Kashmir and Jharkhand. Under the

programme one-time financial assistance for procurement of seeds called Revolving fund and cost of material handling equipment is provided to the implementing agency.

5.10 The targets, achievements and amount released to the participating agencies during 2015-16, 2016-17 and 2017-18 are as under (Table 5.3):

Table: 5.3 Target Achievements and Amounts Released to Participating Agencies

Year	Targets of Physical quantity in lakh quintals	Physical Achievement	Amount released to implementing agencies (Rs. Crore)
2015-16	3.65	2.76	21.48
2016-17	3.65	2.77	19.12
2017-18 (kharif)	3.66	1.91	11.39

Source: Department of Agriculture, Cooperation & Farmers Welfare

Balancing the Rights of Farmers & Breeders

5.11 To balance the rights of farmers and plant breeders, the Government enacted Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act in 2001 which provides for establishment of an effective *sui generis* system for protection of plant varieties. To facilitate the registration of plant varieties and to monitor DUS (Distinctiveness, Uniformity and Stability) and to provide support in the development DUS Guidelines, it has been decided to establish three new branch offices of the PPV&FR Authority at Palampur (HP), Pune (Maharashtra) and Shivamogga (Karnataka) in addition to two branch offices at Birsa Agricultural University, Ranchi and Assam Agricultural University, Guwahati.

5.12 One hundred fourteen (114) crop species have so far been notified for the purpose of registration by the PPV&FR Authority. Distinctiveness, Uniformity and Stability (DUS) test guidelines

during the year 2016-17, till Oct, 2016 for 30 additional crops have been published in the Plant Variety Journal of India and will be notified soon for the purpose of registration under the Act. The Authority has provided financial support of Rs. 199.20 lakh to 71 DUS centres/project. These centres are responsible for conducting DUS tests of varieties applied for registration and also developing DUS guidelines for new, genera/species. The National Gene Bank has been established at New Delhi. In addition, four field gene banks have been established at Balasaheb Sawant Konkan Krishi Vidyapeet, Dapoli; Birsa Agricultural University, Ranchi; YS Parmar university of Horticulture & Forestry, Solan and Central Arid Zone Research Institutes (CAZRI), Jodhpur.

5.13 During 2017-18, the Authority received 1033 applications, representing 76 genera/species belonging to 108 New, 47 extant and 878 farmer's categories. The highest number of application were

received for 424 cereals, followed by 147 legumes, 107 cucurbits, 84 oilseeds, 92 fruits, 78 vegetables, 79 spices, 5 medicinal & aromatic, 5 tree, 4 flowers, 3 fiber crops and 3 other crops. The applications were also received during this year seeking registration of plant varieties belonging to 12 different plant families.

5.14 Strong linkages have been developed with seed industry and, 30 stakeholder including 18 private companies, have submitted applications for registration with the Authority till March 2017. The Authority issued 243 certificate of registration for 24 crop species. The highest number of certificates were issued in Rice (180), followed by cotton (11), Wheat (6), Okra/Lady's Finger (6), Chilli (5) Tomato (4), Millet (8), Maize (4), Sorghum (2), Turmeric (2), Brinjal (1) and other crops.

5.15 The Authority, through the National Gene Fund, rewards farmers, particularly tribal and rural communities engaged in the conservation, improvement and preservation of genetic resources of economic plants and their wild relatives, particularly in 22 agrobiodiversity hotspots across 7 agro-geographical zones. The PPV&FR Authority confers the Plant Genome Saviour Community Award and Plant Genome Saviour Farmers Reward and Plant Genome Saviour Farmers Recognition. The former most has been given to 15 communities as of 30th September, 2016.

5.16 The three categories of awards: Plant Genome Saviour Community Awards, Plant Genome Saviour Farmers' Rewards and Plant Genome Saviour Farmers' Recognition were conferred during the Plant Genome Saviour Awards Ceremony which was

conducted on 19th April 2017 at Mothihari, Champaran, Bihar. A total of thirty five awards amounting to Eighty Five Lakhs Rupees were presented to farmers and farming communities from different parts of India.

Cultivation of Genetically Modified Crop-Bt Cotton in India

5.17 Genetic Engineering Appraisal Committee (GEAC) of Ministry of Environment Forests & Climate Change (MoEF&CC) has approved cultivation of Cotton. This genetically modified cotton, popular as Bt cotton, has proven to be the most widely accepted cotton by farmers in all the 10 major cotton growing states. At present, about 1400 Bt. Cotton hybrid seeds are available for cultivation in the country. These Bt. Cotton hybrids are grown in ten (10) States i.e., Gujarat, Madhya Pradesh, Maharashtra, Andhra Pradesh, Telangana, Karnataka, Tamil Nadu, Haryana, Punjab and Rajasthan. Area under Bt Cotton, which was only 29,073 hectare in 2002-03 (0.38 per cent of total cotton area) increased to 86.39 lakh hectare in 2016-17 (80% of the total cotton area). Presently, India is the largest producer of cotton and the 2nd largest consumer and exporter of cotton in the world.

5.18 The DAC&FW supports research on transgenic crops and field trials if these are conducted as per approved procedure and guidelines and various biosafety and environmental safety measures are followed and the prescribed approvals from the GEAC, constituted under the MoEF&CC, are obtained.

5.19 The DAC&FW has issued Cotton Seed Price Control Order, 2015 under Section 3 of the Essential Commodities Act, 1955 for regulating the Maximum

Sale Price of Bt cotton hybrid seeds. The Price of Bt Cotton seed was fixed at Rs. 635/- per packet of 450 grams for BG-I and Rs. 800/- per packet of 450 grams for BG-II for the year 2016. Similarly, the Department has notified the MSP of Bt. Cotton for 2017-18 in which Rs. 635/- per 450 grams of Bt. Cotton seed plus 120 gram of refugia for BG-I version Bt. Cotton and Rs. 800/- for BG-II version of Bt. Cotton Hybrid. There is no trait value for BG-I version, however, the MSP of BG-II includes Rs. 49/- as trait value.

Cotton Seed Price & Control Order

5.20 In order to provide an effective system for fixation of a uniform maximum price and to ensure the availability of the Bt Cotton Hybrid Seeds to the farmers at fair, reasonable and affordable prices, the Government of India issued a Cotton Seeds Price (Control) Order (CSPCO), 2015, on 07.12.2015 under section 3 of the Essential Commodities Act, 1955. Accordingly, the Government has regulated the sale of Bt Cotton seed by evoking the provision of the EC Act. Under Cotton Seed Price (Control) Order, 2016, the price of seed of Bt. Cotton has been fixed at Rs.635 (with trait value of Zero) and for BG-II at Rs. 800 (with trait value of Rs.49) for a packet of 450 gm plus 120 gm of refugia.

Central Schemes in the Seed Sector

5.21 “Development and Strengthening of Infrastructure Facilities for the Production and Distribution of Quality Seeds”, a Central Sector Scheme to address the gap in infrastructure and to increase availability of quality seeds, has been implemented with the objective to ensure production and multiplication of high yielding certified and quality seeds in sufficient quantities and to make the

same available to farmers across the country in time and at affordable prices.

5.22 Another Central Sector Scheme “Implementation of Plant Variety Protection Legislations” has been subsumed into the new “Sub-Mission on Seed and Planting Material (SMSP)” under the new Centrally Sponsored Scheme “National Mission on Agricultural Extension and Technology (NMAET)” being implemented with effect from 1st April 2014. The main objective of the Sub-Mission is to develop/ strengthen seed sector and to enhance production and multiplication of high yielding certified/ quality seeds of all agricultural crops and making it available to the farmers at affordable prices and also place an effective system for protection of plant varieties, rights of farmers and plant breeders to encourage development of new varieties of plants. For the year 2016-17, allocation of Rs. 186.00 crore was made under the sub-scheme against which the actual expenditure was to the tune of Rs. 167.85 crore. For 2017-18, provision of Rs. 206.06 crore was made as Budget allocation which was further increased to Rs. 486.61 crore at RE stage.

5.23 The salient achievements of the SMSP during 2016-17 are listed below.

- i. Under the Seed Village Programme to upgrade the quality of farm-saved seeds grants-in-aid amounting to Rs. 69.388 crore (GOI Share 60%) was provided during the year 2015-16, 29387 seed villages were organized and 92.11 lakh quintals of seeds produced. During the year 2016-17, an amount of Rs. 77.11 crore (GOI share 60%) released and 25549 seed villages organized and 59.17 lakh quintal seeds produced.

- ii. Availability of quality seeds has increased from 140.51 lakh quintals in 2005-06 to 380.30 lakh quintal during 2016-17 and Seed Replacement Ratio (SRR) of major crops has also increased significantly.
- iii. For creation of seed infrastructure facilities for public sector an amount of Rs.15.11 crore had been released and 1.02 lakh quintals of seed processing capacity and 7.05 lakh quintals of seed storage capacity created during 2015-16. During the year 2016-17, an amount of Rs 19.424 crore grant in aid was provided to create 1.45 lakh quintal seed processing capacity and 2.00 lakh quintal seeds storage capacity.
- iv. For certified seed production of oilseeds, pulses, green manures and fodder through Seed Village an amount of Rs. 1.326 crore has been released and 110 Seed Villages have been organized and total 0.267 lakh qtl. of certified seeds of these crops were produced during 2015-16. During 2016-17, an amount of Rs. 14.077 crore (GOI share 60%) was released for certified seed production of pulses, oilseeds, green manure and fodder through Seed Village programme. 1456 Seed Villages were organized and 2.18 lakhs qtls of certified seeds were produced.
- v. Under the component 'Transport Subsidy on movement of seeds to NE States', during the year 2015-16, an amount of Rs. 4.486 crore was reimbursed for movement of 1.921 lakh quintal of seeds. During 2016-17, an amount of Rs. 3.249 crore reimbursed for movement of 1.55 lakh quintal of seeds.
- vi. Under quality control component of SMSP, 6

seed testing labs including IARI, New Delhi and State Seed Certification Agencies has been strengthened. One seed testing lab and State Seed Certification Agencies and one Grow- Out Test facilities were upgraded.

- vii. Projects numbering 527 have been sanctioned under the component Assistance for Boosting Seed Production in private sector for the small entrepreneurs in 16 States with 131.37 lakh quintals seed processing capacity and storage capacity of 41.78 lakh quintals.

Initiatives Taken by National Seeds Corporation (NSC) to Facilitate Availability of Seeds to Farmers

5.24 National Seeds Corporation (NSC) Limited, a Schedule-B Central Public Enterprise, is under the administrative control of DAC&FW. During 2016-17, NSC earned Profit After Tax (PAT) of Rs. 51.80 crore as compared to Rs. 49.71 crore during 2015-16. During 2016-17, 21.47 lakh quintal seeds have been produced/ procured. NSC is undertaking seed production of more than 600 varieties/hybrids/lines including parental lines of about 60 crops consisting of cereals, millets, oilseeds, pulses, fodder, fibers, green manure, potato and wide range of vegetable crops. NSC has distributed 14.60 lakh quintals of seed in the country in 2016-17 and 3.95 lakh quintals of seed in Kharif 2017 season.

FERTILIZERS

5.25 The actual production of all fertilizers during the year 2016-17 was 414.40 lakh tonnes as against 413.14 lakh tonnes produced in 2015-16. The installed capacity of DAP & Complex Fertilizers during 2016-17 have reached a level of 146.00 LMT as against 144.04 LMT in 2015-16. The rapid build-

up of fertilizer production in the country has been achieved as a result of a favourable policy environment facilitating investments in the public, co-operative and private sectors.

5.26 The sector-wise installed/reassessed capacity of major fertilizers during 2016-17 in 30 large sized urea plants and 21 units of DAP and complex fertilizers are given in the **Table 5.4** below:

Table 5.4: Sector-wise Capacity of Fertilizer Manufacturing Units during 2016-17

(Fig. in Lakh Metric Tonnes)

S. No	Sector	Annual Installed/Reassessed Capacity	
		Urea	DAP & Complex Fertilizers
1	Public Sector	63.09	21.64
2	Cooperative Sector	54.19	43.35
3	Private Sector	90.26	81.01

Source: Department of Fertilizers

New Urea Policy-2015

5.27 The New Urea Policy-2015 (NUP-2015) was notified by the Department of Fertilizers on 25th May, 2015 with the objectives of maximizing indigenous urea production; promoting energy efficiency in urea production; and rationalizing subsidy burden on the government. The Policy is expected to prepare the domestic urea sector to become globally competitive in terms of energy efficiency over a period of three years. On the basis of actual energy consumption and pre-set norms, the units have been divided into three groups and revised energy consumption norms have been fixed for next three financial years and target energy norms have been fixed for 2018-19. It will drive the urea units to select better technology and different measures to reduce energy consumption.

5.28 NUP-2015 is effective from 1st June, 2015 to 31st March, 2019. NUP-2015 has led to additional production of approximately 20 LMT in the year 2015-16 over the production in 2014-15 from the existing plants and the total production of urea during

the year 2015-16 was 244.75 LMT, which is the highest ever urea production in the country.

Neem Coated Urea

5.29 Based on a Cabinet Committee on Economic Affairs (CCEA) decision, vide notification dated 25th May, 2015, Department of Fertilizers has made it mandatory for all the domestic producers of urea to produce 100% Neem Coated Urea with an extra MRP of 5% (of Rs. 5360/- per MT) to be charged by the fertilizer manufacturing entities from farmers. The entire quantity of indigenously produced urea and imported urea is being neem coated w.e.f. 1st September, 2015 and 1st December, 2015 respectively.

5.30 DAC&FW was entrusted to conduct a study to determine the impact of Neem Coated Urea. DACFW has submitted an interim study report prepared by Agricultural Development and Rural Transformation Centre (ADRTC), Bengaluru. The main findings of the study are as under:

- i. Improvement in soil health.

- ii. Reduction in costs with respect to plant protection chemicals.
- iii. Reduction in pest and disease attack.
- iv. Increase in yield of paddy to an extent of 5.79 per cent.
- v. Increase in yield of sugarcane to an extent of 17.5 per cent.
- vi. Increase in yield of maize to an extent of 7.14 per cent.
- vii. Increase in yield of soyabean to an extent of 7.4 per cent.
- viii. Increase in yield of tur/red gram to an extent of 16.88 per cent.
- ix. Diversion of highly subsidized urea towards

non-agricultural purposes negligible among farmers after the introduction of the mandatory policy of production and distribution of only neem coated urea.

Nutrient Based Subsidy (NBS) Policy

5.31 The Government of India is implementing the Nutrient Based Subsidy Policy w.e.f. 1.4.2010. Under the Policy, a fixed amount of subsidy, decided on annual basis, is provided on subsidized P&K fertilizers depending on their nutrient content. Under this Policy, MRP is fixed by fertilizer companies as per market dynamics (**Table 5.5**).

Table 5.5: Subsidy provided to the P&K Fertilizer Companies for the year 2017-18

S. No.	Nutrients	NBS (Rs. Per kg. of Nutrient)
1.	N	18.989
2.	P	11.997
3.	K	12.395
4.	S	2.240

Source: Department of Fertilizers

Policy on Promotion of City Compost

5.32 The Hon'ble Prime Minister in his Independence Day speech on 15th August, 2014 emphasized the need for improving general hygiene and cleanliness in the cities and villages. Government of India on 10.2.2016 notified a Policy on Promotion of City Compost. As per the policy notification, the Department of Fertilizers is providing Rs. 1500/- per MT as Market Development Assistance (MDA) for scaling up production and consumption of City Compost. A fund of Rs. 15 crore for this purpose has been allocated for the financial year 2016-17.

5.33 The processing and use of city waste as compost fully complements the “SWACHH

BHARAT ABHIYAN” campaign of Government of India. The compost, in addition to replenishing the low organic carbon in Indian soils, also has several physical, chemical and biological effects including the supply of micro plant nutrients and the reduction in nitrogen leaching while unlocking fixed phosphorus. The integrated use of optimal dose of nitrogen, phosphorus and potassium (NPK) in conjunction with organic manure ensures better yields in a sustainable manner and also corrects some of the secondary and micro-nutrient deficiencies.

5.34 Composting can reduce the volume of waste to landfill/dumpsite by converting the waste into useful by-products. This also prevents production of

harmful greenhouse gases (especially methane) and toxic material that pollutes groundwater apart from polluting the environment. City Waste composting would also generate employment in urban areas.

Direct Benefit Transfer (DBT) in Fertilizers

5.35 The Government has decided to introduce Direct Benefit Transfer (DBT) system for fertilizer subsidy payments. Under the proposed system, 100% subsidy on various fertilizer grades shall be released to the manufacturers and importers on the basis of actual sales made by the retailer to the beneficiaries. Initially, the modified subsidy

procedure under DBT system will be introduced on pilot basis in 16 select districts and after its due stabilization, the new payment system would be rolled out in all States in the second phase. The proposed DBT will address the issues relating to diversion and smuggling of urea.

Production, Import and Sales of Major Fertilizers

5.36 Production, Import and Sales of Major Fertilizers- Urea, DAP and Complex Fertilizers during 2015-16 and 2016-17 are given below (Table 5.6):

Table 5.6: Production, Import and Sales of Major Fertilizers-Urea, DAP and Complex Fertilizers during 2015-16 and 2016-17

(Lakh Tonnes)

Product Name	Production		Import		Sales	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
Urea	244.75	244.61	84.74	54.81	319.68	296.07
DAP	37.87	43.65	60.08	43.85	97.47	88.23
MOP	-	-	32.43*	37.36	24.23	28.21
Complexes	83.01	63.14	6.29	5.22	88.79	82.45

* Industrial use and agriculture use both

Source: Department of Fertilizers

Fertilizer Subsidy

5.37 The details of fertilizer subsidy released by the

Government during 2011-12 to 2016-17 are given in Table 5.7 below.

Table 5.7: Subsidy Released during 2011-12 to 2016-17

(Rs. in crore)

Year	Subsidy Released		Total subsidy disbursed
	Urea	P & K Fertilizers	
2011-12	37760.00	36809.00	74569.00
2012-13	40016.00	30576.00	70592.00
2013-14	41853.00	29427.00	71280.16
2014-15	54400.00	20667.00	75067.31
2015-16	54600.00	21937.56	76537.56
2016-17	51256.59	18842.87	70100.01*

* Also includes expenditure of Rs. 0.55 crore towards City Compost

Source: Department of Fertilizers

INTEGRATED NUTRIENT MANAGEMENT

5.38 Realizing the utmost importance of timely application of fertilizers in the right mix not just to improve agricultural productivity based on specific agro-climatic zones but also to conserve soil nutrients and water resources; and to improve cost efficiency in application of fertilizers, the Department of Agriculture, Cooperation and Farmers Welfare has been promoting soil-testing based balanced & judicious use of chemical fertilizers, bio-fertilizers and locally available organic manures, like Farm Yard Manure (FYM), vermi-compost and green manure to maintain soil health and its productivity.

5.39 In order to promote balanced fertilizer application, Government has been providing grant for setting up / strengthening of soil testing laboratories, training and demonstrations on balanced use of fertilizers and promotion of micro-nutrients across various Plan periods. By March 2017, there are 1414 Soil Testing Laboratories with analyzing capacity of 195.27 lakh samples per annum.

5.40 Following measures are under implementation by Government for promotion of balanced use of fertilizers.

- (i) **Soil Health Management (SHM):** Soil Health Management (SHM) component under National Mission for Sustainable Agriculture (NMSA) is under implementation in 12th Plan Period to promote soil test based balanced use of fertilizers through setting up / strengthening of soil testing laboratories, training and demonstrations on balanced use of fertilizers.

- (ii) **Soil Health Card (SHC) Scheme:**

Introduced in year 2014-15, Soil Health Card Scheme is to assist State Governments in issuing soil health cards to all farmers in the country. Soil health card provides information to farmer on nutrient status of their soil along with recommendation on appropriate dosage of nutrients to be applied for improving soil health and its fertility. The unique features of the Soil Health Card Scheme are as follows:-

- (a) Uniform approach to collection of soil samples using GPS based soil sampling and testing at the laboratories which tests the soil for 12 soil health parameters, viz., Primary nutrients (NPK) secondary nutrients (S); micronutrients (B, Zn, Mn, Fe & Cu); and others (pH, EC & OC). Analysis of secondary and micronutrients has been made mandatory.
- (b) Universal coverage of all the farm holding in the country.
- (c) Fertilizer recommendation based on crops as against general recommendations.
- (d) Issue of Soil Health Cards after every two years so that nutrient deficiencies are identified and amendments applied.

- (iii) **Soil Health Card Portal:** A single national database on soil health called Soil Health Card portal is being built for registration of soil samples, recording test results of soil samples, generation of Soil Health Card (SHC) along with Fertilizer Recommendation and storehouse of data for future use in research and planning. This single, generic, uniform and web based software is accessible at the URL www.soilhealth.dac.gov.in . The

system has sample tracking feature and will provide alerts to farmers about sample registration and generation of Soil Health Card through SMS and Email.

Assessment of Requirement of Chemical Fertilizers

5.41 To ensure adequate availability of fertilizers, DAC&FW organizes Zonal Conferences before each cropping season to assess requirement of fertilizers of all the States. Initial projection of requirement of fertilizers for specific cropping season is made by State government on the basis of cropping pattern, consumption pattern, cropped area, irrigated area, requirement of nutrient in soil as per soil health status, etc.

5.42 After consultation with States, Department of Fertilizers and Lead Fertilizer suppliers, etc., the total requirement for each State is assessed for the season. The States prepare month-wise requirement and the same is sent to Department of Fertilizers. A monthly supply plan based on the month-wise requirement is made by Department of Fertilizers for all States. This supply movement is jointly monitored by DAC&FW and Department of Fertilizers along with the States through weekly video-conference. Year-wise consumption of fertilizers in India in terms of nutrients is given in **Table 5.8**.

Table 5.8: Consumption of Fertilizers in India (NPK Nutrients, lakh tonnes)

S.No.		1991-92	2000-01	2012-13	2013-14	2014-15	2015-16	2016-17
1	Nitrogenous (N)	80.46	109.2	168.21	167.50	169.46	173.72	167.35
	Phosphatic (P)	33.21	42.15	66.53	56.33	60.98	69.79	67.05
	Potassic (K)	13.61	15.67	20.62	20.99	25.32	24.02	25.08
	Total (N+P+K)	127.28	167.02	255.36	244.82	255.76	267.53	259.49
2.	Consumption of NPK, (Kg/Ha)	69.84	89.63	131.36	118.49	127.45	130.66	123.41

Source: DAC&FW (Based on inputs from State Governments)

Major Schemes for Promotion of Organic Farming Paramparagat Krishi Vikas Yojana (PKVY)

5.43 Government of India is promoting organic farming across the country through the dedicated scheme of Paramparagat Krishi Vikas Yojana (PKVY) from 2015 under National Mission for Sustainable Agriculture (NMSA).

5.44 Under the Scheme, financial assistance is provided towards cluster formation, mobilization of

farmers, PGS (Participatory Guarantee System) certification and quality control, residue analysis of samples in NABL (National Accreditation Board for Testing and Calibration Laboratories), conversion of land to organic farming, establishment of production units (Pachagavya/Beejamruth/Jeevamruth), green manuring/ biological nitrogen harvest planting, botanical abstracts production units, liquid biofertilizers, liquid biopesticides, Phosphate Rich

Organic Manure (PROM), establishment of vermi-compost unit, supply of improved agricultural implements, transportation of organic products, packaging, labeling and branding of organic products etc. Under the Scheme, an area of 2 lakh ha is targeted to be covered under organic farming from 2015-16 to 2017-18.

Status of Scheme

5.45 The Annual Action Plan of 29 States and 1 Union Territory was approved with total outlay for Rs. 511.67 crore to develop 7186 clusters out of which Rs.226.18 crore was released during 2015-16. To achieve the target 10,000 clusters, Rs 143.75 crore

has been allocated to the states to develop 2814 clusters during the 2016-17. The scheme is implemented with a 90:10 (GoI: State Govt.) funding pattern in 8 NE states and 3 hilly states of J&K, Himachal Pradesh, and Uttarakhand, 100% in Union Territory and 60:40 funding pattern in remaining States of the country. During 2016-17, Rs 200 crore RE has been allocated for the Scheme, total amount of Rs 121.92 crore has been released to 20 States. The States of Meghalaya, Mizoram, Uttarakhand, Rajasthan, Tripura, and Uttar Pradesh are performing better in implementation of Scheme. For 2017-18, an allocation of Rs. 350 crore has been made for the Scheme.

Table 5.9: The State-wise Release of funds during 2016-17 (upto 15.02.2017)

(Rs. in lakh)

S.No.	State	No. of Clusters	Approved Outlay	Funds Released
1	Andhra Pradesh	411	2933.75	798.17
2	Chhattisgarh	188	1341.96	314.78
3	Gujarat	100	713.81	238.83
4	Jharkhand	100	713.81	203.13
5	Karnataka	545	3890.26	815.27
6	Madhya Pradesh	880	6281.51	1787.60
7	Odisha	320	2284.18	650.03
8	Rajasthan	755	5274.86	1491.12
9	Telangana	300	2141.42	448.77
10	Bihar	327	2334.15	664.26
11	Haryana	20	142.76	45.98
12	Tamil Nadu	112	799.46	137.70
13	Tripura	50	356.90	308.83
14	Jammu & Kashmir	28	199.87	87.81
15	Uttar Pradesh	575	4104.39	1270.64
16	West Bengal	120	856.57	393.66
17	Meghalaya	45	321.21	296.00
18	Arunachal Pradesh	19	137.08	81.08
19	Mizoram	34	237.54	138.65
20	Uttarakhand	550	3925.94	2019.4
	Total (All-India)	5479	38991.43	12191.71

Source: Department of Agriculture, Cooperation & Farmers Welfare

Mission Organic Value Chain Development for North Eastern Region

5.46 Realizing the potential of organic farming in the North Eastern Region of the country, Ministry of Agriculture and Farmers Welfare has launched a Central Sector Scheme entitled “**Mission Organic Value Chain Development for North Eastern Region**” for implementation in the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura, during 2015-16 to 2017-18. The Scheme aims at development of certified organic production in a value chain mode to link growers with consumers and to support the development of entire value chain starting from inputs, seeds, certification, to the creation of facilities for collection, aggregation, processing, marketing and brand building initiative. The Scheme was approved with an outlay of Rs. 400 crore for three years.

5.47 The assistance is provided for cluster development, on/off farm input production, supply of seeds/ planting materials, setting up of functional infrastructure, establishment of integrated processing unit, refrigerated transportation, pre-cooling /cold stores chamber, branding labeling and packaging, hiring of space, hand holdings, organic certification through third party, mobilization of farmers/processors, etc. Under the Scheme, area of 0.50 lakh ha. has been targeted to be covered under

organic farming in North Eastern Region of the country from 2015-16 to 2017-18.

Status of Scheme

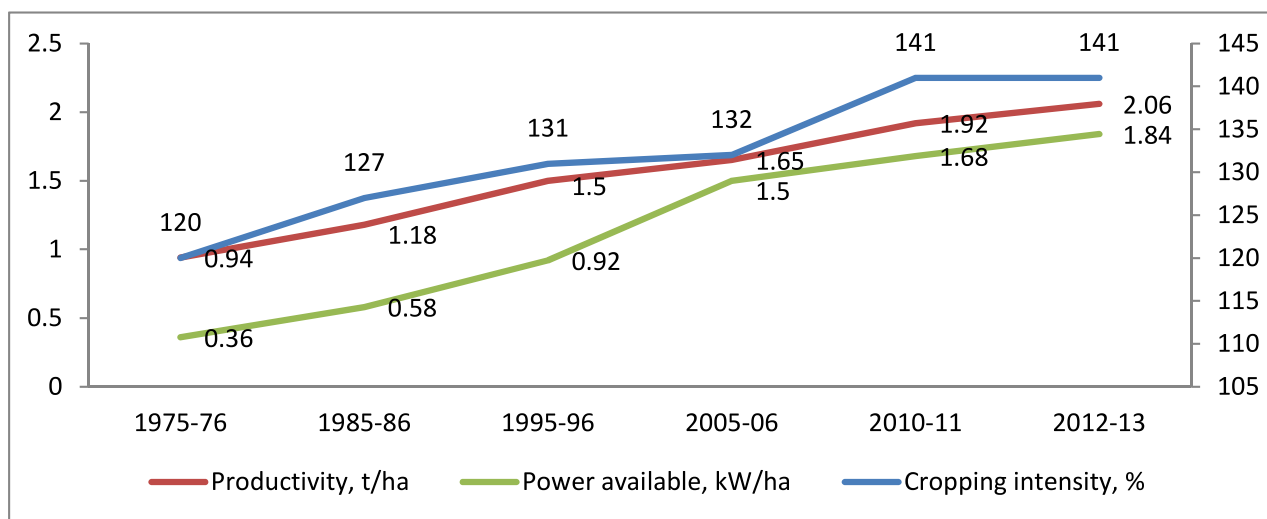
5.48 An amount of Rs. 158.86 crore was allocated to the north eastern states during 2015-16 and for 2016-17 and 2017-18 the allocation was made as Rs. 100 crore respectively. During 2015-16 an amount of Rs. 112.11 crore has been released to the States and Rs. 47.63 crore has been released during 2016-17. During the 2017-18, an amount of Rs. 34.26 crore has been released to States (upto December 2017).

5.49 Under the Scheme, there is a target to form 100 Farmers Producer Companies (FPCs) which would cover 2500 Farmers Interest Groups (FIGs), 50000 ha area and 50000 farmers. Against this target, 2406 FIGs have been formed covering an area of 45863 ha and 44604 farmers in eight North-Eastern States and 79 Farmers Producer Companies have been registered till December 2017.

MECHANIZATION & TECHNOLOGY

5.50 Noting the positive co-relationship between improvement in cropping intensity and farm produce on the one hand and growth of farm power on the other during the last 40 years, the adoption and application of package of farm machinery and technology for agricultural mechanization assumes significant importance (**Figure 5.1**).

Figure 5.1: Farm power availability and average yield of foodgrains and cropping intensity in India during 1975- 2012

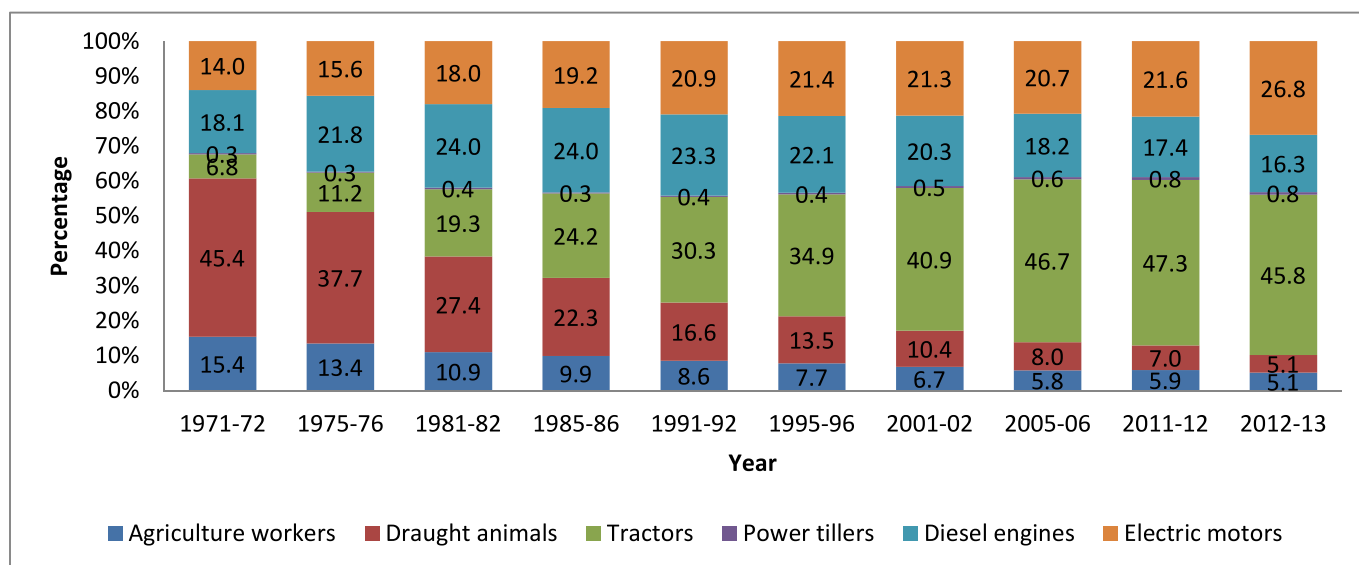


Source: Trends of Agricultural Mechanization in India, CSAM Policy Brief, June 2014, CIAE Bhopal

5.51 Major sources of farm power in Indian agriculture are agricultural workers, draught animals, tractors, power tillers, diesel engines and electric motors. The combined share of agricultural workers and draught animals in total farm power

availability in India has reduced over the years and that of tractor and electric motor in farm power availability has increased over the same time (Figure 5.2).

