सत्यमेव जयते

State of Indian Agriculture 2015-16

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

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PREFACE

In recent years the agriculture and allied sector has been facing numerous challenges. Even as the country has made large strides in increasing food production and achieving food security, the sector remains constrained by low productivity, excessive dependence on monsoon and weather conditions, continuing fragmentation of land and preponderance of fragmented markets. A combination of these factors has led to episodes of agrarian distress which have been widely reported. As a result, Government has engaged in fresh thinking on the development of the agriculture sector. In addition to agricultural development, Government is also focussing on farmers' welfare. Accordingly, the Department of Agriculture & Cooperation has been renamed as Department of Agriculture, Cooperation and Farmers Welfare.

The multi-pronged strategy for agricultural development now comprises focussing on agricultural growth through sustainable use of natural resources such as soil and water and at the same time taking steps for improving the socio-economic conditions of agriculturists. Innovative approaches are being adopted for better management of the farming sector. Emphasis is being placed on improved institutions and better organisation so that farmers' welfare is built into the system. Numerous steps are being taken to strengthen diverse aspects of the agricultural system.

This Report on the State of Indian Agriculture 2015-16 seeks to present a comprehensive analysis of the recent growth and performance of the agriculture and allied sectors and also to analyze the major emerging challenges. I must acknowledge that the revival of this valuable report on agriculture and allied sector became possible due to the farsightedness of my predecessor, Shri Siraj Hussain, former Secretary, DAC&FW. The Report has been enriched with developments and strategies being adopted by the Department of Agriculture, Cooperation & Farmers Welfare and all related Departments and Ministries. I would like to thank all the contributing organizations for their cooperation.

I would also like to compliment Shri P. C. Bodh, Adviser, Directorate of Economics & Statistics and his team specifically Shri Ashutosh Sharma, Economic Officer, Directorate of Economics & Statistics, for their endeavour in bringing out this voluminous work.

I am sure a wide range of policy makers, academicians, research organizations, students as well as agri-business community will find this Report useful.

(S.K. Pattanayak)

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Table of Abbreviations

AAY	Antyodaya Anna Yojana
ACABC	Agri-Clinics and Agri-Business Centres
ADB	Asian Development Bank
AE	Advance Estimates
AGM	Annual General Meeting
AI	Artificial insemination
AIBP	Accelerated Irrigation Benefit Programme
AICRP	All India Coordinated Research Programmes
AIR	All India Radio
AITI	Artificial Insemination Training Institutes
AKIS	Agriculture Knowledge Information System
AMFU	Agro -Meteorological Field Units
AMI	Agriculture Marketing Infrastructure
APL	Above poverty line
APMC	Agricultural Produce Market Committees
APR	Actuarial Premium Rate
APY	Acreage, Productivity and Yield
ARYA	Attracting Rural Youth in agriculture
ASEAN	Association of South East Asian Nations
ASI	Annual Survey of Industries
ATIF	Agri-Tech Infrastructure Fund
ATMA	Agriculture Technology Management Agency
AWD	Alternate wetting and drying
AWS	Automatic Weather Stations
BD Act	Biological Diversity Act
BGREI	Bringing Green Revolution to Eastern India
BOT	Build, operate and transfer
BPL	Below poverty line
BTT	Block Technology Team
CACP	Commission for Agricultural Costs and Prices
CAGR	Compound Annual Growth Rate
CAP	Cover and plinth
CAZRI	Central Arid Zone Research Institute
CBS	Core Banking Solutions
CCE	Crop cutting experiments
CCI	Cotton Corporation of India
CCIS	Comprehensive Crop Insurance Scheme

CCSAMN	Climate Change & Sustainable Agriculture Modelling & Networking
CDB	Coconut Development Board
CDC	Central Data Centre
CDM	Clean Development Mechanism
CFMTTI	Central farm Machinery Training & Testing Institute
CFQC&TI	Central Fertilizer Quality Control & Training Institute
CGAIR	Consultative Group on International Agricultural Research
CMVR	Central Motor Vehicles Rule
CIH	Central Institute of Horticulture
CIP	Central Issue Prices
CMP	Crisis Management Plan
CMU	Central Monitoring Unit
CoE	Centres of Excellence
CoS	Committee of Secretaries
CPC	Central Processing Centres
CPCB	Central Pollution Control Board
CPDO	Central Poultry Development Organizations
CPI	Consumer Price Index
CPIS	Coconut Palm Insurance Scheme
CPMU	Central Project Monitoring Unit
CPPTC	Central Poultry Performance Testing Centre
CRIDA	Central Research Institute for Dryland Agriculture
CRS	Community Radio Stations
CSC	Central Seed Committee
CSCB	Central Seed Certification Board
CSO	Central Statistics Office
CSTL	Central Seed Testing Laboratories
CWC	Central Warehousing Corporation
CWWG	Crop Weather Watch Group
DAAP	District Agriculture Action Plans
DAC&FW	Department of Agriculture, Cooperation & Farmers Welfare
DADF	Department of Animal Husbandry, Dairying & Fisheries
DAESI	Diploma in Agriculture Extension Services for Input
DARE	Department of Agricultural Research and Education
DASD	Directorate of Arecanut and Spices Development
DCCD	Directorate of Cashew and Cocoa Development
DDA	Doha Development Agenda
DES	Directorate of Economics & Statistics

DFPD	Department of Food and Public Distribution
DGFT	Directorate General of Foreign Trade
DIP	District Irrigation Plans
DKMA	Directorate of Knowledge Management in Agriculture
DLC	District-Level committees
DLMC	District-Level Monitoring Committee
DPR	Detailed Project Reports
DSR	Direct seeded rice
DSS	Detailed Soil Survey
DUS	Distinctiveness, Uniformity and Stability
DVC	Damodar Valley Corporation
ECIS	Experimental Crop Insurance Scheme
EDEG	Entrepreneurship Development and Employment Generation
EDV	Essentially Derived Varieties
EIA	End Implementing Agencies
FAO	Food and Agriculture Organization
FAQ	Fair Average Quality
FATI	Free air temperature increment
FCI	Food Corporation of India
FCO	Fertilizer Control Order
FCR	Feed Conversion Ratio
FDA	Forest Development Agencies
FDI	Foreign Direct Investment
FH	Fishing Harbours
FI	Field Investigator
FIG	Farmers into Interest Groups
FIIS	Farm Income Insurance scheme
FIRST	Farmer, Innovation, Resources, Science and Technology
FLD	Frontline Demonstrations
FMD	Foot and Mouth Disease
FMTTI	Farm Machinery Training and Testing Institutes
FPC	Farmer producer companies
FPO	Farmer Producer Organizations
FQCL	Fertilizer Quality Control Laboratories
FRP	Fair and Remunerative Price
FSSAI	Food Safety and Standards Authority of India
FTA	Free Trade Agreements
GAP	Good Agricultural Practices

GBY	Grameen Bhandaran Yojana
GCES	General Crop Estimation Survey
GCF	Gross Capital Formation
GEAC	Genetic Engineering Appraisal Committee
GHG	Green House Gases
GI	Geographical indication
GMO	Genetically modified organisms
GNP	Gross National Product
GoE	Group of Experts
GoI	Government of India
GVA	Gross Value Added
HLC	High Level Committee
HMNEH	Horticulture Mission for North East and Himalayan States
IA	Implementing Agency
IASRI	Indian Agricultural Statistics Research Institute
IAY	Indira Awaas Yojana
IBSA	India, Brazil and South Africa
ICAR	Indian Council of Agricultural Research
ICT	Information and Communication Technology
IDDP	Intensive Dairy Development Programme
IDWG	Inter-Departmental Working Group
IEG	Institute of Economic Growth
IFAD	International Fund for Agriculture Development
IFOAM	International Federation of Organic Agriculture Movements
IFS	Integrated farming system
IINRG	Indian Institute of Natural Resins and Gums
IIP	Index of Industrial Production
IMD	Indian Meteorological Department
INDC	Intended Nationally Determined Contributions
INM	Integrated nutrient management
INSIMP	Initiative for Nutritional Security through Intensive Millets Promotion
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
ISOPOM	Integrated Scheme of Oilseeds, Oil Palm and Maize
ISS	Interest Subvention Scheme
IT	Information Technology
ITD	Innovative Technology Dissemination
ITDP	Indo Tibetan Border Police

ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IVC	Integrated value chains
IWGSC	International Wheat Genome Sequencing Consortium
IWMP	Integrated Watershed Management Programme
JCI	Jute Corporation of India
JFMC	Joint Forest Management Committees
JLG	Joint Liability Group
KCC	Kisan Call Centre
KMS	Kharif Marketing Season
KVK	Krishi Vigyan Kendras
LCS	Land Custom Stations
LDC	Least Developed Countries
LPA	Long Period Average
MBRT	Multi-brand Retail Trading
MEP	Minimum Export Price
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MIDH	Mission for Integrated Development of Horticulture
MIP	Market intervention price
MIS	Market Intervention Scheme
MKSP	Mahila Kisan Sashaktikaran Pariyojana
MMP	Mission Mode Projects
MNAIS	Modified National Agricultural Insurance Scheme
MNCFC	Mahalanobis National Crop Forecast Centre
MoA&FW	Ministry of Agriculture & Farmers Welfare
MoEFCC	Ministry of Environment, Forest and Climate Change
MoFPI	Ministry of Food Processing Industries
MoPNG	Ministry of Petroleum & Natural Gas
MoU	Memorandum of Understanding
MPLS	Multiprotocol Label Switching
MPP	Methane production potential
MRIN	Marketing Research and Information Network
MRP	Maximum retail price
MSC	Marine Stewardship Council
MSP	Minimum Standard Protocol/Minimum Support Prices
NABARD	National Bank for Agriculture and Rural Development
NAEB	National Afforestation & Eco-Development Board
NAIP	National Agricultural Innovation Project

NAIS	National Agricultural Insurance Scheme
NAM	National Agriculture Market
NAPCC	National Action Plan on Climate Change
NARES	National Agricultural Research and Education System
NARS	National Agricultural Research Systems
NASF	National Agricultural Science Fund
NBA	National Biodiversity Authority
NBM	National Bamboo Mission
NBS	Nutrient Based Subsidy
NCAER	National Council of Applied Economic Research
NCBI	National Center for Biotechnology Information
NCCF	National Cooperative Consumers' Federation
NCDC	National Cooperative Development Corporation
NCIP	National Crop Insurance Program
NCMC	National Crisis Management Committee
NCU	Neem coated urea
NDDB	National Dairy Development Board
NDP	National Dairy Plan Phase
NDRF	National Disaster Response Fund
NDRI	National Dairy Research Institute
NDV	Newcastle disease virus
NEC	National Executive Committee
NEHR	North Eastern Hill Region
NFBSFARA	National Fund for Basic Strategies and Frontier Application Research in Agriculture
NFDB	National Fisheries Development Board
NFSA	National Food Security Act
NFSM	National Food Security Mission
NHM	National Horticulture Mission
NIAM	National Institute of Agriculture Marketing
NIC	National Informatics Centre
NICRA	National Initiative for Climate Resilient Agriculture
NLM	National Livestock Mission
NMAET	National Mission on Agricultural Extension and Technology
NMFP	National Mission on Food Processing
NMOOP	National Mission on Oilseeds and Oil Palm
NMPS	National Mission for Protein Supplements
NMSA	National Mission for Sustainable Agriculture
NPBB	National Programme for Bovine Breeding

NPBBD	National Programme for Bovine Breeding and Dairy Development
NPBBDD	National Programme for Bovine Breeding & Dairy Development
NPCBB	National Project for Cattle and Buffalo Breeding
NPDD	National Programme for Dairy Development
NPM	Non-chemical Pest Management
NPMCR	National Policy for Management of Crops Residue
NPMSH&F	National Project on Management of Soil Health & Fertility
NPOF	National Project on Organic Farming
NRCP	National River Conservation Plan
NRCPB	National Research Centre on Plant Biotechnology
NRFMTTI	Northern Region Farm Machinery Training & Testing Institute
NRLM	National Rural Livelihoods Mission
NSAI	National Seed Association of India
NSAP	National Social Assistance Programme
NSC	National Seeds Corporation
NSR	National Seed Reserve
NSRTC	National Seed Research and Training Centre
NSSO	National Sample Survey Office
NTFP	Non Timber Forest Products
NTI	Nodal Training Institutes
NWDPRA	National Watershed Development Project for Rainfed Areas
NWR	Negotiable Warehouse Receipts
O&M	Operations and maintenance
OFWM	On-Farm Water Management
OPAE	Oil Palm Area Expansion
OWS	Other welfare schemes
PAC	Project Appraisal Committee
PAU	Punjab Agricultural University
PDS	Public Distribution System
PEG	Private Entrepreneurs Guarantee
PFZ	Potential fishing zone
PGPR	Plant growth-promoting rhizobacteria
PGS	Participatory Guarantee System
PGSC	Plant Genome Saviour Community
PHTM	Post-Harvest Technology and Management
PIA	Project Implementing Agencies
PKVY	Paramparagat Krishi Vikas Yojana
PMGSY	Pradhan Mantri Gram Sadak Yojana

PMKSY	Pradhan Mantri Krishi Sinchayee Yojana
PPC	Primary Processing Centres
PPP	Public private partnership
PPR	Peste des petits ruminants
PPRV	Peste des petits ruminants virus
PPV&FR	Protection of Plant Varieties and Farmers' Rights
PPVFRA	Protection of Plant Varieties and Farmer's Rights Authority
PRI	Panchayati Raj Institutions
PSF	Price Stabilisation Fund
PSL	Priority sector lending
PSS	Price Support Scheme
PTA	Preferential trade agreements
R&D	Research and development
RAD	Rainfed Area Development
RBF	Rumen bypass fat
RCGM	Review Committee on Genetic Manipulation
RCT	Resource conservation technologies
RDAC	Recombinant DNA Advisory Committee
READY	Rural Entrepreneurship and Awareness Development Yojana
RFCL	Regional Fertilizer Control Laboratories
RIDF	Rural Infrastructure Development Fund
RKVY	Rashtriya Krishi Vikas Yojana
RMS	Rabi Marketing Season
RRS	Rapid Reconnaissance Survey
RS	Remote sensing
RST	Remote Sensing Technology
RTSV	Rice tungro spherical virus
RVP&FPR	River Valley Project & Flood Prone River
SAC	Space Application Centre
SAMETI	State Agricultural Management & Extension Training Institutes
SAS	Situation Assessment Survey of Farmers/Agricultural Households
SASA	State Agricultural Statistics Authorities
SAU	State agricultural universities
SBCC	State Biotechnology Coordination Committee
SCAR	Sequence Characterized Amplified Region
SDRF	State Disaster Response Fund
SEWP	State Extension Work Plan
SFAC	Small Farmers' Agribusiness Consortium

SFCI	State Farms Corporation of India
SFDA	State Forest Development Agency
SHC	Soil Health Card
SHG	Self-help groups
SHM	Soil Health Management
SIA	State Implementing Agency
SIFS	Specialized integrated farming system
SLC	State Level Committees
SLCCCI	State Level Co-ordination Committee on Crop Insurance
SLSC	State Level Sanctioning Committee
SLUSI	Soil and Land Use Survey of India
SMAE	Sub Mission on Agricultural Extension
SMAM	Sub Mission on Agricultural Mechanization
SMART	Specific, Measurable, Achievable, Realistic and Time-bound
SMPP	Sub Mission on Plant Protection and Plant
SMSP	Sub Mission on Seed and Planting
SMTA	Standard material transfer agreement
SPS	Sanitary and Phytosanitary
SREP	Strategic Research and Extension Plan
SRI	System of root Intensification
SRLM	State Rural Livelihoods Missions
SRR	Seed Replacement Ratio
SRSWOR	Simple random sampling without replacement
SS	Sample survey
SSC	State Seed Corporations
SSCA	State Seed Certification Agencies
SSM	Special Safeguard Mechanism
SSP	Single super phosphate
STCR	Soil Test-Crop Response
STE	State trading enterprises
STL	Seed Testing Laboratories
STP	Sewerage treatment plants
STRY	Skill Training of Rural Youth
SWC	State Warehousing Corporations
T.E.	Triennium Ending
TBO	Tree Borne Oilseeds
TNA	Training Need Assessment
TNAU	Tamil Nadu Agricultural University

ToT	Terms of Trade
TPDS	Targeted Public Distribution System
TRC	Transplanted rice cultivation
TRIPS	Trade Related Aspects of Intellectual Property
TSP	Tribal sub-plan
TY	Threshold Yield
UGPL	Under Ground Pipe Line
UNFCCC	United Nations Framework Convention on Climate Change
UPIS	Unified Package Insurance Scheme
VCK	Variety of Common Knowledge
VIUC	Vegetable Initiative for Urban Clusters
VP	Village Panchayat
WBCIS	Weather Based Crop Insurance Scheme
WDPSCA	Watershed Development Project in Shifting Cultivation Areas
WDRA	Warehousing Development and Regulatory Authority
WFP	World Food Programme
WPI	Wholesale Price Index
WTO	World Trade Organization
WUA	Water User Associations
YOY	Year-on-Year

CHAPTER-1

Indian Agriculture: Performance, Challenges and the Way Forward

1.1 The agriculture and allied sector continues to be pivotal to the sustainable growth and development of the Indian economy. Not only does it meet the food and nutritional requirements of 1.3 billion Indians, it contributes significantly to production, employment and demand generation through various backward and forward linkages. Moreover, the role of the agricultural sector in alleviating poverty and in ensuring the sustainable development of the economy is well established.

1.2 The sector is, however, currently facing a dilemma. While it has made large strides in achieving the agricultural development goals of food security, availability and accessibility, it is still being challenged by a formidable agrarian crisis. This situation has recently led to fresh thinking on the developmental approach in the agriculture sector. The need for focusing on the welfare and prosperity of farmers has gained prominence. Consequently, the Department of Agriculture and Cooperation was renamed, by the Hon'ble PM on Independence Day 2015, as the Department of Agriculture, Cooperation and Farmers Welfare. In this fresh approach, priority is to be accorded to making the agriculture and allied sector not only ecologically sustainable in its use of natural resources of soil, water and forests, but also socio-economically sustainable to farmers in terms of prosperity, welfare and social security. Innovating managerial solutions to maximize farmers' welfare—rather than relying solely on modern farming to raise productivity and production—is the clarion call of the day.

1.3 The farmer welfare-centred approach to agricultural development can empower the rural masses with higher income and employment and make balanced development a reality. Hence, in policies of poverty alleviation and enhancing sustainable development, agriculture has enormous potential.

1.4 The pressures emanating from natural resource constraints, increasing fragmentation of holdings, frequent climatic variations, rising input costs and post-harvest losses pose an enormous challenge to sustaining agricultural growth. The agrarian distress in recent years is the result of a complex interplay of these factors. In the past, many of these factors—along with lack of sufficient non-farm and off-farm employment—have perpetuated low productivity and inefficiency in the agricultural sector. Against this backdrop, policies and programmes formulated by the government have focused on increasing farmers' welfare through improved employment opportunities, better farm practices, improving soil heath, increasing investment, creating rural infrastructure, ensuring timely delivery of credit and technology, encouraging market reform and reducing risk in agriculture through the introduction of a new insurance scheme.

1.5 In keeping with the spirit of fiscal federalism, through the implementation of the Fourteenth Finance Commission's recommendations, the Union Government has also provided more flexibility and autonomy to states in formulating and implementing schemes and programmes best suited to meet their specific needs. The Government also recognizes that the future of agriculture lies in shifting focus beyond farming and towards development of food systems, i.e., full agri-value chains. The process also entails the creation of a large number of "near-farm" jobs in post-harvest management, food processing, logistics and modern retail, i.e., by procuring directly from farmers' groups. Development of these efficient value chains will not only help move people from *farm* jobs to *near-farm* jobs but also enable farmers to realize

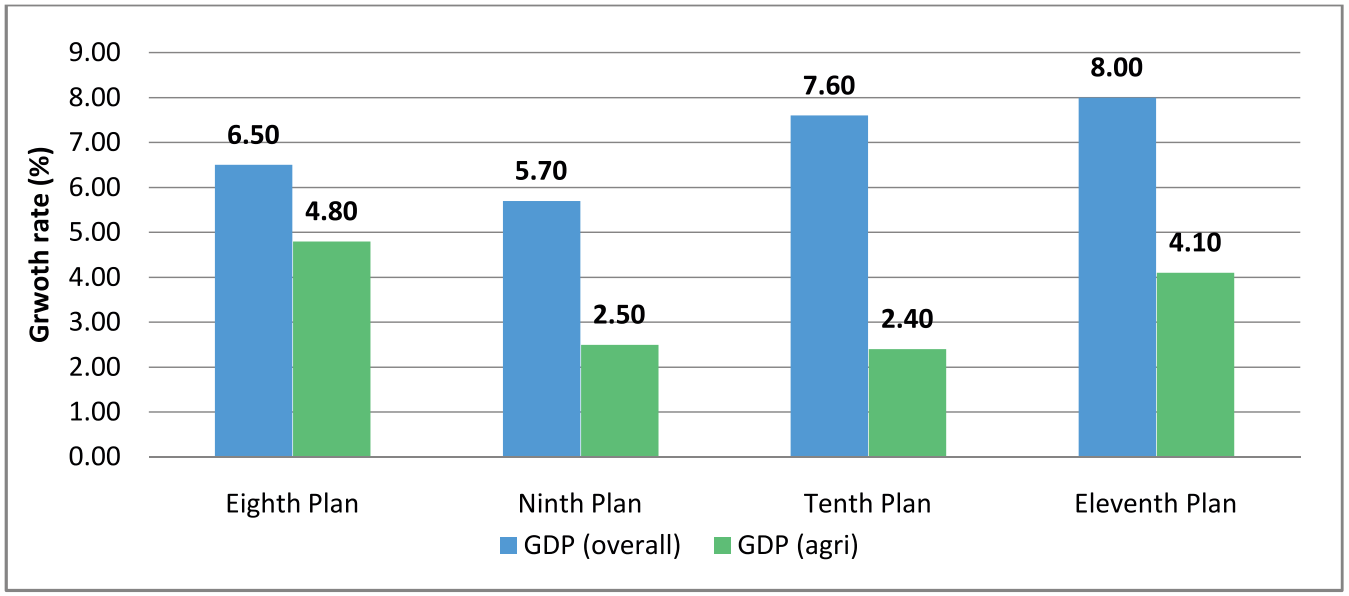
better prices for their produce, as price volatility will drop, while consumers will gain with better quality products at lower prices.

1.6 This chapter provides a review of the recent growth and performance of the agricultural sector and analyses the major emerging challenges. The major policy interventions by the Government and their impact on various sub-sectors have also been briefly surveyed. Towards the concluding part, suggestions on the possible pathways for the future are discussed.

Growth of the Agricultural Sector

1.7 Since the beginning of economic reforms in 1991, growth in agricultural GDP has shown high volatility. It has fluctuated from 4.8 percent per annum in the Eighth Five Year Plan (1992-96) to a low of 2.4 percent during the Tenth Plan (2002-06) before rising to 4.1 percent in the Eleventh Plan (2007-12), as shown in **Figure 1.1**.

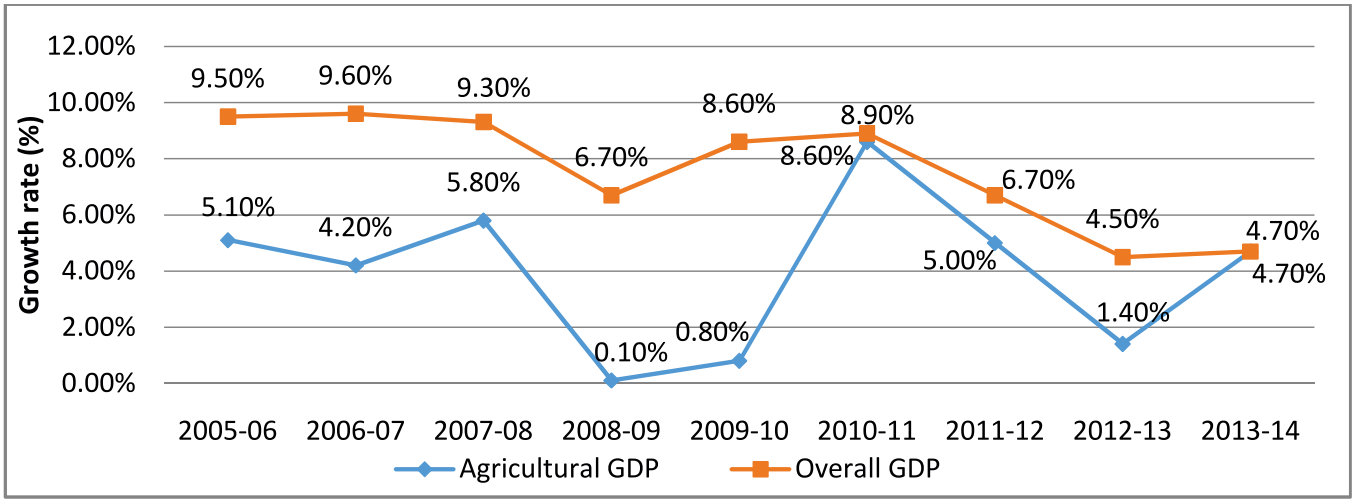
Figure 1.1: Agricultural Growth Rate during Different Plan Periods



Source: ***Central Statistics Office (CSO)***

1.8 To assess the performance of the agricultural sector during the last decade, the period since 2004-05 is divided into two—the first period being between 2004-05 and 2007-08 and the second period being between 2008-09 to 2013-14. The annual average growth rate of the agriculture sector was 5 per cent between 2004-05 and 2007-08, but fell to 3 per cent between 2008-09 and 2013-14. During the same periods, the economy grew at an annual average of 9 per cent and 7 per cent, respectively. Volatility in economic activity is normal but it was much higher in the agriculture and allied sector. Between 2005-06 and 2013-14, the coefficient of variation was only 0.27 in the case of overall GDP growth but 0.69 for agricultural GDP. One major factor to which this high volatility may be attributed is the continued dependence on the vagaries of the monsoon. The preponderance of small and marginal holdings makes this high volatility even more worrisome for policy makers, as small and marginal farmers are highly vulnerable to adverse climatic conditions.

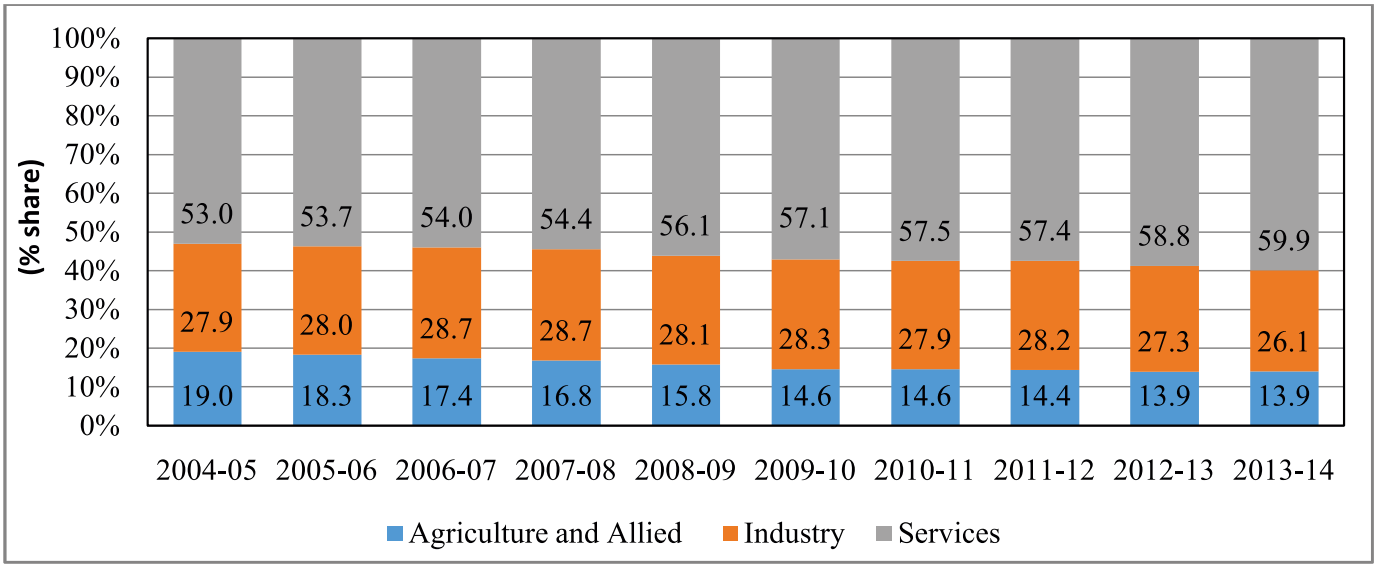
Figure 1.2: Agricultural GDP Growth Rate at Constant (2004-05) Prices



Source: CSO

1.9 As a natural consequence of economic growth and structural changes in the economy, the share of agriculture and allied sectors in the total GDP declined from around 19 per cent in 2004-05 to 14 per cent in 2013-14, calculated at 2004-05 constant prices (Figure 1.3). If the shares of forestry and fishing are removed, agriculture (including livestock) accounted for about 12 per cent of the national GDP. However, with around 50 percent of the population still dependent on agriculture for its livelihood, the sector continues to play a vital role through its multiplier impact on the economy.

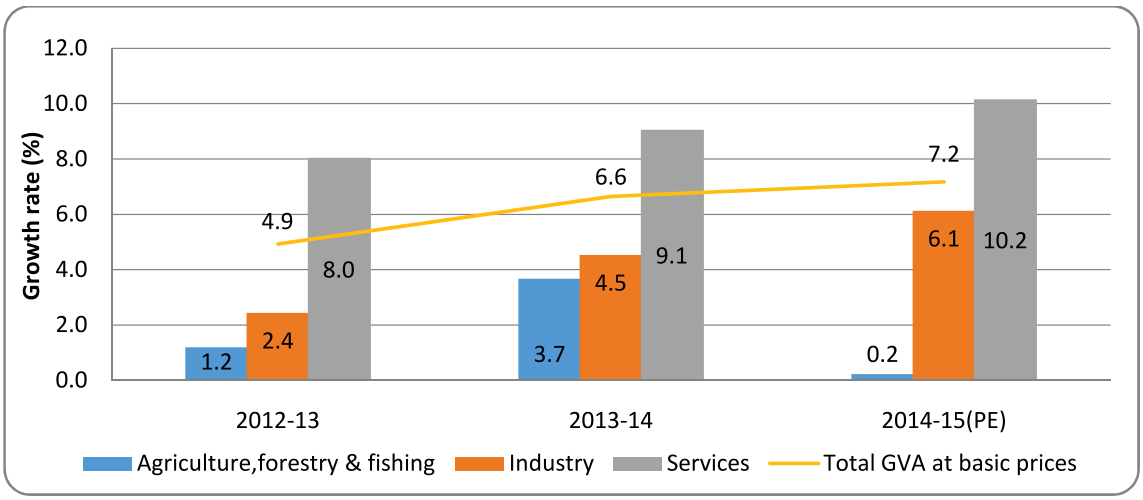
Figure 1.3: Sector-wise Share in GDP at Constant (2004-05) prices



Source: CSO

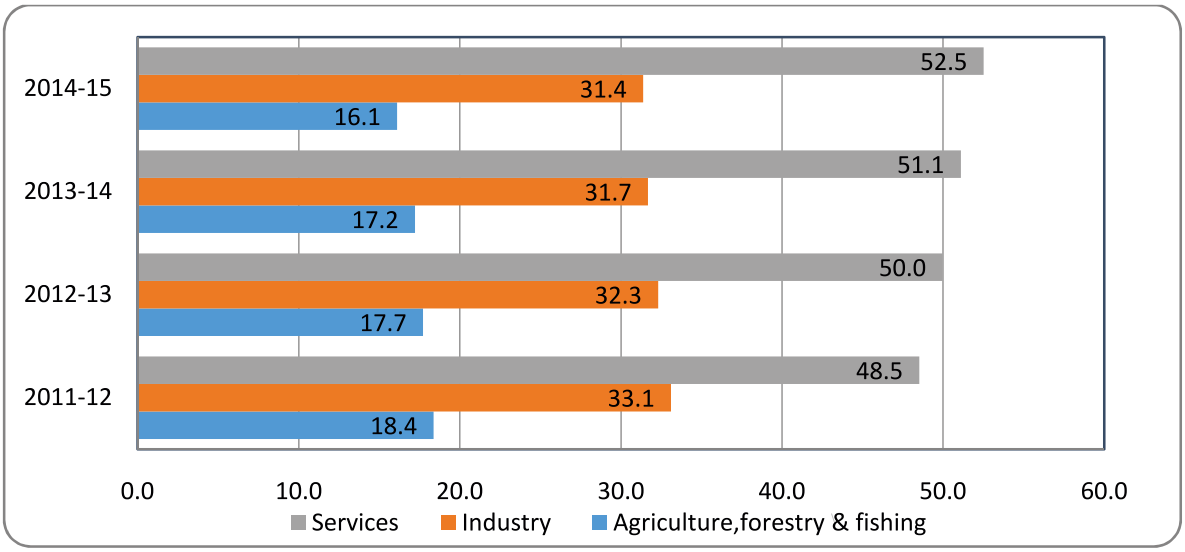
1.10 The CSO has recently revised the methodology for calculating national accounts aggregates to facilitate international comparability and the ease of understanding the analysis. The base year for national accounts has been revised from 2004-05 to 2011-12. As per the new series, the Gross Value Added (GVA, earlier referred as Gross Domestic Product) at 2011-12 basic prices for the agriculture and allied sectors grew to Rs. 15.82 lakh crores in 2014-15 from Rs. 15.79 lakh crores in 2013-14, or 0.2 per cent. The GVA growth rate for the agriculture and allied sector during 2013-14 was 3.7 per cent; the sub-sectoral growth in agriculture including livestock was 3.9 per cent, in forestry and logging was 0.3 per cent and in fishing was 5.8 per cent. The slower rate of growth in the agriculture sector during 2014-15 was mainly on account of a deficient monsoon, which affected the production of kharif crops. The situation aggravated due to unseasonal rainfall and hailstorms in certain parts of the country in 2015 during February and March, which affected the production of rabi crops as well. The rate of growth of GVA in agriculture, forestry and fishing and other sectors and their respective share in total GVA (at constant 2011-12 prices) are depicted in **Figures 1.4 and 1.5.**

Figure 1.4: Rate of Growth of GVA in Different Sectors at Constant 2011-12 prices



Source: CSO

Figure 1.5: Share of Different Sectors in GVA at Constant 2011-12 prices



Source: CSO

1.11 As per the quarterly estimates of GVA at basic prices for 2015-16, released by the CSO on 30 November 2015, the agriculture and allied sector is estimated to have grown by 1.9 per cent during the first quarter and 2.2 per cent during the second quarter. In the first half of 2015-16 (H1), the overall growth in the agriculture and allied sector is estimated to be 2.0 per cent vis-à-vis 2.4 per cent in the corresponding period of 2014-15. The estimated growth of the sector, at 2.0 per cent in 2015-16 (H1), was mainly on account of better performance in the livestock, forestry and fisheries sector. The production of food crops suffered due to a cumulative deficiency in monsoon rainfall (14 per cent). The provisional estimates by the CSO show that more than 40 per cent of the GVA in the sector during the first two quarters of 2015-16 was based on the livestock products, forestry and fisheries sector.

Regional Variations in Agricultural Growth

1.12 The share and growth of the agriculture and allied sector at the state level presents a very different picture from that at the national level. While at the national level, the agriculture and allied sectors contributed about 14 per cent to the GDP in 2013-14 (at constant 2004-05 prices), a number of states showed a much larger share of agriculture in GSDP. As shown in **Table1.1**, about 13 states earn over 20 per cent of their GSDP from agriculture, and only 7 states earn less than 15 per cent of their GSDP.

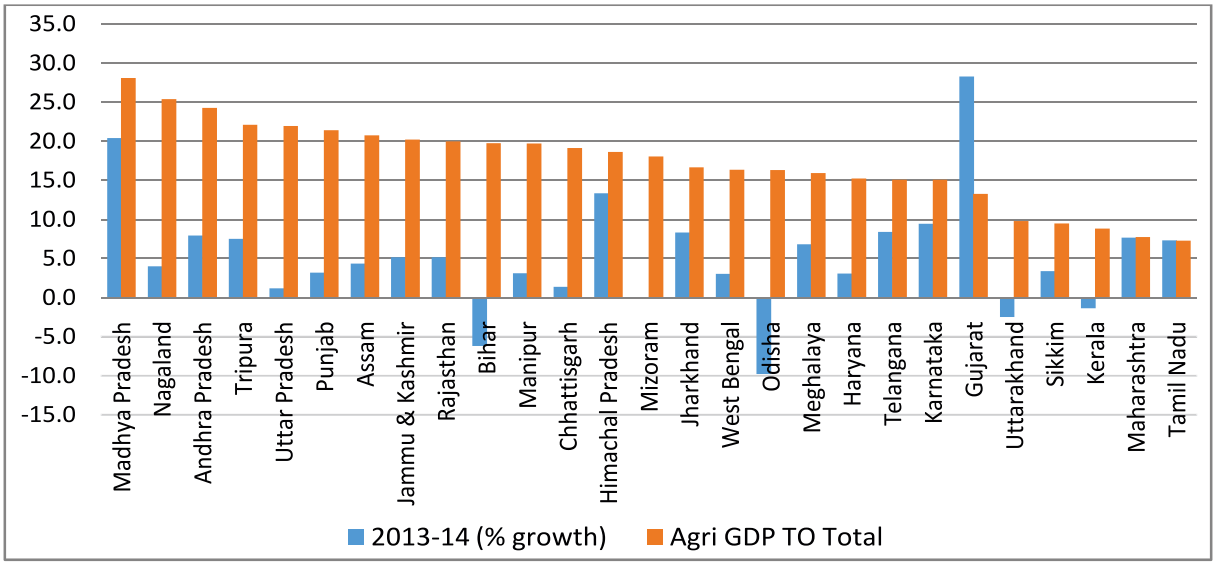
Table 1.1: Share of Agriculture and Allied Activities in State GSDP at constant 2004-05 prices

Share of agriculture and allied sector in GSDP	States
30% and above	Arunachal Pradesh
20 – 29 %	Andhra Pradesh, Assam, Bihar, Chhattisgarh, Jammu and Kashmir, Madhya Pradesh, Manipur, Nagaland, Punjab, Rajasthan, Tripura, Uttar Pradesh
15-19%	Haryana, Himachal Pradesh, Jharkhand, Karnataka, Meghalaya, Mizoram, Odisha, Telangana, West Bengal
Less than 15%	Goa, Gujarat, Kerala, Maharashtra, Sikkim, Uttarakhand, Tamil Nadu

Source: CSO

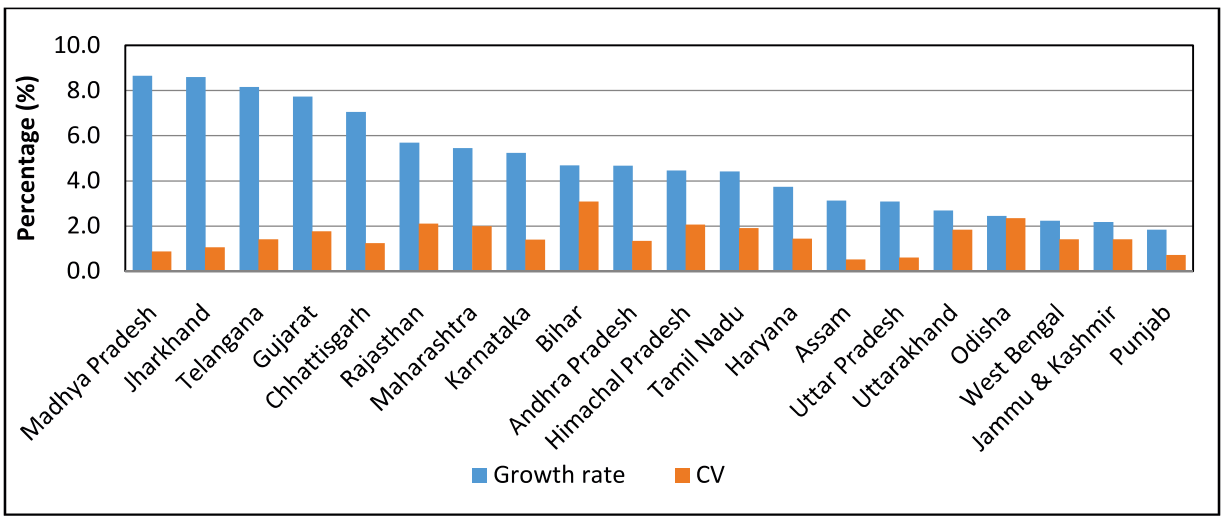
1.13 The growth of the agriculture and allied sector at the state level differs from that at the national level. For instance, at the national level, the GDP from the agriculture and allied sectors grew at the rate of 4.7 per cent in 2013-14 (at constant 2004-05 prices), but the states of Gujarat, Madhya Pradesh and Himachal Pradesh registered double-digit growth during the same period **(Figure 1.6)**. Almost 50 per cent of the states were estimated to have experienced more than 5 per cent growth in the agriculture and allied sectors during 2013-14. The Twelfth Plan document identifies states like Odisha, Madhya Pradesh, Bihar and Chhattisgarh as the major drivers of agricultural growth. These states are showing growth momentum, while soil fatigue is observed in the earlier green revolution states of Punjab and Haryana because of their continued focus on conventional crops, in which there is little yield growth. One factor which appears to have contributed to the high growth rate in the agricultural sector at the state level is the increase in the devolution of funds to states according to the recommendations of successive Finance Commissions and related interventions by the Union Government, which provided financial autonomy and flexibility to state governments in Plan formulation, as per their requirements.

Figure 1.6: State-wise Growth and Share in Agriculture-GDP (2013-14)



1.14 Inter-state and inter-temporal variability in agricultural growth rate has also been observed. For example, Madhya Pradesh, with the highest average agricultural growth of 9.3 per cent between 2005-06 and 2013-14, has a relatively low coefficient of variation of 0.9 per cent, whereas Bihar achieved an average growth of 4.7 per cent during the same period, but with a high coefficient of variation of 3.1 per cent **(Figure 1.7).** It is noteworthy that, as compared to the all-India coefficient of variation of agricultural GDP of 0.65 per cent between 2005-06 and 2013-14, the variation at the state level in Bihar was much higher than in most states. Thus, at the state level, agricultural growth has been more volatile. The large variations among states in the agricultural growth rate can be explained partly in terms of the base effect and partly in terms of such factors as climatic variations, differences in the level of capital formation, access to institutions, pressure on natural resources, level of policy interventions, etc.

Figure 1.7: State-wise Average Growth rate and Coefficient of Variation (2005-06 to 2013-14)



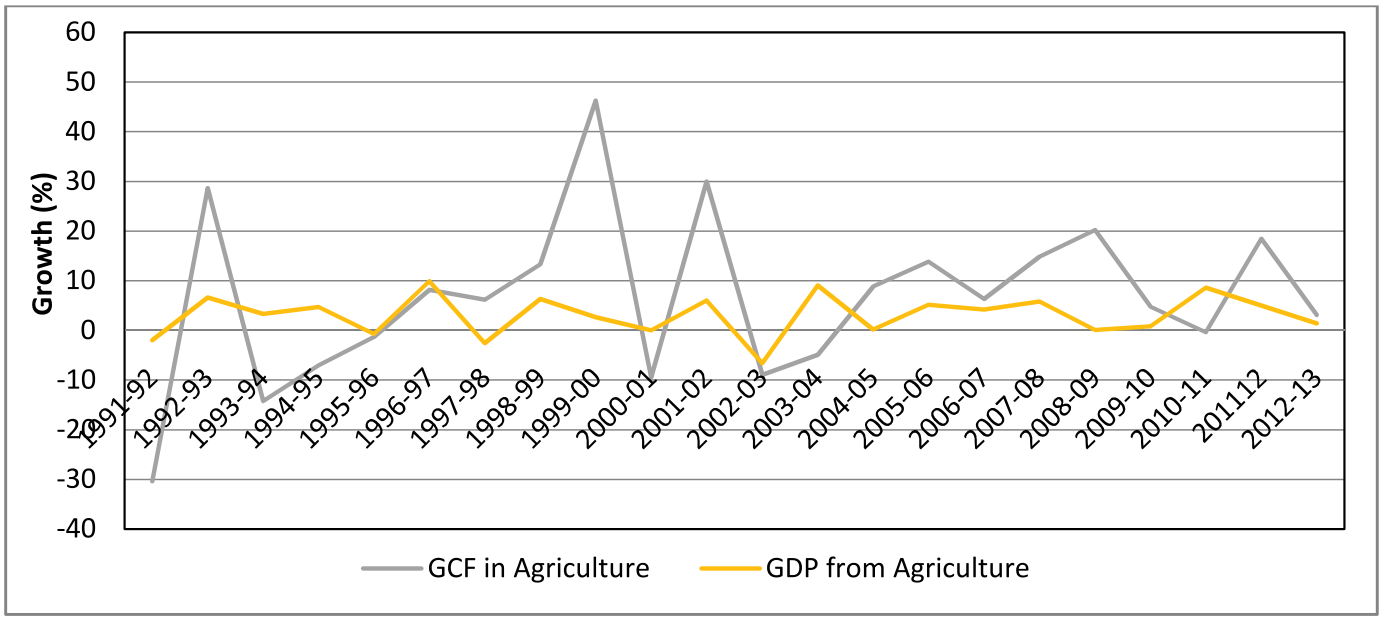
Source: CSO

1.15 The Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report (AR5) 2014 suggests that the pressures emanating from climate change will aggravate in future. Under such a scenario, it is clear that the agriculture development strategy to be adopted now should comprise building climatic resilience and developing short-duration varieties of crops through technological interventions. Also required are changes in farm practices and diversification in cropping patterns for achieving sustainable agricultural growth. These factors have been taken note of, and a number of measures are being undertaken in a convergence framework aimed at incentivizing farmers by mitigating the risks involved and thus improving the profitability of agriculture.

Capital Formation in Agriculture

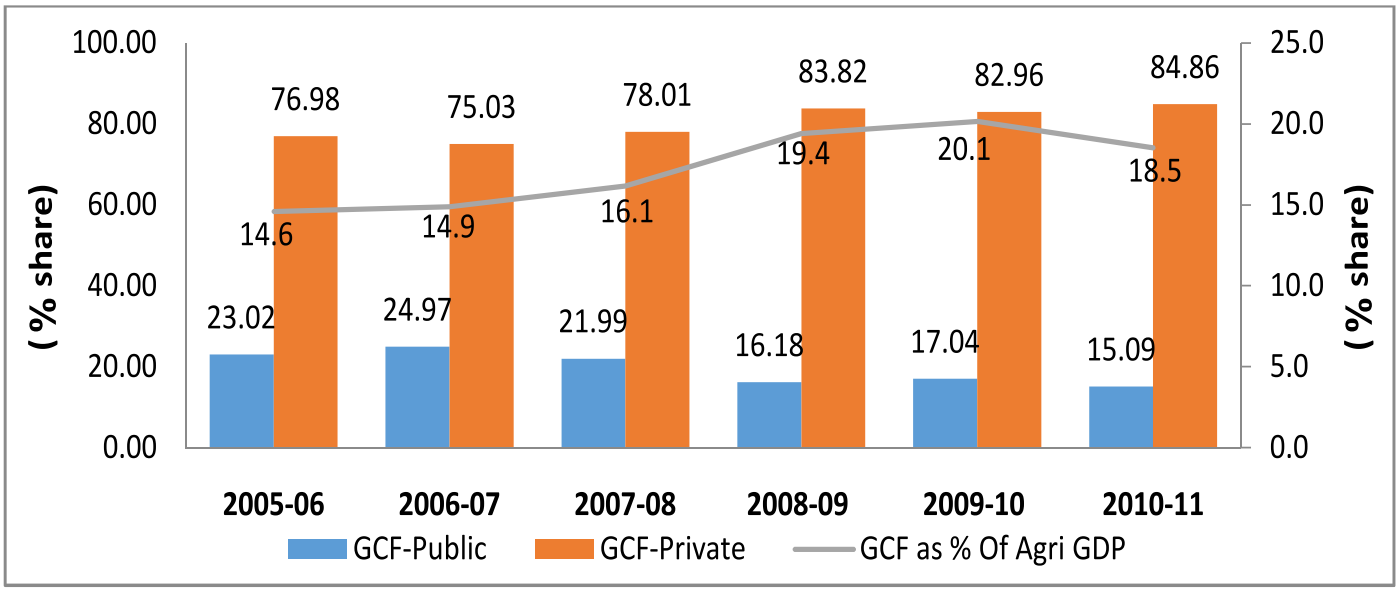
1.16 Capital formation is vital for inclusive and sustainable growth of the agriculture and allied sector. As depicted in Figure 1.8, the rate of growth of gross capital formation (GCF) in agriculture has shown a positive relation with the agricultural output. Public sector investment has been an important source of GCF in agriculture and an enabling factor in maintaining agricultural growth. For example, the relatively higher growth rate of agriculture between 2004-05 and 2007-08 was largely on account of measures taken to infuse public investment in the sector. The much-needed capital infusion in agricultural research and extension was facilitated by the implementation of schemes like Rashtriya Krishi Vikas Yojana (RKVY), National Horticulture Mission, National Agricultural Innovation Project, central support to state extension programmes, etc. As a consequence, the proportion of public sector GCF in agriculture (Base: 2004-05=100) increased between 2004-05 and 2006-07, after which it started falling in comparison to the private sector's share **(Figure 1.9).** Historical analysis shows that public sector investment in agriculture cannot be fully substituted by private sector investment. Most of this capital is a public good in nature and, therefore, is essential to stimulate private investment.

Figure 1.8: Rate of growth of GCF and GDP from agriculture and allied sector (at Constant 2004-05 prices)



Source: CSO

Figure 1.9: Share of Public and Private sector in Agri- GCF



Source: CSO

1.17 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**. The level of GCF in agriculture and allied sector witnessed a sharp decline of 12.9 per cent in 2012-13 as compared to 2011-12. This was mainly on account of a fall in private household investment, which constitutes 85 per cent of total GCF in the sector. However, with the stepping up of investment in the public sector, the fall in GCF was largely contained in 2013-14.

Table 1.2: Sector-wise share in GCF-Agri (Based on 2011-12 series)

(Figures in Rs. Crore)

	GCF in Agriculture (at constant 2011-12 prices)		
	2011-12	**2012-13**	**2013-14**
Households	232442 (84.5)	196087 (81.8)	192810 (80.7)
Public sector	36712 (13.3)	36863 (15.4)	40190 (16.8)
Private Corporation	6165 (2.2)	6829 (2.8)	5977 (2.5)
Total GCF in Agriculture	**275319 (100)**	**239779 (100)**	**238977 (100)**
GCF in Agriculture to overall GCF	*8.64*	*7.58*	*7.45*
GCF in Agriculture to GVA of Agri	*18.29*	*15.74*	*15.13*

Source: CSO

Note: Figures in parentheses indicate percentage share of total GCF in agriculture.

1.18 As two-thirds of capital formation in the private sector is through bank credit, the role of banks is important in meeting the private sector's long-term investment credit demand. However, the current estimates suggest that long-term credit is not just declining but also that it constitutes less than a quarter of total agricultural credit. The policy thrust, therefore, has to be on incentivizing banks through adequate budgetary support. Similarly, reviving public sector investment is critical due to its multiplier effect on the overall GCF in the sector. Thus, there is a need to formulate a long-term perspective plan for rural infrastructure that focuses on infrastructural projects that have the highest total impact and strongest linkages. The convergence of resources of centre and state governments is also important, as it would avoid duplication or concentration of activities in particular areas.

1.19 There is an emerging view that capital formation needs to be seen from two separate viewpoints, i.e., point of capital formation *in* agriculture and point of capital formation *for* agriculture. The estimates for capital formation as compiled by the CSO include only the capital formation "in" the agriculture sector by the public and private sectors. However, in order to have a comprehensive measure of capital formation in the sector, there is a need for a broader data series that includes capital formation in activities such as production of fertilizers and pesticides, development of agricultural markets, rural roads and communications, agricultural education, research and development of agricultural technology, rural electrification, etc., which form part of capital formation "for" agriculture as opposed to capital formation "in" agriculture (NABARD, 2014). Policies will need to take into account the complementarity between capital formation "in agriculture" and "for agriculture" to provide proper direction to investment in the sector.

Production Performance

1.20 Foodgrain production increased from 198.40 million tonnes in 2004-05 to an all-time high of 265.04 million tonnes in 2013-14, which was a good monsoon year. In 2014-15, however, while the pre-monsoon rains were 99 per cent of the long period average, both monsoon and post-monsoon rains were deficient, and deficient rainfall affected the production of both kharif and rabi crops during the year. Production of major crops during the last few years and the estimates for current year are given in **Table 1.3**.

Table 1.3: Production of Foodgrains and Other major Crops

(Million Tonnes)

Crop	Season	2004-05	2010-11	2011-12	2012-13	2013-14	2014-15 (4th Adv. Est.)	2015-16 (1st Adv. Est.)
Rice	Kharif	72.2	80.7	92.8	92.4	91.5	90.9	90.6
	Rabi	10.9	15.3	12.5	12.9	15.2	13.9	
	Total	**83.1**	**96.0**	**105.3**	**105.2**	**106.7**	**104.8**	**90.6**
Wheat	**Rabi**	**68.6**	**86.9**	**94.9**	**93.5**	**95.9**	**88.9**	
Coarse Cereals	Kharif	26.4	33.1	32.4	29.8	31.2	29.8	27.9
	Rabi	7.1	10.3	9.6	10.3	12.1	11.9	
	Total	**33.5**	**43.4**	**42.0**	**40.0**	**43.3**	**41.8**	27.9
Total Cereals	Kharif	98.6	113.7	125.2	122.2	122.7	120.7	118.5
	Rabi	86.6	112.5	117.0	116.6	123.1	114.8	
	Total	**185.2**	**226.3**	**242.2**	**238.8**	**245.8**	**235.5**	**118.5**

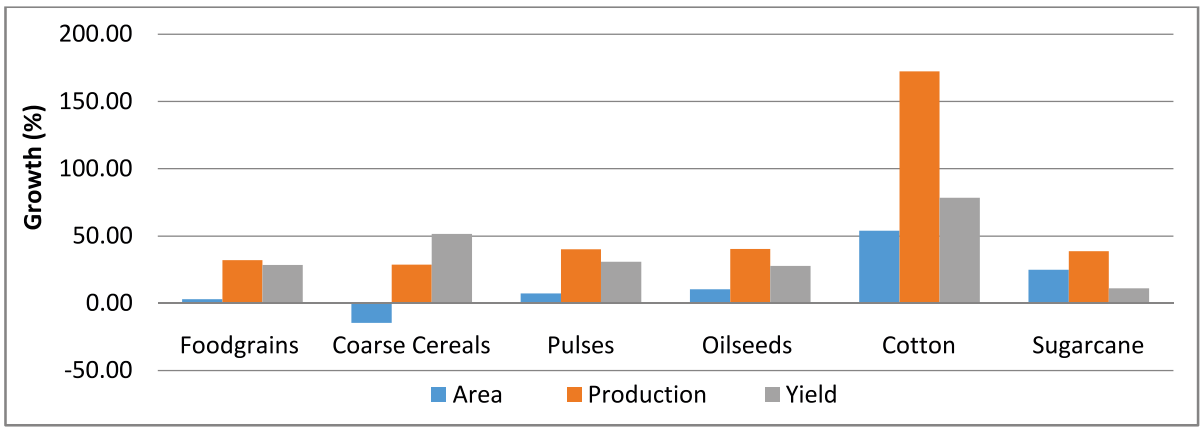
Crop	Season	2004-05	2010-11	2011-12	2012-13	2013-14	2014-15 (4th Adv. Est.)	2015-16 (1st Adv. Est.)
Pulses	Kharif	4.7	7.1	6.1	5.9	6.0	5.6	5.6
	Rabi	8.4	11.1	11.0	12.4	13.3	11.6	
	Total	**13.1**	**18.2**	**17.1**	**18.3**	**19.3**	**17.2**	5.6
Foodgrains	Kharif	**103.3**	**120.9**	**131.3**	**128.1**	**128.7**	**126.3**	124.1
	Rabi	**95.1**	**123.6**	**128.0**	**129.1**	**136.4**	**126.4**	
	Total	**198.4**	**244.5**	**259.3**	**257.1**	**265.0**	**252.7**	**124.1**
Oilseeds (lakh tonnes)	Kharif	141.5	219.2	206.9	207.9	226.1	183.3	198.9
	Rabi	102.0	105.6	91.1	101.5	101.4	83.5	
	Total	**243.5**	**324.8**	**298.0**	**309.4**	**327.5**	**266.8**	198.0
Sugacane (lakh tonnes)	Total	**2370.9**	**3423.8**	**3610.4**	**3412.0**	**3521.4**	**3593.3**	**3414.3**
Cotton*	Total	**164.3**	**330.0**	**352.0**	**342.2**	**359.0**	**354.8**	**335.1**
Jute and Mesta**	Total	**102.7**	**106.2**	**114.0**	**109.3**	**116.9**	**114.5**	**108.0**

** Lakh bales of 170 kgs. each **Lakh bales of 180 kgs. each*

Source: Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare

1.21 Increase in agricultural production during the last decade was largely a result of growth in productivity. In case of some crops, however, such as maize, gram, soybean and cotton, the growth in acreage was also substantial. Growth in acreage under cotton, oilseeds and pulses came at the expense of coarse cereals, particularly jowar and bajra. Overall acreage under coarse cereals declined from 28.94 million hectares in Triennium Ending (T.E.) 2004-05 to 24.71 million hectares in T.E. 2014-15, indicating a drop of about 15 per cent. As crops normally grown in similar agro-climatic conditions, pulses, oilseeds and cotton usually compete for area. An increase of more than 50 per cent in cotton acreage over this period shows that the farmers have exhibited an increasing preference for cotton over pulses and oilseeds **(Figure 1.10).**

Figure 1.10: Increase in Area, Production and Yield between T.E 2004-05 and T.E 2014-15



Source: Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare

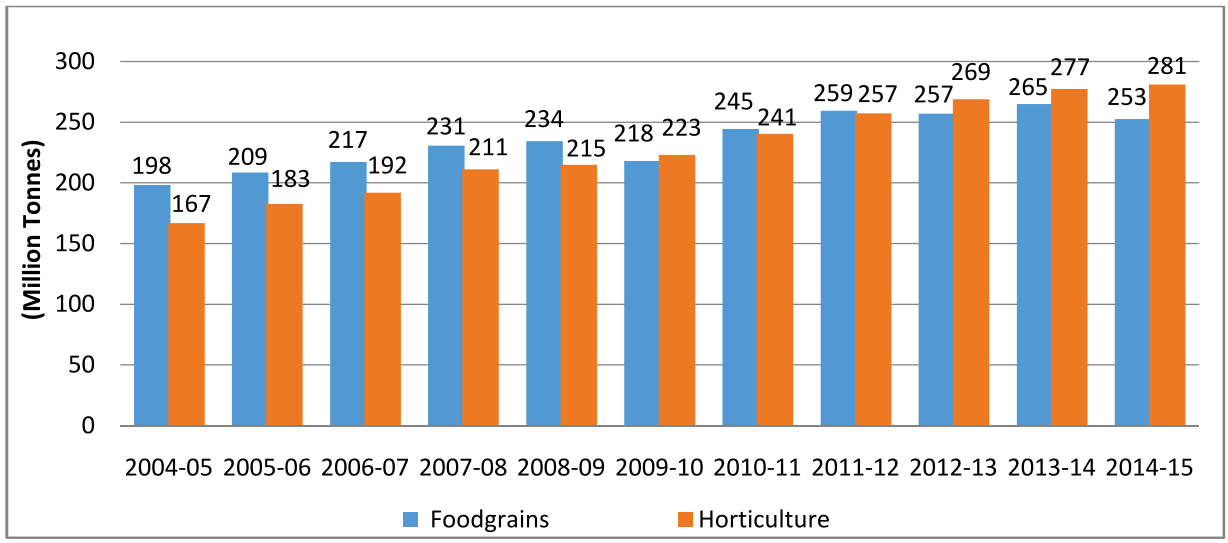
1.22 A sobering aspect is the plateauing of production of many crops in recent years. The year-on-year (YOY) gains have been mostly incremental, except in the case of cotton, where BT technology resulted in strong production growth. The average annual growth in yield of pulses and oilseeds between 2004-05 and 2014-15 was around 3 per cent and 2 per cent respectively, whereas it was around 45 per cent in the case of cotton. However, the increase in domestic production and productivity of cotton amidst lower international demand resulted in lower price realization to farmers. On the other hand, pulses and oilseeds crops witnessed a sharp increase in prices in 2015-16. Thus, a multi-pronged strategy involving both price and technological interventions is required to align the production mix with the changing global and domestic demand patterns.

1.23 The rainfall deficiency trend continued unabated during 2015-16 as well. The cumulative rainfall during the monsoon season of 2015-16 was deficient by 14 per cent, i.e., higher than the rainfall deficit of 12 per cent in 2014-15. The Government took timely contingency measures, which included preparation of district-wise contingency plans, timely advisories and regular monitoring of seed and fertilizer availability. As a result, the production during 2015-16 kharif season was 124.05 million tonnes, which is only 1.7 per cent lower than the Fourth Advance Estimate for 2014-15 kharif season. Since these are the First Advance Estimate for 2015-16, they are likely to undergo revision based on further feedback from states. Production related analysis in this Report has been made on the basis of estimates for fourth advance estimates 2014-15.

Performance of the Horticulture Sector

1.24 In response to 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 sector. On the production and productivity front, the horticulture sector outperformed conventional food crops. Between 2004-05 and 2014-15, horticultural output achieved an annual growth of about 7 per cent as compared to around 3 per cent growth in foodgrain production. This increase in production has come from an increase in acreage and even larger increase in productivity. While the area under horticulture crops grew by about 2.7 per cent per annum, productivity increased by 37 per cent between 2004-05 and 2014-15. 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 foodgrain production over the last few years is given in **Figure 1.11.**

Figure 1.11: Trend in Foodgrain and Horticulture Production



** Based on Fourth Advance Est. for Foodgrains and Third Advance Estimates for Horticulture*

Source: Ministry of Agriculture and Farmers Welfare

1.25 Even as it emerges as a major driver of growth in the agriculture and allied sector, the horticulture sector is also facing numerous emerging challenges. Among these, the prominent ones are pressures emanating from climate change; post-harvest losses; bio-security concerns; absence of market linkages and resultant price fluctuations; changing quality consciousness; and global competition. These concerns need to be addressed in order to sustain the growth momentum in horticulture. The focus of growth strategy, therefore, needs to be on raising productivity by supporting high density plantations, protected cultivation, micro irrigation, quality planting material, rejuvenation of senile orchards and a thrust on post-harvest management to ensure that the farmers do not lose their produce in the transit from the farm gate to the consumer's plate.

Performance of the Livestock and Fisheries Sector

1.26 The livestock sector has emerged as an important sector for ensuring a more inclusive and sustainable agriculture system. Evidence from the National Sample Survey Office's (NSSO) 70th round survey showed that more than one-fifth (23 per cent) of agricultural households with very small parcels of land (less than 0.01 hectare) reported livestock as their principal source of income. Development of the animal husbandry sector supports the livelihood of farmers by providing supplementary income, employment, draught power as well as manure for crops. There is evidence to show that farming households with some cattle head are better able to withstand distress due to extreme weather conditions.

1.27 The growth and development of the dairy sector has been a major success story. With an estimated production of 146.3 million tonnes in 2014-15, India continues to be the largest producer of milk in the world. Per capita availability of milk has reached 322 grams per day during the year 2014-15, which is more than the world average of 294 grams per day. Similarly, in the case of meat, egg, wool and fish production, substantial progress has been achieved. The rate of growth in the livestock sector has been higher than that in the conventional crops sector in recent years. Keeping in view the lower vulnerability of the sector to weather variations and to degradation in the natural resource base, government is focusing on development of livestock, fisheries and social forestry sectors. 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 (Million Tonnes)	Eggs (Million Nos.)	Wool (Million Kgs.)	Meat (Million Tonnes)	Fish (000' Tonnes)
2004-2005	92.5	45201	44.6	2.2	6305
2005-2006	97.1	46235	44.9	2.3	6572
2006-2007	102.6	50663	45.1	2.3	6869
2007-2008	107.9	53583	43.9	4.0	7127
2008-2009	112.2	55562	42.8	4.3	7616
2009-2010	116.4	60267	43.1	4.6	7998
2010-2011	121.8	63024	43.0	4.8	8231
2011-2012	127.9	66450	44.7	5.5	8666
2012-2013	132.4	69731	46.1	5.9	9040
2013-2014	137.7	74752	47.9	6.2	9574
2014-2015(P)	146.3	78484	48.1	6.7	10072

- Not Available (P) = Provisional

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

1.28 In order to give a major thrust to conservation and development of indigenous breeds in a focused and scientific manner, Rashtriya Gokul Mission is being implemented under the National Programme for Bovine Breeding and Dairy Development. The mission is implemented with the objectives of; a) developing and conserving indigenous breeds; b) undertaking breed improvement programme for indigenous cattle breeds so as to improve their genetic makeup and increase the stock; c) enhancing milk production and productivity; d) upgrading nondescript cattle by using elite indigenous breeds like Gir, Sahiwal, Rathi, Deoni, Tharparkar and Red Sindhi; and, e) distributing disease-free high genetic merit bulls for natural service.

1.29 Fishery is one of the most promising sectors of agriculture and allied activities in India, with a projected overall growth rate of 6 per cent for the 12th Five Year Plan. With total production of 10.1 million tonnes (2014-15), India is the largest producer of fish in the world, next only to China. Besides this, fisheries supports the livelihood of almost 1.5 million people in the country. In view of the enormous potential and importance of the sector, an umbrella scheme for integrated development and management of fisheries has been approved by the Government. This Central Sector Scheme covers development and management of inland fisheries, aquaculture, marine fisheries including deep sea fishing, mariculture and all activities undertaken by the National Fisheries Development Board (NFDB) towards realizing "Blue Revolution". The scheme is intended to utilise most of the unutilised fisheries resources keeping in view the overall sustainability, bio-security and environmental concerns. Moreover, it would encourage private investment, entrepreneurship development, more public-private-partnership (PPP) and better leveraging of institutional finance. Besides, the scheme encompasses skill development and capacity building in fisheries and allied activities, and creation of post-harvest and cold chain infrastructure facilities.

Maintaining Food Security Thrust

1.30 Implementation of the National Food Security Mission (NFSM) during the 11th Plan period helped in achieving record levels of foodgrain production. This encouraged the Government to enhance the coverage and ambit of the NFSM during the 12thPlan. The NFSM is now being implemented in 623 districts of 28 states of the country, and also covers coarse cereals and commercial crops. The basic strategy is to promote improved technologies, i.e., adoption of quality seeds, enhancing farm efficiency through improved agronomic practices like line sowing, SRI, soil amendments, INM, IPM, water use efficiency and resource conservation technologies. In view of the increasing demand-supply mismatch, pulses are a focus area under the NFSM in the country. About 50 per cent of the funds under the umbrella scheme of the NFSM is allocated for promoting cultivation of pulses. In 2014-15, the coverage of the programme has been increased to cover 623 districts of 27 states. It has also been extended to include all the districts of North-Eastern and hilly states.

1.31 In order to promote balanced regional development of the agriculture sector, the government is focused on "Bringing Green Revolution to Eastern India". The scheme addresses the constraints that cause low productivity in the rice-based cropping systems in seven states of eastern India. Simultaneously, the Government is taking steps to encourage much-needed crop diversification in the original "Green Revolution" states of Punjab, Haryana and Western Uttar Pradesh, to prevent further decline in soil fertility and water table level in these states. From 2015-16, pulses have also been made a part of the "Bringing Green Revolution in Eastern India" programme for demonstrations under the cropping systems-based approach to target rice-fallow areas.

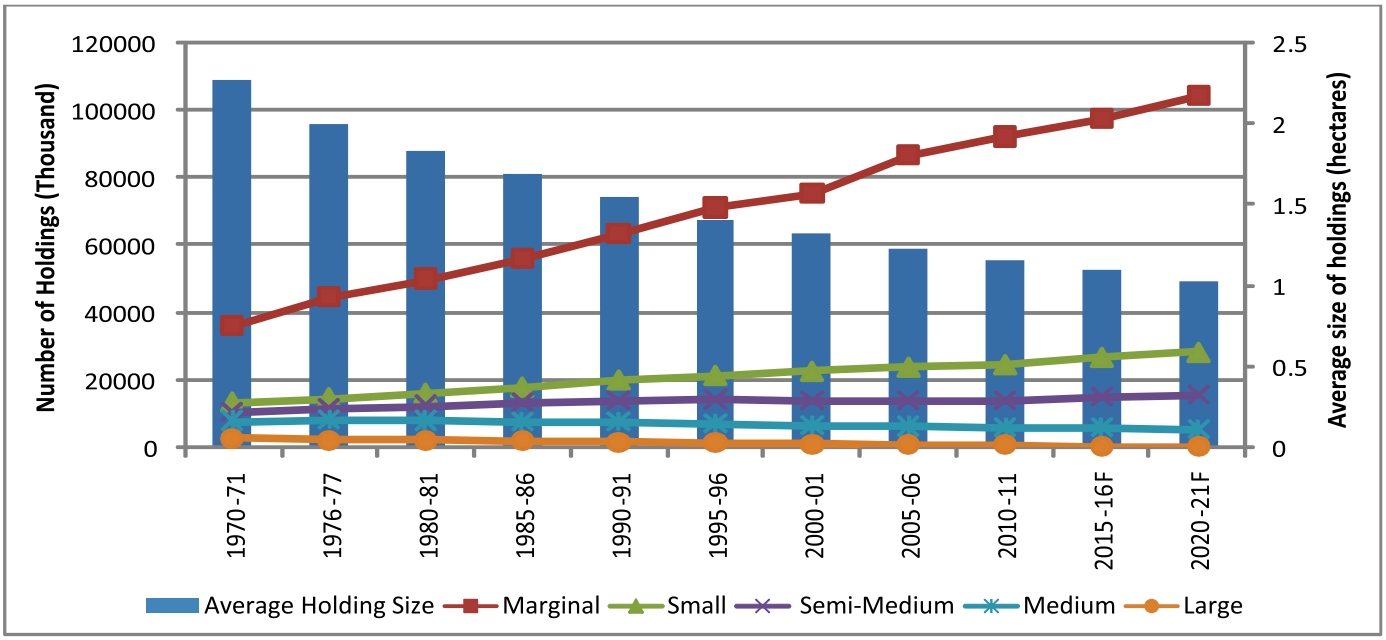
1.32 The horticulture sector is a rapidly growing component of the agriculture sector. In view of its increasing importance, the comprehensive development of the sector has been taken up

under the Mission for Integrated Development of Horticulture(MIDH). The Mission subsumes all the horticulture development programmes, viz., National Horticulture Mission, Horticulture Mission for North East and Himalayan states, National Bamboo Mission, National Horticulture Board, Coconut Development Board and Central Institute for Horticulture, Nagaland. All states, including Uttarakhand and UTs, have been covered under the Mission.

Correcting Land Use Pattern

1.33 Increasing fragmentation of land holdings is a continuing cause for concern. Around 85 percent of the operational holdings in the country are small and marginal, i.e., that is holdings of less than 2 hectares each[1]. Between 2000-01 and 2010-11, the number of marginal holdings increased from 75.41 million to 92.83 million, a rise of 23 per cent and number of small holdings increased from 22.70 million to 24.78 million (9 per cent rise). By contrast, the medium holdings dropped by 3 per cent and large holdings by almost 11 per cent. Semi-medium holdings increased by 0.7 per cent, while the number of medium holdings dropped by 3 per cent and the number of large holdings declined by almost 11 per cent. In terms of the proportion of area under different sized holdings, small and marginal holdings in 2010-11 accounted for 44.6 per cent of the area, while semi-medium and medium holdings accounted for 44.8 per cent of the area and the remaining 10.6 per cent by the large holdings. This is indicative of the significant fragmentation of operational holdings in India. Medium holdings are getting converted frequently into small and marginal holdings, and no signs of reversal can be seen in the foreseeable future. It is estimated that the average size of land holding, which at present is 1.15 hectare, is likely to reduce further by 2020-21 **(Figure 1.12).**

Figure 1.12: Number of Operational Holdings and Average Holding Size in India



Source: Fourth Semi-Annual Medium Term Agricultural Outlook Report, September, 2015, NCAER.

[1] As 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 holdingswith area of 10 hectares and above.

1.34 The results of the SAS (2013) show that positive net monthly income—i.e., difference between income from all sources and consumption expenditure—accrues only to the farmers with land holdings of more than 1 hectare. It is, therefore, established that marginal holdings are too small to provide the farm household with sufficient returns and incomes.

1.35 This makes a strong case for land reforms that promote land holding consolidation, including through reforms in tenancy laws. Tenancy in most Indian states is not allowed legally, though it exists informally. However, it may be recognized that the unorganized market for tenancy operates in different ways and the lease amount or rent is paid in cash, kind or a mix of the two. Legalizing tenancy would permit effective consolidation for farming without the need for depriving land ownership. Another important area is the updating and digitization of land records, which would facilitate convergence with other developmental schemes and activities and also provide a check on leakages in the distribution mechanism.

"*The biggest advantage of a liberalised and secure land lease market will be that it will ease the exit of those farmers who find farming unattractive or non-viable and economically strengthen those farmers who want to stay in the farming and raise the scale of operational holdings*," Dr. Arvind Panagariya, Vice-Chairman, NITI Aayog.

1.36 An Expert Group under the chairmanship of Dr. T. Haque, former Chairman, Commission for Agricultural Costs and Prices (CACP) has been constituted by the Government to formulate a model land leasing law which should help the tenant and protect the landowner's right. The Group has, *inter alia*, considered the idea of setting up "land banks" in which interested landowners could deposit their land parcels for cultivators to lease land. The public agency acts as an intermediary and transfers rent from the actual cultivator to owner while charging a small fee to cover its costs. This is expected to permit the consolidation of operational landholdings, given the steadily declining size, i.e., fragmentation of farmland holdings in the country. Besides, most of the states have also generally agreed that land leasing, updating of land records and land titling would be win-win steps for all affected parties.

Rejuvenating Soil Health

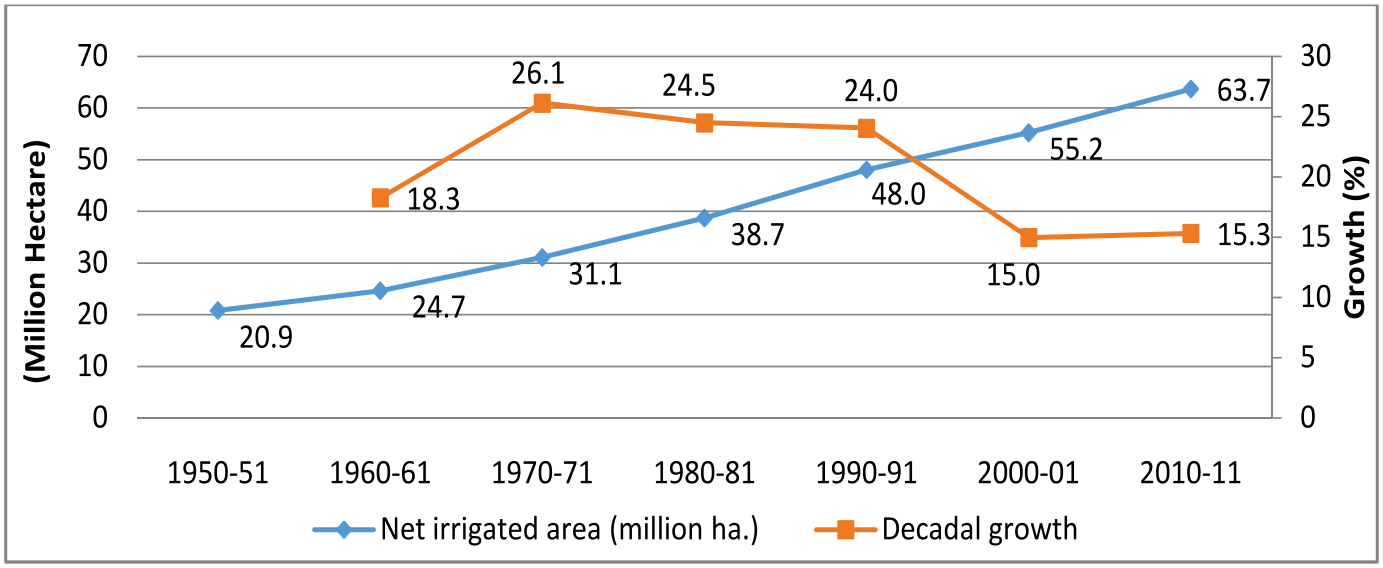
1.37 Degradation of soil is another emerging area of concern. It has been estimated that out of the total 140 million hectares, nearly 120 million hectares of soil suffer from varying degrees of degradation. The quality of soil has deteriorated over time due to a combination of factors, such as injudicious use of fertilizer, accumulation of heavy metals and metalloids through various forms of emissions. Over the years, the Government has implemented several programmes to work with and reclaim degraded soils. Some of these programmes include National Watershed Development Projects, and Rainfed Areas, Soil Conservation in the Catchments of River Valley Projects and Flood Prone River, Integrated Watershed Management Programme, etc. Nearly 82 million hectares of degraded soils were covered during the Eleventh Five Year Plan. Several of these schemes have been subsumed under the RKVY and Pradhan Mantri Krishi Sinchayee Yojana during the Twelfth Plan period. In 2014-15, the Government launched a Soil Health Card (SHC) Scheme, under which the soil of every operational holding will be tested and a SHC issued that indicates to the farmer the health of his soil and the fertilizer mix as well as micro nutrients he should be using. For this purpose, a wide network of soil labs is being 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.

1.38 To give a major impetus to the SHC Scheme, the Government is contemplating revision in the guidelines by involving the local colleges of science/general universities/state agricultural universities (SAUs) to undertake soil sampling, testing and generation of SHCs. In this regard, a benchmark study has also been assigned to Agro-Economic Research Unit at the Institute of Social and Economic Change, Bengaluru.

Drought Proofing and Water Use Efficiency

1.39 Water is the most critical resource for agriculture, gaining primacy even over soil. India has only about 4 per cent of the world's freshwater resources. Thus, large tracts of land are dependent on seasonal rainfall for crop cultivation, which hampers productivity and the adoption of high-yielding varieties and other inputs. Yields in rainfed areas remain low, and this low yield underscores the importance of irrigation in the country. As shown in **Figure 1.13**, the decadal growth rates of net irrigated areas were very high till 1990-91. After 1990-91, the growth rate fell to around 15 per cent each in the next two decades. Besides declining public investments in major and medium irrigation projects, issues related to rehabilitation and resettlement have become more prominent and difficult to address, especially after 1990. A major hurdle has been the underdevelopment of institutions required to effectively manage water resources, especially at the micro level. Undertakings of large irrigation projects are facing numerous hurdles, including in land acquisition, environmental issues, rehabilitation and resettlement. Management and maintenance of irrigation canal networks and field channels is also proving to be a major institutional challenge. These factors together make the expansion of surface irrigation difficult. Secondly, the lack of a clear policy on the utilization of groundwater and the supply of subsidized electricity by state governments is encouraging unchecked wasteful exploitation of groundwater resources.

Figure 1.13: Net Irrigated Area—Decadal Growth

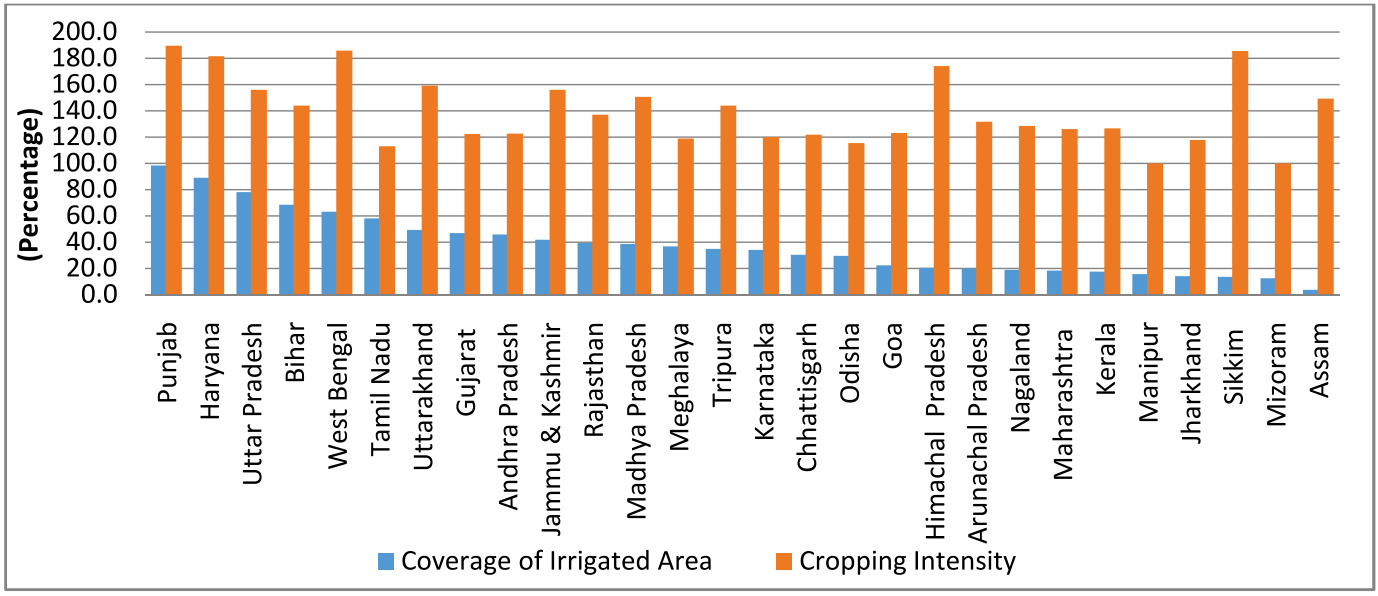


Source: Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare

1.40 The state-wise coverage of irrigated area under major crops in 2012-13 shows that several states have less than 50 per cent irrigated area, as indicated in **Figure 1.14.** However, the cropping intensity[2] in these states is very high, even when the proportion of irrigated area under crops is low. Hence, targeted efforts are required to expand irrigation in such states, where the investment is likely to lead to an increase in cropping intensity. The states that could meet these criteria include Maharashtra, Madhya Pradesh, Chhattisgarh, Gujarat, Rajasthan, Andhra Pradesh, Tamil Nadu and West Bengal.

[2]Cropping Intensity is calculated as ratio of total cropped area to net area sown

Figure 1.14: State-wise Coverage of Irrigated Area and Cropping Intensity



Source: Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare

1.41 In the wake of these issues, policy has also turned to focus on increasing the efficiency of water use through micro irrigation, which includes drip and sprinkler systems. These methods, considered better in terms of water use efficiency, are being promoted in different states through the provision of subsidies. Drip and sprinkler systems are gaining popularity in high value crops, such as horticulture, plantations and sugarcane. It is estimated that about 50 per cent of water conservation can be done through the use of drip and sprinkler systems.

1.42 In view of the decreasing water table in the country, the Government introduced a new scheme in 2014-15 called the **Pradhan Mantri Krishi Sinchai Yojana (PMKSY)** to ensure assured irrigation to every field. The focus is to ensure end-to-end solutions in the irrigation supply chain, from source-to-field application with the vision of "*har khet ko pani*" and "more crop per drop". Moreover, in case of states like Punjab and Haryana, where the water table has already reached a critical level, in addition to improving water-use efficiency, a shift in cropping pattern towards low water-intensive crops is required for sustaining agricultural production.

Orienting Agriculture to Climate Change

1.43 Climate change has become a serious global negative externality with its multiple, far-reaching and persistent effects. Its adverse impact on food production systems, due to rising temperatures and extreme weather events, is at the centre stage of discussion worldwide. Developing countries, in particular, with their large agrarian base, are more prone to threats due to climate change. In India, deficient and uneven rainfall in the last two agricultural years adversely affected overall agricultural production. With India's large size, its numerous agro-ecological zones, preponderance of small, fragmented holdings and persistent dependence on the vagaries of the monsoon, the issue of climate change becomes even more challenging. Estimates suggest that about 18 per cent of the annual GHG emissions in India during 2007 were from the agricultural sector Indian Network of Climate Change (INCCA, 2010). The major sources of these emissions in the agricultural sector are enteric fermentation (63.4 per cent), rice cultivation (20.9 per cent), agricultural soils (13.0 per cent), manure management (2.4 per cent) and on-field burning of crop residues (2.0 per cent).

Thus, quantification and reduction of GHGs from agriculture is fundamental for identifying adaptation solutions that are consistent with the goals of achieving greater resilience in production systems and food security and in supporting farmers in adopting less carbon-intensive farming practices.

1.44 In view of the foregoing, the Government has been implementing several schemes and programmes for promoting sustainable agriculture practices. Some of these are the **National Mission on Sustainable Agriculture (NMSA),** which aims at enhancing food security and protection of resources such as land, water, biodiversity and genetics; the **National Initiative on Climate Resilient Agriculture,** whose four main modules include natural resource management, improving crop production, livestock and fisheries and institutional interventions; the **National Agro Forestry Policy;** and the **Soil Health Card Scheme**. In addition, the **National Food Security Mission**, **Mission for Integrated Development of Horticulture** and **National Mission on Agricultural Extension and Technology** are being implemented to cover other major aspects of farming.

1.45 Organic farming preserves soil quality and diversity in crop production, and avoids hazards to the environment on a long-term basis. Organic farming as a means to sustainable agriculture has benefited farmers. The certified cultivated area under organic farming has grown from 4.55 lakh ha in 2009-10 to 7.23 lakh ha in 2013-14, with around 6 lakh farmers practising it. But, still, the total area under organic farming is insignificant compared to the net sown area of 140 million hectares. In terms of exports also, exports of organic food at about 1.6 lakh tonnes and at an estimated value of USD 220 million is less than 1 per cent of global exports. Against this backdrop, to provide a major fillip to organic farming in India, the existing components of organic farming under the NMSA have been put together under a new programme called "Paramparagat Krishi Vikas Yojana". The programme envisages development of 10,000 organic clusters and provides chemical-free inputs to farmers and increase the certified area by 5 lakh hectare within a period of 3 years. Under this, every farmer in a cluster will be provided an assistance of Rs. 50,000 per hectare in 3 years towards conversion to and adoption of organic farming and towards market assistance. The main objectives of the programme are given in **Box 1.1.**

Box 1.1: Paramparagat Krishi Vikas Yojana (PKVY)

i)	To launch eco-friendly concept of cultivation reducing the dependency on agro-chemicals and fertilizers.
ii)	To optimally utilize available natural resources for input production.
iii)	To create employment opportunities in the rural as well as urban sector.
iv)	To develop potential market for organic products.
v)	To develop an organic village with a cluster of 50 farmers and 50 ha land with a concept of 50:50 for both agriculture and horticulture emphasizing mixed cropping instead of mono cropping.
vi)	To use the viable technology under IPM, INM and local indigenous traditional techniques for management of plant nutrition and plant protection.
vii)	Promotion of low-cost PGS certification system for organic produce.
viii)	Promotion of marketing and branding of organic produce through financial assistance for packaging, labelling, PGS logo and hologram.

1.46 Besides this, a major initiative has been taken by the Government in 2015 with the approval of the implementation of the PMKSY in a convergence framework to promote efficient irrigation practices. The scheme saw a major departure from the earlier irrigation schemes that were being implemented in an isolated fashion by different ministries/ departments. With this, the focus has also been brought on water conservation and its optimal use through drip irrigation. Ongoing canal and surface water schemes will be looked at in conjunction with watershed development, rain water harvesting, micro irrigation, etc.

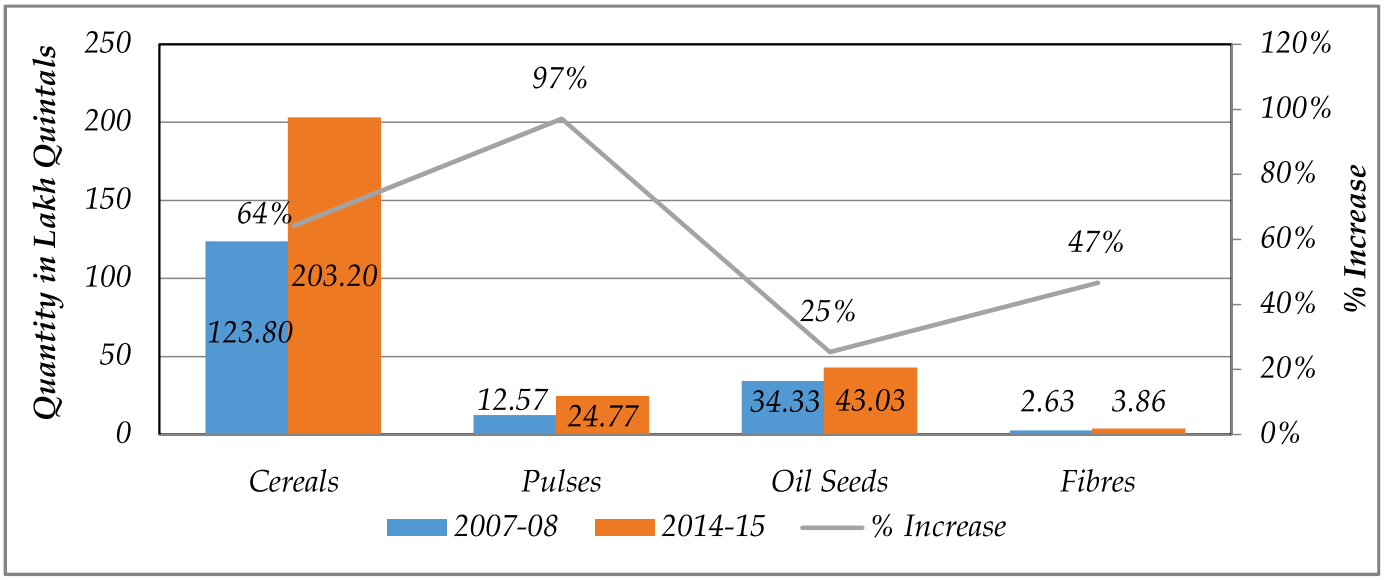
Managing Agricultural Inputs Better

1.47 The agricultural growth experience of India since independence was essentially an outcome of the massive efforts aimed at ensuring availability and use of quality seeds, chemical fertilizers, irrigation, pesticides, farm machinery and equipment, agricultural credit, etc. Quality seeds are crucial for enhancing agricultural production. It is estimated that quality seeds contribute to around a quarter of the overall increase in productivity. Efficacy of all other agricultural inputs, such as fertilizers, pesticides and irrigation, etc., as well as impact of agro-climatic conditions on the crop, is largely determined by the quality of the seed used. The green revolution of the 1960s-1970s, the maize productivity and production growth in the 2000s, the cotton production revolution in the 2000s as well as the increased productivity of fruits and vegetables–all had seed or planting materials as the primary driver of agricultural growth.

1.48 The Indian seed programme recognizes three generations of seeds—breeder, foundation and certified seeds—and provides adequate safeguards for quality assurance in the seed multiplication chain. The programme entails participation of both Central and state governments, the Indian Council of Agricultural Research (ICAR), SAUs, the public sector, the cooperative sector and private sector institutions. The organized sector (including both private sector and public sector companies) accounts for about 30-35 per cent of the total seeds distributed in the country. The unorganized sector, comprising mainly farm-saved seeds, accounts for the remaining portion.

1.49 The Twelfth Plan Sub-Mission on Seeds and Planting Material under the National Mission on Agricultural Extension and Technology is under implementation with the objective of the overall improvement of the seed sector and seed supply chain in India. Of the various objectives of the sub-mission, increasing seed replacement ratio from 25 per cent to 33 per cent in case of self-pollinated crops, 33 per cent to 50 per cent in case of cross-pollinated crops and 100 per cent in hybrids is the most significant. Between 2007-08 and 2014-15, the distribution of certified/quality seeds went up by 69 per cent from 179.05 lakh quintals to 303.12 lakh quintals. The production of foundation seeds increased by more than 80 per cent from 8.52 lakh quintals to 15.76 lakh quintals. Between 2007-08 and 2014-15, among the crop categories, the distribution of certified and quality seeds grew substantially for pulses, followed by cereals and fibres at 97 per cent, 64 per cent and 47 per cent respectively. The seed market for fibres is already mature and dominated by the private sector that supplies a bulk of Bt cotton seed.

Figure 1.15: Distribution of Certified/ Quality Seeds for Major Crop Groups



Source: Department of Agriculture, Cooperation and Farmers Welfare

1.50 The increase in the use of quality seeds for pulses indicates that the push for pulses in the Twelfth Plan almost doubled the use of pulse seeds. However, since most of the pulses and oilseeds are open-pollinated, the participation of the private sector is relatively poor and the public sector has to shoulder the responsibility of providing seeds. There is a need to further strengthen the research for pulses and oilseeds to develop varieties that are high-yielding and drought and pest-tolerant.

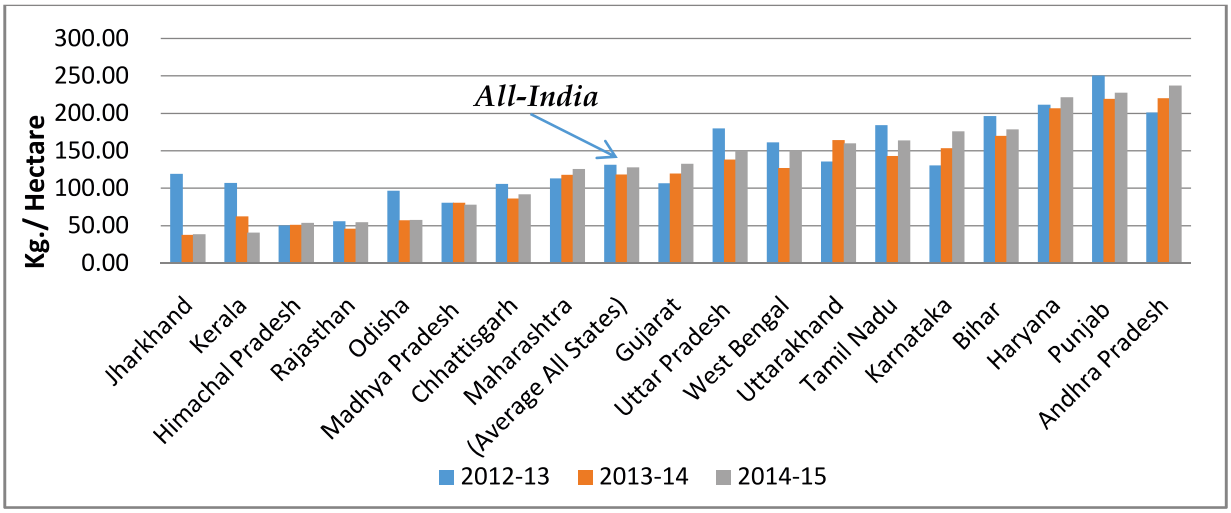
1.51 The issue of seed certification and distribution of certified seeds is largely dependent on the implementation of the provisions of Seeds Act, 1966 by the states. Seed certification agencies and seed inspectors have to be more vigilant to check the sale of spurious seeds in the market. The issues concerning the seed multiplication ratio from breeder seed to foundation seed and from foundation to certified seed needs to be addressed by all seed-producing agencies, in both the public and private sectors. To facilitate this process, the Government has initiated steps to build a comprehensive and authentic database on seed production and distribution in India by public and private sectors.

Integrated Nutrient Management

1.52 Integrated nutrient management (INM) is crucial for maintaining the soil's carrying capacity even while obtaining the maximum productivity of the land to meet the increasing food demand. Soil productivity enhancement depends on the optimal usage of primary, secondary as well as micro nutrients through timely application.

1.53 The consumption of fertilizers in India in terms of NPK has increased substantially from a mere 1.1 million tonnes in 1966-67 in the pre-green revolution period to more than 25 million tonnes in 2014-15. As per the International Fertilizer Association, India ranked second in total world fertilizer consumption in 2012. The all-India average consumption of fertilizers has increased from 69.84 kg per hectare in 1991-92 to 128.08 kg per hectare in 2014-15 **(Figure 1.16).** There is, however, wide inter-state variability in consumption of fertilizers, with states like Punjab, Haryana and Andhra Pradesh having per hectare consumption of over 200 kg and other states, like Odisha, Kerala, Madhya Pradesh, Jharkhand, Chhattisgarh and Rajasthan, reporting less than 100kg per hectare consumption.

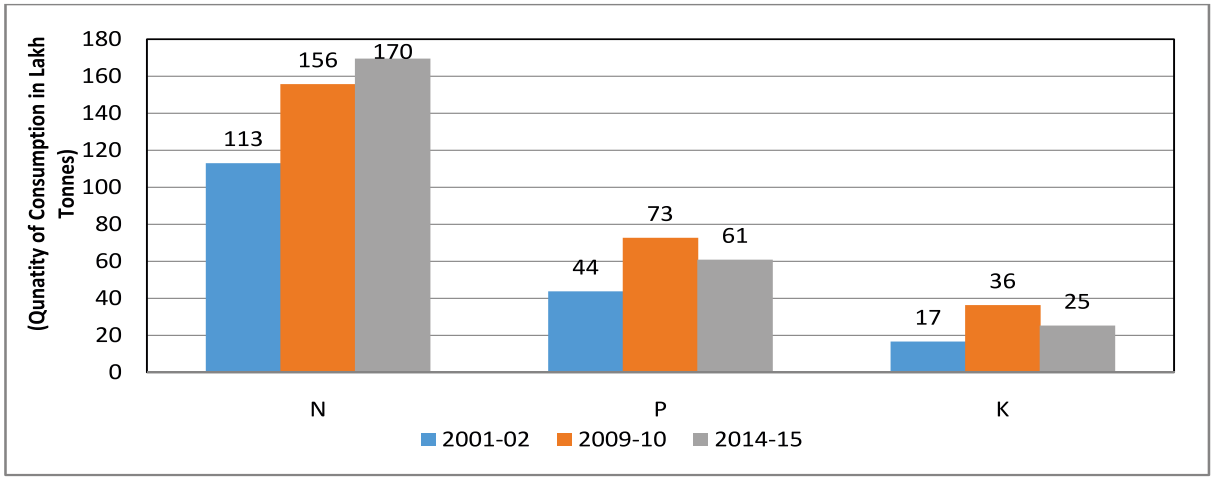
Figure 1.16: State-wise Consumption of Fertilizers



Source: Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare

1.54 With a view to encourage the balanced use of fertilizers, the Government introduced the Nutrient Based Subsidy (NBS) Policy from April 2010 where a fixed rate of subsidy is announced on nutrients. The NBS covers three macro nutrients (nitrogen, phosphorus and potassium) and two micro nutrients (zinc and boron). Urea is the only fertilizer under statutory price control, whereas P and K fertilizers are covered under the NBS Policy since 1 April 2010, in which the maximum retail price (MRP) of fertilizers are fixed by fertilizer companies based on the prices prevailing in the international market. After the introduction of the NBS Policy, there has been a large increase in the prices of P and K fertilizers due to an increase in the international prices of these products and raw materials, but the price of urea has remained Rs 5,360 per MT. This disparity in the prices of urea and P and K fertilizers led to a distortion in the consumption pattern of NPK fertilizers (**Figure 1.17).** Between 2001-02 and 2009-10, consumption of N had increased by 38 per cent, that of P by 66 per cent and K by 118 per cent. After the NBS Policy came into effect, between 2009-10 and 2014-15, consumption of N increased by just 9 per cent, consumption of P and K fell by 16 per cent and 30 per cent respectively. Thus, while the NBS Policy may have reduced 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 1.17: Consumption of Fertilizers in terms of Nutrients



Source: Department of Agriculture, Cooperation and Farmers Welfare

1.55 The present subsidy regime does not take into account the nutrient use efficiency of the fertilizer. Hence, there appears to be no initiative on the part of industry on research and development (R&D) of new, efficient and better products. Thus, the ambit of the NBS Policy may need to be widened to consider the nutrient-use efficiency of fertilizers so that the focus is on the efficient uptake of nutrients by plants. To increase nutrient-use efficiency, the Government has taken two important initiatives: it has initiated a transition towards the total production and import of subsidized urea as neem-coated urea; and a graduated shift from an optional approach to a mandatory approach.

1.56 Moreover, the government has been promoting soil test-based balanced and judicious use of chemical fertilizers, bio-fertilizers and locally available organic manure to maintain soil health and its productivity. The Government has also been taking measures to promote the balanced use of fertilizers by introducing the SHC Scheme and, promoting customized fertilizers, quality fertilizers, organic farming, etc.

Customized Mechanization

1.57 Farm mechanization plays an important role in providing optimal utilization of resources and economy in time and also in reducing drudgery. This judicious use of time, labour and resources facilitates sustainable intensification (multi-cropping) and timely planting of crops, leading to an increase in productivity. Many empirical studies have also established a positive relationship of cropping intensity and foodgrain productivity with availability and growth of farm power.

1.58 The main sources of farm power in agriculture are agricultural workers, draught animals, tractors, power tillers, diesel engines and electric motors. The extent of mechanization in Indian agriculture during the last decade is reflected in the increase in the share of tractor and electric motor in farm power availability from 34.9 per cent and 21.3 per cent, respectively, in 2000-01 to 24.8 per cent and 45.8 per cent, respectively, in 2012-13. Consequently, the share of agricultural workers and draught animal power sources in total power has come down from 10.4 per cent and 6.7 per cent, respectively, in 2000-01 to 5.1 per cent and 5.0 per cent, respectively, in 2012-13.

1.59 As per the ICAR, tractor density in India is estimated to be about 27 tractors for 1,000 hectares in 2013-14 and is showing an increasing trend. This indicates an opportunity for the mechanization of agriculture. However, given the challenges of soil and climatic diversity, the domination of small and marginal farmers with limited capital availability, lack of finances, etc., farm mechanization in India needs innovative solutions. These may comprise customized farm machinery and equipment for different regions, and may have to cater to the needs of minimum tillage as well as inter-cultivation practices. Custom Hiring Centres of Agricultural Machineries operated by cooperative societies, self-help groups and private/rural entrepreneurs are also seen as a solution to increase availability of farm machinery and farmers' access to such machinery and bring about improvement in farm productivity. Moreover, financing of agricultural machinery is an important 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. This would also facilitate a shift towards non-conventional sources of farm mechanization, for example, solar pump sets.

Box 1.2: Solar Agricultural Pump project in Maharashtra

The Government of Maharashtra has introduced a pilot project of 10,000 solar agriculture pumps covering various districts of the state. The task of implementation of the Solar Agriculture Pump Project has been entrusted jointly to Maharashtra State Electricity Distribution Company Ltd and Maharashtra Energy Development Agency. The salient features of the scheme are as under:

- At present, the cost of generation of electricity in Maharashtra is Rs.5/kWh, but the electricity is provided to the farmer at Re.1/kwh, or at a subsidy of Rs.4/kwh. Electricity from solar pumps will be available to farmers throughout the year and the demand-supply gap will be reduced, as will the subsidy burden of the state electricity board.
- If solar pumps are connected with the grid, an additional source of energy as well as income to farmers can be generated.
- Out of the total expected project cost, 30 per cent will be given as grant from the Central Government, 5 per cent each will be contributed by the state government and beneficiary customers and the remaining contribution will be through loans from financial institutions.

Box 1.3: Projected Energy Demand from Agriculture and Allied Sectors

A web-enabled long-term energy demand and supply model, namely Indian Energy Security Scenario (IESS)-2047, has been developed by the NITI Aayog. The broad objectives of the model are to:

- Offer a platform to facilitate the academic and policy discourse about the possible future pathways for the Indian energy sector;
- Help users understand the wide realm of possible energy pathways available to the country from highly pessimistic to highly optimistic scenarios; and
- Provide indicative numbers for demand and supply for each scenario in this range of possibilities, and potential implications on issues such as import dependence, cost and land requirement.

The model provides four plausible energy demand and supply scenarios, viz. '**Least Effort**' scenario (Level 1) which offers projections assuming past trends to continue; '**Determined Effort**' scenario (Level 2) describes the level of effort which is deemed most achievable by the implementation of current policies and programmes of the government; '**Aggressive Effort**' scenario (Level 3) describes the level of effort needing significant change which is hard but deliverable; and the **'Heroic Effort'** scenario (Level 4) indicates heightened efficiency numbers, leading up to the physically best attainable in due course.

2. The energy demand from agriculture sector under the different scenarios is mainly based on the demand from **Irrigation and Mechanization.** Main findings of the model on the energy demand for the agriculture sector as a whole are as under:

i. Under the most optimistic energy demand scenario (Level 4) the aggregate energy demand from agriculture would increase from 243 TWh in 2012 to 612 TWh in 2047. The most pessimistic scenario of energy demand (Level 1) would require almost double the energy demanded in Level 4, i.e., 1212 TWh.

ii. The demand for pumping grows progressively slower between 2012 and 2047 from Level 1 to Level 4, whereas the growth of energy demand from tractors does not slow down as much as that from pumping.

iii. Since electricity is the major fuel used for pumping, and tractors operate exclusively on diesel, the share of electricity in the aggregate energy demand from agriculture reduces from 56 percent to 47 percent across the four levels, whereas the share of diesel increases from 41 percent to 49 percent.

iv. Share of solar energy varies between 3 to 4 percent across the levels.

Furthering IT-Enabled Farming

1.60 Success of all the schemes and programmes implemented by the government hinges upon its outreach to the intended groups. Lack of this effective communication process with farmers in a language they can understand is one of the long standing challenges faced by the agricultural sector. It is, therefore, recognized that in addition to strengthening of traditional extension system, we need to harness digital and mobile technology to effectively reach out to the farmers and also to establish a two-way communication. The increasing mobile penetration in the rural areas has proved to be an effective and powerful medium to disseminate information on agronomic practices, prices, fertilizer and pesticide use and weather and pest related advisories. Thus, in order to develop an integrated approach for communication process in the agricultural sector, all mobile based initiatives in the field of agriculture and allied sectors have been subsumed under the **mKisan Portal**.Through this portal not only can government functionaries, both at the state and Central levels, send out messages to the farmers in their regional languages, the farmers too can ask questions with respect to specific crops. Since its launch on 16 July 2013, 1.6 crore farmers and more than 8,000 subject experts have registered on the mKisan portal. As on 30.11.2015, more than 1,040 crore SMSs have been sent to farmers by all agencies/organizations/ departments in agriculture and allied sectors down to block level throughout the country.

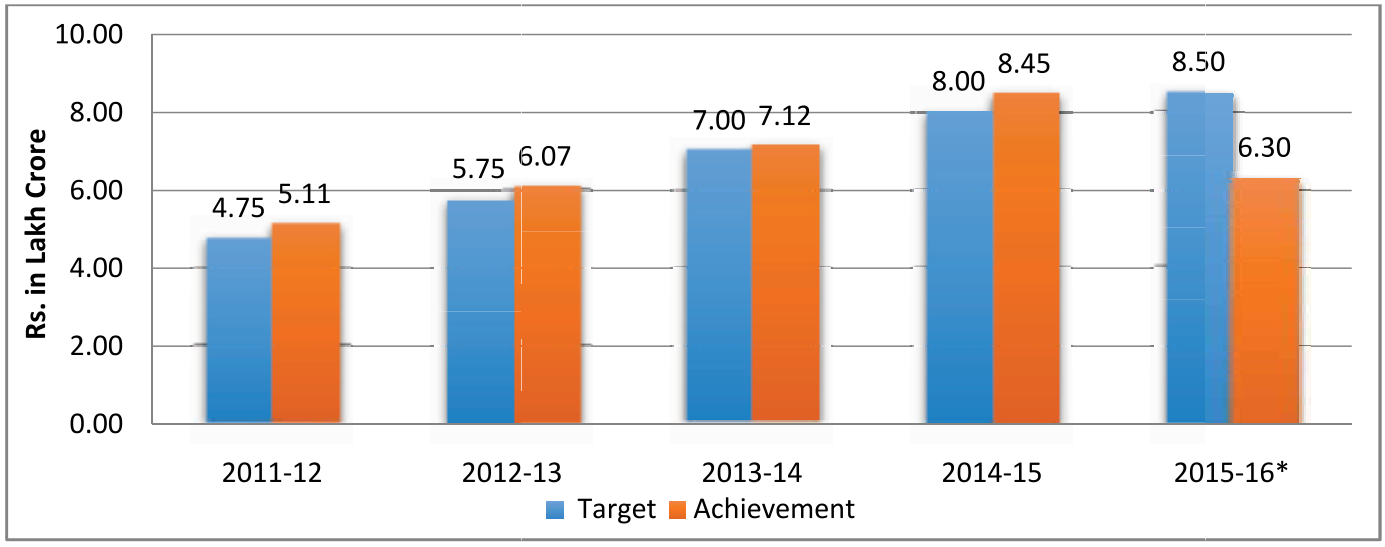
1.61 In 2015-16, the government has also launched **Agri Market** and **Crop Insurance** mobile applications for android phones with GPS tagging. While Agri Market application will enable the farmers to take informed decisions based on changes in market prices, Crop Insurance application will provide complete details about cover available and the Insurance Premium for notified crops based on area, coverage amount and loan amount.

Broad-basing Agricultural Credit

1.62 Credit is one of the most essential inputs for improving farm production and productivity and also to mitigate farmers' distress. Although the informal sector, viz. private moneylenders, friends, relatives, commission agents, traders, etc., has a large presence in the agricultural credit in India, there has been a gradual increase in the share of formal institutions. Policy initiatives revolving around replacing the informal sources of lending to farmers by formal sources and to support enhancement of production and incomes, have been made.

1.63 Over the decades, the agricultural credit system has improved through cooperative credit societies at various levels, expansion of rural branches of commercial banks, and setting up of regional rural banks. Between 2004-05 and 2014-15, institutional credit to agriculture increased from Rs.1,25,309 crores to Rs. 8,45,328 crores, registering a compounded annual growth rate of 24 per cent. It is noteworthy that the flow of agricultural credit has not just increased over the years but has consistently exceeded the target. During 2015-16, against a target of Rs. 8,50,000 crores, more than 70 per cent of the credit has been disbursed by December, 2015 (**Figure 1.18**).

Figure 1.18: Year-wise Targets and Achievements of Institutional Agricultural Credit



*** Achievement upto December, 2015.**

Source: Department of Agriculture, Cooperation and Farmers Welfare

1.64 As per Situation Assessment Survey of Agricultural Households, 2013, the proportion of credit accessed from the institutional sources has increased to 60 per cent as compared to 58 per cent reported in 2003 Survey. Although the results of the two surveys are not strictly comparable, due to definitional issues, but it reflects that concerted efforts are needed to expand the institutional coverage of agricultural credit. One of the major reasons for slow expansion is the shrinking farm holding size in the country. In view of this, the thrust of policy has been shifted towards improvingsmall and marginal farmers' access to agricultural credit through progressive institutionalization. In view of this, several steps have been initiated to galvanize the institutional credit system with special focus on small and marginal farmers. Schemes like Kisan Credit Card; interest subvention for short-term crop loans; 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. More recently, in October 2015 government constituted a committee under the Chairmanship of Shri U.C. Sarangi, former Chairman, NABARD, to suggest feasible measures for improving targeted lending to small and marginal farmers and ensuring maximum utilization of limited budgetary resources under the Interest Subvention Schemes.

Assuring Farm Insurance

1.65 The continued dependence on nature makes crop production vulnerable to numerous risks. In order to protect farmers against such risks, including crop failure due to natural calamities, pest and diseases and weather conditions, two major crop insurance schemes, namely **National Crop Insurance Programme** with its three component schemes: Modified National Agricultural Insurance Scheme(MNAIS); Weather Based Crop Insurance Scheme(WBCIS); and (iii)Coconut Palm Insurance Scheme, and **National Agricultural Insurance Schemes(NAIS)** are being implemented by the government. However, despite the best efforts of the centre and state governments, low coverage of agricultural insurance remained a continuing concern for the policy makers **(Table 1.5 and 1.6).**

Results of the NSSO's 70th round Survey also indicates that only a small segment of agricultural households insured their crops against possible crop loss during the crop period surveyed. This poor coverage was primarily on account of lack of awareness among the cultivators. For example, in case of pulses, 58 per cent of urad cultivators and 49 per cent of moong cultivators were not aware of and were not insuring their pulses crops during the Survey period.

Table 1.5: State-wise Insured Area 2014–15 (area in million hectares)

States	2014-15		
	Gross Cropped Area	Area Insured	% of Area Insured
(1)	**(2)**	**(3)**	**(4)**
Rajasthan	23.95	11.91	*49.70*
Bihar	7.78	3.74	*48.02*
Madhya Pradesh	23.13	10.62	*45.91*
Maharashtra	21.87	4.87	*22.26*
Karnataka	11.75	1.44	*12.25*
Gujarat	12.60	1.39	*11.03*
Uttar Pradesh	25.82	2.05	*7.95*
Andhra Pradesh	13.65	0.54	*3.96*
All India Level	**194.4**	**45.34**	***23.32***

Source: Department of Agriculture, Cooperation and Farmers Welfare

Table 1.6: Crop-wise Insurance Coverage Under All Schemes

(Area in Million Hectares)

S. No.	Crops	2014-15		
		Gross Area Sown	Area Insured	Insurance Coverage (%)
(1)	(2)	(3)	(4)	(5)
1	Paddy	42.76	10.02	*23.43*
2	Wheat	30.50	7.74	*25.39*
3	Coarse Grains	25.15	5.95	*22.88*
4	Sugarcane	5.44	0.15	*2.67*
5	Cotton	11.90	1.53	*12.92*
6	Jute and Mesta	0.85	0.07	*8.18*
7	Oilseeds	29.10	10.43	*35.84*
8	Pulses	21.96	5.77	*26.27*
9	Vegetables	5.51	2.09	*37.99*
10	Fruits	3.77	0.21	*5.58*
	Grand Total	**194.40**	**45.34**	***23.32***

Source: Department of Agriculture, Cooperation and Farmers Welfare

1.66 In view of the limited coverage of existing crop insurance schemes, as shown above and taking note of the financial burden and other difficulties faced by the farmers under these schemes, a new Crop Insurance Scheme namely, Pradhan Mantri Fasal Bima Yojana has been approved by the government in January 2016. The Scheme will replace the ongoing schemes of NAIS/MNAIS from kharif 2016. Salient features of the new Scheme are given in **Box 1.4**:

Box 1.4: Pradhan Mantri Fasal Bimal Yojana

The Union Cabinet, chaired by the Hon'ble Prime Minister, approved the **'Pradhan Mantri Fasal Bima Yojana'** - a path breaking scheme for farmers' welfare on 13th January, 2016. Key features of the Scheme are as follows:

a) For food and oilseeds crops, farmer's share of premium has been reduced to 1.5 per cent for rabi crops and 2.0 per cent for kharif crops. For annual commercial/horticultural crops, the premium has been kept at a maximum of 5 per cent.

b) Provision of capping of actuarial premium rates and reduction in sum insured has been removed.

c) Three indemnity levels – 70 per cent, 80 per cent and 90 per cent.

d) Inundation has been incorporated as a localized calamity for individual farm level assessment.

e) For more effective implementation– cluster approach will be adopted under which a group of districts with variable risk profile will be allotted to an insurance company for a longer duration say 3 years.

f) Use of Remote Sensing Technology and improved technology for planning and assessment of crop losses/yield estimation.

g) Better administration of crop insurance through Crop Insurance Portal by linking/coordination with major stakeholders including financial institutions insurance companies, etc.

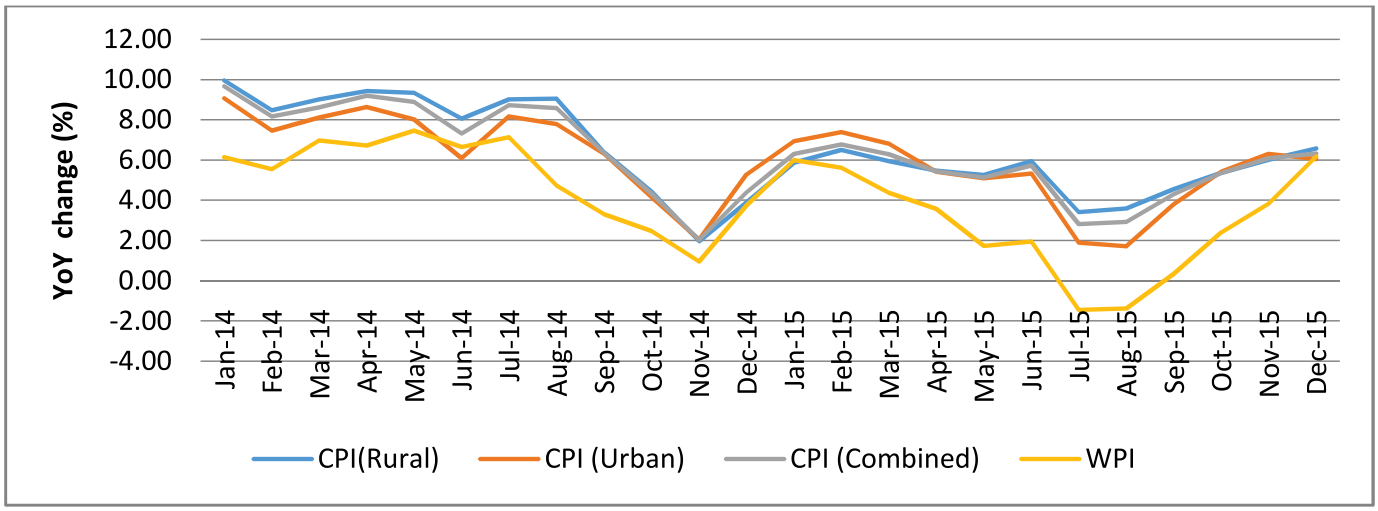
h) Premiums rates under WBCIS have been rationalized to make it at par with the new scheme.