Figure.5.2: Percentage Availability of farm power from different farm power resources 1971-72 to 2012-13



Source: Trends of Agricultural Mechanization in India, CSAM Policy Brief, June 2014, CIAE Bhopal

5.52 The steady increase in farm mechanization over the years is evident from the sale of tractors and power tillers, taken as an indicator of the adoption of

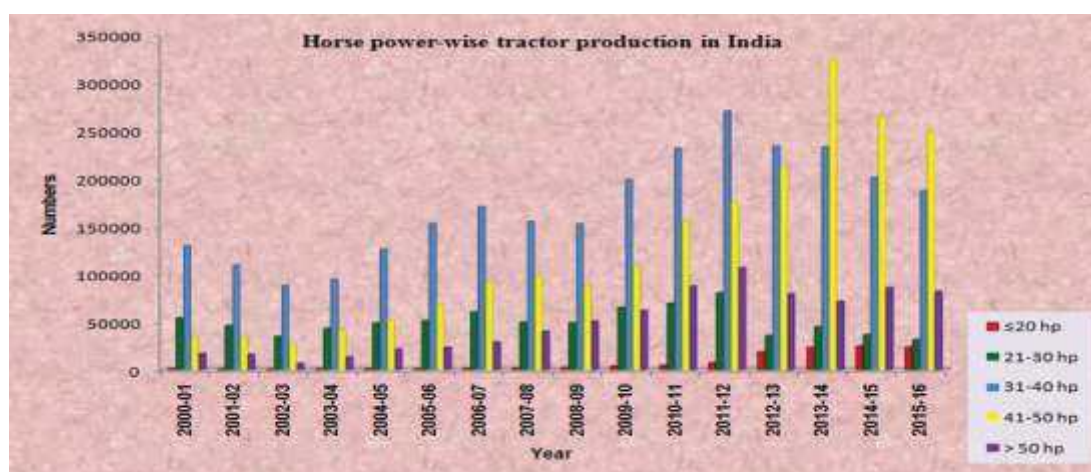
the mechanized means of farming. Year-wise sale of tractors and power tillers during the last five years is given below in **Table 5.10 and Figure 5.3.**

Table 5.10: Year-wise Sale of Tractors and Power Tillers

Year	Tractor Sales (Nos.)	Power tiller Sale (Nos.)
2004-05	2,47,531	17,481
2005-06	2,96,080	22,303
2006-07	3,52,835	24,791
2007-08	3,46,501	26,135
2008-09	3,42,836	35,294
2009-10	3,93,836	38,794
2010-11	5,45,109	55,100
2011-12	5,35,210	60,000
2012-13	5,90,672	47,000
2013-14	6,96,828	56,000
2014-15	5,51,463	46,000
2015-16	6,26,839	48,882
2016-17	5,80,000	45,200

Source: ICAR

Figure 5.3: Percentage sale of different range of Tractors of their total sale



Source: Agricultural research Data Book-2016, IASRI (ICAR)

Sub-Mission on Agricultural Mechanization (SMAM)

5.53 The Sub-Mission on Agricultural Mechanization (SMAM) is providing a suitable platform for converging all activities related to agricultural mechanization by providing a 'single window' approach for implementation with accelerated and inclusive growth of agricultural mechanization in India. The Scheme is being implemented in all the States, to promote the usage of farm mechanization and increase the ratio of farm power to cultivable unit area up to 2 kW/ha by the end of 12th plan. The main objectives of SMAM is to increase the reach of farm mechanization to small and marginal farmers and to the regions where availability of farm power is low, promoting 'Custom Hiring centers' to offset the adverse economies of scale arising due to small landholding and high cost of individual ownership, creating hubs for hi-tech & high value farm equipments, creating awareness among stakeholders through demonstration and capacity building activities and ensuring performance testing and certification at designated testing centers located all over the country.

5.54 There are four Farm Machinery Training & Testing Institutes (FMTTIs) in the country {located at Budni (Madhya Pradesh), Hissar (Haryana), Garladinne (Andhra Pradesh) and Biswanath Chariali (Assam)} which conduct in-campus courses of different durations on correct operational techniques, maintenance, repair and management of agricultural machinery for different categories of personnel ranging from actual user owners, technicians, and rural artisans, under graduate, engineering students, government nominees, representative of machine manufacturers, defense personnel and foreign nationals. Institutes also conduct off-campus training

programmes and undertake demonstration of newly developed agricultural/horticultural equipments and post-harvest technology, at farmers' fields.

5.55 The Farm Machinery Training and Testing Institute at Budni is authorized to conduct commercial tests on tractors and other agricultural machines as per relevant BIS test codes besides conducting the testing of tractors and power tillers under CMV Rules 1989. CFMTTI is also National designated authority for testing of tractors as per OECD codes. The institute at Hisar, conducts commercial tests on self-propelled combine harvesters, plant protection equipments, agricultural implements and other machines as per relevant BIS codes and authorized to issue the CMVR certificate in respect of the combined harvesters under CMVR 1989. The Institute at Garladinne is authorized to test power tillers and also conduct tests on various agricultural implements & equipments. The institute at Biswanath Chariali (Assam) tests bullock drawn implements, manually operated equipment, tractor drawn implements, self propelled machines and small hand tools. During the financial year 2016-17, the four FMTTIs altogether have tested 358 machines of various categories, including tractors, power-tillers, combine harvesters, and other machinery and equipments, till 31st March, 2017 against the target of 165. During 2017-18, total 239 farm machines have been tested till 31st December, 2017 against the annual target of 165 machineries.

5.56 To cope up with the ever increasing demand of testing of agricultural machines and equipments, DAC&FW has designated 31 testing centers at State Agricultural Universities (SAUs), ICAR Institutions and State Agricultural Departments as Authorized Testing Centers to test selected type of agricultural

machinery and equipments under different categories of farm machinery. Relevant information has been made available on the departmental website <http://farmech.dac.gov.in> for wider publicity among the users/manufacturers and other stakeholders. Central Institute of Agricultural Engineering (CIAE), Bhopal and Punjab Agricultural University (PAU), Ludhiana has been designated as authorized testing centers in addition to FMTTI, Hisar and Budni to test tractor mounted combine harvesters. Central Institute of Agricultural Engineering (CIAE), Bhopal and Junagarh Agricultural University (JAU), Junagarh, Farm Machinery Testing, Training and Production Centre, Department of FM&P, Dr. PDKV, Akola, Maharashtra, College of Agricultural Engineering and Technology, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli Maharashtra, has

been designated as authorized testing centers in addition to FMTTI, Hisar to test plant protection equipments. Central Institute of Post harvest Engineering and Technology (CIPHET), Ludhiana and SLFMT&TC, Agricultural Department, Government of Odisha, Bhubaneswar, have been designated as authorized testing centers for testing all types of post harvest technology equipments and machinery.

Progress during 12th Five Year Plan

5.57 The targets and achievements in respect of the Central Sector and Centrally Sponsored Schemes implemented by DAC&FW through respective State governments during the 12th Five Year Plan are presented as below (Table 5.11, 5.12, 5.13, 5.14, 5.15).

Table 5.11: Promotion and Strengthening of Agricultural Mechanization through Training, Testing and Demonstration

Quantifiable Activities of Scheme	2012-13		2013-14	
	Targets	Achievements	Targets	Achievements
Trainees trained At FMTTIs(Nos.)	6000	6445	6000	6671
Trainees trained through outsourcing (Nos.)	2000	4785	2000	5080
Holding of demonstrations (Nos.)	4000	16028	4000	29282
Testing of Machines (Nos.)	165	199	165	223

Source: Department of Agriculture, Cooperation & Farmers Welfare

Table 5.12: Post Harvest Technology and Management (PHTM)

Quantifiable Activities of Scheme	2012-13		2013-14	
Establishment and transfer of technology, value addition, scientific storage and packaging unit in production catchment/supply of PHT equipments (nos.)	950	1128	950	1846
Demonstration of PHT Technology (nos.)	4000	4808	4000	7649
Training of farmers through outsourcing(nos.)	4000	3450	4000	1505

Source: Department of Agriculture, Cooperation & Farmers Welfare

Table 5.13: Physical Achievements as on 31.10.2016 during 12th Five year Plan (2014-15 onwards)

Name of the Scheme	Components	Unit	Achievements		
			2014-15	2015-16	2016-17 till October 2016
Sub Mission on Agricultural Mechanization wef. 1 April,2014	Demonstration of Equipment at farmers fields	ha.	3249	11704	Not implemented
	Training of framers, users and stakeholders	Nos.	6773	7545	6272
	Performance Testing of Equipment	Nos.	260	349	221
	Strengthening of ICAR institutes/SAU for equipments for testing	Nos.	7	1	1
	Procurement Subsidy for Agriculture Machinery and Equipment	Nos.	69330	87545	92670
	Establish Farm Machinery Banks for Custom Hiring	Nos.	663	268	699
	Establishing Hi-Tech Productive Equipment Centres to Target Low Productive Agricultural Regions.	Nos.	16	13	16
	Promotion of farm mechanization in selected villages	Nos.	384	218	554
	Promotion of farm machinery and equipment in north eastern region	Nos.	524	532	1194

Source: Department of Agriculture, Cooperation & Farmers Welfare

Table 5.14: Financial Target and Achievement during 12th Five Year Plan

(Rs. in lakhs)

Scheme	2012-13		2013-14		2014-15		2015-16		2016-17 (as on 31.10.2016)	
	Targets	Achievements	Targets	Achievements	Targets	Achievements	Targets	Achievements	Targets	Achievements
Promotion and Strengthening of Agricultural Mechanization through Training, Testing and Demonstration. (nos.)	1100	1208	1952	2111.99	Promotion and Strengthening of Agricultural Mechanization through Training, Testing and Demonstration and Post Harvest Technology and Management (PHTM) merged into Submission on Agricultural mechanization wef. 1 April 2014					
Post Harvest Technology and Management (PHTM) (nos.)	1200	1200	1700	1936.52						
Submission on Agricultural mechanization (nos.)					1957	18129.24	1775	15174	15500	14400

Source: Department of Agriculture, Cooperation & Farmers Welfare

Table 5.15: Funds released to different States/Organizations during 12th Five Year Plan for the scheme of Promotion and Strengthening of Agri. Mechanization/ Post-Harvest Technology and Management/ SMAM

Total Funds released (Rs. In crore)						
2012-13		2013-14		2014-15	2015-16	2016-17
Promoti on and strengthen ing of agri. Mechan ization	Post - harvest technolog y and managem ent	Promotion and strengthen ing of agri. Mechanizat ion	Post - harvest technolog y and managem ent	Sub Mission On Agricultural Mechanizati on (SMAM)	Sub Mission On Agricultural Mechanizatio n (SMAM)	Sub Mission On Agricultural Mechanization (SMAM) (Allocation)
12.08	12.00	19.12	19.37	181.35	151.74	163.00

Source: Department of Agriculture, Cooperation & Farmers Welfare

Achievements under Mechanization in SMAM of DAC&FW since 2014-15

5.58 Under SMAM, Rs. 477.04 crore has been released to State Governments for assistance for establishment of 72032 nos. Farm Machinery banks,

including custom hiring centers and Hi-Tech hubs, distribution of 2,47,321 agricultural machinery and tools to farmers. Some of the latest techniques developed/ machinery used are shown below.



Self Propelled Paddy Trans-planter



Sugarcane Harvester



Self propelled Vertical conveyor reaper



Baler



Coconut tree Climber



Raised bed Planter



Coconut tree Climber



Raised bed Planter



Laser land leveler



Aero Blast Sprayer for tall crops, and trees

PLANT PROTECTION AND PLANT QUARANTINE

5.59 With a view to keep crops disease free using scientific and environmental friendly techniques, Government is implementing Sub- Mission on Plant Protection and Plant Quarantine (SMPP), which is one of the Sub-Missions under National Mission on Agricultural Extension and Technology.

5.60 The primary aim of the Sub-Mission is to

minimize loss to quality and yield of agricultural crops from the damage of insect pests, diseases, weeds, nematodes, rodents, etc., and to shield our bio-security from the incursions and spread of alien species. The Mission also seeks to facilitate export of Indian agricultural commodities to global markets and to promote good agricultural practices, particularly with respect to plant protection strategies and techniques. In this regard, the destructive Insect

and Pests Act, 1914 and the Insecticides Act, 1968 provide the legal framework for the regulatory function. The Sub-Mission has four major components: (i) Strengthening and Modernization of Plant Quarantine Facilities (SMPQF); (ii) Strengthening and Modernization of Pest Management Approach (SMPMA); (iii) Monitoring of Pesticide Residues at National Level (MPRNL); and (iv) National Institute of Plant Health Management (NIPHM).

i) Strengthening and Modernization of Plant Quarantine Facilities (SMPQF)

5.61 The objective of Plant Quarantine primarily is to prevent introduction of exotic pests, diseases and weeds which are likely to be introduced through import of agricultural commodities or plant material into India and similarly fulfill obligation of the International Plant Protection Convention (IPPC) carrying out phytosanitary certification to prevent introduction of pests, diseases and weeds in other countries through exports of such material.

5.62 The Plant Quarantine (Regulation Import into India) Order, 2003 issued under provisions of Destructive Insect and Pest Act, 1914 (DIP Act) regulates imports. Post entry quarantine inspection is undertaken in case of propagating plant material. Phytosanitary Certificates (PSC) are issued for exports as per International Plant Protection Convention (IPPC), 1951 of the Food and Agricultural Organization (FAO). These functions are being discharged by 57 Plant Quarantine Stations (PQS) functioning under Directorate of Plant Protection Quarantine & Storage (DPPQ&S), Faridabad at various international airports, seaports and land customs stations across the country to

facilitate international trade in agricultural products. To bolster the Plant Quarantine infrastructure, 16 new Plant Quarantine Stations have been proposed at the notified points of entry.

5.63 During 2017-18, Pest Risk Analysis (PRA) of 50 agricultural commodities was carried out, technical information provided for export of 35 commodities to the 10 concerned National Plant Protection Organizations. 78,915 Import Release Orders (IROs) were issued for seed and plant material and screening of 111 lakh metric tonnes of imported agricultural commodities was undertaken. Phytosanitary inspection for export of 153 lakh metric tonnes of plant and plant materials was conducted and 2,38,870 Phytosanitary Certificate (PSC) issued. 604 Pest Control Agencies have been accredited for undertaking fumigation with methyl bromide as on 31.10.2017 including 27 new agencies and 453 agencies have been accredited for Forced Hot Air Treatment (FHAT) for wood and wood packing material including 35 new agencies.

5.64 Further, 439 Pest Control Agencies have been accredited for undertaking fumigation with Aluminium Phosphide under NSPM-22 including 36 new agencies. In addition to the above, 111 Rice Processing Mills for export of Rice to USA and 42 for China & 67 units for peanut Processing and 32 pack houses for fresh fruit and vegetables have been registered to ensure pest free export of agri commodities to the foreign countries. Pest interception recorded in imported commodities from various countries into India during 2017-18 are *Aonidiellaaurantii*, *Pseudococcuscomstocki*, *Callosobruchuschinensis*, *Cladosporium paraclado sporoides*, *Apatemonachus*, *Lyctodermacoomani*,

Silvanus bidentatu, *Trogoxylonparallelipedum*, *Trogoxylonaequale*, *Xylionadustus*, *Xylothrips flavipes*, *Gnatocercuscornutus*, *Lepidosaphesbeckii* & *Diplodiaseriata*, in RPQS, Chennai; *Lyctusbrunneus* & *Silvanus bidentatus* in Tuticorin Plant Quarantine Station; *Ahasverusadvena*, *Oriusspand* & *C. solstitialis* in RPQS, Kolkata.

ii) Strengthening and Modernization of Pest Management Approach (SMPMA)

5.65 Integrated Pest Management (IPM) is an eco-friendly approach, which aims at keeping pest below economic thresholds level by employing all available alternate pest control methods and techniques such as cultural, mechanical and biological control with greater emphasis on use of bio-pesticides and pesticides of plant-origin like Neem formulations. The use of chemical pesticides is advised as a last resort when pest crosses economic threshold level (ETL). IPM related activities are being implemented through 35 Central Integrated Pest Management Centers (CIPMCs) located in 29 States and 01 Union Territory. These activities are funded under Central Sector Plan Scheme “Strengthening and Modernization of Pest Management Approach (SMPMA)”.

5.66 IPM activities are propagated through Farmers Field Schools (FFSs). This is a form of adult education evolved from the concept that farmers learn optimally from field observations and experimentation. FFSs are organized to help farmers tailor IPM practices to suit their needs. These schools are conducted separately for the kharif and rabi seasons each FFS lasting 14 weeks. During 2017-18 (up to December), 480 FFSs were conducted in which 14,400 farmers were trained. Apart from

conducting FFS, the CIPMCs carry out pest/disease monitoring and conservation, production and release of bio-control agents. Pest and disease situation have been surveyed in 7.00 lakh hectares. 16.50 crore bio-control agents were mass produced in laboratories and released against targeted insect-pests in various crops. Augmentation and conservation was taken up in 725.00 thousand hectares. Under short duration HRD programme total 68 (two days) and 6 (five days) programmes were also organized. 02 numbers of Season Long Training Programmes (SLTPs) were also organized in coconut and apple crop through which 80 Master Trainers were trained. Eighty-seven (87 Nos.) IPM Packages of practices for pest/diseases management in major crops have been developed in collaboration with NIPHM, Hyderabad and NCIPM, New Delhi. The revised IPM Packages of practice have also been circulated to State Department of Agriculture/ horticulture/ICAR Institutions/State Agriculture Universities & all States/UTs. These packages have already been uploaded in the DPPQS and DAC&FW websites as well as on farmers' portal.

5.67 Seed treatment and Grow Safe Food (GSF) were also taken up. Seed treatment is the application of chemical and biological agents on seeds to control primary soil and seed borne infestation of insects and diseases, which are serious threats to crop production. Since 2006, seed treatment campaign is taken up every year by DAC&FW during kharif and rabi seasons involving State Departments of Agriculture and CIPMCs. Similarly, GSF campaign has been taken up on large scale to avoid misuse of chemical pesticides in agriculture. Farmers and pesticide dealers are being sensitized through display

of hoardings and distributing literature. Special surveys were conducted by special teams constituted by DAC&FW comprising officers / officials from Central Government, CIPMCs, State Department of Agriculture, SAUs and ICAR on various crop pest, like wheat blast in West Bengal, Pink boll worm and white fly in Maharashtra, Andhra Pradesh, Gujarat, Karnataka, Punjab and Telangana, Army worm in Odisha, Assessment of pesticide poisoning in Yavatmal in Maharashtra etc. Besides, Department has organized various Krishi Melas and Seminars, viz., Exhibition cum Seminar in Mathura, Krishi Unnati Mela in New Delhi, Bundelkhand Sarjan in Teekamgarh, Raipur, etc.

Implementation of Insecticides Act, 1968

5.68 The Insecticides Act, 1968 regulate import, manufacture, sale, transportation, distribution and use of insecticides with a view to prevent risk to humans or animals, and for matters connected therewith. Registration Committee, constituted under Section 5 of the Act, is empowered to register the pesticides/insecticides under Section 9 of the Act after verifying its efficacious and safe for use by farmer. In order to bring about greater transparency and efficiency in the process of registration of pesticides, online registration of insecticides has been partially operationalized. The system enables partial online filing of applications for registration in all categories, viz., under section (4)/9 (3B)/9(3)/ Export/Endorsements. The Certificates of Registration under section 9(4) along with label and leaflets are being generated from the database of 9(3) in Computerized Registration of Pesticides (**CROP**) Software. Label/leaflets of pesticides containers have been revised to facilitate farmers for safe use of pesticide.

iii) Monitoring of Pesticide Residues at the National Level

5.69 This Scheme was launched in 2005, as a Central Sector Scheme to collect, collate and analyze data and information on a centralized basis, on prevalence of pesticide residues in agricultural products at farm-gate and market yards. Samples of agricultural commodities and food commodities, including animal produce are drawn and analyzed in 25 participating laboratories of Central Government and Agricultural Universities. All the participating laboratories are accredited by National Accreditation Board for Testing and Calibration of Laboratories (NABL) in the field of pesticide residue analysis as per ISO/IEC 17025:2005. The pesticide residue data generated is shared with concerned State Governments for corrective action for judicious and proper use of pesticides on crops with an integrated pest management approach.

iv) National Institute of Plant Health Management

5.70 National Institute of Plant Health Management (NIPHM) as a part of its mandate has trained around 1300 agricultural field functionaries and farmers in the past 6 months, apart from research and extending technology support to the farmers and other functionaries at various levels from across the country. During the year 2017-18 (for the period from April to December, 2017), 103 regular training programs were conducted, wherein 1156 and 756 officers and farmers were trained respectively.

5.71 Various initiatives were taken up as part of capacity building training programmes under IPM model village project, which is approved by the Tamil Nadu State Planning Commission. Around 300 farmers from Tamil Nadu were trained under this

initiative. As part of CROPSAP project, 73 participants from Maharashtra were trained in field diagnosis for Integrated Pest Management. NIPHM has become the first All India Coordinated Research Project (AICRP - Nematology) Centre on Nematodes in Telangana State. As a part of the DAC&FW Project on “Impact of Indiscriminate use of chemical fertilizers and pesticides”, a review meeting of the project was conducted on 28th and 29th June, 2017 and the work done report for the rabi 2016 was presented by the project implementation Universities.

5.72 NIPHM, in collaboration with MANAGE is implementing the District Pest Management Plan (DPMP), which is a district specific pest management plan developed with an aim to bring convergence between the different agencies to disseminate the timely control measures for tackling various constraints caused by pests and diseases of important crops, viz., Paddy, Cotton and Chilli in the case of Warangal urban and Warangal rural districts. As part of the project, functionaries from NIPHM conducted around 50 field visits and disseminated 85 weekly SMS messages to the farmers and functionaries. NIPHM, as one of the participating centers under the National Project on “Monitoring of pesticide Residues at National Level” has analyzed 1107 samples sent to CIPMC, Hyderabad and Bhubaneshwar during the period. 19.55% samples were detected with pesticide residues and 1.58% of samples were detected with residues above MRLs. During the period, 106 pesticide formulation samples were received and analyzed for active ingredient and other parameters and 10 microbial bio-pesticide samples from various insecticide inspectors.

5.73 NIPHM has developed a modified low cost

“Burrow Smoke Generator” to control rodent pest at farmers' fields. Research on development of alternative fumigation treatment to Methyl Bromide for pulses, wheat and wood is apace resulting in some encouraging observations being recorded. Project studies on Distribution Pattern of rodents in three agro-climatic zones of Telangana and Andhra Pradesh using geo spatial tools is under process with collaboration of ICAR. A two-day National Workshop on “Weed Risk Assessment” was organized at NIPHM on 30th and 31st August 2017 with the objective to analyze current status of invasive alien plants and their impacts, importance of WRA w.r.t. international trade and SPS issues.

5.74 NIPHM, for the first time has conducted “Feed The Future India Triangular Training (FTF ITT) International Training Program on “Plant Health Management Technologies and Approaches” in collaboration with MANAGE and USAID. A total of 24 executives from 10 countries participated in the programme conducted from 04th – 18th September 2017. DAC&FW, Government of India in collaboration with Department of Agriculture and Water Resources, Government of Australia has organized a three-day training program on “Managing Biosecurity Treatment Systems” at NIPHM from 07-08-2017 to 09-08-2017. The aim of the program is to promote increased trade in agricultural commodities by improving biosecurity treatment methods that may be required by importing countries.

AGRICULTURAL CREDIT

5.75 Agriculture is a dominant sector of our economy and credit plays an important role in increasing agriculture production. Availability and

accessibility to adequate, timely and low cost credit from institutional sources is of great importance especially to small and marginal farmers. Along with other inputs, credit is essential for establishing sustainable and profitable farming systems. Studies have shown that easy access to financial services at affordable cost positively affects the productivity, asset formation, and income and food security of the rural poor.

5.76 The Government of India has taken several policy measures to improve the accessibility of farmers to the institutional sources of credit. The emphasis of these policies has been on progressive institutionalization for providing timely and adequate credit support to all farmers with particular focus on small and marginal farmers and weaker

sections of society to enable them to adopt modern technology and improved agricultural practices for increasing agricultural production and productivity. These policy measures have resulted in significant increase in the share of institutional credit. Agricultural credit flow has increased consistently over the years and it reached Rs.10,65,756 crore against the target of Rs. 9,00,000 crore during 2016-17. The agriculture credit target for the year 2017-18 has been fixed at Rs. 10,00,000 crore and the achievement against this target till November, 2017 is Rs. 7,60,339.22 crore. Progress in regard to flow of agricultural credit against target set through different agencies during the last few years is given below (Table 5.16):

Table 5.16: Progress in regard to flow of agricultural credit against target

(Rs. Crore)

Year	Cooperative Banks		Commercial Banks		Regional Rural Banks	
	Target	Achievement	Target	Achievement	Target	Achievement
2011-12	69500	87963	355000	368616	50500	54450
2012-13	84000	111203	420000	432491	71000	63681
2013-14	125000	509005	475000	119964	100000	82652
2014-15	140000	138470	540000	604376	120000	102483
2015-16	140000	153295	590000	604971	120000	119261
2016-17	150000	142758	625000	799781	125000	123216
2017-18*	156000	97862	704000	567512	140000	94965

*Achievement figures are upto November, 2017

Source: Department of Agriculture, Cooperation & Farmers Welfare

Interest Subvention Scheme

5.77 From Kharif 2006-07 onwards, the Government has been providing to farmers short-term crop loans upto Rs.3 lakh at 7% rate of interest. Government has introduced additional interest subvention since 2009-10 as an incentive to

encourage farmers to repay their crop loans on time. Since 2011-12, the Government has increased the additional interest subvention from 1% to 3%. Thus, the effective rate of interest for such farmers becomes 4 percent per annum. During 2016-17, the DAC&FW released a sum of Rs.13,397.13 crore to RBI/

NABARD, the implementing agencies for settling the claims under the Interest Subvention Scheme. For the year 2017-18, the Government has allocated a sum of Rs.15,000 crore for settling the claims under the Scheme against which an amount of Rs.10,233

crore has been released to RBI/NABARD for settlement of audited claims under the scheme (as on 20-11-2017). The year-wise release of funds under the Interest Subvention Scheme (**Table 5.17**) is as follows.

Table 5.17: Year-wise release of funds under Interest Subvention Scheme

Year	Rs. Crore
2014-15	6,000.00
2015-16	13,000.00
2016-17	13397.13
2017-18	10233*

Source: Department of Agriculture, Cooperation & Farmers Welfare

Kisan Credit Card Scheme

5.78 In order to ensure that all eligible farmers are provided with hassle free and timely credit for their agricultural operation, Kisan Credit Card (KCC) scheme was introduced for marginal farmers, share croppers, oral lessee and tenant farmers. The main objectives of the Scheme are to meet the short term credit requirements for cultivation of crops; post harvest expenses; produce marketing loan; consumption requirements of farmer household; working capital for maintenance of farm assets and activities allied to agriculture like dairy animals, inland fishery etc., investment credit requirement for agriculture and allied activities like pump sets, sprayers, dairy animals, etc. KCCs have now been converted into Smart Card cum Debit Cards to facilitate its operation through ATMs. The cumulative number of live/ operative KCCs issued by Commercial Banks, Cooperative Banks & Regional Rural Banks as on 31 March, 2017 was

1734.73 lakh with outstanding loan amount of Rs. 598159.36 crore.

5.79 The major features of revised KCC Scheme are as follows:

- i. Assessment of crop loan component based on the scale of finance for the crop plus insurance premium x Extent of area cultivated + 10% of the limit towards post-harvest/ household/ consumption requirements + 20% of limit towards maintenance expenses of farm assets.
- ii. Flexi KCC with simple assessment prescribed for marginal farmers.
- iii. Validity of KCC for 5 years.
- iv. For crop loans, no separate margin need to be insisted as the margin is in-built in scale of finance.
- v. No withdrawal in the account to remain outstanding for more than 12 months; no

need to bring the debit balance in the account to zero at any point of time.

- vi. Interest subvention/ incentive for prompt repayment to be available as per the Government of India and/or State Government norms.
- vii. No processing fee up to a limit of Rs.3.00 lakh.
- viii. One time documentation at the time of first availment and thereafter simple declaration (about crops raised/ proposed) by farmer.
- ix. KCC cum SB account instead of farmers having two separate accounts. The credit balance in KCC cum SB account to be allowed to fetch interest at saving bank rate.
- x. Disbursement through various delivery channels, including ICT driven channels like ATM/ PoS/ Mobile handsets.

Joint Liability Group

5.80 A Joint Liability Group (JLG) is an innovative mechanism for provision of credit to a group comprising of 4 to 10 individuals who come

together for the purpose of availing bank loan on individual basis or through group mechanism against mutual guarantee. The JLG mode of financing serves as collateral substitute for loans to be provided to the target group, i.e., small, marginal, tenant farmers, oral lessees, share croppers, etc. It builds mutual trust and confidence between the bank and the target group and minimizes the risks in the loan portfolio for the banks through group dynamics, cluster approach, peer education and credit discipline.

5.81 The objective of the JLG mode of financing is to provide food security to vulnerable section by enhanced agriculture production, productivity and livelihood promotion. JLGs can also easily serve as a conduit for technology transfer, facilitating common access to market information, training and technology dissemination in activities like soil testing, training and assessing input requirements, etc. The total number of JLGs and total loan amount provided (cumulative) as on 31.03.2017 are as under **(Table 5.18)**.

Table 5.18: Total number of JLGs and total loan amount provided (cumulative) as on 31.03.2017

No.	Amount
24.53 lakh	Rs.26848.13 crore

Source: Department of Agriculture, Cooperation & Farmers Welfare

FARM INSURANCE

5.82 With a view to insure the farmers against numerous risks involved in agriculture, Government has introduced various crop insurance schemes from time to time by factoring in changing requirements of the farmers. Ministry of Agriculture introduced a crop insurance scheme in 1985 and thereafter brought improvements in the erstwhile scheme(s) from time to time based on the experience gained and views of the stakeholders, states, farming community, etc. To enlarge the coverage in terms of farmers, crops and risks, National Agricultural Insurance Scheme (NAIS) was notified/implemented w.e.f 1999. Weather Based Crop Insurance Scheme (WBCIS), Coconut Palm Insurance Scheme (CPIS) and Modified NAIS (MNAIS) were introduced on pilot basis from kharif 2007, 2009-10 and rabi 2010-11 respectively. To make the crop insurance schemes more farmers' friendly, a re-structured Central Sector crop insurance scheme namely, "National Crop Insurance Programme (NCIP)" was implemented by merging erstwhile Pilot schemes of Modified National Agricultural Insurance Scheme (MNAIS), Weather Based Crop Insurance Scheme (WBCIS) and Coconut Palm Insurance Scheme (CPIS) (as its components) with some improvements for its full-fledged implementation from Rabi 2013-14 season throughout the country. National Agricultural Insurance Scheme (NAIS) was to be discontinued after implementation of NCIP from Rabi 2013-14 season, but due to some inherent issues under NCIP, at the option of States, NAIS was also allowed for implementation upto 2015-16.

5.83 Keeping in view the shortcomings of the

above discussed insurance schemes and in view of the representations from States/UTs especially on account of increase in premium rates & farmers' share in premium, capping on premium rates and reduction in sum insured etc., NAIS has recently been reviewed, and a new scheme namely, **Pradhan Mantri Fasal Bima Yojana (PMFBY)** has been approved for implementation from kharif 2016 onwards in place of MNAIS/NAIS. Premium structure under the Restructured Weather Based Crop Insurance Scheme has also been rationalized and made at par with PMFBY. The Coconut Palm Insurance Scheme component will also be continued. In addition, a Unified Package Insurance Scheme (UPIS) covering other risks of farmers, including life, accident like house, tractor, pump set, student safety, etc., besides crop insurance has also been approved for implementation on pilot basis in selected 45 districts.

5.84 The crop insurance schemes remain optional for State Governments and they also have the option to notify crops and areas according to their priorities. The existing Schemes of PMFBY & RWBCIS are being implemented in the country on 'Area Approach' basis where yield of notified areas under PMFBY and weather data of notified Reference Automatic Weather Stations (AWSs) under RWBCIS are taken as one unit for assessment/ payment of claims for widespread calamities/ defined perils respectively. However, claims due to localized calamities of hailstorm, landslides and inundation and post-harvest losses under PMFBY and add-on/ index-plus coverage for hailstorm and cloudburst under RWBCIS, are being assessed & paid on the basis of losses at the level of individual farms.

5.85 During 1st year of its implementation, the penetration/ coverage of these schemes has reached about 28.35 per cent of Gross Cropped Area (GCA) of the country. The total funds released by

Government of India during last 5 years under various schemes for crop insurance are given in **Table 5.19**.

Table 5.19: Funds Released under various Crop Insurance Schemes

(Rs. crore)

Year	Expenditure
2012-13	1549.68
2013-14	2551.52
2014-15	2598.35
2015-16	2982.47
2016-17	11054.63
2017-18	8058.75*

* As on 20.12.2017

Source: Department of Agriculture, Cooperation & Farmers Welfare

5.86 While the Coconut Palm Insurance Scheme has been continued with its existing features, Government has recently restructured/ revamped the other major schemes to meet the emerging challenges faced by the farmers. Salient features of the new/ restructured schemes are as under:-

Silent Features of Pradhan Mantri Fasal Bima Yojana (PMFBY)

- i. PMFBY will provide a comprehensive insurance cover against failure of the crop thus helping in stabilising the income of the farmers and encouraging them to adoption of innovative practices.
- ii. The Scheme covers all food & oilseeds crops and annual commercial/horticultural crops.
- iii. The Scheme is compulsory for loanee farmers obtaining Crop Loan /KCC account for notified crops. However, it is voluntary for other/non-loanee farmers who have

insurable interest in the insured crop(s).

- iv. The Scheme provisions have been simplified for easy understanding and the Maximum premium payable by the farmers will be 2% for all kharif food & oilseeds crops, 1.5% for rabi food & oilseeds crops and 5% for annual commercial/horticultural crops.
- v. The difference between premium and the rate of insurance charges payable by farmers shall be shared equally by the Centre and State.
- vi. The Scheme will be implemented by Agriculture Insurance Company of India Ltd., (AIC) and other empanelled private general insurance companies. Selection of Implementing Agency (IA) will be done by the concerned State Government through bidding on premium rates.
- vii. The existing State Level Co-ordination Committee on Crop Insurance (SLCCCI),

- Sub-Committee to SLCCCI, District Level Monitoring Committee (DLMC) shall be responsible for proper management of the Scheme.
- viii. The Scheme shall be implemented on an '**Area Approach basis**'. The unit of insurance shall be Village/Village Panchayat level for major crops and for other crops it may be a unit of size above the level of Village/Village Panchayat.
 - ix. In case majority of farmers in a notified area are prevented from sowing/planting the insured crops due to adverse weather conditions then insured farmers will be eligible for indemnity claims upto maximum of 25% of the sum-insured.
 - x. Claims for wide spread calamities are being calculated on area approach. However losses due to localised perils (Hailstorm, landslide & inundation) and Post-Harvest losses due to specified perils, (Cyclone/Cyclonic rain & Unseasonal rains) shall be assessed at the affected insured field of the individual insured farmer.
 - xi. Three levels of Indemnity, viz., 70%, 80% and 90% corresponding to crop risk in the areas shall be available for all crops.
 - xii. The Threshold Yield (TY) shall be the benchmark yield level at which Insurance protection shall be given to all the insured farmers in an Insurance Unit. Threshold Yield of the notified crop will be moving average of yield of last seven years excluding yield upto two notified calamity years multiplied by Indemnity level.
 - xiii. In case of smaller States, the whole State shall be assigned to one Implementing agency (IA) (2-3 or more for comparatively big States). Selection of IA may be made for 3 years.
 - xiv. The designated / empanelled companies participating in bidding have to bid the premium rates for all the crops notified / to be notified by the State Govt.
 - xv. Crop Cutting Experiments (CCE) shall be undertaken per unit area /per crop, on a sliding scale, as prescribed under the scheme outline and operational guidelines. Improved Technology like Remote sensing, Drone and other techniques will be utilised for estimation of yield losses.
 - xvi. State governments should use Smart phone apps for video/image capturing CCEs process and transmission thereof with CCE data on a real time basis for timely, reliable and transparent estimation of yield data.
 - xvii. There will be a provision of on account claims in case of adverse seasonal conditions during crop season viz. floods, prolonged dry spells, severe drought, and unseasonal rains.
 - xviii. On account payment upto 25% of likely claims will be provided, if the expected yield during the season is likely to be less than 50% of normal yield.
 - xix. The claim amount will be credited electronically to the Bank Account of individual Insured farmers.
 - xx. Adequate publicity will be done in all the villages of the notified districts/ areas.
 - xxi. The cost of using technology etc. for conduct of CCEs will be shared between Central Government and State/U.T. Governments on 50:50 basis.

xxii. Rs. 1753.47 crore have been released for implementation of PMFBY during 2016-17.

Restructured Weather Based Crop Insurance Scheme (RWBCIS)

WBCIS has undergone the following important change in its features:

- i. The structure of farmer's premium under WBCIS will be at par with PMFBY.
- ii. The criteria of selection of Implementing Agency and area allocation will be same as PMFBY.
- iii. The other broad features will remain same as in the earlier Scheme

Unified Package Insurance Scheme (UPIS): The revised features of the UPIS scheme are as under:

- i. Unified Package Insurance Scheme will be implemented in selected 45 districts on pilot basis to provide financial protection & comprehensive risk coverage of crops, assets, life, and student safety to farmers.
- ii. Pilot will include seven sections, viz., crop insurance (PMFBY/WBCIS), Loss of Life (Pradhan Mantri Jivan Jyoti Bima Yojana PMJJBY), Accidental Death & Disability (Pradhan Mantri Suraksha Bima Yojana-PMSBY), Student Safety, Household, Agriculture Implements & Tractor.
- iii. Crop insurance will be compulsory. However, farmers can choose atleast two sections from the remaining six sections.
- iv. Farmers shall be able to get all requisite insurance products for farmers through one simple proposal/ application Form.
- v. Two flagship Schemes of the Government, viz., Pradhan Mantri Suraksha Bima Yojana (PMSBY) & Pradhan Mantri Jivan Jyoti

Bima Yojana (PMJJBY) have been included apart from insurance of assets.

- vi. Pilot scheme will be implemented through a single window.
- vii. Premium of PMSBY & PMJJBY is to be transferred to insurance companies which have tie up with the concerned banks.
- viii. Processing of claims (other than Crop Insurance) shall be on the basis of individual claim report

AGRICULTURAL EXTENSION SERVICES

5.87 Gains made in the past in agriculture production and productivity are being consolidated and strengthened through increased penetration of extension services via. promotion and adoption of agricultural technology and improved agronomic practices. At Central level, extension services in the agricultural sector at present are being undertaken mainly by the Department of Agriculture, Cooperation and Farmers Welfare (DAC&FW) and Indian Council of Agricultural Research (ICAR).

(i) Extension services by DAC&FW

5.88 Interventions in extension services by DAC&FW take place through the umbrella initiative called National Mission on Agricultural Extension and Technology (NMAET) consisting of 4 Sub-Missions namely- Sub-Mission on Agricultural Extension (SMAE), Sub-Mission on Seed and Planting Material (SMSP), Sub-Mission on Agricultural Mechanization (SMAM) and Sub-Mission on Plant Protection and Plant Quarantine (SMPP).

5.89 The Mission uses a judicious mix of extensive physical outreach & interactive methods of information dissemination including use of ICT as

well as capacity building and institution strengthening to promote the objectives of the Mission. Through the use of ICT, Ministry of Agriculture and Farmers Welfare has envisioned fulfilling SMART (Specific, Measurable, Achievable, Realistic and Time-bound) objectives which are- improving access of farmers to timely and relevant information & services throughout crop-cycle; bringing farmer centricity & service orientation to the programs by providing location specific and up-to-date crop management related information; increasing effectiveness of Government service delivery; more effective management of schemes of DAC&FW through redesigning of processes and enabling private sector participation to benefit farmers by providing an integrated platform to promote value added services. Optimizing information dissemination through ICT is in form usage of pico projectors, low-cost films, handheld devices, mobile based services, Kisan Call Centres (KCCs), etc. Personnel training are being provided through Agri-Clinics and Agri-Business Centres Scheme (ACABC) for improvement of agricultural productivity as well as provision of self employment opportunities to the youth.

5.90 Ever since the launch of Agri-Clinics and Agri-Business Centres Scheme in the year 2002, a total of **56452** candidates have been trained; and out of which **23517** have established their ventures by December, 2017. This shows that the Scheme has invoked tremendous interest in the unemployed agriculture graduates towards entrepreneurship in the rural areas. Maharashtra, UP, Bihar, Tamil Nadu and Karnataka and have shown remarkable achievement in the number of candidates that

enrolled for ACABC training. States like Rajasthan, Karnataka, Andhra Pradesh, Telangana, Gujarat, Madhya Pradesh and J&K have also exhibited a modest progress.

5.91 The Agri-Clinics and Agri-Business Centres Scheme has been revised. Under the revised Scheme, a refresher training of about 3-5 day duration in specialized Institutions has been introduced. The revised training cost per trainee is now Rs. 35,000/- by proportionately raising the limits under different components and adding the new area of hands-on industry training. Similarly, NABARD has been given support to organize sensitization training and workshops to motivate the bankers across the country to provide credit to agripreneurs for establishing ventures. The initial Interest and Capital Subsidy pattern of the scheme has been replaced with a composite subsidy (36 per cent for general and 44 per cent for women, SC/ST & NE) in place of earlier Interest + Capital Subsidy to make the assessment simpler. The benefit of subsidy shall be limited for the project cost up to Rs. 20 lakhs (plus 5 lakhs for extremely successful individuals) for individual projects and project cost up to Rs. 100 lakhs for a group project (established by a group comprising of minimum of five individuals) of trained candidates under the Scheme. An effective monitoring mechanism has been put in place with the active involvement of all the stakeholders, including MANAGE, NABARD, Banks, State Functionaries, SAUs and ICAR to ensure desired success rates.

5.92 Use of Media in reaching the farmers is also being extensively deployed by the Government in propagation of extension services. Under the Central Sector Scheme “Mass Media Support to Agriculture

Extension”, a 30 minute programme is being telecast 5-6 days a week on one National, 18 Regional Kendras and 180 High Power/Low Power Transmitters of Doordarshan. Similarly, 96 Rural FM Radio Stations of All India Radio are being utilized to broadcast 30 minutes of programme for farmers six days a week. DAC&FW is also producing films to consciously project inter-alia positive aspects of agriculture in India. The massive penetrations of television and radio have the advantage of reaching a wide audience at a very low cost. The Department is also supporting KVKs' and Private Organizations for setting up of Community Radio Stations (CRS), which would make a major contribution to agricultural extension by utilizing reach of radio transmitter and disseminating information and knowledge, produced locally and having relevance for a specific area.

5.93 DAC&FW has launched a “Focused Advertisement Campaign” to create awareness of assistance available under various schemes. The campaign at the national level is being implemented by way of short advertisements Audio & Video Spots of 30, 40, 50 and 60 seconds duration. The spots are Broadcast / Telecast through All India Radio, Doordarshan and Private Channels operating at the National and Regional Level during News, Serials, and Entertainment programmes having maximum viewership. A new format of medium, i.e., Digital Cinema Advertisement, has been introduced from 2011-12 under the Focused Advertisement campaign. To monitor the Campaign, software has been developed with the help of National Informatics Centre (NIC).

Skill Training of Rural Youth (STRY)

5.94 The component aims at training rural youths, rural artisans (blacksmiths, carpenter etc. designing/manufacturing farm implements) including farm women across the country. The training under this component would be of 7 days duration for 15 trainees per batch and would focus on specific vocational areas in agriculture & allied sectors. Both public and private/ Non-Governmental Institutions including Vocational Training organizations, Youth Organizations (like Nehru Yuva Kendra) will be actively involved in implementation of this programme.

Farmers Capacity Assessment & Certification (FCAC)

5.95 It is aimed at providing recognition to traditionally skilled farmers including farm women in various sectors of agriculture & allied disciplines through certification. The exercise of certification covers the process of “Recognizing of Prior Learning (RPL) Skill” by testing and certification process by a designated agency. If farmers/ farm women are found competent in possessing the traditional or prior possessed skill by the certifying bodies, they are issued certificates, so that the farmers/ farm women after obtaining the certificate may be recognized for getting employment in the concerned skill sector by the prospective employers in the job market.

Diploma in Agricultural Extension Services for Input Dealers (DAESI)

5.96 DAESI is of one year (extended to 48 weeks) regular course launched in 2003 with an objective to impart education in agriculture and other allied areas to the Input Dealers so that they can establish linkage to their business with extension services, besides discharging regulatory responsibilities enjoined on them.

5.97 This programme was earlier implemented through National Agriculture Extension and Management Institute (MANAGE) @ Rs. 20,000/- per candidate in self-financing mode in Andhra Pradesh, Maharashtra, Tamil Nadu, Odisha, Jharkhand & West Bengal, and so far **6473 candidates** have been trained till March, 2017. During 2016-17, 61 batches of DAESI programme to train 2440 agricultural input dealers have been finalized for implementation through SAMETIs. During 2017-18, as against the revised target of 149 programmes, 100 programmes have been started till December, 2017.

Extension Strategy

5.98 Farmers' skill trainings and field extension as contained in all 4 Sub Missions of NMAET (viz. SMSP, SMAE, SMAM and SMPP) are being converged with similar farmer-related activities going on through ATMA. Five-tiered modes of extension carried out in broadcast or interactive electronic modes also cut across extension activities in all the four Sub-Missions with mutually synergetic linkages established among various activities instead of unilaterally mandating that all such farmer-centric activities being carried out through ATMA.

5.99 Strategic Research and Extension Plan (SREP) is a comprehensive document prepared at the district level identifying research/extension priorities for district, keeping in mind agro-ecological conditions and existing gaps in technology generation and dissemination in all agriculture and allied sector areas/activities including in the area of Seeds, Mechanization, Plant Protection. The gaps in all farmer centric trainings and field extension in respect of other Sub-Missions of NMAET are also

included in the SREP being prepared in coordination with the line departments, Krishi Vigyan Kendras (KVKs), Panchayati Raj Institutions (PRIs), Private Sector, farmers and other stake-holders at the district-level.

5.100 Five-Tiered Modes of Awareness Campaign (TV, Newspapers, Booklets, KCC, Internet, SMS) is being used for disseminating information or providing services under all schemes and programmes pertaining to agriculture and allied sector (including various Sub-Missions of NMAET).

5.101 Requisite HRD Support is also being provided to cater to the training needs of field extension functionaries working under agriculture and allied departments of States/ UTs in the areas of communication technology, extension methodology, training management, Agriculture Knowledge Information System (AKIS) and Information Technology, The National Agriculture Extension and Management Institute (MANAGE); Regional Extension Education Institutes (EETIs) are catering to the training needs of senior and middle level field extension functionaries of the States/UTs under their respective jurisdiction through organization of On-campus and Off-campus trainings on thrust areas based on Training Need Assessment (TNA) of various States/UTs.

5.102 With a view to encourage employment, entrepreneurship and skill development for youth, including women, the 'Extension Training Unit' of the Directorate of Extension is in the process of implementing following components under skill development in consultation with States through SAMETIs/ ATMAs involving district-level Training Institutes and facilitation by MANAGE.

National e-Governance Plan in Agriculture (NeGP-A):

5.103 The Government is implementing a State sector Plan Scheme (erstwhile Centrally Sponsored Mission Mode Project (MMP) **National e-Governance Plan in Agriculture (NeGP-A)** for helping farmers to access information related to latest technology. This project has been approved at a total cost of Rs. 858.79 crore for implementation of this Scheme in entire country. Dissemination of information to the farmers has been aimed through various delivery channels, including Common Service Centres, Web Portals, SMSs and Kisan Call Centres, Mobile apps etc. Twelve identified clusters of services under the project is under implementation. The services include Information on Pesticides, Fertilizers and Seeds; Soil Health; Information on crops, farm machinery, training and Good Agricultural Practices (GAPs); Weather advisories; Information on prices, arrivals, procurement points, and providing interaction platform; Electronic certification for exports and import; Information on marketing infrastructure; Monitoring implementation /evaluation of schemes and programmes; Information on fishery inputs; Information on irrigation infrastructure; Drought Relief and Management; Livestock Management.

Development of Portals

5.104 DAC&FW has developed 80 portals, applications and websites (primarily in collaboration with National Informatics Centre) covering both the headquarters and its field offices. The important portals include Soil Health Card, National Agriculture Market, Pradhan Mantri Fasal Bima Yojana(PMFBY), PMKSY, AGMARKNET, etc.

5.105 New and innovative combinations of web technologies, push and pull SMS, Mobile Apps, and IVRS, etc., have been used to disseminate the information to the farmers and all other stakeholders. Some of the successful initiatives in ICT are discussed in the following sections.

5.106 **Farmers' Portal (<http://farmer.gov.in>)** intends to cover entire value chain of agricultural production. It is a one stop shop for information needs of a farmer. The range of information includes from cultivation/production, input supplies information to up to marketing of end products by the farmers. The portal covers information on four important pillars of agrarian economy and includes Agriculture, Horticulture, Fisheries and Animal Husbandry. With the help of a map, one can drill down to the block and find out information related to inputs, post harvest, weather and soil or dealers, etc. The information is mostly aggregated at national-level from various applications of the States/UTs.

5.107 **mKisan Portal:** This Portal subsumes all mobile based initiatives in the field of Agriculture & Allied sectors. It brings together SMS (both Push and Pull), Interactive Voice Response System, Mobile Apps and Services. Officers, Scientists and Experts from all Organizations and Departments of the GoI and State Governments (including State Agriculture Universities(SAUs), Krishi Vigyan Kendras(KVKs) and Agro –Meteorological Field Units (AMFUs) are using this Portal all over the country for disseminating information (giving topical & seasonal advisories and providing services through SMSs to farmers in their local languages) on various agricultural activities to registered farmers, during FY 2015-16. More than 780 crore SMSs have been

sent to farmers by all agencies/ organisation/ departments in agriculture and allied sectors down to Block level throughout the country since its inception July-2013. So far (till December, 2017) around 1837 crore SMSs have been sent through mkisan since its inception in 2013. The content may include information about the Schemes, Advisories from Experts, Market Prices, Weather Reports, Soil Test Reports, etc. The farmers can register for this service by calling Kisan Call Center on the toll free number 1800-180-1551 or through the Web Portal/SMS.

5.108 Mobile Apps. As part of multiple channels of delivery of information to the farmers, DAC&FW has already launched five mobile apps (Kisan Suvidha, Pusa Krishi, Crop Insurance, Agrimarket & Bhuwan Hail storm). It has also been decided to make complete information and services available to the farmers through suitable Mobile Apps. Few important Mobile Apps developed by the Department are:

- (a) **Hail Storm application:** Farmer or other stakeholder may upload hail storm photograph with GPS tagging.
- (b) **Crop Insurance:** Farmer can know insurance premium, notified area, etc., on the mobile.
- (c) **Agri Market:** Farmer can know the prices of various crops in the mandis near him within 50 km of the devices location. This app will be beneficial for farmers, entrepreneurs, extension workers, researcher, NGOs and policy makers.
- (d) **Kisan Suvidha:** has a simple interface and provides information on **five critical parameters** - weather, input dealers, market

price, plant protection and expert advisories. An additional tab directly connects the farmer with the Kisan Call Centre where agriculture experts answer their queries. Unique features like extreme weather alerts and market prices of commodity in nearest area and the maximum price in State as well as India have been added to empower farmers in the best possible manner. Kisan Suvidha mobile app is presently functioning in English & Hindi with a facility of language translation. States have been given a facility of translating the app in their own language. This translation facility will help in extending the outreach of this app and thus more and more farmers can be benefited throughout the length and breadth of the nation. It is available in Google Play Store and on mKisan – Mobile Apps section (mkisan.gov.in). Till December 2017, 622932 lakh users have downloaded this App.

- (e) **Pusa Krishi - Mobile App:** Pusa Krishi Mobile App has been launched recently by the Government. The objective of this app is to help farmers to get information about technologies developed by IARI, which will eventually help in increasing returns to farmers. This mobile app is also intended towards Agri. Start-ups, industry partners to whom these technologies will be transferred for further taking it to the farmers.
- (f) **CCE App:** For undertaking crop cutting experiments.

5.109 Kisan Call Centres (KCC): KCCs was launched on 21st January 2004 with the basic aim to

provide information to farming community through toll free telephone number (1800 180 1551) on all seven days a week from 06.00 AM to 10.00 PM. In FY 2015-16, more than 57 lakh calls were attended. Since inception of the scheme till 31st December, 2017 over 353.75 lakh calls have been registered in the KCCs. During the year 2017-18 around 46.88 lakh calls have been received upto 31st December, 2017. KCC also have the facility of technological innovations like Voice/Media Gateways, Dedicated MPLS leased line network with dedicated bandwidth, Call barging, Voice mail system for recording farmer's queries during idle time of KCC or during call lines busy, with provision for call back to the caller, Facility of video conferencing of each KCC for interaction of Farm Tele Advisors with the Divisional/ Zonal Level Officers of the State Agriculture and allied departments as well as on line monitoring for the working of KCCs. The KCC programme has been recently restructured and the restructured programme has various special features, viz., 100% call recording; call barging; voice mail service; customized IVRS; call conferencing through the experts; playing state specific advisories during call wait time and SMS to caller farmers giving a gist of answers given by the KCC Farm Tele Advisor. The farmer calling KCC can also register for receiving SMSs from experts on the subject area.

5.110 Strengthening of IT Apparatus in Agriculture and Cooperation in the States and Union Territories (AGRISNET): The Government is implementing a Central Sector Plan Scheme “Strengthening/ Promoting Agricultural Informatics & Communications”, of which one of the components is AGRISNET. The objective of

AGRISNET is to provide improved services to the farming community through use of ICT. Under the AGRISNET Scheme funds are released to the State Government concerned for provisioning of software and hardware systems including networking, data digitization, manpower training to ensure computerization upto Block level. However, under the revised guidelines under NeGP-A, this scheme has been subsumed under NeGP-A.

Support to State Extension Programmes for Extension Reforms (ATMA Scheme)

5.111 The erstwhile Scheme 'Support to State Extension Programmes for Extension Reforms (ATMA)' implemented since 2005 has now been included as a component of the Sub-Mission on Agriculture Extension (SMAE) under NMAET with some cost revisions and additional components. It is now under implementation in 676 districts of 29 States & 3 UTs of the country. The scheme 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. Under the scheme grants-in-aid are released to States with an objective to support State Governments efforts of revitalization of the extension system and making available the latest agricultural technologies in different thematic areas to increase agricultural production through extension activities, viz., Farmers Training, Demonstrations, Exposure visits, Kisan Mela, Mobilization of Farmers Groups and Setting up of Farm Schools. Through these activities, latest agriculture technologies are disseminated to farmers of the country.

5.112 Overall 433.57 lakh farmers have been benefitted so far since inception of Scheme through various extension activities like Exposure Visits, Trainings, Demonstrations, Farm Schools & Kisan Melas. Over 2.3 lakh Commodity based Farmer Interest Group (CIGs)/ FIGs have been mobilized under the Scheme and more than 1.19 lakh Farm Schools have been organized on the fields of outstanding farmers upto December 2017.

(ii) Extension Services by ICAR

5.113 Application of science and technology towards increasing agricultural production and productivity is a major plank of agricultural development and agricultural extension program plays a crucial role in making this possible. The main components of agricultural extension as undertaken by ICAR are discussed in the following sections.

Technology Assessment, Refinement and Demonstration

5.114 **Krishi Vigyan Kendras (KVKs)** play very important role as frontline extension system and are mandated mainly for Technology Assessment and Demonstration for its Application and Capacity Development under different farming situations across the country. The major activities of KVKs are conducting on-farm trials (OFTs) to identify location specific technologies in various farming systems; frontline demonstrations (FLDs) for exhibiting the production potential of the technologies and skill oriented training for farmers, farm women, rural youth and extension personnel. In order to show the potentiality of technologies, KVKs provide technological inputs, information and knowledge, and also serve as the knowledge and resource centre at the district level in the country.

5.115 During the year 2016-17, 3446 technology interventions were assessed across 3340 locations by laying out 26029 trials on the farmers' field on various crops under different thematic areas, viz., cropping systems, disease management, drudgery reduction, farm machineries, integrated crop management, integrated disease management, integrated nutrient management, integrated pest management, integrated weed management and varietal evaluation for cereals, pulses, oilseeds, fruits, vegetable crops and commercial crops.

5.116 In livestock, 580 technology interventions across 584 locations covering 6160 trials on animals under the thematic areas of disease management, evaluation of breed, feed and fodder management, nutrition management, integrated farming systems, production and management, processing and value addition were taken up for assessment. The major livestock covered were cows, buffaloes, sheep, goat, poultry birds, pigs and fisheries.

5.117 As many as 159 technologies related to rural women were assessed on 483 locations through 2398 trials under the thematic areas of drudgery reduction, health and nutrition, processing and value addition, energy conservation, small scale income generation, and storage techniques. The major enterprises included were mushroom, vermi-compost production, nutritional gardens, processing of fruits and vegetables, etc.

5.118 **Refinement:** Total 109 technological interventions were refined across 123 locations by laying out 593 trials in the farmers' fields under various thematic areas viz., cropping systems, farm machineries, integrated crop management, integrated disease management, integrated farming

system, integrated nutrient management, integrated pest management, integrated weed management, processing and value addition, resource conservation technologies and storage techniques. The major crops included cereals, pulses, oilseeds, fruits and vegetables.

Frontline Demonstrations

5.119 During the year 2016-17, a total of 182696 demonstrations covering an area of 66203 ha were organized to demonstrate the production potential of the newly released improved varieties/production technologies in crops/animal husbandry and other agricultural enterprises. Of these 1,62,003 (89%) demonstrations covering an area of 60,906 ha were on crops (cereals, millets, oil seeds, pulses, commercial crops, fiber crops, spices, medicinal plants, plantation crops, fodder crops, horticultural crops etc.).

Capacity Development

5.120 As many as 49,768 training programmes were organized through which 14.21 lakh farmers/farm women, rural youths and extension personnel were benefitted.

Farmers and farm women

5.121 For the benefit of 11.31 lakh farmers and farm women, total of 38941 training courses were organized on various technologies to update their knowledge and skills. Most of these courses were on productivity enhancement of field crops (22.55 %), horticultural crops (15.57%), empowerment of rural women (14%), plant protection (14.68%), livestock production and management (11.09%), soil health and fertility management (8.56%), farm machinery tools and implements (2.4%), and capacity building and group dynamics (5.39%), production of input at

site (2%) fisheries (2.4%), agro-forestry (1.4%) and others (2%). Out of these courses, 51% were conducted on campus (19522) and 49% were organized off-campus (19419). Among the crop production technologies, about 36% of the training courses were on integrated crop production technologies, followed by weed management (7.36%) and seed production (11.35%).

Rural Youth

5.122 Skill-oriented vocational training courses (6788) were organized for 1.75 lakh rural youth, including 55742 young women (32%) during 2016-17. These courses were on integrated farming, mushroom production, value-addition, dairy farming, seed production, vermin-culture, nursery management of horticultural crops, bee-keeping, protected cultivation of vegetables, repair and maintenance of farm machineries and implements, sheep and goat rearing, poultry production, production of organic inputs and small-scale processing.

Extension Personnel

5.123 Capacity development programmes (4039 courses) were conducted for 1.14 lakh extension personnel, out of which 28614 (25%) were women participants. These courses were organized for extension functionaries working in government and non-government organizations who were directly or indirectly related with the development of agriculture sector.

Sponsored Training

5.124 A total of 5109 sponsored training courses were conducted benefitting 2.08 lakh farmers and farmwomen, rural youth and in-service extension personnel. Most of the sponsored courses were

related to on-site input production, economic empowerment of women, processing and value-addition, methods of protective cultivation, farm machinery tools and implements, fisheries management, household nutritional security, animal nutrition management, animal disease management, drudgery reduction of women and fisheries.

Extension Programmes

5.125 For creating awareness among farmers about improved technologies and to provide timely advisory to farmers, KVKs organized different extension programmes. A total of 6.07 lakh extension programmes/activities in the form of advisory services, diagnostic and clinic services, celebration of important days, exhibitions, exposure visits, ex-trainees *sammelan*, farm science club conveners meet, farmers' seminar, farmers visits to KVK, field days, film shows, group meetings, *kisanghosthi*, *kisanmelas*, lectures delivered as resource persons, *mahilamandals* conveners meetings, method demonstrations, plant/animal health camps, scientists' visit to farmer's field, self-help group meetings, soil health camps, soil test campaigns, workshops and others were organized which attracted the participation of 147.50 lakh participants of which 144.15 lakh were farmers and 3.34 lakh extension personnel. The KVKs also organized 2.98 lakh other extension programmes through electronic and print media to have wider coverage in the districts. These included electronic media in the form of TV programmes, radio talks, CDs/DVDs, extension literature, newspaper coverage, popular articles, leaflets, folders and books/booklets.

Demonstrations on Climate Resilient Technologies

5.126 Under the sub theme-Technology

Demonstrations and Dissemination for Climate Resilient Agriculture, 1.18 lakh farmers were covered in 151 villages of 121 districts. Integrated packages of proven technologies were demonstrated in at least one village of every selected district for adaptation and mitigation of the crop and livestock production system to climate vulnerability. During 2016-17, 121 KVKs carried out 14213 demonstrations on natural resource management covering 5,785 ha; 18,337 demonstrations on crop production technologies covering 5,887 ha, 1819 demonstrations on fodder and feed production covering 727 ha area. Besides, 14,594 demonstrations related to livestock and fisheries were carried out. Capacity-building interventions and the extension activities like exposure visits benefited 43,969 farmers.

Technological Backstopping

5.127 The Directorates of Extension Education (DEEs) of SAUs/CAU organized 311 capacity development programmes for updating the technical knowhow of 13995 staff of KVKs. Likewise, the ICAR-Agricultural Technology Application Research Institutes (ATARIs), upgraded the knowledge and skills of 5362 staff of KVKs by arranging 100 capacity development programmes at various SAUs and ICAR Institutes. Besides, DEEs also organized 767 workshops and meetings for effective implementation of programmes of KVKs. The officials of these Directorates made 2856 visits to the KVKs during Scientific Advisory Committee meetings, Field days, Technology Weeks, Workshop/seminar, Training programmes, etc. to review and monitor the activities of KVKs in the operational areas of respective directorates. They also made 2679

field visits to review and monitor activities at farmers' fields like, On-farm trials, frontline demonstrations, farmer-scientist interaction and exhibitions etc. These directorates also provided technological backstopping to KVKs by making available high quality technology inputs and products like seed to 455 KVKs; planting materials to 168 KVKs; bio-products to 151 KVKs; livestock breeds to 73 KVKs; livestock products to 64 KVKs; poultry breeds to 82 KVKs; and poultry products to 27 KVKs. As many as 124 technology inventories were also published by the DEEs for the benefit of farmers and other stakeholders.

Agricultural Technology Information Centre (ATICs)

5.128 Forty-seven Agricultural Technology Information Centers (ATICs) in the country served as single window delivery systems by providing technology information, technology services and technology inputs to the farmers. In all, 7.03 lakh farmers visited the ATICs for the technological solutions during 2016-17. Technological information was provided to about 2.36 lakh farmers both through print and electronic media. Likewise, 4.52 lakh farmers got quality technological inputs namely; 17827.59 quintal seeds, 12.44 lakh planting material, 899 livestock, 0.09 lakh poultry birds and 228.7 quintal bio-products.

Awareness on Soil Health

5.129 The KVKs celebrated Soil Health Day on 5th December, 2015 across the country. Soil Health Cards were distributed by 599 KVKs by emphasizing the excess and lower doses of fertilizers by farmers without any focus on nutrient budgeting in the soil. It was also highlighted that without soil analysis,

application of inputs are taxing on soil health as well as monetary losses to the farmers. In these programmes, more than 1.62 lakh soil health cards were distributed to the farming community. Public representatives took keen interest in these programmes and graced the occasion with the participation of 07 Union Ministers; 26 State Govt. Ministers; 107 MPs; 131 MLAs; 147 Chairman/Members of Zila Panchayats, 17 District Collectors, 19 bank officers, 225 Govt. Officers & PRI Members, besides more than 2500 scientists. On this occasion, 352 exhibitions were also organized by KVKs to create awareness on improved technologies, their activities and achievements along with soil health cards based application of the fertilizers in the fields.