1.67 Government has also initiated efforts to use technological innovation, such as satellite based information to generate accurate and timely weather data and crop loss estimates, to encourage even non-loanee farmers to adapt crop insurance. A pilot study has also been initiated by the Mahalanobis National Crop Forecast Centre to explore the possibility of using Remote Sensing Technology (RST)/Satellite imageries to supplement the yield assessment through crop cutting experiments (CCEs) in the implementation of crop insurance schemes.

Farm Prices

1.68 The rate of food inflation as measured by the WPI moderated in the latter half of 2014-15, after staying high persistently during the past two years. The movement of retail prices of food items as measured under the new series of CPI with base year 2012, also witnessed a downward trend during this period **(Figure 1.19).**

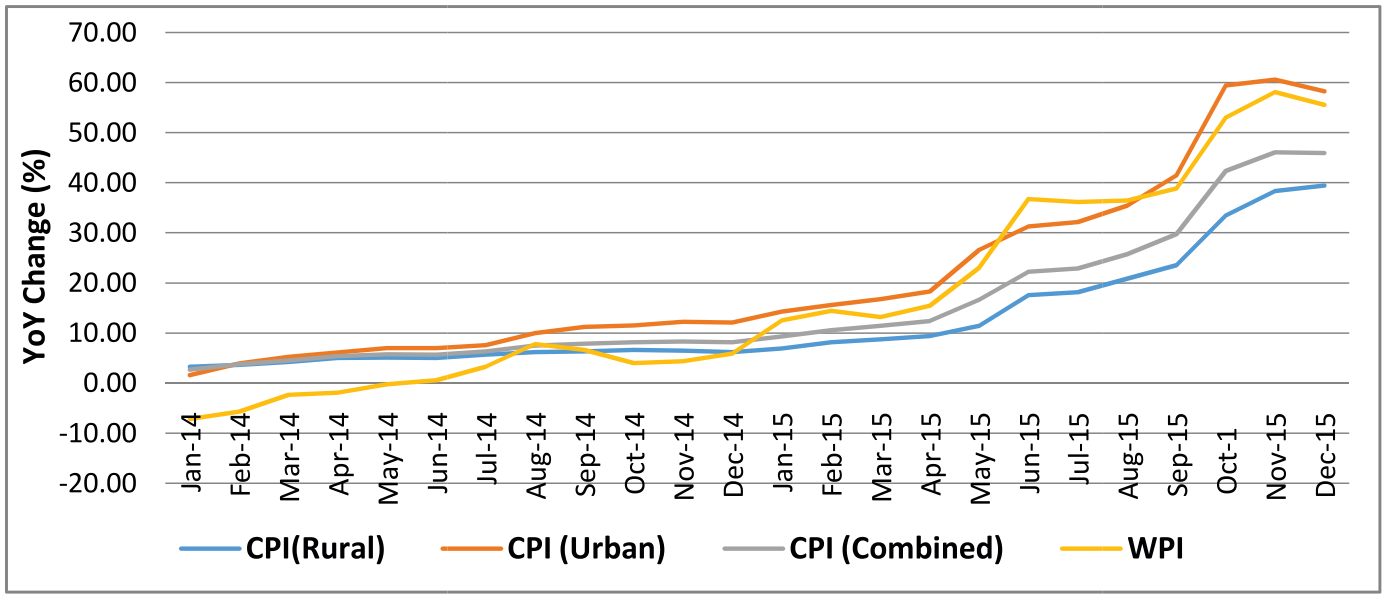
Figure 1.19: Month-wise Trend in Food Inflation under WPI and CPI



Source: Office of the Economic Adviser and CSO

1.69 However, on account of deficient and untimely rainfall, and hailstorms in certain parts of the country which adversely affected both kharif and rabi production in 2014-15, prices of certain agricultural commodities remained elevated in 2015. Pulse production, in particular, with an estimated lower production by 2 million tonnes vis-à-vis 2013-14, triggered a steep price rise, esp., in the second half of 2015. As shown in the **Figure 1.20**, year-on-year inflation for pulses reached an all-time high of more than 40 per cent in the month of October, 2015. A slew of measures taken by the government to check the alarming price rise in case of pulses are discussed in **Box 1.5**:

Figure 1.20: Month-wise Inflationary trend in case of Pulses



Source: Office of the Economic Adviser and CSO

Box 1.5: Steps Taken by the Government to Check Increase in Prices of Pulses

i. As a price stabilization measure to control rising prices of pulses in 2015, it was decided to import pulses through Metals and Minerals Trading Corporation of India (MMTC) with assistance from the Price Stabilisation Fund (PSF).

ii. Cabinet Committee on Economic Affairs, in December, 2015 has given its approval for creation of buffer stock of pulses. The buffer stock will be created in current year itself. It has approved procurement of about 50,000 ton pulses from the kharif crop 2015-16 and one lakh ton out of arrivals of rabi crop of 2015-16. Procurement of pulses will be done at market prices through Food Corporation of India (FCI), National Agricultural Cooperative Marketing Federation of India Ltd. (NAFED), Small Farmers' Agribusiness Consortium (SFAC) and any other agency as may be decided. SFAC will undertake procurement through Farmer Producer Organisations (FPOs). The procurement in kharif and rabi 2015-16 will be done at market price above Minimum Support Price (MSP) out of the PSF.

iii. Since prevailing prices in the Kharif Marketing Season (KMS) 2015-16 for Urad and Tur were above MSP, procurement of these pulses was commenced by FCI, SFAC and NAFED with assistance from PSF. The KMS was from 15.10.2015 to 29.02.2016 (extended from 15.02.2016). The three agencies procured 4891.66 MT of Urad against the target of 5000 MT of Urad and 45530.86 MT of Tur against the target of 45,000 MT of Tur. During the Rabi Marketing Season from 15.03.2016 till 15.07.2016, Chana (80,000 MT) and Masur (20,000 MT) is to be procured by the three agencies.

iv. To safeguard the interest of farmers the government, on the recommendations of CACP, increased MSPs for kharif pulse for 2015-16 season and keeping in view the deficit of pulses, government decided to give a bonus of Rs.200 per quintal for pulses payable over and above the MSP.

v. A major hurdle faced by the pulse producers are the insufficient procurement channels in the country. To overcome this, government has designated FCI as the nodal agency for procurement of pulses and oilseeds for the agricultural year 2015-16, due to its pan India presence. SFAC and National Agricultural Cooperative Marketing Federation of India (NAFED) also supplement the efforts of FCI on the procurement of pulses and oilseeds.

vi. Extension of "Zero import duty" on pulses up to 30th September 2016.

vii. Imposition of stock holding limits and coordinated de-hoarding operations to increase the availability pulses in the market.

Terms of Trade (ToT)

1.70 The ToT between agriculture and non-agriculture, calculated as the ratio the combined indices of prices received by the farmers for their produce to the combined index of prices paid by the farming community for different items purchased, is one of the factors considered by CACP in recommending MSPs of agricultural commodities. In view of the changing composition of the agricultural sector, a committee under the Chairmanship of Prof. S. Mahendra Dev was set up by the Ministry of Agriculture and Farmers Welfare in 2012 to update methodology of computing ToT, including revision of the base year. Since the agriculture population consists of both farmers and agricultural labourers, the report gives two separate indices of ToT for farmers and agriculture sector where the latter comprises both famers and agricultural labourers.

1.71 As per the revised methodology, with base year 2011-12, during 2004-05 to 2014-15, ToT have

become favourable for farmers and agriculture. The index for ToT during the last 10 years is shown in **Table 1.7**. Major factors attributed for improvement in ToT, includes significant increase in MSPs, rise in global agricultural prices, high food inflation vis-à-vis non-food articles, substantial increase in private investment, etc.

Table 1.7: Index of ToT

(Base T.E.: 2011-12=100)

Year	Farmers Index for ToT	Agriculture Index for ToT
2004-05	87.82	81.56
2005-06	84.80	79.82
2006-07	87.06	82.82
2007-08	92.20	86.74
2008-09	99.98	93.86
2009-10	100.15	98.35
2010-11	102.95	102.89
2011-12	97.26	98.79
2012-13	97.34	100.91
2013-14	98.46	104.19
2014-15(P)	97.49	106.59

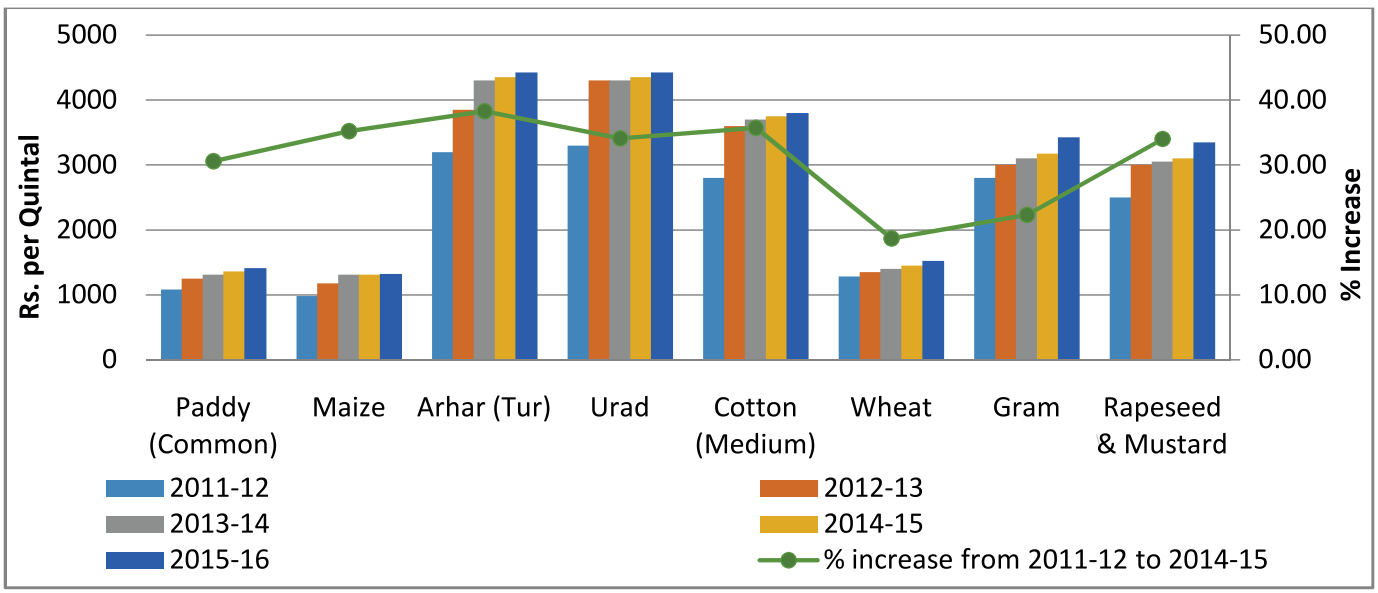
Source: Directorate of Economics and Statistics, M/o Agriculture and Farmers Welfare

Instruments of Agricultural Price Policy

1.72 The current instruments of agricultural price policy include: MSP, market interventions, buffer-stock operations, distribution of foodgrains under public distribution systems, encouraging producer's cooperatives to undertake farming on behalf of farmers; regulation of agricultural trade and processes activities; creation of agricultural marketing infrastructure.

1.73 The main objective of the price support is to ensure remunerative prices to the growers for their produce with a view to encourage higher investment and production. Taking into account factors like cost of production, overall demand-supply, domestic and international prices, inter-crop price parity, ToT between agricultural and non-agricultural sectors, etc., the MSP for various agricultural commodities has been raised consistently over the years. **Figure 1.21** shows the increase in MSPs of certain crops between 2011-12 and 2015-16. The highest increase in MSP between 2011-12 and 2015-16 was for arhar (tur), an increase of 38 per cent, MSP for cotton (medium staple) increased by 35 per cent; for maize, urad and rapeseed and mustard by around 34 per cent.

Figure 1.21: MSP of major Agricultural Commodities



Source: Directorate of Economics and Statistics, M/o Agriculture and Farmers Welfare

Taking Marketing Reforms Further

1.74 The development of agricultural marketing infrastructure is the foremost requirement for the growth of integrated agricultural system in the country. Over the years a number of initiatives have been taken with the objective of creating an effective supply chain in the agricultural sector. However, post-harvest management including agricultural marketing has not been able to keep pace with the changes in the economy. Some of the continuing areas of concern in the agricultural marketing system are: huge variation in the density of regulated markets, lack of proper grading and packaging at farm level, wide variations in market fee, asymmetries in market information, non-issue of sales receipts/invoices, post- harvest losses, etc.

*"Small Farms have proven to be more efficient than large ones in using land and resources, especially in labour-intensive crops or tending livestock, but the holdings are often too small to generate sufficient income to support a family. Crucially small farmers suffer serious disadvantages in marketing and distribution. Their smaller outputs, fragmented landholdings and often distant location from major markets deprive small farmers of access to modern storage facilities for perishable items and distribution networks."- **Indian Rural Development Report, 2012-13.***

1.75 Thus, keeping in view the objective to usher in reform of the agriculture marketing system and to provide farmers/producers with access to markets across the country, Government of India approved a scheme for "Promotion of National Agricultural Market (NAM) through Agritech Infrastructure Fund (ATIF)" in July 2015. The Scheme aims to promote market efficiency, market access, transparency in trading and payment, increase competition and ensure better price discovery. Under the scheme, a common e-market platform is being created. This will be deployed in 585 regulated wholesale markets across the country in a phased manner during next three years (2015-16 to 2017-18).

Box 1.6: National Agricultural Market

The National Agricultural Market (NAM) is envisaged as a pan-India electronic trading portal networking the existing APMCs across the country. The programme will enable buyers/sellers situated within and outside the state to participate in trading at the local level. The main features of the scheme are as follows.

- To establish quality management system for quality assurance and grading.
- Provides end-to-end solutions to all sellers and buyers: grading, price discovery, payment and transportation and delivery.
- Rationalize transaction costs, reduction of wastages, provide higher return to farmers, better quality and price to consumers.
- The common platform will be deployed in 585 selected regulated mandis in states subject to their bringing in the following necessary reforms by 2017-18:
  - i) Provision for e-trading.
  - ii) One single licence for each state.
  - iii) Single Point Levy of transaction fee.
- The DAC&FW will share the software with the states free of cost. A grant up to Rs.30 lakhs per mandi for related hardware/infrastructure will also be provided by the Department.

1.76 Moreover, government has been implementing demand driven Plan Schemes to develop an efficient agricultural marketing network in the country. These schemes 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.

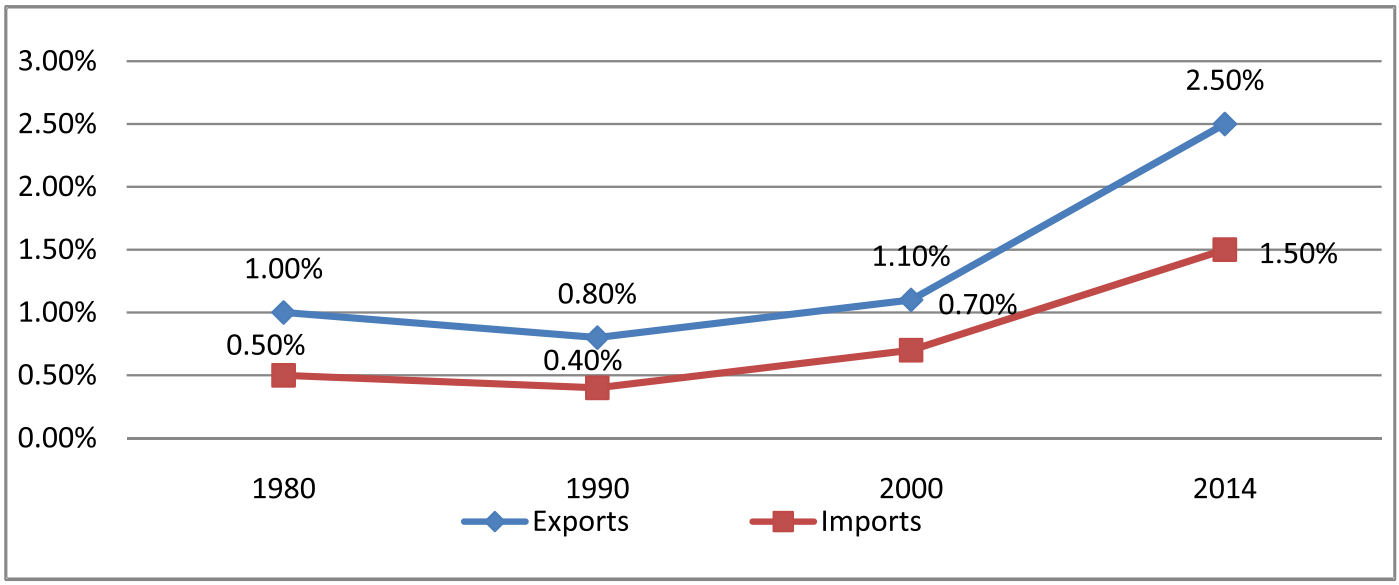
1.77 In view of the slow progress in the amendment of APMC Acts by the state governments, a Group of Experts has been constituted by the Ministry of Agriculture and Farmers Welfare in January 2015 to study the Report of the Committee of State Ministers, in-charge of agricultural marketing and suggest action plan to implement reforms in agriculture marketing sector.

Capitalizing on Global Trade Opportunities

1.78 India has emerged as a significant exporter of rice, cotton, meat, oil meals, pepper and sugar. Export competitiveness has been developed in certain specialized agriculture products like basmati rice, guar gum and castor. During 2014-15, agricultural exports was to the tune of Rs. 2,29,996 crores, as compared to Rs 1,22,188 crore of agricultural import bill. The increase in value of agricultural exports during 2014-15 was mainly on account of higher exports of marine products, basmati and non-basmati rice, meat and meat preparations, cotton, oil meals, spices and guar gum. Imports of vegetable oils, pulses, cashew nuts, spices, sugar and cotton have also registered an increase during the period. During 2015-16 (Apr-Dec) due to subdued global demand, total agricultural exports were estimated to be Rs. 1,58,129 crores as compared to Rs. 1,82,385 crores during the same period last year. Agricultural imports on the other hand, have increased to Rs. 1,06,935 crores during Apr-Dec (2015-16) as compared to Rs. 94,634 crores during the corresponding period in 2014-15.

1.79 The share of India's agricultural exports and imports in world exports/imports is shown in **Figure 1.22** below:

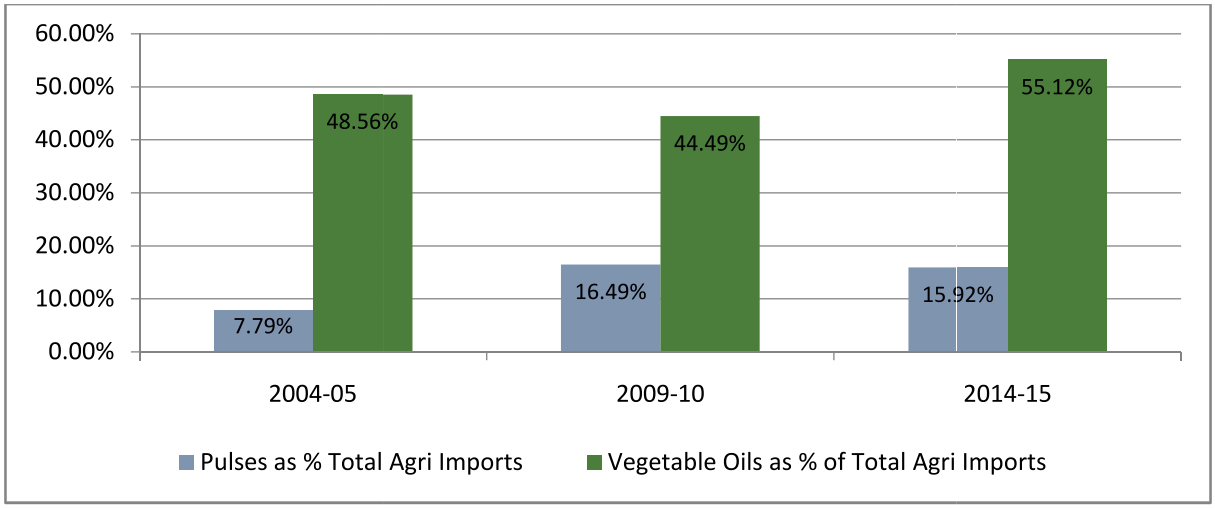
Figure 1.22: Share of India's Agricultural Exports/Imports in World Exports/Imports



Source: International Trade Statistics 2015, World Trade Organization (WTO)

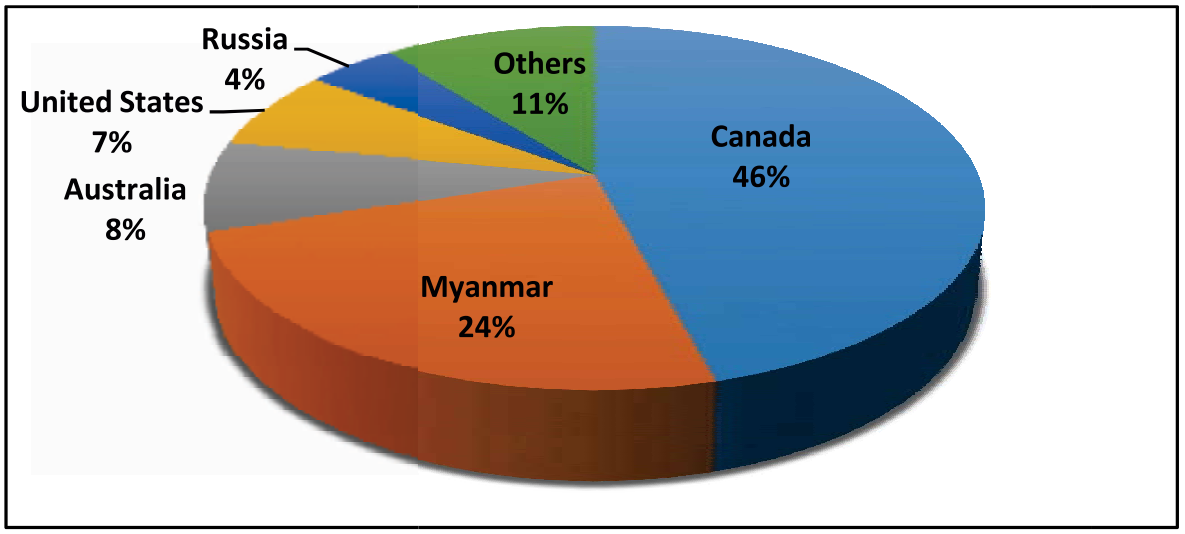
1.80 India's export basket as well as export market has diversified over the years. This reduces India's dependence on any one particular national market. However, India's agricultural imports have become too lopsided with pulses and edible oil emerging as the two largest imports procured from a few nations **(Figure 1.23 and 1.24).** India's pulse imports are largely from Canada, Myanmar and Australia while imported edible oil is usually palm oil from Malaysia. Increasing consumption of pulses and edible oils coupled with lack of technological breakthrough in production of these commodities and heavy dependence on a few trade partners have become important policy concerns. Government is taking numerous steps towards a long-term solution for the perennial shortage of pulses and oilseeds in the country.

Figure 1.23: Share of Edible Oils and Pulses in Agricultural Imports



Source: Department of Commerce

Figure 1.24: Share of India's Pulse Imports from various Countries in 2014-15 (Rs. Lakhs)



Source: APEDA, Department of Commerce

1.81 Agricultural Trade Policy has emerged as an important instrument of growth for the sector. The policy has been amended from time to time for various agricultural commodities in response to domestic availability and price situation. The opening up of export of certain 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 a major increase in area coverage and growth rate of production.

Reorienting Farm Management

1.82 Small scale operations reduce the bargaining power of farmers, makes them vulnerable, increases costs and adversely affects access to markets and sometimes to technology. One of the ways suggested to overcome the barrier caused by small scale is pooling or coming together of farmers as groups. Cooperatives have been promoted as one alternative to enable farmers to come together for collective interests.

1.83 Some cooperatives have been very successful and the most famous success story has been that of Amul, a cooperative of dairy farmers in Gujarat. However, there have been challenges and often interference due to vested interests has been a major cause for the failure of cooperatives. In addition to cooperatives, the importance of forming groups or associations of farmers is tremendous as seen in the western countries. Apart from cooperatives, the concept of self-help groups (SHGs) as JLGs has become quite successful and important in many activities. While most SHGs were initially formed to facilitate group lending, it was found that the advantages of SHGs could be extended to other areas of rural and agrarian activities. These groups, however, continue to remain largely informal in nature and hence outside the purview of direct regulatory intervention.

1.84 The concept of Farmer Producer Organizations was floated to facilitate formation of associations of farmers which offer the benefits of a cooperative and but also have the advantages of a private company. The Small Farmers Agribusiness Consortium has been acting as the nodal agency to promote creation of FPOs in the country. By 2014-15, there were about 570 FPOs established across the country. SFAC also helped in creation of state-level farmer producer companies (FPC) with smaller FPOs being the shareholders of the state-level FPC. These organizations are aimed at helping farmers to obtain the benefits of better packing, processing and marketing of agricultural products and value addition to improve the share and the return of the farmers from the consumer's rupee. There are several success stories of FPOs. What is further needed is to equip these organizations with good technical and managerial expertise.

1.85 Stakeholders' involvement and organization for natural resource management through Participatory Management has shown good results. Revival of Water User Associations (WUA) for developing and managing watersheds and water bodies, especially in water scarce regions, in place where they have worked well, they have been found to enhance sustainable use of water, conservation of soil, diversification of farm and non-farm activities leading to poverty alleviation and an improvement in the livelihoods and living conditions in many areas.

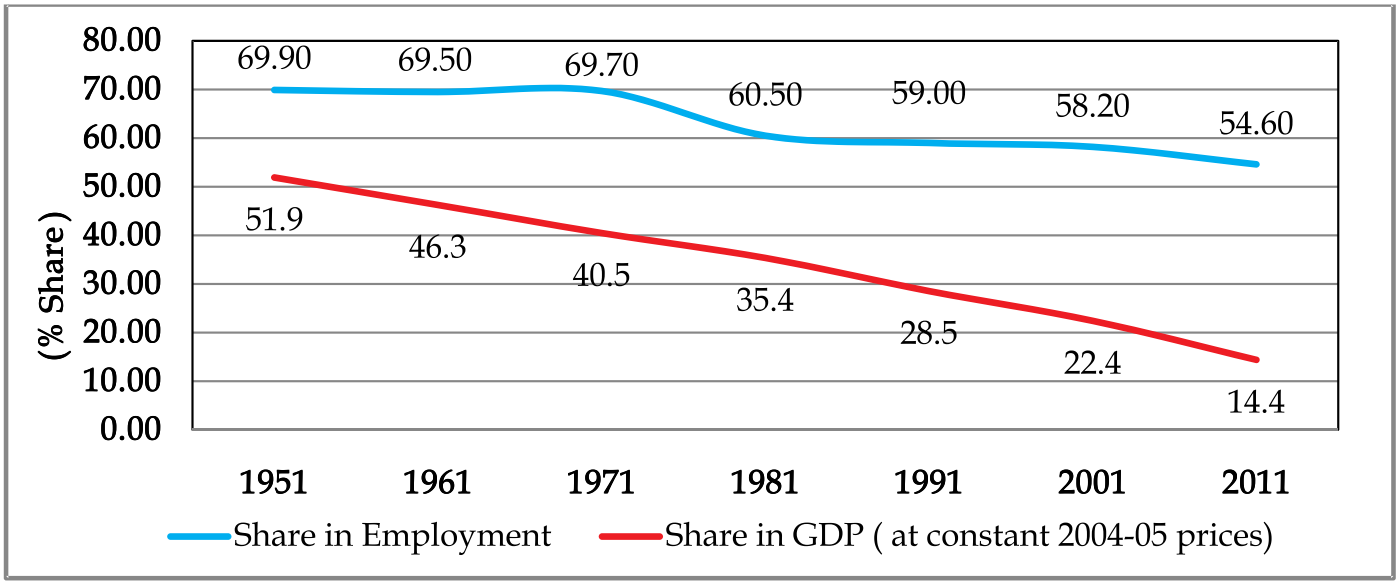
1.86 It is well established that these grassroots organizations can play a major role in changing the face of agricultural resource chain and value chain in the coming days. Policy and technological interventions have often overlooked the human potential in agriculture. Managerial solutions through cooperatives, FPOs, SHGs and WUAs and watershed management committees alone can handicaps of small scale and ensure effective implementation, better performance and benefits.

Employment in Agriculture

1.87 Economic theory posits a shift in the workforce from agriculture (primary) sector to secondary and tertiary sectors as a normal phenomenon of the development process. It is not surprising, therefore, that the percentage of agricultural workers in the total workers in the country has come down from 58.2 per cent to 54.6 per cent during 2001 to 2011 (Census,

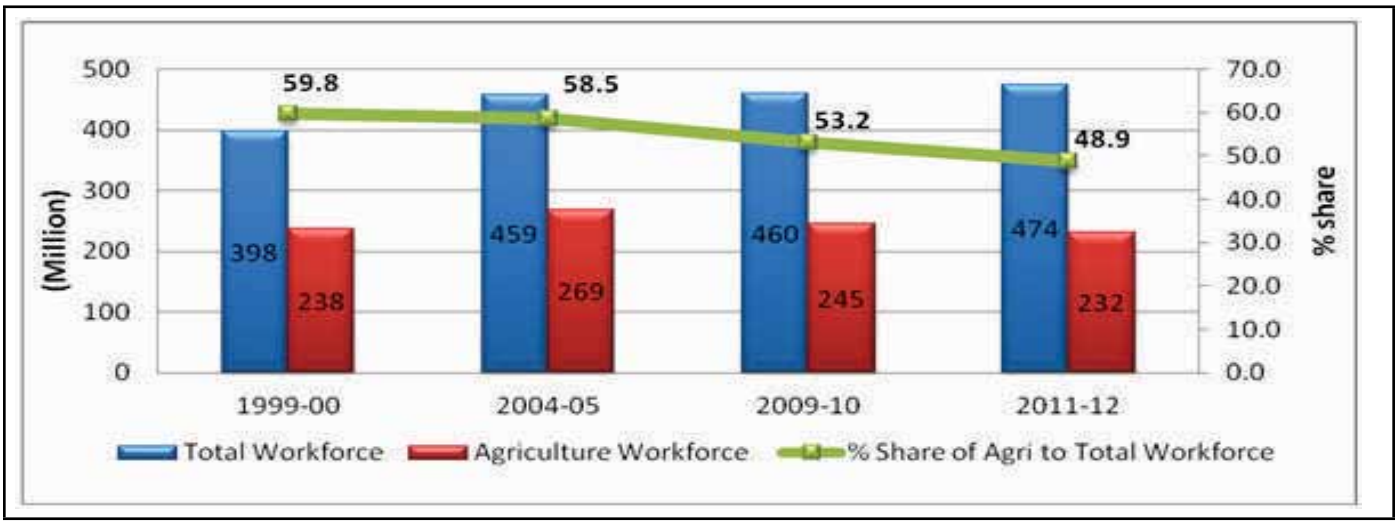
2011). The recent NSSO report on Employment and Unemployment Situation in India (68th Round) also reinforces the accepted wisdom that employment in agriculture declines with the increase in economic growth and development. The Survey shows that the share of the primary sector in total employment has gone below 50 per cent for the first time in 2011-12 **(Figure 1.25)**. What is worrisome, however, is that the decline in the sector's share in employment has not kept pace with changes in inter-sectoral share in output. As shown in **Figure 1.26,** the share of agriculture and allied sector in GDP has come down sharply from 52 per cent in 1951-52 to 13.9 per cent in 2011-12, whereas, share in workforce remained high at 54.6 per cent, declining by merely 15 percentage points during the same period. The slow pace of structural transformation in agriculture can be attributed to lack of non-farm employment opportunities in rural areas to absorb a larger proportion of the workforce from agriculture. The resultant high level of dependence on agriculture makes the sector more vulnerable, as any drop in agricultural production, can affect incomes and expenditure of large number of population and have a direct impact on poverty.

Figure 1.25: Share of Agriculture and Allied Sector in Employment and GDP



Source: Registrar General of India and CSO

Figure 1.26: Workforce Engaged in Agriculture Sector



Source: NSSO

1.88 The challenge, therefore, is to create sufficient off-farm employment opportunities to absorb surplus agricultural labour force, while increasing productivity in the agriculture sector through increased mechanization, optimal use of natural resources, supplementing income through livestock and other allied activities. This may involve engaging rural youth in agriculture with proper training and skill sets on sustainable agricultural practices. There is also a need to encourage young budding entrepreneurs in the rural sector to discover new and innovative solutions for farming problems. To this end, a new central scheme, ARYA (Attracting Rural Youth in agriculture) has already been introduced by the government. The scheme proposes a direct engagement of the National Agricultural Research System with rural youth and thus to enthuse them towards the sector.

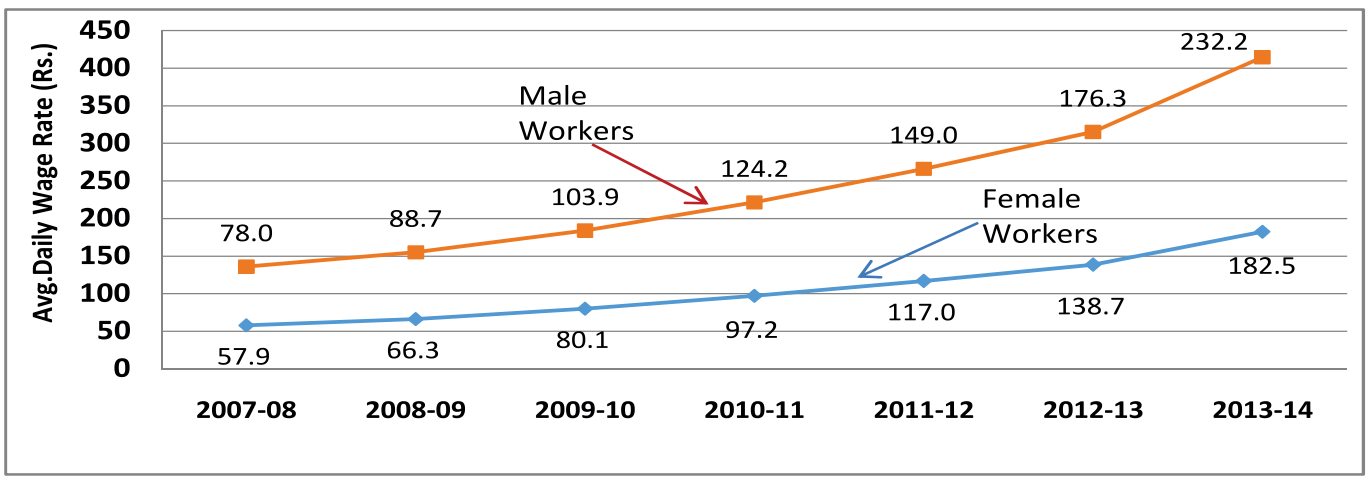
"Start-up India had created an impact on non-farm sectors as many entrepreneurs started vibrant enterprises. It is time to extend start-up India to the farm sector by replicating the success stories of enterprises in honey production, dairying and fisheries"
Shri Radha Mohan Singh, Agriculture Minister

1.89 At present in order to assess employment levels by activity, 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.

Agricultural Wages

1.90 Agriculture is a labour intensive activity. Cost of cultivation data shows that labour accounts for more than 50 per cent of the total variable cost of production for most crops. Due to rapid economic growth, increase in minimum wages, and adoption of employment generation programmes, like, MGNREGA, the recent years have witnessed a significant increase in agricultural wages. The average daily wage rate of male and female workers under different agricultural operations, viz. ploughing, sowing, weeding, harvesting and transplanting, is depicted in **Figure 1.27.**

Figure 1.27: Average Daily Wage Rate in Agricultural Operations



Source: Labour Bureau

Notes:
i. All India annual average is calculated for 20 major states.

ii. Agri. Wage is average of five operations viz. ploughing, sowing, weeding, harvesting and transplanting.

1.91 As a consequence of implementation of MGNRGEA, temporary shortage of labour has been reported during the peak agricultural season. This has led to increased labour costs in agricultural sector. The CACP in its Report on Price Policy for Kharif Crops of 2013-14, *inter alia*, mentioned that labour costs have risen by almost 20 percent per annum, during the 3 years (2011-12 to 2013-14), which have pushed the cost of production in agriculture. But beyond the much debated impact of MGNREGA on wages and availability of labour in farming, the evidence provided by agro-economic research studies show that the scheme has an unmistakable edge in: a) raising the real-daily agricultural wage rate; ii) increasing employment among the unskilled labour; and iii) adding to women empowerment through actualizing gender parity in wages. Moreover, even when the debate on MGNREGA is going on, the scheme has further oriented itself to the agricultural economics by bringing watershed development, flood management and irrigation related water resources under it. About 60 per cent of the total expenditure under MGNREGA is being utilized for creating assets in agriculture sector for increasing agricultural productivity. This is expected to have a positive impact on the productivity of agriculture. The labour shortage and high wage rate impact arguments against MGNREGA even if true do not prove a case against the scheme because providing rural labour more employment and income opportunities was its objective. Whether to work on a MGNREGA scheme site or on a farmer's field depends upon the labour's decision to maximize his wage earnings and other benefits. Resolving farm wage rate hike and labour scarcity issues by limiting the employment and income opportunities is avoidable.

1.92 To contain the rising costs of production in agriculture and to make sure that MGNREGA operations are in line with the needs of agriculture, there is a need to adopt better convergence between MGNREGA and agricultural operations. Further, due to the huge forward and backward linkages of the agriculture sector, there is a need to map/identify in each development block the basic minimum common infrastructure required for the development of the agriculture sector and to the extent possible, MGNREGA funds should increasingly be utilized for such activities.

Way Forward

1.93 The way forward that has emerged in the key areas of concern in the agricultural development experience so far are as follows:

Towards Efficient Land Use

a) **Incentivizing** sustainable farm operations, among other things, by encouraging appropriate input use, use of renewable energy, and emphasizing soil health, etc.

b) **S**uitable **State legislation** for regulation against conversion of agricultural land into non-agricultural purposes and integration of land use planning with all developmental programmes, especially with MNREGA, for holistic rural development, natural resource management, and eco-restoration.

c) **Implementation** of land-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) New **legislation on** land tenancy rules, automatic land rights inheritance need to be made to encourage shared-cropping, contract farming, and rendering physical boundaries and fencing irrelevant.

e) **Improving land** use surveys for better methodology to capture area under village houses, and implementing soil-to-satellite approach and computerization of land records.

f) Enforcing *No Land Diversion Policy,* permitting exceptional cases only with compensatory reclamation of equivalent area from wasteland.

g) Encouraging **Public-Private-Partnership** model for land use and soil health improvement activities.

Towards Better Soil Health

a) **Balanced use** of organic and inorganic fertilizers may be permitted in view of its direct impact on soil fertility.

b) The ambit of NBS scheme may be made broader to **consider nutrient use efficiency of fertilizers** so that the focus is on efficient uptake of nutrients by plants. Water soluble fertilizers need to be promoted by bringing them under subsidy regime.

Towards Higher Water Use Efficiency

a) To understand the requirements of a particular area, land should be studied in detail to determine the constraints hampering the improvement of water management and better agricultural production.

b) To address the problem of ever increasing pollution loads in the rivers and other water bodies, the following measures can be adopted:

   1) Reuse of treated sewage for agriculture and horticulture purposes.

   2) Use of sludge generated at sewage treatment plants which does not contain heavy metal as manure and soil conditioner.

   3) Water use efficient technologies of drip irrigation, micro irrigation, sprinklers, etc., may be encouraged to reduce the pressure on water consumption by agricultural sector, and reduce excessive withdrawal of groundwater.

Towards Better Managing Climate Change

a) Both mitigation and adaptation strategies will need to be adopted. Agriculture will need to be progressively adapted to climate change and agricultural research system needs to be more oriented towards monitoring and evaluation of climate change and recommend changes in agricultural practices accordingly.

b) Preparation of database on the impact of climate change in agriculture and evaluation of its impact in selected locations.

Towards Crop Insurance Coverage:

a) States/UTs should deploy additional manpower and provide adequate training to the personnel engaged in the Crop Cutting Experiments (CCE) to ensure accurate and timely availability of yield data for effective implementation of the insurance schemes.

b) Use of modern technology like Remote Sensing Technology (RST)/Satellite imageries to supplement the yield assessment through CCEs in the implementation of crop insurance schemes should be enhanced.

c) To make weather based insurance system efficient and to cover the entire country, the present number of Automatic Weather Stations should be increased.

Towards Realizing Horticultural Potential

a) Ensuring production and supply of quality planting material, with special emphasis on establishment of hi-tech nurseries having provision for mother or scion blocks of improved varieties, good quality rootstock banks and hi-tech green house, through accredited nurseries.

b) Establishing crop based Centres of Excellence in each state to serve as a hub for supply of planting material and dissemination of technology to farmers.

c) Covering more area under vegetable hybrids and export-oriented varieties of ginger, turmeric and chillies. High density planting and tree canopy management of orchards right

from establishment stage need to be focused on to derive better yield.

d) Rejuvenation of old and unproductive orchards continue to be a focus area for enhancing productivity, profitability and sustainability.

e) Thrust on protected cultivation, particularly of high value crops.

Towards Better Agriculture Marketing

a) The development of competitive marketing channels is necessary to induce competition in the existing marketing systems and to facilitate sale of farm produce at remunerative prices. This would require states to make changes in their legislative policy framework, effective government support services as well as harnessing of the potential of the private sector.

b) Government has taken steps to establish an e-trading platform under the NAM. Twenty state governments have already come on board and are taking steps to undertake market reforms, specifically to permit a single licence, single mandi fee and to amend their APMC Acts to permit e-trading. These market reforms will go a long way in improving price discovery and reduce the risks farmers face due to price volatility. These efforts at market reforms, specifically bringing more states on board will need to be continued.

c) Efforts would also be needed to improve marketing linkages for farm inputs.

Towards Higher Extent of Food Processing

The way forward consists in achieving targets of waste reduction, value addition and employment generation by:

a) Greater infrastructure development by involvement of State government and private sector for setting up food parks and cold chains.

b) Filling up institutional gaps for enabling contract farming, direct marketing, stocking and movement policies.

Towards Healthy Livestock

a) Ensuring adequate and immediate veterinary disease diagnosis, surveillance and monitoring, hospital infrastructure and trained manpower development.

b) Evolving a strong programme for supply of sufficient veterinary vaccines with long duration immunity is necessary.

c) Strengthening small-ruminant based, i.e., goats and sheep, livelihood through national and international multi-stakeholder participation.

CHAPTER-2

Natural Resource Management

2.1 The challenge of natural resources management is evident from the fact that with a mere 2.4 per cent share of the world's land and only 4.0 per cent share of the world's freshwater resources, the agricultural sector of India has to cater to 17.5 per cent of the world's population. The net sown area has been stagnant at about 140 million hectares and, in view of the competing demands for land, it is not likely to increase. What is worrisome in this context is that an estimated 120 million hectares of Indian soil is considered degraded to varying degrees. Thus, for resolving the twin issues of food security and environmental quality that the country faces, natural resource management needs to be accorded the highest priority.

2.2 Similarly, water resources are also under pressure due to ever-increasing demand. While the irrigation potential of the country is estimated at about 140 million hectares, at present only about 66 million hectares[3] (47.6 per cent) of the cropped area is irrigated. A large part of agriculture continues to be rainfed, and husbanding of water resources has acquired primacy.

2.3 The progressive fragmentation of landholdings, degrading natural resource base and emerging concerns of climate change will further escalate pressure on land and water. Food demand in the country is constantly increasing not only due to increase in population, but also due to increasing per capita income, changes in preferences, tastes, lifestyles, occupational structure and growing urbanization. The challenges faced in natural resources management and the way forward are discussed in the following sections.

[3]As per Land Use Statistics 2012-13, Directorate of Economics & Statistics, Ministry of Agriculture & Farmers Welfare

Land Use

2.4 Land use is a multifaceted subject concerning many disciplines and serves as a means of earning and meeting one's needs. The challenge of bringing more of the 328.73 million hectares of the country's land area under productive use necessitates the devising of a pragmatic and scientific approach.

2.5 Human interaction with land can depend critically on whether the land is leasehold, freehold or a common property resource, and whether government regulations or fiscal measures restrict or encourage user activities. Land user ability to invest on land improvement is constrained by such factors as (i) lack of capital and economic benefit perception; (ii) inadequacy of technical and managerial knowledge; and (iii) inadequate income returns and high cost of borrowing. On the natural resource conservation side, the issue is that regulation against over exploitation cannot be left entirely to individuals. Policies must be designed to arrest and reverse the processes of degradation.

Box 2.1: Land Use in India

- Forest area: 70 mha (21.30per cent)
- Non-agricultural uses: 26.5 mha (8.05per cent)
- Barren & uncultivable: 17.3 mha (5.26per cent)
- Culturable waste:12.6 mha (3.83per cent),
- Permanent pastures:10.2 mha (3.12per cent)
- Miscellaneous tree crops: 3.2 mha (0.96per cent)
- Fallow land: 26.3 mha (8per cent),
- Agricultural land: 181.95 mha (55.3per cent)
- Net Sown Area: 139.9 mha (42.57per cent)

Source: Land Use Statistics (2012-13), Ministry of Agriculture & Farmers Welfare

2.6 There is a comprehensive system of land use statistics in India covering changes in land under various categories on a temporal and spatial basis. As per the latest available land use statistics (2012-13), out of the total land mass of 328.73 million hectares in the country, about 181.95 million hectares of land is agricultural land, which consists of 139.9 million hectares net sown area, 3.2 million hectares miscellaneous tree crops and groves, 12.6 million hectares culturable wasteland and 26.3 million hectares of fallow land. Similarly, area under non-agricultural uses is about 26.3 million hectares. Over the years, there has been a gradual increase in the area of land under non-agricultural uses. During the period 2001-02 to 2012-13, the area under non-agricultural uses has increased by 2.60 million hectares (11 per cent). During the same period, cultivable land has marginally declined by 1.60 million hectares (0.9 per cent) and net sown area has stagnated at about 140 million hectares. As a normal process of urbanization and development, while the area under non-agricultural uses is increasing, agricultural land is decreasing at a slow rate due to various measures taken by the government to bring degraded/culturable wasteland under cultivation. The net sown area increased significantly, i.e., by about 18 per cent, from 119 million hectares in 1950-51 to 140 million hectares in 2012-13, whereas the cropping intensity increased from 111 per cent to 139 per cent during the same period. The all-India land use classification is given in **Annexure 2.1.**

Resources for Agricultural Production System

2.7 Various resources and inputs required for enhancing agricultural production are land and soil, water, energy and farm power, credit and insurance, etc. Out of these resources, land and water are the basic infrastructural resources essential for crop production; therefore, proper management of these resources needs to be ensured.

Figure 2.1: Resource Management

Challenges

Land Degradation

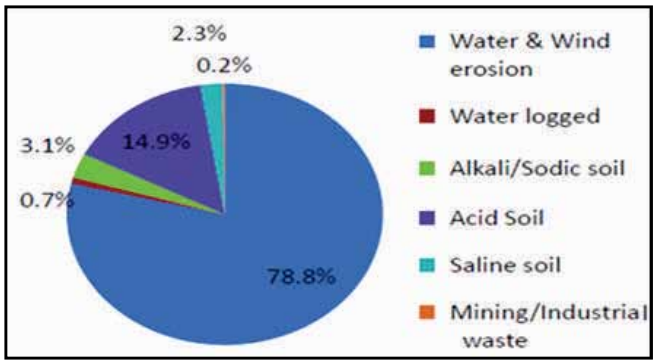
2.8 Land serves as the storage for water and nutrients required for different crops, and demands for food, energy and human requirements are also met from the limited land resources. Soil formation and erosion are simultaneously occurring natural processes, and about 1 millimetre of top soil is being lost annually in the country due to soil erosion. Such erosion leads to land degradation in the upper reaches of the river system, but may increase soil fertility when deposited at various locations of river systems.

2.9 Land degradation takes many forms and is prevalent throughout the country. In the absence of comprehensive and periodic scientific surveys, estimates on various forms of land degradation were made on the basis of localized surveys and studies. In 2010, the Indian Council of Agricultural Research (ICAR) harmonized land degradation data[4] and reported that out of the total geographical area of 328.73 million hectares, about 120.40 million hectares (37 per cent) was affected by various kinds of land degradation (Figure 2.2). This includes water and wind erosion (94.87 million hectares), water logging

[4]Degraded and Wastelands of India: Status and Spatial Distribution, 2010, ICAR

(0.91 million hectares), soil alkalinity/sodicity (3.71 million hectares), soil acidity (17.93 million hectares), soil salinity (2.73 million hectares) and mining and industrial waste (0.26 million hectares).

Figure 2.2: Forms of Land Degradation



Source: Indian Council of Agricultural Research (ICAR), Ministry of Agriculture & Farmers Welfare

2.10 Soils also become contaminated by the accumulation of heavy metals and metalloids through emissions from rapidly expanding industrial areas, mine tailings, disposal of high-metal wastes, leaded gasoline and paints, application of fertilizers, animal manure, sewage sludge, pesticides, wastewater irrigation, coal combustion residues, spillage of petrochemicals and atmospheric deposition. Heavy metals constitute an ill-defined group of inorganic chemical hazards; 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 serve as major sinks for heavy metals released into the environment by the aforementioned anthropogenic activities. 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 soil persists for a long time after their introduction. The presence of toxic metals in soil can severely inhibit the biodegradation of organic contaminants. Heavy metal contamination of soil may pose risks and hazards to humans and the ecosystem through direct ingestion or contact with contaminated soil, the food chain (soil-plant-human or soil-plant-animal-human), drinking of contaminated ground water, reduction in food quality (safety and marketability) via phytotoxicity, reduction in land usability for agricultural production causing food insecurity and land tenure problems.

Land Fragmentation

2.11 Land fragmentation refers to a small or incomplete part or piece of land broken off or separated from the whole land to which it originally belongs. Increasing human and animal population has reduced the availability of land over the decades. Per capita availability of land has declined from 0.91 hectares in 1951 to 0.27 hectares in 2011, and is projected to slide further to 0.20 hectares in 2035. As far as agricultural land is concerned, the per capita availability of land has declined from 0.5 hectares in 1951 to 0.15 hectares in 2011, and is likely to decline further. Many other 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 are compounded when parcels are spatially dispersed, and by travel time and the costs of moving labour, machines, etc., from one parcel to another. In addition, land fragmentation involves a complicated boundary network among parcels (hedges, stone walls, ditches, etc.) that causes land wastage. On tiny parcels, the use of modern machinery is difficult or impossible; 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, because there is no network of farm roads, landowners do not allow neighbouring landowners to cultivate overlapping areas between fields; as a result, some land remains uncultivated. Thus, this situation demands the need for agricultural commercialization via large/medium farm sizes to attain economies of scale.

Diversion of Agricultural Land

2.12 Agricultural and cultivable land has marginally declined from 185.16 million ha in 1980-81 to 181.95 million ha in 2012-13 (Land Use Statistics 2012-13, DES). During the same period, the land under non-agricultural uses has increased from 19.60 million ha to 26.45 million ha. Although during the 1980s (between 1980-81 and 1990-91) the 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 million ha during the most recent decade (2001-02 to 2012-13). However, with a view to conserve top soil, and to prevent soil erosion and land degradation, the 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, leading to a net sown area of around 140 million ha in last two decades. The details of agricultural land by use in India have been given in **Annexure 2.2**.

Land Holdings

2.13 As per the Agriculture Census, during 2000-2011 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. The average size of operational land holdings dropped from 1.33 ha in 2000-01 to 1.15 ha in 2010-11 **(Table 2.1).** Consequently, during the same period, the number of landholdings in the marginal and small categories swelled by about 17 million and 2 million, respectively. Landholding size determines investment in agriculture, productivity, farm mechanization and the sustainability of farm incomes itself. Landholdings in the marginal category (less than 1 ha) constitute 67 per cent of the operational holdings in the country (2010-11). In terms of area operated, the share of marginal holdings has increased to 22 per cent (2010-11) from 19 per cent (2000-01).

Table 2.1: Number and Area of Operation Holdings by Size-Group

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

Category of Holdings	Number ('000) of Holdings			Area			Average Size of Holdings		
	2000-01*	2005-06*	2010-11	2000-01*	2005-06*	2010-11	2000-01*	2005-06*	.....2010-11(P)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Marginal (Less than 1 hectare)	75408 (62.9)	83694 64.8	92826 67.1	29814 (18.7)	32026 (20.2)	35908 (22.5)	0.40	0.38	0.39
Small (1.0 to 2.0 hectares)	22695 (18.9)	23930 18.5	24779 17.9	32139 (20.2)	33101 (20.9)	35244 (22.1)	1.42	1.38	1.42
Semi-Medium (2.0 to 4.0 hectares)	14021 (11.7)	14127 10.9	13896 10.0	38193 (24.0.)	37898 (23.9)	37705 (23.6)	2.72	2.68	2.71
Medium (4.0 to 10.0 hectares)	6577 (5.5)	6375 4.9	5875 4.2	38217 (24.0)	36583 (23.1)	33828 (21.2)	5.81	5.74	5.76
Large (10.0 hectares and above)	1230 (1.0)	1096 0.8	973 0.7	21072 (13.2)	18715 (11.8)	16907 (10.6)	17.12	17.08	17.38
All Holdings	**119931 (100.0)**	**129222 (100.0)**	**138348 (100.0)**	**159436 (100.0)**	**158323 (100.0)**	**159592 (100.0)**	**1.33**	**1.23**	**1.15**

**-Excluding Jharkhand*

Source: Department of Agriculture, Cooperation & Farmers Welfare [Agriculture Census 2010-11 (Phase-1)].

2.14 Similarly, the share of operated area under small farm holdings (1 ha to 2 ha) increased from 20.2 per cent to 22.1 per cent during the same period. Small and marginal holdings together constitute 85 per cent of the number of operational holdings and 44 per cent of the operated area in the country.

Policies & Programmes

2.15 **National Policy for Management of Crops Residue (NPMCR):** In our country, harvesting of various crops generates large volume of residues, both on and off-farm. A huge portion of crop residues is burnt "on farm" to prepare the field for sowing the next crop, as the time gap between the harvesting of kharif crops and the sowing of rabi crops is very limited. Burning crop residues not only causes air pollution but also damages soil property and the available soil nutrients, besides creating human health problems. In view of these, the National Policy for Management of Crops Residue (NPMCR) has been formulated and circulated to all the states for implementation, to ensure prevention of crop residue burning by incentivizing the purchase of modern machinery to minimize the crop residue left over in the field and to facilitate multiple uses of crop residues and by the formulation of fodder pellets and briquettes.

2.16 National Policy for Farmers 2007 (NPF 2007) formulated by the Ministry of Agriculture & Farmers Welfare recommended 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 or wastelands elsewhere. For non-agricultural purposes, 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".

2.17 Similarly, the **National Rehabilitation and Resettlement Policy, 2007 (NRRP),** formulated by the Department of Land Resources, Ministry of Rural Development, recommends that only the minimum area of land commensurate with the purpose of a project may be acquired. Also, as far as possible, industrial 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.

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

2.19 For developing degraded lands, the Government of India has been implementing various programmes, namely, the National Watershed Development Project for Rainfed Areas (NWDPRA), Soil Conservation in the Catchments of River Valley Project & Flood Prone River (RVP&FPR), Reclamation and Development of Alkali & Acid Soils (RADAS), Watershed Development Project in Shifting Cultivation Areas (WDPSCA) and the Integrated Watershed Management Programme (IWMP). Under these programmes, about 81.70 million ha area of degraded lands had been developed during the Eleventh Five Year Plan. As per the decision of the erstwhile Planning Commission, Central funding for the RVP&FPR, RADAS and WADPSCA programmes was discontinued from 1 April 2013, and states were allowed to undertake the interventions of these programmes under the Rashtriya Krishi Vikas Yojana (RKVY) during the Twelfth Five Year Plan. The IWMP has been merged with Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) as PMKSY-Watershed in 2015-16.

Contract Farming

2.20 Contract farming involves agricultural production carried out on the basis of an agreement between buyers and farm producers. Sometimes, the buyer specifies the quality required and the price, and the farmer agrees to deliver the produce at a future date. The farmer undertakes to supply the agreed quantities of a crop or livestock product based on the quality standards and delivery requirements of the purchaser. In return, the buyer, usually a company, agrees to buy the product, at a price that is often established in advance. The company often also agrees to support the farmer by supplying inputs, assisting in land preparation, providing production advice and transporting produce from the farmer's field to its premises. Contract farming 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 the arrangement can offer both an assured market and access to production support. One 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. There are potential benefits for the national economy, as contract farming leads to economies of scale, and has also come to be viewed as an effective approach to solving many of the market access and input supply problems faced by small farmers.

2.21 Also, there are a number of risks associated with contract farming. Common problems include farmers selling to a buyer other than the one with whom they hold a contract, or their using inputs supplied by the company for purposes other than the ones intended. On the other side, a company sometimes fails to buy products at the agreed prices or in the agreed quantities, or arbitrarily downgrades produce quality. Therefore, an adequate legal framework is crucial for the successful implementation and long-term sustainability of contract farming operations. The biggest stumbling block, however, is the absence of enabling tenancy laws that make it possible to transfer land for various terms without problems. Most of the contract-farming is managed with make-shift arrangements, and large numbers of farmers do not go for this solution. A legal framework is essential to assist farmers and buyers in the negotiation of their produce and in the drafting of contracts. It is also important to protect them from risks that may occur during contractual execution, such as abuse of power by the stronger bargaining party or breach of contract. Strengthening farmer organizations to improve their contract negotiating skills can redress the potential for subsequent misunderstanding.

Soil and Its Survey

2.22 Soil is an integral part of human and animal health. Soil health, defined as the capacity to function within ecosystem and land use boundaries to sustain biological productivity, maintains 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.

Box 2.2: Soil Loss in India

- Nature takes about 300 years to form only 1 cm of topsoil
- 5.3 billion tonnes of soil gets eroded annually
- Soil loss is about 16.4 t/ha/year.

2.23 The **Soil and Land Use Survey of India (SLUSI)** under the Ministry of Agriculture and Farmers Welfare has been conducting soil surveys in the country since 1958 for national land-based developmental programme. A soil survey aims at

generating a scientific database on soil and land resources for planning and implementing soil and water conservation through watershed programmes for natural resource management. After completing the Watershed Atlas of India, the delineation and codification of micro-watersheds of the whole country is near completion. A database is being generated to meet the needs for planning at national, state, basin, district, catchment, village and micro-watershed levels. A Rapid Reconnaissance Survey (RRS) is being conducted to demarcate and identify high-priority watersheds in the catchment areas on 1:50K scale based on either sediment yield index or runoff generation potential index. A Detailed Soil Survey (DSS) is being conducted to generate detailed information on soil and land characterization of the priority areas using cadastral map (1:4K/1:8K) or high resolution or satellite images (1:10k to 1:25k) for micro-level developmental planning. The survey is an established tool to identify various morphological, physical, chemical and mineralogical properties of soils in a systematic way through examination of soils in the field and in the laboratory. The soils are classified and interpreted based on the potentials and limitation of the database for various utility purposes, such as land capability classification, soil hydrological grouping, suitable cropping pattern and soil fertility.

Table 2.2: Soil Survey Status

Survey Type	Achievement (million Ha)		
	During 2014-15	Up to 2014-15	Target 2015-16
Rapid Reconnaissance Survey (1:50 K)	-	258.38	-
Detailed Soil Survey (1:10 K/12.5 K or larger)	0.67	16.14	0.88
Land Degradation Mapping (1:50 K)	-	45.92	-
Soil Resource Mapping (1:50 K)	5.76	132.29	6.55

Training and Capacity Building for Officials Working for Watershed Management & Climate Change

2.24 The **Damodar Valley Corporation (DVC)** was established on 7 July 1948 through an Act of Parliament to cater to the training needs of watershed development programmes, soil health management, micro irrigation, integrated farming systems, agroforestry, climate change adaptation and mitigation, etc. Similarly, a multidisciplinary Soil Conservation Training Centre was established at DVC, Hazaribagh. Every year, this centre organizes 8 to 10 short-duration training programmes to train officials working in the agriculture sector, especially those working in watershed development and climate change.

Table 2.3: Number of Officials Trained

Training	During 2014-15	Up to 2014-15	Target 2015-16
Number of officials trained	208	3569	250

Way Forward

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

a) **Incentivize Conservation Agriculture**

Conservation 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 hectares in the last two decades. However, it could be even lower as in villages farmers build houses and put agricultural land to other purposes 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 land is put to crop production.

g) **Contract Farming and Public Private 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—lack of capital; availability 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**

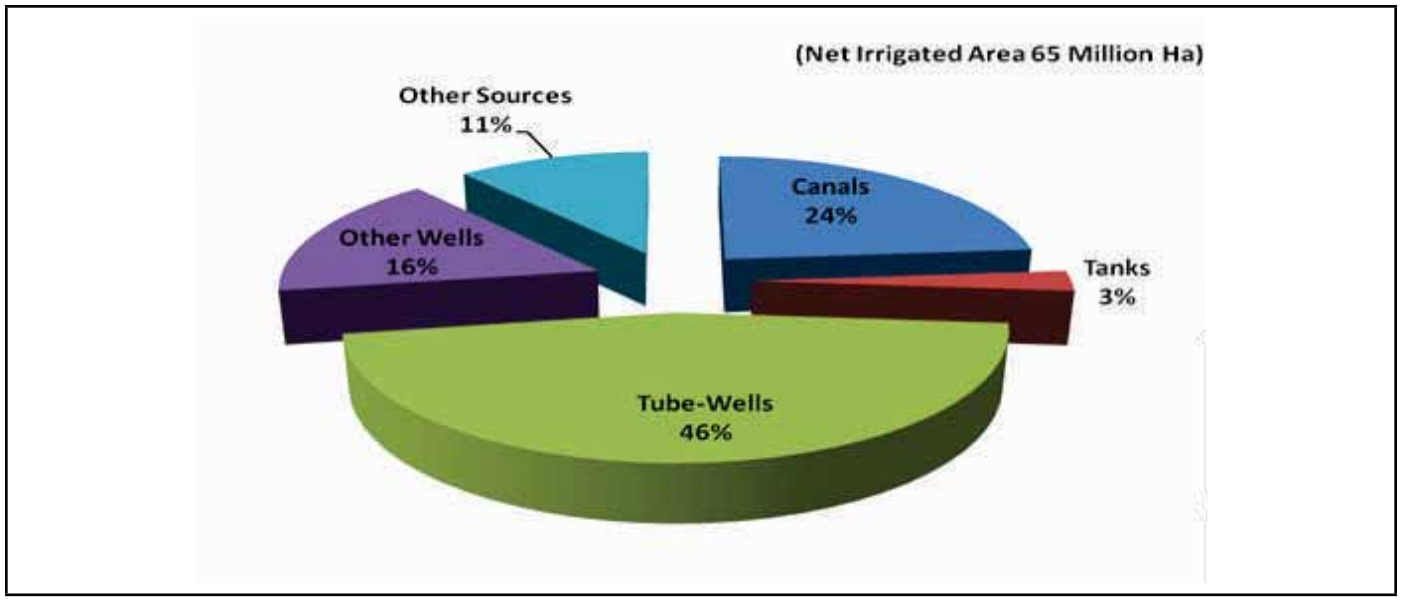
Multiple succession acts need to be revised, and a common succession act needs to be put in place for smooth inheritance. It is necessary to ensure that land rights go to the inheritors but land fragmentation is avoided.

Water Resources

2.26 India has only 4 per cent of the world's renewable water resources. The average annual precipitation in India is estimated to be 4,000 BCM (billion cubic metre), 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.

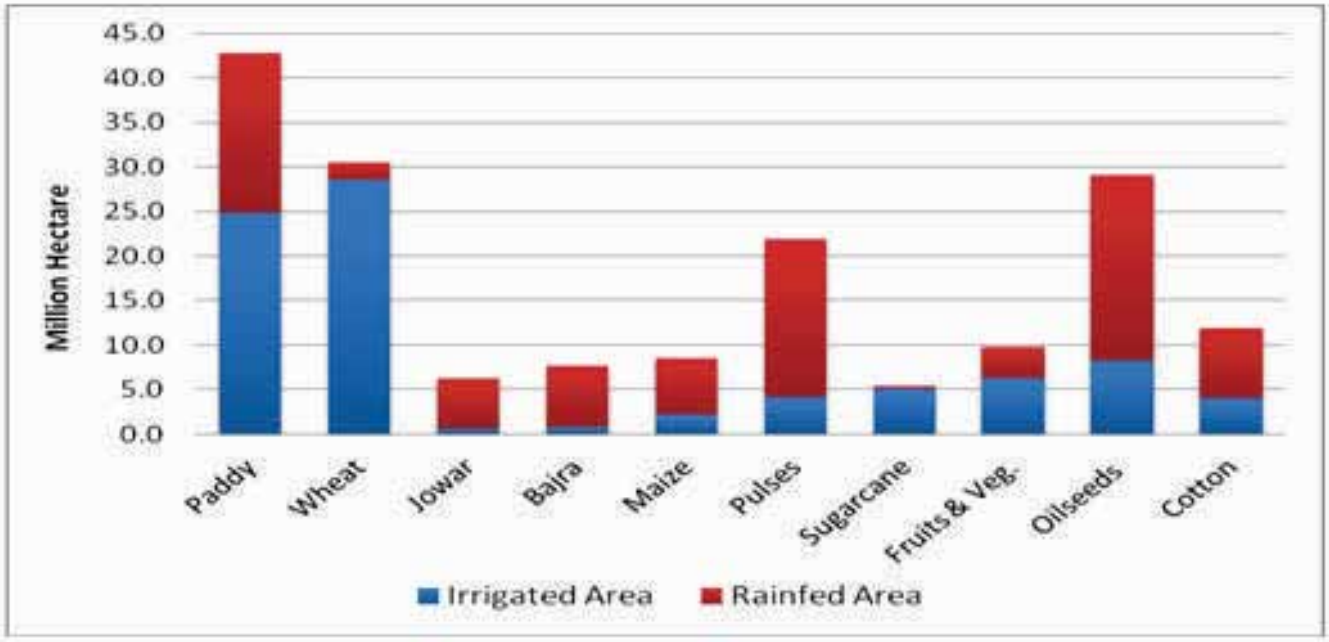
2.27 A large number of dams, barrages, hydro power structures, canal networks, etc., were built all over the country during the successive Plan periods. A cumulative storage capacity of about 225 BCM from major and medium irrigation projects has made it possible to provide assured irrigation in command 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 66.10 million hectares (2012-13) of the 139.9 million hectares of net sown area **(Figure 2.3).**

Figure 2.3: Various Sources of Irrigation in 2012-13



Source: Land Use Statistics (2012-13), Ministry of Agriculture & Farmers Welfare

Figure 2.4: Irrigated Area Under Different Crops (2012-13)



Source: Land Use Statistics (2012-13), Ministry of Agriculture & Farmers Welfare

Issues & Challenges

Regional Imbalance

2.28 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 per cent of the net sown area, the medium rainfall zone (750-1125 mm) accounts for 35 per cent of the net sown area, the high rainfall zone (1125 to 2000 mm) covers 24 per cent of the net sown area and the very high rainfall zone (more than 2000 mm) accounts for the remaining 8 per cent of the net sown area. The basin-wise availability of water is quite varied—the Ganga-Brahmaputra river basin contributes more than 50 per cent of the total annual water availability, and the Southern and Western basins contribute about 15 per cent each.

Sub-optimal utilization of created facilities

2.29 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

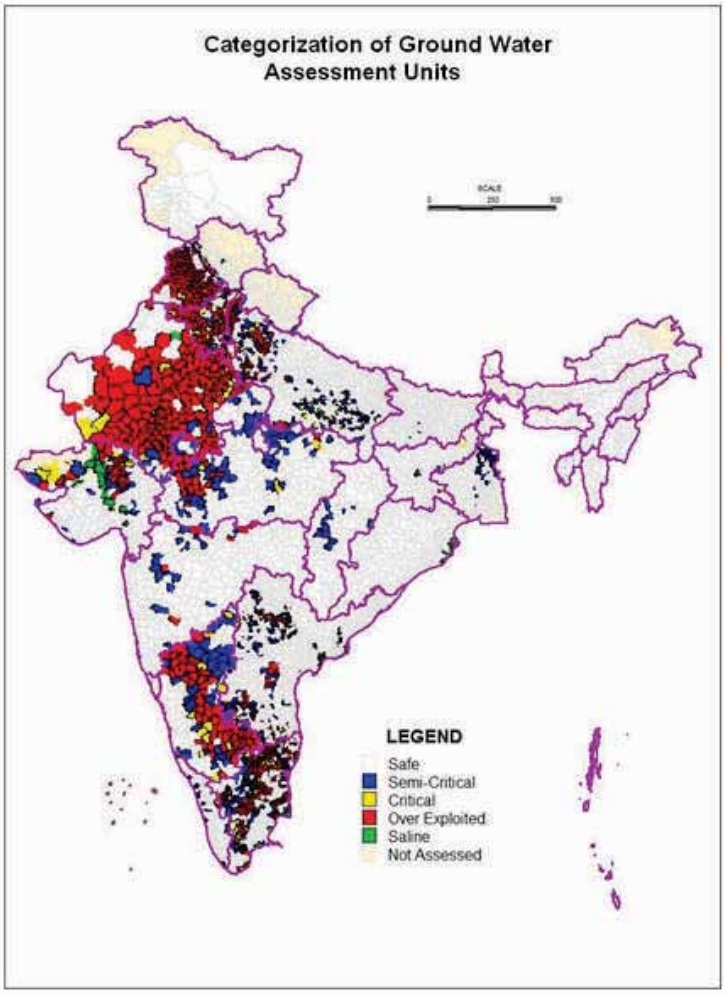
2.30 As per the Report of the Task Force on Irrigation (2009) constituted by the then Planning Commission, for a gross irrigated area of about 91 mha, the water use is 634 BCM, which gives a delta of 0.68 m per ha of gross irrigated area. The average annual rainfall is

1170 mm (1.17m). Taking 70 per cent 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 per cent to 35 per cent in most irrigation systems, with efficiency of 40 per cent to 45 per cent in a few exceptional cases.

Groundwater Policy

2.31 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 per cent of the irrigated area. About 70 per cent 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.

Figure 2.5: Categorization of Ground Water



Source: Ground Water Year Book 2013-14

Ultimate Irrigation Potential

2.32 In the total 329 million hectares (mha) of geographical area of the country, the total cropped area is about 194 mha, out of which net sown area is only about 140 mha. Only about 66 mha, i.e., 47.6 per cent 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 of the country is estimated at about 140 mha, with about 76 mha from surface water sources and about 64 million hectares from groundwater sources. High priority needs to be accorded to harnessing the balance irrigation potential.

Table 2.4: Ultimate Irrigation Potential

Sl.	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		**139.90**

Source: Ministry of Water Resources

Competing Demand

2.33 The demand for water for various purposes is increasing due to population growth, urbanization and industrialization. Presently, the agriculture sector is using about 83 per cent of available water resources, but demand from other sectors may reduce availability for agricultural use to 68 per cent 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 **(Table 2.5).**

Table 2.5: Water Demand in India

Sector	Water Demand (BCM)			
	Standing Sub-Committee of MoWR		NCIWRD	
Year	**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

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

Impact of Climate Change

2.35 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 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 a signal 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 Sinchayee Yojana (PMKSY)

2.36 On 1 July 2015, the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) was launched with an outlay of Rs. 50,000 crores over a period of five years (2015-16 to 2019), to boost irrigation facilities. The motto of the PMKSY is "*Har Khet Ko Pani*" and "*More crop per drop*". The scheme will coordinate the ministries, departments, agencies and research and financial institutions engaged in the creation, use, recycling and potential recycling of water under a common platform so that a comprehensive and holistic view of the entire "water cycle" is taken into account, and proper water budgeting is done for all sectors, namely, household, agriculture and industries.

2.37 The PMKSY amalgamates ongoing schemes, viz., Accelerated Irrigation Benefit Programme (AIBP) of the Ministry of Water Resources, River Development & Ganga Rejuvenation; Integrated Watershed Management Programme (IWMP) of the Department of Land Resources; and On-Farm Water Management (OFWM) component of the National Mission on Sustainable Agriculture (NMSA) of the DAFC&W. The key objectives and deliverables of the Scheme are as follows:

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 extend and bridging the gap between irrigation potential created and 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 sub-district, 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.

Programme component

- **Accelerated Irrigation Benefit Programme (AIBP):** To focus on faster completion of ongoing major and medium irrigation projects, including national projects.
- **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 the IWMP & the MGNREGA, repair, restoration, renovation of traditional water bodies.
- **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.
- **PMKSY (Watershed):** Ridge area treatment, drainage line treatment, soil and moisture

conservation, water harvesting structure, livelihood support activities and other watershed works.

2.38 Various committees have been formulated for effective implementation and coordination. The Steering Committee is chaired by the Hon'ble Prime Minister and National Executive Committee (NEC) is chaired by the Vice-Chairman, Niti Aayog. Meetings of NEC are conducted at regular intervals for better inter departmental coordination and monitoring of progress of the programme. All state-level and district-level committees as envisaged under the programme are formulated.

2.39 During the financial year 2015-16, three participating ministries/departments have released a total sum of Rs. 7298.7 crores to states for the implementation of the programme. Under the 'Per Drop More Crop' Component, the total area brought under micro-irrigation in FY 2015-16 was about 5.4 lakh ha. All implementing ministries/departments have allocated Rs. 5717 crore for the PMKSY during 2016-17. A static website has been operationalised for the PMKSY, and the MIS for consolidating the information of all programme components has been operationalised. A page has been created for the PMKSY under the Bhuvan portal of the ISRO.

Way Forward

2.40 Scientific and systematic problem identification is necessary to understand the requirements of a particular area. Such requirements should be studied in detail to determine the constraints involved in the improvement of water management and better agricultural production. The major strategies for improving water use in agriculture are summarized as under.

Conveyance Loss

2.41 The operation and maintenance of irrigation systems is very poor 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

2.42 According to the Sub-Group-II Report of Ministry of Water Resources on Efficient Utilization of Existing Irrigation Facilities (2008), traditional flow irrigation has very low application efficiency, and 15-90 per cent of water may be saved and significant increase in yield achieved by adopting non-conventional methods like sprinkler, drip or micro-sprinkler irrigation. Compared to flow irrigation, when sprinkler irrigation is used, water saving in various crops ranges from 16 per cent to 69 per cent, and the increase in yield ranges between 3 per cent and 57 per cent. Similarly, as compared to traditional flow irrigation, drip irrigation saves water between 5 per cent to 68 per cent and increases yield between 10 per cent to 50 per cent. Although it involves more operations and maintenance (O&M) cost for energy charges compared to surface irrigation, the micro-irrigation system increases water use efficiency. Irrigation efficiency in drip irrigation is about 90 per cent, compared to about 65 per cent in the case of sprinkler irrigation and about 35-50 per cent in the case of conventional method of irrigation, as per the Central Water Commission studies, 1991. Drip irrigation technology irrigates plants at the root zone through emitters fitted on a network of pipes, called mains, sub-mains and laterals. The emitting devices could be drippers, micro-sprinklers, mini-sprinklers, micro-jets, misters, fan jets, micro-sprayers, foggers, etc., each designed to discharge water at prescribed rates. So far, under the National Mission on Micro Irrigation, an area of about 4 million ha has been covered under micro-irrigation.

Over-Exploitation of Ground Water

2.43 While achieving their high food grain production targets under the green revolution, and emerging as the major contributors of foodgrains to the national pool stocks, Punjab, Haryana, Uttar Pradesh, Andhra Pradesh, etc., have experienced serious groundwater depletion. The overexploited regions need to be given integrated treatment of i) artificial recharge of groundwater; ii) rainwater harvesting; iii) conjunctive use of surface water and

groundwater; iv) management of poor/marginal quality groundwater; v) water conservation by increasing water use efficiency; vi) regulation of groundwater development, etc. Separation of feeders for domestic and agricultural power, and timely but controlled supply for irrigation, help regulate groundwater use. Implementation of participatory irrigation through water user associations is the way out to empower and entrust village communities with the right and responsibility to collect electricity charges in overexploited blocks to regulate access through obligation on groundwater users to undertake rainwater harvesting and groundwater recharge. A gradual withdrawal of cultivation of rice, sugarcane and other water-guzzling crops from the overexploited western region of the country is the call of the day.

Secondary Storage

2.44 During the monsoon, the reservoirs reach the peak storage level, making water available even at the tail end of the system. Considering that irrigation water demand is minimum at this point of time, water should be stored in secondary storage structures constructed at feasible locations along the tail end of the canal system, and used when tail-end farmers face water shortage.

In-situ Moisture Conservation and Rainwater Harvesting

2.45 An ecologically sound conservation technique is recharging aquifers. This is carried out by impounding water in surface structures like ponds, khadins, tanks, check dams, gabions, etc. This helps create micro-storage for lifesaving irrigation and for replenishment of groundwater through seepage. Similarly, practices like zero tillage and sub-soiling were found useful as in-situ moisture conservation. Yet another effective technique is shallow inter-row cultivation and contour farming for conserving rainwater in the soil. The watershed approach has been found to be the best for these interventions and should be vigorously promoted.

Irrigation Development in Eastern & North-East Region

2.46 Although East and North East India is blessed with sufficient rainfall, groundwater resources lie underutilized to the extent of 58-82 per cent. There is a need for a shift in land use and cropping patterns in accordance with this region's climatic characteristics, water availability scenarios and food requirements. Hence, in the Eastern, North Eastern and coastal pockets of India, the priority should be to exploit the abundant availability of groundwater. In Assam, Bihar, Chhattisgarh, Orissa, parts of Jharkhand, Eastern Uttar Pradesh, West Bengal and other coastal regions and pockets, a battery of shallow and deep tube wells could be installed for withdrawing groundwater during the *rabi* season, which will also act as a sink for subsequent floods. For small and marginal farmers in the Eastern states, the provision of community tube wells and mobile pump sets may be encouraged. There is need to create irrigation potential in the Eastern and North Eastern states through adequate power supply by energizing new tube wells and pump sets and through soft credit for farmers for installing tube wells and pump sets.

On-farm Water Management

2.47 On-farm water management can reduce wasteful use of water and, at the same time, lead to increases in productivity. As the rates for irrigation water are generally low, and independent of the quantity of water used, farmers have no incentive to economize water use, and resort to wasteful water use practices. The All India Coordinated Research Programmes (AICRP) of the ICAR in water management network centres have successfully demonstrated 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 Waterlogging and Soil Salinity

2.48 Waterlogging leads to soil salinity. The problem of waterlogging is very often observed in surface

irrigation systems and also in areas of poor drainage, and results in the accumulation of water. Apart from lining the canals, drainage development—through either surface, sub-surface, bio-drainage, or a combined approach—should be accorded priority, followed by appropriate agronomic measures.

Water Pricing

2.49 Like any commodity available in abundance at little or no cost, irrigation water is heavily misused, with serious economic and ecological implications. The only way out is the adoption of volumetric, metered supply of water as soon as possible. As one of the most important natural resources, water needs a serious regulatory system of use to ensure that it is treated as a national property and used judiciously. Effective distribution and pricing is necessary for this. Not only regulation of water pricing, but also the regulation of the price of energy that goes into lifting and using water is needed to prevent its side effects on water as a natural resource.

Recycling of Water

2.50 Currently, reuse and recycling of waste water is not practised on a large scale in India. There is considerable scope and incentive to use this alternative in irrigation.

Emphasis on Awareness Generation & Training

2.51 Awareness training on the use of irrigation water in critical stages of crop growth under different soil and environment conditions should be imparted to farmers, and be an integral part of water resource development and management. Such training should be conducted for all categories of farming personnel, and should focus on information systems, sectoral planning, project planning and formulation, project management, operation of projects and their physical structures and systems and the management of water distribution systems.

Coordination & Convergence Mechanism

2.52 The key to higher, cost-effective yield and sustainable water use is efficient water management, and its precondition is the convergence of resources of various concerned line ministries and departments. For instance, for water conservation through groundwater recharge and rainwater harvesting, the efforts of watershed development project authorities have to converge with those of the ministries of rural development, agriculture, water resources, urban development and power, etc., to enable the project to deliver results effectively. Enhancing productivity of water using micro irrigation, supplemental and deficit irrigation is possible only through the combined efforts of the Ministries of Agriculture, Water Resources and Power. A coordinated action plan needs to be put in place through the collaborative efforts of the concerned ministries not only at the Central level but also at the state level.

Water Pollution

2.53 Under the National Water Quality Monitoring Programme, the Central Pollution Control Board (CPCB) has been monitoring the water quality of rivers in India in collaboration with State Pollution Control Boards. In its February 2015 report, based on water quality data for the years 2009-12, the CPCB identified 302 polluted river stretches in the country based on levels of BoD (bio-chemical oxygen demand, a critical parameter of water quality) levels.

2.54 The National River Conservation Plan (NRCP) aims to improve the water quality of polluted stretches of rivers by preventing pollution loads from reaching rivers by undertaking various pollution abatement works. The Ministry of Environment, Forest and Climate Change (MoEFCC) is working with state governments to make the NRCP a success. The works 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) riverfront development, such as improvement of bathing ghats, etc.

2.55 Pollution abatement/sewerage works are also being taken up under the schemes financed by the Ministry of Urban Development as well as the Ministry of Water Resources, River Development & Ganga Rejuvenation.

2.56 The efforts of state governments are supplemented by financial support for conservation of lakes and wetlands under the National Plan for Conservation of Aquatic Eco-Systems (NPCA), MoEFCC.

Way Forward

2.57 To address the problem of ever-increasing pollution loads in river and other water bodies, which are the lifeline of mankind, the following possible corrective measures can be adopted.

i. Reuse of treated sewage for agriculture and horticulture purposes.

ii. Use of sludge generated at sewerage treatment plants (STP) as manure and soil conditioner if such sludge does not contain heavy metal.

iii. Water use-efficient technologies such as drip irrigation, micro irrigation, sprinklers, etc., may be encouraged to reduce the pressure on water consumption by the agriculture sector and reduce the excessive withdrawal of groundwater.

iv. The farming community to be educated on the diversification of cropping patterns and introduce the crop varieties requiring minimum water.

v. An awareness campaign to be launched to apprise the farming community of the adverse effects of indiscriminate use of pesticides and fertilizers and of the benefits of compost, manure, sewage sludge, etc.

Forest Ecosystems

2.58 Forests are essential for maintaining favourable and stable conditions needed for sustained agricultural productivity. Organic matter is essential to maintain fertility, structure and water-holding capacity of soils in the high rainfall region. Forests provide food directly in the following categories: fruits, flowers, leaves, stems, seeds, roots, tubers, mushrooms, etc. Forests are vital for maintaining the hydrological cycle and regulating water flows and sub-soil water regimes, recharging aquifers and maintaining water flow in rivers and rivulets. However, the relationship between forests and water flow, especially low base flows, is not always as straightforward as often believed. Forest ecosystems are the source of a large number of rivers and rivulets in the country. Forested watersheds have better availability as well as quality of water than watersheds under alternative land uses.

2.59 The National Afforestation Programme is a major scheme that was launched in 2002-03. It is being implemented by the National Afforestation & Eco-Development Board (NAEB), MoEFCC. Over the 10 years of its implementation, the scheme has acquired a pan-India ambit. It is implemented by states of the country through a twin institutional set-up of Forest Development Agencies (FDA) at the forest division level and Joint Forest Management Committees (JFMC) at the village level. In 2010-11, the State Forest Development Agency (SFDA) was created to smoothen the fund flow from the NAEB to FDAs. This decentralized three-tier institutional structure (SFDA, FDA and JFMC) allows greater community participation, in both planning and implementation, to improve forests and the livelihood of people living in and around forest areas. An amount of Rs. 243.78 crore was released during 2014-15.

Agrobiodiversity

2.60 Agriculture remains the mainstream and one of the dominant drivers of economic growth in India. The direct and indirect drivers of loss of biodiversity, particularly in developing economies, may include a high rate of human population growth and high population density, increasing consumption, effects induced by technological change and inadequate awareness of biodiversity values among the public and at the decision-making levels. The demands of a growing human population for food, medicine,

fibre, fodder, shelter and fuel, along with the need for economic development, are increasing the pressure on biodiversity and ecosystems throughout the country. A reduction in agrobiodiversity would make farming communities vulnerable to future environmental changes and accentuate poverty.

2.61 To protect the agrobiodiversity, **17 agrobiodiversity hotspots** have been identified jointly by the Protection of Plant Varieties and Farmer's Rights Authority (PPVFRA) and the National Biodiversity Authority (NBA).

2.62 The National Biodiversity Authority has issued guidelines to states for identifying biodiversity heritage. Under Section 37 of the Biodiversity Act, 2002, the state may declare as biodiversity hotspots areas that contain significant domesticated biodiversity components and/or representative agro-eco-systems with ongoing agricultural practices that sustain this diversity.

Expert Committee on Agrobiodiversity

2.63 Section 13(1) of the Biodiversity Act defines the term "agro-biodiversity" as "biological diversity of agriculture-related species and their wild relatives" and provides for the constitution of a committee to deal with matters related to agrobiodiversity. In 2005, the National Biodiversity Authority constituted the Expert Committee on Agro-biodiversity to deal with the biological diversity of agriculture-related species and their wild relatives. The Expert Committee discussed various agrobiodiversity issues in the Act and provided valuable inputs and recommendations to the Authority.

Exemption of Biological Resources When Normally Traded as Commodities

2.64 Pursuant to the notification issued by the Central Government, biological resources which are normally traded as commodities are exempted from the purview of the Act under Section 40. Such exemption is available only when the notified item is normally traded as a commodity. However, if these biological resources are used for research, commercial utilization, bio-survey or bio-utilization for commercial utilization, previous approval of the NBA/SBB, as the case may be, is required as per the provisions of the Act.

2.65 The NBA has exempted 190 plant varieties, including several crop varieties. The NBA, in consultation with various stakeholders, is in the process of augmenting the list.

Relevance of the Nagoya Protocol

2.66 On 29 October 2010, the Nagoya Protocol on access and benefit-sharing was adopted in Nagoya, Japan. It recognizes the interdependence of all countries with regard to genetic resources for food and agriculture. The Protocol recognizes the special nature of genetic resources and their importance in achieving food security worldwide and for the sustainable development of agriculture in the context of poverty alleviation and climate change. It acknowledges the fundamental role of the International Treaty on Plant Genetic Resources for Food and Agriculture.

Fulfilment of Obligation to the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)

2.67 In 2002, India ratified the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), which creates the multilateral system of access and benefit-sharing. The ITPGRFA states that "contracting parties shall take necessary legal and other appropriate measures" to facilitate access to plant genetic resources for food and agriculture included in the multilateral system. As such, there is a need to harmonize the provisions of the Biodiversity Act with India's commitment to provide facilitated access to plant genetic resources in the multilateral system, and more particularly, to enable providers within India to use the standard material transfer agreement (SMTA) when exchanging such resources.

2.68 In exercise of the powers conferred by Section 40 of the BD Act and in fulfilment of the obligations of the Government of India to the ITPGRFA for facilitating

access to plant genetic resources for food and agriculture, the Central Government, in consultation with the National Biodiversity Authority, has declared that the Department of Agriculture, Cooperation & Farmers Welfare may, from time to time, specify such crops as it considers necessary from among the crops listed in the Annex I of the ITPGRFA, being food crops and forages covered under the multilateral system thereof, and accordingly exempted them from Section 3 and 4 of the said Act, for the purpose of utilization and conservation for research, breeding and training for food and agriculture. However, such exemption shall not be applicable for includes chemical, pharmaceutical and/or other non-food or feed industrial uses. Accordingly, out of the 64 crops at Annexure-I of ITPGFRA in notification of the Ministry of Environment & Forests and Climate Change (MoEFCC) dated 18.12.2014, 9 crops have been exempted by the Seed Division, Department of Agriculture, Cooperation & Farmers Welfare (DAC&FW). Details of such crops are given in **Annexure 2.3.**

National Biodiversity Authority and Protection of Plant Varieties & Farmers' Rights Authority

2.69 As per section 6 (3) of the BD Act, the provisions of this section viz. seeking approval of the NBA for obtaining IPR protection in or outside India for any invention based on any research or information on a biological resource obtained from India, shall not apply to any person making an application for any right under any law relating to protection of plant varieties enacted by Parliament *(Protection of Plant Varieties & Farmers' Right Act, 2001).*

Consultative Process

2.70 The NBA follows the principle of continued consultative process while implementing the provisions of the BD Act/ Rules and conducts meetings with several agriculture-related stakeholders, including the Department of Agriculture, Cooperation & Farmers Welfare (DAC&FW), Department of Agricultural Research and Education (DARE), CGAIR centres, Seed Industries, etc., for inputs whenever sought for.

Microbial Diversity

2.71 Microbial diversity is the largest of the diversities. However, what has been collected, characterized, conserved and utilized is not to the desired level, despite various public institutions (ICAR, DBT, CSIR, etc.) engaged in this effort. Their value and use in agriculture as bio-control and bio-fertilizer agents (*Trichoderma* and *Psuedomonas* and many endophytes) is assuming importance in our effort to develop ecologically and economically sustainable agriculture. Research needs to be strengthened to collect, conserve, and evaluate more and more microbes for addressing many more problems like mitigation of greenhouse gases from rice paddies. In this context the following interventions are important:

i. The farmers should be incentivized to practice agro-biodiversity on their farms. This will greatly help the bio diverse farmers and provide a new impetus. Ecological criteria would be a double benefit since organic agriculture is a mandate of the state also. International Federation of Organic Agriculture Movements (IFOAM) definition of organic cultivation includes biodiversity as a compulsory element.

ii. The definition of agro-biodiversity can be multiple crops on the field. For the sake of easy comprehension traditional definitions of mixed cropping as in Saatdhan of Rajasthan, Navadhanya of Karnataka, Baranaja of Uttarakhand and Pannendu Pantalu of Deccan can be accepted. The coexistence of 6 to 12 crops on the field denotes agro-biodiversity. Further, the crops must be complementary and companion such as millets and pulses, rice and legumes etc.

iii. Irrigation and electricity subsidies form a significant part of the agricultural subsidies. There is a case to extend similar assistance to dry land farmers who grow their crops only under rainfed conditions. They should be

treated as water conservers for the nation. It is estimated that every rainfed millet farmer conserves between 6 million to 10 million litres of water every cropping season in comparison to the rice and sugarcane farmers. This happens due to the principles of diversity they follow in which leguminous crops on the side of millets enhances soil fertility, increases soil moisture by fixing soil carbon. All these are critical elements in keeping soils alive and moist without demanding irrigation.

Climate Change

2.72 Climate Change refers to statistical variations in properties of the climate system such as changes in global temperatures, precipitation, etc., due to natural or human drivers over a long period of time. Climate change could drastically alter the distribution and quality of natural resources thereby adversely affecting livelihood security of people. It is a serious global environmental concern. It is primarily caused by the building up of Green House Gases (GHG) in the atmosphere. The global increase in carbon dioxide (CO_2) concentration is primarily due to fossil fuel use and land use change. Global warming is a specific example of the broader term 'climate change' and refers to the observed increase in the average temperature of the air near Earth's surface and oceans in recent decades. Its effect particularly on developing countries is adverse as their capacity and resources to deal with the challenge is limited. 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 trends and more frequent and intense extreme weather events are being observed across India in the recent years. Several areas have been identified as risk prone due to impact of climate change like coastal areas, Indo-Gangetic plains and the drought and flood prone regions of the country. Besides production from crops and livestock, fresh water and marine ecosystem is also likely to be affected due to warming of sea surface temperatures. Such climatic fluctuations could adversely affect agricultural sustainability resulting in unforeseen situational shortages which could also impact other economic sectors.

2.73 Agriculture is an important source of Green House Gas (GHG) emissions and **17.6 per cent** of the annual emissions were from agriculture in India during 2007 (INCCA, 2010). The major sources of emission in agriculture sector are enteric fermentation (63.4 per cent), rice cultivation (20.9 per cent), agricultural soils (13.0 per cent), manure management (2.4 per cent) and on-field burning of crop residues (2.0 per cent). Quantification and reduction of GHGs from agriculture is fundamental for identifying mitigation solutions that are consistent with the goals of achieving greater resilience in production systems, food security, guiding national planning for low carbon development, informing consumers' choices with regard to reducing their foot prints and supporting farmers in adopting less carbon intensive farming practices. Agriculture sector has the potential to reduce GHG emissions and can also contribute towards sequestering carbon in to vegetation and soils which has multiple advantages and also contributes towards enhancing the productivity and to the sustainability of agricultural production systems. Different farm management practices, fertilizer materials and application techniques can significantly towards GHG emission reduction and increased carbon sequestration rate.

Issues and Challenges

2.74 Vulnerability of India in the event of climate change is more pronounced due to its ever increasing dependency on agriculture, excessive pressure on natural resources and poor coping mechanisms. The warming trend in India over the past 100 years (1901-2000) is estimated to be 0.4 degree Celsius. The projected impact of further warming is likely to aggravate yield fluctuations of many crops. While in the short run the impact might not be severe, many crops may witness yield decline after 2020 when the temperature threshold limit of many crops might get breached. A one-degree Celsius rise in

mean temperature is likely to affect wheat yield in the heartland of green revolution. There is already evidence of negative impacts on yield of wheat and paddy in parts of India due to increased temperatures, increasing water stress and reduction in the number of rainy days. Irrigation requirements in arid and semi-arid regions are estimated to increase by 10 per cent for every 1 degree Celsius rise in temperature. Rise in sea level is also likely to have adverse effects on the livelihoods of fishermen and coastal communities. Climate change is likely to significantly alter the dynamics of extreme events such as tropical cyclones, associated storm surges and extreme rainfall events; possibly increasing their frequency and intensity. Low lying regions, including small islands, will face highest exposure to rising sea levels, which will increase risk of floods bringing more cultivable area under submergence and degradation.

2.75 Agriculture represents a core part of the Indian economy and provides food and livelihood activities to much of the Indian population. While the magnitude of impact varies greatly by region, climate change is expected to impact on agricultural productivity and shifting crop patterns. The policy implications are wide-reaching, as changes in agriculture could affect food security, trade policy, livelihood activities and water conservation issues, impacting large portions of the population. The impact of climate change on agriculture could result in problems with food security and may threaten the livelihood activities upon which much of the population depends. Climate change can affect crop yields (both positively and negatively), as well as the types of crops that can be grown in certain areas, by impacting agricultural inputs such as water for irrigation, amounts of solar radiation that affect plant growth, as well as the prevalence of pests.

2.76 Significant negative impacts are being projected in the medium-term (2010-2039) depending on the magnitude and distribution of warming. In the long run, the effect could even be more detrimental "if no adaptation measures are taken". The negative impact on agricultural production will imply significant percentage fall in the annual GDP. However, its fallout for livelihood security in the farming sector could be much more severe vis-à-vis other economic sectors. While short term mitigation measures would always demand immediate attention, the complexities of abiotic stress on crops and livestock in the long term would require intensive research to effectively address the adaptation processes required for making our production systems resilient to climate change.

2.77 India's commitments under Intended Nationally Determined Contributions (INDCs) submitted to the UNFCCC included all elements pertaining to climate change with a targeted approach to be fulfilled by 2030. The session of Conference of Parties (COP 21) involving 196 countries held at Paris, during December 2015 agreed to mitigate the climate change impact and targeted to maintain the global rise in temperature below 2 degree Celsius specifically by 1.5 degree Celsius, addressing particularly the emission of GHG and to create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2equivalent through additional forest and tree cover by 2030. In the context of agriculture, the major programmes, namely, National Mission for Sustainable Agriculture (NMSA), Pradhan Mantri Krishi Sinchayee Yojana (PKVY), Paramparagat Krishi Vikas Yojana (PMKSY), National Initiative for Climate Resilient Agriculture (NICRA), National Food Security Mission, Soil Health Card Scheme (SHC), Mission for Development of Integrated Horticulture (MIDH), etc., have been factored in the climate resilient initiatives. A specific sub-mission on Agroforestry has is also under pipeline for implementation.

Schemes & Programmes

National Mission for Sustainable Agriculture (NMSA)

2.78 NMSA, one of the eight missions under the National Action Plan on Climate Change (NAPCC), seeks to address issues associated with climate change. Adaptation and mitigation strategies were devised for ensuring food security, equitable access to food resources, enhancing

livelihood opportunities and contributing to economic stability of the people at the end. The mission got its full operational status during 2014-15.

2.79 The Mission focuses to transform Indian agriculture into a climate resilient production system through suitable adaptation and mitigation measures in the domain of crops and animal husbandry. The Mission interventions are judiciously embedded in research and development activities, absorption of improved technology and best practices, creation of physical and financial infrastructure and institutional framework, facilitating access to information and capacity building. While dryland agriculture would receive focused importance by way of developing suitable drought and pest resistant crop varieties with necessary institutional support, the Mission would also expand its coverage to rainfed areas for integrating farming systems with management of livestock and fisheries, so that the agricultural production system continues to grow in a sustainable manner. The Mission identifies ten key dimensions for promoting the sustainable agricultural practices in terms of adaptation and mitigation measures. The major components of mission area) Rainfed Area Development (RAD) components of the Mission focuses on Integrated Farming System, Value Addition & Farm Development Activities with emphasis not only on maximizing the farm returns but to mitigate the impacts of climatic aberrations; b)On-Farm Water Management (OFWM) focuses on enhancement of water use efficiency (WUE) by promoting micro irrigation, efficient water application & distribution system, secondary storage & drainage development and reduction of conveyance loss of water and conservation of resources ultimately reduces GHG and enhancing agricultural productivity and quality. However, this component has now been subsumed with the recently launched Centrally Sponsored Scheme "Pradhan Mantri Krishi Sinchai Yojana (PMKSY)"; c) Soil Health Management components aims at promotion of location as well as crop specific sustainable soil health management including residue management, organic farming; d) Climate Change & Sustainable Agriculture Modelling & Networking (CCSAMN) components aims at illustration of functional mechanism for dissemination of rainfed technologies, planning convergence and coordination in pilot blocks, research / model/ pilot projects for different agro climatic conditions on climate change adaptation & mitigation, capacity building trainings and networking projects on climate change adaptation and mitigation.

2.80 NMSA envisages sustainable agriculture growth through seventeen deliverables focusing on ten key dimensions of Indian agriculture. During Twelfth Five Year Plan, these deliverables have been mapped against the restructured missions/ Schemes of DAC&FW. The programmes subsumed under NMSA are: Rainfed Area Development Programme (RADP); National Mission on Micro Irrigation (NMMI); National Project on Organic Farming (NPOF); National Project on Management of Soil Health & Fertility (NPMSH&F); and Soil and Land Use Survey of India. These programmes address comprehensive soil health management; efficient water management practices and mainstreaming rainfed technologies.

National Agroforestry & Bamboo Mission (NAFM)

2.81 With the insisting desire of Hon'ble PM and with the approval of Union Cabinet, the National Agriforestry Policy was put into action in February, 2014. The ongoing National Bamboo Mission was also being implemented under the umbrella of MIDH so far. The newly formulated Sub-Mission on Agroforestry (SMAF) has been proposed to be implemented for a five-year period (2015-16 to 2019-20) embracing the ongoing National Bamboo Mission and other interventions of Agriforestry with an outlay of Rs. 990 crores under the umbrella of NMSA. The programme is now in the pipeline awaiting implementation throughout the country.

Policies

National Agroforestry Policy- 2014 (NAP)

2.82 National Agroforestry Policy- 2014 (NAP) was approved by GOI to bring about coordination, convergence and synergy among various elements of agroforestry, through horticulture, bund plantation, agroforestry, biomass retained in the field for a relatively longer period and thus enhance the carbon sequestration. Agroforestry systems have the potential for being an effective tool in climate change mitigation and adaptation strategy.

Way Forward

2.83 Agriculture will need to be progressively adapted to climate change and agricultural research system needs to be more oriented towards monitoring and evaluation of climate change and recommend changes in agricultural practices accordingly. This needs to be supported by the convergence and integration of traditional knowledge and practice system, information technology, geospatial technologies and biotechnology. Focus would be on improving productivity of rainfed agriculture. Further research on precision in climate change predictions with agricultural production systems to suggest suitable options for sustaining agricultural production; preparation of database on climate change impacts in agriculture; evaluation of impacts of climate change in selected locations; and development of models for pest population dynamics is to be undertaken.

2.84 Further, there is a need for synergy of activities being undertaken under various schemes addressing climate change adaptation and mitigation initiatives.

Drought Management

2.85 The year 2014-15 turned out to be a below average year for the agricultural sector in terms of rainfall. The south-west monsoon (June to September), which accounts for more than 70 per cent of the annual rainfall in the country, was 88 per cent of the long period average (LPA) during 2014-15.While the pre-monsoon period, from March to May 2014 witnessed 99 per cent of LPA rainfall, the post-monsoon period received only 68 per cent of LPA. This has largely affected the production of both kharif and rabi production during the agricultural season 2014-15. The erratic pattern of rainfall continued unabated in 2015-16. The cumulative rainfall during the monsoon season of 2015-16was deficient by 15 per cent deficient which was even higher than the 12 per cent rainfall deficit in 2014-15. As per the Indian Meteorological Department (IMD) report there was deficit rainfall in 18 States/UTs for the period between 1 June 2015 and 30 September 2015 as shown in **Table 2.6.** District-wise details of deficient and scanty rainfall during the monsoon season 2015-16 are given in **Annexures 2.4 and 2.5.**

Table 2.6: States with Deficiency in Rainfall

State/UT	Departure from Normal (%)
1. Nagaland	(-)50
2. Manipur	(-)28
3. Mizoram	(-)41
4. Bihar	(-)28
5. Uttar Pradesh	(-)46
6. Uttarakhand	(-)28
7. Haryana	(-)38
8. Chandigarh (UT)	(-)35
9. Punjab	(-)32
10. Himachal Pradesh	(-)23
11. Dadra & Nagar Haveli (UT)	(-)28
12. Daman & Diu (UT)	(-)49
13. Goa	(-)21
14. Maharashtra	(-)27
15. Telangana	(-)20
16. Puducherry (UT)	(-)24
17. Karnataka	(-)20
18. Kerala	(-)26

2.86 The Department of Agriculture, Cooperation & Farmers Welfare (DAC&FW) is mandated for coordination of relief efforts necessitated by drought. State Governments are primarily responsible for taking necessary relief in the wake of natural

calamities and are empowered to initiate immediate relief measure 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 items and norms in vogue for assistance. Details of amount sought and sanctioned from NDRF to various states during 2014-15 and 2015-16 is as under:

Table 2.7: Assistance sought and approved from National Disaster Response Fund (NDRF) for Natural Calamities (Drought & hailstorm) in the States

(Rs. in crores)

During 2014-2015				
S.No.	**State**	**Calamity**	**Amount sought**	**Amount approved**
1.	Haryana	Drought	4829.25	168.87
		Hailstorm	1925.97	369.09
2.	Karnataka	Drought	779.20	200.85
		Hailstorm	151.28	105.33
3.	Uttar Pradesh	Drought	4819.49	777.34
		Hailstorm	7573.70	2801.59
4.	Maharashtra	Drought	6013.28	1962.99
5.	Andhra Pradesh	Drought	1532.00	237.51
6.	Rajasthan	Hailstorm	11885.45	1447.73
7.	Bihar	Hailstorm	2041.10	791.42
8.	Telangana	Hailstorm	117.59	83.744
9.	Himachal Pradesh	Hailstorm	353.395	71.534
	Total:		**42021.71**	**9017.998**
During 2015-2016				
1.	Karnataka	Drought-K	3830.84	1540.20
		Drought-R	1417.14	#
2.	Chhattisgarh	Drought-K	6093.79	1276.25
3.	Madhya Pradesh	Drought-K	4821.64	2032.68
4.	Maharashtra	Drought-K	4002.82	3049.36
5.	Odisha	Drought-K	2217.08	815.00
6.	Telangana	Drought-K	2601.17	791.21
7.	Uttar Pradesh	Drought-K	2057.79	1304.52
8.	Andhra Pradesh	Drought-K	2000.56	433.77
9.	Jharkhand	Drought-K	2142.78	336.94
10.	Rajasthan	Drought-K	10537.02	1193.41
	Total:		**41722.63**	**12773.34**

K: Kharif, R: Rabi

 # Sub-Committee of National Executive Committee (SC-NEC) meeting is scheduled to be held on 5.4.2016.

2.87 The DAC&FW has nominated an Additional Secretary as Central Drought Relief Commissioner. The Crisis Management Group on drought headed by the Central Drought Relief Commissioner reviews situation with the representatives of all the Line Departments, as and when warranted.

2.88 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 stakeholder Ministries and Departments.

2.89 Ministry of Agriculture & Farmers Welfare through ICAR-Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad, has prepared detailed crop Contingency Plans for 600 districts **(Table 2.7).** States have been advised for preparing, updating and fine-tuning Contingency Plans for each district in consultation with CRIDA-ICAR and the State Agriculture Universities and to prepare location specific remedial measures based on these contingency plans in the event of late arrival of monsoon, long dry spells, scanty rainfall or drought conditions, tying up availability of seeds and other inputs for implementing the Contingency Plans. As seen from the experience of last year, these are highly useful in case of a deviant monsoon.

Table 2.8: Crop Contingency Plan

State	No of districts for which plans are available
Andhra Pradesh	13
Arunachal Pradesh	14
Assam	22
Bihar	38
Chhattisgarh	27
Gujarat	25
Haryana	19
Himachal Pradesh	12
J & K	22
Jharkhand	24
Karnataka	29
Kerala	14
Madhya Pradesh	50
Maharashtra	33
Manipur	6
Meghalaya	11
Nagaland	8
Odisha	30
Punjab	19
Rajasthan	33
Sikkim	4
Tamil Nadu	31
Telangana	9
Tripura	1
Uttaranchal	13
Uttar Pradesh	75
West Bengal	18
Total	**600**

2.90 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 and 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.

2.91 A meeting with States to review preparedness of kharif season, contingency plan and the availability of seeds, etc., was held on 2nd & 3rd June, 2015 by the DAC&FW. Availability of these inputs is being monitored and reviewed on a regular basis in the weekly Crop Weather Watch Group (CWWG) Meetings being held in the Department. Weekly video conference with States is also being held to get first-hand information about State's preparedness and to advise States appropriately whenever needed.

2.92 States were advised to keep aside about 5-10 per cent 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 allocation under Centrally Sponsored Scheme to the tune of 10 per cent may be utilized in flexible manner by the States to meet contingent requirement arising out of deficient rains.

2.93 To mitigate the adverse impact of drought, State Governments were advised to initiate advance remedial action e.g. 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 tubewells, 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 (IWWP) to verify their utility in harvesting the rainfall.

Box 2.3 : Relief Measures by the Government

To provide immediate relief to the farmers, in view of the deficit monsoon during kharif 2015, Cabinet Committee on Economic Affairs has approved a proposal for providing the following relief measures to the farmers:

i. **Implementation of Diesel Subsidy Scheme with an allocation of Rs.100 cr:** Government decided to provide diesel subsidy to the farmers to enable them to provide lifesaving irrigation through diesel pump sets in the drought and deficit rainfall areas to protect the standing crops. The farmers in the affected regions would be covered between South-West monsoon periods till 30th September, 2015. The scheme on diesel subsidy will be implemented with the participation of the State Governments/UT Administration, with a view to offset the cost of diesel used for pumping water for providing supplementary irrigation/protective irrigation. The scheme will be applicable to such districts/talukas/areas where the rainfall deficit is more than 50 per cent as on 15 July 2015, as reported by India Meteorological Department (IMD) or to such districts/talukas/areas, which have been declared as drought affected area by the respective State Govt./ UT Administration or areas with prolonged dry spell continuously for 15 days, i.e., scanty rainfall (deficit of 60 per cent or more of normal) for any continuous 15 days period, after the onset date of the monsoon as per reports of IMD. It is proposed to provide 50 per cent subsidy on the cost of diesel (Rs 2000 per hectares) to the affected farmers, limited to maximum of two hectares per farmer. Assistance so provided through subsidy shall be shared between the Government of India and the State Government/UT Administration concerned on 50:50 basis. The Government of Bihar, Nagaland and Jharkhand have informed that they have implemented the diesel subsidy scheme during kharif 2015.

ii. **Enhancement of ceiling on seed subsidy:** In order to partially compensate the farmers in the drought affected districts for the additional expenditure incurred in the sowing and /or purchasing appropriate varieties of drought resistant seeds it has been decided to raise the extant ceiling on seed subsidy by 50 per cent for distribution in drought notified districts. The enhancement is valid till 31.12.2015.

iii. **Implementation of interventions for saving perennial horticulture crops with an additional allocation of Rs. 150 cr:** Appropriate input support measures will be provided to rejuvenate water stressed horticulture crops. The scheme is proposed to be implemented in all drought affected districts/blocks in the country which are covered under Mission for Integrated Development of Horticulture (MIDH), being implemented by Dept. of Agriculture, Cooperation & Farmers Welfare. Farmers in the drought affected districts/blocks will be provided assistance at the rate of Rs. 6000/- per hectares as per cost norms for a maximum area of two ha per beneficiary for taking up appropriate combination of interventions. Assistance so provided through subsidy shall be shared between the Government of India and the State Government/ UT Administration concerned on 50:50 basis.

iv. **Implementation of additional fodder development programme with an allocation of Rs. 50 cr.:** Assistance will be provided for additional interventions for production of fodder for mitigating adverse impact of drought on livestock. Farmers in the drought affected districts/ blocks will be provided assistance at the rate of Rs.3200/- per hectares as per cost norms for a maximum area of two ha per beneficiary for taking up additional production of fodder in these districts/blocks. Assistance so provided through subsidy shall be shared between the Government of India and the State Government/UT Administration concerned on 50:50 basis.

CHAPTER-3

Farm Inputs and Management

3.1 The agricultural growth that India has experienced since independence is an outcome of efforts to ensure availability and use of high-quality seeds of high-yielding varieties; fertilizers; irrigation; pesticides; farm machinery and equipment; and agricultural credit. Foremost among the agricultural inputs credited for revolutionizing the agricultural sector are improved seeds and planting materials.

Seeds and Planting Material

3.2 Seed is considered the basic input for enhancing agricultural production and productivity. Efficacy of all other agricultural inputs, such as fertilizers, pesticides and irrigation, etc., as well as the impact of agro-climatic conditions, is largely determined by the quality of the seed used. The estimated contribution of seeds in the productivity is considered to be 20-25 per cent. Therefore, ensuring the availability of quality seeds for enabling farmers to achieve higher agricultural production is a strategic requirement.

3.3 The Indian seed programme largely adheres to the limited generation system for seed multiplication. The system recognizes three generations—breeder, foundation and certified seeds—and provides adequate safeguards for quality assurance in the seed multiplication chain to maintain the purity of variety as it flows from the breeder's backyard to the farmers. The Indian seed 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. In India, the public seed sector consists of national-level corporations, i.e., the National Seeds Corporation (NSC) and state-level organizations, viz., State Seed Corporations (SSCs) and seed companies. While the Seeds Act (1966), Seed Rules (1968) and Seeds (Control) Order (1983) provide the legal framework, the New Policy on Seed Development 1988 and National Seed Policy 2002 provide the road map for the development of the seed sector in the country. 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. Under the Seeds Act, State Seed Certification Agencies (SSCA), State Seed Testing Laboratories (STL), Central Seed Testing Laboratories (CSTL), Seed Law Enforcement Authorities (at the state level) and National Seed Research and Training Centre (NSRTC) were set up to deal with all matters relating to the regulation of quality seeds. In recent years, the private sector has started to play a significant role in the production and distribution of seeds. The organized sector (including both private and public sector companies) accounts for about 30-35 per cent of the total seeds distributed in the country. The unorganized sector, comprising mainly farm-saved seeds, accounts for the remaining portion. New opportunities have opened up for the export of seeds of several varieties of crops, particularly those varieties for which India has a competitive edge.

3.4 The details of production of breeder and foundation seeds as well as production of certified seeds from 2005-06 onwards is given in **Table 3.1**.

Table 3.1: Production of Seed (Metric Tonnes)

Year	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	9849	157616	3517664
2015-16	8621	149542	3435248

Source: ***Department of Agriculture, Cooperation & Farmers Welfare***

Release of New Varieties

3.5 The purpose of releasing newly evolved varieties of seeds is to introduce these to the public for cultivation in the region in which it is suitable. It enables farmers to choose varieties for cultivation in a region. Before a variety is released, it is tested on the All India Coordinated Trial of the ICAR for three years for performance and one year for pests and diseases. After release, the variety is notified under Section 5 of the Seeds Act, 1966 to bring the new varieties under the purview of seed law enforcement. During 2015-16, 111 new varieties of agricultural and horticultural crops were notified; in the current year, 43 new varieties have been notified. At present, 5150 varieties of different crops stand notified under Section 5 of the Seeds Act.

3.6 Six rice varieties from Bangladesh have also been notified based on the Protocol of Discussions among India, Bangladesh and Nepal for speedy release of new varieties signed on 17 February, 2013 at Dhaka, Bangladesh.

Seed Quality

3.7 Seed quality is maintained through seed certification, seed testing, seed labelling and seed law enforcement by the State Seed Certification Agencies, numbering 24 at present, functioning in various states. Seed testing is carried out by seed analysts who are experts in seed technology, and seeds being sold in the market are compulsorily required to be labelled as prescribed under the Seeds Act, 1966. Seed quality standards are prescribed under the Seeds Act, 1966 and Seed Rules, 1969. The label should contain the minimum prescribed seed quality standards.

3.8 To ensure the quality of seeds being sold in the market, state governments appoint Seed Inspectors under the Seeds Act, 1966 and the Seeds (Control) Order, 1983. These inspectors draw samples from seed packets being sold in the market and send these samples to the notified seed testing laboratories for quality checking. 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.

3.9 At present, 124 Seed Testing Laboratories are functioning and testing more than 6 lakh seed samples in the country. During the last five years, 82 Seed Testing Laboratories were strengthened and established along with training of manpower. Further, the DAC&FW has conducted a technical audit of existing Seed Testing Laboratories, evaluated their technical capability and proficiency and, accordingly, proposed further strengthening.

Hybrid Seeds

3.10 Hybrid seeds in cross-pollinated crops give higher yield; hence, to improve crop productivity, greater emphasis should be laid on hybrid seeds. The aggressive promotion measures undertaken for the use of hybrid seeds resulted in the increased demand and production of hybrid seeds in the country. The crop-wise requirement and availability of hybrid seeds during each of last five years as reported by the states is shown in **Table 3.2**.

Table 3.2: Requirement and Availability of Certified/ Quality Seeds of Hybrids ('000 tonnes)

S.No.	Crop	2011-12		2012-13		2013-14		2014-15		2015-16	
		REQ.	AV.	REQ.	AV.	REQ.	AV.	REQ.	AV.	REQ.	AV.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	Paddy	9.9	9.2	31.6	31.4	42.8	34.2	15.1	19.5	38.5	61.4
2	Maize	101.7	122.0	97.0	103.5	94.0	96.6	93.5	106.9	101.6	120.5
3	Jowar	13.1	13.9	13.3	14.0	7.9	10.2	15.6	19.0	17.7	20
4	Bajra	24.6	28.4	24.0	27.1	23.6	33.2	21.0	24.8	24.1	26.6
5	Arhar	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0
6	Sunflower	6.9	9.6	6.4	6.6	4.9	5.4	2.9	3.0	4.4	4.6
7	Safflower	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
8	Castor	3.4	4.5	4.0	4.3	3.4	4.3	7.1	8.4	6	6.1
9	Cotton	19.5	22.5	22.4	25.4	15.9	17.9	17.9	21.7	18.7	19.8
	TOTAL	**179.1**	**210.1**	**198.7**	**212.3**	**192.5**	**201.8**	**173.2**	**203.4**	**211.2**	**259.1**

Req: Requirement Av.: Availability

Export of Seeds

3.11 The country has a liberal seed export policy, which is being linked with the long-term plan for export of seeds. 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. In consultation with the National Seed Association of India (NSAI), National Seeds Corporation (NSC) and State Seed Corporations, the DAC&FW is developing a strategy for further streamlining the process of seeds export. The strategy will cover identification of crops/varieties with potential for export of seeds, present difficulties in export of seeds, suggestions for overcoming such bottlenecks, etc. In 2015-16, the EXIM Committee recommended 143 export proposals and 95 import proposals for the export of seeds and planting materials.