Attracting and Retaining Youth in Agriculture (ARYA)

5.130 Attracting and Retaining Youth in Agriculture (ARYA) project is being implemented in 25 districts of 25 states to train youth in entrepreneurial activities. 200-300 youth per district are being empowered to establish their income generating units and work as model for other youth in the villages. Skill training was given to 3879 rural youth through 92 various training programmes pertaining to the enterprise units allotted to each ARYA Centre.

Mera Gaon-Mera Gaurav

5.131 The scientists of NARES working with SAUs and ICAR Institutes are engaged in enhancing direct interface of scientists with farmers under Mera Gaon Mera Gaurav initiative. The objective of this initiative is to provide farmers with required information, knowledge and advisories on regular

basis. It will also provide regular feedback to research institutions for conducting relevant researches. During 2016-17, total 1226 groups were formed by involving 4774 scientists under ICAR Institutes and SAUs.

KVK Knowledge Network Portal

5.132 “Krishi Vigyan Kendras Knowledge Network” portal has been launched for regular monitoring of KVKs and to provide information and advisories to the farmers. It is dynamic portal having read and write facility. Farmers and other stakeholders can get information related to facilities and services at KVKs, weather and market related information, past and forth coming events and details of the programmes.

RURAL DEVELOPMENT PROGRAMMES

5.133 The Ministry of Rural Development is implementing various rural development programmes which have a significant contribution in sustaining natural resources namely, Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Deendayal Antyodaya Yojana - National Rural Livelihoods Mission (DAY-NRLM), Mahila Kisan Sashaktikaran Pariyojana (MKSP) under DAY-NRLM, Pradhan Mantri Gram Sadak Yojana (PMGSY), Pradhan Mantri Awaas Yojana - Gramin (PMAY-G) and National Social Assistance Programme (NSAP).

5.134 Conscious efforts have been made to reorient MGNREGA to support the Government's resolve to double farmers' income. Initiatives made under Rural Development programmes would help in realizing equitable and inclusive growth through enhanced productivity and multiplier effect as nearly 60 per cent of India's rural population continue to depend on

agriculture for livelihood. Rejuvenation of common land and water bodies offer sustenance to the rural poor through provisioning of goods and ecosystem services.

(I) Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)

a) To minimize the impact of drought on the agriculture productivity, it has been suggested to ensure that at least 60 per cent of the works taken up in a district in terms of cost is for creation of productive assets directly linked to agriculture and allied activities through development of land, water conservation and plantation of trees.

b) The list of permissible works under MGNREGA has been expanded with a focus to strengthen the synergy between MGNREGA and rural livelihoods, particularly agriculture, and create durable assets. The permissible activities under MGNREGA (Schedule-1 of MGNREGA Act, 2005) directly related to agriculture are as following:

1. *Agriculture Activities*

- i. Water Conservation and water harvesting structures to augment and improve groundwater like underground dykes, earthen dams, stop dams, check dams with special focus on recharging ground water, including drinking water sources.
- ii. Watershed management works such as contour trenches, terracing, contour bunds, boulder checks, gabion structures and spring shed development resulting in a comprehensive treatment of a watershed.
- ii. Micro and minor irrigation works and creation, renovation and maintenance of

- irrigation canals and drains.
 - iv. Renovation of traditional water bodies including desilting of irrigation tanks and other water bodies.
 - v. Afforestation, tree plantation and horticulture in common and forest lands, road margins, canal bund, tank foreshores and coastal belts duly providing usufruct to the households covered in Paragraph 5 of the Schedule-1 of MGNREGA Act, 2005.
 - vi. Land development works in common land.
 - vii. Improving productivity of lands of households specified in Paragraph 5 of the Schedule-1 of MGNREGA Act, 2005 through land development and by providing suitable infrastructure for irrigation, including dug wells, farm ponds and other water harvesting structures.
 - viii. Improving livelihoods through horticulture, sericulture, plantation, and farm forestry.
 - ix. Development of fallow or waste lands of households defined in Paragraph 5 of the Schedule-1 of MGNREGA Act, 2005 to bring it under cultivation.
 - x. Agriculture related works such as NADEP composting, vermi composting, liquid bio-manures have also been permitted, especially in context of small and marginal farmers.
 - xi. Production of Azolla as a Cattle Feed Supplement. This activity is only for those households eligible under MGNREGA for work on private land.
- 2. *Allied Sector Activities of Agriculture***
- a) Creating infrastructure for promotion of livestock such as poultry shelter, goat shelter, piggy shelter, cattle shelter and fodder troughs for cattle; and
 - b) Creating infrastructure for promotion of fisheries such as, fish drying yards, storage facilities, and promotion of fisheries in seasonal water bodies on public land
 - c) Works for promoting agricultural productivity by creating durable infrastructure required for bio-fertilizers and post-harvest facilities including pucca storage facilities for agricultural produce.
 - d) Construction of Food Grain Storage Structures for implementing the provisions of The National Food Security Act 2013 (20 of 2013).
 - e) Considering the importance of water conservation, irrigation and given all the scientific and technological advances at their command, the Ministry of Rural Development in consultation and agreement with the Ministry of Water Resources, River Development & Ganga Rejuvenation and the Ministry of Agriculture and Farmer's Welfare has developed an actionable Framework under overall framework of PMKSY to ensure that MGNREGA funds are used in accordance with the best practices in the sector. Accordingly, District will be the synergizing unit for convergent planning where the DPC/District Collector will ensure that the Natural Resource Management (NRM) component of Labour Budget of MGNREGS is essentially made part of the District Irrigation Plan (DIP) and that at least 65% of expenditure under MGNREGS is on NRM works in FY 2017-18 in the Irrigation deprived Districts and Overexploited and Critical Blocks of the country.

Table 5.20: Expenditure on Water Conservation/Harvesting Works during FY 2015-16 and FY 2016-17 under MGNREGA (till January, 2017)

Works	Expenditure (in Rs Cr) FY 2015-16	Expenditure (in Rs Cr) FY2016-17*
Water Conservation and Water Harvesting	43154.43	51869.38
Renovation of traditional water bodies	77935.16	85994.62
Drought Proofing	13229.86	16127.73
Flood Control and Protection	10657.78	12967.89
Micro Irrigation Works	12555.64	15005.69
Works on Individuals Land (Category IV)	15987.35	24067.80
Land Development	17862.47	22626.17
Total	191382.72 (65.7%)*	228659.28 (65.7%)*

* Figures in bracket represent percentage expenditure of total expenditure

Source: Department of Rural Development

(II) Deen Dayal Antyodaya Yojana-National Rural Livelihoods Mission (DAY-NRLM)

Farm Livelihoods

5.135 DAY-NRLM's strategy is to support every poor household in at least two of their key livelihoods to ensure household level food and nutrition security and sustainable livelihood.

5.136 To strengthen the existing livelihoods of the poor, DAY-NRLM endeavors to organize the poor producers engaged in farm sector into producers' organizations where every producer is not only the members of Self Help Groups (SHG) but also members of producers groups formed around specific livelihoods activities. The principle is that the SHGs would be catering to their credit needs required to improve their asset quality or to acquire new assets and the producers groups would help them to access technical knowledge for productivity enhancement, cost reduction and also provide the marketing services.

5.137 Livelihoods interventions are made at both

farmer's household level and village level for holistic development.

Agro Ecological Practices:

- **Farmer's Household Level Interventions**

The household level interventions are categorized into following headings:

- a) **Soil Health: set of practices that could improve soil health**

- I. Composting-(Heap composting/NADEP), Vermi composting
- ii. Dung-based inoculants: Ghanjeevamruth
- iii. Promotion of monocot/dicot crop combinations
- iv. Green manure crops
- v. Tank silt application
- vi. Azola in paddy field

- b) **Moisture regime management (water)**

- i. Land and water development: land levelling,

- rain water harvesting (farm ponds)
- ii. In situ moisture conservation
- iii. Mulching, weeds used in mulching
- iv. Zero tillage
- c) Seed**
 - i. Seed replacement
 - ii. Seed selection, germination, priming and seed treatment using Beejamruth
 - iii. Seed storage in raised platforms
- d) Pest and disease management**
 - I. Eliminating chemical fertilizer usage
 - ii. Building of pest ecology
 - iii. Managing pests by understanding them (NPM)
 - iv. Inter crop, border crops, white/ yellow sticky plates from nursery stage,
 - v. Preparation and usage of bio-pesticides such as Agnayastram, Neemastram and Brahmastram.
- e) Other interventions**
 - I. SRI/SWI/SCI
 - ii. 36X36 model for round the year household nutritional security and regular income as well;
 - iii. Homestead kitchen garden - replication of 36X36 model on smaller plots (2 cents or decimal of land)
 - iv. Integration of small ruminants or backyard poultry
- f) Post-harvest practices**

- i. Sorting
- ii. Grading
- iii. Drying floor-Optimum moisture content
- iv. Storage practices
- v. Minimize post-harvest loss
- g) Village Level Interventions:**
 - i. Livelihood intervention plan of the village
 - ii. Annual resource mobilization plan under convergence (IPPE -2)
 - iii. NPM shop
 - iv. Custom hiring center (CHC)
 - v. Regular farmer field school (FFS)
 - vi. Village grain bank
 - vii. Village seed bank
 - viii. Compact, contiguous block/patch of land
 - ix. Seed bank
 - x. Wall writings and boards
 - xi. Maintenance of records
 - xii. VO sub-committee
 - xiii. Producers group

5.138 Non Timber Forest Products (NTFP):
Under NTFP practices the emphasis has been laid on the following points with respect to the promotion of bio-diversity and climate change resilience:

- i. Ensure a better control of the institutions of the poor women NTFP collectors over the NTFP value chain in a sustainable manner.
- ii. Plantation work has been carried under NTFP component of MKSP (e.g. tasar host trees plantation etc.) and plantation has

been promoted in convergence with MGNREGA.

- iii. DAY-NRLM is promoting value chain activities on medicinal plants especially in forest fringes areas.
- iv. Promoting regeneration of NTFP species to improve the bio diversity and enhanced productivity.
- v. Use of locally adopted community centric technologies.
- vi. Build the capacity of the community in modern harvesting and post harvesting techniques to increase their income.

5.139 Livestock: DAY- NRLM is promoting ethno- veterinary treatment for livestock and is thus evolving the methodology to prevent the indiscriminate use of antibiotic and other chemical drug on animals which are hazardous in nature. Major focus is on reducing morbidity and mortality of livestock by delivering livestock and animal husbandry extension services at the doorstep of the SHG member households through a cadre of 'Pashu Sakhi'. DAY-NRLM has initiated training and capacity building programme for *Pashu Sakhi*.

5.140 Capacity Building Architecture: A very strong three tier Capacity Building Architecture is being created. At the national level resource persons known as National Resource Persons (NRPs) have been empanelled by NIRD and Farm Livelihood Team. 29 NRPs have been empanelled for three thematic areas- Sustainable Agriculture, Livestock and NTFP.

5.141 The Farm Livelihood Team with the help of NRPs, finalized the training content, training

module, and training tools for Sustainable Agriculture and Livestock. The training module consists of 6 days class room sessions and 2 days Field Sessions. State Resource Pool, consisting of senior members of livelihood team in the state, staff from MKSP partners, and individual consultants engaged by the SRLMs. There are 750 plus SRPs already identified by different SRLMs.

5.142 Rounds of SRP trainings are going on by NRPs all over the country for SRPs of all the state. 75 SRPs in Sustainable Agriculture and 82 SRPs under Livestock have been already trained from eight states, Madhya Pradesh, Chhattisgarh, Odisha, Assam, Meghalaya, Mizoram, Uttar Pradesh and Haryana. During the training continuous assessment have been done through conduct of Tests, and each SRP has been graded and certified to conduct the CRP training. Post SRP training the SRLMs are to plan for the CRP training through preparation of CRP training calendar, preparation of training tools, form training team consisting of 3 / 4 trained SRPs to conduct training in the state.

5.143 NRLM is promoting farm livelihoods through three components:

1. Mahila Kisan Sashaktikaran Pariyojana (MKSP)
2. Value chain intervention with market linkage initiatives
3. State Rural Livelihoods Mission's Annual Action Plan on livelihoods.

(III) Mahila Kisan Sashaktikaran Pariyojana (MKSP)

5.144 Mahila Kisan Sashaktikaran Pariyojana (MKSP) was launched to empower the women in

agriculture which is also to address many of the above issues. MKSP projects are implemented by NGOs and SRLMs. Under MKSP, the majority of work is carried out in two major domains- sustainable agriculture and NTFP activities and livestock is envisaged as the universal intervention in both the domains. DAY-NRLM is also focusing towards value chain development interventions for establishing market linkage initiatives as a step forward for the ongoing MKSP projects.

5.145 A total of 71 MKSP projects spread over across 18 States are currently being implemented. The total outlay of the project is Rs. 1157 Crore covering more than 30 lakh Mahila Kisans.

5.146 Approximately 50% of the budget of all

MKSP projects are devoted towards training and capacity building of Community Professionals or CRPs and women farmers and building their institutions. More than 18 thousand Community Resource Persons (CRP) were trained in livelihoods activities- Sustainable agriculture or NTFP or Livestock and deployed through MKSP in 16 states by Project Implementation Agencies.

5.147 MKSP annual action plans (AAPs) are getting approved regularly and projects have been grounded. State Livelihoods Missions of Andhra Pradesh, Bihar, Haryana, Tamil Nadu, Telangana and Uttar Pradesh are implementing MKSP project along with NGOs in rest all the states(**Table 5.21**).

Table-5.21: State-wise MKSP Outreach

SL. No.	State	Number of the Districts	Number of the Blocks	Number of the Villages	Number of Mahila Kisan
1	AP	13	392	9640	1301595
2	Assam	7	14	140	14,000
3	Bihar	10	18	677	132096
4	Chhattisgarh	4	6	81	3999
5	Gujarat	4	10	442	32605
6	Haryana	4	4	45	1538
7	Himachal Pradesh	1	2	133	2,510
8	Jharkhand	11	46	964	48396
9	Karnataka	3	3	483	19000
10	Kerala	14	152	1243	310714
11	Maharashtra	5	10	166	5,663
12	MP	7	14	552	37116
13	Odisha	9	33	882	37543
14	Rajasthan	7	19	460	26063
15	Tamil Nadu	4	8	124	12800
16	Telangana	10	291	5862	1022291
17	West Bengal	6	13	933	58060
	Total	119	1035	22827	3065989

Source: Department of Rural Development

5.148 Value Chain Development under Special Fund and MKSP: To ensure sustainable livelihoods of the poor, DAY-NRLM is actively promoting interventions on sustainable agriculture, non-timber forest produce (NTFP) and Livestock. Building market linkages of the poor through a value chain development approach is an important strategy being pursued under DAY-NRLM. DAY-NRLM has been mandated to promote livelihood diversification through commodity value chain interventions.

5.149 DAY-NRLM has brought a strong focus on sub sector approach under its various farm based livelihoods initiatives and has been working steadily to promote sustainable agriculture and NTFP through formation of Producers' Groups and subsequently organizing the producers' groups into their higher level federations.

5.150 Under Mahila Kisan Sashaktikaran Pariyojana (MKSP), a total of 74,498 Producers' Groups and 58 Producers' Companies have been formed so far in 16 states (Table 2).

5.151 During 2016-17, under DAY-NRLM, Annual Action Plan (AAP) for MKSP has been approved for six states. The SRLMs have planned to promote 13255 producers' groups and 10 producers' companies.

5.152 DAY-NRLM has also initiated a special fund specifically to promote value chains where a core intervention strategy would be the formation of producers' groups and producers companies. There are plans to promote 2425 producers' groups and 10 producers companies under this special fund. 94200 households would be covered in four states under different commodity value chain activities like Lac, tamarind, vegetables, cashew, mango, ginger, fishery, goatary and NTFP.

5.153 Technical Support Agency for Value Chain Development: To facilitate the States to hire technical support agencies (TSA) for development of commodity value chains and market linkage, four technically qualified agencies have been empanelled. The SRLMs may procure the services of the TSA for supporting them in implementing value chain based farm livelihood projects. The TSA will not only facilitate the SRLMs to identify the commodity and scope of the value chain projects but also to implement the projects on ground.

5.154 **DAY-NRLM Value Chain Support Cell:** To implement the value chain development interventions, it has been observed that State Rural Livelihood Missions may require support to augment their technical capacity for identification of commodity value chain interventions, business models and preparation of proposals. With this objective, NRLM, through a competitive process, has identified Techno Serve as a Technical Support Agency to set-up a Value Chain Support Cell at the NMMU level. The Value Chain Support Cell would provide timely and higher order technical assistance and capacity building support to participating State Rural Livelihoods Missions (SRLMs) and Community Based Organizations (CBOs) in the development of Commodity value chain and market linkages in the Agriculture and allied activities, livestock and Non-Timber Forest Produce (NTFP) products so that these become profitable, bankable, and self-sustaining in the long run.

5.155 Sustainable Livelihoods and Adaptation to Climate Change Project (SLACC): The Ministry of Rural Development has approved a four years Project for "Sustainable Livelihoods and Adaptation to Climate Change (SLACC)" with support from Special Climate Change Fund (SCCF) of Global Environment

Facility (GEF), under NRLM. This project aims to improve the adaptive capacity of the rural poor through enabling adoption of climate change resilient agriculture practices so as to reduce the risks in agriculture livelihoods of the poor. The SLACC project is being implemented in 200 villages in the states of Bihar and Madhya Pradesh. While SLACC's outreach is limited to two states, its successful implementation will pave the way for scaling-up and mainstreaming 'climate resilient livelihoods' into the core livelihood interventions of the NRLM at the national scale. The project targets 8000 farmers

initially who will be capacitated to demonstrate climate resilient agricultural practices. Eight Hundred Village Organization/self-help groups will be trained in adaptation-related technologies and 200 CBOs will be provided technical and/or financial support for climate adaptation plans through convergence with government programs. In addition, a cadre of 400 trained CRPs is being created and 300 staff of state and district offices as well as extension and rural service providers will be trained on technical adaptation themes to support scaling up of the project activities to other parts of the states and in other states.

Animal Husbandry, Dairying and Fisheries

6.1 The animal production system in India is predominantly a part of the mixed crop-livestock farming system vital for livelihood security of the farmers. In such systems, the livestock sector supplements income of the farmers, provides employment, draught power and manure, etc. The livestock production system assumes special significance in the present context of sustained economic growth, rising income, increasing urbanization, changes in taste and preference that have led to dietary changes reflecting the growing demand for milk, meat, egg and fish. The development of livestock sector is more inclusive and can result in a sustainable agriculture system. India has the world's largest livestock population, accounting for about half the population of buffaloes and one sixth of the goat population.

PRODUCTION PERFORMANCE

6.2 During 2016-17 except wool, all other items of animal production registered increase. The estimated production of milk, meat, wool, egg and fish and its growth rates for the year 2016-17 are given in the following sections.

Milk

6.3 India continues to be the largest producer of milk in the world. The Dairy sector in India has grown substantially over the years. As a result of prudent policy interventions, India ranks first among the world's milk producing nations, achieving an annual output of 163.7 million tonnes during the year 2016-17 as compared to 155.5 million tonnes during

2015-16, i.e., a growth of 5.3 percent. The per capita availability of milk has reached a level of 355 grams per day during the year 2016-17, which is more than the world average of 299 grams per day. This is an outcome of a sustained growth in the availability of milk and milk products for growing population.

Meat

6.4 Total meat production from cattle, buffalo, sheep, goat, pig and poultry at the all-India level increased from 4.0 million tonnes in 2007-08 to 7.4 million tonnes in 2016-17. Poultry meat production from commercial poultry farms was included in the production estimates of meat from 2007-08 onwards. Meat production achieved an estimated growth of 5.7 percent in 2016-17 over the previous year.

Wool

6.5 At the national level, wool production in 2016-17 was estimated at 43.5 million kg; it has declined marginally by 0.2 percent as compared to 43.6 million kg produced in 2015-16.

Egg

6.6 Egg production has shown an upward trend during the year 2016-17. The production reached to 88.1 billion as compared to 82.9 billion during 2015-16, i.e., an increase of 6.2 percent.

Fish

6.7 India is the second largest producer of fish in the world; it contributes about 6 percent of the global fish production. India is also a major producer of fish through aquaculture, and ranks second in the world,

after China. The total fish production during 2016-17 was 11.4 million metric tonnes; the contribution from the inland sector was 7.8 million metric tonnes, and from the marine sector was 3.6 million metric tonnes.

Fishery is one of the most promising sectors of agriculture and allied activities in India, with an overall growth rate of 6 percent projected during the Twelfth Five Year Plan (Table 6.1, 6.2).

Table 6.1: Compound Annual Growth Rates (CAGRs) in Production of Milk, Egg, Wool, Meat and Fish at All-India Level(%)

	1980-81 to 1989-90	1990-91 to 1999-00	2000-01 to 2009-10	2010-11 to 2015-16	1980-81 to 2015-16
Milk	5.6	4.2	4.2	4.2	4.7
Eggs	8.1	4.2	5.7	5.9	6.5
Wool	3.0	1.7	-1.3	3.7	1.3
Meat	-	-	7.2*	8.2	7.6**
Fish	4.8	4.5	3.5	5.1	4.5

Note: *CAGR for meat production is for the year 2007-08 to 2009-10 and **CAGR for meat production is for the year 2007-08 to 2013-14. Meat production data from 2007-08 is not comparable with the previous year's data as poultry meat production from commercial poultry farms was included from 2007-08 onwards

Source: Department of Animal Husbandry, Dairying and Fisheries

Table 6.2: Production of Milk, Eggs, Wool, Meat and Fish- All India

Year	Milk	Eggs	Wool	Meat	Fish
	(Million Tonnes)	(Million Nos.)	(Million Kgs.)	(Million Tonnes)	(000' Tonnes)
1950-51	17.0	17.0	27.5	-	752
1955-56	19.0	19.0	27.5	-	839
1960-61	20.0	20.0	28.7	-	1160
1968-69	21.2	21.2	29.8	-	-
1973-74	23.2	23.2	30.1	-	1958
1979-80	30.4	30.4	30.9	-	2340
1980-81	31.6	31.6	32.0	-	2442
1981-82	34.3	34.3	33.1	-	2444
1982-83	35.8	35.8	34.5	-	2367
1983-84	38.8	38.8	36.1	-	2506
1984-85	41.5	41.5	38.0	-	2801
1985-86	44.0	44.0	39.1	-	2876
1986-87	46.1	46.1	40.0	-	2942
1987-88	46.7	46.7	40.1	-	2959
1988-89	48.4	48.4	40.8	-	3152
1989-90	51.4	51.4	41.7	-	3677
1990-91	53.9	53.9	41.2	-	3836

1991-92	55.7	55.7	41.6	-	4157
1992-93	58.0	58.0	38.8	-	4365
1993-94	60.6	60.6	39.9	-	4644
1994-95	63.8	63.8	40.6	-	4789
1995-96	66.2	66.2	42.4	-	4949
1996-97	69.1	69.1	44.4	-	5348
1997-98	72.1	72.1	45.6	-	5388
1998-99	75.4	75.4	46.9	1.9	5298
1999-00	78.3	78.3	47.9	1.9	5675
2000-01	80.6	80.6	48.4	1.9	5656
2001-02	84.4	84.4	49.5	1.9	5926
2002-03	86.2	86.2	50.5	2.1	6200
2003-04	88.1	88.1	48.5	2.1	6399
2004-05	92.5	92.5	44.6	2.2	6305
2005-06	97.1	97.1	44.9	2.3	6572
2006-07	102.6	102.6	45.1	2.3	6869
2007-08	107.9	107.9	43.9	4.0	7127
2008-09	112.2	112.2	42.8	4.3	7616
2009-10	116.4	116.4	43.1	4.6	7998
2010-11	121.8	121.8	43.0	4.8	8231
2011-12	127.9	127.9	44.7	5.5	8666
2012-13	132.4	132.4	46.1	5.9	9040
2013-14	137.7	137.7	47.9	6.2	9579
2014-15	146.3	146.3	48.1	6.7	10335
2015-16	155.5	155.5	43.6	7.0	10795
2016-17	163.7	163.7	43.5	7.4	11.41

Note: Meat Production from Commercial Poultry Farm is included from 2007-08.

Source: Department of Animal Husbandry, Dairying and Fisheries

LIVESTOCK SECTOR

6.8 India with the world's largest livestock population, has both opportunity and the challenge for sustaining production and tap the potential of livestock by the application of modern science and technology incentives and policies. Various initiatives taken by the Government in Livestock sector and the way forward are discussed in the following sections.

National Livestock Mission

6.9 The National Livestock Mission (NLM) was launched in 2014-15 during the 12th Five Year Plan to bring about sustainable and continual

development in the livestock sector by emulating the success achieved in the dairy and poultry sectors across species and regions. This Mission focuses on improving availability of quality feed and fodder, risk coverage, effective extension, improved flow of credit and organization of livestock farmers/ rearers, etc. It has four Sub-Missions:

- i. Sub-Mission on Livestock Development.
- ii. Sub-Mission on Pig Development in the North Eastern Region.
- iii. Sub-Mission on Fodder and Feed Development.
- iv. Sub-Mission on Skill Development, Technology Transfer and Extension.

Engrained within the above four Sub-Missions of the NLM there are further components and sub-components which broadly cover all the activities required to ensure quantitative and qualitative improvement in livestock production systems and capacity building of all stakeholders.

Livestock Health

6.10 Growth in the livestock sector is impeded by the high prevalence of various animal diseases, like Foot and Mouth Disease (FMD), Peste des Petits Ruminants (PPR), Brucellosis, Classical Swine Fever, Avian Influenza, etc. The economic loss on account of Foot and Mouth Disease alone is estimated to be more than Rs.20,000 crore per annum (NCAP Preliminary report 2010). The Department of Animal Husbandry, Dairying and Fisheries (DADF) has initiated National Control programmes for prevention and control of Foot and Mouth Disease, Peste Des Petits Ruminant, Brucellosis and Classical Swine Fever through the State governments. The Foot and Mouth Disease control programme initially started in 54 districts in 2003, has been extended to all the remaining States and UTs during 2017-18. Further funds are being provided under Rashtriya krishi Vikas Yojana (RKVY) for FMD control. Intensive FMD Control Programme has led to drastic reduction in number of FMD outbreaks from 1957 during 2011-14 to 505 only during 2014-17. FMD Control programme has also been recognized by OIE (World Animal Health Organization) in 2015. Based on the effective implementation of FMD Control programme, three zones have been established in the country as “FMD Free Zones” where vaccination is practiced.

Veterinary Support Services

6.11 As on 31st March, 2016, India has a total of 11,962 veterinary hospitals and polyclinics and 25,921 veterinary dispensaries, most of which have poor infrastructure and equipment's. Further the technical manpower is inadequate to support health programmes for the massive livestock population (the estimated requirement of veterinarians in government sector is about 67,000, but there are only about 25,000 veterinarians in government sector). To strengthen veterinary services at the field level the DADF initiated a programme for “Establishment and Strengthening of Existing Veterinary Hospitals and Dispensaries (ESVHD)”. There is a further need to strengthen veterinary hospital facilities for timely diagnosis and treatment of animal diseases. Emphasis has also been given to strengthen mobile veterinary services to ensure doorstep veterinary support, particularly in inaccessible areas.

6.12 A web based information technology system, namely National Animal Disease Reporting System (NADRS) for reporting the diseases from field level is being implemented. It is a part of Centrally Sponsored Scheme of Livestock Health and Diseases Control and being executed with support through National Informatics Centre (NIC). The main objective of NADRS is to record and monitor the livestock disease situation in the country with a view to initiate preventive and curative action in a timely manner. NADRS involves a computerized network, linking each block, district and the state/UT headquarters in the country to Central Project Monitoring Unit in the DADF at New Delhi. The Department has made improvements in the system based on inputs received from stakeholders.

Challenges

6.13 The main challenges confronting the animal health sector includes inadequate veterinary hospitals, dispensaries, technical manpower, cold storage infrastructure and availability of long duration immunity vaccines.

The Way Forward

6.14 The following measures will strengthen the animal health sector:

- i. Development of adequate veterinary infrastructure for immediate veterinary disease diagnosis and door step delivery of veterinary services, strengthening surveillance and monitoring and availability of trained manpower.
- ii. Development of a strong programme for the supply of sufficient veterinary vaccines with long duration immunity.

Cattle and Buffalo Breeding

6.15 India has a very large population of cattle and buffaloes. According to the Livestock Census 2012, the country had 76.69 million adult female cattle and 56.59 million adult female buffaloes. The country is bestowed with rich bio-diversity. There are 40 cattle breeds and 13 buffalo breeds identified as unique cattle breeds. Centuries of natural and human selection have resulted in genetically diverse breeds fitting into a wide range of environmental conditions and human needs each characterized by its unique adaptive and productive traits.

6.16 The National Programme for Bovine Breeding is focussed on extension of Field AI Network through “MAITRI-Multi-purpose AI Technician in Rural India”, monitoring of AI

programme, development and conservation of indigenous breeds, streamlining storage and supply of Liquid Nitrogen, procurement of disease free high genetic merit bulls for AI, supply of breeding bulls of high genetic merit for natural service, strengthening bull mother farms, and establishment of Breeders' Associations and Societies to encourage conservation and development of recognized indigenous breeds of the country. The actual implementation of National programme for Bovine Breeding has been initiated from 2014-15. Upto March 2017, twenty seven projects from 27 States with the total project cost of Rs 1077.83 crore have been approved and out of this amount of Rs 345.22 crore has been released to the States for implementation of the project including funds released under Rashtriya Gokul Mission.

Development and conservation of indigenous Breeds

6.17 Indigenous bovine breeds of India are robust and possess the genetic potential which can play a crucial role in the national economy. In the absence of a specific programme on development and conservation of indigenous breeds, their population has been declining and their performance is below the potential at present. Hence, there is an urgent need to take up a scientific programme for their development and conservation. For development and conservation of indigenous cattle and buffalo breeds, various initiatives have been taken up by the Government which are discussed in the subsequent sections.

Rashtriya Gokul Mission

6.18 Rashtriya Gokul Mission' has been launched by Government of India for conservation and development of indigenous breeds in a focussed and

scientific manner. The Mission also envisages the establishment of integrated cattle development centre or Gokul Grams to develop indigenous breeds including upto 40% non descript breeds. Mission is the focussed project under the National Programme for Bovine Breeding and Dairy Development, with an outlay of Rs 500 crore during last three years of the twelfth five year plan. Twenty Seven Projects received from 27 States have been approved with allocation of Rs 582.09 crore. Out of this amount, Rs 226 crore has been released for implementation of the project.

National Kamdhenu Breeding Centres (NKBC)

6.19 “National Kamdhenu Breeding Centres” for development, conservation and preservation of Indigenous Breeds are being set up one each in north and south India, as a Centre of Excellence to develop and conserve indigenous breeds in a holistic and scientific manner. A Nucleus Herd of all the Indigenous Bovine Breeds (37 Cattle and 13 Buffaloes), Mithun and Yak will be conserved and developed with the aim of enhancing their productivity and upgrading genetic merit. An allocation of Rs 50.00 crore has been made available under the Scheme. Besides being a repository of indigenous germplasm, the centre will also be a source of certified germplasm in the country. Elite certified germplasm - in the form of bulls for artificial insemination and natural service, heifers, male and female calves, semen doses and embryos-will be made available to farmers, breeders, breeding organizations maintaining Indigenous Breeds. An amount of Rs. 25 crore each has been released to Madhya Pradesh for establishment of NKBC in Northern Region and to Andhra Pradesh for establishment of NKBC in Southern region of India.

National Mission on Bovine Productivity

6.20 In order to improve productivity and enhance milk production, thereby making dairying more remunerative to the farmers a new Scheme namely “National Mission on Bovine Productivity” has been initiated in November 2016 with an allocation of Rs 825 crore (Rs 575.80 crore Central share and Rs 249.20 crore State share) over a period of three years and implementation of spill over activities of the project beyond the project period. The National Mission on Bovine Productivity (NMBP) is being implemented as a part of Rashtriya Gokul Mission under Umbrella Scheme White Revolution-Rashtriya Pashudhan Vikas Yojna. The NMBP has four major components.