Seed Rolling Plan

3.12 Production of the right kind of certified seed requires at least three years of activities, beginning with the production of breeder seeds and followed by

that of the foundation seeds. This needs systematic planning and implementation of activities. It has been assessed that to achieve food production targets, there is a need to replace the existing seeds (seed replacement ratio) at the rate of 33 per cent for self-pollinated crops, 50 per cent for cross-pollinated crops and 100 per cent for hybrids.

3.13 It is well known that many farmers do not have access to certified seeds and depend on farm-saved seeds for boosting agricultural production. Further, the country is often affected by natural calamities of different magnitude and type, viz., flood, drought, cyclones, etc., during the normal cultivation season (kharif/rabi), when agricultural programmes are stranded and a contingency crop plan is resorted to for salvaging the situation. State governments are giving thrust to the creation of seed banks, wherein seed for emergency situations can be stored for use during unforeseen and unknown situations. 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 SRR, requirements of contingency situations like flood, drought, cyclones etc.

Protection of Plant Varieties and Farmers' Rights Authority

3.14 The legislation for Protection of Plant Varieties and Farmers' Rights (PPV&FR) was enacted in 2001 to fulfill its commitments to the agreement of Trade Related Aspects of Intellectual Property Rights (TRIPS) of the World Trade Organization (WTO). The Act provides for establishment of an effective *sui generis* system for protection of plant varieties by balancing the rights of farmers and plant breeders. On 11 November 2005, the Central Government established the "Protection of Plant Varieties and Farmers' Rights Authority" at New Delhi to implement the provisions of the Act. To facilitate the registration of plant varieties, the Authority has opened two branch offices of the Plant Varieties Registry, at Birsa Agricultural University, Ranchi and Assam Agricultural University, Guwahati. The Authority protects plant breeders' rights by registering the variety. Applications can be filed for registration of varieties of crop species as notified under various categories viz. new, extant, Variety of Common Knowledge (VCK) and Essentially Derived Varieties (EDV). The PPV&FR Act, 2001 also provides for the protection of the rights of farmers in respect of their contribution made in conserving, improving and making available plant genetic resources, and also enables them to register their varieties.

3.15 Ninety-two crop species have so far been notified for the purpose of registration by the Authority. Distinctiveness, Uniformity and Stability (DUS) test guidelines for 10 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 to 137 DUS centres/projects. 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 for conserving seeds of registered varieties to handle the orthodox or true seeds of the varieties of crop species notified for registration. For maintaining referral samples of perennial asexually/vegetative propagated crops, 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 Institute (CAZRI), Jodhpur. At its headquarters at New Delhi, the Authority maintains the National Register of Plant Varieties, which contains the details of the registered varieties of seed. The Authority publishes the monthly *Plant Variety Journal of India* (PVJ). The *PVJ* also contains important notices and circulars of the Authority. On the recommendation of the Authority, the Central Government issues gazette notifications on various statutory majors, including genera/species eligible for registration. The DUS test

guidelines on new crop species and passport data for the application are also published in the *PVJ* for inviting objection, if any, within a specified time frame.

3.16 During 2015-16, the Authority received 2468 applications representing 70 genera/species belonging to 328 new, 181 extant, 1957 farmers and 2 EDV categories. Highest number of applications were received for 1252 cereals, followed by 368 vegetables, 315 fruits, 209 legumes, 155 oilseeds, 84 cucurbits, 37 spices, 16 fibre crops and 32 others.

3.17 Strong linkages have been developed with the seed industry, and 139 stakeholders, including 98 private companies, have submitted applications for registration with the Authority. The Authority has issued 385 certificates of registration as on 31 December 2015, which include 63 certificates to the public sector, 122 to the private sector and 200 belonging to farmers. 65 certificates have been issued to new category, 120 extant (VCK) and 200 farmers category.

3.18 The Authority operates the National Gene Fund, constituted by the Government of India under Section 45 of the Act, Rule 70(2)(a) of PPV&FR Rules, 2003. It provides that the National Gene Fund could be utilized to support and reward 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 Agro-biodiversity hotspots across 7 agro-geographical zones.

Box 3.1: Plant Genome Saviour Community Awards

In consultation with the Government of India, the Protection of Plant Varieties and Farmers' Rights (PPV&FR) Authority instituted the Plant Genome Saviour Community (PGSC) Awards (maximum of five award per consisting of citation, and memento and cash of Rs. 10 lakh each). The awards aim to recognize the important contribution of farmers and farming communities, and their role in value addition in research and development in agriculture. These aim to implement the provisions of Section 45 of PPV&FR Act, 2001 and Rule 70 (2) (a) of PPV&FR Rules, 2003. This award is being conferred since 2009-10. As on 31 March 2013, the Authority had awarded the Plant Genome Saviour Community Award to 10 communities. The Central Government approved the Award for five committees for the year 2012-13. The selection process is in progress for the year 2013-14. The Authority has advertised the Award for the year 2014-15.

Under Section 39 (1) (iii) of PPV&FR Act, 2001, the Government of India has notified the Protection of Plant Varieties and Farmers Rights (Recognition and Reward from the Gene Fund) Rules, 2012, whereby a farmer who is engaged in the conservation of genetic resource of land races and wild relatives for economic plants and their improvement through selection and preservation and the material so selected and preserved has been used as donors of gene in varieties registrable under the PPV&FR Act, 2001 shall be entitled to Plant Genome Saviour Farmers Rewards (maximum of 10 Rewards per year comprising of a citation, memento and cash of Rs. 1 lakh each) & Plant Genome Saviour Farmers Recognition (Maximum 20 recognitions per year consisting of a citation and memento). So far, the Authority has conferred 10 Plant Genome Saviour Farmers Reward 10 and 15 Plant Genome Saviour Farmers Recognitions as on 31st March, 2013. The PGSC Reward and Recognitions for the last two years i.e. 2013 and 2014 are under finalization. The reward and recognition for the year 2015 have been advertised in newspapers.

Planting Materials

3.19 Horticulture has emerged as a powerful source of employment to millions of people right from production, post-harvest operation, chains of value addition, marketing and, ultimately, product development.

3.20 Despite continuous increase in the demand for horticultural products in the country, productivity and quality of several horticultural crops is much below the expected levels, due to inadequate availability of quality planting material of elite cultivars and rootstocks, large scale prevalence of old and senile orchards, poor tree canopy, low planting density, etc.

3.21 The DAC&FW is according highest priority to bridge this critical gap during the 12th Plan period to boost availability of quality planting material. Important actions taken in this regard include establishing of strong nursery infrastructure for mass multiplication of varieties, rootstocks in commercial fruit crops; mother blocks of improved varieties for mass multiplications of disease-free quality planting material; rootstocks bank to mitigate problems related to biotic and abiotic stress; ensuring that implementing agencies procure planting material only from accredited nurseries; import of poly embryonic/clonal facilitating rootstocks and planting material of improved varieties of fruit crops, especially for establishment of mother/scion/root, stock, blocks; popularizing tree Canopy Management to enhance production and productivity of horticulture crops, establishing excellence of horticultural crops all across the country.

Genetically Modified Crops in India

3.22 As per international convention, modern biotechnology refers to biotechnological techniques for the manipulation of genetic material and the fusion of cells beyond normal breeding barriers.

Cultivation of Bt Cotton in India

3.23 Cotton is the first, and, until now, the only GM crop which is commercially cultivated in India. Bt cotton was approved for commercial cultivation in the country by the Genetic Engineering Appraisal Committee (GEAC) of Ministry of Environment Forests & Climate Change (MoEF&CC) in 2002 for three Mahyco cotton hybrids for cultivating in the Central Zone and South Zone states, which was later also approved in 2005 for cultivation in the North Zone States (Punjab & Haryana). Area under Bt Cotton, which was 29,000 ha in 2002-03 (0.38 per cent of total cotton area) increased to about 118.35 lakh ha in 2014-15 (92 per cent of total cotton area). Presently, India is the 2nd largest producer, consumer and exporter of cotton in the world.

Impact of Bt Cotton in India

3.24 Bt cotton hybrids have proven to be the most accepted cotton technology by farmers in all the 10 major cotton growing states. In 2013-14, approximately 11.75 million hectares of BT cotton were cultivated, with an adoption rate of 94 per cent.

Bio-safety Regulatory Framework in India for Release of GM Crops

3.25 Genetically modified organisms (GMO) and products thereof, including GM crops, are regulated products in India under the provisions of the Environment (Protection) Act, 1986 and Rules 1989. These rules and regulations are implemented by the MoEF&CC, DBT and state governments through the following six committees:

i. the Recombinant DNA Advisory Committee (RDAC), under the DBT, gives advice and reviews regulatory procedures;

ii. the Review Committee on Genetic Manipulation (RCGM), under the DBT, monitors the safety-related aspects of ongoing research and activities including field trials;

iii. the Genetic Engineering Appraisal Committee (GEAC), under the MOEF&CC, gives approval for BRL-I and BRL-II field trials as well as for the release of any GM crop for commercial cultivation (it is the apex body of Government);

iv. a State-Level Committee and State Biotechnology Coordination Committee

(SBCC), under the state government, monitors the field trials at the state level;

v. a District-Level Committee, under the state government, monitors the field trials at the district level; and

vi. the Institutional Biosafety Committee acts through the institutes involved in trials for research.

3.26 The DAFC&W 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.

Central Schemes in the Seed Sector

3.27 A Central Sector Scheme **"Development and Strengthening of Infrastructure Facilities for the Production and Distribution of Quality Seeds"** was under implementation on all-India basis since 2005-06 to address the gap in infrastructure and to increase availability of quality seeds for different crops through various interventions. The objective of the scheme was to ensure production and multiplication of high yielding certified and quality seeds of all crops in sufficient quantities and to make the same available to farmers across the country on time and at affordable prices.

3.28 This scheme along with another Central Sector Scheme "Implementation of PVP 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 1 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. Total Budget of Rs. 219.70 crore was allocated to SMSP for 2014-15, which was reduced to Rs. 185.50 crore at RE stage, which was released to the State Governments/ Implementing agencies. For the year 2015-16, against BE allocation of Rs. 150.80 and RE of 136.50 crore, up to Rs. 136.50 crore has been released up to 30.03.2016. Further at the time of Zero Based Budgeting, only Seed Village programme was identified for Central: State share apart from already identified components. Again as per direction of NITI Aayog and M/o Finance, sharing pattern of Seed Village Programme and Certified Seed Production through Seed Village Programme is changed to 60:40 and sharing pattern of remaining components are as per EFC/CCEA approval.

Table 3.3 Sharing Pattern under the Sub Mission on Seed and Planting Material

Sl. No.	Intervention	Centre: State Share
1.	Strengthening for Seed Quality Control	100% GOI share except one sub-component viz. Strengthening of Seed Law Enforcement (75:25)
2.	Strengthening of Grow Out Test(GOT) Facilities	100% GOI
3.	Support to Seed Certification Agencies	25%: 75%
4.	Seed Village	60% (GOI) :40% (States)
5.	Certified seed production through seed villages	60% (GOI): 40 % (States)
6.	Seed Processing Plant	100 % GOI

Sl. No.	Intervention	Centre: State Share
7.	Seed Storage	100% GOI
8.	Transport Subsidy	100 % GOI
9.	National Seed Reserve	100 % GOI
10.	Application of Bio-technology in Agriculture	100 % GOI
11.	Public Private Partnership in Seed Sector	60% (GOI): 40 % (States)
12.	Assistance for Boosting Seed Production in Private Sector	100 % GOI
13.	Support to Sub-Mission Director and Survey / Studies	100 % GOI
14.	PPV&FRA	100 % GOI

3.29 The salient achievements of the SMSP during 2015-16 are listed below.

i. Under the Seed Village Programme to upgrade the quality of Farm-Saved Seeds grants-in-aid amounting to Rs. 108.50 crore was provided during the year 2014-15, 47981 seed villages were organized and 188.91 lakh quintals of seeds produced.

ii. During the year 2015-16 an amount of Rs. 57.76 crore (GOI share) released and 8987 seed villages organized and 24.45 lakh quintal seeds produced (as reported as on date).

iii. Availability of quality seeds has increased from 140.51 lakh quintals in 2005-06 to 343.52 lakh quintal during 2015-16, and Seed Replacement Ratio (SRR) of major crops has also increased significantly.

iv. For creation of seed infrastructure facilities for public sector an amount of Rs. 19.877 crore had been released and 1.20 lakh quintals of seed processing capacity and 4.90 lakh quintals of seed storage capacity during 2014-15.

v. During the year 2015-16, an amount of Rs 12.34 crore grant in aid was provided to create 1.75 lakh quintal seed processing capacity and 2.97 lakh quintal seeds storage capacity (as on date).

vi. For strengthening of State Seed farms, grants-in-aid of Rs. 3.80 crore has been released during 2014-15. This component is not in operation during 2015-16.

vii. For certified seed production of oilseeds, pulses, green manures and Fodder through Seed Village an amount of Rs. 11.666 crore has been released during 2014-15.

viii. During 2015-16 an amount of Rs. 1.3266 crore (GOI share) was released for certified seed production of pulses, oilseeds, green manure and fodder through Seed Village programme.

ix. An amount of Rs. 0.937 crore was reimbursed for movement of 75,786 quintal of seeds under the component of transport subsidy on movement of seeds NE States etc during 2014-15.

x. During 2015-16, an amount of Rs. 2.996 crore reimbursed for movement of 1.47 lakh quintal of seeds (up to as on date).

xi. Under quality control component of SMSP 26 seed testing lab and State Seed Certification Agencies and 7 Grow- Out Test facilities were upgraded as well as 5 training were conducted and 375 officials were trained in 2015-16 and during the current year, one seed testing lab and State Seed Certification Agencies and one Grow- Out Test facilities were upgraded.

xii. 475 projects have been sanctioned under the component Assistance for Boosting Seed

Production in private sector for the small entrepreneurs in 16 States with 101.10 lakh quintals seed processing capacity and storage capacity of 35.09 lakh quintals.

Infrastructural Development in the Seed Sector

3.30 In order to establish and strengthen infrastructure facilities for production and distribution of quality seeds, grants-in-aid for creating facilities of seed cleaning grading, processing, packing and seed storage are being provided. The financial assistance for strengthening of existing Seed Corporations in respect of above mentioned infrastructure is also considered on case to case basis. The seed processing and seed storage capacity created under above scheme during the last five years is as under.

Table 3.4 Seed Processing and Seed Storage Capacity

S. No.	Item/component	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
1.	Seed Processing capacity (Lakh Qtl.)	7.75	19.86	8.92	5.94	1.60	3.30	1.20	1.75**
2.	Seed Storage Capacity (lakh qtl.s)	6.42	19.96	4.98	5.75	5.68	0.40	4.90*	2.97**

**The physical progress is yet to be received from implementing agencies.*

*** Target*

National Seed Reserve

3.31 The establishment and maintenance of the Seed Bank Programme has been re-structured as the National Seed Reserve for implementation during the remaining period of 12th Plan with effect from 2014-15 – 2016-17. The basic objectives of the scheme are to meet the requirement of seeds of short and medium duration crops during natural calamities and unforeseen conditions. The National Seed Reserve (NSR) programme is implemented by 22 implementing agencies in the country, namely, NSC, State Seeds Corporations and State Department of Agriculture Tamil Nadu, Himachal Pradesh and Jammu & Kashmir.

3.32 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. Assistance is also provided for maintenance of certified and foundation seeds of identified crops, construction of seed godown, establishment of seed processing plant, Cost of Material handling equipment, cost of service out sourced and computerization & networking facilities, besides price differential cost for left over stock of seeds as per norms of the scheme.

3.33 The targets, achievements and amount released to the participating agencies during 2014-15 and 2015-16 (up to July 2015) are as under.

Table 3.5: Target Achievements and Amounts Released to Participating Agencies (in lakhs of rupees)

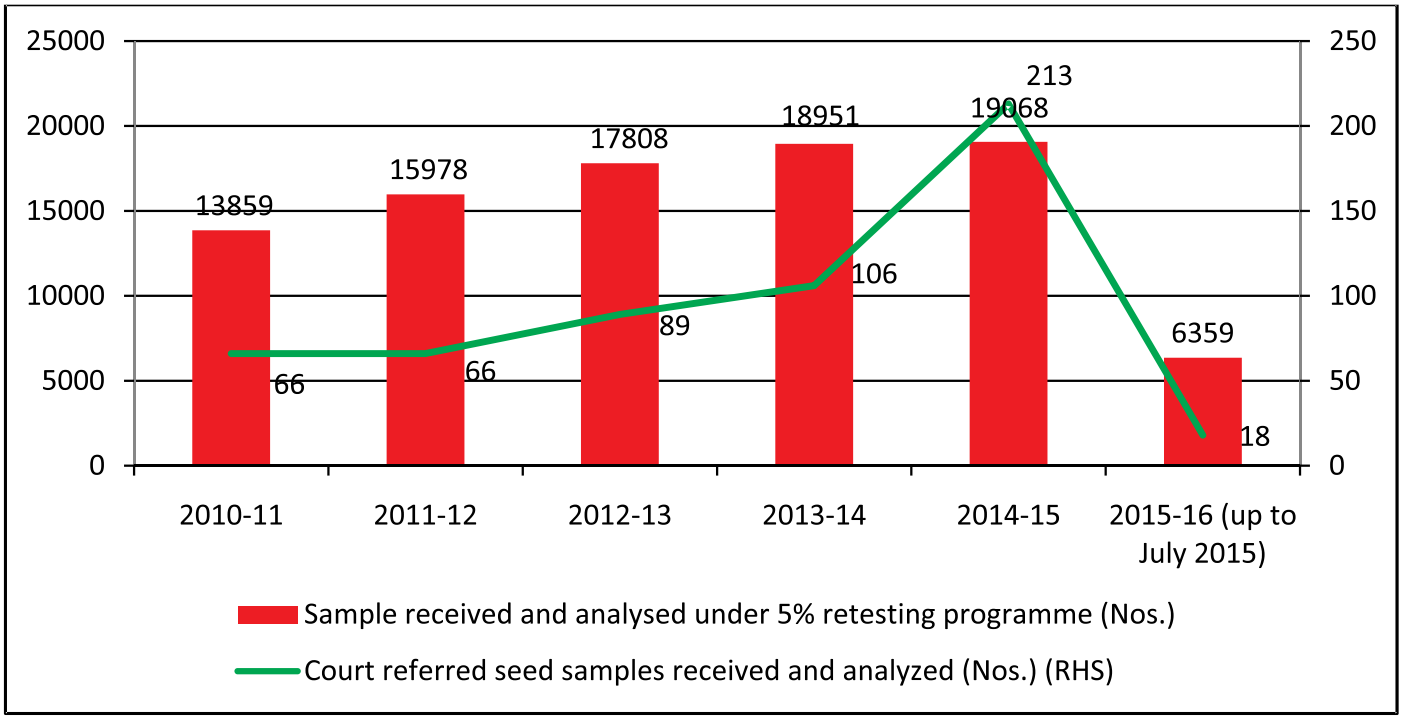
Year	Targets of Physical quantity in lakh quintals	Physical Achievement in lakh quintals	Amount released to implementing agencies
2014-15	3.65	2.29	1382.00
2015-16	3.65	3.00 (Target)	155.78 (up to July 2015)

National Seed Research and Training Centre (NSRTC)

3.34 The National Seed Research and Training Centre (NSRTC), Varanasi, is an apex Institute under Ministry of Agriculture & Farmers Welfare to impart National level training and to organize national workshops, conferences, congress, symposia, trainings etc., on seed related topics. The primary objective of establishing the NSRTC is to have a separate National Seed Quality Control Laboratory, to serve as a Central Seed Testing Laboratory (CSTL), under the Seeds Act, and to have a Referral Laboratory for evaluation of seeds under a court of law. Further, in order to obtain uniformity in seed testing at the national level, the CSTL is responsible to coordinate and monitor the functioning of all the notified State Seed Testing Laboratories across the country. More importantly, for facilitating International movement of seeds, the CSTL is a member laboratory of International Seed Testing Association (ISTA), Zurich, Switzerland for seed testing and issuing International seed movement Certificates on behalf of Government of India after obtaining accreditation.

3.35 The details of the seed sample received and analysed during the last five years are depicted below.

Figure 3.1: Seed Samples Received and Analysed



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

3.36 National Seeds Corporation Ltd. (NSC) and State Farms Corporation of India Ltd. (SFCI) are working under the administrative control of the Ministry of Agriculture & Farmers Welfare. To bring about greater synergy in production and distribution of quality seeds, it was decided to amalgamate SFCI with NSC. The Cabinet in its meeting held on 26.12.2013 approved the amalgamation of State Farms Corporation of India Ltd (SFCI) with National Seeds Corporation (NSC). After completion of codal formalities, the Ministry of Corporate Affairs issued sanction for amalgamation of SFCI with NSC with effect from 1 April 2014.

3.37 The NSC was established in 1963 under the Companies Act, 1956, with the objective of producing

and distributing seeds of high quality to the farmers. The Corporation undertakes production of seeds through contract growers, agricultural universities, etc. The NSC has played a key role in the success of Green Revolution in 1960s by importing 18,000 tonnes of Dwarf Mexican wheat. The NSC works with the mission of contributing to the prosperity of the farmers through supply of quality seeds and other agro inputs and with a vision to lead the Indian Seed Industry by producing and marketing quality seed of wider ranges.

3.38 Presently, the NSC undertakes production of seed of 60 crops and 600 varieties/hybrids consisting of cereals, millets, oilseeds, pulses, fodder, fibres, green manure, potato and a wide range of vegetable crops. Apart from the seed production of varieties, the NSC also undertakes production of hybrid seeds of maize, sorghum, bajra, paddy, cotton, sunflower, castor, vegetables, etc.

3.39 The Corporation has shown remarkable growth both in terms of the total production of seed and its marketing.

3.40 The total quantity of seed produced during 2013-14 was 14,28,575 qtls. Similarly, the turnover of the Corporation through the marketing of seed has increased to Rs. 738.74 crore during 2013-14 from Rs. 691.25 crores of 2012-13. This increase in the production and marketing of the seeds was due to the increasing demand for quality seeds by different consumers namely farmers and State Departments like Agriculture and State Seed Corporations. Further the Corporation has also made a policy of increasing the production of the high value low volume seeds of crops like pulses and oilseeds and has also diversified its production activity to increase the production of hybrid of field crops and vegetables. A substantial quantity of oilseeds, pulses and maize has also been sold under the Govt. of India schemes like ISOPOM and NFSM during the period. NSC paid a dividend of Rs. 4.12 crore to the GOI for the year 2013-14. During 2014-15 NSC earned profit after tax (PAT) of Rs. 38.84 crores as compared to Rs. 54.07 crores during 2013-14, and declared dividend Rs. 8.13 crore @ 15% on prorate basis on the paid up capital of the corporation. A quantity of 15.51 lakh Qtl seeds has been procured during the financial year 2014-15. NSC is undertaking seend 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 vegetables crops. Dividend for 2015-16 will be paid by the NSC in October/ November, 2016 after the Annual General Meeting (AGM) of shareholders.

Integrated Nutrient Management

3.41 Chemical fertilizers are the immediate source of nutrients in soils. It provides a vital input for the growth of agriculture and is an inevitable factor that has to be reckoned with the attainment self-sufficiency goal in production of foodgrains. Apart from the primary nutrients ('N', 'P', 'K'), the secondary and micro-nutrients are also required for plant growth. Calcium, magnesium and sulphur are termed as secondary nutrients and deficiencies in supply of these nutrients reduce the efficiency of primary nutrients by restricting the yield to a lower level. Hence, to obtain optimum results, crops have to be supplied with secondary nutrients in addition to primary nutrients. Micro-nutrients are a group of nutrients which are essential for plant growth in minute quantities. Intensive cropping depletes all nutrients, including micro-nutrients, from the soil. Therefore, selective use of micro-nutrients is necessary for increasing agricultural production.

Assessment of Requirement of Chemical Fertilizers

3.42 At present, the country has achieved 80 per cent self-sufficiency in production capacity of urea. As a result, India could manage its substantial requirement of nitrogenous fertilizers through the indigenous industry. Similarly, 50 per cent indigenous capacity has developed in respect of phosphatic fertilizers to meet domestic requirements. However, the raw materials and intermediates for the same are largely imported. For potash (K), since there are no viable sources/reserves in the country, its entire requirement is met through imports.

3.43 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 basis of cropping pattern, consumption pattern, cropped area, irrigated area, requirement of nutrient in soil as per soil health status etc.

3.44 After consultation with states, the 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.

Growth of Fertilizer Industry

3.45 The installed capacity of fertilizers has reached 123.83 LMT in respect of nitrogen and 62.20 LMT in respect of phosphatic nutrient in the year 2014-15, making India the 3rd largest fertilizer producer in the world. The rapid build-up of fertilizer production capacity in the country has been achieved as a result of a favorable policy environment facilitating large investments in the public, co-operative and private sectors.

3.46 At present, there are 30 large size Urea plants in the country manufacturing urea, 21 units manufacturing DAP and complex fertilizers and 2 units manufacturing ammonium sulphate as a by-product. Besides, there are 104 medium and small-scale units in operation producing single super phosphate (SSP). The sector-wise installed capacity is given in **Table 3.6**.

Table 3.6: Installed Capacity by Sector

S. No.	Sector	Capacity (LMT)		Percentage share	
		N	P	N	P
1	Public Sector	34.94	3.99	28.22	6.41
2	Cooperative Sector	31.69	17.13	25.59	27.54
3	Private Sector	57.19	41.08	46.19	66.05
	Total	123.83	62.20	100.00	100.00

Source: Department of Fertilizers

3.47 The production of Urea, DAP and Complex Fertilizers during last 5 years are also given below:

Table 3.7: Production of Urea, DAP and Complex Fertilizers (in LMT)

Sector	2010-11	2011-12	2012-13	2013-14	2014-15
	Urea				
Public	62.67	62.74	63.73	67.73	69.29
Cooperative	62.43	59.19	66.42	65.90	63.51
Private	93.71	97.91	95.60	93.52	93.05
Total	**218.81**	**219.84**	**225.75**	**227.15**	**225.85**
DAP					
Public					
Cooperative	9.77	14.92	19.43	14.32	14.04
Private	25.60	24.71	17.04	21.79	20.40
Total	**35.37**	**39.63**	**36.47**	**36.11**	**34.44**

Sector	2010-11	2011-12	2012-13	2013-14	2014-15
	Urea				
Complex					
Public	12.48	13.02	12.48	12.20	13.34
Cooperative	32.02	24.58	14.34	17.61	19.28
Private	42.77	40.10	34.98	39.32	45.70
Total	**87.27**	**77.70**	**61.80**	**69.13**	**78.32**

Source: Department of Fertilizers

New Urea Policy 2015

3.48 The New Urea Policy-2015 (NUP- 2015) was notified on 25th May 2015 and will be implemented from 1st June 2015 to 31st March 2019 with the objective to maximize indigenous urea production; promote energy efficiency in the urea units; and to rationalize the subsidy burden on the Government of India. These objectives will be achieved by supply of gas at uniformed price to all indigenous urea units; revision of pre-set energy consumption norms of all gas based urea units; and simplification of provisions for calculation of subsidy above re-assessed capacity.

3.49 The NUP 2015 will enable the domestic urea sector to become energy efficient. It would rationalize the subsidy burden and incentivize the urea units to maximize their production at the same time. It would ensure timely supply of urea to the farmers at the same Maximum Retail Price with lesser financial burden on the exchequer. The scheme of pooling of gas for urea sector notified by the Ministry of Petroleum & Natural Gas (MoPNG) in May 2015 will ensure supply of gas to all urea units at a uniform price. Therefore, it will minimize effect of the external factors on operations of a unit and urea unit will have to focus on energy efficiency measures and reducing cost to remain competitive and viable. This would create an environment to encourage the urea units to adopt best available technology in the world and become globally more competitive. It will result in additional production of around 17 lakh MT annually and savings in energy shall reduce the carbon-footprint thus would be more environment friendly.

Consumption of Fertilizers in India

3.50 All-India average consumption of fertilizers increased from 69.84 kg per ha in 1991-92 to 128.08 kg per ha in 2014-15 (**Table 3.8**).

Table 3.8: Consumption of Fertilizers (NPK Nutrients, lakh tonnes)

S. No		1991-92	2000-01	2012-13	2013-14	2014-15
1.	Nitrogenous (N)	80.46	109.2	168.21	167.50	169.46
	Phosphatic (P)	33.21	42.15	66.53	56.33	60.98
	Potassic (K)	13.61	15.67	20.62	20.99	25.32
	Total (N+P+K)	**127.28**	**167.02**	**255.36**	**244.82**	**255.76**
2.	**Consumption of Fertilizer, (Kg / Ha)**	**69.84**	**89.63**	**131.36**	**118.55**	**128.08**

Source: State Governments

Table 3.9: Consumption of Fertilizers in India (Lakh Tonnes)

S.No.	Fertilizers	1991-92	2000-01	2012-13	2013-14	2014-15
1.	**Urea**	140.04	191.86	300.02	306.00	306.10
2.	**DAP**	45.18	58.84	91.54	73.57	76.26
3.	**MOP**	17.01	18.29	22.11	22.80	28.53
4.	**NPK Complex**	32.21	47.80	75.27	72.64	82.78
5.	**SSP**	31.65	28.60	40.30	38.79	39.89

Source: State Governments

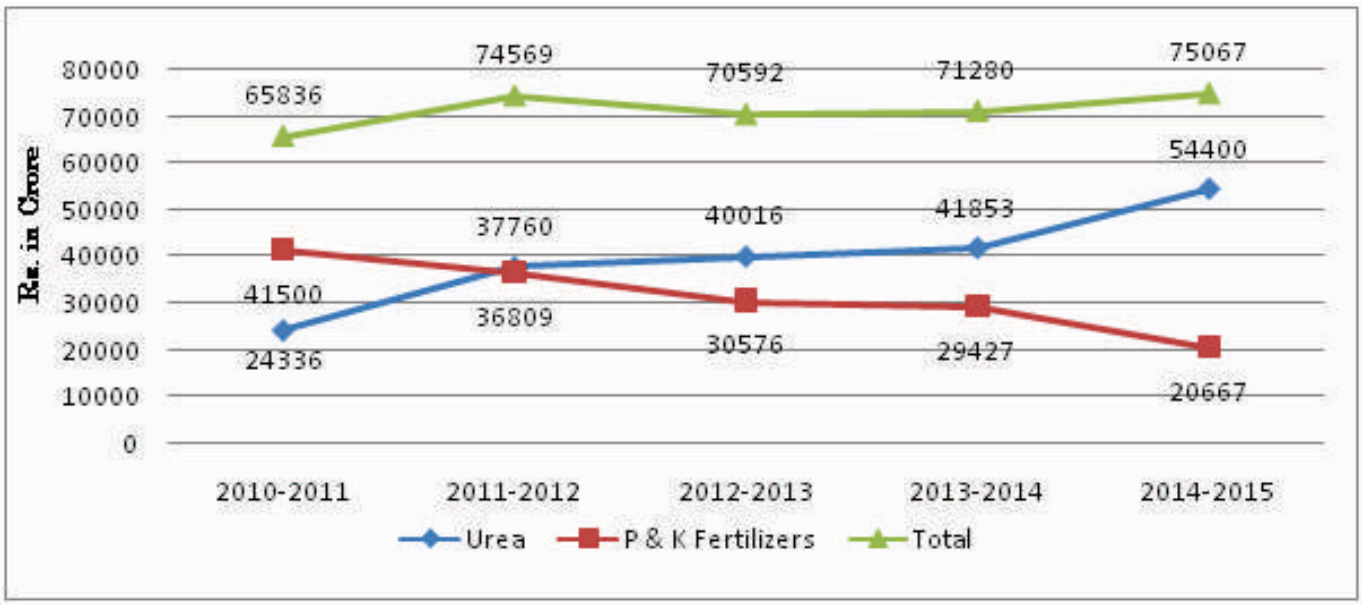
3.51 To ensure adequate availability of fertilizers, the Department of Agriculture, Cooperation & Farmers Welfare (DAC&FW) in consultation with Department of Fertilizers makes an assessment of the requirement for major fertilizers namely, Urea, DAP, MOP and Complex fertilizers before each cropping season viz. Kharif (1 April to 30 September) and Rabi season (1 October to 31 March) in consultation with all the states and concerned agencies. Requirement of fertilizers is assessed on the basis of requirements of N, P & K nutrients, which is calculated after the comparison of consumption in last season vis-à-vis recommended dose. Gross Cropped Area, Irrigated Area and Cropping Pattern are also taken into account while calculating the total requirements of N, P & K nutrients.

3.52 Further, to ensure the availability of adequate quantity and proper quality of fertilizers to farmers, fertilizer was declared as an essential commodity under Essential Commodities Act, 1957. Fertilizer (Control) Order (FCO), 1985 was promulgated to regulate the price, quality and distribution of fertilizers in the country.

Fertilizer Subsidies

3.53 During 2010-11 to 2014-15 the subsidy disbursed in Urea witnessed an increasing trend from Rs. 24336 crores in 2010-11 to Rs. 54400 crores in 2014-15, whereas, subsidy released has a decreasing trend in case of P&K Fertilizers from Rs. 41500 crores in 2010-11 to Rs. 20667 crores in 2014-15. Details of subsidies released and disbursed during the period are given in **Figure 3.2**.

Figure 3.2: Subsidy Disbursed (2010-11 to 2014-15)



Source: Department of Fertilizers

Balanced Use of Fertilizers

3.54 Balanced use of fertilizers is normally defined as the timely application of all essential plant nutrients (which include primary, secondary and micronutrients) in readily available form, in optimum quantities and in the right proportion, through the correct method, suitable for specific soil/crop conditions. Balanced use aims at ensuring adequate availability of nutrients in soil to meet the requirement of plants at critical stages of growth.

3.55 The DAC&FW has been promoting soil test 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.

3.56 In order to promote balanced fertiliser application, Government has been providing grant for setting up / strengthening of soil testing laboratories, trainings and demonstrations on balanced use of fertilizers and promotion of micro-nutrients across various Plan periods. At present, there are 1,244 Soil Testing Laboratories with analysing capacity of 1.78 crore samples per annum. State-wise details are given at **Annexure 3.1**.

3.57 The Government is taking the following measures to promote the balanced use of fertilizers.

1. Soil Health Management (SHM)

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

2. Soil Health Card (SHC) scheme

In 2014-15, Soil Health Card Scheme was introduced to assist State Governments to issue soil health cards to all farmers in the country. It supplements the ongoing scheme to create/strengthen capacity in terms of rapid and low-cost diagnostic techniques, mobile laboratories, portable soil testing kits and referral labs. It provides improved and targeted guidelines to manage deficiencies and scientific expertise in diagnostic and management of nutrients deficiencies.

Soil health card will provide 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. Soil status will be assessed regularly every 3 years so that nutrient deficiencies are identified and amendments applied. Salient features of the Soil Health Card scheme are as follows: -

Soil Sampling

i. For the first time a unified soil sampling criteria has been proposed.

ii. Samples are to be collected at a grid of 2.5 ha in irrigated area and 10 ha in un-irrigated area.

iii. GPS based soil sampling has been made mandatory so as to create a systematic database and allow monitoring of changes in the soil health over the year.

Soil analysis

i. Uniform soil testing methodology is being adopted.

ii. 12 Soil Health parameters viz. primary nutrients (NPK); secondary nutrient (S); micronutrients (B, Zn, Mn, Fe & Cu); and others (pH, EC & OC)are being analysed for comprehensiveness.

iii. It is for the first time that a country-wide campaign for the training of soil testing staff of has been started in the scheme.

iv. Analysis of secondary and micronutrient is now mandatory.

Issue of Soil Health Card

i. Uniform format of Soil Health Card has been adopted.

ii. Scientifically sound fertilizer recommendation approach is being adopted for soil test based crop-wise fertilizer recommendation in the soil health card.

iii. Soil health cards to the individual farmer will be issued within 2 years and their renewal after 2 years interval.

Soil Health Card portal

i. Soil Health Card portal has been developed for registration of soil samples, recording test results of soil samples and generation of Soil Health Card (SHC) along with Fertilizer Recommendations. This is a single, generic, uniform, web based software accessed at the URL www.soilhealth.dac.gov.in.

ii. It promotes uniform adoptions of codes, e.g., Census Codes for locations. 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.

iii. Soil Health Card portal aims to generate and issue Soil Health Cards based on either Soil Test-Crop Response (STCR) formulae developed by ICAR or General Fertilizer Recommendations provided by State Governments. Based on test results, these recommendations will be calculated automatically by the system. Micronutrients suggestions will also be provided by the system.

iv. The System envisages building up a single national database on soil health for future use in research and planning.

Box 3.2: Neem-coated Urea

Neem coated urea (NCU) was notified as a provisional fertilizers under the FCO, 1985 in the year 2003. In the year 2010, it was incorporated as regular fertiliser in Schedule I of the Fertiliser (Control) Order, 1985. Though it was a notified fertiliser prior to May 2014, the indigenous manufacturers of urea were allowed to produce neem coated urea up to a maximum limit of 35 per cent of their total production of subsidized urea. Government has been progressively transitioning to a position on 100 per cent of indigenous NCU, besides graduating from an optional to a mandatory approach, through the announcement of following measures:

- In January 2015, the Government of India removed the cap/restriction of 35 per cent on the production of neem coated urea and the indigenous producers of urea were allowed to produce neem coated urea up to maximum of their total production of subsidized urea.
- In March 2015, the Government of India decided to make it mandatory for all the indigenous producers of urea to produce 75 per cent of their total production of subsidized urea as neem coated urea.
- In May 2015, the Government of India decided to make it mandatory for all the indigenous producers of urea to produce 100 per cent of their total production of subsidized urea as neem coated urea
- The States were asked to educate farmers on the benefits of neem coated urea and to advise them to apply the dose taking into account the enhanced efficiency of neem coated urea.
- Doordarshan and AIR are telecasting/broadcasting programmes on benefits of use of neem coated urea. DAVP is also giving print advertisements in newspapers for wide publicity of benefits of use of neem coated urea.

3. Promotion of Customized Fertilizers

The customized fertilizers are soil specific, crop specific and area specific. These fertilizers are formulated on the basis of soil testing and the agronomic multi-locational trials. These fertilizers besides carrying the major nutrients also contain the secondary and micro nutrient. So far thirty-one such fertilizers have been notified under clause 20B of the Fertilizer (Control) Order, 1985.

4. Quality Control of Fertilizers

i) To ensure availability of quality fertilizers to farmers, the fertiliser was declared as an essential commodity in 1957. In sequel, the Fertiliser (Control) Order (FCO) was promulgated in March 1957 under section 3 of the Essential Commodities Act (ECA), 1955 to regulate quality, trade and distribution of fertilizers in the country. The FCO has since been revised and re-enacted in the year 1985.

ii) The FCO provides for specification of all fertilizers manufactured or imported and sold in the country; compulsory registration of fertilizer manufacturers, importers and dealers; methods of sampling and analysis of fertilizers; appointment of fertilizer inspectors; establishment of Fertiliser Quality Control Laboratories; and restrictions on the manufacture/import and sale of fertilizers not in conformity with the laid down specifications.

iii) At present, there are 78 notified Fertilizer Quality Control Laboratories (FQCLs) in the country. The State-wise details of laboratories are shown at **Annexure 3.2**. Out of these, 4 laboratories viz. Central Fertilizer Quality Control & Training Institute (CFQC&TI) and its three Regional Fertilizer Control Laboratories (RFCLs) located at Navi Mumbai, Chennai and Kalyani are under the control of Central Government and the remaining are under the control of different State Governments.

v) No person shall manufacture or import for sale, sell, offer for sale, stock or exhibit for sale or distribute any fertiliser which is not notified in the Fertiliser (Control) Order or not of standard prescribed in the said Order. State Governments are empowered under the said Order to take appropriate administrative and legal action against those not complying with the provisions prescribed in the Order.

vi) The Government also provides assistance for setting up of new Fertilizer Quality Control Laboratories and strengthening/upgradation of existing State Fertilizer Quality Control Laboratories under Soil Health Management (SHM) component of National Mission for Sustainable Agriculture (NMSA).

Box 3.3: Organic Farming in India

The Ministry of Agriculture & Farmers Welfare is promoting Organic Farming as a sub-component under National Mission on Sustainable Agriculture (NMSA). Under the scheme, financial assistance is provided for setting up of mechanized Fruit and Vegetable market wastes, agro wastes compost units, setting up of liquid carrier-based biofertilizer biopesticide production units.

In order to promote participatory certification of Organic Farming in a cluster approach, Paramparagat Krishi Vikas Yojana (PKVY) was formulated in year 2014-15. The various components of NMSA are: (a) adoption of organic farming through cluster approach under Participatory Guarantee System (PGS) certification, (b) support to PGS system for online data management and residue analysis, (c) training and demonstration on organic farming, (d) organic village adoption for manure management and biological nitrogen harvesting, have been clubbed together under PKVY.

The new components under PKVY have been designated as: (a) adoption of PGS certification through cluster approach; (b) adoption of organic village for manure management and biological nitrogen harvesting through cluster approach. The DAC&FW intends to enhance the area under organic farming to 5.0 lakh acres within a period of 3 years. It is targeted to cover 10000 clusters of farmers (about 50 farmers in each cluster) in three years with an expenditure of Rs 1,495 crore

Participatory Guarantee System (PGS): India Portal

For online operation of PGS certification system, a web portal has been developed. It is accessible at www.pgsindia-ncof.gov.in. This web portal has online facility for: (i) Registration, (ii) Approval, (iii) Documentation, (iv) Record of inspection, and, (v) certification. It will promote transparency in certification process. It will lead to creation of a database of (i) Organic producers and (ii) area under PGS certification with due traceability.

Saansad Adarsh Gram Yojana (SAGY)

The organic farming is being promoted through Saansad Adarsh Gram Yojana in the selected villages adopted by Hon'ble Saansads in their constituencies.

Mission Organic Value Chain Development for North Eastern Region

A Central Sector Scheme namely, Mission Organic Value Chain Development for North Eastern Region has been launched for promoting Organic Farming in the North Eastern Region with an outlay of Rs. 400 crores for three years from 2015-16 to 2017-18. For the year 2015-16, Rs. 125 crores have been allocated under the Scheme.

Issues and Challenges

3.58 Urea is the only fertilizer under statutory price control, whereas P&K fertilizers are covered under Nutrient Based Subsidy (NBS) scheme since 01.04.2010, in which MRPs of fertilizers are fixed by fertilizer companies based on the prices prevailing in international market. After introduction of NBS scheme, there has been substantial increase in prices of P&K fertilizers due to increase in international prices of these products/raw materials but price of Urea has remained fixed at Rs 5360/ MT. Disparity in prices of Urea and P&K fertilizers is considered one of the reasons for distortion in the consumption pattern of NPK fertilizers.

Way Forward

3.59 In order to address the issue of price disparity, improvement in fertilizer policy is a must. The following policy measures are needed:

- Balanced use of organic and inorganic fertilizers has a direct impact on soil fertility. Present policy may be revisited to promote both inorganic and organic fertilizers. Efforts may be made to move towards direct cash transfer on unit area basis so that farmers are free to choose between chemical fertilizers and organic fertilizers on their own as per soil health status/fertility.
- In short-medium term, gradual and reasonable increase in price of urea along with its inclusion under Nutrient Based Subsidy (NBS) scheme is a desirable policy option.
- Nutrient use efficiency varies from fertilizer to fertilizer, even nutrient use efficiency of a similar kind of fertilizer may vary depending upon its composition/coating and form (granulated/powdered). At present subsidy is given on fertilizers depending upon the content of nutrients in the fertilizer. The present subsidy regime does not take in to account the nutrient use efficiency of the fertilizer due to which, there seems to be no initiative on part

of industry on research and development of new efficient/better products. The ambit of NBS scheme may be made broader to consider nutrient use efficiency of fertilizers so that the focus is on efficient uptake of nutrients by the plants. Water-soluble fertilizers need to be promoted by bringing them under subsidy regime.

Plant Protection

3.60 Plant protection strategies and activities have become pertinent in ensuring environment friendly and sustainable agriculture. Plant protection strategies encompass activities aimed at minimizing crop losses due to pests through integrated pest management, plant quarantine, regulation of pesticides, locust warning and control besides training and capacity building in plant protection.

3.61 As per the input surveys conducted under the aegis of agricultural census, the cultivated area treated with the pesticides has increased in the last two decades. Around 40 per cent of the total cultivated area is treated with the pesticides. Approximately, 65-70 per cent of the cultivated area treated with pesticides is irrigated. As regard to pesticide usage, land holding size-wise, medium size land holding are treated the most, followed by the small and marginal land holding. Large land holding (above 10 hectare) are least treated. At a micro level, on an average 65 per cent of the area under the fiber crops are treated with pesticides followed by fruits (50 per cent), vegetables (46 per cent), spices (43 per cent), oilseeds (28 per cent) and pulses (23 per cent).

3.62 The **"Monitoring of Pesticide Residues at National Level"** scheme has been initiated for monitoring and analysis of pesticide residues in agricultural commodities in different agro-ecological regions of the country. During the last five years, the incidence of residues in various commodities has shown an increase from 1.2 per cent to 2.6 per cent.

3.63 The DAC&FW have taken a number of measures to ensure that chemical pesticides are employed as a last resort to pest management. Department has revised 68 Integrated Pest Management (IPM) Packages of Practices for major crops giving impetus to ecological and cultural techniques of pest management. Capacity building and training programmes are held annually to sensitize stakeholders (farmers, extension officers, pesticides dealers, etc) about various facets of pest management. "Grow Safe Food" Campaign has been launched to create awareness among the stakeholders regarding judicious use of Plant Protection chemicals. Efforts are in the pipeline to explore usage of Information Technology (IT) in pest management to ensure that pest assessment report and advisories thereon are disseminated on real time basis.

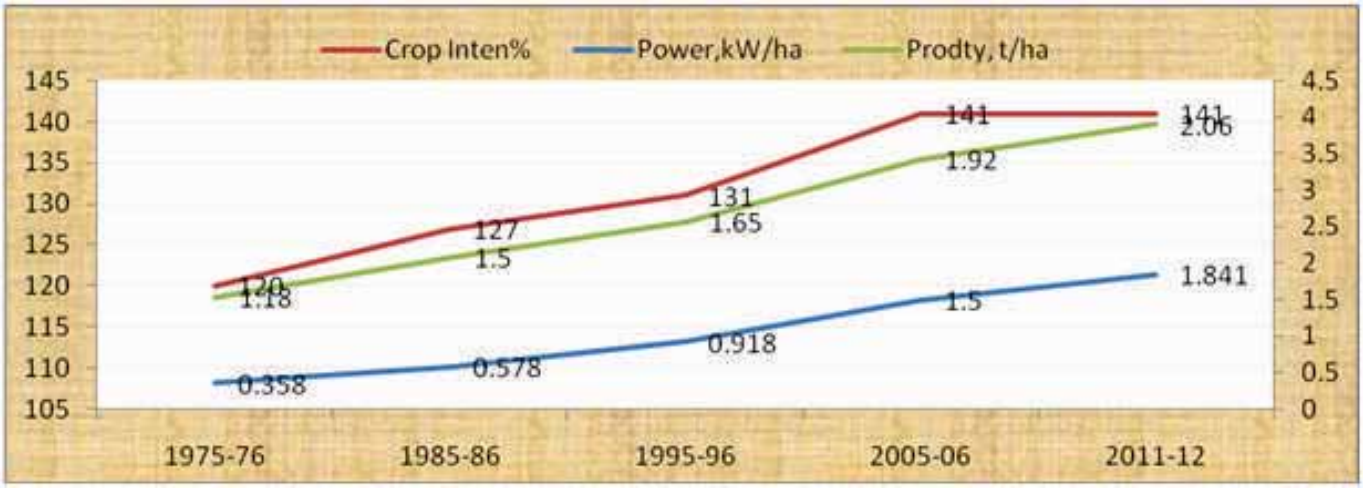
Mechanization and Technology

3.64 Farm mechanization not only provides optimal utilization of resources, e.g., land, labour, water but helps farmers to save valuable time and also reduces drudgery. This judicious use of time, labour and resources facilitates sustainable intensification (multi-cropping) and timely planting of crops, leading to an increase in productivity.

Growth and Impact of farm Mechanization

3.65 The adoption and application of package of farm machinery and technology for agricultural mechanization has significantly contributed to improve the cropping intensity and farm produce during the last 40 years. **Figure 3.3** depicts the positive relationship between cropping intensity, productivity of foodgrains with availability and growth of farm power.

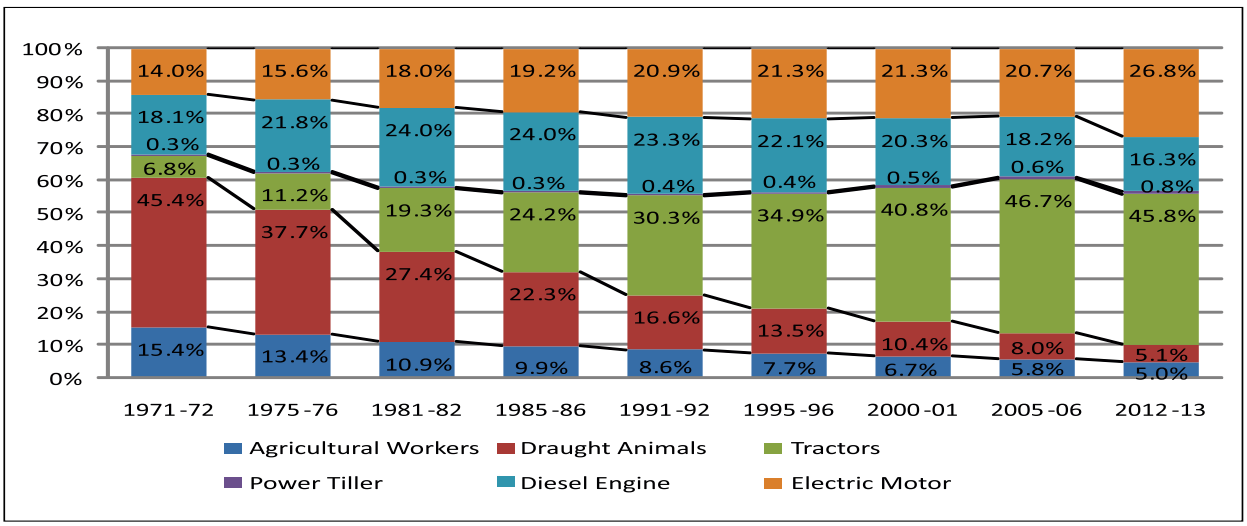
Figure 3.3: Farm Power Availability and Average Yield of Foodgrains and Cropping Intensity in India (1975- 2012)



Source: CR Mehta et.al, PC FIM, CIAE Bhopal Trends of Agril. Mechanization in India CSAM Policy Brief, June 2014

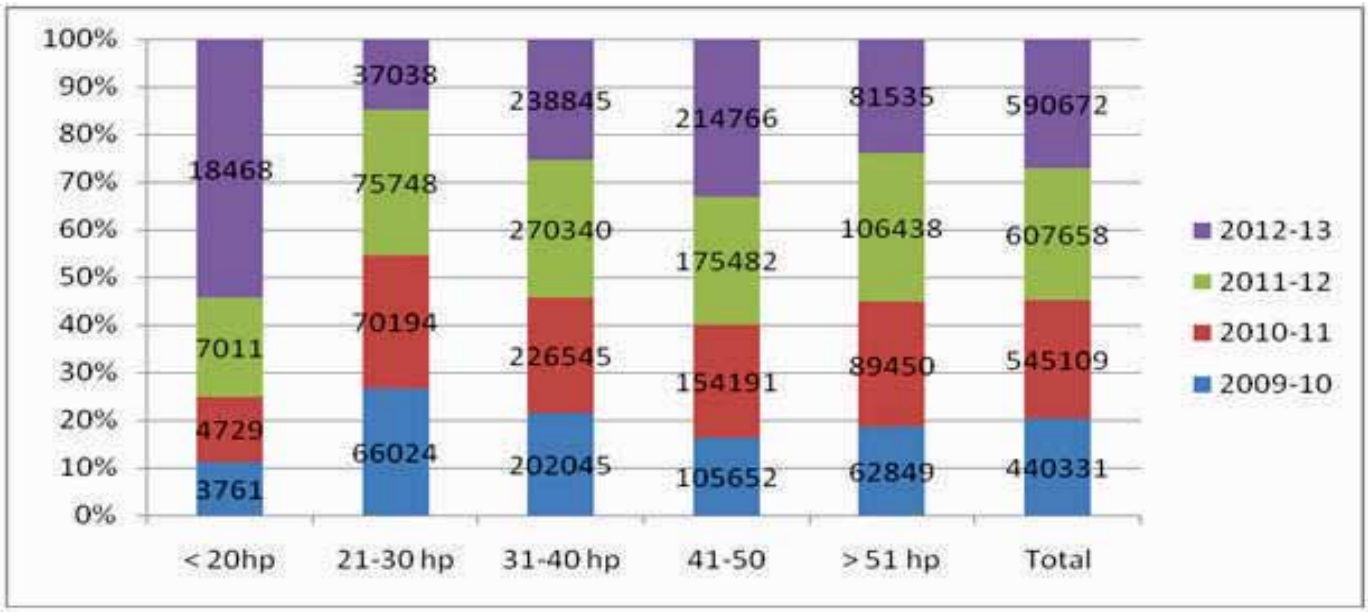
3.66 Agricultural workers, draught animals, tractors, power tillers, diesel engines, electric motors are used as sources of farm power in Indian agriculture. The percentage share of agricultural workers and draught animal power sources in total power reduced from 15.4 to 5.0 per cent and 45.4 to 5.1 per cent, respectively over the years from 1971-72 to 2012-13 **(Figure 3.4).** The combined share of agricultural workers and draught animals in total farm power availability in India reduced from 60.8 per cent in 1971-72 to 10.1 per cent during 2012-13. On the other hand, the share of tractor and electric motor in farm power availability increased from 6.8 to 45.8 per cent and 14 to 26.8 per cent, respectively, during the last 41 years. The share of tractor power was maximum and increased by 39 per cent during the period. The share of diesel engine was almost the same over the years from 1971-72 to 2012-13. The share of power-tiller is less than one per cent during the period in spite of small size farms in India. The availability of percentage farm power through different resources during the last four decades is presented in **Figure 3.4.** The percentage sale of different range of tractors of their total sale during the years 2010- to 2012-13 is presented in **Figure 3.5.**

Figure 3.4: Availability of Farm Power different resources 1971-72 to 2012-13 (in percentage)



Source: CR Mehta et al, Project Coordinator, FIM, CIAE, Bhopal, Trends of Agricultural Mechanization in India CSAM Policy Brief, June 2014.

Figure 3.5: Percentage Sale of Different Range of Tractors of their Total Sale (2010-11 to 2012-13)

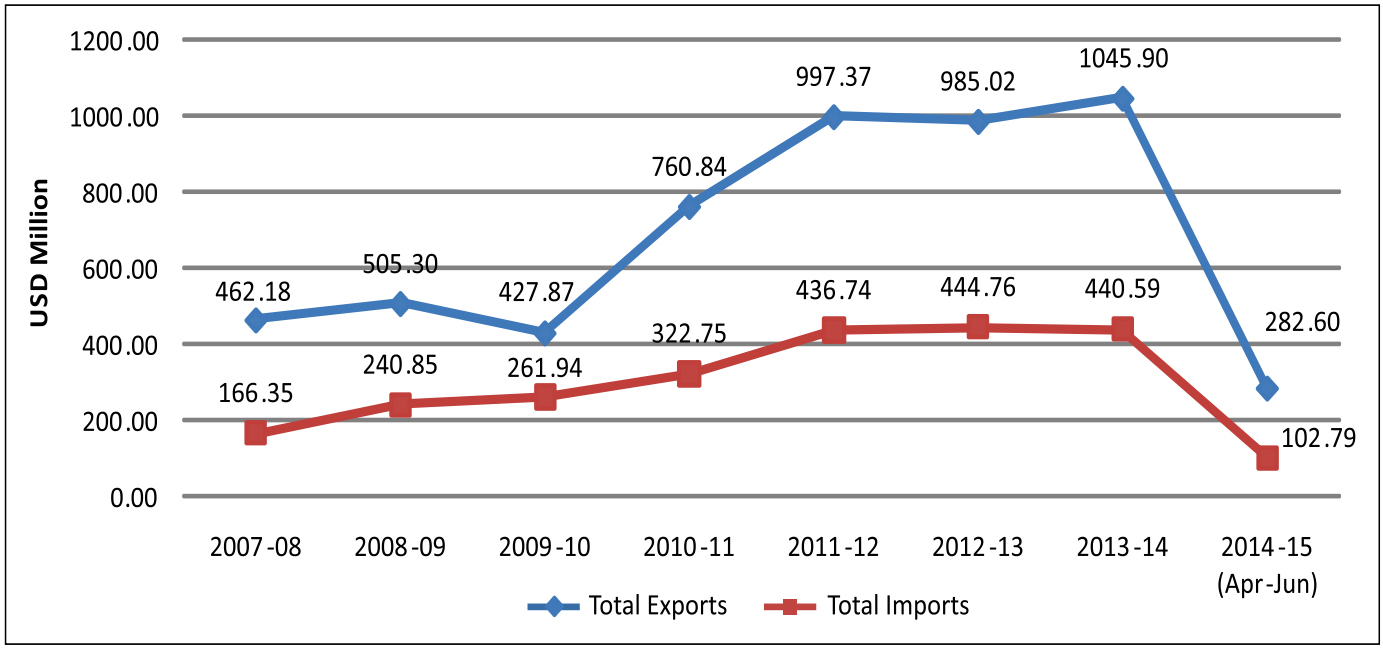


Source: Agricultural Research Data Book-2014, IASRI (ICAR)

Export–Import of Selected Agricultural Machinery

3.67 India's total export has been increased from 462.18 USD million in 2007-08 to 1045.9 USD million in 2013-14 which includes tractors, cultivation equipment, harvesters & threshers and PHT equipment. Import has also been increased from 166.35 USD million in 2007-08 to 440.59 USD million in 2013-14 which includes Power tillers, PHT equipment, dairy and poultry equipment as shown in **Figure 3.6.**

Figure 3.6: Export-Import of Selected Agricultural Equipment



Credit Flow to Farm Mechanization

3.68 As per Annual Report (2013-14) of NABARD, the share of long term credit in overall credit flow reduced from 40 per cent in 2006-07 to 22 per cent in 2012-13. The table below indicates less than 3 per cent of credit flow to the farm mechanization when compared to the total credit flow to the agriculture.