- (i) **Pashu Sanjivni** : Pashu Sanjivni is an animal Wellness Programme encompassing provision of Animal Health Cards ('Nakul Swasthya Patra') along with UID identification of animals in milk and a National Database. Under the component, 8.8 crore milch animals will be identified using UID and their data will be uploaded in the INAPH database. Animal Health Cards (Nakul Swasthya Patra) will be issued to the animals covered under the Scheme. The health card will have information on vaccination of animals, de-worming and treatment of animals. This will play a crucial role in control of spread of animal diseases, implementation of scientific breeding programmes. This will also lead to increase in trade of livestock and livestock products.
- (ii) **Advanced Breeding Technology** : including Assisted Reproductive Technique IVF/

MOET and sex-sorted semen Technique to improve availability of disease free high genetic merit female bovines. Under the component, 150 sex sorting machines will be established at 10 semen stations in the country including semen stations managed by dairy cooperatives. It envisages creation of facility for production of 8 million doses annually. Under the component, 50 embryo transfer technology labs and In-Vitro-Fertilization labs will be established for exponential multiplication of elite animals of indigenous breeds. This will lead to increase in milk production and productivity of animals in an exponential manner.

(iii) National Bovine Genomic Center for Indigenous Breeds (NBGC-IB) :

In developed dairy countries genomic selection is used to increase milk production and productivity for attaining faster genetic gain. In order to increase milk production and productivity of indigenous cattle, a National Bovine Genomic Centre will be established in the country. By using genomic selection indigenous breeds can be made viable within few generations. This Centre will play a crucial role in identification of disease free high genetic merit bulls of indigenous breeds.

(iv) E-Pashu Haat : At present there is no authentic market in the country for quality-disease free germplasm in the form of: (a) semen; (b) embryos; (c) calves; (d) heifers; and (e) adult bovines available with different agencies/stake holders. Farmers depend on middlemen for sale and purchase of quality

germplasm. Breed wise information on availability of bovine germplasm is not available which is essential for promotion of indigenous bovine breeds. For the first time in the country, under the NMBP, an e-Pashudhan Haat portal has been developed for connecting breeders and farmers regarding availability of quality bovine germplasm. The portal has been launched on 26th November,2016. Through the portal breeders/farmers can sale or purchase their breeding stock. Information on all forms of germplasm, including semen embryos and live animals with all the agencies and stake holders in the country has been uploaded on the portal. Through this portal, farmers will be aware of the availability of quality disease free bovine germplasm with different agencies in the country. It will also lead to propagation of high genetic merit germplasm. Since, price evaluation will be made available with the farmers/ breeders through this portal, there will be no involvement of middlemen in sale and purchase of animals. Such portal for sale and purchase of germplasm in all the forms is not even available even in developed dairy countries.

DAIRYING

6.21 Dairying has become an important secondary source of income for millions of rural families and has assumed the most important role in providing employment and income generating opportunities, particularly for women and marginal farmers. Most of the milk in the country is produced by small, marginal farmers and landless labourers. About

15.83 million farmers have been brought under the ambit of 1,70,992 village level dairy cooperative societies up to March 2016. The cooperative milk unions have procured an average of 42.55 million kg of milk per day during the year 2015-16 as compared to 38 million kg in the previous year recording a growth of 12 per cent. The sale of liquid milk by cooperative sector has reached 32 million litres per day during the year 2015-16 as compared to 31.24 million tonnes registering a growth of 2.7 per cent over the previous year.

6.22 The efforts of the DADF in the dairy sector are concentrated on promotion of dairy activities, including non-operation flood areas with emphasis on building up cooperative infrastructure, revitalization of sick dairy cooperative milk unions and creation of infrastructure in the States for production of quality milk and milk products. The National Dairy Development Board (NDDB) continues its activities for overall development of dairy sector in Operation Flood areas. The brief details of Dairy Development Schemes being implemented by DADF are given below.

National Programme for Bovine Breeding and Dairy Development (NPBBDD)

6.23 The restructured scheme namely National Programme for Bovine Breeding & Dairy Development (NPBBDD) was launched in February 2014 by merging three schemes of Dairy Development of Intensive Dairy Development Programme (IDDP), Strengthening Infrastructure for Quality & Clean Milk Production (SIQ&CMP) and Assistance to Cooperative and National Programme for Cattle and Buffalo Breeding. The Scheme has two components: (a) National Programme for Bovine Breeding

(NPBB); (b) National Programme for Dairy Development (NPDD). The NPBB focuses on extension of field AI Network through “MAITRI (Multi Purpose AI Technician in Rural India) and to encourage conservation and development of recognized indigenous breeds of the country. Achievements under NPBB has been discussed in the previous sections. The NPDD focuses on creating infrastructure for Production, Procurement, Processing and Marketing of Milk & Milk Products by the State Implementing Agency (SIA) (State Milk Marketing Federations/ District Cooperative Milk Producers' Union).

6.24 The budgetary provision of Rs. 1,800 crore has been provided for implementation of NPBBDD during 12th Plan. An amount of Rs. 170 crore has been allocated for the year 2017-18 under the component of NPDD. Under NPDD component, 33 new projects in 19 states have been approved with total outlay of Rs. 379 crore till 31st March, 2017. A total sum of Rs.119.70 crore has been released for implementation of projects approved under the scheme till 31st March 2017.

Dairy Entrepreneurship Development Scheme (DEDS)

6.25 Dairy Entrepreneurship Development Scheme (DEDS) was launched in September 2010 with the objective of providing self employment opportunities in dairy sector. This scheme is being implemented through NABARD which provides financial assistance to commercially bankable projects with loans from Commercial, Cooperative, Urban and Rural Development Banks with a back ended capital subsidy of 25% of the project cost to the beneficiaries of General category and 33.33% of the

project cost to SC & ST beneficiaries. The Scheme is being implemented with the budget provision of Rs. 1400 crore during 12th Plan. An amount of Rs. 240 crore allocated for the year 2016-17 has been released to NABARD. Further an amount of Rs. 240 crore has been allocated for the year 2017-18. Since inception, an amount of Rs 1049.56 crore has been disbursed by NABARD as back-ended capital subsidy to the beneficiaries for setting up of 2,69,049 dairy units upto 31st March, 2017.

National Dairy Plan Phase-I

6.26 National Dairy Plan-Phase I (NDP-I) was launched in March 2012 by Government of India for implementation from 2011-12 to 2016-17 & extended up to 2018-19 with a total investment of about Rs.2242 crore comprising Rs.1584 crore as International Development Association (IDA) credit, Rs.176 crore as Government of India share, Rs.282 crore as share of End Implementing Agencies (EIAs) and Rs.200 crore as NDDDB's contribution for providing technical and implementation support to the project. The Board of the World Bank approved the IDA credit of \$350 million (Rs 1584 crore) for the scheme on 15.3.2012.

6.27 NDP-I envisages to meet the projected national demand of around 200 million tonnes by 2021-22. It is, therefore, imperative that a scientifically planned Multi State initiative is launched to increase productivity in existing herd through a focused programme of breeding and feeding. The NDP has been envisaged with 15 years horizon considering that 3 to 5 years are required to produce more productive animal and the time required to develop and expand system to increase milk production. The first phase of NDP to be

financed largely by the World Bank has been extended upto 2018-19 with the following objectives:

- a) To increase the productivity of milch animals and thereby increase milk production to meet the rapidly growing demand for milk; and
- b) To provide rural milk producers with greater access to the organized milk processing sector.

6.28 Initially NDP-I was started to areas with higher potential in 15 major milk producing States contributing about 90% of country's milk production, including Uttar Pradesh, Punjab, Haryana, Gujarat, Rajasthan, Madhya Pradesh, Bihar, West Bengal, Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Telangana (newly created), Orissa and Kerala. Further, the area of operation of NDP-I has been extended to three more states, i.e., Uttarakhand, Jharkhand and Chhatisgarh. Now NDP –I covers total 18 states. The benefits accruing from NDP-I will be however across the country through availability of superior quality semen. An amount of Rs. 390 crore has been allocated for the year 2017-18 for implementation of the Scheme.

6.29 Up to March 2017, 390 sub projects from 18 States have been approved with a total outlay of Rs 1993.20 crore. Out of the total approvals, Rs. 1665.11 crore would be grant assistance and Rs. 328.09 crore would be contributed by the EIAs.

New Initiatives

6.30 Consequent to the Union Budget 2017-18 announcements by Ministry of Finance, the DADF has initiated the proposal for setting up of corpus fund titled “Dairy Processing and Infrastructure

Development Fund (DIDF)” for augmenting and strengthening of processing infrastructure of milk cooperatives with loan assistance from NABARD under DIDF. Dairy Processing and Infrastructure Development Fund to be set up with a corpus of Rs. 2000 crore for 2017-18 and will be increased to Rs. 8000 crore over 3 years. The Department is in the process of formulation of a DIDF scheme for implementation of the budget announcement.

POULTRY DEVELOPMENT

6.31 Poultry rearing has been a household activity in India. Through policy interventions by Government and enterprise of private players, poultry farming has transformed into a scientific operation. Following components related to poultry are covered under National Livestock Mission.

i) Modernisation and Development of Breeding Infrastructure

6.32 Central Farms: Central Poultry Development Organizations (CPDOs) located at four regions, viz., Chandigarh, Bhubaneswar, Mumbai and Bengaluru have been playing a pivotal role in the implementation of the policies of the Government with respect to poultry. The mandate of these organizations is to focus on improved variety of birds for backyard poultry which can survive at the farmer's doorstep, provide basic training to backyard poultry farmers and conduct feed analysis. CPDOs are also promoting diversification with species other than poultry, like ducks, Japanese quail, Guinea fowl, etc.

6.33 Kalinga Brown, Kaveri, Chhabro and Chann are the varieties / strain of Low Input Technology birds (Chicken) developed by these CPDOs and based on demand, hatching eggs, day old chick of

parent / commercials of these varieties are being supplied to the States / UT's and individual farmers. Besides, they also maintain indigenous varieties like Kadaknath, Aseel, etc., to promote breed conservation.

6.34 The CPDOs also impart training to farmers and a model of training module for training of Poultry farmers/ Entrepreneurs has been devised and is being followed. CPDO & Training Institute (CPDO&TI), Hessarghatta is also imparting Trainers' training to in-service personnel from within the country as well as overseas. Regular poultry management courses and tailor-made specialized, advanced and laboratory courses are available at this institute. CPDO&TI has opened a Skill Development and Training Centre exclusively for training purpose. This organisation (CPDO & TI) is accredited with ISO9001:2008 by Bureau of Indian Standards since 2005. The Institute is also taking steps to align with the National Skill Development Framework.

6.35 CPDOs are also doing feed analysis for all animal feed. Three CPDOs at Bhubaneswar, Mumbai and Hessarghatta have Near Infra-Red (NIR) Spectrophotometer to analyse feed samples. Automation System for feeding and watering the birds is being done at Hessarghatta, Chandigarh and Bhubaneswar.

6.36 The Central Poultry Performance Testing Center (CPPTC), located at Gurgaon, is entrusted with responsibility of testing the performance of layer and broiler varieties. This Centre gives valuable information relating to different genetic stock available in the country. One layer and two broiler tests are usually initiated in a year.

6.37 During the year 2016-17, around 0.87 lakh & 11.43 lakh number of parent chicks and commercial chicks respectively have been supplied by the CPDOs. Around 2723 number. of farmers and trainers have been trained and around 4768 no. of feed samples have been analyzed.

ii) Strengthening of breeding infrastructure of State/University farms

6.38 The component aims at strengthening existing State poultry farms so as to enable the flow of suitable germplasm from the Research Institutions / Laboratories to the grassroots level alongwith other technical services, like capacity building, developing and implementing package of practices at the ground level for different types of poultry system including family poultry system for supplementary income generation and family nutrition.

6.39 During the year 2016-17, 9 State Poultry farms (Karnataka-1, Madhya Pradesh-2, Meghalaya-3, Uttarakhand-1(Duck), Nagaland-1 and Odisha-1) have been assisted under this component with the Central Share of Rs.284.39 lakh.

iii) Rural Backyard Poultry Development

6.40 This component is envisaged to cover beneficiaries from BPL families to enable them to gain supplementary income and nutritional support. The SHGs/ NGOs, entrepreneurs may take up mother unit activity which will procure the day old chicks either from the State Poultry Farms or from the private hatchery and will rear the birds upto 4 weeks of age. This scheme component aims at supporting BPL beneficiary families wherein 4-week old chicks, suitable for rearing in the backyard, reared at the 'mother units' are further distributed to them in batches. Further, provision is there to raise the birds

in a bio-secure manner for night-shelter etc. Under this programme, so far funding of Rs.4496.27 lakh has been done to cover around 2,17,747 BPL beneficiaries. A number of 297 Mother Units has been also established for raising day old chicks.

SHEEP AND GOAT DEVELOPMENT

6.41 Sheep and Goats are important species of livestock for India. They contribute greatly to the agrarian economy, especially in areas where crop and dairy farming are not economical, and play an important role in the livelihood of a large proportion of landless as well as small and marginal farmers. Following components related to Sheep and Goats are covered under National Livestock Mission:

i) Modernization and Development of Breeding Infrastructure

6.42 Central Farms: Central Sheep Breeding Farm, Hisar, Haryana: The farm was established with the objectives of producing acclimatized exotic rams for distribution to various State Sheep farms and training of personnel in Sheep Management and Mechanical Sheep Shearing. Presently the Farm is keeping Nali X Rambouillet cross and Sanadi X Corriedale cross, as well as Beetal Goats. During 2016-17, the farm supplied 305 rams and 35 bucks to different State agencies and farmers. In addition, a total of 100 farmers were trained in sheep management and production while another 120 farmers were trained in machine shearing techniques and 1138 nos. of farmers have been trained under one day training programme.

ii) Strengthening of Breeding Infrastructure of State/University Farms

6.43 Under this sub-component the Government of India provides assistance to strengthen the

State/University sheep and goat farms. During 2016-17, three State Goat farms and one State Sheep farm were assisted to strengthen and modernize their set-up and infrastructure. These farms include one Goat Farm at Odisha and Telangana each and one Goat and one Sheep farm at West Bengal and funds to the tune of Rs.37.53 lakh, Rs.29.04 lakh, and Rs.416.862 lakhs, respectively, have been released to these States.

iii) Interventions towards productivity enhancement

6.44 Propagation of Artificial Insemination

(A.I.): Under this Sub-component, during 2016-17, an amount of Rs.16.462 lakh was released as second instalment to Palampur, Himachal Pradesh and Rs.49.73 lakh released as last instalment to Nimbkar Agricultural Research Institute (NARI), Maharashtra.

iv) Cluster based mass de-worming/health cover programme

6.45 During 2016-17, under this Sub-component, Rs.243 lakh was released to the State of Chhattisgarh to cover 3 lakh nos of animals.

PIGGERY DEVELOPMENT

6.46 Government of India has taken various initiatives for Piggery Development, under the National Livestock Mission (NLM). Following are the components related to Piggery Development under NLM.

I) Modernization and Development of Breeding Infrastructure

6.47 Strengthening of Breeding Infrastructure of State/University Farms: Under this Sub-component the Government of India during 2016-17, has provided assistance to the State of Punjab for

strengthening 2 State Government Pig Farms and for setting up of 1 Swine Semen Processing Laboratory. An amount of Rs.290.40 lakh has been released for the mentioned projects.

ii) Sub-Mission on Pig Development in North-Eastern Region

6.48 There has been persistent demand from the North-Eastern States, including Sikkim seeking support for the all-round development of pigs. Therefore, in the North-Eastern Region, pig development is being implemented as a Sub-mission of the NLM. During the year 2016-17, a total of 14 pig farms were assisted for strengthening, including 6 in Arunachal Pradesh, 2 in Manipur, 1 in Meghalaya, 2 in Mizoram, 2 in Nagaland and 1 in Sikkim and funds to the tune of Rs.184.69 lakh, Rs.133.398 lakh, Rs.45.00 lakh, Rs.117.99 lakh, Rs.90.00 lakh and Rs.11.16 lakh, respectively, have been released to the states.

6.49 Under the health cover, during 2016-17, amounts of Rs.85.50 lakh to cover 1.4 lakh numbers, of animals in Meghalaya, Rs.54.00 lakh to cover 3 lakh numbers. of animals in Mizoram, Rs.81.00 lakh to cover 5 lakh numbers. of animals in Nagaland and Rs.22.067 lakh to cover 12,250 nos. of animals in Tripura, have been released. Beside these, an amount of Rs.72.396 lakh to 4 farms under Support to Breeding Programme and Rs.15.21 lakh to 1 farm under Propagation of Reproductive Technologies has been given to the State of Mizoram. In addition, during 2016-17, for importing 225 numbers of germplasm, funds amounting to Rs.40.5 lakh were released to Nagaland.

Entrepreneurship Development and Employment Generation (EDEG)

6.50 In order to encourage entrepreneurship development and technology infusion, under the Sub-mission of Livestock Development of NLM, there is a Component-Entrepreneurship Development and Employment Generation (EDEG), wherein a basket of bankable activities related with poultry, pig and sheep/goat rearing & breeding units are placed from which farmers, individuals, NGOs, etc., can choose from. During 2016-17, an amount of Rs.8,495.70 lakh has been released to NABARD to channelize the funds for establishment of poultry, pig and sheep/goat rearing & breeding units in various states. A total number of 6,440 beneficiaries have been assisted for establishment of poultry (1,629), sheep/goat (4,336) and piggery (475) units for Entrepreneurship Development and Employment Generation among women, poor and marginal farmers.

FODDER AND FEED DEVELOPMENT

6.51 The DADF is implementing the Sub-Mission on Feed and Fodder Development so as to ensure the availability of fodder. The Scheme supports the use of post-harvest technologies to cultivate and preserve fodder.

6.52 To improve the seed replacement scenario, the Department has taken up production of foundation seeds from breeder seeds at its eight Regional Fodder Stations for the last four years. For the production of certified seeds from foundation seeds, the Department has introduced the “Fodder Seed Procurement Production and Distribution” component. After the foundation seeds are produced at Department's regional stations, these are offered

for further multiplication to State governments, preferably through milk federations, dairy cooperatives and progressive farmers, etc., under a buy-back arrangement for the production of certified seeds. Assistance is provided to States for the purpose.

6.53 The components of the Scheme under the Sub-Mission on Feed and Fodder Development are as follows.

- 1) Forage production from non-forest wasteland/ rangeland/ grassland/ non-arable land (ha).
- 2) Forage production from forest land (ha).
- 3) Cultivation of nutri grains and dual purpose crops (ha).
- 4) Fodder seed production/ procurement and distribution.
- 5) Conservation of fodder through post-harvest technologies.
 - a) Distribution of hand-driven chaff cutters.
 - b) Distribution of power-driven chaff cutters.
 - c) Establishment of high-capacity fodder block making units.
 - d) Distribution of low-capacity, tractor-mountable fodder block making units/ hay baling machine/ reaper/ forage harvester.
 - e) Establishment of silage making units.
 - f) Establishment of area- specific mineral mixture/ feed processing units.
 - g) Establishment/ modernization of feed testing laboratories.

6.54 Under Feed and Fodder Development during the year 2014-15, 2015-16 & 2016-17, a sum of Rs. 47.68 crore, Rs. 16.86 crore & Rs. 35.73 crore, respectively, has been utilized for various

components of the Scheme. The year- wise physical achievement made in last three years under the

Scheme is given in **Table 6.3**

Table 6.3: Physical Achievement for Feed & Fodder Development

SI. No.	Name of the Component	2014-15	2015-16	2016-17	Total
1	Hand Driven Chaff Cutter (nos)	21516	3634	600	25750
2	Power Driven Chaff Cutter (nos)	9307	12351	7522	29180
3	Silage Making Unit (nos)	2272	56	1495	3823
4	Fodder Seed Distribution (in Qt.)	46031	44778	5511	96320
5	Fodder Production for non-forest (in ha)	535	Nil	715	1250
6	Fodder Production from forest (in ha)	Nil	45	100	145

Source: Department of Animal Husbandry, Dairying and Fisheries

FISHERIES SECTOR

National Fisheries Development Scheme

6.55 National Fisheries Development Board (NFDB) was established by the Government in 2006 as a special purpose vehicle (SPV) for accelerated development of the fisheries and aquaculture in a sustainable manner through upgradation of production technologies, management and utilization of resources, establishment of infrastructure for post-harvest operations and markets. NFDB had during the Twelfth Plan Period invested nearly Rs. 459.60 crore for various developmental activities. It is proposed to merge all Centrally Sponsored Schemes aimed at growth and enhancement of production and productivity in NFDB during Twelfth Plan and beyond to provide greater focus and an integrated approach to the development and management of fisheries in the country.

Marine Fisheries Development Scheme

6.56 During the Eleventh Five Year Plan, the Marine Fisheries Development Scheme made

provision for development of 13 fishing harbors and 4 fish landing centers. These were taken up for implementation while 4 existing Fishing Harbors (FH) were repaired and renovated. In addition, 53 projects of post harvest infrastructure like ice plants, retail, outlets were taken up. Besides 8843 traditional craft motorized; 3516 safety appliances provided; 40,993 KL of HSD provided to fishermen with rebate; 3 deep sea resource-specific fishing vessels were promoted; introduction of 88 intermediate craft was taken up and one new private fishing harbor was funded under a Build, Operate and Transfer (BOT) package.

6.57 During the 12th Plan, 18 new fishing harbor and 18 fish landing centre projects have been taken up for development. Supply of 13,462 safety kits to fishing vessels and motorization of 10,520 traditional fishing boats and introduction of 123 intermediate craft have been taken up. Besides, 85 ice plants, 76 insulated trucks and 229 retail outlets were taken up during the 12th plan under the Central Plan Scheme.

Inland Fishery Development Scheme

6.58 Under the Scheme, since inception 8,98,825.33 ha area of fresh water and 46,290.7 ha area of brackish water were covered for aquaculture and 15,86,644 fish farmers were benefited for freshwater aquaculture and 40,456 fish farmers for brackish water aquaculture.

Fishermen Welfare Scheme

6.59 During 2016-17, under the scheme, funds were released for coverage of 46.47 lakh fishers for insurance, construction of 1877 houses, benefit of 29,173 fishermen under Saving-cum-Relief Scheme.

Food Processing and Value Addition

7.1 A strong and dynamic food processing sector plays a vital role in diversification and commercialisation of agriculture, enhancing shelf life, ensuring value addition to agricultural produce, generation of employment, enhancing income of farmers and creating markets for export of agro foods. The term “food processing” covers all the processes that food items go through, right from the farm gate till the time they reach the consumer's plate. Value addition processes include: i) basic cleaning, grading and also alteration of the raw material to a stage just before the final preparation; and, ii) making ready-to-eat and ready-to-drink foods, such as bakery products, instant foods, flavoured and health drinks, etc.

7.2 The Ministry of Food Processing Industries (MoFPI) acts as a catalyst for mobilizing investment into this sector, guiding investors and creating a supportive environment for the healthy growth of the food processing industry. It realizes that the food processing sector offers rural communities an opportunity for creating sustainable livelihoods and economic development. Food processing benefits all sections of society as given below.

Farmers enjoy higher returns, higher yields and lower risks.

Consumers enjoy access to larger variety, newer products and better prices.

The economy enjoys higher levels of activity, income, investment, employment and productivity.

PERFORMANCE OF FOOD PROCESSING SECTOR

7.3 Growth in the food processing sector is expected to open up a lot of opportunities for players having strong linkages in the agri-value chain. Significant investment opportunities await in supply chain management, cold storage, financing, retailing and exports. Historically, agriculture and food processing industries remained stagnant due to low public investment, poor infrastructure, inadequate credit availability and high levels of fragmentation. These issues are being resolved expeditiously by the Government, so that significant improvement is possible in terms of the creation of supporting infrastructure and investment and consequently the overall growth of the sector.

7.4 With its huge production base, India can easily become one of the leading food suppliers to the world while at the same time serving its vast growing domestic population of over a 1.25 billion people. India's large population size, with increase in disposable income and changing lifestyles create incredible market opportunities for food producers, food processors, machinery makers, food technologists and service providers in this sector.

7.5 The food processing sector, identified as a thrust area for development, needs huge investments in logistics for supporting the value chain from farm to plate. The Government is well aware that rules and the policy regime determine the sector's performance, and has, therefore, exempted most food

processing enterprises from the provisions of the Industries (Development and Regulation) Act, 1951 (except beer and alcoholic drinks, and items reserved for the small-scale sector).

7.6 Effective post-harvest management not only minimizes losses but also increases the value of agricultural products marketed by transforming agricultural raw materials. Central Government policy initiatives include assistance in the form of grants-in-aid to the individual, Farmer Producer Organizations (FPOs), entrepreneurs, cooperatives, Self Help Groups (SHGs), private companies and central/State PSUs, etc., to enable them to set up food processing industries/units/projects. Government

also provides assistance for skill development and R&D activities. Various State governments are also implementing their own food processing promotion policies and schemes.

7.7 Food Processing Sector has emerged as an important segment of the Indian economy in terms of its contribution to GVA, employment and investment. During 2016-17, the sector constituted as much as 7.90 and 6.29 per cent of GVA at constant prices in Manufacturing and Agriculture sector respectively (**Table 7.1**). Food Processing Industries sector has grown at 3.53 per cent during the same period at constant prices.

Table 7.1: Contribution of Food Processing Industries to Gross Value Added at 2011-12 Prices

Contribution of Food Processing Industries to Gross Value Added (GVA) at 2011-12 prices							
S. No.	Economic Activity	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Rs. Crore							
1.	GVA-All India	81.07	85.46	90.64	97.12	105.03	112.48
2.	GVA- Manufacturing	14.10	14.87	15.61	16.84	18.99	20.49
3.	GVA-Agriculture, Forestry and Fishing	15.02	15.24	16.09	16.06	16.15	17.17
4.	GVA- FPI	1.47	1.30	1.30	1.34	1.47	1.52
(%) Growth							
	Economic Activity	AAGR	2012-13	2013-14	2014-15	2015-16	2016-17
5.	GVA-All India	6.77	5.42	6.05	7.15	8.15	7.09
6.	GVA- Manufacturing	7.79	5.45	4.97	7.90	12.76	7.90
7.	GVA-Agriculture, Forestry and Fishing	2.74	1.49	5.57	-0.22	0.59	6.29
8.	GVA- FPI	0.91	-11.72	0.39	2.66	9.70	3.53
(%) Share in Total GVA							
	Economic Activity	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
9.	GVA- FPI	1.81	1.52	1.44	1.38	1.40	1.35
10.	GVA- Manufacturing	17.3	17.40	17.22	17.34	18.08	18.21
11.	GVA-Agriculture, Forestry and Fishing	918.53	17.84	17.75	16.53	15.38	15.26
(%) share of FPI in							
	Economic Activity	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
12.	GVA- Manufacturing	10.42	8.72	8.34	7.94	7.72	7.41
13.	GVA-Agriculture, Forestry and Fishing	9.78	8.51	8.09	8.32	9.08	8.84

Note: All GVAs have been adjusted for Financial Intermediation Services Indirectly Measured (FISIM).

Source: National Account Statistics, Central Statistical Office

7.8 The Annual Survey of Industries (ASI), released by the Central Statistics Office (CSO), provides information on a number of characteristics, like the number of factories, employment and investment, etc., of factories registered under the Factories Act, 1948. The major industries that

constitute the food processing sector are meat, fish, fruits and vegetables, oil, animal feed, dairy, grain mill and beverages. **Table 7.2** lists the state-wise estimated number of registered factories in Food Processing Sector for 2015-16.

Table 7.2: State-wise estimated number of registered factories in Food Processing Sector for 2015-16

State/UT-wise No. of Registered Food Processing Units in India		
S. No.	Name of the State/UTs	Number of registered units
1	Andaman & Nicobar Islands	5
2	Andhra Pradesh	5,913
3	Arunachal Pradesh	30
4	Assam	1,354
5	Bihar	894
6	Chandigarh (U.T.)	18
7	Chhattisgarh	1,274
8	Dadra & Nagar Haveli	6
9	Daman & Diu	33
10	Delhi	166
11	Goa	97
12	Gujarat	2,068
13	Haryana	857
14	Himachal Pradesh	171
15	Jammu & Kashmir	152
16	Jharkhand	233
17	Karnataka	2,159
18	Kerala	1,579
19	Lakshadweep	-
20	Madhya Pradesh	846
21	Maharashtra	3,031
22	Manipur	25

23	Meghalaya	19
24	Mizoram	-
25	Nagaland	20
26	Odisha	1,064
27	Pudducherry	59
28	Punjab	2,895
29	Rajasthan	880
30	Sikkim	21
31	Tamil Nadu	5,082
32	Telangana	3,961
33	Tripura	79
34	Uttar Pradesh	2,086
35	Uttarakhand	364
36	West Bengal	1,879
	Total	39,320

Source: ASI 2015-16, CSO

7.9 Food Processing Industry is one of the major employment intensive segments constituting 12.34 per cent of employment generated in all Registered Factory sector in 2015-16. According to ASI 2015-16, the total number of persons engaged in registered food processing sector was 17.65 lakh. During the last 6 years ending 2015-16, employment in

registered food processing sector grew at an Average Annual Growth Rate (AAGR) of 1.65 per cent. **(Figure 7.1)**. Unregistered food processing sector supports employment to 51.1 lakh workers as per the NSSO 73rd Round, 2015-16. The overall scenario of employment in food processing sector is given in **Table 7.3**.

Table 7.3: Employment in Food Processing Industry: Registered and Unregistered Units

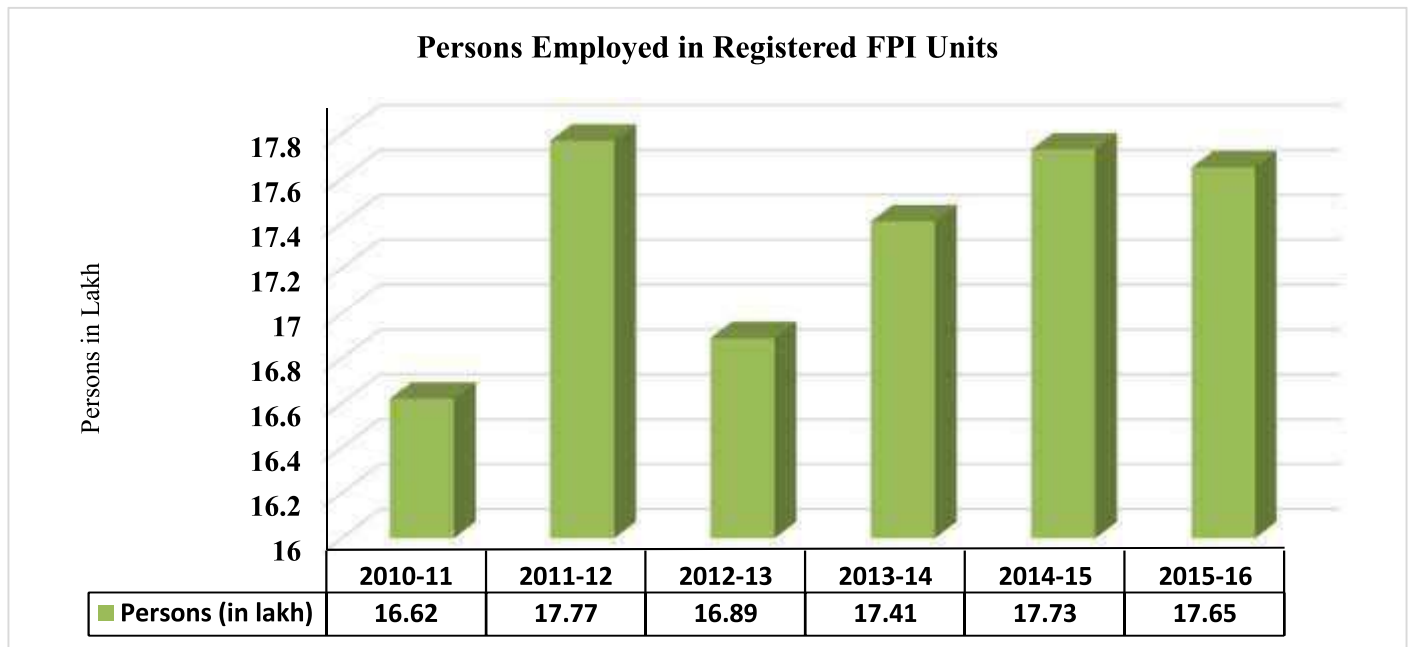
Employment in Food Processing Industry			
Sector	Food Processing* Industry	Overall Industry	(%) Share of FP sector
Registered [#] (2015-16)	17.65 lakh	142.99 lakh	12.34
Un-incorporated (2015-16)**	51.11 lakh	360.41 lakh	14.18

*: Includes food products and beverages segments ;

#: Factory Registered under sections 2m(i) and 2m(ii) Factory Act 1948, Source: Annual Survey of Industries 2015-16;

Source: NSSO Report No. 581(73/2.34/1) on Operational Characteristics of Unincorporated Non-agricultural Enterprises (Excluding Construction) in India; NSS 73rd Round (July 2015-June 2016)

Figure 7.1: Persons Employed in Registered Food Processing Units



Source: ASI 2015-16, CSO

7.10 In terms of investment in fixed capital, registered food processing sector grew annually at an average of 13.09 per cent during last six years ending 2015-16. As per the latest, ASI 2015-16, the Fixed

Capital in Food Processing Industry stood at Rs. 2,06,339 crore. The amount of Fixed Capital in Food Processing Industries is shown in Table 7.4 and Figure 7.2.

Table 7.4: Fixed Capital in Food Processing Industries (Rs. Crore)

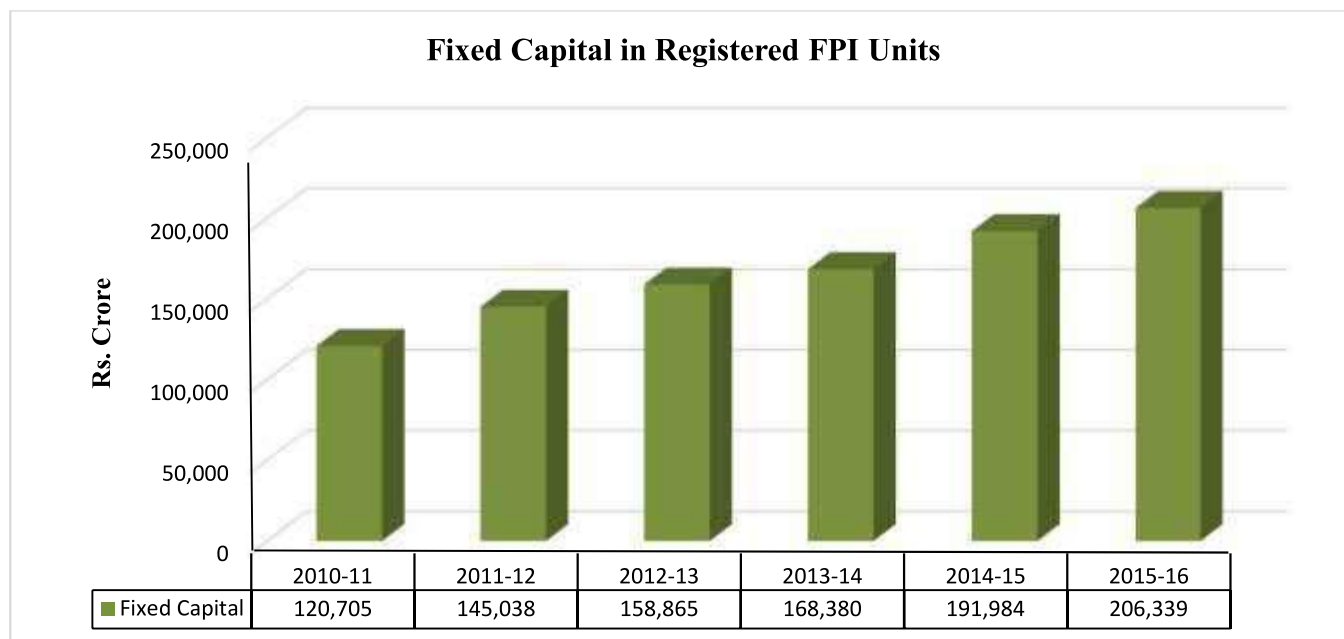
Fixed Capital * in Food Processing Industries (Rs. Crore)							
Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	AAGR#
Fixed Capital	1,20,705	1,45,038	1,58,865	1,68,380	1,91,984	2,06,339	13.09
Growth Rate(%)	21.33	20.16	9.53	5.99	14.02	7.48%	

Source: ASI 2015-16, CSO

* Fixed capital: Depreciated value of Fixed Assets owned by factory.

#: Average Annual Growth Rate of 6 years.

Figure 7.2: Fixed Capital in Registered Food Processing Units



Source: ASI 2015-16, CSO

FOREIGN DIRECT INVESTMENT (FDI)

7.11 As per the extant policy, FDI up to 100 per cent is permitted under the automatic route in Food Processing Industries. Further, 100 per cent FDI is permitted under Government route, i.e., through approval, for retail trading, including through e-commerce in respect of food products manufactured

and/or produced in India. Details of FDI in food processing sector are given in **Table 7.5**.

GOODS AND SERVICES TAX (GST) ON FOOD COMMODITIES

7.12 As per the latest revision in the GST rates, of the all food categories taken together under different

Table 7.5: Foreign Direct Investment (FDI) Equity Inflows in the Food Processing Sector

S. No.	Year (April- March)	FDI (In Rs. crore)	FDI (US \$ Million)
1.	2010-11	860.99	188.67
2.	2011-12	859.02	170.21
3.	2012-13	2,193.65	401.46
4.	2013-14	25,106.77	3,982.89
5.	2014-15	3,164.72	515.86
6.	2015-16	3,312.00	505.88
7.	2016-17	4,865.85	727.22
8.	2017-18	5,835.62	904.90

Source: Department of Industrial Policy and Promotion (DIPP)

chapter heads/ sub-heads, 31.46% of the food items have been exempted from GST and 34.26% of the food items shall attract GST of 5%. In other words, almost 66% of the food items will be under lowest tax slab of 0% or 5%. These items constitute bulk of raw material that goes into further value addition. Hence, cost of production of processed item is expected to fall. Only 16.08% of the total food items under different chapter heads/ sub-heads will fall under GST slab of 12%. Similarly, 16.08% of the total food items under different chapter heads/sub-heads will fall under GST slab of 18%. The remaining 2.09% of the items under different heads/sub-heads shall attract GST of 28%. This can augur food processing industries.

MAJOR INITIATIVES TO PROMOTE FOOD PROCESSING INDUSTRIES

7.13 The Ministry of Food Processing Industries (MoFPI) has developed an “Investors' Portal: Nivesh Bandhu ([http:// foodprocessingindia.co.in](http://foodprocessingindia.co.in))” which was launched on 3rd Nov, 2017 in the inaugural session of “World Food India 2017”. The portal brings together all relevant information related to food processing sector, on one platform, for the benefit of the investors to take informed decisions on investment. The portal provides information on State profiles and State Government policies, incentives offered for promotion of food processing sector, Geo-tagged information on agri-production clusters, availability of raw materials, processing units, processing infrastructure, industrial plots, cold chain, testing laboratory, communication network etc. It is a platform for business networking by the farmers, processors, traders and logistic operators. The investor can seek guidance in specific investment related issues by posting their query on the portal.

Investor Portal: Nivesh Bandhu” can also be accessed through website of Ministry of Food Processing Industries.

7.14 With a view to help investors and prospective entrepreneurs to identify the raw material base in different parts of the country, the MoFPI released “Food Maps of India” on 18 December, 2014, which have been uploaded on the Ministry's website.

7.15 A special fund of Rs 2,000 crores has been created in NABARD since the financial year 2014-15 for extending affordable credit to designated food parks and the individual processing units in the designated food parks.

7.16 The Reserve Bank of India classified loans to food and agro-based processing units and cold chains under agriculture activities for Priority Sector Lending (PSL), subject to an aggregate sanctioned limit of Rs 100 crores per borrower. It will ensure greater flow of credit to entrepreneurs for setting up food processing units and attract investment to the sector.

MAJOR PLAN SCHEMES

Scheme for Infrastructure Development

7.17 Integrated and holistic infrastructure is extremely important for the food processing sector. Towards this end, the Ministry of Food Processing Industries (MoFPI) is implementing a Central Sector Scheme, namely Pradhan Mantri Kisan Sampada Yojana (PMKSY) with an allocation of Rs. 6,000 crore for period 2016-20 co-terminus with the 14th Finance Commission cycle for development of Food Processing Industry in the country. The PMKSY is designed to create robust modern infrastructure along the entire value chain in food processing with a

view to, inter alia, reduce wastage and improve the supply position of quality food products to various locations. PMKSY has seven component schemes viz; (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.

Scheme for Integrated Cold Chain and Value Addition Infrastructure

7.18 Approved in 2008, the Scheme aimed to provide a complete, integrated cold chain, and value addition and preservation infrastructure facilities, without any break for perishables from the farm gate to the consumer in order to reduce post-harvest losses of horticulture and non-horticulture agri-produce. Under the scheme, Ministry provides maximum grant-in-aid of Rs. 10 crore per project. As per the revised scheme guidelines, the scheme will have two types of pattern of financial assistance:-

- (a) For storage infrastructure including Pack House and Pre cooling unit, ripening chamber and transport infrastructure, grant-in-aid @ 35% for General Areas and @ 50% for North East States, Himalayan States, ITDP Areas & Islands, of the total cost of plant & machinery and technical civil works will be provided.
- (b) For value addition and processing infrastructure including frozen storage/ deep freezers associated and integral to the processing, grant-in-aid @ 50% for General Areas and @ 75% for North East States,

Himalayan States, ITDP Areas & Islands, will be provided.

- (c) For irradiation facilities, grant-in-aid will be provided @ 50% for General Areas and @ 75% for North East States, Himalayan States, ITDP Areas & Islands.

Scheme for Creation/Expansion of Food Processing & Preservation Capacities

7.19 The main objective of the Scheme is for promotion of processing / preservation of agro food products and modernization /capacity enhancement of food processing units which will help in increasing the level of processing, value addition thereby reduction of wastage. The processing activities to be undertaken by the individual units will cover a wide range of post-harvest processes resulting in value addition and/or enhancing shelf life with specialized facilities required for preservation of perishables. Induction of modern technology will make a clear difference in both process efficiencies as well as quality of the end product.

7.20 The Scheme envisages grants-in-aid@ 35% of eligible project cost in general areas and @50% of eligible project cost in the North East States including Sikkim and difficult areas namely Himalayan States (i.e. Himachal Pradesh, Jammu & Kashmir and Uttarakhand), State notified ITDP areas & Islands subject to max. of Rs. 5.00 crore per project.

7.21 During the period of the scheme, about 400 new projects are proposed to be taken up with an allocation of Rs. 1290 crore.

Scheme for Infrastructure for Agro Processing Cluster

7.22 The scheme aims at development of modern infrastructure to encourage entrepreneurs to set up food processing units based on cluster approach. These clusters will help in reducing the wastage of the surplus produce and add value to the horticultural / agricultural produce which will result in increase of income of the farmers and create employment at the local level.

7.23 The Scheme envisages grants-in-aid @ 35% of eligible project cost in general areas and @50% of eligible project cost in the North East States, including Sikkim and difficult areas namely Himalayan States (i.e. Himachal Pradesh, Jammu & Kashmir and Uttarakhand), State notified ITDP areas & Islands subject to max. of Rs. 10.00 crore per project.

7.24 It is expected that on an average, each project may have around 5-10 food processing units to be set up in each Agro-processing cluster with an employment generation potential, both direct and indirect of about 500 to 1500 persons. However, the actual configuration of the project may vary depending upon the business plan for each Agro-processing cluster.

Scheme for Creation of Backward and Forward Linkages

7.25 The objective of the Scheme is to provide effective and seamless backward and forward integration for processed food industry by plugging the gaps in supply chain in terms of availability of raw material and linkages with the market. Under the Scheme, financial assistance is provided for setting up of primary processing centers/ collection centers

at farm gate and modern retail outlets at the front end along with connectivity through insulated/ refrigerated transport. The Scheme would enable linking of farmers to processors and the market for ensuring remunerative prices for agri produce.

7.26 The Scheme envisages grants-in-aid @ 35% of the eligible project cost for general areas and @ 50% for North East States, Himalayan States, ITDP areas and islands respectively subject to maximum of Rs. 5.00 crore per project.

Modernization of Abattoirs

7.27 The MoFPI had launched a comprehensive scheme for modernization of abattoirs across the country in the year 2008-09 to give a fillip to upgradation of technology to ensure hygienic slaughtering of animals for meat processing. The Scheme provides for implementation of projects with the involvement of local bodies (Municipal Corporations and Panchayats)/ Public Sector Undertakings/ Co-operatives/ Boards under Government and private investors on PPP basis. Regulatory functions continue to be discharged through local bodies. The scheme has since been discontinued but provision has been made to meet the committed liabilities.

CHALLENGES & THE WAY FORWARD

7.28 One of the major challenges faced by the sector is the post-harvest wastage of agricultural produce, particularly in fruits and vegetables. Such wastage may be minimized by creating an efficient system of transportation, storage and product delivery, and by increasing the level of processing of agricultural produce.

7.29 Apart from infrastructure constraints, the

food processors face problems in procurement of raw materials for processing due to restrictive provisions in marketing of agricultural produce. The MoFPI has been engaging various stakeholders to identify problems faced by the processing sector and the areas of intervention. There is an urgent need to address these issues to ensure hassle-free procurement of raw material by food processors.

7.30 Another major constraint faced by food processors is the lack of availability of processable varieties of fruits and vegetables, due primarily to the inadequate linkage between production and processing. This is often addressed through a system of contract farming between food processors and farmers. Some States permit contract farming, but a number of states are yet to notify the rules. Food processors also face difficulty in terms of registration at multiple locations. In some states, registration for contract farming has been provided with the Marketing Committee whereas in others, the contract has to be registered with the state-level Nodal Agency. A few States have exempted the market fee on purchases under contract agreements, while some states have exempted partially. Other States require buyers to render a bank guarantee for the entire value of the contracted produce. Thus, there is a need to streamline the contract farming system for the benefit of both farmers and food processors.

7.31 Policies on the stocking and movement of agricultural commodities play a major role in ensuring the availability of adequate raw materials for food processors. Agricultural commodities are produced in specific parts of the country—production is dependent on topographical and climatic conditions—but demand is countrywide.

Hence, there is a need to move agricultural produce from supply centres to various processing and consumption centres in the fastest possible way at minimal cost. The provisions of the Essential Commodities Act are enforced to regulate the production, manufacturing and distribution of essential commodities in India. The Act allows states to issue orders in case of malpractice, like hoarding and black marketing. However, policies on stocking and movement of agricultural commodities often have not been found stable—there are sudden restrictions on stock limits that makes it difficult for processing industries to plan their purchase of raw material. Thus, there is a need to distinguish between hoarding and stocking of goods by genuine processors/exporters.

7.32 Some corporate entities operating in the food processing sector have successfully organized farmers, and supply farm inputs and provide training on crop practices. They have also entered into arrangements for procuring agricultural produce from farmers and agreed to a price. The farmer is assured of a reasonable return, and the processor is assured of adequate, timely supply of raw materials of the required quality, with no further intermediation. This kind of collaboration is critical for the success of the food processing industry in India because of the peculiar nature of landownership. Effective tie-ups across the value chain will translate into assured supply of adequate inputs, efficient agri-practices, monitoring of quality, minimization of cost and reduction of wastage. In the era of trade liberalization, the constraints of technology and skill can be overcome; what is perhaps needed is a long-term partnership with farmers on mutually beneficial terms.

7.33 State governments must involve themselves in improving outreach, supervision and monitoring, and must collaborate with the private sector to create infrastructure. At present, the main infrastructure schemes, for setting up mega food parks and cold chains, are close-ended; these should be open-ended, so that the Ministry can fund all viable project proposals received, rather than limiting the number of projects.

7.34 The inadequacy of funds for financing infrastructural projects is an important factor in the programme for the food processing sector, but much bigger problems are the institutional gaps in terms of

constraints relating to contract farming, direct marketing, policies on stocking and the movement of agricultural commodities. The recent initiatives by the Government, like release of Model Contract Farming Act, Agricultural Produce and Livestock Marketing (Promotion & Facilitation) Act, 2017, formulation of draft Model Act for Agricultural Produce & Livestock Contract Farming and Services Act, implementation of e-NAM, etc., are expected to play a major role in addressing some of these issues and developing a dynamic and competitive food processing sector in India.

Agricultural Research and Education

8.1 Agricultural research and education is the most important plank of agricultural development strategy. It makes possible the application of science and technology in farming, livestock, fisheries and other activities. Agricultural research and education have been focussed on genetic resources for improvement in foodgrain and horticulture productivity, new breeds of animal, livestock management, marine fish harvest; and in agricultural engineering discipline. It makes possible better post harvest management and value addition through constant research on improving processing, packaging, storage and transportation of agricultural produces.

8.2 Engaged in agricultural research and education is a vast scientific and technical manpower of Indian Council of Agricultural Research (ICAR) and Krishi Vigayan Kendras (KVKs) under the Department of Agricultural Research and Education (DARE). The ICAR as the apex institution of DARE consist of a network of about 109 institutes, 78 All India co-ordinated projects and networks and 662 KVKs; and 71 state agricultural veterinary horticultural, and fisheries universities and 4 general universities.

GENETIC RESOURCES

8.3 Genetic resources provide valuable traits with potential for developing new varieties/ hybrids/ animal strains/breeds. In this endeavor, 17 explorations were undertaken in eight states and 1,115 accessions including 531 of wild species were

collected. Three hundred eighty seven herbarium specimens were added to the National Herbarium of Cultivated Plants. Germplasm added to the National Gene bank for long-term storage comprised 10,224 accessions of orthodox seed species; shoot tips/ meristems (14) of different vegetative propagated species were cryo-stored and 14 accessions were added to the in-vitro Gene bank. A total of 31,110 accessions were imported from 39 countries, which included international trial material (32,684 accessions). Promising introductions were rice with high yield (EC881897-903), salinity (EC881904-1905) and submergence tolerance (EC881906 and EC887557) from Philippines; maize with red colored cob (PI550473 and PI558532) with genes *Vip3Aa20*, *Cry2A.127* (Mod E) and *Cry1A.88* (EC866742-69) from USA, varieties protected by US Patent, for use in new line development (EC881923-2007) from USA; wheat with heat tolerance (EC870177-247) from USA; oil palm with carotene rich, drought tolerance, low free fatty acid (EC869395-414) from Malaysia; cotton with high yielding, high ginning outturn, big bolls, short duration varieties (EC881780-2431) from USA; cabbage with red, purple, pickling, drum headed types (EC889990- 90015) from UK; tomato wild species (EC870961-1137, EC879895-905) from USA; mango root stocks (EC890387-9) from Israel; grapes promising hybrids (EC873363-75) from USA; eucalyptus wild species (EC881243-50) from Israel; sesbania wild species (EC882381-97) from Ethiopia; orchard grass with late maturing, excellent

forage quality and increased winter tolerance (EC871140) from USA; coffee hybrids with large beans, drought and rust resistance (EC884110, 14 and 16) from USA.

8.4 A total of 18,601 accessions were characterized and evaluated, including wheat and rice for terminal heat and drought tolerance. A total of 4,163 accessions were supplied for research use and crop improvement within the country. Biochemical evaluation of 1,805 accessions was undertaken in different crops for oil content, fatty acid profile, protein, sugar, minerals, amino acids and antioxidants.

8.5 A total of 53 novel germplasm accessions comprising of cereals and pseudocereals, millets, grain legumes, fibre and forages, vegetables, oilseeds, commercial crops, medicinal and aromatic plants and spices and agro-forestry species were registered and conserved in gene bank.

CROP IMPROVEMENT

8.6 ICAR strives to develop new crop varieties having specific traits that improve yield and nutritional quality along with tolerance/resistance to various biotic and abiotic stresses besides matching crop production and protection technologies for target agro-ecologies. Three hundred and eight new improved varieties/hybrids of different field crops were released for cultivation in varied agro-climatic regions of the country in 2016. The first zinc-rich rice variety (DRR Dhan 45) have been released for cultivation in Tamil Nadu, Andhra Pradesh, Telangana and Karnataka under irrigated ecologies. Its zinc content in polished rice is 22 ppm with mean yield of 5.2 tons/ha and first Canola Indian mustard

variety namely Pusa Double Zero Mustard 31 (PDZ-1) with less than 2% erucic acid in oil and less than 30 ppm glucosinolates in seed meal has been released for timely sown irrigated areas of National Capital Region, Delhi. An early maturing (52-55 days) summer mungbean variety (IPM 205-7;Virat) released for cultivation in irrigated areas of Punjab, Haryana, Rajasthan, Uttar Pradesh, Bihar, Jharkhand, Madhya Pradesh, Gujarat, Tamil Nadu, Telangana, Andhra Pradesh and Karnataka in newer niches of rice-wheat system after wheat and in rice-rice cropping after second crop of rice. It has a yield potential of 1.0-1.2 tonnes/ha, and can be safely harvested before the onset of monsoon. It is highly resistant to mungbean yellow mosaic disease and powdery mildew and moderately resistant to *Cercospora* leafspot.

8.7 A unique genic-single nucleotide polymorphism (SNP) genotyping chip for genetic and evolutionary studies as well as molecular breeding applications in rice has been designed and validated. The chip designed for Affymetrix platform incorporated 50051 SNPs from 18980 different genes spanning 12 rice chromosomes, including 3710 single-copy (SC) genes conserved between wheat and rice, 14959 SC genes unique to rice, 194 ergonomically important cloned rice genes and 117 multi-copy rice genes. A total of 320 wild rice accessions were genotyped by 50K SNP chip. Assays with this chip showed high success rate and reproducibility.

8.8 **Decoding of wheat rust genome:** Leaf rust is most widespread among all rusts and causes maximum loss in India. Next generation sequencing (NGS) technology was used to decode genomes of 15 strains (~1500 MB data) of wheat leaf- rust

fungus. A high quality draft genome (~100Mb) sequence of Race 77 with 33X genome coverage and predicted 27678 protein coding genes responsible for various functions have been generated. Genome wide comparative analysis has revealed that *P. triticina* genome is 37.5 % and 40.0 % repetitive in case of race77 and race106, respectively; race77 substantially differs from race106 at segmental duplication (SD), repeat elements and SNP/InDel levels. Certain "host spot regions" in the genomes of race 77 are found vulnerable for reshuffling, leading to variability in it.

Horticultural Crops

8.9 Horticulture sector has emerged as a key driver for economic development in several States in the country and it contributes about 30 per cent to value of output from agricultural sector. The research priorities under horticulture sector are focused on genetic resource enhancement and its utilization in breeding to evolve high yielding varieties with resistance to pests and diseases, adapt to adverse soil and climatic conditions and enhancing the total factor productivity including input use efficiency. In addition, horticultural research have been focused on production of safe food and reducing the harvest and post-harvest losses through developing technologies on processing and production of value added products to ensure nutritional security of a vast population in

India and also meet export demands.

8.10 During the year, several improved varieties and production technologies for fruits, vegetable crops and spices/herbs were evolved and are discussed below.

Fruits

8.11 Under fruit component of research the following new techniques/ varieties were introduced:

- i) NRCC Nagpur Mandarin Seedless-4, a clonal selection, attractive seedless fruits, 679 fruits/plant yield, 27.15 tons per ha (98 kg/plant), high yielding NRCC Acid Lime -7 (195 kg/tree) yielding variety (54 t/ha) with high juice content (50.50%) content and NRCC Acid Lime -8 (216 kg/tree) yielding (59 t/ha) and cluster bearing.
- (ii) Thar Kranti (65 kg/plant) and CISH-J-42 jamun; hybrid progenies of pomegranate, Thar Malti, a high yielding ber (60 kg/plant); Thar Harit, an improved mulberry variety (20-25 kg/plant), suitable for cultivation under hot-arid conditions; Thar Pragati phalsa (3-4 kg/plant); bael 'Thar Neelkanth (70-75 kg/tree) were identified for cultivation.

Figure 8.1 : New varieties of fruits



[NRCC Acid Lime 7]



[NRCC Acid Lime 8]



[Hybrid pomegranate NRCP H-6]

- iii) Coconut hybrid 'Kalpa Samrudhi' (Dwarf x Tall) and Kalpatharu (high yielding, premium ball copra, coconut variety) were released and notified in the Gazette of India for cultivation in Kerala, Karnataka and Tamil Nadu.
- iv) One high yielding areca nut selection of VTL146, with dry kernel yield of 3.91 kg/palm/year and tender nut yield of 3.26 kg/palm/year, was identified for release.
- v) One cocoa hybrid VTCP1, with average dry bean yield of 3.2 kg/tree/year was recommended for release.

Vegetable Crops

8.12 Under vegetable crops, the following initiatives were taken:

- i) Arka Samrat tomato (~100 t/ha) and in

brinjal, Arka Avinash, Arka Harshita and Arka Unnati (34 to 40 t/ha); Arka Khyati (MSH-206), chilli (40-45 t/ha fresh) & 5-5.5 t/ha (dry) were identified for cultivation.

- (ii) In addition, garden pea varieties with high yield (8-8.5 t/ha) like Arka Nirmal, Arka Harini, & Arka Mayur and, tolerance to high temperature like Arka Tapas, Arka Uttam & Arka Chaitra (6.7-7.5 t/ha) and photo-insensitive, pole type Indian bean cultivars like Arka Pradhan (35 t/ha), **Arka Krishna** (30 t/ha), **Arka Adarsh** (41 t/ha), **Arka Prasadhi** (37 t/ha), **Arka Bhavani** (32 t/ha) and **Arka Vistar** (37 t/ha) were identified for cultivation.

- iii) French bean 'Arka Sharath' with 18.5 t/ha

Figure 8.2 : New varieties of Vegetable crops



fresh pod yield was recommended for cultivation.

- iv) Pumpkin 'Thar Kavi' (7-8 kg yield/plant) and Musk melon 'Sel-3' (31.6 t/ha) and Long melon 'VRSLM-16' (175-200 q/ha) were identified for cultivation under semi-arid and arid climatic conditions.
- v) Leafy vegetable, Arka Samraksha (10.9 t/ha) and Arka Varna (10.6 t/ha) in 30-35 days with higher nutritive values were identified.
- vi) Onion Arka Bheem, a tri-parental synthetic variety (42 t/ha in 130 days) has been recommended for cultivation in Karnataka.

Spices and herbs

8.13 For the development of spices & herbs following initiatives were taken:

- i) Ajmer Coriander-1 (11.7 q/ha), Ajmer Fennel-2 (17.9 q/ha) and Ajmer Dill-2 (14.6 q/ha) were released for cultivation.
- ii) Drumstick Thar Harsha (45-48 kg per plant) and potato Kufri Mohan (35-40 t/ha) were recommended for cultivation. Several advanced breeding lines of tuber crops and high yielding varieties of gladiolus like Arka Manorama & Arka Aayush; Vallabh Isabgol-1 (12 q/ha) were identified.

Figure 8.3 : New varieties of Spices and Herbs



Ajmer Coriander



Vallabh isabgol-1

ANIMAL SCIENCE

8.14 The vision of the Government is to develop new technologies to support production enhancement, profitability, competitiveness and sustainability of livestock and poultry sector for food and nutritional security. The details of new animal

Genetic resources/ population of Livestock and Poultry is given in **Table 8.1**. The major scientific developments/initiatives taken under Livestock and Poultry sector during the year are discussed in the following sections.

Table 8.1: New Animal Genetic Resource / population of livestock and poultry registered

Livestock and Poultry Breed	Estimated Population
Indigenous Badri cattle of Uttarakhand	16 lakhs
Teressa, indigenous goat breed of tribal farmers of Nicobar group of islands	7,721
Nicobari, indigenous pigs reared by Nicobari tribes	35,000
Kodi Adu goats, Thoothukudi & Ramanathapuram districts of Tamil Nadu	1,67,000
Chevaadu sheep, Tirunelveli district of Tamil Nadu	1,58,200
Kendrapada sheep, six coastal districts (Kendrapada, Jagatsingpur, Cuttack, Puri, Jajpur and Bhadrak) of Odisha	1,23,000
Tenyi, indigenous pig of Nagaland	60,000-70,000
Doom pigs, Dhubri, Bongaigaon and kokrajhar districts of Assam	3,000
Kaunayen chicken, Thoubal, Imphal West, Imphal East and Bishnupur Districts of Manipur	60,000-80,000

Source : ICAR

New Breeds

8.15 Developed and released five new dual purpose Poultry varieties (Srinidhi, Kamrupa, Narmadanidhi, Pratapdhan and Jharsim) suited for rearing under backyard system in different agro-climatic conditions of the country. These varieties were developed looking into the region specific consumer preferences (meat, egg or both) under the All India Coordinated Research Program on Poultry Breeding which is being operated at different locations of the country in collaborations with state agricultural/ veterinary universities, states animal

husbandry departments/ICAR institutes. The germplasm is being provisioned to farmers as well as to development agencies (for further large scale production and distribution in the field area)

Livestock Management and Improvement

8.16 Under livestock management and improvement the following major initiatives were taken:

- i) Produced cloned calf 'HISAR GOURAV', from cells of ventral side of tail of superior Murrah bull, which is least exposed to sunlight and may have less mutation rate, and

can be good choice for isolation of donor cells to produce healthy clones. It is distributed from the earlier clone produced in india.

- ii) Set up eight multiplier flocks in Agra and Mathura district to increase the availability of Barbari goat breed bucks in the field for genetic improvement.
- iii) Provided more than 5,500 Piglets to farmers and development agencies.
- iv) Provided more than 11.00 lakhs poultry seed including hatching eggs, day old chicks and 6 weeks chicks (including parents) to farmers and development/ Government agencies.

Animal Health and Welfare

8.17 Under animal health and welfare the following were provided with:

- i) Kit for detection of *Listeria monocytogenes* in milk developed.
- ii) Developed a two-stage test at NDRI for detection of *E. coli* based on the principle of targeting “enzyme substrate reaction for specific marker enzyme (s) to release free chromogen in stage-1 which can be visually detected by a colour change after 12.0 ± 1.0 h of incubation in *E. coli* selective medium.
- iii) Developed replacement of capture antibody and reference antigens of PPR Sandwich-ELISA kit with HIS against recombinant “N” protein & inactivated antigens for large scale application.
- iv) Ambulatory clinics developed for addressing health related problems of farmers; training

of farmers; creating awareness among farmers through exhibitions.

- v) Developed Taqman probe based real-time PCR assay for quick detection of *Brucella melitensis*.
- vi) Developed a proteomic based approach using OFFGEL fractionation and tandem mass spectrometry (LC-MS/MS).
- vii) Developed Loop mediated isothermal amplification (LAMP) for the detection of *Brucella* in various clinical samples like vaginal swabs, preputial swabs and milk in goats.
- viii) Provided diagnostic services for avian influenza in poultry and birds with detection of H5N8 viruses for the first time in country.
- ix) Characterized whole genome of Indian PRRS (Porcine Reproductive and Respiratory Syndrome) virus isolates from Mizoram and Meghalaya.
- x) Developed a diagnostic PCR assay for simultaneous detection of 23 prioritized exotic and emerging viruses.
- xi) Developed indirect ELISA kit for detection of antibodies against Japanese encephalitis virus in pigs.
- xii) Developed competitive inhibition ELISA for detection of antibodies against *Trypanosoma evansi*.
- xiii) Economic analysis revealed an estimated annual loss of Rs. 1611 crore due to PPR in sheep and goats in India.

xiv) Generated forewarning bulletin for some of the important animal diseases in country

Animal Waste Management

8.18 Under Animal Waste Management following actions were taken:

- I) Technologies developed for dairy (through use of Jai Gopal Earthworm technology) goat and sheep waste management for production of vermi-compost through ICAR institutes.
- ii) In the area of poultry waste management efficient bio-gas production (Green energy) exclusively from poultry excreta has been done.

FISHERIES SCIENCE

Marine Fish Harvest

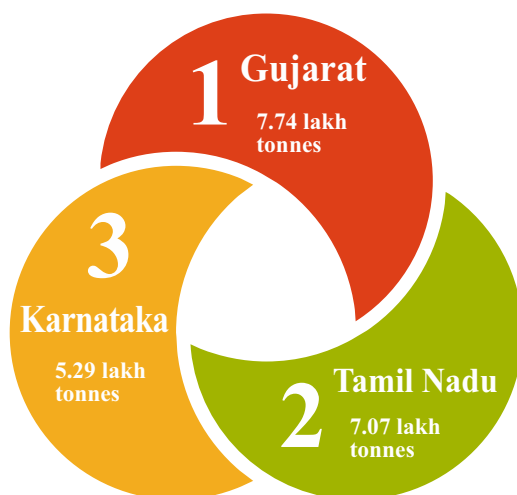
8.19 The Indian marine fish landing in 2016 was 3.63 million tonnes, representing an increase of 6.6 per cent with respect to 2015. The bulk of country's landings (63%) came from southeast and northwest regions. Gujarat remains by far the largest producer

with an estimated landing of 7.74 lakh tonnes and contributed about one-fourth of country's production followed by Tamilnadu and Karnataka. In all about 735 species were captured, maximum species diversity was in Kerala and Tamil Nadu.

National Plan of Action for shark fishery

8.20 Guidelines for preparing National Plan of Action for conservation and management of sharks in India has been spelt out by ICAR-CMFRI in a book entitled "Guidance on National Plan of Action for Sharks in India". Following the guidelines of Food and Agriculture Organization's International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks), adopted in 1999, the book outlines a theme-based action plan for shark conservation and management in India. The status of India's shark fisheries (including sharks, rays and skates), its trade, existing management and conservation measures have been summarized in the book.