Table 3.10: Credit Flow to Farm Mechanization (Rs. Crore)

Particulars	Year				Growth Rate (per cent)	
	2007-08	2008-09	2009-10	2010-11	2007-11#	2010-11*
Total Credit to Agriculture	254658	301908	384514	468291	16.45	21.79
Farm Mechanization	8303(3.26 per cent of total credit)	8334(2.76 per cent of total credit)	10211(2.66 per cent of total credit)	12799(2.73 per cent of total credit)	11.43	25.35

Source: NABARD, Annual Report 2013-14.

#Compound Annual Growth Rate (CAGR); *Percentage change over previous year.

3.69 The total investment in Farm Mechanization sector through the various Schemes of Government of India is about Rs. 1354 crores during 2014-15 which needs to be enhanced to Rs. 4000 crores per annum by supplementing through State plan or other sources like Rural Infrastructure Development Fund (RIDF) etc., to achieve the target of farm power availability of 2kW/ha by 2017 which is presently about 1.73kW/ha.

Sub Mission on Agricultural Mechanization (SMAM)

3.70 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 implementing 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 are:

i. to increase the reach of farm mechanization to small and marginal farmers and to the regions where availability of farm power is low;

ii. promoting custom hiring centres to offset the adverse economies of scale arising due to small landholding and high cost of individual ownership;

iii. creating hubs for hi-tech & high value farm equipment's;

iv. creating awareness among stakeholders through demonstration and capacity building activities; and,

v. ensuring performance testing and certification at designated testing centres located all over the country.

Farm Machinery Training and Testing Institutes (FMTTI'S)

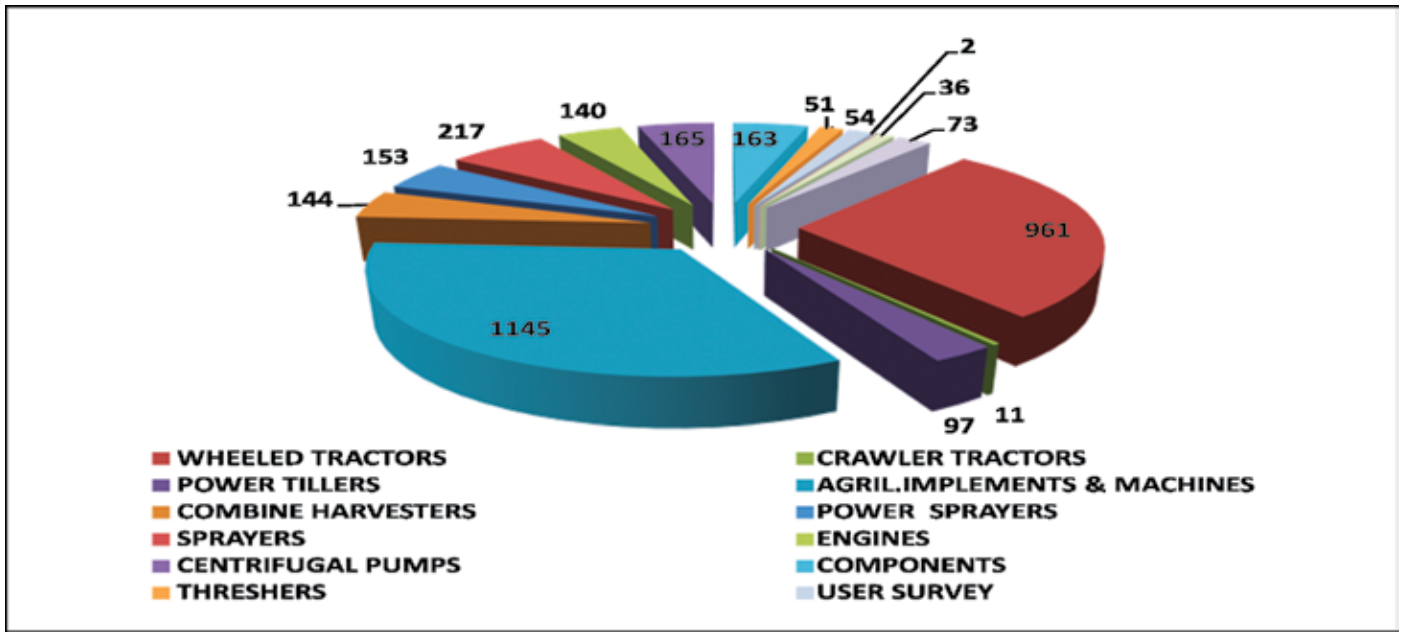
3.71 All the four Farm Machinery Training & Testing Institutes (FMTTIs) located at Budni (Madhya Pradesh), Hissar (Haryana), Garladinne (Andhra Pradesh), and Biswanath Chariali (Assam), are conducting 39 in-campus Courses of different durations on correct operational techniques, maintenance, repair and management of agricultural machinery for different categories of personnel ranging from actual user owners, technicians, rural artisans, under graduate engineering students,

government nominees, representative of machine manufacturers, defence personnel and foreign nationals. Institutes are also conducting off-campus training programmes and demonstration of newly developed agricultural/horticultural equipment's and post-harvest technology, at farmers' fields. Details of course conducted at FMTTIs for skill development on farm mechanization is at **Annexure 3.3.**

3.72 All the four FMTTIs are conducting performance testing of tractors and agricultural machinery for the benefits of manufacturers of agricultural machines, R&D institutions engaged in development of farm machinery. Testing is being carried out as per relevant Indian Standards of BIS. The testing of imported or domestically manufactured agricultural machines for functional suitability and performance characteristics helps to decide the type of machine best suited for Indian conditions, it helps financial institutions in recommending financial assistance to the manufacturers as well as the farmers, to carry out trials on machines and implements which have proved successful in other regions of the world with a view to examining the possibility of their introduction in the country, another advantage is to ensure quality through `Batch Testing' programmes which also assists the manufacturers in product improvement. Course-wise details of trainees trained at the four FMTTIs are at **Annexure 3.4.**

3.73 As per the directives of Ministry of Agriculture & Farmers Welfare CFMTTI, Budni is testing tractors, power tillers, combine harvesters, self-propelled machines for compliance under CMVR, engines for mass emission of exhaust gasses. NRFMTTI, Hissar is testing Combine harvesters, plant protection equipment, irrigation pumps, diesel engines and other self-propelled crop production equipment and machines; it is also testing combine harvesters for compliance under CMVR. SRFMTTI Garladinne is testing power tillers, self-propelled crop production machines equipment, including power drawn agricultural machines and equipment. NERFMTTI, Biswanath Chariali (Assam) is testing power drawn agricultural machines and equipment including non-self-propelled agricultural equipment in order to meet requirements of manufacturers of Eastern and North Eastern Region.

Figure 3.7: Machine Tested at FMTTIs since Inception to March 2015



3.74 To cope up with ever increasing demand for testing of newly developed agricultural machines and equipment, in addition to four FMTTIs, DAC&FW, Ministry of Agriculture & Farmers Welfare has authorized 29 State Agricultural universities (SAUs)/ ICAR, including 3 State Agriculture Departments, as to test, selected type of farm machinery under different categories of farm operations.

Progress during 12th Five Year Plan

3.75 The financial targets and achievements in respect of the central sector and centrally sponsored schemes implemented by the government through respective state governments during the 12th Five Year Plan are presented in Table 3.11 and 3.12. Physical progress and achievements from 2014-15 onwards is at **Annexure 3.5.**

Table 3.11: Financial Target and Achievement during 12th Five Year Plan (Rs. in lakhs)

Scheme	2012-13		2013-14		2014-15	
	Targets	Achievements	Targets	Achievements	Target	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 Sub mission on Agricultural mechanization w.e.f. 1 April 2014	
Post-Harvest Technology and Management (PHTM) (nos.)	1200	1200	1700	1936.52		
Sub mission on Agricultural mechanization(nos.)					19507	18129.24

Table 3.12: Year-wise Fund Released to Different States/Organizations in 12th Plan

Total Funds released (Rs. In Lakh)					
2012-13		2013-14		2014-15	2015-16
Promotion and strengthening of agri. Mechanization	Post -harvest technology and management	Promotion and strengthening of agri. Mechanization	Post -harvest technology and management	Sub Mission On Agricultural Mechanization (SMAM)	Sub Mission On Agricultural Mechanization (SMAM) **(Allocation)**
1208.00	**1200.00**	**1911.99**	**1936.52**	**15130.76**	**14975**

Figure 3.8: Some Popular Farm Machinery for Different Operations

Sugarcane Harvester

Self Propelled Riding Type Reaper

Combine Harvester

Raised bed Planter

Gender Friendly Manual Weeder

Aero Blast Sprayer for tall crops, and trees

Agricultural Credit

3.76 Government of India initiated 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. For the financial year 2014-15, the agriculture credit target was fixed at Rs. 8,00,000 crores and the target has been surpassed with disbursement of agriculture credit of Rs.8,45,328.23 crores **(Annexure 3.6).** During 2015-16, against a target of Rs. 8,50,000 crores, about 75 per cent of the targeted credit has been disbursed by December, 2015.

3.77 The Government is providing short-term crop loans up to Rs.3 lakhs to farmers at the interest rate of 7 per cent per annum. Government of India has introduced an interest subvention scheme in 2006-07 to incentivize prompt repayment. The farmers, who promptly repay their crop loans as per the repayment schedule fixed by the banks, are availing 3 per cent interest subvention. Thus, the effective interest rate for crop loan since 2011-12 has been 4 per cent per annum.

3.78 In order to discourage distress sale of crops by farmers, the benefit of interest subvention has been made available to small and marginal farmers having Kisan Credit Card for a further period of up to six months (post-harvest) on the same rate as available to crop loan against negotiable warehouse receipts.

3.79 In order to ensure that all eligible farmers are provided with hassle-free and timely credit for their agricultural operations, the Government has introduced the Kisan Credit Card Scheme, which enables them to purchase agricultural inputs such as seeds, fertilizers, pesticides, etc., and draw cash to satisfy their consumption needs. The KCC Scheme has since been simplified and converted into ATM enabled debit card with, inter alia, facilities of one-time documentation, built-in cost escalation in the limit, any number of withdrawals within the limit, etc., which eliminates the need for disbursement through camps and mitigates the vulnerability of farmers to middlemen.

3.80 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 pumpsets, sprayers, dairy animals, etc. The State Governments were advised to launch an intensive branch or village level campaign to provide Kisan Credit Card to all the eligible and willing farmers in a time bound manner. KCCs have now been converted into Smart Card cum Debit Cards to facilitate its operation through ATMs. The cumulative number of KCCs as on 31 October, 2015 and the outstanding loan amount is given in **Table 3.13** below:

Table 3.13: Operative KCC Accounts and Outstanding Amount as on 31.10.2015

Agency	Total operative KCC Accounts	Amount outstanding (Rs. Crore)	Out of these ATC enabled RuPay KCC-cum-Debt Cards
Commercial Banks (as on 31.03.2015)	2,25,24,560	3,30,384.51	76,14,956
Cooperative Banks	3,88,40,776	1,13,324.37	2,50,086
Regional Rural Banks	1,25,26,342	84,235.03	31,01,504
Total	7,38,91,678	5,27,943.91	1,09,66,546

Source: RBI and NABARD.

3.81 A Joint Liability Group (JLG) is an informal group comprising 4 to 10 individuals coming 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. 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.

3.82 The Scheme for financing of Joint Liability Groups of Tenant Farmers was started by NABARD in 2005-06. The scheme was extended to non-farm sector from 2009 onwards. Thus, JLGs consists of those of farmers and also non-farmers. The exclusive scheme for Bhoomi Heen Kisan was launched by Government of India during the Union Budget Announcements - 2014-15, with a target for financing 5 lakh Joint Farming Groups of "Bhoomi Heen Kisan" through NABARD. The total number of JLGs and total loan amount provided (cumulative) as on 31.12.2015 are as under.

Table 3.14: No. of JLGs Financed (as on 30.12.2015)

No.	Amount
14.11 lakh	Rs.13968.76 crore

3.83 Total number of Joint Farming Groups of "Bhoomi Heen Kisan" promoted and loan amount disbursed during 2014-15 and 2015-16 is given in **Table 3.14.**

Table 3.15: No. of JLGs Promoted and Financed

2014-15		2015-16 (up to December, 2015)	
No.	**Loan Amount (Rs. Lakh)**	**No.**	**Loan Amount (Rs. Lakh)**
456,636	**441443.81**	**282,126**	**277860.00**

Note: Figures for the year 2014-15 and 2015-16 are part of the cumulative figures in Table 3.14

Box 3.4 : Major Features of Revised KCC Scheme

- Assessment of crop loan component based on the scale of finance for the crop plus insurance premium x Extent of area cultivated + 10 per cent of the limit towards post-harvest/ household/ consumption requirements + 20 per cent of limit towards maintenance expenses of farm assets.
- Flexi KCC with simple assessment prescribed for marginal farmers.
- Validity of KCC for 5 years.
- For crop loans, no separate margin need to be insisted as the margin is in-built in scale of finance.
- 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.
- Interest subvention /incentive for prompt repayment to be available as per the Government of India and / or State Government norms.
- No processing fee up to a limit of Rs.3.00 lakh.

- One-time documentation at the beginning month thereafter simple declaration (about crops raised/ proposed) by farmer.
- 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.
- Disbursement through various delivery channels, including ICT driven channels like ATM/ PoS/ Mobile handsets.

3.84 The Union Cabinet in its meeting held on 21.07.2015 had approved, *inter-alia,* constitution of a Committee under the Ministry of Agriculture & Farmers Welfare to suggest feasible measures/options for improving targeted lending to small and marginal farmers and ensuring maximum utilization of limited budgetary resources under the Interest Subvention Scheme (ISS). The Committee of Secretaries (CoS) in its meeting held on 27.08.2015 had also examined the matter and recommended constitution of a Committee to suggest measures for reviewing the design, implementation and effectiveness of ISS, improving lending to small and marginal farmers and ensuring maximum utilization of limited budgetary resources and also examining the feasibility of providing subvention benefits to farmers through direct benefit transfer.

3.85. Accordingly, a Committee has been constituted under the Chairmanship of Shri U. C. Sarangi, former Chairman, NABARD with representatives from National Federation of State Cooperative Banks Ltd., Unique Identification Authority of India, Reserve Bank of India, Department of Financial Services, NITI Aayog, Government of Maharashtra and Department of Agriculture, Cooperation & Farmers Welfare as Members of the Committee. The Committee has so far held 5 meetings.

Insurance

National Crop Insurance Programme

3.86 Government of India has adopted crop insurance programme as risk mitigation mechanism in agriculture to provide financial support to farmers, including small and marginal farmers, in the event of failure of any of the notified crop as a result of non-preventable natural calamities, pests & diseases, adverse weather conditions and to stabilize farm income particularly in disaster years. Accordingly, an all-risk Comprehensive Crop Insurance Scheme (CCIS) was introduced in 1985 and remained in operation till Kharif 1999 season. The CCIS had limited scope of coverage of only loanee farmers for food and oilseeds crops and risk commitment of Rs. 10,000/- per farmers per season. CCIS was criticized on account of limited coverage of farmers, crops and risks and treated as loan insurance scheme. To cover farmers who did not borrow from institutional source (non-loanee), an Experimental Crop Insurance Scheme (ECIS) was piloted during Rabi 1997-98 season in 14 districts in 5 States. The scheme was limited for small & marginal farmers and 100 per cent subsidy was provided to them.

3.87 Subsequently, CCIS was replaced with National Agricultural Insurance Scheme (NAIS) w.e.f. Rabi 1999-00. The Scheme has been preceded by years of preparation, studies, planning, experiments and trials on a pilot basis. The NAIS has been conceptualized as a comprehensive set of tools to cover yield losses due to natural non-preventable risks like flood, inundation, landslide, drought, pest & diseases, natural fire, lightening, storm, hailstorm, cyclone, etc., and provides for greater coverage of farmers (loanee and non-loanee), crops (all food & oilseed crops and annual horticultural/ commercial crops) and risk commitment (up to 150 per cent of threshold yield). The premium structure has also been rationalized (actuarial premium rate of annual horticultural/commercial crops) and Scheme is required to operationalise at smaller unit

area of insurance. However, the Scheme could not provide desirable results due to some constraints, mostly operational, faced in implementation of schemes. These constraints include inadequate infra-structure at field to conduct requisite number of crop cutting experiments (CCEs), delay in settlement of admissible claims on account of late submission of yield data by the state, delay in release of State share towards its committed financial liabilities, phasing out of premium subsidy (to S/M farmers), larger unit areas of insurance (high basis risk), little interest shown by the financial institutions (insurance under-wiring point), lower level of indemnity, inadequate Guaranteed yield to compensate adequately, non-coverage of perennial horticultural/commercial crops, risks of prevented sowing & post-harvest losses etc. The Scheme could not translate into actuarial regime as conceptualized. Government has also faced difficulties in their budgeting due to open ended financial liabilities on account of premium subsidy, claims, administrative expenses, bank service charges, publicity expenses etc.

3.88 Meantime, to ensure farmer's income by providing minimum guaranteed income, a Farm Income Insurance scheme (FIIS) was piloted during rabi 2003-04 and kharif 2004 season to cover yield and price risks in a single instrument. The Scheme covered rice and wheat on actuarial premium rates with 75 percent subsidy to S/M farmers and 50 percent to others. The total financial liabilities under FIIS was rested with the Government of India and MSP operations were to be suspended in pilot districts/crops. The outcome of the Scheme was not encouraging as States did not want to suspend MSP procurement, difficulties in collecting price data from markets. The guaranteed income was also not attractive as Yield and Price have offsetting behaviour. Premium rate was substantially high despite premium subsidy. Moreover, MSP is available to cover price risks to all farmers at no cost and NAIS to cover to yield risks is also in operation. Further, the Joint Group constituted by this Department to review the erstwhile crop insurance schemes and to develop broad parameters of an appropriate and farmer friendly crop insurance scheme has found that as long as MSP regime continue FIIS would only be a parallel effort with additional cost.

3.89 To bring more farmers under the fold of Crop Insurance programme, a Weather Based Crop Insurance Scheme (WBCIS) was introduced from kharif 2007 season in selected areas on pilot basis. WBCIS is intended to provide insurance protection to the farmers against adverse weather incidence, such as deficit and excess rainfall, high or low temperature, humidity, etc., which are deemed to impact adversely the crop production. It has the advantage to settle the claims within shortest possible time.

3.88 Based on the recommendations of the Joint Group and views/comments of various stake-holders, a Modified National Agricultural Insurance Scheme (MNAIS) was implemented on pilot basis in 50 districts from rabi 2010-11 season with improved features over NAIS. The superiority of this modified scheme was in its actuarial premium with subsidy in premium ranging up to 75 per cent to all farmers, with only upfront premium subsidy shared by the Central and State Governments on 50 : 50 basis, all claims liability is on the insurance companies, unit area of insurance reduced to Village/village panchayat level for major crops, indemnity for prevented sowing/ planting risk & for post-harvest losses due to cyclone, on-account payment up to 25 per cent advance of likely claims as immediate relief, more proficient basis for calculation of threshold yield, minimum indemnity level of 70 per cent instead of 60 per cent, uniform seasonality disciplines both for loanee & non-loanee farmers, participation of private sector insurers for creation of competitive environment for crop insurance.

3.90 To make the crop insurance schemes more farmers friendly, recently, a re-structured Central Sector Scheme namely "National Crop Insurance Program (NCIP)" was approved by merging the erstwhile pilot schemes of Modified National Agricultural Insurance Scheme (MNAIS), Weather Based Crop Insurance Scheme (WBCIS) and Coconut Palm Insurance Scheme (CPIS) with some

improvements for full-fledged implementation as component schemes 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. However, on the request of some States, NAIS was allowed in few States during Rabi 2013-14 & 2014-15. Again, NAIS has been allowed at the option of States for the year 2015-16.

3.91 All the above schemes are demand driven and no state-wise allocation/release are made under these schemes. Funds were released to the implementing agency which in turn settled the claims of farmers and provide premium subsidy as per provisions of the schemes.

3.92 The component scheme of NCIP has the following main features.

Modified National Agricultural Insurance Scheme (MNAIS)

i. actuarial premium rates are charged with a provision of subsidy up to 75 per cent, which is shared by the Central and State Governments on 50:50 basis;

ii. entire liability of claims is on the implementing insurance companies;

iii. it is compulsory for loanee farmers and optional for non-loanee farmers;

iv. risk coverage for pre-sowing/prevented sowing and post-harvest losses due to cyclone in coastal areas;

v. on-account payment up to 25 per cent advance of likely claims as immediate relief in the areas which suffered at least 50 per cent crop yield loss;

vi. more proficient basis for calculation of threshold yield;

vii. two higher indemnity levels of 80 per cent & 90 per cent instead of earlier 70 per cent, 80 per cent & 90 per cent;

viii. reduction in Unit Area of Insurance to village/ village Panchayat level; and

ix. private insurance companies have been involved to provide the benefits of competition.

Weather Based Crop Insurance Scheme (WBCIS)

i. Provide coverage against weather deviation from the notified standards on the basis of weather data received from the notified Automatic Weather Stations (AWSs) and Automatic Rain-gauges (ARGs);

ii. actuarial premium rates are charged with a provision of subsidy up to 50 per cent, which is shared by the Central and State Governments on 50:50 basis;

iii. entire liability of claims is on the implementing insurance companies;

iv. it is compulsory for loanee farmers and optional for non-loanee farmers;

v. add on coverage in respect of hailstorm and cloud burst on individual assessment basis; and

vi. private insurance companies have been involved to provide the benefits of competition.

Coconut Palm Insurance Scheme (CPIS)

i. Individual farmer/planter/grower offering at least 5 healthy nut bearing palms in a contiguous area/plot is eligible for insurance;

ii. provide coverage against total loss of palm on account of happening of peril insured leading to death of the insured palm or its becoming unproductive;

iii. fixed premium rates ranging from Rs. 9/- to Rs. 14/- per palm depending upon the age of palm. However, Government is providing subsidy up to 50 per cent by GOI and 25 per cent by State Government;

iv. sum insured per palm is ranging from Rs. 900/- to Rs. 1750/-;

v. scheme is being implemented by AIC; and

vi. state-wise business statistics of all Schemes and all Companies from 1999-2000 to kharif 2015(since inception to kharif 2015 season) are at **Annexure 3.8 and 3.9.**

3.93 A comparative picture of state/district-wise operational status of the above mentioned schemes is given in **Table 3.16:**

Table 3.16: Agricultural Insurance Schemes in Operation

Modified NAIS (since Rabi 2013-14)	Andhra Pradesh (4 districts), Goa, Kerala, Rajasthan, Uttar Pradesh (65 districts) & Uttarakhand.
WBCIS (since Rabi 2013-14)	Assam, Andhra Pradesh (few districts), Himachal Pradesh, Kerala, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Telangana, Uttarakhand, Uttar Pradesh (10 districts) & West Bengal.
NAIS (since Rabi 1999-2000)	Assam, Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Maharashtra, Madhya Pradesh, Odisha, Tamil Nadu, Telangana & West Bengal.
No crop insurance	Punjab, Arunachal Pradesh & Nagaland
Occasional	Haryana, Manipur, Meghalaya, Sikkim, Tripura

3.94 During the implementation of above schemes, stakeholders have experienced the problem of high premium burden on farmers, inadequate compensation in the risky areas due to provision of capping on premium subsidy & reduction of Sum Insured, delay in settlement in claims to the farmers, poor awareness amongst stakeholders, inadequate density of Automatic Weather Stations (AWSs) for recording weather data for effective capture of weather data etc. Under MNAIS, number of Crop Cutting Experiments (CCEs) has also increased substantially compared to NAIS due to reduction in insurance unit area to Village / Village Panchayat, which requires more infrastructure & manpower. There are also challenges of reducing time taken in providing yield data by states for calculation of admissible claims.

3.95 Taking note of all these shortcomings/hardships faced by the farmers Government has recently reviewed the existing crop insurance schemes to ease their shortcomings and reduce the financial burden of premium on farmers. Accordingly, a new crop insurance scheme, namely Pradhan Mantri Fasal Bima Yojana has been approved which will replace the ongoing schemes of NAIS/MNAIS from kharif 2016. Premium under WBCIS has also been rationalised and made at par with PMFBY. CPIS will also continue from kharif 2016 season. In addition, a Unified Package Insurance Scheme (UPIS) has also been approved which will be implemented on pilot basis in 25 districts. The basic features of the scheme are given below.

PMFBY Yield Based

i. PMFBY will provide a comprehensive insurance cover against failure of the crop thus helping in stabilising the income of the farmers and encourage them for adoption of innovative practices.

ii. The Scheme can cover all Food & Oilseeds crops and Annual Commercial/Horticultural Crops for which past yield data is available and for which requisite number of Crop Cutting Experiments (CCEs) will be conducted being a part of the General Crop Estimation Survey (GCES).

iii. The scheme is compulsory for loanee farmer obtaining Crop Loan /KCC account for notified crops. However, voluntary for other/non-loanee farmers who have insurable interest in the insured crop(s).

iv. 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 seasonality discipline shall be same for loanee and non-loanee farmers.

vii. The scheme will be implemented by AIC and other empanelled private general insurance companies. Selection of Implementing Agency (IA) will be done by the concerned State Government through bidding.

viii. 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.

ix. 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.

x. The Loss assessment for crop losses due to non-preventable natural risks will be on Area approach.

xi. In case of majority of insured crops of a notified area are prevented from sowing/planting the insured crops due to adverse weather conditions that will be eligible for indemnity claims up to maximum of 25% of the sum-insured.

xii. However, losses due to localized 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.

xiii. Three levels of Indemnity, viz., 70%, 80% and 90% corresponding to crop Risk in the areas shall be available for all crops.

xiv. 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 of the notified crop will be moving average of yield of last seven years excluding yield up to two notified calamity years multiplied by Indemnity level.

xv. In case of smaller States, the whole State shall be assigned to one IA (2-3 for comparatively big States). Selection of IA may be made for at least 3 years.

xvi. 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. and non-compliance will lead to rejection of company's bid

xvii. 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, drones, etc., will be utilised for estimation of yield losses.

xviii. 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

xix. The cost of using technology etc. for conduct of CCEs etc will be shared between Central Government and State/UT Governments on 50:50 basis.

xx. 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.

xxi. On-account payment up to 25% of likely claims will be provided, if the expected yield during the season is likely to be less than 50% of normal yield.

xxii. The claim amount will be credited electronically to the individual Insured Bank Account.

xxiii. Adequate publicity needs to be given in all the villages of the notified districts/ areas

PMFBY Weather Based

i. The structure of farmer's premium under WBCIS will be at par with the proposed 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.

Unified Package Insurance Scheme (UPIS)

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 (PMJJBY), Accidental Death & Disability (PMSBY), Student Safety, Household, Agriculture implements & Tractor.

iii. Crop Insurance will be compulsory. However, farmers can choose at least two section from remaining.

iv. Farmers may be able to get all requisite insurance products for farmers through one simple proposal/ application Form.

v. Two flagship schemes of the Government, viz., PMSBY & PMJJBY have been included apart from insurance of assets.

vi. Pilot scheme will be implemented through 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) on the basis of individual claim report.

3.96 A comparative picture of the changes in the new scheme vis-à-vis existing ones is given in **Table 3.17** and **Table 3.18:**

Table 3.17: Comparison between National Agricultural Insurance Scheme (NAIS), Modified National Agricultural Insurance Scheme (MNAIS) and Pradhan Mantri Fasal Bima Yojana (PMFBY)

S. No.	Parameter	NAIS	MNAIS	PMFBY
1	Insurance Unit	Scheme provided for reduction of unit to Village Panchayat (VP)	Unit to be reduced to Village / Village Panchayat (VP) or other equivalent unit for all crops. States who are not able to implement are allowed to notify higher unit area (up to 15 village /VP) for 3 years.	Ordinarily Insurance Unit to be Village / Village Panchayat (VP) for major crops and higher than village/village panchayat like block, taluka for other crops
2	Data Requirement	Past yield data as well as actual yield data based on CCEs is required	Yield data as well as rainfall data required	Same as MNAIS

S. No.	Parameter	NAIS	MNAIS	PMFBY
3	Threshold Yield	Moving average of last three years for wheat & rice and five years for other crops multiply by Indemnity level	Moving average of last seven years excluding maximum two calamities year for all crops multiply by Indemnity level	Same as MNAIS.
4	Indemnity Level	(a) 60%, 70% & 80% based on Yield variability in the past 10 years measured in terms of Coefficient of Variation (CV) (b) Assigned at State level	(a) 80% & 90% Claim experience (as if) in the past 7 / 10 years measured in terms of 'loss cost' (b) Assigned at District-level	(a) 70%, 80% & 90% based on the risks experiences and coefficient of variation in the past 10 years. (b) Assigned at Group of districts
5	Premium	1.5 to 3.5% for food and oilseeds for normal coverage and actuarial premium for higher sum insured &/ or indemnity level. Actuarial premium for annual commercial/ horticultural crops.	Actuarial premium.	Actuarial Premium Rate (APR), limited to 2% of SI for Kharif Food & Oilseed crops, 1.5% of SI for Rabi Food & Oilseed crops and 5% of SI for Annual commercial/ Horticultural Crops.
6	Criteria for selection of implementing Insurance company	Only AIC is implementing the scheme.	Both AIC & Private Insurance company are implementing the Scheme. Allocation at district-level based on lowest premium quoted by them. Large variation in the premium rates of the crop between neighbouring districts Selection of companies for a season	Both AIC & Private Insurance company will implement the Scheme. Allocation of State to one company for Smaller States and 2-3 companies for big States by adopting cluster approach under which a group of districts/ areas with variable risk profile may be bid out with a view to have uniform spread of the risk within the group and a uniform premium rate. Selection of company may be made for at least 3 years

S. No.	Parameter	NAIS	MNAIS	PMFBY
7	Claim liability	AIC up to premium collected and beyond that Govt.	All claims on insurers and beyond 500% claims ratio by govt.	All claims liability on insurer and beyond 350% of premium collected or 35% of SI at national level by GoI & States on 50:50 on pro rata basis.
8	Premium subsidy	10% for Small / Marginal farmers	Only upfront premium subsidy by the government ranges from 'ZERO' to 75% depending on the premium slabs.	The difference between the Actuarial Premium Rate (APR) and Insurance charges payable by farmers shall be provided by Government as subsidy, and shall be shared equally by the Centre & State.
9	Risks covered	Practically 'all-risk' insurance	"All risk" with added advantage of sowing failure cover.	Same as MNAIS
10	Localized calamities	Provides for 'individual assessment' of claims for localized calamities (hailstorm, landslide, flooding) in one or two areas on experimental basis	Individual farm assessment of claims in case of hailstorm and landslide for all areas / crops notified under the scheme.	Same as MNAIS. However, inundation have been added.
11	In-season settlement of claims	The claims are settled based on the final yield estimates submitted by States. There is no provision to provide for in-season / on-account settlement of claims	On-account settlement of claims up to 25% of likely claims is paid during the crop season based on composite index (weather data / crop health report / satellite imagery etc.)	Same as MNAIS
12	Prevented / failed Sowing Risk	Presently not covered (covers risk only from sowing)	Prevented / Failed Sowing Risk to be covered with a benefit of up to 25% of sum insured being paid as claim, and the insurance cover gets terminated.	Same as MNAIS.
13	Post-Harvest losses	Presently not covered (as yield are estimated at harvest time)	Coverage is available up to 2 weeks for harvested crop lying in the field in 'cut & spread' condition, against specified perils of cyclone in coastal areas.	Same as MNAIS

S. No.	Parameter	NAIS	MNAIS	PMFBY
14	Basis of Sum Insured	Loanee: Loan amount / value of TY / 150% value of AY Non-Loanee: value of TY / 150% value of AY	Loanee: Sanctioned Credit Limit / value of TY / 150% value of AY Non-Loanee: value of TY / 150% value of AY	Loanee & Non-loanee: up to scale of finance .
15	Service Charge / Commission	2.5% of gross premium (i.e. flat rate premium) payable under the Scheme	Banks: 4% of gross premium payable under the Scheme Others: As decided by Insurer subject to IRDA capping	Same as MNAIS
16	Basis Risk	Basis risk is high as the insurance unit is rarely homogeneous.	Basis risk for localized calamities is reduced.	Basis risk for localized calamities is reduced.
17	Services to the famers/ Management of Scheme.	AIC only acts as implementing agency. Lack of professional management.	Multiplayer to provide better services to the farmers.	Competition to provide better services to farmers. Provision for better administration through crop insurance portal for transparency and early benefits to the farmers
18	Use of better Technologies for yield Estimation	Yield estimation through traditional CCEs	Pilot studies for Yield Estimation through use of Remote Sensing Technology (RST)	Provision for adoption of RST, Drone & other technologies in yield estimation and categorization of number of CCEs after validation by pilot studies. Use of Smartphone apps for accurate & fast transmission of CCEs data to facilitate early settlement of claims

Table 3.18: Premium Rates MNAIS vs. PMFBY

Districts /State	Crop	Farmers share in premium (in %) (Maximum)	
		MNAIS	PMFBY
Mahoba (Uttar Pradesh)	Black Gram	6.00	1.50
	Sesamum	7.00	1.50
Gorakhpur (UP)	Maize (Kharif)	14.25	2.00
Bhilwara (Rajasthan)	Til	10.59	1.50
	Guar	6.00	1.50
	Moong	6.00	1.50
Beed (Maharashtra)	Cotton	5.50	5.00
Tuticorin (Tamil Nadu)	Maize (Kharif)	8.64	2.00

3.97 To expedite settlement of crop insurance claims, alternative methodology for yield/loss assessment through Remote Sensing Technology/ Satellite Imageries, etc., is being explored. Pilot study on supplementing Crop Cutting Experiments with drones/satellite imageries is being conducted by the Mahalanobis National Crop Forecast Centre.

3.98 The Government of India has recently designed an insurance portal www.agri-insurance.gov.in for farmers, states, insurers and banks. The basic information like notified areas, crops, sum insured, government subsidy, premium to be paid by farmers, concerned insurance companies in the particular insurance unit of three major schemes has been digitized and put on the web portal so that farmers and other stakeholders may get information about insurance their crop insurance, premium cut off dates and insurance companies on Internet and through SMS. Further, to ensure better administration and ease in accessing information by farmers, an android based crop insurance app has been launched which could be downloaded from either the website or Google play Store.

Way Forward

3.99 The Government is also endeavouring for the integration of all the stakeholders, viz., farmers, insurance companies, financial institutions & Government functionaries on IT platform to ensure better administration, coordination & transparency for getting real-time information and monitoring, etc. However, integration of the Core Banking Solutions (CBS) of the Banks with Crop Insurance Portal is major challenges for faster transmission of information, online payment of premium/proposal, quick payment of claims and for direct benefits transfer to the beneficiary farmers.

3.100 To explore the possibilities to use modern technology like Remote Sensing Technology (RST)/Satellite imageries to supplement the yield assessment through CCEs in the implementation of Crop Insurance Schemes, a pilot study has been initiated by the Mahalanobis National Crop Forecast Centre. Few insurance companies and states are also undertaking pilot study on the matter.

3.101 All the insurance schemes are multi-agency schemes wherein agencies like Government of India, State Governments, Banks and Insurance Companies come together for delivering the product to the farmers. One of the major challenges in implementation under this framework is the lack of data on real-time basis for monitoring, supervision and effective implementation of the scheme. The need of the hour is to integrate all these agencies on one virtual platform wherein all relevant data related to crop loans (since the scheme is compulsory for loanee famers) and crop insurance shall be entered by the respective agencies which will be available

for viewing validation across the agencies for better planning and implementation of the scheme including de-duplication of beneficiaries and reduction in time of transmission of data as well as electronic transmission of premium from Banks to Insurance Companies and claims from Insurance Companies directly into the accounts of farmers through DBT. This will also help in properly focusing the benefits under the existing Interest Subvention Scheme and its convergence with the Crop Insurance Scheme.

Extension Services

3.102 Agricultural technology, including the adoption and promotion of critical inputs, and improved agronomic practices were being disseminated under 17 different schemes of the DAC&FW during the 11th Plan. The Modified Extension Reforms Scheme was introduced in 2010 with the objective of strengthening the extension machinery and utilizing it for synergizing the interventions under these schemes under the umbrella of Agriculture Technology Management Agencies National Mission on Agricultural Extension and Technology (NMAET) consists of 4 Sub Missions:

i. Sub Mission on Agricultural Extension (SMAE)

ii. Sub-Mission on Seed and Planting Material (SMSP)

iii. Sub Mission on Agricultural Mechanization (SMAM)

iv. Sub Mission on Plant Protection and Plant Quarantine (SMPP)

3.103 The common thread running across all 4 Sub-Missions is extension & technology. The aim of the Mission is to restructure & strengthen agricultural extension to enable delivery of appropriate technologies and improved agronomic practices to the farmers. This is envisaged to be achieved by a judicious mix of extensive physical outreach & interactive methods of information dissemination, use of ICT, popularisation of modern and appropriate technologies, capacity building and institution strengthening to promote mechanisation, availability of quality seeds, plant protection, etc., and encourage the aggregation of farmers into Interest Groups (FIGs) to form Farmer Producer Organizations (FPOs).

3.104 Sub-Mission on Agricultural Extension, focuses on awareness creation and enhanced use of appropriate technologies in agriculture & allied sectors. Gains made in the past are being consolidated and strengthened through increased penetration of extension functionaries. Personnel trained under Agri-Clinics and Agri-Business Centres Scheme (ACABC) and Diploma in Agriculture Extension Services for Input Dealers (DAESI) are also envisaged to provide extension services to the farmers. Use of interactive and innovative methods of information dissemination like pico projectors, low-cost films, handheld devices, mobile based services, Kisan Call Centres (KCCs) etc. are also in the process of being used and convergence brought among extension efforts under different programmes and schemes at village level through the institution of ATMA (Agriculture Technology Management Agency) and Block Technology Teams (BTTs).

Support to State Extension Programmes for Extension Reforms

3.105 The Scheme is currently in operation in 652 districts of 29 States & 3 UTs. The Scheme essentially focuses on institutionalizing key reforms. The extension support to farmers under the scheme is provided through ATMA Cafeteria (i.e., list of extension related activities to choose from), which covers activities that are to be implemented at both State and District levels. State level activities include preparation of State Extension Work Plan (SEWP), support for up-grading State level training institutions, such as, State Agricultural Management & Extension Training Institutes (SAMETI), Human Resource Development of extension functionaries, organization of various agriculture related activities including monitoring and evaluation. District-level activities are further categorized into four groups; namely: (i) Farmer Oriented Activities; (ii) Farm Information Dissemination Activities; (iii) Research-Extension-

Farmer Activities; (iv) Innovative Activities; and (v) Innovative Technology Dissemination (ITD). Based on SREP, and the Block Action Plans jointly firmed up by the Block Technology Team (BTT) and BFAC, the District Agriculture Action Plans (DAAPs) are prepared annually following bottom-up approach. At the State Headquarter, district plans are collated and a State Extension Work Plan (SEWP) is approved by Inter-Departmental Working Group (IDWG) headed by the Agriculture Production Commissioner/ Principal Secretary (Agriculture) of the State. The State Extension Work Plan (SEWP) approved by IDWG is further put up to State Level Sanctioning Committee (SLSC) for approval and Government of India for release of funds.

3.106 The status of implementation of Extension Reforms Scheme is as under.

i. Over 359.58 lakh farmers have been benefitted so far since inception of the Scheme through various extension activities.

ii. Over 33.38 lakh farmers benefited through Exposure Visits.

iii. Over 83.27 lakh farmers through various training programs at different levels;

iv. Over 43.26 lakh farmers through Demonstrations and

v. Over 177.23 lakh farmers through Kisan Melas/ Field Dadys and Kisan Goshities.

vi. Over 1.94 lakh Farmers Interest Groups (FIGs) have been mobilized.

vii. Over 91463 Farm Schools have been set up on the field of Progressive/ Awardees farmers.

3.107 The Government has been trying its utmost to strengthen the institution of ATMA. Under Sub-Mission on Agriculture Extension (SMAE) under National Mission on Agricultural Extension and Technology (NMAET) launched during 12th Five Year Plan to disseminate timely information and appropriate technologies to the farmers through the structure of ATMA and Block Technology Teams.

Establishment of Agri-Clinics and Agri-Business Centres

3.108 Launched in 2002, the Establishment of Agri-Clinics and Agri-Business centres (ACABCs) Scheme was aimed to strengthen the extension services and to tap the potential of unemployed agriculture graduates in order to provide them self-employment opportunities. Under the scheme, free training and handholding support is provided to unemployed agriculture graduates so as to enable them with required knowledge, skill and orientation towards agripreneurship. Needed support is also extended to the trained graduates for developing a bankable agri-business project and for availing loans from a commercial bank at concessional rates. A provision of back-ended capital subsidy and interest subsidy to them on the loans availed of for Agri-venture establishment was also made in the year 2006. The Scheme is being implemented by Government of India through National Institute of Agricultural Extension Management (MANAGE) and the National Bank for Agriculture and Rural Development (NABARD). MANAGE coordinates and implements the training and handholding support through a network of 72 Nodal Training Institutes (NTIs) identified through a well designed process of screening and assessment. NABARD looks after the credit part of the scheme by the refinancing the agri-business loans granted by commercial banks to the trained graduates and release of subsidy thereon.

3.109 Ever since its launch the year 2002, under this scheme a total of 46231 candidates have been trained; and out of which 19471 have established their ventures by January, 2016. This shows that the scheme has invoked tremendous interest in the unemployed agriculture graduates towards entrepreneurship in the rural areas. Maharashtra, UP, Tamil Nadu and Bihar have exhibited 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. Overall progress in the establishment of agri ventures by

trained graduates was 42 per cent (approx.) since its inception. The previous years' success rate was also 42 per cent. A higher success rate during subsequent years is anticipated.

3.110 Many factors contribute to the development of agripreneurs through ACABC Scheme, including agricultural development in the State, awareness of prospective candidates about the ACABC scheme and infrastructure facilities available for training them. Thus, the need for efficient support organizations to monitor the activities of small enterprise was felt. Moreover, prediction of the future demand, introduction of modern technologies, cost control and business expansion are the important areas, where entrepreneurs need regular support. Major revisions in the Scheme were done during 2010-11 to accommodate these concerns. The modified scheme component was included in SMAE during 12th Plan.

3.111 The revised training cost per trainee is now limited to Rs. 35,000/- by proportionately raising the limits under different components and adding the new area of hands on industry training. In order to incentivize most successful agri-preneurs under that scheme an element of refresher training has been introduced in the revised scheme format. The training of about 3-5 day duration would be conducted in specialized Institutions like SAUs/ ICAR Institute/IIMs/IITs/CSIR Institutes/DST Institutes/Private Institutions. 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. In order to ensure that the provisions made under the revised Scheme are gainfully utilized and Scheme achieves the desired success rates, sufficient checks and balances, and 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.

Use of Media in Reaching the Farmers

3.112 The Central Sector Scheme "Mass Media Support to Agriculture Extension" has been launched during the Tenth Five Year Plan Period with a view to contribute to revamping the extension services in the country by using electronic media, i.e., the wide network of Doordarshan and All India Radio for transfer of technology/information to the farmers. The primary objective of the Scheme is to use Television and Radio with their massive penetration as a vehicle that could be exploited for the purpose of extension. They have the advantage of reaching a wide audience at a very low cost.

3.113 Under this Scheme existing infrastructure of Doordarshan (DD) and All India Radio (AIR) is being utilized to make the farmers aware about modern technologies and researches related to agriculture and allied areas. A 30 minute programme is being telecast 5-6 days a week through 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 6 days a week. For telecasting success stories, innovations and for popularization change-setting technology and farming practices through the Saturday slot of Doordarshan's National Channel, DAC&FW is producing films, which would consciously project inter-alia positive aspects in agriculture in India.

3.114 A three-tier system was set up, i.e., Apex Committee at Centre, the State Level Committees (SLC) and the District-Level committees (DLC) to provide guidance and monitor the programmes telecast/ broadcast through DD and AIR.

Focused Advertisement Campaign

3.115 DAC&FW has launched a **"Focused Advertisement Campaign"** to create awareness of assistance available under various schemes.

3.116 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.

3.117 A new format of medium, i.e., Digital Cinema Advertisement, has been introduced from 2011-12 under the Focused Advertisement Campaign. Spots are being telecast during all the 4 shows of cinema halls through Digital Cinema Network empanelled with DAVP and as per rates approved by DAVP.

3.118 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.

3.119 The following AV spots are currently being telecast/broadcast through DD, AIR and private TV channels at National level and Regional-level Farm School (Munim)

(i) Farm School (Sass Bahu and MunimJi)
(ii) Kisan Credit Card
(iii) Judicious use of Fertilizers
(iv) Kisan Call Centre (Sadhu Baba)
(v) Kisan Call Centre (Audio)
(vi) Kisan Call Centre (Sequel)
(vii) Agri-Clinics & Agri-Business Centres
(viii) Judicious Use of Pesticides
(ix) Cooperatives Video and Audio
(x) Machinery and Technology.

3.120 The spots have been telecast through DD National and 25 Regional Kendras of DD as well as private channels operating at National & regional level as per approved media plan. To monitor the campaign, a software has been developed with the help of National Informatics Centre (NIC). All the channels are uploading the pre-logs (time band of 20 minutes) and post logs. IP TVs have also been installed to monitor the campaign. A Focused Campaign Committee has been formed in DAC&FW and regular meetings of the committee are being held to monitor the programme. The impact of the campaign has already been evaluated by M/s Spectrum Panning India Ltd., Faridabad, as third party evaluation of the 'Evaluation and Impact Assessment Study' of "Mass Media Support to Agricultural Extension" Scheme.

Box 3.5: Kisan Call Centre (KCC)

Kisan Call Center (KCC) initiative aims to provide information to the farming community through toll-free telephone lines (telephone No. 1800 180 1551). Recently KCCs have been further revamped by consolidation and appointing a new service provider for KCC to set up state of the art KCCs at 14 identified locations. The restructured KCCs are now more professional with the following technological innovations:

- Voice Media Gateways (IPPBX based decentralized system).
- Dedicated MPLS leased line network with dedicated bandwidth.
- SMS to caller farmers providing a gist of advisories given to them on phone.
- 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.
- Call Conference/Call Escalation for advice at higher levels.
- 100 per cent Call Recording to check quality of service provided.

Extension Strategy

3.121 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.

3.122 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.

3.123 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).

3.124 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 (EEIs) (4) 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.

3.125 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.

3.126 The new component of **Skill Training of Rural Youth (STRY)** aims at training rural youths, rural artisans (blacksmiths, carpenter etc. designing/ manufacturing farm implements) including farm women across the country.

3.127 Another new component on **"Farmer's Capacity Assessment & Certification"** has been included in HRD intervention which aims at providing recognition to traditionally skilled farmers including farm women in various sectors of agriculture & allied disciplines through certification.

3.128 Diploma in Agricultural Extension Services for Input Dealers (DAESI). DAESI another innovation, the objective of which is to impart education in agriculture and other allied areas to the Input Dealers to enable them to established linkage between business them and extension services. This programme was earlier implemented through MANAGE in self-financing mode in Andhra Pradesh, Maharashtra, Tamil Nadu, Odisha, Jharkhand & West Bengal. However, the effort is now to spread it all States through SAMETI.

Information Technology

3.129 Information and Communication Technology (ICT) in agriculture is an emerging field focusing on integrated agricultural and rural development through the use of improved information and

communication processes. The thrust of these processes has been to create a conducive environment for raising farm productivity and income through the provision of relevant information and services to the stakeholders in an efficient and transparent manner. Timely and accurate dissemination of such information is beneficial for the different stakeholders involved in the process, viz., farmers, policy makers, agribusiness community with primary focus on value chain in agriculture, research professionals, etc.

3.130 In order to achieve the aforesaid aims and objectives, the Ministry of Agriculture and Farmers Welfare has articulated key **SMART (Specific, Measurable, Achievable, Realistic and Time-bound)** objectives which need to be achieved. These are as follows:

i. **Improve access of farmers to timely and relevant information and services throughout crop cycle with the following interventions:**
   a) by providing multiple delivery channels to access information;
   b) by reducing time between generation and dissemination of information; and
   c) by providing information to the farmer through a uniform platform

ii. **Bringing in farmer centricity & service orientation to the programs by providing location specific and up-to-date crop management related information in terms of:**
   a. **GAP**– how many days, season specific, crop specific, location/zone specific
   b. **POP**– how many days, season specific, crop specific, location/zone specific
   c. Providing personalized advisory services

iii. **Increasing effectiveness of Government service delivery in the following:**
   a. Certification and licenses related to Manufacturing and Marketing through use of ICT
   b. Providing easier and approachable channels for grievance registration and tracking

iv. **More effective management of schemes of DAC&FW through process redesign aimed at**
   a. Effective Monitoring of the Schemes (timeliness of implementation)
   b. Reducing time required for data consolidation and reporting of schemes at all levels

v. **Enable private sector participation to benefit farmers by providing an integrated platform to promote value added services in**
   a. Extension
   b. Marketing (both input and output)
   c. Post-harvest & Storage.

3.131 Government of India has initiated multiple steps to usher ICT interventions in Indian agriculture. A Central Sector Plan Scheme "Strengthening/Promoting Agricultural Informatics & Communications", with AGRISNET as one of the components, is being implemented since 2005-06 to provide improved services to the farming community through the use of ICT. Under this funds were released to the concerned State Government for provisioning of software and hardware systems, including, networking, data digitization, and manpower training to ensure computerization up to block level. A total of 26 States have so far availed funds released by the Government under AGRISNET. The Scheme has now been integrated under the National Mission on Agriculture and Information Technology (NMAET).

3.132 The Agriculture Mission Mode Project (NeGP-A) is another effort under the Mission Mode Projects (MMPs) of the National e-Governance Plan of the Government of India. It aims to replicate the agricultural e-governance projects being carried in different states at a National level and provides the services through multiple delivery channels such as

the centralized agricultural portal, Kisan Centres, touch screens, and mobiles. This project stresses on using IT in all stages of the agricultural crop cycle, i.e., starting from crop selection stage to pre-cultivation, crop management, pre-harvest, harvesting and finally up to post-harvest stage.

3.133 The availability of aforesaid services has basically been through web only. However, the low internet coverage at 12.89 per cent in rural areas of the country makes it a daunting task for the policy makers to disseminate timely and accurate information to the farming community. Although the data on mobile phone penetration, in both urban and rural areas, shows some encouraging results, the costlier android based phones and low availability of 2G or 3G enabled networks in major parts of the country, poses major challenge for the policymakers in formulating IT enabled policies in the agricultural sector. Keeping these factors into consideration, government has been focusing on new and innovative combinations of web technologies, push and pull SMS, USSD, IVRS, etc. to disseminate information to the farmers and all other stakeholders.

3.134 Besides low internet penetration in rural areas, lower level of literacy is also an inhibiting factor. India being a federal democracy with agriculture being the state subject, it is extremely difficult to implement "one size fit all" applications, services or policies. Getting all State Governments to agree on a common platform of services is an onerous task, as each State has its own set of rules and procedures. Within States/ UTs also there are differing levels of ICT penetration which make the task more formidable. Surmounting all these above challenges, some of the successful initiatives in ICT by the Government of India are as under.

i) **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 the national level from various applications of the States/UTs.

ii) **The mKisan Portal** (http://mkisan.gov.in/) subsumes all mobile based initiatives in the field of Agriculture & allied sectors. It brings together SMS (both Push and Pull), Interactive Voice Response System, Unstructured Supplementary Services of Data or USSD (which is essentially Interactive SMS and can facilitate data entry and query on Web Portals without internet), 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. As on 30.11.2015, more than 1040 crore SMSs have been sent to farmers by all agencies/organization/departments in agriculture and allied sectors down to Block level throughout the country, since its inception on 16 July 2013. The farmers can register for this service by calling Kisan Call Centre on the toll free number **1800-180-1551** or through the Web Portal. A farmer can give up to 8 choices for his/her preferred while registering for the service. The SMS Portal provides a platform for integration of service delivery under different sectors viz. Agriculture, Horticulture, Animal Husbandry and Fisheries.

iii) **Mobile Applications** have been developed by

the DAC&FW for android with GPS tagging. Details are as under:

(a) **Hail Storm application:** Farmer or other stakeholder may upload hail storm photograph with GPS tagging.

(b) **Crop Insurance:** Famer 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

3.135 Besides above, the DAC&FW has developed many more portals, applications and websites (primarily in collaboration with the National Informatics Centre) covering both the headquarters and its field offices/ directorates. The important portals include SEEDNET, DACNET, AGMARKNET (prices and arrivals in Mandis), RKVY (Rashtriya Krishi Vikas Yojana), PGS India (for organic food products), NHM (National Horticulture Mission), FARMAP (calculation of input costs of growing different crops), PQIS and SIP (for awarding permissions for import or export of Agriculture & Animal related products), INTRADAC, NFSM (National Food Security Mission) and APY (Acreage, Productivity and Yield). The list is ever growing as more and services are being brought under ICT.

3.136 Kisan Call Centres (KCC) was launched in 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. Since its inception, it has registered more than 2.30 crore calls till November, 2015. Recently, KCCs have been revamped and restructured by consolidation and appointing a new service provider for KCC to set up state of the art calls centres at 14 identified locations. The restructured KCCs are now more professional with the technological innovations like Voice/Media Gateways, dedicated MPLS leased line network with assured 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.

Way Forward

3.137 Digital Agriculture has been approved by the Cabinet as one of the 10 new MMPs to be implemented under e-Kranti, or now designated as Digital India. This is an extension of existing Agriculture NeGP-A 1.0 to areas or services not covered earlier and also to strengthen the efforts initiated during earlier ICT implementations. Some of the key thrust areas identified under Digital India for the Ministry of Agriculture & Farmers Welfare are:

a) Real Time Price Information
b) Online ordering of inputs
c) Online cash, loan, relief payments with mobile banking

3.138 Key components proposed by DAC&FW to be included under Digital Agriculture are as under:-

a) Sector specific services for Horticulture and Fisheries.
b) Governance & Citizen-Centric services for Cooperation and Fertilizer Testing Labs.
c) Agriculture Census
d) Cooperation
e) Integrated Cold Chain Availability Platform (ICAP)
f) Integration of Farmer Oriented Services.
g) Integration of Research and Development initiatives in Agriculture and Allied sectors

Rural Development Programmes

3.139 The Ministry of Rural Development is implementing various rural development programmes namely the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), National Rural Livelihoods Mission (NRLM),

Pradhan Mantri Gram Sadak Yojana (PMGSY), Indira Awaas Yojana (IAY) and National Social Assistance Programme (NSAP) in rural areas of the country through State Governments/UT Administrations to bring about overall improvement in the quality of life of the people in rural areas through employment generation, development of rural infrastructure and provision of other basic amenities. These schemes help in bringing about inclusive development in the rural areas of the country. Rural development programmes especially Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) and Mahila Kisan Sashaktikaran Pariyojana (MKSP) under National Rural Livelihood Mission (NRLM) have a significant contribution on sustaining natural resources. These schemes contribute immensely towards regenerating common land water bodies which offer sustenance to the rural poor through provisioning of goods and ecosystem services.

Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)

3.140 To minimize the impact of drought on the agriculture productivity it has been suggested to the States 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.

3.141 The list of permissible works under MGNREGA has been expended with a focus to strengthen the synergy between MGNREGA and rural livelihoods, particularly agriculture, and create durable quality assets. The permissible activities under MGNREGA (Schedule-1 of MGNREGA Act, 2005) that directly relates to agriculture are as below:

I. Agricultural 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.

(iii) 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 bunds, tank foreshores and coastal belts duly providing right to 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, vermin 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.

II. Allied Sector Activities of Agriculture

i. Creating infrastructure for promotion of livestock such as poultry shelter, goat shelter, piggery shelter, cattle shelter and fodder troughs for cattle; and

ii. Creating infrastructure for promotion of fisheries such as, fish drying yards, storage facilities, and promotion of fisheries in seasonal water bodies on public land

iii. Works for promoting agricultural productivity by creating durable infrastructure required for bio-fertilizers and post-harvest facilities including pucca storage facilities for agricultural produce;

iv. Construction of Food Grain Storage Structures for implementing the provisions of The National Food Security Act 2013 (20 of 2013)

3.142 Detailed guidelines have been issued for convergence with the watershed projects for convergent action in developing the natural resources.

Table 3.19: Expenditure on Water Conservation/Harvesting Works since Inception under MGNREGA (till January, 2016)

Works	Expenditure (In Rs Lakh)	Percentage of Total Expenditure (%)
Water Conservation and Water Harvesting	4315443.4	14.8
Renovation of traditional water Bodies	7793516.7	26.8
Drought proofing	1322986.5	4.5
Flood control and protection	1065778.2	3.7
Micro irrigation works	1255564.2	4.3
Works on individual land (like (like wells)	1598735.9	5.5
Land development	1786247.5	6.1
Total on water related works	**19138272.4**	**65.7**

National Rural Livelihood Mission (NRLM)

3.143 The Mission aims at creating efficient and effective institutional platforms of the rural poor enabling them to increase household income through sustainable livelihood enhancements and improved access to financial services.

Mahila Kisan Sashaktikaran Pariyojana (MKSP)

3.144 It is a special programme for livelihood enhancement under NRLM. It is a concerted effort to recognize the role of women in agriculture and an investment is being made to enhance their capacities and increase their income to take lead in agriculture and allied activities. The primary objective of MKSP is to make systematic investments to enhance women's participation and productivity in agriculture based livelihoods. Under the sustainable agriculture theme of MKSP, specific objectives of MKSP are as follows:

i. To enhance the productive participation of women in agriculture;

ii. To create sustainable agricultural livelihood opportunities for women in agriculture;

iii. To improve the skills and capabilities of women in agriculture to support farm and non-farm-based activities;

iv. To ensure food and nutrition security at the household and the community level;

v. To enable women to have better access to inputs and services of the government and other agencies;

vi. To enhance the managerial capacities of women in agriculture for better management of bio-diversity;

vii. To improve the capacities of women in agriculture to access the resources of other institutions and schemes within a convergence framework.

Core focus

3.145 The core focus of MKSP is to promote sustainable agriculture, where the inputs are localized, risks are mitigated, productivity is enhanced, food security is ensured and hence net income of family is increased. It promotes sustainable, and climate change resilient agriculture practices (such as Non-Pesticide Management, system of root Intensification (SRI)) that preserve local biodiversity.