Figure 8.4 : Top three maritime States of Fish Landings

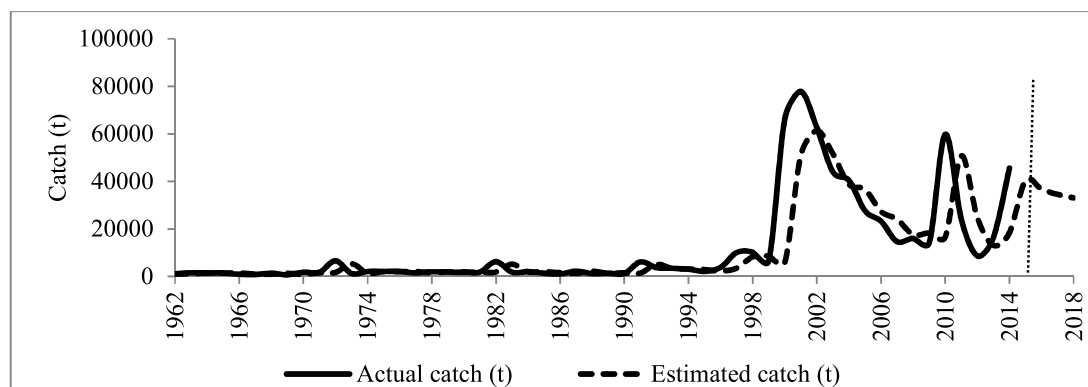


Hilsa fisheries

8.21 The catch analysis of Hilsa, *Tenualosa ilisha*, a high value fish which migrates to freshwater riverine habitats for breeding was studied. The stratified multistage random sampling method involving 51 stations along the Hooghly-Bhagirathi river system and Northern Bay of Bengal estimated total Hilsa catch at 12191 tonnes during 2015-16, which amounts to only 27% of the previous year's landing, indicating drastic decline in current year's catch. Maximum catch (98.6%) is realized from the marine sector. The catch per unit effort (CPUE)

varied from 37.5-260 kg/boat/day for multiday gillnetters in peak fishing months (July-September), whereas in estuarine and freshwater zones, it was 0.4-14.0 and 0.08-1.25 kg/boat/hour, respectively for single day gillnetters. Based on exploitation pattern and population structure analysis, there is 20% overexploitation from maximum sustainable yield (MSY) levels and 72.4% decline in standing stock biomass. Time series analysis of catch data using autoregressive integrated moving average (ARIMA) model suggests progressive decline in production of hilsa in coming years in the Hooghly system (**Figure 8.5**).

Fig 8.5: ARIMA based forecasting of catch from Hooghly



Source : ICAR

Mass production of hybrid clownfish

8.22 ICAR-CMFRI achieved mass production of hybrid percula clownfish for the first time. First successful cross breeding between Picasso and Platinum clownfish was achieved in February 2016 at Mandapam Regional Centre. Larviculture protocols were standardized to achieve year round fingerlings production by feeding with rotifers, *Artemia* nauplii and larval inert diets. An average 65% survival was obtained from larvae to fingerlings.

Freshwater ornamental fish feed- Varsha

8.23 ICAR-CMFRI developed and evaluated freshwater ornamental fish feed- Varsha. The feed is available in two sizes (1 and 2 mm) at protein levels of 25, 30, 35, 40 and 45%. Varsha contains a high quality marine protein mixture (fish, shrimp, squid and clam), soy, wheat, fish oil, vitamins, minerals, spirulina, assorted carotenoids, anti-oxidants and anti-fungal agents.

Fish database updated

8.24 The database on Indian fish diversity is updated on a continuous basis. The database contains a total of 3,436 fish species, related to 936 freshwater, 113 brackish water, 1,887 marine ecosystem species and 500 exotic fish species.

FV Sagar Harita launched

8.25 ICAR-CIFT, Kochi launched the 19.75m multi-purpose energy efficient fishing vessel, “FV Sagar Harita” on April 18, 2016. The vessel is built under the project “Green Fishing Systems for the Tropical Seas” funded by National Agricultural Science Fund (ICAR-NASF). The vessel has array of novel features such as hull is made of marine grade steel and the cabin and wheel is made of FRP to reduce weight, improve carrying capacity and speed. It is powered by 400 hp main engine and has 400 watt solar powered emergency lighting, acoustic trawl telemetry system with under-water sensor, fishing gear handling equipment's (such as split trawl winch, long line setter and hauler and gillnet hauler) and two RSW (0to -10°C) tanks of one ton capacity each.

Seed production technology of Orange spotted grouper *Epinephelus coioides*

8.26 Larviculture protocols for the successful rearing of the orange spotted grouper *Epinephelus coioides* were standardized using live feeds and larval inert diets.

β - Noda virus detection kit

8.27 ICAR-CMFRI, Kochi developed single tube reverse transcription–loop– mediated isothermal amplification (single tube RT-LAMP) kit named 'β-Noda detect' for the detection of beta noda virus in fish. The kit is highly specific, sensitive and rapid and can detect a single copy of virus in less than one hour.

Positive reaction is diagnosed by a green fluorescence that can be visualized by naked eye under visible or UV light (using protective goggles) without the help of sophisticated equipment. Mainly intended to screen marine brood stock fish to ensure certified specific pathogen free eggs and larvae in a sensitive and rapid way, it will also aid in timely diagnosis and prevention of spread of disease in marine culture system.

Broodstock diet for pearlspot

8.28 'EtroBrood^{plus}', a functional feed for sustaining higher fry yield is developed by ICAR-CIBA. With EtroBrood^{plus} fry yield per spawning ranged between 1380 and 4115 corresponding to 4.6 and 15.4 fry/g of female body weight. In one of the spawning a record of 5244 eggs were obtained.

New Initiatives in Fisheries Science

8.29 **Web based online data collection system for marine fish landings:** Web based online software for uploading marine fish landings data directly from landing centres / fisheries harbours has been developed by ICAR-CMFRI. This will enable fast data transmission and estimation of species-wise, fishing gear-wise and zone-wise marine fish landings for all nine maritime states and union territories of Puducherry and Daman & Diu. The application has four components, namely, (i) online data entry using PC tablets; (ii) Utilities for scrutiny of data; (iii) Analysis and estimation; and, (iv) Report generation. With the GPS enabled tablets, data collection process can be efficiently monitored.

8.30 **Transplanting cryopreserved germ cells in allogeneic host:** Cryopreserved germ cells (GCs) of rohu (*Labeo rohita*) were tested for viability and colonization ability in the allogeneic host (*Catla*

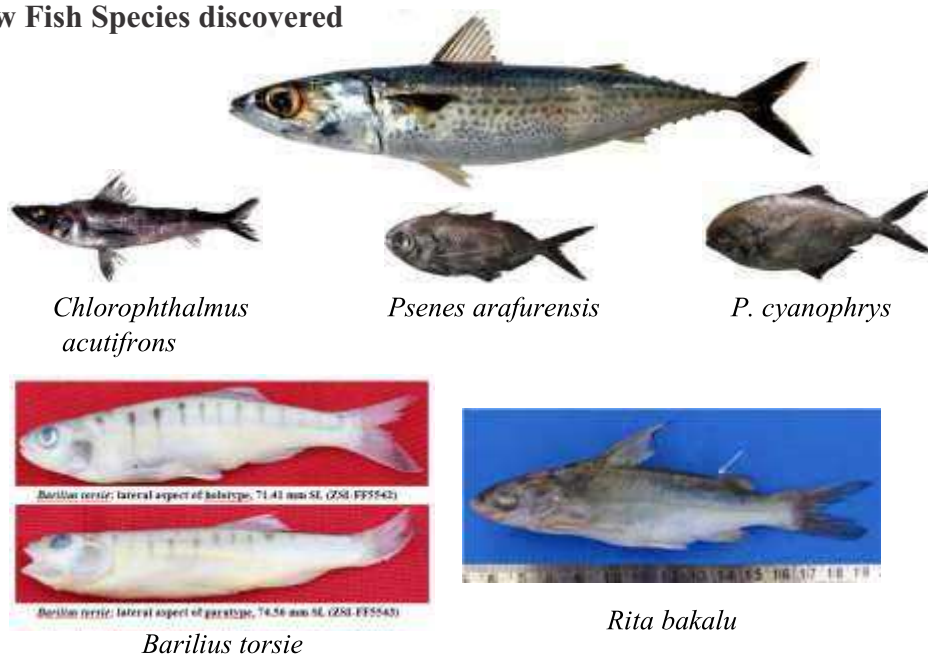
catla). GCs cryopreserved using Dimethyl Sulfoxide (DMSO) medium and slow cooling rate of -1 °C/min had higher viability. On transplantation the frozen/thawed GCs colonized and proliferated in the recipients' gonad. This technique of transplantation of GC into adult gonads paves way for further applications in surrogate animal development.

8.31 Surrogate brood stock development: Production of surrogate brood stock will help to propagate commercially important fishes that are difficult to breed in confinement and also help in recovery of endangered fish populations. Sterile gonads of common carp, *Cyprinus carpio* were produced using heat-chemical method. These can be used as recipient for transplantation of donor germ cells, for development of surrogate brood stock. On injection of cytotoxic drug, busulfan, severe gonadal degeneration was observed after 10 weeks at 38°C water temperature. Hundred per cent sterile (devoid of endogenous germ cells) male and female were obtained. Quantitative analysis of *vasa* gene transcription and change in colouration of gonads were found to be additional tools to measure the

degree of gonad sterility.

8.32 New fish species discovered: A new species of mackerel, *Scomber indicus* (Indian chub mackerel) was first detected from Gujarat coast and later it was observed all along the west coast of India up to Kanyakumari. The fish is caught mainly in ring seines and trawls and small quantities in hooks and lines operated around knolls. Since, July 2016, shoals of juveniles of this species are being noticed along Kerala coast, which indicates that a viable population of this species is getting established in the region. Similarly, specimens of three new deep-sea fishes namely *Chlorophthalmus acutifrons* (Hiyama, 1940), *Psenes arafurensis* (Günther, 1889) and *Psenes cyanophrys* (Valenciennes, 1833) were obtained from Kollam, Southwest coast of India as by-catch of deep-sea fishing. From the rivers, *Barilius torsie* (Cyprinidae: Rasborinae) was recorded from river Torsa of Brahmaputra drainage system, and *Rita bakalu*, (Siluriformes: Bagridae) from the Godavari river basin.

Figure 8.6 : New Fish Species discovered



AGRICULTURE ENGINEERING

8.33 Establishment of Custom Hiring Centres for Agricultural Machinery in Madhya Pradesh:

The ICAR–CIAE, Bhopal in association with Directorate of Agricultural Engineering, Government of Madhya Pradesh, has taken an initiative to train the farmer entrepreneurs for successful setting up and management of custom hiring centres. ICAR-CIAE has trained about 800 entrepreneurs and 462 of them have successfully started their Custom Hiring Centres in different districts of Madhya Pradesh. These centres are successfully providing services of agricultural machineries to local and nearby farmers on custom hiring basis for different field operations of production agriculture. The training provided by ICAR-CIAE, includes topics on selection, operation, repair and maintenance of agricultural machinery and the basic entrepreneurial skills and economics of operation of custom hiring centres. To ensure the success of these centres on sustainable basis, the ICAR-CIAE has developed a user friendly Decision Support System (DSS) for the entrepreneur to assist them in deciding the minimum cost of operation for selected machinery so that the enterprise operates on profitable basis. A follow-up survey of established custom hiring centres revealed that the training provided by ICAR-CIAE benefitted the entrepreneurs a great deal and most of the surveyed units were operating on profitable basis with net profit being in the range of Rs. 1 lakh to Rs. 4.5 lakh per annum. The most commonly used machine for custom hiring includes reversible plough, cultivator, rotavator, front dozer, raised bed-planter, seed drill, weeder, multi-crop thresher, harvester, straw reapers and trolley. The Custom Hiring Centres provide services

of these machinery on rental basis for critical agricultural operations like levelling, deep ploughing, sowing, planting, weeding, harvesting, threshing straw management and transport. The survey of beneficiary farmers revealed that farmers are highly appreciative of these custom hiring centres as agricultural machinery are available to them easily and on time at an affordable cost even during peak season of agricultural operations. The best five entrepreneurs were felicitated by the ICAR-CIAE on its foundation day on February 15, 2016.

RESEARCH AND DEVELOPMENT

Farm Mechanization

8.34 Seed-cum-fertilizer drill for two stage placement of fertilizer: Fertilizer application at two vertical locations has been reported beneficial by agronomists. However, equipment for placement of fertilizer in such a manner in single pass was not available. Therefore, a tractor drawn five-row seed-cum-fertilizer drill has been developed that can place fertilizer at two stages (first at level of the seed and second at 50 mm below the seed) in single pass. Field capacity of the machine is 0.5 ha/h at forward speed of 3.5 km/h with the cost of operation of Rs 600/h. Two years experimental results on wheat and soybean crops, cultivated on permanent broad beds, revealed marked improvement in root growth and maximum yield (increase of 15% for wheat and 22% for soybean) by applying the fertilizer at two stages *i.e.* 40 mm away from seed at same depth and 50 mm below the seed.

8.35 Seed-cum-fertilizer planters for minor millets: Based on two selected metering mechanisms, viz., vertical rotor type and inclined plate type, six different configurations of minor millet planters,

viz., manually operated single row, bullock drawn three-row (two prototypes with different metering mechanisms) and tractor drawn six-row machine (two prototypes with different metering mechanisms) and an attachment to power tiller have been developed. These equipment are suitable for sowing of minor millets and other small seeds such as

kodo millet, little millet, porso millet, foxtail millet, barnyard millet, finger millet, mustard, jute, etc. Using the multi millet seed-cum-fertilizer planters, savings of 90% and 70% of seed is possible in comparison to that of broadcasting and drilling by traditional methods.

Figure 8.7 : Minor millet planters of different configurations



Tractor operated



Bullock operated



Power tiller operated

8.36 Pre-emergence herbicide strip applicator-cum-planter: The 6-row pre-emergence herbicide strip-application system, as an attachment to inclined-plate planter applies herbicide at the time of sowing in widely spaced crops to control weeds along the crop rows which often not possible in mechanical weeding. It consists of a frame on which 6 flat fan spray nozzles are mounted by means of clamps, a single action piston pump with 9 l/min capacity, pressure regulator valve, and pressure gauge and pressure pipes. The spacing between the spray nozzles, angle and height of spray nozzles can be varied by adjusting the clamps. The developed

system has the ability of strip as well as blanket application of herbicides. The machine was tested and evaluated during kharif season for soybean and pigeon pea crops. The field capacity of the developed system is 0.4 ha/h with an operating cost Rs 1,350/- per ha thus saving 40-50% herbicide. The same machine can be used as post-emergence herbicide/pesticide applicator after the removal of furrow openers and increasing the height of nozzles from the ground. The initial cost of the applicator with inclined plate planter is approximately Rs. 70,000.

Figure 8.8 : Herbicide strip applicator



8.37 Loose straw chopper for paddy straw management: Tractor-operated loose paddy straw chopper with an additional chopping cylinder of smaller diameter has been developed for better chopping and conveying of chopped paddy straw. It consists of a comb type pick up conveyor as used in the conveyor wheat seeder for picking up and conveying the loose paddy straw into straw chopping unit. The straw chopping unit consists of chopping cylinder having serrated blades for chopping the loose straw into small pieces and uniformly spreading on the field without disturbing the standing stubbles. The working width of the machine is 1.7 m. The loose straw chopper was evaluated in combine harvested paddy field for chopping loose straw of paddy variety, viz., PR 124 and Pusa Basmati 1121 at three chopping speeds of 700, 900 and 1100 rpm for both front and rear chopping cylinders. The effective field capacity of the tractor operated loose straw chopper is 0.33 ha/h and average fuel consumption is 4.8-5.3 l/h. The percentage of chopped straw up to 70 mm size varies from 62% to 71% at chopping speed of 1100 rpm. The cost of operation of loose straw chopper plus happy seeder is Rs. 3416 per ha as compared to Rs. 3164 per ha under conventional sown condition.

8.38 Light weight paddy thresher cum cleaner: The electric motor (0.75 kW) operated light weight paddy thresher cum cleaner for paddy crop consists of main frame, wire loop type threshing unit, blower, sieving unit and power transmission unit. The separation of paddy grain from the straw is achieved due to combing action of the wire loops fitted on the threshing cylinder. The separated grains fall on the vibrating screen through the cleaning duct. A blower

is used to blow off the chaff, dust and other light foreign materials from the grain. The vibrating screen separates sand, weed seeds and other heavy weight smaller size impurities. The threshing efficiency, grain output capacity and losses due to shattering of the machine are 99%, 143 kg/ha and 2%, respectively.

8.39 Mechanization package for sugarcane single bud technology:

- a) **Double head single bud cutting machine for sugarcane:** The machine has two pairs of two circular blades made of high carbon steel, rotating at 2800 rpm. A spacer is provided between the two blades, which facilitate variation in the size of single bud set as per the requirement. Two people can operate the machine simultaneously and can cut about 3000 single buds in an hour. The machine can be operated by 0.75 kW (1 hp) electric motor which powers both the sets of cutting blades. The cost of the equipment is about Rs 25,000.
- b) **Two row tractor single bud settling planter:** A tractor operated two-row sugarcane settling planter has been modified for adjustments of spacing and depth of planting. The row-to-row spacing can be adjusted to 900, 1200 and 1500 mm. The depth of planting can be adjusted from 60 to 100 mm. The plant to plant spacing can be adjusted to 450, 600 and 900 mm. The cost of the equipment is about Rs 1.00 lakh. The field capacity of the machine is 0.2ha/h at 1200mm spacing with a field efficiency of 70%.

8.40 Pedal-operated maize dehusker sheller:

The machine performs operations of dehusking and shelling of maize. The capacity of the machine is 130 kg/h. The dehusking and shelling efficiencies of the dehusker sheller are 97 per cent and 95 per cent, respectively.

8.41 Light weight pneumatic wheel bullock cart:

A pneumatic two wheeled bullock cart for payload capacity of 1.0 tonne has been developed. The cart is provided with brakes and shock absorbers for smooth travel on rural roads. The tare weight of the cart is 100 kg. Under plain tar road condition, the average draft increased from 83.3 to 305.7 N and the average speeds decreased from 3.96 to 2.73 km/h when pay loads increased to 800 kg on tar road. It has been observed as the small size bullocks could sustain pulling of 800 kg pay loads for three hours on the tar road comfortably with a fatigue score of 13. Under plain kuchha road, the average draft increased from 92.1 to 324.4 N and the average speed decreased from 3.60 to 2.69 km/h when pay load increased to 800 kg. The small size bullocks could sustain pulling 800 kg pay loads for three hours on the kuchha road comfortably with a fatigue score of 14.

Figure 8.9 : Light weight pneumatic wheel bullock cart



POST-HARVEST MANAGEMENT AND VALUE ADDITION

8.42 Application of science and technology in processing, preservation, packaging and storage is the key to post harvest management. DARE has taken several initiatives in this direction, as given below:

A. Machines/ Equipments developed

Indigenous Pilot Plant for Production of Protein Isolates from De-oiled Cakes

8.43 ICAR-CIPHET, Ludhiana has designed an indigenous pilot plant for production of protein isolates from groundnut de-oiled cake. The capacity of the pilot plant is 40 kg of raw material/day. This pilot plant comprises of extraction tank, centrifuge, precipitation tank and a commercially available spray dryer. Isolates produced from this plant contains more than 90% protein. The de-oiled cake (DOC) left after oil extraction from major oilseeds, viz., soybean, groundnut, mustard and sunflower is about 10 million tonnes (soy meal: 4 MT, groundnut cake: 3 MT, mustard: 2 MT, sunflower cake: 1 MT). At present, these cakes are either utilized as animal feed or being exported to other countries like China and Malaysia. Protein-isolate from these de-oiled cakes (rich in protein) can be incorporated into food products to combat protein malnourishment.

Live Fish Carrier System

8.44 Live Fish Carrier System developed at ICAR-CIPHET, Ludhiana is a battery operated three-wheeled vehicle for transporting live fish from one place to another. This technology is useful for transporting fish in live condition for marketing at premium price.

8.45 Live fish carrier system (LFCS) is an electric

tri-cycle based live fish transportation system for short and medium distance (about 80 km) transportation of fish including the table carps (rohu, catla, mrigal, common carp, grass carp, silver carp, bighead carp) in live condition from one place to another for marketing, rearing, ornamental displaying and breeding purposes. It is devised with water filtration, aeration and cooling system providing good quality water to reduce fish mortality during transportation. It can travel a distance about 60-80 km with maximum speed of 25 km/h with total carrying capacity of 500 kg (200 kg fish + 200 kg water + 100 kg driver etc.). The invented new system reduces fish mortality to less than 5 per cent for a journey period of about 4-5 hours. The system is convenient to handle fish by single person whereas 4-5 laborers/trip are required in traditional method.

Figure 8.10 : Live Fish Carrier System



Ginger-Turmeric washer cum peeler

8.46 Ginger/ turmeric washer-cum-peeler having a capacity of 60-70 kg/h has been developed by AICRP on PHET co-coordinating centre, Imphal. The machine consists of a mild steel perforated revolving drum of size 600 mm (length) x 500 mm (diameter) and thickness 1.0 mm. The mild steel drum is mounted on bearings supported on the angle

iron frame. The rotational speed of the drum at 100 rpm and 10 minutes residence time was observed to be optimum for removing the adhering dirt, stains, other foreign materials or caked dirt on the rhizome or between segments of the rhizome. The capacity of machine is 7-8 times more as compared to traditional method of washing and peeling.

Solar-Biomass Integrated Drying System for Spices

8.47 Integrated Drying System (IDS) using solar and biomass energy has been developed for drying ginger and turmeric rhizomes at AICRP on PHET coordinating centre, Jorhat. The capacity of the dryer is 100 kg/batch and its cost is Rs 80,000/unit. Overall dimensions of the IDS are 3700 mm (H) x 4300 mm (L) x 2000 mm (B). Drying air temperature can be maintained at 50° to 55° C and 65°C using paddy husk and wood stalks, respectively. Rehydration ratio values of ginger samples dried in IDS was highest in comparison to samples from other drying methods. As far as colour, volatile oil and oleoresin content is concerned, no significant difference was observed in dried ginger obtained between IDS and normal sun drying. Effective moisture diffusivity in case of turmeric drying was nearly 21 per cent more in comparison to ginger drying. Energy utilization efficiency by the solar collector assembly was found to be 49.27 per cent. Energy utilization efficiency of the bio-waste fired assembly was found to be 62.32 per cent. Considering total heat available in the plenum chamber and latent heat of evaporation, the IDS showed 39.33 per cent of overall energy utilization efficiency.

Figure 8.11 : Solar-biomass Integrated Drying System for Spices



Hybrid Solar cum Biogas Drier for Mushroom

8.48 A solar cum biogas based hybrid dryer (Capacity: 3 kg) has been developed for mushroom drying. The maximum temperature of air inside the drying chamber has been observed as 55°C during full load testing. Mushroom flakes have been dried from moisture content 88.0 per cent to 9.6 per cent (w.b.) within 8 hours. The water evaporation rate during drying of mushroom flakes varies from 2.47 to 0.08g/ g of dry matter/h. The saving in electrical energy has been observed as 62 per cent with hybrid drying system. The constant temperature maintained during the drying process improves the quality of flakes resulting in increased rehydrated ratio of dried mushroom. The rehydration ratio of dried mushroom has been found to be 4.8 where as it is 3.2 for sundried mushroom flakes.

Mechanization package for rope making from outer sheath of banana pseudo stem

8.49 The package consists of equipment for

splitting the outer sheath of banana pseudo stem and equipment for twisting and winding of split strands from outer sheath of banana pseudo stem. This package of equipment would greatly help in value addition from banana waste and the total value of the produce generated from this waste would be about Rs 1.0 lakh per hectare.

8.50 Equipment for splitting the outer sheath:

The equipment contains a pair of rotating nylon rollers with HSS circular cutting blades embedded on the first roller. The second roller has the grooves on its surface such that the blades embedded on the first roller exactly fit into the grooves of the second roller. The first roller is mounted on a shaft rotated at a preset speed by a 0.5 hp variable speed motor. The outer sheath of banana pseudo stem is fed in between the two rotating rollers, at 150 rpm. As the outer sheath passes between the two rollers, the sheath is split into various strands. The rollers are to be changed for different width of strands of sheath required, viz., 2 mm, 3 mm and 4 mm. The cost of the machine is approx. Rs. 20,000 and the capacity is 3-3.5 m/min.

8.51 Equipment for twisting and winding of splitted strands:

The equipment contains a mechanism for twisting and another mechanism for winding the twisted strands on four bobbins through a bobbin building mechanism. Provision is made to vary the number of twists with the help of speed control mechanism, based on the requirement of the end product. Two 0.25 hp single phase motors with suitable power transmission mechanism are provided to operate the drawing, twisting and winding mechanisms. The developed equipment has got advantages over manual method of twisting and

winding in terms of more uniform twist, lower space requirement, less dependency on skilled labour, cheaper than manual labour and higher output. The initial cost of the machine is Rs. 90,000. The capacity of the equipment is 4,800 m/day.

Millet flaking machine and process for fermented millet flakes

8.52 The flaking machine produces flakes from pre-treated whole sorghum grains. It comprises of two sets of stainless steel rollers running at differential speed, in opposite direction. The machine is powered by a 0.5 hp single phase motor. Raw material is fed to the flaking rolls by a polygonal teflon feeder. The minimum flake thickness achievable by the machine is about 0.5 mm with flaking efficiency of about 92 per cent. A process has also been developed for fermenting the sorghum grains with suitable cultures. The fermented grains were steamed and flaked. The appearance and texture of flakes prepared from fermented grains was observed to be better in comparison to non-fermented grains.

B. Process Protocols Developed

8.53 **Process Protocol for De-Bittered Kinnow Juice:** Kinnow mandarin (*Citrus reticulata*) is one of the major citrus fruit crops of India. However, the development of bitterness (initial as well as delayed) in its juice, is the major hindrance in its processing. This bitterness is mainly caused by inherent naringin and limonin present in different portions of kinnow (initial bitterness). With maximum being observed in seed (224.37 ± 5.58 ppm) while peel/albedo portion contained the highest amount of naringin (13589.82 ± 6.86 ppm). Also, during processing and storage of juice, an enzyme mainly present in seeds

(Limonate-D-ring lactone hydrolase/LDLH), catalyses the conversion of limonate A-ring lactone/LARL (a non-bitter precursor) to bitter limonin in acidic condition and thereby results in delayed bitterness of extracted kinnow juice. To overcome this problem, ICAR-CIPHET, Abohar has developed a process protocol for de-bittering of kinnow juice using different enzymes and adsorbents. The developed process reduces limonin to undetectable levels and considerably curtails the activity of LDLH enzyme.

8.54 **Pear canning in non-nutritive sweetener:** A process for canning of pear slices was developed at ICAR-CIPHET by using stevia extract as non-nutritive sweetener in order to produce a low calorie food. Sugar syrup of 40 °Bx and stevia extract to the taste of 40 °Bx were prepared and mixed in five different proportions of 100:0, 75:25, 50:50, 25:75 and 0:100 for using as a canning syrup. The composition of non-nutritive sweetener was optimized based on sensory score and calorific value of canned pear slices. The drained weight after 20 days of canning was found to be in the acceptable range (426 to 434 g) for most of the treatment combinations. However, highest sensory score was obtained when the pear slices were canned in canning syrup of 50:50 followed by 75:25 and 25:75 for sugar and stevia extract, respectively.

8.55 **Cotton textiles using *in situ* generated nano-ZnO for high end applications:** Cotton based textiles are mostly used for apparel due to their good feel and comfort. With the growing awareness of health and hygiene, cotton textiles are required to satisfy not only their comfort properties but also their functional properties like antibacterial, UV

protection, etc. The advent of nano science and nanotechnology has opened a new frontier in the realm of textile finishing, i.e., nano-finishing for imparting various functional properties to the cotton materials. A method has been developed for the functional finishing of cotton fabrics using nano zinc oxide particles, synthesized in situ by reacting zinc nitrate and sodium hydroxide.

8.56 Nanocellulose based product development with improved functionality: Nanocellulose, a novel nano-sized cellulosic material, exhibits very high strength, large surface area to volume ratio, novel rheological & optical properties, and have proven applications as reinforcing agents in bio-composites, additives in high-end papers and paints, etc. ICAR-CIRCOT has developed novel chemo-mechanical processes for production of nanocellulose from cotton linters/waste and cotton stalks and following products with nanocellulose as additive for improved functionality.

- a) **Natural Rubber composite** with Nanocellulose as a filler, improved the strength by 15-20 per cent and reduced the permeability by 20-25 per cent. This can replace the carbon fillers and thereby reduce the cost of production.
- b) **Kraft paper** (recycled) with nanocellulose as additive, exhibits 15 per cent increase in the tensile strength and reduces the requirement of virgin pulp and hence the cost.
- c) **Cement Concrete** with nanocellulose as filler improves the curing process and reduces the porosity, thereby increasing the shelf-life of cement concrete. Also the mechanical properties like compression strength and flexural strength improved by 10-15 per cent.

8.57 Polyhouse for cultivation of mushroom during summers in Punjab: ICAR-CIHET, Abohar Centre developed structure for mushroom cultivation which has overall dimensions (length 14.63 m, width 3.66 m and height 4.27 m). Floor of the structure has been kept at 0.9 m depth below the ground level. This arrangement provide extra height to the structure which minimized the risk of overturning due to strong winds. Such floor arrangement will also help to keep the structure cooler and hotter than ambient temperature in summer and winter, respectively. Structure has multilayered roof composed of iron net (half inch mesh), polyethylene (25 micron thick), jute (2-3 mm thick), EPF thermocol (8 mm thick) and UV stabilized polyethylene (300 gsm). The polyhouse structure has capacity to grow 4000 kg of mushrooms.. Two crops of button mushroom and one crop of *dhingri* mushroom can be grown in the structure. Approximately Rs. 170000/- can be earned from the structure per annum.

8.58 Development of semi-permanent shade net house to reduce the sun burn of pomegranate fruits in hot and arid region of Punjab: Semi-permanent shade net houses were constructed at Abohar, Punjab for pomegranate fruits to reduce sun burn. Five different shade nets with different colour and shade percentage (Green shade nets 35%, Red shade nets 50%, Black shade net 50%, Green shade net 50%, and 50 % black shade net in combination of fogger) were used in the experiment. Fogger and micro sprinkler were installed at the height of 2.5 meter with the help of bamboo. Rest two treatments (Kaolin 4% and borax 0.4%) were applied at three times during the fruit development stage. Results revealed that only 1-2% fruits were affected by sun burn under

black shade net (50%) as compared to control where 43.56% fruits are affected by sunburn. Higher pH (3.83) was recorded for fruits inside shade net as

compared to control (3.68). Firmness varied from 22.1 to 38.6 g. However, firmness was lower in arils of fruits produced under shade net.

Agro-Economic Research and Statistical System

9.1 Agricultural development policy has to be firmly based on robust agricultural economic and statistical inputs. These inputs provide the foundation on which policies for the development of the sector are built. Thus, for sound policy and planning, it is vital that the system of generation of relevant data for the agricultural and allied sector has a high degree of credibility and is able to capture a wide range of parameters. The focus of agricultural policy, worldwide, has shifted from merely increasing production to doing so sustainably, while not losing sight of the goals of equity and poverty alleviation. This has increased the demands on agricultural statistics in terms of scope, reliability and timeliness. There are numerous aspects to agricultural data, which inter alia, include the structure of agriculture, i.e., agricultural holding by size, operational tenure, land use and input use; and annual agricultural activities which include crop and livestock yield and production, and information related to cost of cultivation, trade and prices of agricultural products. Disaggregated agricultural estimates are also required for agricultural planning at the district and lower levels of the administrative hierarchy. In view of this, Government of India has evolved statistically sound systems for obtaining reliable data on all the above parameters.

9.2 This chapter discusses how the agro-economic research and statistical system has evolved overtime to cater to the changing policy requirements.

AGRICULTURAL DEVELOPMENT POLICY AND INPUT STUDIES

9.3 The agricultural development policy making was put on a twin system of agricultural field research inputs. These include agricultural economic research system and cost of cultivation data collection system. The agricultural economic research system was founded by Prof. V. K. R. V. Rao in 1950s when the earliest network of agro-economic research centres were set up for carrying out continuous village studies in some state agricultural universities by the Ministry of Agriculture, Government of India with 100% grants-in-aid funding. The research management was based on partnership between the two parties with the Government of India providing funds and the host institution providing infrastructure and institutional support in terms of governance. The idea behind it was to ensure that the much needed agricultural economics policy inputs system is located in autonomous academic environment of the agricultural universities and other similar organisations. Similarly, the cost of cultivation data collection system emerged in 1970s with the launch of the current Minimum Support Price Scheme. By setting up cost of cultivation centres following the same pattern of partnership between the Ministry of Agriculture and the host institutions, in the course of time, there came up 16 Cost of Cultivation Centres. The Cost of Cultivation and Agro Economic Research Centres presently exist side by side in different Universities and other

Institutions with a few exceptions and follow the same pattern of partnership. Both AERCs and Cost of Cultivation Centres are salary based grants-in-aid funded schemes with the staff recruited for the work of Department of Agriculture Cooperation & Farmers Welfare by the host institutions.

Agro Economic Research Centres

9.4 With the initiation of the era of plan development, the need for scientific field evidence based analysis by competent economists on the socio-economic aspects of various programmes was felt for the development of the agrarian economy of the rural India. Further, it was felt crucial to engage impartial non-Government institutions that carry conviction with the public and are capable of providing unbiased field research inputs. It was in this context that Agro Economic Research Centres came up as grass-root level agro-economic research network as a brainchild of Prof. V.K.R.V. Rao in 1953 when agricultural development policy inputs were mainly focused on agricultural science and agronomy inputs. This undermined the fact that the goals of growth, stability and equity can be achieved only through having the agricultural economics right.

9.5 Initially four Agro-Economic Research (AER) Centres were established under a Central Sector Scheme by the Ministry of Agriculture in the year 1954 at Visva-Bharati, Santiniketan (West Bengal), Gokhale Institute of Politics and Economics, Pune (Maharashtra), Delhi University, Delhi and Madras University, Chennai (Tamil Nadu). Later on a few more Centers were set up. Besides these, the Ministry of Agriculture has also set up three Agro-Economic Research Units of national importance, one each at the Institute of Economic

Growth, New Delhi; Centre for Management in Agriculture at Indian Institute of Management, Ahmedabad and Agricultural Development and Rural Transformation Centre at the Institute for Social and Economic Change, Bangalore. Presently there are 12 AERCs and 3 AERUs situated in different States. These institutions conduct agro-economic research studies on various issues / topics as entrusted to them by the Ministry of Agriculture, through an inter-Departmental Research Advisory Committee headed by Secretary, Department of Agriculture, Cooperation and Farmers' Welfare. These are funded with grants-in-aid provided by the Ministry of Agriculture and Farmers Welfare, Government of India.

9.6 Three AER Units namely Agricultural Development and Rural Transformation Centre (ADRTC), Bengaluru; Centre for Management in Agriculture (CMA), Ahmedabad; and AER Unit, Delhi are functioning under the Institute for Social and Economic Change (ISEC), Bangalore; Indian Institute of Management (IIM), Ahmedabad; and Institute of Economic Growth (IEG), Delhi respectively. AERC Pune is functioning under the Gokhale Institute of Politics and Economics. The rest 11 Centres are functioning under different Universities, out of which AERCs at Jorhat, Ludhiana and Jabalpur are under Agricultural Universities following ICAR guidelines; AERCs at Allahabad, Delhi and Visva-Bharati, Shantiniketan are under Central Universities and the rest 5 Centres are functioning under the respective State Universities.

Objective of the AER Scheme

9.7 With the mandate of providing field research

inputs for evidence based policy making, the objectives of AERCs are as follows:-

- (i) to conduct investigations into specified agro-economic problems which are of special interest to the Ministry, either at the macro or the micro level;
- (ii) to carry on continuous studies on changes in the rural economy by means of periodic surveys and re-surveys of selected villages representing typical situations;
- (iii) to carry on research work on structural changes and fundamental problems of agricultural economy and rural development of the country; and
- (iv) to give technical advice to the Union Government and state Government on such issues as with mutual agreement may be referred to them.

9.8 The AER Centres and Units fulfil the agro-economic study inputs requirement of the DAC&FW which are requisitioned by various subject Divisions of agriculture and allied sector Departments. The network of AER Centres and Units also fulfil the increasing need for better agricultural economics analysis to tackle the persisting agrarian crisis. The network of AER Centres and AER Units gives Government evidence based inputs on programmes and policies of agro-economic nature. They cater to the demand driven requirements of various Ministries/ Departments of the Central Government for field studies and provide inputs based on scientific and independent investigation. The AER Centres and Units, located in different agro-ecological zones, have an in-depth, field based knowledge of the ground reality and local phenomena. Through the system of network and coordination, AER Units

are able to integrate the regional findings and present an all India (macro) picture, which is crucial for the Central Government's understanding and intervention in agriculture, which is a State subject.

9.9 These AER Centres and Units have so far conducted above 2500 research/evaluation studies covering the areas of core importance from agriculture, viz., fertiliser, horticulture, seeds, credit, water resources, rural development, agriculture marketing, pulses and oilseeds, irrigation as well as emerging thrust areas like horticulture, rainfed farming, agricultural subsidies, food economy, fishery, international cooperation, trade, environment and forests, agro rural industries, food processing industries, market integration, market reforms, WTO, climate change, etc. No wonder, above two thousand studies, conducted by these centres/units, since their inception, constitute a treasure trove of valuable information covering the discipline of Agro-Economic Research in its entirety.

Cost of Cultivation

9.10 Data on the cost of cultivation plays a crucial role in agricultural price policy in India. Keeping this in view, a comprehensive Scheme for Studying the Cost of Cultivation of Principal Crops in India is being implemented by the Government since 1970-71. It is Central Sector Scheme with 100 percent grants-in-aid to State Implementing Agencies. The Scheme envisages the collection of representative data on inputs used by farmers and outputs obtained in both physical and monetary terms. This information is used for computing state-wise and crop-wise estimates of the cost of cultivation/ production in respect of the selected principal crops. The estimates so generated facilitate the CACP in recommending minimum support prices for various crops.

9.11 Under the Scheme, field data is collected on the Cost Accounting Method by 16 cost of cultivation centres located in different institutions from 8,100 sample holdings spread over 20 States. The sampling design is based on a three-stage, stratified random sampling design with the tehsil as the first stage unit, village/cluster of villages as the second-stage unit and operational holdings as the third and ultimate stage unit. Daily entries of debit/credit for expenditure/income are made to assess the total cost/benefit incurred/accrued to each farmer covered under the Scheme.

9.12 As per cost concepts, cost of production includes both paid-out costs (out-of-pocket) and imputed costs. Paid-out costs include the cost incurred by farmers towards the value of seeds, insecticides and pesticides, manure, fertilizer, irrigation charges, hired human, animal and machine labour, land revenue, rent paid for lease in land, and imputed cost includes value of family, animal and machine (owned) labour, rent of own land and interest of own fixed capital, depreciation on implements and farm buildings, etc.

9.13 In April 2013, the Government constituted a Committee under the Chairmanship of Dr. Ramesh Chand, then Director of National Centre for Agricultural Policy and Research (NCAP), to examine the methodological issues in fixing minimum support prices. The Committee submitted its report to the Government on 30 March 2015. The Committee has given various recommendations, which include methodological issues, sampling design, sample size under the CS Scheme to generate credible cost estimates. The Report of the Committee is being examined by the Government.

9.14 The current cost of cultivation data processing uses an old FAO software, which is being replaced by an advanced web based software, namely FARMAP 2.0. It reduces the time lag between data collection and generation of cost estimates with a high degree of automation. FARMAP 2.0 as a comprehensive, web-based, scalable solution for managing the data and generating the desired output, will provide an easy-to-use platform on the internet/intranet and mobiles/tablets medium.

METHODOLOGY FOR ESTIMATION OF MAJOR AGRICULTURAL CROPS

9.15 All-India estimates of major agricultural crops are prepared on the basis of data received from State Agricultural Statistics Authorities (SASA) in various States and Union Territories (UTs). State governments prepare their estimates on the basis of area enumeration in a sample of 20 percent villages and yield assessment through Crop Cutting Experiments (CCEs) conducted in a sub-sample of the villages selected for area enumeration. The fieldwork for area enumeration and CCEs in States and UTs is normally carried out by the staff of Department of Revenue/Agriculture. A fresh sample of 20 percent of villages is taken every year, so that each of the 6,00,000 villages in the country is covered over a period of five years.

9.16 For every Agricultural Year (July-June), the Directorate of Economics & Statistics (DES), an attached office of the Department of Agriculture, Cooperation and Farmers Welfare, releases four Advance Estimates (AE) of the production of major agricultural crops of the country, followed by Final Estimates. Each of these five estimates is available state-wise and at the national level for the identified

crops. While finalizing all-India level estimates, the crop-wise data on area, production and yield received from State governments is thoroughly scrutinized on the basis of information from alternative sources on area, production and yield, rainfall conditions, previous trends in crop-wise area, production and yield in the respective states, commodity-wise trends in prices, procurements, etc. The time of release and coverage under each of these estimates are explained below.

- i) The First Advance Estimates are released in the month of September when kharif sowing is generally over. These cover only kharif crops.
- ii) The Second Advance Estimates are released in February of the following year, when rabi sowing is also over. These estimates cover kharif as well as rabi crops. They take into account firmed up figures on kharif area coverage along with available data on crop-cutting experiments for yield assessment of kharif crops as well as tentative figures on area coverage of rabi crops.
- iii) The Third Advance Estimates incorporate the revised data on area coverage for rabi crops and better yield estimates of kharif crops. These are released in April-May.
- iv) The Fourth Advance Estimates are released in July-August. By this time, fully firmed up data on area as well as yield of kharif crops and rabi crops are expected to be available with states. As such, Fourth Advance Estimates are expected to be very close to the Final Estimates.
- v) Final Estimates are released about seven months after the Fourth Advance Estimates in

February of the following year. This allows states sufficient time to take into account even the delayed information while finalizing area and yield estimates of various crops.

- vi) No revision in State-level data is accepted after the release of Final Estimates.

9.17 This system gives the Government an assessment of State-wise area, production and yield of major crops within the shortest time after the sowing of crops in a season is over. Thus, the Government is in a position to take important policy decisions, viz., procurement of crops, imports, exports of agricultural commodities, fixation of policy rates, etc. Although the estimates are periodically revised, due to advancement in data calculation and estimation techniques, the variation is not significant.

Forecasting Agricultural Output Using Space Agro-meteorology And Land-based Observations (FASAL)

9.18 A Central Sector Scheme, 'Forecasting Agricultural output using Space Agro-meteorology and Land based observations (FASAL)', is a major alternative source of data on selected crops. The Scheme is being implemented with the help of three partner organizations, viz., India Meteorological Department (IMD), New Delhi; Space Application Centre (SAC), Ahmedabad; and Institute of Economic Growth (IEG), New Delhi. Under the scheme, the release of multiple in-season forecasts is envisaged at the national, state and district levels based on remote sensing, Agromet and econometric models in respect of 11 major crops: (i) rice (kharif and rabi); (ii) jowar (kharif and rabi); (iii) maize; (iv) bajra; (v) jute; (vi) ragi; (vii) cotton; (viii) sugarcane;

(ix) groundnut (kharif andrabi); (x) rapeseed and mustard; and (xi) wheat.

9.19 Under the revised strategy since 2011, the operationalization of crop forecasts and drought assessment through Remote Sensing methodology developed by ISRO is being done by the Mahalanobis National Crop Forecast Centre (MNCFC), DAC&FW. Presently, the MNCFC provides forecasts based on remote sensing technology in respect of eight crops, viz. (i) rice (kharif/rabi), (ii) wheat, (iii) rapeseed and mustard, (iv) cotton, (v) jute, (vi) sugarcane, (vii) jowar and (viii) potato. The forecasts generated by the MNCFC are based on the yield models developed by the IMD and the area coverage is based on remote sensing technology. **Table 9.1** describes the calendar of release of various forecasts by the MNCFC.

9.20 The Institute of Economic Growth(IEG), Delhi, one of the partner organizations of the FASAL scheme, has been providing state-/national-level forecasts of area, yield and production for selected

kharif and rabi crops based on econometric models. These are provided at two stages, pre-sowing (F0) and sowing (F1), for each season. The variables used in the model include crop price (expected), substitute crop price (expected), irrigated area, previous years' area and rainfall in the sowing season. The IEG has been providing forecast for 12 crops for the kharif season, viz., (i) rice, (ii) bajra, (iii) cotton, (iv) groundnut, (v) jowar, (vi) jute, (vii) maize, (viii) soyabean, (ix) arhar, (x) moong, (xi) urad and (xii) sugarcane, and nine crops for the rabi season, viz., (i) rice, (ii) groundnut, (iii) jowar, (iv) rapeseed and mustard, (v) maize, (vi) wheat, (vii) gram, (viii) potato and (ix) onion.

METHODOLOGY FOR ESTIMATION OF HORTICULTURE CROPS

9.21 Fruits and vegetables account for nearly 90 percent of the total horticulture production in the country. India is now the second largest producer of fruits and vegetables in the world, and is the leader in several horticultural crops, namely, mango, banana,

Table 9.1: Calendar of Release of Various Forecasts by the Mahalanobis National Crop Forecast Centre

Season	Crop	Forecast	Month of release	Season	Crop	Forecast	Month of release
Kharif	Jute	F1	July	Rabi	Mustard	F1	December
	Rice	F1	September			F2	February
		F2	October			F3	March
		F3	February		Wheat	F1	February
	Cotton	F1	November			F2	March
		F2	December			F3	April
	Sugarcane	F1	August		Sorghum	F1	February
		F2	December		Rice	F1	April

Source : Department of Agriculture, Cooperation & Farmers Welfare

papaya, cashewnut, arecanut, potato and okra. However, the nature of horticulture crops is such that it is not easy to assess their production. These crops, especially vegetables, are grown in small plots or fields or at the back of houses, and do not have single harvesting in most cases, which makes their assessment difficult. Many horticulture crops have multiple pickings in a single season. Similarly, many fruit trees are scattered, which do not count for assessment.

9.22 In view of above difficulties, several research studies were taken up by agricultural scientists in the past. Then a Central Sector Plan Scheme namely ‘Crop Estimation Survey of Fruits & Vegetables (CES-F&V)’- was introduced as a component of ‘Improvement of Agricultural Statistics Scheme’, being implemented by the DES. The Scheme envisaged the generation of area and productivity estimates of fruits and vegetables using sampling and estimation methodology evolved by Indian Agricultural Statistics Research Institute (IASRI). The Scheme was implemented in 11 States (Andhra Pradesh, Gujarat, Haryana, Himachal Pradesh., Karnataka, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu and U.P.) covering selected crops- 7 fruit crops (Apple, Mango, Citrus, Pineapple, Grapes, Banana and Guava) and 7 vegetable crops (Potato, Cabbage, Cauliflower, Onion, Tomato, Ginger and Turmeric). The Scheme was initiated in 1982- 83 and was implemented by central funding through DAC&FW. However, the Scheme was fraught with some problems which was noted by National Statistical Commission (NSC) which recommended that:

- i. The methodology adopted in the pilot Scheme of “*Crop Estimation Survey on*

Fruits and Vegetables” should be reviewed and an alternative methodology for estimating the production of horticultural crops should be developed taking into account information flowing from all sources, including market arrivals, exports and growers associations.

- ii. Special studies required to establish the feasibility of such a methodology should be taken up by a team comprising representatives from Indian Agricultural Statistics Research Institute (IASRI), Directorate of Economics and Statistics, Ministry of Agriculture (DES, MoA), Field Operations Division of National Sample Survey Organization (NSSO, FOD) and from one or two major States growing horticultural crops.
- iii. The alternative methodology should be tried out on a pilot basis before actually implementing it on a large scale.

9.23 Accordingly the earlier Scheme of CES F&V was discontinued from 2013-14. A new alternative methodology has been developed by IASRI which is much simpler and easy to implement. As per the recommendations of NSC, this new alternative methodology is now being tried out on pilot basis in 6 states under the project Coordinated Programme on Horticulture Assessment and Management using Geoinformatics (CHAMAN) of DAC&FW.

Coordinated Programme on Horticulture Assessment and Management using Geoinformatics (CHAMAN)

9.24 DAC&FW has launched a project called CHAMAN under the Mission for Integrated Development of Horticulture (MIDH). The

programme has the objective to develop and firm up scientific methodology for estimation of area and production of horticultural crops. It has two main components namely: (1) Remote Sensing (RS) Technology and (2) Sample Survey (SS) methodology for estimation of area and production of horticultural crops.

1. **Remote Sensing: Proposed Programme and its Objectives-** The programme is being implemented by Mahalanobis National Crop Forecast Centre (MNCFC) and will have the following components.

9.24(a) **Area and production assessment** of seven major horticultural crops in major states. **Area assessment** will be carried out for selected crops in the selected districts of major states. The crops will

be selected based on the production share. Accordingly the crops and study area being proposed are given in **Table 9.2**. Satellite data to be used are either of LISS III (23.5 m resolution) or LISS IV, depending upon the spatial extent of the crop. In absence of availability of Indian satellite data during the crop growth, foreign satellite data will also be explored. For **production forecasting**, yield modeling has to be carried out. India Meteorological Department, under FASAL project, develops district-level, empirical agro-meteorological yield models for different crops. Similar procedures will be followed for yield forecasting of vegetable crops. The funding support for yield forecasts by IMD will continue to be under FASAL project.

Table 9.2: Crop Selection from Various States

Crop Type	Crop	State (Districts)
Fruit	Banana	Tamil Nadu, Andhra Pradesh, Maharashtra, Gujarat, Karnataka
	Mango	Uttar Pradesh, Gujarat, Karnataka, Andhra Pradesh, Bihar
	Citrus	Andhra Pradesh, Maharashtra, Punjab, Madhya Pradesh, Gujarat
Vegetables	Potato	Uttar Pradesh, Bihar, West Bengal, Gujarat, Punjab
	Onion	Maharashtra, Gujarat, Madhya Pradesh, Karnataka, Bihar
	Tomato	Andhra Pradesh, Odisha, Karnataka, Madhya Pradesh, West Bengal, Bihar
Spices	Chilli	Andhra Pradesh, Karnataka, West Bengal, Madhya Pradesh, Odisha

Source : Department of Agriculture, Cooperation & Farmers Welfare

9.24(b) **Remote sensing for developmental studies** like site suitability and post-harvest infrastructure development. **Horticultural Development Studies** can be grouped under the following categories:

i) **Site suitability** for the introduction/ expansion of important horticulture crops, e.g., the scope of replicating village-level horticulture plans developed for the North-Eastern states in various other states.

ii) **Post-harvest infrastructure:** GIS and remote sensing will be used to assess the need and find the optimum locations for infrastructure such as cold chains, markets, etc.

iii) **Crop intensification** in areas where cropping intensity is low and regions of unutilized/under-utilized, short-duration horticultural crops can be incorporated into

the crop rotation. This will also link with watershed and wasteland development programmes of the Government of India.

- iv) **GIS database creation:** The GIS database will include inputs required for managing horticultural crops, such as soils, weather, infrastructure (e.g. markets). This will help in better income generation for farmers, especially in tribal and remote areas.
- v) **Orchard Rejuvenation:** This would aid in identifying plantations/orchards that need rejuvenation and assess the shifting of orchard areas, especially of apples in Himachal Pradesh, mango (Malda), orange (Darjeeling) and citrus in Arunachal Pradesh.
- vi) **Aqua-horticulture:** Wetlands in Andhra Pradesh have been created at 1:50000 scale all over the country using satellite data. Various horticultural crops (e.g. makhana/gorgon nut) are grown in wetlands. A GIS database will be created for selected sites to understand the ecology and economics of these crops so that these can be replicated.

9.24(c) **Detailed, scientific, field-level research studies** for developing technology for crop identification, yield modelling and disease assessment for other horticulture crops. Crop discrimination within vegetable crops, yield modelling, stress detection (disease & nutrient) are still research issues. It is proposed that, 2-3 sites of major vegetable growing areas (e.g. Malerkotla in Punjab, Gurgaon, Salt Lake Area in Kolkata, etc.) will be chosen, where multi-level (ground, airborne, satellite based) remote sensing data will be collected. The analysis will result in improving the

understanding towards better remote sensing applications for horticulture.

2. Estimation of Area and Production of Main Horticulture Crops using Sample Survey Techniques

9.25 This component is being implemented by the Indian Agricultural Statistics Research Institute (IASRI) as “*Study to test the developed alternative methodology for estimation of area and production of horticultural crops*”. The study will be taken up in eight states (Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Gujarat, Madhya Pradesh, Haryana and Himachal Pradesh). In each state, the study will cover about 40 percent of all the districts, covering about 70-80 percent of the total area under fruits and vegetables in the entire state, and two of the rest of the districts, covering about 20-30 percent of the total area under fruits and vegetables in the entire state will be undertaken for the study.

Objectives of the Study

9.26(a) To test the developed alternative methodology for **estimation of acreage under each major fruit and vegetable crop**

9.26(b) To test the developed alternative methodology for **estimation of yield rates and total production of major fruit and vegetable crops grown in the State**

9.26(c) To validate the accuracy of estimates of area under major fruits and vegetables using remote sensing techniques with the area estimates using complete enumeration.

Proposed Sampling Design

9.27(a) The sampling design to be adopted for the survey will be stratified multi-stage random

sampling. First of all, the important districts are to be identified for conducting the survey on the basis of district-wise area figures under fruits and vegetables of the state. The identified districts, i.e. high productive districts covering about 70-80 percent of the total area under fruits and vegetables in the entire state, are to be treated as one stratum, and the rest of the districts, i.e., low productive districts, are to form another stratum. From stratum one, about 40 percent of the total number of districts, and two districts from stratum two, will be selected by simple random sampling without replacement (SRSWOR).

9.27(b) Taluk/tehsil-wise area figures under fruits and vegetables will be used for sub-stratifying the taluks/tehsils of the high productive districts into two groups, viz., high productive taluks/tehsils and low productive taluks/tehsils. High productive taluks/tehsils are those which constitute 60-70 percent of the total area under fruits and vegetables of the district; the rest of the taluks/tehsils fall under low productive taluks/tehsils.

9.27(c) A sample of two taluks/tehsils will be selected by SRSWOR from both the groups after rejecting taluks/tehsils contributing less than 5 percent of the total area under fruits and vegetables of the district. From each of the four selected taluks/tehsils, a sample of 20 villages will be selected by SRSWOR. The selected villages will be completely enumerated, so as to record the number of orchards under different fruits and cropping pattern with respect to vegetables. An orchard for the selection process should have a minimum of 12 fruit trees of bearing age of a single fruit crop.

9.27(d) For the fruits survey, a sample of five orchards will be selected from each selected village

by SRSWOR. In case more than one fruit crop is available in a village, orchards of two major fruits will be selected in proportion to the number of orchards for the two major fruit crops in each village, with a minimum of two orchards for each fruit crop. The major fruit crops are to be decided on the basis of the number of orchards of different fruits available in a village. From each selected orchard, a sample of three clusters, each consisting of four trees of bearing age, will be selected randomly out of the total number of trees of bearing age. The yield of selected trees will be collected through an enquiry, and the yield of any four trees will be collected through physical observation.

9.27(e) For the vegetable survey, a sample of 10 vegetable growers will be selected out of the qualified vegetable growers of a village. For this, after complete enumeration of the selected village, a list of qualified vegetable growers will be prepared. Qualified growers are those who have 0.1 ha and above gross cropped area under vegetables in the case of a plain state, and 0.01 ha and above in the case of a hilly state. Qualified vegetable growers will be ranked by gross cropped area and then divided into two groups. If there is an odd number of growers, the first group will have one more grower than the second group. A total of six vegetable growers will be selected from the first group, and the rest four from the second group. In case the total number of qualified vegetable growers in any village is less than or equal to ten, all the growers will be selected for the detailed survey enquiry. The produce of all the vegetable crops grown by the selected grower will be recorded through enquiry, and physical observation will be taken on the day of the visit. The Field Investigator (FI) is to be advised to get in touch with

the grower of the selected field from time to time, ascertain the date of the harvest and be present on the day of the harvest. He must locate the experimental plot of specified size (5mx5m) before the cultivator starts harvesting the field. In each selected field, the experimental plot of the specified size must be located at random, beginning with the south-west corner of the selected field.

9.27(f) An attempt will also be made to explore the possibility of utilizing personal digital assistants (PDA)/handsets for the collection/uploading of data in one district in each of the six states proposed under study.

9.28 **Proposed Estimation Procedure:** In case of fruits, the developed procedures for estimating area, number of bearing trees, number of stray bearing trees, average yield per tree and production of fruits at district level will be followed in the present study. In case of vegetables also, the developed procedures for estimating area, production and productivity of vegetables at district level will be followed. The district-wise market arrival data for each of the States under study for the last ten to fifteen years for important fruits and vegetables under the study will be acquired from respective State Agricultural Marketing Board. The district-wise data for the last ten to fifteen years pertaining to area, production and productivity of important fruits and vegetables in the States will be acquired from the respective State departments. The estimates for non-surveyed districts will be obtained using market arrival data. Separate suitable models will be developed using market arrival data and production data for the last ten to fifteen years for the non-surveyed districts of both the strata namely, high productive and low

productive districts. The district level estimates of non-surveyed districts of both the strata will be obtained using these developed models. The State level estimates will be obtained as per the proposed sampling design.

LAND USE STATISTICS

9.29 The availability of timely and reliable statistics of land utilization plays an important role in policy formulation in the agricultural sector. The Directorate of Economics and Statistics (DES), has been entrusted with the task of collecting and disseminating land use statistics by district and state. The DES receives land use statistics by state and district in three different parts, viz., classification of land, area under irrigation (by source and crop) and area under crops in the prescribed format from State Agricultural Statistics Authorities (SASA). The SASAs comprise the following bodies designated to collect land use statistics in each State and UT in the country:

- Directorate of Economics & Statistics/ Bureau of Statistics/Planning (Andhra Pradesh, Assam, Bihar, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Odisha, Rajasthan, Tamil Nadu, Telangana, Andaman & Nicobar Islands, Chandigarh, Dadra & Nagar Haveli, Daman & Diu and Puducherry (19);
- Office of the Land Record & Revenues (Chhattisgarh, Punjab, Himachal Pradesh, Madhya Pradesh, Haryana, Uttarakhand, Uttar Pradesh (7); and
- Directorate of Agriculture (Arunachal Pradesh, Goa, Gujarat, Mizoram, Nagaland, Sikkim, Tripura, West Bengal, Delhi, Lakshadweep 10).

Land use statistics is presently available as per the nine-fold classification of land use, which includes

- i. forest area,
- ii. area under non-agricultural use,
- iii. barren and unculturable land,
- iv. permanent pasture and other grazing land,
- v. land under miscellaneous tree crops, etc.,
- vi. culturable waste land,
- vii. fallow lands other than current fallows,
- viii. current fallows and
- ix. net area sown.

9.30 Agricultural land consists of net area sown, current fallows, fallow lands other than current fallows, land under miscellaneous tree crops and culturable waste land. Non-agricultural land, includes forest area, area under non-agricultural use, barren and unculturable land and permanent pasture and other grazing land.

9.31 The information based on the above three parts-Part I (total area and classification of land), Part II (area irrigated: source-wise and crop-wise) and Part III (area under crops)-is compiled and released in the DES publication entitled “Land Use Statistics at a Glance”. The data from 1998-99 to 2014-15 (latest) is also available on the website of DES.

AGRICULTURE CENSUS

9.32 The DAC&FW has been conducting Agriculture Census, quinquennially, since 1970-71. The reference period for Agriculture Census is the Agriculture Year, i.e. July-June. Being the ultimate unit for taking agriculture-related decisions, operational holding has been taken as statistical unit

at micro-level for data collection. The data is collected in three distinct Phases following two broad approaches; in States where comprehensive land records exist (Land Record States), data is collected and compiled through re-tabulation of information available in the Village Land Records. For other States (Non-Land record States), the data is collected on sample basis following household enquiry method. During Phase-I and Phase-II of the Census, data on primary and other characteristics of operational holdings such as number and area of operational holdings, land use, cropping patterns, irrigation status, dispersal of holdings etc. are collected. The Phase-III of Agriculture Census, (referred as Input Survey) is conducted as a follow up survey to the Agriculture Census (reference year as next Agriculture year to that of the Agriculture Census) to collect data on input use pattern of operational holdings in the country.

9.33 Eight Agriculture Censuses have been conducted since 1970-71. The results of 9th Agriculture Census 2010-11 (all the three phases) have been released and are available on <http://agcensus.nic.in>. As per the results of Phase-III of Agriculture Census 2010-11 (9th Agricultural Census) information on: (i) number of holdings and area operated; (ii) average number of parcels, average area per parcel and area per holding; (iii) distribution of Net Sown Area according to number of crops taken; and (iv) Percentage of Irrigated and Unirrigated Areas Treated with Chemical Fertilizers, FYM(Farm Yard Manure) and Pesticides for 'All Crops' are discussed in the **Table 9.3 to 9.6**. The work relating to 10th Agriculture Census with reference year 2015-16 is in progress in the country.

Table 9.3: Number of Holdings and Area Operated

Sl. No.	Size Groups	No. of holdings		Area operated (in ha)	
		2006-07	2011-12	2006-07	2011-12
1	Marginal (Below 1.0 ha)	64316370	92687952	27166960	37241694
2	Small (1.0 – 2.0 ha)	18776330	24746125	26694643	34871976
3	Semi-medium (2.0 – 4.0 ha)	11217907	13869059	30526047	37369276
4	Medium (4.0 – 10.0 ha)	5335501	5853712	30863582	33387123
5	Large (10.0 ha and above)	1003432	953045	15626172	14735059
	All Size Groups	100649540	138109893	130877404	157605128

Source: Department of Agriculture, Cooperation & Farmers Welfare

Table 9.4: Average number of parcels, average area per parcel and area per holding

Sl. No.	Size Groups	No. of parcels per holding		Area per holding (in ha)	
		2006-07	2011-12	2006-07	2011-12
1	Marginal (Below 1.0 ha)	1.64	1.63	0.42	0.40
2	Small (1.0 – 2.0 ha)	2.63	2.34	1.42	1.41
3	Semi-medium (2.0 – 4.0 ha)	3.46	2.98	2.72	2.69
4	Medium (4.0 – 10.0 ha)	4.46	3.79	5.78	5.70
5	Large (10.0 ha and above)	5.61	5.06	15.57	15.46
	All Size Groups	2.22	2.01	1.30	1.14

Source: Department of Agriculture, Cooperation & Farmers Welfare

Table 9.5: Distribution of Net Sown Area according to number of crops taken

Sl. No.	Size Groups	Net sown area (in '000 ha)		
		Once	Twice	More than twice
1	Marginal (Below 1.0 ha)	20989 (62.2)	12063 (35.8)	676 (2.0)
2	Small (1.0 – 2.0 ha)	21173 (66.8)	10070 (31.8)	439 (1.4)
3	Semi-medium (2.0 – 4.0 ha)	22235 (66.7)	10792 (32.4)	296 (0.9)
4	Medium (4.0 – 10.0 ha)	18866 (65.1)	9932 (34.3)	176 (0.6)
5	Large (10.0 ha and above)	7912 (66.3)	3985 (33.4)	45 (0.3)
	All Size Groups	91176 (65.3)	46842 (33.5)	1631 (1.2)

Source: Department of Agriculture, Cooperation & Farmers Welfare

Note: Figures in parentheses indicate percentage in total.

Table 9.6: Usage of Chemical Fertilizers, Farm Yard Manure and Pesticides by major size groups

Sl. No.	Size Groups	Percentage of irrigated area treated with			Percentage of unirrigated area treated with		
		Chemical Fertilizers	Farm Yard Manures	Pesticides	Chemical Fertilizers	Farm Yard Manures	Pesticides
1	Marginal (below 1.0 ha)	89.2	19.6	43.4	65.8	28.2	35.9
2	Small (1.0 - 1.99 ha)	89.4	20.6	46.9	69.5	24.7	42.5
3	Semi-medium (2.0 - 3.99 ha)	89.9	18.2	48.8	67.9	22.1	42.3
4	Medium (4.0 - 9.99 ha)	90.3	15.8	53.5	60.2	18.6	38.9
5	Large (10.0 ha and above)	91	13.7	58.9	41.5	14.3	32.4
	All Size Groups	89.8	18.2	48.7	63.9	22.7	39.3

Source: Department of Agriculture, Cooperation & Farmers Welfare



Government of India
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Department of Agriculture, Cooperation & Farmers Welfare
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