Expected outcomes under MKSP

3.146 The expected outcomes of MKSP Project implementation are as follows:

i. Net increase in the income of women in agriculture on a sustainable basis.

ii. Improvement in food and nutritional security of women in agriculture and their families

iii. Increased access of women in agriculture to productive land, inputs, credit, technology and information

iv. Drudgery reduction for women in agriculture through use of gender friendly tools/ technologies.

v. Improved market access for women's produce/ products

vi. Increased soil health and fertility to sustain agriculture based livelihoods

vii. Increased levels of skills and performance by women in agriculture

viii. Increase in area under cultivation and food production by women

ix. Increased visibility of women in agriculture as an interest group in terms of increased number of women institutions and increase in their entrepreneurship.

Activities under MKSP

3.147 Under MKSP, the work is mainly carried out in two major domains – **Sustainable Agriculture and Non Timber Forest Products (NTFP) activities.** The overall strategy endeavours to increase the access of Mahila Kisan to a basket of activities, which will dilute the risk associated with any one activity keeping intact the bio-diversity and promoting climate change resilient agriculture. Emphasis has been laid on the following activities to achieve the desired outcome. These are as under:

i. Low-cost sustainable practices such as Non chemical Pest Management (NPM)/Integrated Pest Management (IPM)/Integrated Nutrient Management

ii. Soil health improvement

iii. Promotion of indigenous variety of seeds

iv. Soil and water conservation

v. Diversified poly crop model

vi. Reduction in Greenhouse gas emission

vii. Reduction in water pollution affected by chemical pesticide usage.

Figure 3.9: Mahila Kisan Sashaktikaran Pariyojana Sustainable Agriculture

3.148 Under NTFP practices, the emphasis has been laid on plantation work (like tasaa host trees plantation, etc.), rehabilitation of degraded watersheds through MGNREGS convergence, promoting regeneration of NTFP species, use of locally adopted community centric technologies etc.

Implementation status since 2012-2013

3.149 A total of 65 MKSP projects spread over 117 districts across 14 States are currently being implemented. Projects in Andhra Pradesh and Kerala cover all the districts and blocks in the states and are being implemented by State Rural Livelihoods Missions (SRLMs) of these states. In remaining 12 states, MKSP is implemented in 178 blocks across 95 districts. As on March 2014, MKSP has reached out to 24.5 lakh Mahila Kisan.

Proposed Interventions Specific to Agriculture

3.150 Some of the key interventions in the field of agriculture being promoted by various Project Implementing Agencies (PIAs) are as follows:

i. Promoting SRI, 36*36 model and Rain fed Sustainable Agriculture

ii. Organizing farmer's field schools to upgrade women farmer's knowledge in eco-friendly farming technologies

iii. Organizing exposure visits, demonstrations for women farmers.

iv. Promoting community seed banks in selected villages, promoting tool banks and common facility centres, and drudgery reduction low-cost tools.

v. Establishing decentralized extension system through trained community resource persons and paraprofessional / master farmers

vi. Promoting collecting farming models through Joint Liability groups

vii. Soil Testing, promoting agro clinics for crop management.

viii. Promoting NPM (Non pesticide management) /IPM mode of farming, vermin-compost, usage of bio-pesticides, etc.

ix. Promoting INM (Integrated nutrient management practices)

x. Promoting Integrated Framing system, organic mode of faming / zero budget farming models.

xi. Promoting SWI and similar models in other crops; vegetable cultivation; and kitchen garden

xii. Training on principles of improved grain production; demonstration of new seed varieties, seed treatment and seed germination; impart practical training for in-situ soil and moisture conservation to increasing farm productivity; and training and demonstration on low-cost modern micro irrigation system.

xiii. Establishing farmers'/producers' groups and federations and creating market linkage; promoting better post-harvest practices for value addition.

xiv. Promoting local varieties and crops and low-cost farming practices.

Agricultural Production and Programmes

4.1 Recent policy initiatives of the Government have evolved from the failures and successes of past development strategies. While the Green Revolution years led to greater food security, this largely remained confined to a few states, including Punjab, Haryana and Western Uttar Pradesh and covered only wheat and paddy. It also led to soil fatigue in Punjab, Haryana and Western UP, and a general failure to elicit a developmental response from other major agro-climatic zones. The failure to reach other states, foodgrains and agricultural produce is being addressed through the initiatives discussed in this chapter.

Agricultural Performance

4.2 The phenomenal increase in foodgrains from 196.81 million tonnes in 2000-01 to an all-time high of 265.04 million tonnes in 2013-14 led to a surplus compared to domestic requirements and contributed substantially to overall exports. However, a bad monsoon during 2014-15 affected the production of kharif crops, and added to it was the effect of the unseasonal rains and hailstorms during February-March 2015 on the production of rabi crops. As a result, food grain production during 2014-15 is estimated at 252.68 million tonnes according to the Fourth Advance Estimates. Crop-wise trends in production and yield are discussed in the following section.

Rice

4.3 Vigorous rice farming initiatives undertaken during 2006-07 to 2013-14 raised rice production from 93.36 million to 106.65 million tonnes. The introduction of better crop varieties, intensive application of inputs, irrigation, adequate price support and timely procurement by the Government made this achievement possible. During 2014-15, production stood at an estimated level of 104.8 million tonnes, indicating a decline of 1.85 million tonnes over the last year.

4.4 The productivity in rice cultivation has increased from 2,131 kg per hectare in 2006-07 to 2,390 kg per hectare during 2014-15. Although yield differentials within the country are significant, yield of rice in most of the states has been lower than that of Punjab. However, there has been significant improvement in the yield of rice in the recent years.

4.5 The Government is encouraging farmers to adopt suitable technologies and agronomic practices; incentivizing the production of location specific, high yielding varieties, hybrid rice seeds and tolerant varieties against abiotic and biotic stresses; and promoting marketing infrastructure.

4.6 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

4.7 The area under wheat cultivation increased from 27.99 million hectares in 2006-07 to 30.47 million hectares in 2013-14, whereas the production increased from 75.81 million tonnes in 2006-07

to an all-time record high of 95.85 million tonnes in 2013-14, implying a significant improvement in productivity. This more than three times rise in wheat production was made possible by increasing the area under assured irrigation facilities, better seed treatment and adoption of newer varieties, timely rust management and timely sowing of crop to escape terminal heat stress. The unseasonal rains and hailstorm during Feb-March 2015, however, adversely affected the production of rabi crops. As a result, wheat production in 2014-15 is estimated at 88.94 million tonnes (Fourth Advance Estimates) as compared to 95.85 million tonnes in 2013-14.

4.8 The productivity of wheat, which was at 2,708 kg per hectare in 2006-07, increased to 2,872 kg per hectare in 2014-15. This rise in productivity resulted from a developmental focus on increasing the seed replacement rate (SRR) along with varietal replacement with rust resistant ones and seeds resistant to different biotic and abiotic stresses including multi stress tolerant cultivars. The improvement in productivity is equally ascribed to technological interventions, such as maintaining an optimum sowing time, line sowing, avoiding terminal heat stress, avoiding early sowing in mid hills to break green bridge to contain rusting, cultivating rust resistant varieties like DPW-621-50, PBW-550, DBW-17, HD-1105, etc. in the plains of NWPZ and testing and popularizing rust resistant varieties like HS-375 and VL-832 in the higher hills during summer cultivation, adopting resource conservation technologies (RCT) including zero tillage, laser land leveller, revising rust epidemiology in higher hills, management of adequate spacing between row to row to augment yield and weed and nutrient management.

Coarse Cereals

4.9 Coarse cereals such as barley, jowar, bajra, ragi, other small millets (kudo, kutiki, sanwa, and foxtail) and maize are the major components of the traditional Indian food basket for the poor in India. These are grown predominantly in the rain-fed regions of Karnataka, Maharashtra, Tamil Nadu, Madhya Pradesh, Rajasthan, Haryana and Gujarat. The area, production and yield trends in the coarse cereals segment during 2006-07 to 2014-15 highlight the success of the development strategy, wherein despite a decline in area under cultivation for these crops, production increased due to increase in yield. The decline in the area coverage under coarse cereals was from 28.71 million hectares in 2006-07 to 24.15 million hectares in 2014-15. However, the productivity of coarse cereals has increased significantly during this period from 1,182 kg per hectare to 1,729 kg per hectare. The increase in productivity was observed in almost all the major coarse cereals producing states resulting in an increase in the total production of coarse cereals from 33.92 million tonnes in 2006-07 to 41.75 million tonnes in 2014-15.

4.10 Millets are grown in arid and semi-arid areas which receive low rainfall ranging between 200 to 600 mm where fine cereals like wheat and rice cannot be grown profitably. Millets have more food, feed and fodder values. These crops are more environment friendly and resilient to climate change. A majority of millet grains contain higher protein, fibre, calcium and minerals than fine cereals, earning them the name "nutri-cereals".

4.11 To address various problems such as the non-adoption of the recommended doses of inputs due to high risk in the rain-fed agro-climatic regions, the non-availability of high yielding varieties and quality seeds particularly of small millets, cultivation in rain-fed areas, lack of assured procurement under MSP and the poor resource base of the farmers, the Initiative for Nutritional Security through Intensive Millets Promotion (INSIMP) was subsumed under NFSM-Coarse Cereals from 2014-15. Interventions like cluster demonstrations of improved technologies as the sole crop and intercrop and distribution of quality seeds are being promoted to enhance production and productivity of coarse cereals in the country under NFSM-Coarse Cereals.

4.12 In order to refine and demonstrate post harvest technologies, build entrepreneurship capacity and promote market linkages between

producers and processors, two commodity–wise Centres of Excellence (CoE) for sorghum and earl millet have been operationalised at the Directorate of Sorghum Research (DSR), Hyderabad and CCS Hisar Agricultural University, Hisar. A third CoE for small millets is being established at the University of Agriculture Sciences, Bengaluru. These centres have developed a large number of bakery and other food products and organize consumer awareness campaigns and training programmes for entrepreneurs.

Pulses

4.13 India grows the largest variety of pulses in the world, accounting for about 32 per cent of the area under cultivation and 25 per cent of the world production. The important pulse crops are chickpea with a 49 per cent share, pigeon pea with a 16 per cent share, lentils with a 7 per cent share, mungbean with a 5 per cent share, field pea with a 5 per cent share and urdbean with 4 per cent. The major pulse producing states are Madhya Pradesh with a 27 per cent share, Rajasthan with an 11 per cent share, Maharashtra with a 10 per cent share, Uttar Pradesh with an 8 per cent share and Andhra Pradesh with a 7 per cent share, which together accounted for 63 per cent of the total production during 2014-15.

4.14 Pulses production has registered a remarkable increase from 14.20 million tonnes in 2006-07 to a record level of 19.25 million tonnes in 2013-14. The increase in the total production of pulses has been on account of improvements in the production levels of urdbean and gram. The production of pulses during 2014-15 is, however, estimated at 17.19 million tonnes according to the Fourth Advance Estimate.

4.15 Productivity of pulses increased from 612 kg per hectare in 2006-07 to 744 kg per hectare in 2014-15. A major increase in the productivity of pulses was noticed in the states of Himachal Pradesh, Gujarat, Punjab, Madhya Pradesh, Chhattisgarh, Bihar and Jharkhand.

4.16 The Government of India gives priority to increasing the production of pulses. Around 50 per cent of the budget under the National Food Security Mission (NFSM) is allocated for pulses. Under NFSM, 623 districts of 27 states, including all the districts of the North Eastern and hill states, are covered for promoting the cultivation of pulses. In order to increase the production of pulses in the Eastern states, pulses have been included under the Bringing Green Revolution in Eastern India (BGREI) scheme from 2015-16 as part of demonstrations under the cropping system based approach to targeting rice fallow areas.

4.17 Besides, new avenues are also being explored in collaboration with the ICAR, SAU and other international organizations, viz., ICRISAT, ICARDA, etc., for addressing various researchable issues and demonstrating improved pulses production technologies.

4.18 Emphasis is also being placed on area expansion through promoting pulse cultivation in rice fallow areas, intercropping of pulses with commercial crops, oilseeds, cereals, etc., and productivity enhancement through demonstrations, integrated nutrient management (INM), IPM and popularization and promotion of high yielding varieties or hybrids. Under NFSM, financial assistance is provided to ICAR institutes to conduct frontline demonstrations (FLDs) of rice, wheat, pulses and coarse cereals across the country for validation and refinement of technologies in farmers' fields.

4.19 Major interventions under the NFSM include distribution of certified seeds, cluster demonstrations on improved technologies, INM, IPM, resource conservation techniques, efficient water application tools, cropping system based training, local initiatives and project management teams and other expenses at the district and state level.

4.20 The MSP of arhar (tur), moong and urad for the kharif marketing season 2015-16 has been fixed at Rs. 4,425, Rs. 4,650 and Rs. 4,425 per quintal respectively. In order to give more incentive to farmers, a bonus of Rs. 200 per quintal over and above the MSP has been given for all the three pulses in 2015-16. Similarly,

the cultivation of rabi pulses, i.e., gram and lentils, is also sought to be incentivized by fixing the MSP at Rs. 3,425 and Rs. 3,325 per quintal respectively, with a bonus of Rs. 75 per quintal over and above the MSP.

Oilseeds

4.21 The diverse agro-ecological conditions in the country are favourable for growing groundnut, rapeseeds and mustard, soybean, sunflower, sesamum, safflower, niger and non-edible oilseeds like castor and linseed. Oilseeds, raised about 72 per cent under rain-fed conditions, are important for the livelihood of small and marginal farmers in arid and semi-arid regions of the country. The Indian vegetable oil economy is the world's fourth largest after USA, China and Brazil. Oilseed cultivation is undertaken across the country across 260 lakh hectares, largely in rain-fed areas with risk in investment. Oilseeds account for 13 per cent of the gross cropped area, 3 per cent of the Gross National Product (GNP) and 10 per cent of all the agricultural commodities.

4.22 The domestic consumption of edible oils increased substantially over the years and touched 21.06 million tonnes in 2013-14 (Nov-Oct) and is likely to increase further with enhancement in income and population. The growth in the production of oilseeds at 32.75 million tonnes in 2013-14 has not been able to keep pace with the growth in consumption, and the gap between production and consumption is being met through imports. More than 14 million tonnes of vegetable oil was imported with a total value of more than Rs. 64,000 crores during 2014-15, which includes large share of palm oil and palmolein at 78 per cent followed by soybean at 10 per cent and sunflower oil at 9 per cent.

4.23 Area, production and yield, which was 225.96 lakh hectares, 202.29 lakh tonnes and 895 kg per hectare respectively during 2003-04, touched record production of 327.49 lakh tonnes and yield of 1,168 kg per hectare respectively during 2013-14 with an increase of more than 62 per cent in production and more than 30 per cent in yield. However, the area, production and productivity of oilseeds sharply declined to 257.26 lakh hectares, 266.75 lakh tonnes and 1,037 kg per hectare respectively during 2014-15 as per the Fourth Advance Estimates due to delayed and deficit rainfall. Almost 2 million tonnes of vegetable oils is being produced from cotton seeds and rice bran in the country. Coconut is also a major source of vegetable oil, which is mainly used for cooking in Kerala and as hair oil.

4.24 Oil palm was introduced in India in the early 1970s in plantations in Kerala, Andaman Nicobar and Goa. It has now been well acclimatized and is under commercial cultivation over an area of 2.69 lakh hectares in the country during 2013-14. Out of this, 1.75 lakh hectares is at the fruiting stage and approximately 1.5 lakh tonnes of palm oil is being produced. The major oil palm growing states are Andhra Pradesh, Karnataka, Tamil Nadu, Mizoram, Kerala, Odisha, Gujarat, Goa, Maharashtra and Chhattisgarh.

4.25 The existing Centrally Sponsored Schemes of Integrated Scheme of Oilseeds, Oil Palm and Maize (ISOPOM), Tree Borne Oilseeds (TBOs) and Oil Palm Area Expansion (OPAE) have been restructured into the National Mission on Oilseeds and Oil Palm (NMOOP), for implementation from 1 April 2014. The mission aims at enhancing the production of oilseeds from 28.93 million tonnes (average of 11th Plan) to 35.51 million tonnes by 2016-17 and to bring an additional area of 1.25 lakh hectares under oil palm cultivation with an increase in the productivity of FFBs from 4,927 kg per hectare to 15,000 kg per hectare by end of 12th Plan. The strategy includes increasing irrigation coverage for oilseeds crops, improving varietal replacement, area expansion of land cultivating oilseeds and oil palm, improving mechanization and strengthening procurement machinery for oilseeds and tree borne oilseeds and processing of oil palm. An outlay of Rs. 333 crores at the revised estimate stage of 2014-15 and Rs. 353 crores (BE) during 2015-16 have been allocated under NMOOP.

Sugarcane

4.26 Sugarcane, grown across an area of 5.14 million hectares (Fourth Advance Estimates, 2014-15), with a 55 per cent and 45 per cent geographical distribution between the sub-tropical and tropical India, is one of the important cash crops of the country. With sugarcane holding about a 5 per cent in total value of output from the crop sector, and a 2.8 per cent share in total gross cropped area, India is the second largest sugar producing country in the world after Brazil.

4.27 The total production of sugarcane reached the highest production level of 361.04 million tonnes during 2011-12 and is estimated to be 359.33 million tonnes during 2014-15 (Fourth Advance Estimates). Yield of sugarcane was 71.67 tonnes per hectare during 2011-12, which declined marginally to 69.86 tonnes per hectare during 2014-15 (Fourth Advance Estimates).

4.28 A centrally sponsored scheme, National Food Security Mission-Commercial crops (NFSM–CC) – Sugarcane, is being implemented in Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Telangana, Tamil Nadu, Uttarakhand and Uttar Pradesh with effect from 2014-15. The scheme aims at enhancing production and productivity in sugarcane based cropping systems through demonstration of intercropping and single bud chip technology, production of tissue culture raised plantlets/seedlings, strengthening/establishment of tissue culture and bio-agent laboratories, breeder seed production and national and state level training. Under the NFSM–CC, Rs. 800 lakhs was allocated for the sugarcane programme during 2014-15. For 2015-16, an amount of Rs. 1457.60 lakhs have been allocated for the above purpose.

Cotton

4.29 India is the largest cotton producer, consumer and exporter of cotton in the world. Gujarat, Maharashtra, Andhra Pradesh, Telangana, Haryana, Madhya Pradesh, Karnataka, Rajasthan and Punjab are the major cotton producing states.

4.30 Cotton production in India has increased more than two times in a span of a decade and reached a peak of 359.02 lakh bales during 2013-14 as compared to 164.29 lakh bales in 2004-05. As per the Fourth Advance Estimates for 2014-15, production of cotton is estimated at 354.75 lakh bales (of 170 kg each). The area under cotton cultivation during the last five years has increased from 101.32 lakh hectares in 2009-10 to 119.60 lakh hectares in 2013-14 and is estimated at 130.83 lakh hectares in 2014-15. Cotton productivity in the country has increased significantly from 403 kg per hectare in 2009-10 to 510 kg per hectare in 2013-14. As per the Fourth Advance Estimates for 2014-15, productivity of cotton is estimated at 461 kg per hectare. The decline in productivity in 2014-15 was due to a whitefly infestation in Punjab and Haryana and moisture stress in many cotton growing states.

Box 4.1: Status of Commercialization of Transgenic Crops in India

Even though India began developing and deploying transgenic crops (GM crops) in the early 1990s, Bt cotton is the only transgenic crop approved for commercial cultivation in India. Bt technology was deployed in cotton crop through genetic engineering techniques for control of bollworms, a major pest, thereby reducing the risk of crop failures and the use of pesticides. Bt cotton produces a natural insecticide that comes from the ubiquitous soil bacterium known as Bacillus thuringiensis. It was approved by the Genetic Engineering Appraisal Committee (GEAC) for cultivation in the cotton growing states namely Andhra Pradesh, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu and Telangana. India's Bt cottons are unique in that they are hybrids and not varieties, as used by all other countries planting Bt cotton. India cultivated approximately11.75 million hectares of Bt cotton with an adoption rate of 94 per cent approximately (2013-14).

The GEAC has also approved confined field trials of 20 GM crops viz. cotton, mustard, brinjal, okra, sorghum, groundnut, maize, potato, tomato, chick pea, pigeon pea, banana, castor, papaya, watermelon, sugarcane, wheat, rice, rubber tree, Artemisia annua, for generation of biosafety data from both, private and public sector institutions.

Jute

4.31 India is the largest producer of raw jute in the world with more than a 50 per cent share in global production. The production of jute has fluctuated during the period 2009-10 to 2014-15. During 2014-15, production was estimated at 10.93 million bales (of 180 kg each). The area under jute cultivation ranged from 749.1 to 811.2 thousand hectares during 2009-10 to 2014-15. As per the Fourth Advance Estimates for 2014-15, the area under jute crop cultivation is estimated at 749.1 thousand hectares. Production of jute is concentrated in the states of West Bengal, Bihar, Assam and Odisha, which accounted for 99.29 per cent of total production in 2014-15. The share of West Bengal in the total production and area was 77.91 per cent and 71.28 per cent respectively in 2014-15. For the years 2014-15 and 2015-16, Rs. 700 lakh and Rs. 1,716 lakh were allocated respectively for the development of jute in the country under the NFSM.

Commodity Outlook

4.32 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 the emerging agricultural scenarios both in the short term of one or two quarters and also in the medium to longer term. The medium term production projections of major agricultural commodities by the NCAER and other international organizations are given in **Table 4.1.** These reports are available on the website of the NCAER at http://www.ncaer.org/publication.php.

Table 4.1 Average Annual Growth Rate of Production of Selected Food Commodities in India

Crops	Actual Growth Rate	FAO/ OECD	USDA	FAPRI	IGC	NCAER	
						India stand-alone Cosimo Model	Econometric Model
	2004-2014	2013-23	2013-23	2013-21	2013-19	2015-24	2015-23
Wheat	3.55	1.54	0.77	1.11	1.04	1.23	1.63
Rice	2.00	1.46	0.76	NA	1.91	1.47	2.51
Coarse grains	2.09	1.75	2.26	1.91	1.8	1.52	2.63
Pulses	3.77						1.29
Total oilseeds	0.98	2.63	2.09	0.6	1.25	1.47	4.93
Vegetable oil	0.94	2.77	2.49	0.76	na	1.37	
Sugar	3.80	2.00	NA	1.75	NA	2.37	
Root and tubers	4.55					1.42	
Egg	4.62					3.99	
Milk	3.89					3.37	
Poultry	6.59					2.44	

Source: *Agricultural Outlook and Situation Analysis Report (Semi-Annual Medium Term), September 2015, NCAER.*

Special Initiatives for Enhancing Agricultural Production

National Food Security Mission (NFSM)

4.33 In 2012-13, six North Eastern states, viz., Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Sikkim, were brought under the NFSM – Rice and Hill States and Himachal Pradesh and Uttarakhand were included in NFSM - Rice and Wheat and while Jammu and Kashmir was included under NFSM-Wheat. Thus, NFSM is now being implemented in 28 states of the country.

4.34 Coarse cereals and commercial crops are also covered under the revamped NFSM from 2014-15. The number of districts under NFSM was also revisited and is now being implemented in 623 districts across 28 states. Emphasis is being placed on the promotion of technologies and adopting the cropping system approach in identified districts. The basic strategy is to promote adoption of quality seeds and enhance farm efficiency through improved agronomic practices like line sowing, SRI, direct seedling, soil amendments, INM, IPM, water use efficiency and resource conservation technologies. Proven crop production technologies developed by the National Agricultural Research would be made available to farmers through a series of planned interventions and financial incentives.

4.35 Institutional strengthening and capacity building of human resource, particularly in the context of small and marginal farmers, oral lessees and tenant farmers in remote areas with respect to high risk yet strategic crops like pulses and millets would be taken up through the development of Farmer Producer Organizations (FPOs), creation of value chains and providing market linkages.

4.36 Strengthening of post-harvest management measures such as value chain integration of small producers and setting up of dal mills and mini-millet mills are included under local initiatives.

4.37 Under the National Food Security Mission (NFSM), NFSM – Rice is being implemented in 194 districts across 25 states; NFSM – Wheat is being implemented in 126 districts across 11 states; NFSM – Coarse Cereals is being implemented in 265 districts across 28 states; NFSM – Pulses is being implemented in 623 districts across 27 states during 2015-16.

4.38 The three major commercial crops of India are cotton, jute and sugarcane. Cotton is mainly grown in Assam, Andhra Pradesh, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Telangana, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal. Jute is mainly grown in Andhra Pradesh, Assam, Bihar, Meghalaya, Nagaland, Orissa, Tripura, Uttar Pradesh and West Bengal. Sugarcane is mainly grown in Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Telangana, Tamil Nadu, Uttarakhand and Uttar Pradesh.

4.39 The Government of India has approved the Crop Development Programme for enhancing the production and productivity of cotton, jute and sugarcane under National Food Security Mission – Commercial Crops (NFSM–CC) from 2014-15. In this scheme, emphasis is placed on the transfer of technology through frontline demonstrations and trainings. Under the NFSM–CC, an allocation of Rs. 5,204.10 lakhs has been made for 2015-16, .with Rs. 1,381 lakhs for sugarcane, Rs. 1,673 lakh for cotton and Rs. 1,586 lakhs for jute, which would be implemented with a sharing pattern of 50:50 between the Centre and states and an amount of Rs. 564.10 lakh has been allocated for central agencies which is being implemented with 100 per cent funding by the Central Government.

Bringing Green Revolution to Eastern India (BGREI)

4.40 The Bringing Green Revolution to Eastern India programme (BGREI) has been operational in the seven states of Assam, Bihar, Chhattisgarh, Jharkhand, Odisha, Eastern Uttar Pradesh and West Bengal since 2010-11, with the objective of increasing the productivity of rice based cropping systems

by intensive cultivation through the promotion of recommended agricultural technologies and practices that address the underlying constraints of different agro-climatic sub-regions. The activities carried out under the programme include cluster demonstrations on rice and wheat, asset building activities, site specific activities and marketing support.

4.41 Drawing on the implementation experience of beneficiary states during the last five years under the NFSM – Rice, certain modifications were made in this scheme from the year 2015-16. This included a few more interventions like seed distribution of rice and wheat, seed production incentives for newer varieties or hybrids of rice and wheat, the inclusion of IPM and INM, the introduction of farm implements like laser land leveller, etc. and cropping system based training for farmers, which were not covered so far.

4.42 The programme was being implemented in BGREI states on 100 per cent central assistance till 2014-15, and an amount of Rs. 400 crores was allocated for the programme for the years 2010-11 and 2011-12. Looking at the significant impact of the programme during the course of its implementation in the last two years, the budget allocation was enhanced to Rs. 1,000 crores during 2012-13. The same amount was allocated for the years 2013-14 and 2014-15.

4.43 From the year 2015-16, the programme is implemented on a 60:40 sharing basis between the GOI and states, except for Assam where it is being implemented on a 90:10 sharing basis. Rs. 512.5 crores has been earmarked by the Central Government for the implementation of the programme.

Impact of Bringing Green Revolution to Eastern India

4.44 The production of rice in Eastern India has showed a significant rise of 25.5 per cent since 2009-10. This was achieved as the seven Eastern states r aised their total rice production from 45.65 million tonnes during 2009-10 to 55.80 million tonnes during 2014-15 (Four Advance Estimates) after implementation of BGREI and NFSM. The production of rice in the BGREI states over years is given in **Table 4.2** below.

Table 4.2 Production of Rice in Bringing Green Revolution to Eastern India States

S. No	State	Production of Rice (Lakh Tonnes)							%Increase in 2014-15 Over Average of Last 5Years' Production
		2009-10	2010-11	2011-12	2012-13	2013-14 (Final)	Average 2009-10 to 2013-14	2014-15 (4th Advance Estimate)	
1	Assam	43.36	47.37	45.16	51.28	49.27	47.29	48.63	2.83
2	Bihar	35.99	31.02	71.63	75.29	55.06	53.8	63.77	18.53
3	Chhattisgarh	41.1	61.59	60.28	66.09	67.16	59.24	60.21	1.64
4	Jharkhand	15.38	11.1	31.31	31.65	28.11	23.51	33.2	41.21
5	Odisha	69.18	68.28	58.07	72.96	76.13	68.92	82.86	20.23
6	Uttar Pradesh	108.07	119.92	140.22	144.16	146.36	131.75	122.21	-7.24
7	West Bengal	143.41	130.46	146.06	150.24	153.71	144.78	147.11	1.61
	Total of Seven States	**456.49**	**469.74**	**552.73**	**591.67**	**575.8**	**529.29**	**557.99**	**5.42**
	Per Cent Share to All India	**51.24**	**48.95**	**52.49**	**56.23**	**53.99**	**52.69**	**53.24**	**-**
	All India	**890.83**	**959.7**	**1,053.01**	**1,052.32**	**1,066.46**	**1,004.46**	**1,047.98**	**4.33**

Source: Directorate of Economics & Statistics, DAC&FW

Crop Diversification in the Green Revolution States

4.45 The Crop Diversification Programme is being implemented as a sub-scheme of the Rashtriya Krishi Vikas Yojana (RKVY) programme in the original Green Revolution states, viz., Punjab, Haryana and Western Uttar Pradesh, since 2013-14 to diversify cropping patterns from water guzzling crops such as paddy to pulses, oilseeds, maize and agro-forestry with the objective of tackling the problem of declining of soil fertility and a depleting water table in these states. Alternate crop demonstrations, promotion of farm mechanization and value addition, site specific activities and awareness campaigns and training are the major interventions of the programme. In order to encourage tobacco growing farmers to shift to alternative crops/cropping systems, a component has been included under the ongoing sub-scheme CDP to diversify crops in tobacco plantations in the states of Andhra Pradesh, Bihar, Gujarat, Karnataka, Maharashtra, Odisha, Tamil Nadu, Telengana, Uttar Pradesh and West Bengal with effect from 2015-16. An amount of Rs. 150 crores has been allotted by the Central Government (Rs. 125 crores for CDP in the original Green Revolution states and Rs. 25 crores for CDP for replacing tobacco with alternate crops/cropping systems) for implementation of the programme during 2015-16.

Box 4.2: Krishi Karman Awards

The Krishi Karman Awards were instituted in the year 2010-11 to reward the best performing states in the production of foodgrains and individual crops of rice, wheat, pulses and coarse cereals. During the year 2011-12, in addition to the Krishi Karman Awards, Commendation Awards were also included for those states which achieved high production and productivity over their previous five years but were not eligible for the Krishi Karman Award. Besides, the Agriculture Minister's Krishi Karman Awards for Progressive Farmers were also instituted from the year 2011-12 to reward one male and one female farmer in each of the eight Krishi Karman Award winning states. From the year 2013-14, oilseeds crops have also been included under the individual crop category.

From the year 2013-14, the Krishi Karman Awards for foodgrains (Category I, II and III) comprised cash prizes of Rs. 5 crores (in place of Rs. 2 crores in earlier years) for each state, a trophy and citation; for individual crops including oilseeds, the award comprised Rs. 2 crores in place of Rs. 1 crore during earlier years, a trophy and citation; and Commendation Awardee states received a citation plus cash of Rs. 1 crore (in place of Rs. 25 lakhs during earlier years) for improving the work environment in the Agriculture Departments of awardee states. Besides, awardee farmers were given a citation plus cash awards of Rs. 2 lakhs (in place of Rs. 1 lakh during earlier years) to improve their infrastructure development.

The following awards were presented on 19 February 2015 by the Hon'ble Prime Minister of India:

(A) Krishi Karman Awards, 2013-14:

Total Food Grains Production:

Category I (> 10 million tonnes) - Punjab

Category II (< 10 to 1 million tonnes) - Odisha

Category III (> 1 million tonnes) - Meghalaya

Individual Crops:

Rice - Chhattisgarh

Wheat- Madhya Pradesh

Pulses- Assam and Tamil Nadu

Coarse cereals - West Bengal

Oilseeds – Gujarat

(B) Commendation Awards:

Total Food Grains:

Category – III- Nagaland and Arunachal Pradesh

Individual Crops:

Pulses- Maharashtra

Coarse Cereals- Jharkhand

Oilseeds – Karnataka

(C) Agriculture Minister's Krishi Karman Awards for Progressive Farmers:

Punjab: Shri Kulwinder Singh and Miss Veerpal Kaur for wheat

Odisha: Shri Nirakara Dharua and Smt. Nirupama Mohanty for paddy

Meghalaya: Shri Shatter Wann and Smt. Thersesa D. Sangma for paddy

Chhattisgarh: Shri Prabhat Chandrakar and Smt. Hemkumari for rice

Madhya Pradesh: Shri Manohar Patidar and Smt. Rekha Saini for wheat

Assam: Shri Pradip Kumar Das for peas and Smt. Amrita Surin for lentil

Tamil Nadu: Shri S. Veerama Reddiyar for redgram and Smt. Visalatchi for blackgram

West Bengal: Shri Bijoy Baskey and Smt. Jharna Modal for maize

Gujarat: Shri Parsottambhai Bhut and Smt. Jayashreeben Mulabhai Patat for groundnut

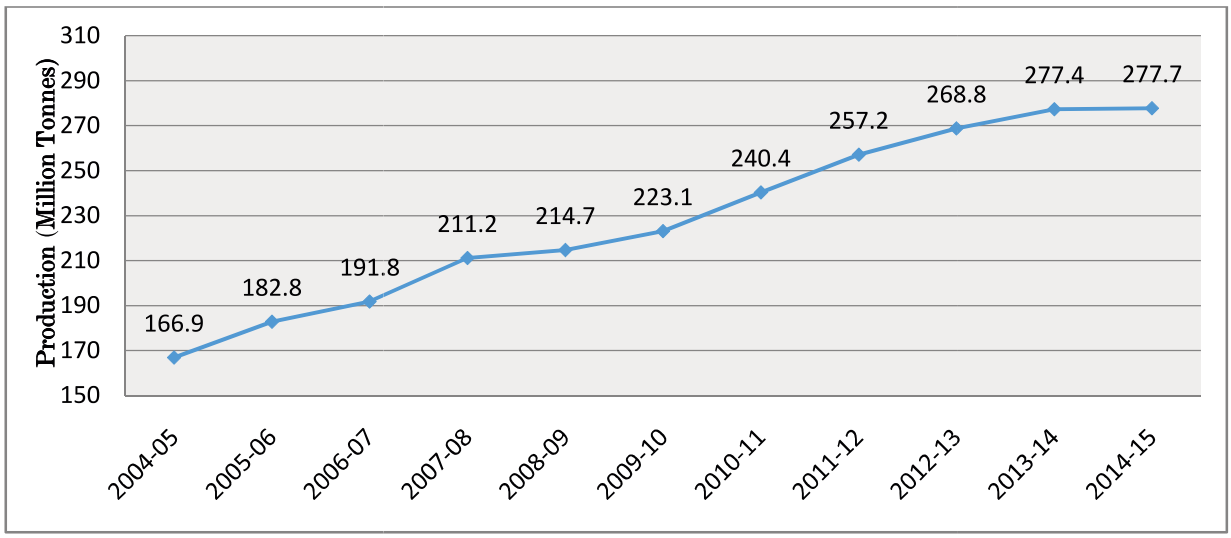
Horticulture

4.46 The horticulture sector has been a driving force in stimulating growth in Indian agriculture. India is currently producing 277.7 million tonnes of horticulture produce from an area of 23.2 million hectares, which has surpassed the estimated food grain production of 257 million tonnes. Though the production of foodgrains and horticultural produce are not meaningfully comparable due to fundamental differences in the nature of their farming, characteristics of produce, nature of land requirements, and most importantly, their nutritional purpose and value, it has come to light that

horticultural farming is much productive and gainful. The productivity of horticultural crops has increased by about 34 per cent between 2004-05 and 2014-15. The special attention given to the sector, especially after the introduction of the Horticulture Mission for North East and Himalayan States (HMNEH) and the National Horticulture Mission (NHM) in the 11th Plan, has borne bumper fruit. Given the increasing pressure on land, growth strategies have been focusing on raising productivity through high density plantations, protected cultivation, micro irrigation, quality planting material, rejuvenation of senile orchards and an emphasis on post harvest management and marketing of produce for better price realization.

4.47 The trend in horticultural production growth over the last 10 years is depicted in Figure 4.1 and the share of different commodities in horticulture production is given in Figure 4.2.

Figure 4.1: Growth Trend in Horticulture Production

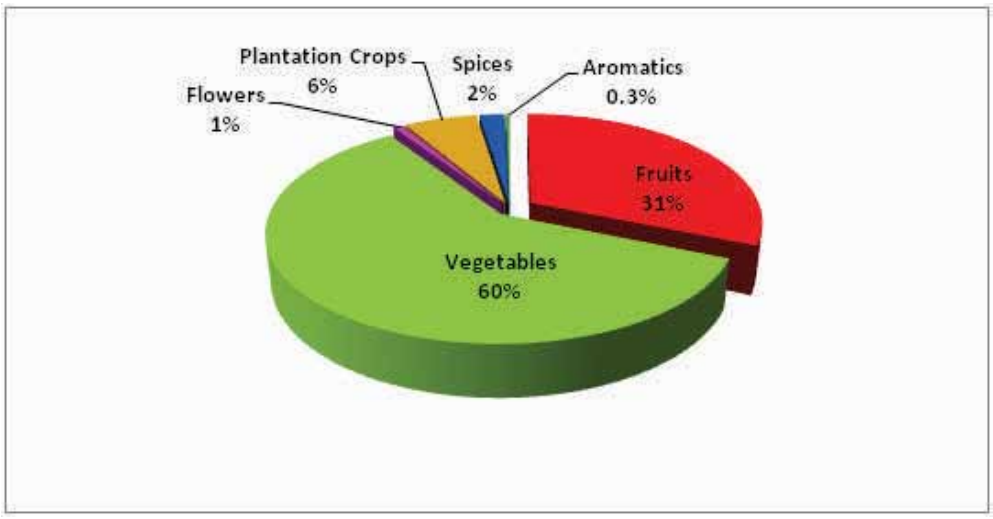


Source: ***Department of Agriculture, Cooperation and Farmers Welfare***

Note: ***Figures for 2014-15 are based on the Third Advance Estimates***

Figure 4.2: Share of Different Commodity Groups in Horticulture Production

(per cent of 277.7 million MT)



Source: ***Department of Agriculture, Cooperation and Farmers Welfare***

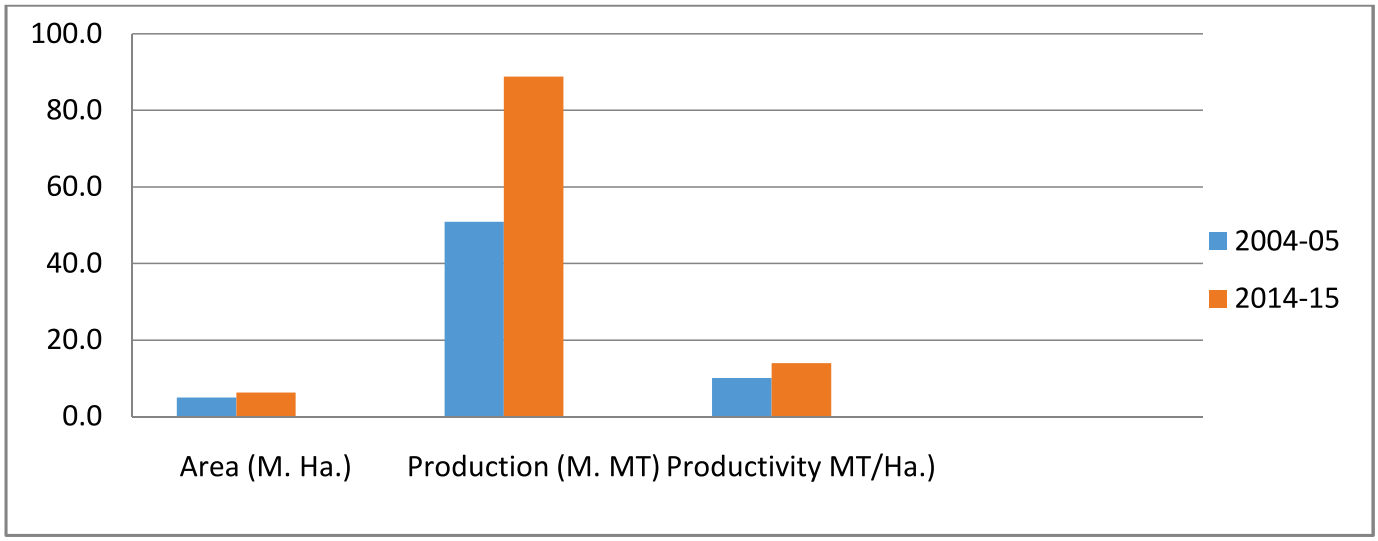
Fruits

4.48 With a production of 88.8 million tonnes, fruits account for about 31 per cent of total production of horticulture crops. The area under fruit crops cultivation during 2013-14 was 6.3 million hectares, which is about 27 per cent of total area under horticulture cultivation in India. The area under fruit crops cultivation has increased from 5 million hectares in 2004-05 to 6.24 million hectares in 2014-15, with a corresponding increase in production from 50.9 to 86.2 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 per cent of the total world production of fruits and leads in the production of mango, banana, papaya, sapota, pomegranate, acid lime and aonla.

4.49 During 2014-15, Maharashtra stood first in terms of fruit production with a 12.22 per cent share in total production followed by Andhra Pradesh with 10.57 per cent, Uttar Pradesh with 10.03 per cent, and Gujarat with 9.27 per cent and Tamil Nadu with 6.26 per cent shares. These states together contributed about 50 per cent of the total fruit production in the country. Banana is the most cultivated fruit accounting for 33 per cent of total production, followed by mango at 21 per cent, citrus at 14 per cent, papaya at 6 per cent, guava at 4 per cent, grapes at 3 per cent, apple at 2 per cent and others with a 16 per cent share in the country. In the case of the 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.

4.50 The area under cultivation, production and productivity of fruit crops have registered significant increases during the last decade, as depicted in **Figure 4.3.**

Figure 4.3: Area, Production and Productivity of Fruits



Source: ***Department of Agriculture, Cooperation and Farmers Welfare***

Box 4.3: 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 better 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 to the Indian population is 189 gm/person/day and has been helping in supplementing nourishment.

Vegetables

4.51 Vegetables occupied an area of 9.5 million hectares during 2014-15 with a total production of 167 million tonnes having average productivity of 17.6 tonnes per hectare. Vegetable production registered a quantum jump of 66 per cent between 2001-02 and 2014-15.

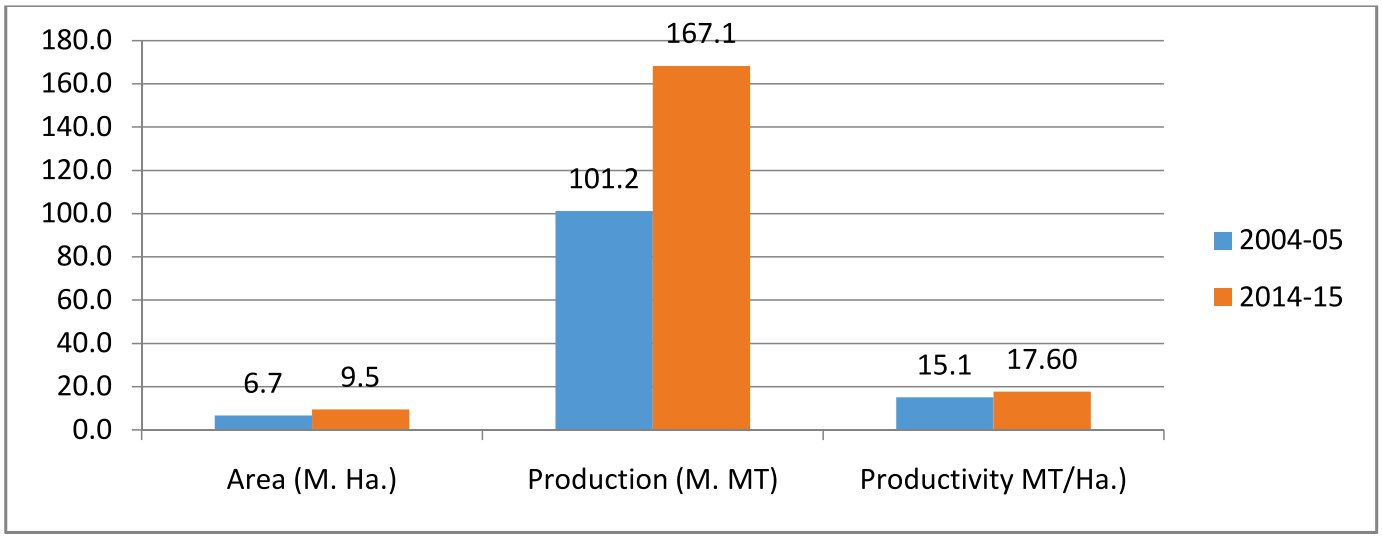
4.52 The major vegetable crops grown in the country are potato, tomato, onion, brinjal, cabbage, cauliflower, peas, okra, chillies, beans, melons, etc. West Bengal has been maintaining the lead in vegetable production in the country, contributing about 16 per cent to total production, while Uttar Pradesh is producing almost 14 per cent of vegetables in the country with the difference being that the productivity of vegetables in Uttar Pradesh is as high as 21 tonnes per hectare against 19 tonnes per hectare in West Bengal. Other leading vegetable producing states are Bihar with an 8.6 per cent share, Madhya Pradesh with an 8.75 per cent share, Gujarat with a 7 per cent share, Odisha with a 6 per cent share, Karnataka with a 5 per cent share, Tamil Nadu with a 3.4 per cent share and others. Amongst vegetables, potato is the most cultivated vegetable accounting for 27 per cent of the total production of vegetables in the country, followed by onion (11 per cent), tomato (10 per cent), brinjal (7 per cent), cabbage (5 per cent), cauliflower (5 per cent), peas (3 per cent) and others in the country.

Box 4.4: Vegetable Sector

- Productivity of vegetables in India continues to be low compared to world average productivity.
- Special emphasis is being given for production of vegetables under protected cultivation under Mission for Integrated Development of Horticulture (MIDH).
- Per capita availability of vegetables in India is 357 gm/ person/day, which is helping in fighting malnutrition.

4.53 Details of the area, production and productivity of vegetables during the last decade are depicted in **Figure 4.4** below:

Figure 4.4: Growth in Area, Production and Productivity of Vegetables



Source: ***Department of Agriculture, Cooperation and Farmers Welfare***

4.54 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 potato and tomato in the world.

Spices

4.55 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 Gujarat (18 per cent), Andhra Pradesh (14 per cent), Rajasthan (11 per cent), Madhya Pradesh (8 per cent) and Karnataka (6 per cent). Spice production in India is currently estimated at 5.7 million tonnes from an area of about 3.2 million hectares.

4.56 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 30 per cent of total spice production in the country. Garlic accounts for a 23 per cent share in production, while turmeric accounts for a 15 per cent share in production.

Box 4.5: Spices Sector

- Spices are low volume high value crops which have the potential to provide better remuneration for farmers.
- The productivity of spices continues to be low compared to world average productivity.
- World prices have some influence on domestic prices as well.

Flowers

4.57 During 2014-15, floriculture covered an area of 0.24 million hectares, with total production of 1.6 million tonnes of loose flowers and 0.5 million tonnes of cut flowers. 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 lilium.

4.58 The important flower growing states are West Bengal, Karnataka, Maharashtra, Andhra Pradesh, Tamil Nadu, Odisha, Uttar Pradesh, Jammu and Kashmir and the North Eastern states. 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 4.6: Floriculture Sector

- Flowers and foliage are being used increasingly within 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

4.59 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 2014-15 has been 15.6 million tonnes from an area of 3.5 million hectares. 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 Tamil Nadu with 31 per cent share, Karnataka with 26 per cent share, Kerala with 23 per cent and Andhra Pradesh 8 per cent share, which together contribute to about 87 per cent of all India production.

Medicinal and Aromatic Plants

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

Growth in Horticulture Exports

4.61 Commensurate with increased horticulture production, there has been a significant improvement in terms of export earnings in the horticulture sector as shown in **Table 4.3** below.

Table 4.3 Value of Exports of Horticulture Commodities

Sl. No.	Commodity	Value (Rs in crore)		
		2004-05	2014-15	2015-16 (Apr-Nov)
1.	Fresh fruits and vegetables	1,725.25	7,759.72	4,727.99
2.	Floriculture products	222.92	460.76	306.95
3.	Spices	1,883.18	14,842.36	10,531.46
4.	Cashew	2,477.18	5,565.77	3,361.06
	Total	**6,308.53**	**28,628.61**	**18,927.46**

Source: ***Directorate General of Commercial Intelligence and Statistics (DGCIS), M/o Commerce & Industry***

4.62 The Department of Agriculture, Cooperation and Farmers Welfare is working closely with the Agricultural and Processed Food Export Development (APEDA) Department 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 in the country, 52 focus on horticultural crops.

Box 4.7: Achievements in Horticulture Sector during 2014-15 & 2015-16 (up to Dec.)

- Attention has been paid to increasing the cold chain capacity in the country. About 1.5 million tonnes of capacity has been increased during last two years.
- India is the second largest producer of fruits and vegetables globally. Horticulture contributes about 30 per cent to agriculture GDP, using only 17 per cent of the land area.
- Horticulture exports were valued at Rs. 28,628 crores in 2014-15.
- Storage capacity has been increased by 66,000 tonnes by establishing 2,600 low cost onion storage units at farmers' field.
- Exports of fresh fruits like grapes, banana, mango and vegetables like peas and potato are on the rise.
- Nine Centres of Excellence (CoEs) have been established for demonstrating the latest technologies in fruits, vegetables and fruits cultivation through Indo-Israel and Indo-Dutch cooperation during the last two years.
- Integrated cold chain availability platform – an online portal providing information about all Government assisted cold chain projects – was launched.
- Area of 2,27,473 hectares is being cultivated with various horticulture crops.
- Over 50,031 hectares of old and senile orchards have been rejuvenated.
- 10,426 post harvest infrastructures have been established.
- 39,758 hectares have been brought under organic farming.
- Special focus on skill development has resulted in 1.25 lakhs farmers trained.
- 409 new nurseries were established; 1,219 nurseries were accredited.
- 235 new markets for horticultural produce were established.

Support for Horticulture Development

4.63 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.

Box 4.8: Salient Achievements under MIDH

- Area under horticulture increased 29 per cent in 8 years, from 18.7 million hectares in 2005-06 to 24.5 million hectares in 2014-15, as more farmers are venturing into horticulture in their quest for diversification in agriculture.
- Horticulture production increased from 167 million tonnes in 2004-05 to 278 million tonnes in 2014-15 (P) or a 66 per cent increase in 9 years.
- Investments in horticulture have been steadily increasing, from Rs. 5,025 crores in the 10th Plan to Rs. 16,840 crores in the 12th Plan, keeping pace with increased demand in the sector.
- About 1.50 lakh hectares were covered under protected cultivation for improving productivity.
- Cold chain capacity of about 32 million tonnes created.
- Over 12 lakh farmers have been trained so far on improved horticulture practices.
- In all, 27 Centres of Excellence were established through Indo-Israel and Indo-Dutch collaboration.

Towards Sustainable and Inclusive Growth in Horticulture

4.64 The major challenge for horticulture is to sustain this growth in a manner which ensures a higher income for the primary producer through better intuitional 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 centres 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

4.65 Several initiatives of the DAC&FW have the potential to impact farmers' incomes in a positive manner. These include the Vegetable Initiative for Urban Clusters (VIUC), 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 to be operated by Small Farmers' Agri-Business Consortium (SFAC).

Box 4.9: Major Milestones Achieved under NBB, DASD, DCCD, CIP and MI under PMKSY [2014-15 and 2015-16 (till December 2015)]

National Bee Board

- 9,434 farmers and beekeepers were trained in scientific bee keeping.
- The number of honey bee colonies increased by more than 2 lakhs.
- Honey production increased from 76,150 MTs in 2013-14 to 82,500 MTs (latest estimates).
- Financial support for NBB was increased from Rs. 5.94 crores to Rs. 10.42 crores.
- 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.

- Five bee breeders were developed to multiply quality nucleus stock/queen bees for further use by farmers/beekeepers
- 20 projects for the Integrated Development of Scientific Beekeeping programme, including one at Vidarbha, Maharashtra, have been approved or implemented.
- Designed technical standards for food grade plastic containers for storing honey.

Directorate of Arecanut and Spices Development (DASD), Calicut

- 31.64 lakhs 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 8,200 hectares.
- Cashew has been replanted across 2,250 hectares.
- 30 nurseries have been accredited.

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, Medziphema, Nagaland

- Launched four certificate courses of three months' duration each targeting rural youth and farmers to promote horticultural activities in the North Eastern states in the year 2015-16. Forty persons have been trained under this programme.
- Central Institute of Horticulture (CIH) has trained 2,500 farmers from the North Eastern states.
- Accredited four nurseries in the North Eastern region.

PMKSY (Micro Irrigation)

- Total area of 6,51,220 hectares have been covered under micro irrigation under PMKSY.

Support for Cold Chain Development

4.66 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 crores from the Government in 2011-12 in PPP mode. The NCCD particularly addresses issues relating to cold chain management including standards, protocols and HRD. While the General Council of NCCD is headed by the Secretary of the DAC&FW, its members include 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 4.10: Cold Chain

- The Government's focus on the cold chain sector has yielded positive outcomes by way of creating over 32 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

4.67 The major challenges are as follows:

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

Way Forward

4.68 A few potential ways to address the above mentioned challenges have been discussed below:

- Developmental programmes on horticulture are being continued during Twelfth Five Year Plan under the umbrella of the MIDH by subsuming the existing schemes of the NHM, HMNEH, NHB, Coconut Development Board (CDB), Central Institute of Horticulture (CIH) and National Bamboo Mission (NBM).
- Production and supply of quality planting material 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.
- The establishment of crop based Centres of Excellence 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 established through Indo-Israel collaboration and more are in the pipeline in collaboration with other countries.
- Horticulture is emerging as a prospective sector for replacing tobacco cultivation. High priority will be given for promoting remunerative horticulture crops for weaning farmers away tobacco cultivation.
- 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. 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.

- Rejuvenation of old and unproductive orchards continue to be a focus area for enhancing productivity, profitability and sustainability.
- A major thrust is on protected cultivation, particularly of high value crops, in green houses, shade net houses, plastic mulching etc.
- 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.
- Setting up of market infrastructure has been linked with reforms in the APMC Act, for permitting direct marketing of horticulture produce.
- 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.
- Human resource development is being emphasised for capacity building of farmers, horticulture entrepreneurs and supervisors and field functionaries.
- One of the key areas to be looked into is developing an accurate system of collection of Horticulture Statistics. As the majority of horticulture crops are grown as part of the homestead, it is difficult to collect timely and proper statics. Considering the fact that India is endowed with a remarkably heterogeneous area for production of a variety of horticulture crops, there is all the more need to use modern technologies for collection of authentic information in this field. To develop and firm up a scientific methodology for collection and estimation of robust Horticulture Statistics, the DAC&FW has launched a Project called "Coodinated programme on Horticulture Assessment and Management using geoinformatics (CHAMAN)". It has two main components, namely Remote Sensing and Sample Survey methodology. Details of the Project are discussed in Chapter-9. For ensuring the timely availability of relevant and latest data on horticulture crops at sub-nation level, a web enabled work flow based system, namely, Horticulture Area production Information System (HAPIS) has also been introduced by the Horticulture Statistics Division of DAC&FW. The system provides online interface enabling data-flow from district to states and thereon to the centre. It is accessible within the NIC network.

Rashtriya Krishi Vikas Yojana (RKVY)

4.69 Rashtriya Krishi Vikas Yojana (RKVY) was launched in 2007-08 wherein funds are provided as a 100 per cent grant to states to choose projects specifically tailored to their condition for enhancing growth in agriculture and allied sector. The approved outlay of the scheme for the Twelfth Plan was Rs.63,246 crores as against the Rs.25,000 crores during the Eleventh Plan.

4.70 An amount of Rs.23,895.71 crores has been released for the implementation of the scheme during the first three years of the Twelfth Plan. States have approved a total of 2,024 projects in various agriculture sectors such as crop development, horticulture, animal husbandry, fisheries, agriculture mechanization, natural resource management and micro and minor irrigation for implementation under RKVY during 2014-15. The activity wise share of the value of projects approved by the states during 2014-15 are shown in **Table 4.4.**

Table 4.4 Sector-wise List of Projects Approved during 2014-15

(Rs. in crores)

Sl. No.	Name of the Sector	Number of Project	Amount of Projects	% Share
1	Crop development	136	2,415.30	21.15
2	Horticulture	302	1,203.56	10.54
3	Sericulture	68	115.16	1.01
4	Animal husbandry	288	1,099.35	9.63
5	Innovative programmes/training/ capacity building/others	69	311.05	2.72
6	Fisheries	153	327.01	2.86
7	Cooperatives and cooperation	35	279.83	2.45
8	Integrated pest management	31	45.42	0.40
9	Seed	81	627.49	5.49
10	Fertilizers and INM	25	93.88	0.82
11	Agriculture mechanization	105	952.55	8.34
12	Extension	86	338.48	2.96
13	Marketing and post-harvest management	83	518.34	4.54
14	Non-farm activities	45	97.81	0.86
15	Information technology	9	94.71	0.83
16	Research (agriculture/horticulture/animal husbandry, etc.)	159	208.66	1.83
17	Natural resource management	98	867.28	7.59
18	Micro/minor irrigation	125	1,407.99	12.33
19	Organic farming/bio fertilizer	54	114.12	1.00
20	Dairy development	72	302.02	2.64
	Total	**2,024**	**11,420.01**	**100**

Source: ***Department of Agriculture, Cooperation & Farmers Welfare***

4.71 The scheme is being implemented on a 90:10 sharing basis between the Centre and the states in eight North Eastern and three Himalayan states, and in a 60:40 ratio in all the other states from 2015-16 as against the 100 per cent funding provided by the Centre till 2014-15. The Central Government's share for the implementation of the scheme during the current year (2015-16) is Rs. 4,500 crores.

4.72 Several sub-schemes have been introduced under RKVY since 2010-11 for promoting programmes of national priority. During the current year (2015-16), five special programmes/ schemes have been implemented as sub-schemes of RKVY with a total allocation of Rs. 825 crores. The schemes have very focused objectives and are under implementation in suitable states. Details of these programmes and their allocation for 2015-16 can be seen in **Table 4.5.**

Table 4.5 Rashtriya Krishi Vikas Yojana Sub-Schemes (2015-16)

S. No	Sub-Scheme	Allocation (Rs. in crore)
i)	Bringing Green Revolution to Eastern India (BGREI)	500
ii)	Crop Diversification Programme	150
iii)	Saffron Mission – Economic Revival of J&K Saffron	50
iv)	Vidarbha Intensive Irrigation Development Project (VIIDP)	75
v)	Additional Fodder Development Programme	50
	Total	**825**

Source: *Department of Agriculture, Cooperation and Farmers Welfare*

4.72 The statement on state-wise allocation and release of funds, including allocations for sub-schemes, under RKVY during the previous year 2014-15 and the current year as on 09 December 2015, are given at Annexure 4.1 and 4.2 respectively. Details of all projects taken up by the states under RKVY, including their progress, outcomes and actual achievements since inception of the scheme in 2007-08 can be accessed at www.rkvy.nic.in.

Success Stories

4.73 RKVY comprises a wide spectrum of interventions which effectively cater to the diverse needs and requirements of the states. A few of the successful interventions taken up by the states under the scheme are listed below.

1. Ferrying Sweet Water through Underground Pipes: Haryana

Background and Objective

4.74 Rice-wheat and cotton-wheat are the two principal cropping sequences of Haryana. Before the implementation of the RKVY programme in 2007-08, the area cultivated with these crops was around 17 lakh hectares. These crops were irrigated mainly through canal water which results in loss of appreciable quantities of water by way of evaporation and seepage from irrigation channels. The farmers at the tail end of the irrigation command area suffer as the irrigation water normally does not reach their fields. The farmers in the districts of Karnal, Kaithal, Kurukshetra, Panipat, Sonipat and Yamunanagar were the worst affected.

Intervention

4.75 Haryana initiated the Under Ground Pipe Line (UGPL) programme in the first year of the RKVY Scheme (2007-08). In the UGPL system, irrigation pipes are placed underground to fetch the water from the main canal to the fields avoiding wastage of water. To start with, Haryana allocated Rs. 115 lakhs in 2007-08 to irrigate 2,193 hectares. The programme subsequently built up in momentum and reached 36,748 hectares by way of allocating Rs 4,457.24 lakhs within three years of implementation under RKVY. By the fourth year of the implementation of the project, the cumulative allocation was Rs. 8,034 lakhs which helped irrigate 72,560 hectares of land which is benefitting 19,658 farmers.

Outcome

4.76 The UGPL programme of Haryana is very popular with the farming community and there is huge demand for this project. Farmers are highly convinced about its benefits. Average production and productivity have increased by more than 30 per cent in the areas where such irrigation systems were installed. Farmers are now planting 2-3 crops instead of only one crop earlier. In water deficit areas and areas that have unsuitable and brackish ground water, although the crop production and productivity are very low, at least one crop can now be grown with life-saving irrigation provided by UGPLs.

4.77 The evaluation report for this project stated that there has been a significant increase in crop productivity, including increases of 18 per cent for paddy, 52 per cent for wheat and 161 per cent for sorghum due to the use of UGPL system. There programme has water saving benefits as well –on average, 36.1 per cent of water was saved in irrigating one acre of paddy field, whereas 43.3 per cent was saved for wheat. The UGPL system has helped in reducing labour costs and drudgery for the farmers. Some of the benefits include land saving by about 3 per cent, elimination of water logging near channel to the extent of 1.5 per cent, elimination of additional wells in the area, safety in operations, etc. Some of the pictures of these projects during implementation can be seen below.

Figure 4.5: Implementation of UGPL Programme in Haryana under RKVY

2. Canopy Management in Grape Cultivation: Kashmir Valley

Background and Objectives

4.78 Traditionally, grape cultivation in Kashmir was confined to certain villages where there was no concept of canopy management. Farmers used to make the grape vines climb over non-bearing trees, fence walls and habitation structures. During the rainy season, frequent attacks of fungal diseases, especially powdery mildew, downy mildew, Anthracnose, etc., were very common in such grape vines. Such an unscientific management also resulted in the under maturity of most of the produce due to lack of proper sunlight. This ultimately resulted in poor quality fruit and poor returns to the growers.

4.79 With the concerted efforts of the Department of Horticulture, the growers were trained in canopy management techniques and started using wooden structures. These wooden structures were often damaged during heavy snowfall in winter, and as such, the growers had to re-install these structures every year. The collapse of such wooden structures either due to heavy snowfall or the load of fruit crop and vegetative growth would generally damage the fruit plants and reduced the productivity potential of the vineyards. Moreover, these structures were not ideal for facilitating proper training and pruning of vines, which hampered the production of quality grapes. Heavy infestation of diseases, especially during the rainy season, was a very common phenomenon in these vineyards.

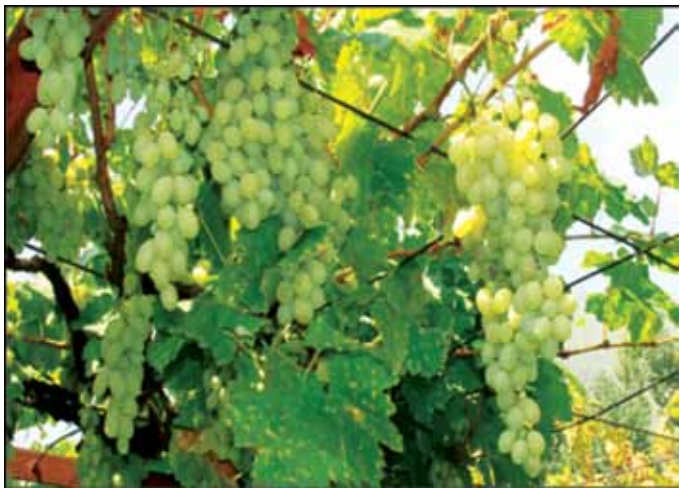
Intervention

4.80 Rashtriya Krishi Vikas Yojana (RKVY) canopy management was introduced in the Lar Block, especially in Repora and the adjoining villages of the Ganderbal District. Assistance of 50 per cent was provided to the grape growers for installing permanent canopy management systems (bower system) in replacement of traditional wooden structures for the entire life span of grapevines and even to give support to extended rejuvenated vines as well.

Outcome

4.81 The quality improvement has ultimately resulted in higher returns for the growers. As against about Rs.10,000 per quintal prior to the installation of the canopy management infrastructure, the growers have started getting about Rs.25,000 per quintal, thereby recording an increase of 150 per cent on the sale realization of the crop. Some of the pictures of these projects during implementation can be seen below.

Figure 4.6: Implementation of Canopy Management in Kashmir Valley



3. State Level Breed Confirmation (DNA Fingerprinting) Centre in Rajasthan

Background and Objectives

4.82 The objective of the project is to establish a state level breed confirmation (DNA fingerprinting) centre to identify the superior germ plasm of Rathi, Tharparkar, Kankrej, and Gir breeds of indigenous cattle using DNA fingerprinting techniques. The project also aims to establish the morphological attributes of the chromosomes of the Rathi, Tharparkar, Kankrej and Gir breeds of indigenous cattle. Further, the project also aims at fingerprinting the available Rathi, Tharparkar, Kankrej, and Gir breeds through DNA markers. The other objectives of the project are to identify microsatellite markers specific to particular Rathi, Tharparkar, Kankrej and Gir breeds and to carry out chromosomal analysis and karyotyping of bulls.

Intervention

4.83 With RKVY funding, a DNA fingerprinting centre was established in the Department of Veterinary Microbiology and Biotechnology, Rajasthan. The centre undertook microsatellite typing for the selected animals of different breeds and DNA fingerprinting was done.

Outcome

4.84 The Department of Veterinary Microbiology and Biotechnology studied the genetic diversity of the indigenous cattle of Rajasthan and found that the Rathi breed had the maximum heterozygocity, whereas Tharparkar had the minimum. The Gir breed was the most distinct from the other three breeds. Genetic distance was least (1.320) between Rathi and Kankrej and highest between Gir and Kankrej.

4. Safeguarding Sheep in Himachal Pradesh

Background and Objectives

4.85 Ecto-parasite infestations are a serious problem amongst the sheep and goat flocks of Himachal Pradesh. This is due to the non-availability of water bodies where these flocks can be dipped in order to get rid of various parasites like ticks, lice and mites at regular intervals. It is highly recommended that the sheep and goat are dipped at least thrice a year to keep the animals free from infections. However, due to a lack of awareness coupled with the non-availability of dipping infrastructure in the state, there were huge losses both in terms of wool and meat amongst the sheep flocks of the state.

Intervention

4.86 To overcome the situation, Himachal Pradesh, using the RKVY allocation of Rs. 142 lakhs, purchased three mobile sheep dip tanks to cover approximately 1,50,000 sheep in the districts of Hamirpur, Bilaspur, Kullu, Mandi, Solan, Sirmour, Una and Lahaul and Spiti. These mobile dip tanks are arranged on the migratory routes of sheep and goats and the flocks are dipped and drenched in ecto-parasiticide for cleaning.

Outcome

4.87 Since these are mobile sheep dip tanks, different migratory routes can be accessed leading to more coverage of flocks. So far, 1.25 lakh sheep and goats have been dipped in these tanks. This has resulted in healthier sheep and lower mortality. The production of meat and wool increased from 1,427 tonnes to 1,441 tonnes (estimated) and 1,114 tonnes to 1,137 tonnes (estimated) respectively during the period

2009-10 to 2011-12. As a result, the income of sheep owners has also increased. Some of the Pictures of these projects during implementation are as under:

Figure 4.7: Safeguarding Sheep in Himachal Pradesh

5. Vegetable and Flower Market Complex: Parulia Bazar, Burdwan District, West Bengal

Background

4.88 More than 10,000 farmers specially cultivating vegetables and flowers faced problems caused by the devaluation of their product by middleman. The un-organized market structure created lots of problems for the farmers who wished to sell their products to a definite marketplace as a whole. The absence of a regulated market complex resulted in a 30-35 per cent downgrading of the harvested vegetables and flowers in the Kalnasub-division.

Intervention

4.89 Through the RKVY scheme, the market complex is well equipped with washrooms and grading facilities for better post harvest handling of vegetables, fruits and flowers at Parulia Bazar, Kalna sub-division, Burdwan.

Outcome

4.90 More than 10,000 horticultural farmers of Kalna sub-division are benefitting from selling their products directly to businesses. Also, more than 10,00 horticultural businesses are benefitting from wholesale and retail marketing of horticultural products. Further, approximately 42 per cent of the production value is being saved by resisting the devaluation of horticultural products.

Cooperative Development in Agriculture

4.91 The main objective of cooperative development in agriculture is to promote, strengthen and develop farmers' cooperatives with the aim of increasing production, productivity and the institutionalization of post harvest facilities. The National Cooperative Development Corporation (NCDC), which was established in March 1963 under the NCDC Act, has emerged as a development financing institution for the cooperative sector in the country.

4.92 The Government of India offers assistance to the NCDC for the development of cooperatives under the Central Sector Integrated Scheme on Agricultural Cooperation. The main objective of the Scheme is to provide financial assistance for the following:

(i) Improving the economic condition of cooperatives

(ii) Removing regional imbalances

(iii) Speeding up cooperative development in the agricultural and allied sectors

(iv) Help cotton growers fetch remunerative prices for their produce

(v) Ensuring supply of quality yarn at reasonable rates to the weavers

(vi) Overall development of cooperatives in selected districts through the Integrated Cooperative Development Project (ICDP).

4.93 The Government of India provides subsidies to the NCDC for assisting cooperatives. The NCDC provides loans (short term and long term) to cooperatives from its own sources for undertaking various income generating activities. The Restructured Central Sector Scheme for assistance to NCDC programmes for the development of cooperatives has four sub-components.

(i) **Assistance for Marketing, Processing, Storage, etc. Programmes in Cooperatively Under or Least Developed States and UTs:** The main objective of this component is to accelerate the pace of development related to cooperative, marketing, processing, storage, etc. programmes in cooperatively under or least developed states and UTs so as to help people from the weaker sections and to avoid distress in sale of produce by the farmers and to ensure a remunerative price for produce.

(ii) **Share Capital participation in Growers' and Weavers' Cooperative Spinning Mills:** This component intends to do the following:

a) Help cotton growers/weavers secure a remunerative price for cotton by processing and marketing it in a value added form.

b) Avoid middlemen in the process of marketing the produce of cotton growers/weavers.

c) Creation of employment in rural areas.

d) Supply of yarn to the decentralized handloom power loom and hosiery sectors, which have emerged as the major cloth suppliers to the nation.

e) Promoting an export orientation to generate better returns for cotton growers on their produce.

(iii) Integrated Cooperative Development Project in Selected Districts (ICDP): The objectives of this component are as follows:

a) To strengthen the existing PACS and other functional cooperatives.

b) To develop PACS as multi-purpose entities.

c) To orient and improve the existing cooperative structure wherever necessary including modernization and upgradation of management of the cooperatives.

(iv) Assistance to Multi-State Cooperative Societies: The basic objective of this sub-component is to strengthen the base of multi-state cooperative societies by providing grants up to 90 per cent of the expenditure on activities like promotional, technical and consultancy services, research studies, improvement of infrastructural facilities, conferences/ workshops/seminars/trainings, skill development programmes and commercial/economic activities to improve self-reliance and sustained growth and development.

Revised Guidelines for Direct Funding by NCDC

4.94 The NCDC has been providing financial assistance to cooperatives through the state government or directly against Government guarantees, except in the case of multi-state cooperatives where direct funding without Government guarantee is permissible.

4.95 The NCDC Act has been amended vide Gazette Notification No. 50 dated 16 August 2002 facilitating direct funding of cooperatives without Government guarantees in case the borrowing cooperative society can furnish security to the satisfaction of the corporation.

4.96 Guidelines for direct funding by NCDC has been revised recently to encourage all types of cooperatives, including newly formed cooperatives who have some track record and whose project is viable.

Performance During 2014-15

4.97 During financial year 2014-15, against a target of Rs.4,800 crores, the NCDC disbursed Rs.5,735.51 crores, comprising loans of Rs.5,619.45 crores and subsidies of Rs.116.06 crores (including Rs.3.47 crores from the NCDC's own corpus) for various development programmes through cooperatives. The activities for which financial assistance was disbursed during 2014-15 and the cumulative assistance extended to the project as on 31 March 2015 are detailed in **Table 4.6.**

Table 4.6: Funds Released by National Cooperative Development Corporation under Various Components during 2014-15 (Rs. Crores)

S.No.	Activity	Release During 2014-15		Cumulative Release upto 31 March 2015	
		Amount	%	Amount	%
i)	Marketing and inputs	3,634.02	63.36	17,453.18	33.81
ii)	Agro-processing	1,063.92	18.55	13,620.81	26.39
iii)	Industrial and service coops.	510.59	8.90	13,278.60	25.73
iv)	ICDP	234.81	4.09	2,807.80	5.44
v)	Weaker sections	204.45	3.57	2,622.94	5.08
vi)	Storage(including cold storage)	48.11	0.84	1,188.63	2.30
vii)	Consumer cooperatives	2.98	0.05	302.92	0.59
viii)	Computerisation of cooperatives	31.93	0.56	234.08	0.45
ix)	Promotional and developmental activities	4.70	0.08	107.41	0.21
	Total :	**5,735.51**	**100.00**	**51,616.37**	**100.00**

Performance During 2015-16

4.98 The outlay for the current financial year (2015-16) has been estimated at Rs.5,600 crores (Rs.1,037.15 crores) including subsidies of Rs. 192.94 crores (BE) under the Central Sector Integrated Scheme on Agricultural Cooperation and Rs. 4,562.85 crores under the Cooperation Sponsored Scheme. Details of releases for 2015-16 (as on 21 December 2015) are as under:

Table 4.7 Funds Released by National Cooperative Development Corporation under Various Components during 2015-16 (Rs. Crores)

S. No.	Activity	Release During 2015-16		Cumulative Release upto 21 December 2015	
		Amount	%	Amount	%
i)	Marketing and inputs	3,640.55	69.40	21,093.73	37.10
ii)	Agro-processing	717.06	13.68	14,337.87	25.22
iii)	Industrial and service coops	570.23	10.88	13,848.83	24.36
iv)	ICDP	129.28	2.47	2,937.08	5.17
v)	Weaker section	120.58	2.30	2,743.52	4.83
vi)	Storage (including cold storage)	55.73	1.06	1,244.36	2.19
vii)	Consumer cooperatives	3.75	0.07	306.67	0.54
viii)	Computerisation of cooperatives	3.66	0.07	237.74	0.42
ix)	Promotional and developmental activities	0.75	0.01	108.16	0.19
	Total	**5,241.59**	**100.00**	**56,857.96**	**100.00**

CHAPTER-5

Agricultural Prices, Marketing and International Trade

5.1 Agricultural prices, marketing and international trade are important spheres of agricultural policy for the state and Central governments. These factors, to a large extent, determine the prices at which farmers sell their produce and at which consumers buy food for consumption and manufacturers buy inputs for manufacturing their products. Hence, Government policy and operational mechanisms have evolved over time to fix remunerative prices to farmers for major agricultural crops, regulate markets and determine the orientation of foreign trade policy.

5.2 The agricultural price policy initially focused on providing food at affordable prices to consumers. It was only with the Agricultural Price Commission (1965), set up to advise the Government on a regular basis to evolve an integrated price structure, that maintaining the balance between farm price and consumer price became a main objective. The later modifications in 1980 and 1986 shifted the focus of agricultural price policy i) from maximizing agricultural production to evolving a production pattern supportive of general economic development needs; and ii) to making the farm sector more vibrant, productive and cost-effective. The current instruments of agricultural price policy include minimum support prices, market interventions, buffer stock operations, distribution of foodgrains through public distribution systems, the encouragement of producers' cooperatives, regulation of agricultural trade and creation of agricultural marketing infrastructure.

5.3 Agricultural marketing in India faces many challenges. These include lack of reforms in the State Agricultural Produce Market Committees (APMC) Acts, absence of private sector competition, lack of proper grading and packaging at the farm level, non-issue of sales receipts and invoices, post-harvest losses, etc. Against this backdrop, the Government has initiated many reforms, including the creation of an e-trading platform for a national agriculture market. Similarly, with the increasing share of agricultural commodities in overall exports/imports, trade policy has been amended from time to time in response to domestic availability and the price situation.

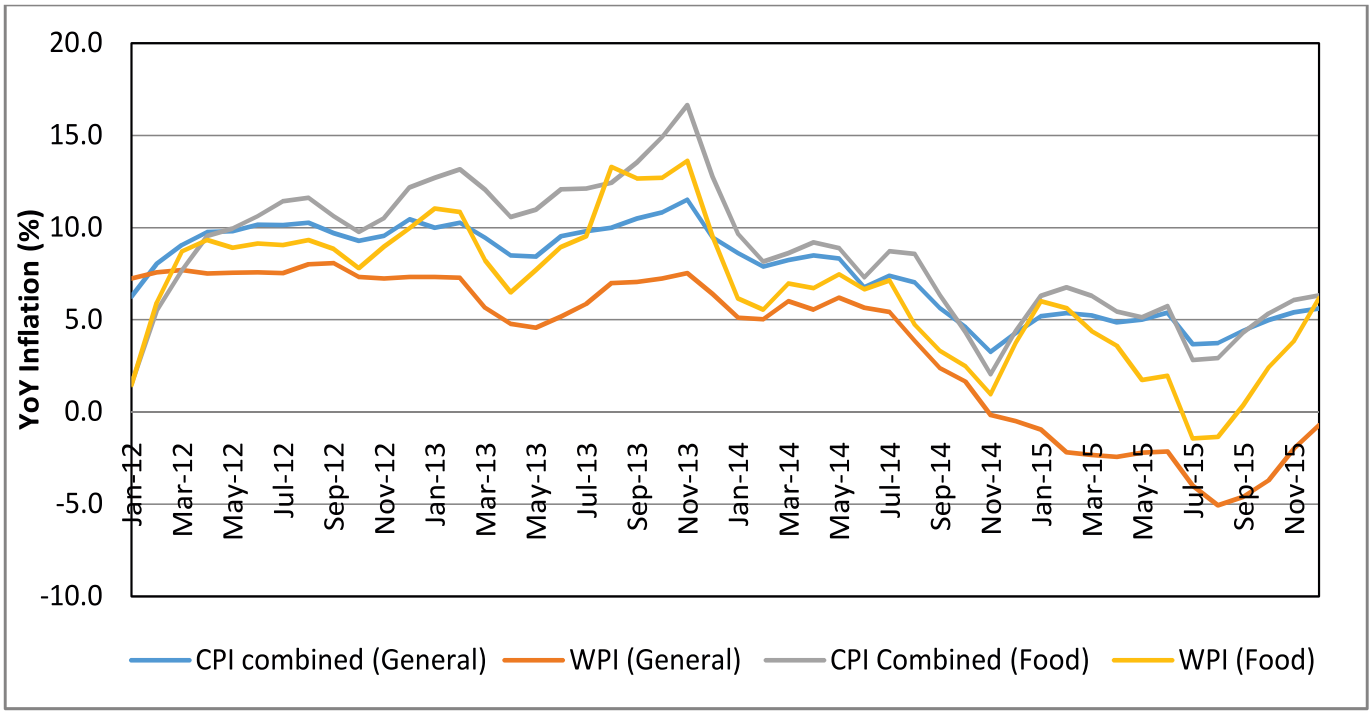
Agricultural Prices

5.4 The movement in food and agricultural commodity prices is an outcome of the complex interplay of demand and supply forces conditioned by domestic and international policies and market situations. While short-run supply shocks are often held responsible for the price rise, equally responsible are long-run demand and growth, and relatively inelastic food supply conditions owing to low investment. Increasing climatic variations, as evident from the recent episodes of uneven and untimely rainfall in certain parts of the country, further accentuate the pressure on food prices.

5.5 The changes in food prices in India at the wholesale and retail level are captured in the movement of the Wholesale Price Index (WPI) and Consumer Price Index (CPI). In the WPI (Base: 2004-05), food inflation is broadly classified into food articles and food products, with a combined share of 24.31 per cent. The CPI, on the other hand, measures changes in the retail prices of food items over time. As per the new series of CPI (Base: 2012) released by the Central Statistics Office (CSO), the "food and beverages" category has 54.18 per cent, 36.29 per cent and 45.86 per cent weight in the rural CPI, urban CPI and the CPI (combined), respectively. With the decision of the Reserve Bank of India to anchor its monetary policy stance on the headline CPI (combined) inflation rate from April 2014 onwards, food inflation, which has a weightage of 46 per cent in the index, plays a crucial role in shaping the overall growth prospects of the economy.

5.6 As shown in **Figure 5.1,** the rate of food inflation as measured by the WPI and CPI moderated since July 2014, after staying high persistently during the past two years. While the wholesale inflation rate for all commodities stood at 2 per cent during 2014-15, prices of food articles and food products rose by 6.1 per cent and 2.4 per cent, respectively, aggregating to an overall food inflation rate of 4.9 per cent. The retail prices of food items under the new series of CPI also witnessed a downward trend in the second half of 2014-15. This moderation in inflation was mainly on account of low international commodity and oil prices, subdued demand, supply-side interventions by the Government to tame inflationary tendencies and a proactive monetary policy by the Reserve Bank to anchor inflationary expectations. During 2015-16 (Apr-Dec), while overall inflation (WPI) remained negative, the rate of food inflation witnessed a sharp increase since August 2015, mainly due to an unprecedented rise in the prices of pulses. During the period, as against an average rate of 2 per cent food inflation, the prices of pulses rose by about 40 per cent. Similarly, the retail prices of pulses, as measured by the CPI (combined), increased by around 30 per cent during 2015-16 (Apr-Dec), as compared to an average increase of 5 per cent in the overall food and beverages group. The significant increase in inflation in the case of pulses was attributed mainly to a shortfall in production owing to adverse climatic conditions and partly due to the statistical base effect.

Figure 5.1: Month-wise Trends in Food Inflation

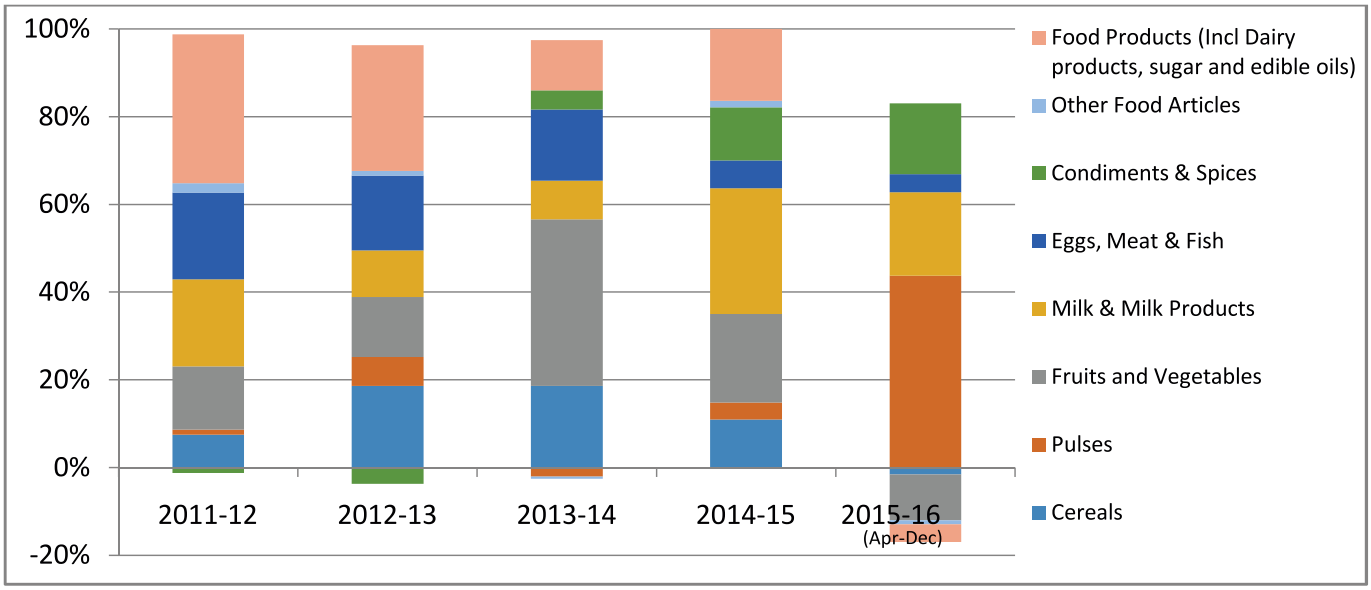


Source: ***Office of the Economic Adviser and CSO.***

5.7 As may be seen in **Figure 5.2**, during the last few years, three categories of food commodities contributed substantially to food inflation—fruits and vegetables, milk and egg and meat and fish. Various studies have shown that the pressure on food inflation has been shifting from conventional food items, like cereals, to high-value and protein products such as fruits and vegetables, pulses, milk, egg, fish and meat, as a result of increase in per capita income. The National Sample Survey Office (NSSO) studies on household consumption expenditure clearly brought out the shifting pattern of consumption from cereals to high-value foods, as indicated in **Table 5.1.** During 2015-16 (Apr-Dec), pulses accounted for the majority

of food inflation, followed by milk and milk products and condiments and spices. The share of cereals, fruits and vegetables and other food articles, however, witnessed a sharp decline during this period. It is to be noted that while the shift in consumption patterns towards a protein rich diet is a natural phenomenon, the inelastic demand for certain crops has accentuated inflationary tendencies. For example, the price of arhar (tur) and urad increased substantially in the latter half of 2015-16, while the prices of other crops witnessed only a moderate increase. This may be partly attributed to the inability to diversify the pulse basket to include other crops like chana and field peas in the event of price rise.

Figure 5.2: Percentage Share of Major Food Groups in Total Food Inflation (Food Articles and Food Products)



Source: Office of the Economic Adviser, DIPP

Table 5.1: Per Capita Consumption of Emerging Food Items

Commodities	Quantity Consumed per Annum					
	2004-05		2009-10		2011-12	
	Rural	Urban	Rural	Urban	Rural	Urban
Vegetables (kg)	35.53	38.57	49.14	50.11	82.25	83.24
Milk (litre)	47.09	62.17	50.09	65.19	52.72	65.97
Eggs (no.)	12.29	20.93	21.08	32.53	23.6	38.69
Fish (kg)	2.45	2.51	3.27	2.9	3.24	3.07
Chicken (kg)	0.61	1.03	1.5	2.19	2.17	2.91

Source: ***NSSO, various rounds***

Way Forward

5.8 In view of the alarming increase in the prices of pulses, concerted efforts have been made by the Government, as discussed in Chapter 1 (Box 1.4). While imports of pulses have been used as a price stabilization measure to meet the current crisis, efforts have also been made towards finding a long-term solution for demand-supply imbalances through price and technological interventions. These include, *inter alia,* allocation of more than 50 per cent of funds under the NFSM for the enhancement of production of pulses; creation of a buffer stock of pulses; developing short-duration, drought-resilient varieties of pulses; and providing incentives for farmers by enhancing the minimum support price (MSP). As discussed above, the low price elasticity of demand for certain pulse crops has also contributed to the significant increase in prices of pulses during 2015-16. Thus, efforts are needed to induce diversification in the pulse basket of consumers through widespread campaigning, using both print and visual media. Further research on the impact of inelastic demand patterns on the overall inflationary pattern would be useful for developing effective policy interventions.

5.9 Moreover, keeping in view the high volatility and seasonal variations in the prices of horticulture produce, price stabilization efforts, including building up of efficient supply lines, have been pursued. Since these commodities are largely perishable in nature, further improvement is needed in cold storage, processing facilities including creation of infrastructure for logistics, buffer stocking of onion in the dehydrated form, canning of fruits and freezing of vegetables. Appropriate policy intervention can help in reducing price volatility to a large extent, by enabling organized retail, and private investor participation in creating supply chain infrastructure from the farm gate to the consumer. In this regard, cooperation with advanced economies for sharing of resources—material and technological, including innovative models and best practices—will play a crucial role.

Agricultural Price Policy and Minimum Support Price

5.10 The Agriculture Price Policy aims to ensure remunerative prices for agricultural commodities, encourage higher investment, incentivize production and evolve a balanced and integrated price structure, while safeguarding the interests of consumers by making supplies available at reasonable prices. The Government fixes the minimum support price (MSP) for various agricultural commodities based on the recommendations of the Commission for Agricultural Costs and Prices (CACP) and on the views of state governments, Central ministries and other relevant factors. However, farmers are free to sell their produce to Government agencies or in the open market as advantageous to them.

5.11 The CACP recommends an MSP for 22 crops and a 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, sesamum, nigerseed, 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 CACP considers various important factors while formulating its recommendations on price policy, which include, *inter alia*, the cost of cultivation, trends in market prices, the demand and supply situation, effects on general price level, effects on cost of living, etc. Produce of Fair Average Quality (FAQ) alone is procured under the Price Support Scheme (PSS).

5.12 The MSPs announced for major agricultural commodities for the 2015-16 kharif and rabi seasons is given in **Table 5.2**. To encourage farmers to increase acreage and invest in increasing the productivity of pulses, the Cabinet made an exception in 2015-16 and decided to give a bonus of Rs. 200 per quintal for

kharif pulses and Rs. 75 per quintal for rabi pulses over and above the recommendations of the CACP. A detailed statement on the MSPs announced in recent years is given in **Annexure 5.1**.

Table 5.2: Minimum Support Prices (According to Crop Year)

(Rs. per Quintal)

Sl. No.	Commodity	Variety	2014-15	2015-16	(#) increase in MSP 2015-16 over 2014-15
	Kharif Crops				
1	Paddy	Common	1,360	1,410	50(3.7)
		Grade A	1,400	1,450	50(3.6)
2	Bajra		1,250	1,275	25(2.0)
3	Maize		1,310	1,325	15(1.1)
4	Arhar(Tur)		4,350	4,425^	75(1.7)
5	Moong		4,600	4,650^	50(1.1)
6	Urad		4,350	4,425^	75(1.7)
7	Cotton	Medium staple	3,750	3,800	50(1.3)
		Long staple	4,050	4,100	50(1.2)
8	Groundnut in shell		4,000	4,030	30(0.8)
9	Sesamum		4,600	4,700	100(2.2)
	Rabi Crops				
10	Wheat		1,450	1,525	75(5.2)
11	Gram		3,175	3,425**	250(7.9)
12	Rapeseed/Mustard		3,100	3,350	250(8.0)
	Other Crops				
13	Copra	Milling	5,250	5,550	300(5.7)
	(Calendar Year)	Ball	5,500	5,830	330(6.0)
14	Sugarcane*		220	230	10(4.5)

Source: ***Directorate of Economics and Statistics, DAC&FW***

 # Figures in brackets indicate percentage increase.

** Fair and remunerative price.*

*** Bonus of Rs. 75 per quintal is payable over and above the MSP.*

^ Bonus of Rs. 200 per quintal is payable over and above the MSP.

5.13 The procurement infrastructure is, however, effective only for a few commodities, and that too only in a few states. This limits the effectiveness of the price signalling mechanism. In its Price Policy Report for the 2015-16 marketing season, the CACP stressed on the need for enhancing procurement mechanisms in the eastern belt of the country. It mentions that the low procurement level coupled with weak marketing infrastructure has affected market prices in these states, which have been lower than the MSPs. Moreover, while the procurement mechanism in the country is strong for rice and wheat, it needs to be improved for pulses and oilseeds. In this regard, the Cabinet directed that the arrangements for procurement in eastern India be strengthened. The Cabinet also directed that a

credible procurement mechanism for pulses and oilseeds be put in place if the need arises.

Market Intervention Scheme (MIS)

5.14 The DAC&FW implements the Market Intervention Scheme (MIS) for the procurement of agricultural and horticultural commodities that are perishable in nature and are not covered under the PSS. The objective of the intervention is to protect the growers of these commodities from having to make a distress sale in the event of a bumper crop during the peak arrival period when prices tend to fall below economic levels and do not cover production costs. The condition is that there should be either at least 10 per cent increase in production or a 10 per cent decrease in the ruling market prices over the previous normal year. The scheme is being implemented at the request of governments of states/union territories which are ready to bear 50 per cent of the loss (25 per cent in the case of the North Eastern states), if any, incurred on its implementation. The extent of the total amount of loss, to be shared on a 50:50 basis between the Central Government and the state government, is restricted to 25 per cent of the total procurement value, which includes the cost of the commodity procured plus permitted overhead expenses.

5.15 Under the scheme, in accordance with MIS guidelines, a predetermined quantity is procured by state government agencies at the fixed market intervention price (MIP) for a fixed period or until 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 schemes implemented during the year 2013-14, 2014-15 and 2015-16 (as on 16 November 2015) can be seen at **Annexure 5.2**.

Price Support Scheme (PSS)

5.16 The main objective of the Price Support Scheme (PSS) is to encourage higher investment and production by ensuring growers remunerative prices for their produce. If the ruling prices are below the MSP, the Government shall procure the produce at MSP. However, farmers are free to sell their produce to Government agencies or in the open market as is advantageous to them. The number of procurement centres under the PSS is decided by Central agencies in consultation with state governments and agencies and on the basis of its economic viability.

5.17 The Central Government extends price support to foodgrains and other agricultural produce through the Food Corporation of India (FCI) for paddy, wheat and coarse cereals; the Cotton Corporation of India (CCI) for cotton; and the Jute Corporation of India (JCI) and National Agricultural Cooperative Marketing Federation of India (NAFED) for jute. Recently, the FCI has also been included as a central nodal agency for the procurement of pulses and oilseeds. To supplement the efforts of the FCI, procurement of oilseeds and pulses will be undertaken also by the National Agricultural Cooperative Marketing Federation of India Limited (NAFED), National Cooperative Consumers' Federation (NCCF), Central Warehousing Corporation (CWC) and Small Farmers Agri-Business Consortium (SFAC). All the foodgrains conforming to the prescribed specifications and offered for sale at the specified centres are bought by the public procurement agencies. The producers have the option of selling their produce to Government agencies at support prices or in the open market as is advantageous to them. These Central agencies undertake to procure foodgrains as and when prices of these commodities fall below the MSP.

5.18 Under the PSS, the losses, if any, incurred by the Central agencies are fully reimbursed by the Government. The profit earned, if any, is credited to the Government. The DAC&FW provides working capital to Central agencies in the form of bank guarantees for procurement under the PSS. A standing Government guarantee of Rs. 2,500 crores is available with the NAFED and Rs. 150 crores to the SFAC. Over and above this, the Department also provides letters of comfort to financial institutions for providing short-term loans to Central agencies.

Achievement under PSS

5.19 During the 2014-15 season, the prices of various oilseeds and pulses fell below their respective MSPs fixed for the relevant marketing season. During the years 2014 and 2015, NAFED and SFAC procured agricultural commodities as per the details given below.

Table 5.3: Procurement made by NAFED

S. No.	Commodity	State	Quantity (in MTs)	Ex-Godown value (in Rs. Lakhs)
1.	Mustard seed (Rabi 2014)	Rajasthan	1,728.04	527.05
2.	Groundnut pods (Rabi 2014)	Odisha	6,407.60	2,491.92
3.	Sunflower seeds (Rabi 2014)	Odisha	338.75	125.34
		Haryana	3,814.37	1,411.31
		Total	**4,153.12**	**1,536.65**
4.	Sunflower seeds (Rabi 2015)	Odisha	76.019	28.51
		Haryana	4,161.665	1,562.20
		Total	**4,237.684**	**1,590.71**
5.	Urad (Kharif 2013-14)	Maharashtra	3,029.60	1,302.72
		Uttar Pradesh	1,972.85	848.32
		Total	**5,002.45**	**2,151.04**
6.	Tur (Kharif 2013-14)	Maharashtra	24,722.00	10,630.46
		Uttar Pradesh	21,983.00	9,452.69
		Total	**46,705.00**	**20,083.15**
7.	Gram (Rabi 2014)	Karnataka	14,098.60	4,370.56
		Maharashtra	31,027.40	9,618.49
		Andhra Pradesh	46,307.22	14,355.23
		Gujarat	3,730.56	1,156.47
		Rajasthan/Jaipur	1,23,262.6	38,211.40
		Rajasthan/SGNR	56,215.6	17,426.83
		Madhya Pradesh	37,760.38	11,705.71
		Uttar Pradesh	2,326.69	721.27
		Total	**3,14,729.05**	**97,565.96**

Table 5.4: Procurement made by SFAC

S.No.	Year/Season	Commodity	Procured Quantity (in MTs)	MSP for FAQ (in Rs. Per Qtl.)	Procurement Value (in Rs. Lakhs)
1.	2013-14	Sunflower seed	516.00	3,700	190.92
		Groundnut	14,680.00	4,000	5,872.00
2.	2013-14	Urad Tur	5.00	4,300	2.15
			6,394.00	4,300	2,749.42
3.	2014-15	Gram	50,285.00	3,100	15,588.00

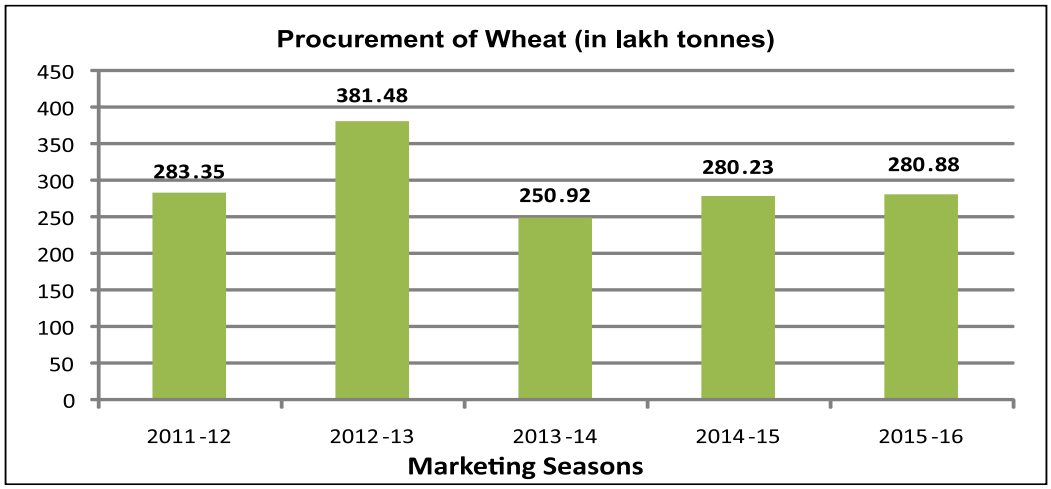
Procurement of Foodgrains

5.20 The Central Government extends price support to paddy, coarse grains and wheat through the FCI and state agencies. All the foodgrains conforming to the prescribed specifications offered for sale at specified centres are bought by public procurement agencies at the MSP. Farmers have the option of selling their produce to the FCI or 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.

5.21 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 sales. It aims to service the Targeted Public Distribution System (TPDS) and other welfare schemes of the Government so that subsidized foodgrains can be supplied to the poor and needy and to build up buffer stocks of foodgrains to ensure foodgrain security.The Government procurements of wheat and paddy and rice during the last five years can be seen in **Figures 5.3** and **5.4**, respectively.

Figure 5.3: Procurement of Wheat

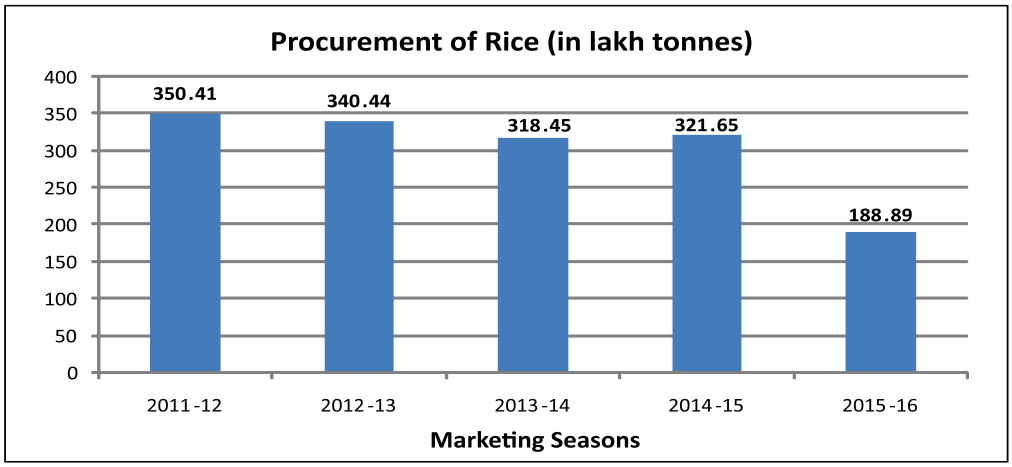
(for 2015-16 as on 31 December 2015)



Source: ***Department of Food and Public Distribution***

Figure 5.4: Procurement of Rice

(for 2015-16 as on 31 December 2015)



Source: ***Department of Food and Public Distribution***

5.22 A High Level Committee (HLC) was set up by the Department of Food and Public Distribution (DFPD) under the chairmanship of Shri Shanta Kumar, Member of Parliament, for restructuring the FCI. The Government has accepted the recommendations of the committee that the FCI should focus more in the eastern states of India, where there are frequent complaints of distress sales of paddy and where the procurement system is ineffective. Accordingly, state-wise five-year action plans have been drawn up by the FCI for UP (with a focus on eastern UP), Bihar, Jharkhand, West Bengal and Assam, where concerns exist about distress sales of paddy (procurement is already robust in Chhattisgarh and Odisha).

5.23 As far as coarse grain is concerned, State Government or its agencies procure coarse grains at MSP on behalf of FCI or Government of India after obtaining prior approval of procurement plan as per extant policy guidelines issued by the Department of Food and Public Distribution (DFPD). So far prior approval of procurement was subject to the condition that the procured coarse grains are planned to be distributed under TPDS/OWS by the State. However, at the time of announcing MSP for kharif 2015-16, Government made a decision that FCI would be the central nodal agency for procurement of coarse grains, irrespective of its distribution under TPDS/PDS. During 2015-16, there was no procurement of coarse grains at MSP.

Storage of Food Grains

5.24 The total storage capacity available with the FCI as on 31 December 2015 was 359.25 lakh MT. However, the total storage capacity available with FCI and state agencies for storage of central pool stocks is 812.09 lakh MT.

Constructions of Godowns under Private Entrepreneurs Guarantee (PEG) Scheme of FCI

5.25 Due to the increased procurement of foodgrains and to reduce the storage in cover and plinth (CAP), the Government formulated a scheme for the construction of storage godowns through private entrepreneurs, the Central Warehousing Corporation (CWC) and State Warehousing Corporations (SWCs). The assessment of additional storage needs under the scheme is based on overall procurement/consumption and the storage space already available. For the consuming areas, storage capacity is to be created to meet four months' requirement of the Public Distribution System (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. As on 31 December 2015, the FCI has sanctioned a total storage capacity of 151.19 lakh MT, out of which a capacity of about 115.51 lakh MT has been sanctioned to private entrepreneurs. The CWC and SWCs have been sanctioned 7.16 lakh MT and 28.52 lakh MT respectively. A capacity of about 14.96 lakh MT is under construction. At present, about 131.65 lakh MT has been completed, out of which 121.67 lakh MT has been taken over. All possible efforts are being made to eliminate the lag between constructed capacity and taken-over capacity.

Box 5.1: Warehousing Development and Regulatory Authority (WDRA)

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 warehousing intending to issue negotiable Warehouse Receipts (NWRs) in the country. The authority has so far notified123 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, 792 warehouses of the CWC, SWCs, private and Project Appraisal Committees (PACs) have been registered with the WDRA till 31 January 2016.In order to create an effective regulatory framework in the warehousing sector, and for improving the effectiveness of NWRs, a transformation plan for the WDRA was conceptualized in the year 2014, and implementation is going on.

Distribution of Foodgrains under the Public Distribution System (PDS)

5.26 With a view to ensure the receipt of foodgrains under the Targeted Public Distribution System (TPDS), the Government of India enacted the National Food Security Act (NFSA), which came into force in July 2013. The Act provides for the coverage of upto 75 per cent of the rural population and upto 50 per cent of the urban population for receiving subsidized foodgrains under the TPDS, thus covering about two-thirds of the population. Persons identified by states/UTs as eligible will be entitled to receive 5 kg of foodgrains per person per month at a subsidized price of Rs 3/2/1 per kg for rice/wheat/coarse grains. The existing Antyodaya Anna Yojana (AAY) households, which constitute the poorest of the poor, will receive 35 kg of foodgrains per household per month.

5.27 The states/UTs which have not implemented the Act are receiving foodgrains under the existing TPDS, which is based on March 2000 population estimates of the Registrar General of India and on the 1993-94 poverty estimates of the erstwhile Planning Commission, under which foodgrains (including additional allocations) are allocated at the rate of 35 kg per family per month for AAY and below poverty line (BPL) families and at the rate of 15-35 kg per family per month for above poverty line (APL) families.

5.28 So far the NFSA has been implemented by the governments of only 27 states and UTs (Andhra Pradesh, Assam, Bihar, Chhattisgarh, NCT of Delhi, Goa, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Sikkim, Telangana, Tripura, Uttar Pradesh, Uttarakhand, West Bengal, Chandigarh, Lakshadweep, Puducherry, Andaman and Nicobar Islands, Meghalaya and Daman and Diu), and revised monthly allocations of foodgrains under the NFSA have been made for these states/UTs. The other nine states and UTs continue to get foodgrains under the existing TPDS for AAY, BPL and APL families on the basis of the 1993-94 poverty estimates of the Planning Commission and the March 2000 population estimates of RGI.

5.28 Under the existing TPDS, the Government has so far made a provisional allocation of 287.79 lakh tonnes for the 27 states and UTs that have implemented the NFSA and of 208.64 lakh tonnes of foodgrains for the remaining nine states and UTs during the current year. Further, an additional quantity of 50.11 lakh tonnes of foodgrains have also been allocated during the current year for BPL and APL families in the states and UTs where the NFSA has not been implemented. In addition, 11.45 lakh tonnes of foodgrains have been allocated to the states for festivals, calamities and additional TPDS requirements etc., and 52.09 lakh tonnes have been allocated under other welfare schemes (OWS) for 2015-16 so far.

5.29 Thus, during the current year, the Government has so far made a provisional allocation of 610.07 lakh tonnes for TPDS, OWS, festivals, relief, etc. 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 January 2015.

Table 5.5: Food Grain Stocks Norms (In Million Tonnes)

As On	Operational Stocks		Strategic Reserve		Grand Total
	Rice	Wheat	Rice	Wheat	
1st April	11.58	4.46	2.00	3.00	21.04
1st July	11.54	24.58	2.00	3.00	41.12
1st October	8.25	17.52	2.00	3.00	30.77
1st January	5.61	10.80	2.00	3.00	21.41

Source: Department of Food & Public Distribution

Central Issue Prices of Rice and Wheat

5.30 Wheat and rice are issued to the state governments and UT administrations from the central pool at uniform central issue prices (CIP) for distribution under the TPDS. The CIPs of wheat and rice are subsidized and have remained unchanged for BPL families since July 2002. The CIPs of wheat and rice are given in **Table 5.6**. However, as more states implement the NFSA, foodgrains, i.e., rice, wheat and coarse grains, are to be supplied at Rs 3 per kg, Rs 2 per kg, and Rs 1 per kg, respectively, to beneficiaries.

Table 5.6: Central Issue Prices of Food Grains

(Rs. per quintal)

Effective From	Food Grains-Wise	Scheme-Wise		
		BPL	APL	AAY
From 01 July 2002 till date	Wheat	415	610	200
From 01 July 2002 till date	Rice	565	830	300
From 27 November 2007 till date	Coarsegrains	300	450	150

Source: Department of Food & Public Distribution

Export of Rice and Wheat

5.31 There has been free export of wheat and rice to private parties out of privately held stocks through electronic data interchange (EDI)-enabled ports from September 2011. State trading enterprises (STEs), including the National Cooperative Consumers' Federation of India Limited (NCCF) and the 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 the Indo-Bangladesh and Indo-Nepal border from 23 February 2012.However, there has been no export or import of wheat and rice during 2015-16 until now out of the central pool stock held by the FCI.

Way Forward

5.32 The MSP policy is relevant only so long as there is a Government agency to procure the item at the announced price if the market price falls below the MSP. In the eastern part of the country, particularly in Assam, Bihar, Jharkhand, Odisha, eastern Uttar Pradesh and West Bengal, which have, of late, started producing a surplus in rice, adequate procurement agencies are not available to ensure price support to farmers. Further, with a view to create competition among procurement agencies and make them more cost-effective, in addition to the FCI and state agencies, there is a need to strengthen PACs and SHGs to procure from farmers on the Government's behalf by providing the minimum working capital and grain management expertise and by investing in upgrading the marketing infrastructure.

5.33 Currently, taxes, mandi fees, commissions and cess on basic commodities like paddy, rice and wheat range from as high as 14.5 per cent in the case of Punjab, 12.5 per cent in Andhra Pradesh, 11.5 per cent in Haryana to less than 5 per cent in the case of Jharkhand, Gujarat, Karnataka, Madhya Pradesh, Maharashtra and West Bengal. There is a need to rationalize these taxes, fees and commissions, particularly for procurement to the central pool, subject to a maximum of 5 per cent of MSP, to bring about rationality in pricing and to contain the food subsidy bill.

5.34 An imbalance is emerging between cereals and pulses and oil seeds, leading to higher surpluses in cereals and deficits in pulses and oil seeds. One of the causes for this growing imbalance is the MSP procurement bias that favours rice and wheat on the one hand and an input subsidy structure that operates on power, fertilizers and irrigation on the other. This incentive environment is highly skewed in favour of a few crops and a few states. To correct this imbalance, the incentive environment has to be modified to induce diversified growth towards more pulses, oilseeds, fruits and vegetables. The way out is by providing additional incentives through supportive marketing and procurement infrastructure keeping in view the import competitiveness of these crops.

5.35 Promoting oil palm cultivation and de-reservation of edible oil processing, which had previously been reserved for the micro and small-scale sectors, would help increase domestic production of edible oils, and could lead to the upgradation and modernization of processing technology and higher oil recovery, thus making the production process more cost-effective. This will promote value addition and reduction in the import of edible oils.

Agriculture Marketing

5.36 Organized marketing of agricultural commodities has been promoted in the country through a network of regulated markets to ensure reasonable gains for farmers and consumers by creating a conducive market environment for fair play of the forces of demand and supply. There is huge variation in the density of regulated markets in different parts of the country, which varies from 119 sq km in Punjab to 11,215 sq km in Meghalaya, while the all-India average area served by a regulated market is 449 sq km. The National Farmers Commission (2004) had recommended that a regulated market should be available to farmers within a radius of 5 km (corresponding market area of about 80 sq km). Such a low density of market spread creates problems in terms of market access for small and marginal farmers. Moreover, due to resource constraints, few of these state-controlled regulated markets provide the required facilities and amenities.

5.37 There are wide variations across states in terms of market fees levied on buyers/traders on the sale of notified agricultural produce for the services provided by APMCs, ranging between 0.30 per cent and 2.0 per cent. In addition, commission charges paid to commission agents vary from 0.5 per cent to 4.5 per cent in foodgrains and from 3 per cent to 7 per cent in the case of fruits and vegetables, resulting in higher marketing transaction costs and low price realization by farmers in regulated markets. This has resulted in fragmented supply chains and the emergence of many intermediaries.

5.38 Huge post-harvest losses in perishable fruits and vegetables remain a key concern. A study conducted by the ICAR in 2015 revealed that post-harvest losses on various commodities declined in comparison to losses indicated by the Millennium Study (2004), and range from 4.65 per cent to 6 per cent of the value of output for cereals, 6.36 per cent to 8.41 per cent for pulses, 6.7 per cent to 15.88 per cent for fruits and 4.58 per cent to 12.44 per cent for vegetables. The ICAR Report indicates that total post-harvest losses on agriculture commodities have been estimated at about Rs. 92,651 crores at 2011-12 base prices.

Agricultural Market Reforms

5.39 Reforms in agricultural marketing regulations make up an important plank of policy for streamlining

supply chains. With the objectives of controlling price rise, reducing post-harvest wastage and promoting the emergence of alternative marketing channels, the Department is promoting the de-regulation of marketing of fruits and vegetables outside market yards while continuing regulation inside market yards. This is expected to provide farmers additional marketing options to sell their horticultural perishables wherever they get better prices. Simultaneously, notified market areas outside market yards would be open for emergence of alternative channels. During recent years, 13 states have either exempted market fees on fruits and vegetables or de-listed fruits and vegetables from the Schedule of the APMC Act or de-regulated marketing of fruits and vegetables.

Status of Marketing Reforms

5.40 Agriculture marketing is administered by the governments of states and union territories as per their agri-marketing regulations. In order to bring in reforms in the sector, the Ministry of Agriculture and Farmers Welfare prepared a Model Act in 2003, which it circulated to all the states and UTs for adoption. The Model Act, *inter alia*, provides for direct marketing, contract farming, establishment of markets in private and cooperative sectors, single point levy of market fee, promotion of e-trading and issue of a unified licence for traders. These market reforms necessitate reforms in three areas, viz., direct marketing, contract farming and markets in the private and cooperative sectors. In these three areas, so far, only 18 state governments have amended their respective APMC Acts and only 10 states have notified rules thereunder to implement the amended provisions. The state-wise status of APMC reforms is indicated in **Table 5.7**.

Table 5.7: State-wise Progress of Reforms in Agricultural Markets (APMC Act)

S.No.	Stage of Reforms	Name of States/Union Territories
1.	States/UTs where reforms to the APMC Act have been legislated to provide for direct marketing, contract farming and markets in private/cooperative sectors	Andhra Pradesh, Arunachal Pradesh, Assam, Chhattisgarh, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Maharashtra, Mizoram, Nagaland, Odisha, Rajasthan, Sikkim, Telangana, Tripura and Uttarakhand.
2.	States/UTs where reforms to APMC Act have been done partially	**a) Direct Marketing:** NCT of Delhi, Madhya Pradesh, Punjab (in Rule only) and UT of Chandigarh (in Rule only), West Bengal. **b) Contract Farming:** Madhya Pradesh, Haryana, Punjab (separate act) and Chandigarh (only waiver of market fee and in Rule only). **c) Private Market:** Punjab, West Bengal and UT of Chandigarh.
3.	States/UTs where there is no APMC Act and hence do not require reforms	Bihar (repealed on 1 September 2006), Kerala, Manipur, Andaman and Nicobar Islands, Dadra and Nagar Haveli, Daman and Diu and Lakshadweep.
4.	State where APMC Act already provides for the reforms	Tamil Nadu.
5.	States/UTs where reforms have not yet been initiated.	Meghalaya, Jammu and Kashmir, Pondicherry and Uttar Pradesh.

5.41 On 2 March 2010, the Ministry of Agriculture and Farmers Welfare set up a Committee of State Ministers in charge of agricultural marketing to persuade various state governments and union territory administrations to implement reforms in their agriculture marketing sector by adopting the model APMC Act and model APMC Rules; to suggest further reforms necessary to provide a barrier-free national market for the benefit of farmers and consumers; and to suggest measures to effectively disseminate market information and to promote grading, standardization, packaging and quality certification of agricultural produce. The Committee consists of members from the states of Maharashtra, Gujarat, Haryana, Uttarakhand, Bihar, Assam, Odisha, Andhra Pradesh, Karnataka and Madhya Pradesh. The Committee deliberated upon various issues relating to market reforms, promotion of private investment in the development of post-harvest and marketing infrastructure and barrier free supply chain, etc. The Committee submitted its final report to the Government on 2 July 2013, which was forwarded to all states and union territories for implementation. Further, on 7 January 2015, the Ministry of Agriculture and Farmers Welfare constituted a Group of Experts (GoE) to study the Report of the Committee of State Ministers in charge of Agricultural Marketing, which suggested an action plan to implement reforms in the agriculture marketing sector. It is expected that the GoE will shortly submit its report to the Government.

Emerging Marketing Channels

5.42 In order to provide efficient and competitive marketing, a transparent price mechanism and a higher share of consumer price to farmers, there is a need to modernize the supply chain through the promotion of innovative marketing channels, e-marketing, etc. Several states, like Maharashtra, Karnataka, Andhra Pradesh and Gujarat, have taken initiatives. Farmers' markets, like Apni Mandi in Punjab, Kisan Mandi in Rajasthan, Hadaspur Vegetable Market in Pune, Rythu Bazaars in Andhra Pradesh, Uzhawar Santhai in Tamil Nadu and Krushak Bazaars in Odisha have been established as part of this initiative. The Small Farmers Agribusiness Consortium (SFAC) also recently launched the Kisan Mandi in Delhi with the objective of linking farmers and farmer producer organizations (FPO) for direct sale of fruits and vegetables to wholesale and retail buyers in Delhi/NCR. The establishment of farmers' markets has helped both consumers and farmers.

5.43 Contract farming has considerable potential in our country. Small and marginal farmers may be able to access modern technology, quality inputs and marketing support through a contractual agreement with a processing and/or marketing firm for production support at predetermined prices. It stipulates a commitment on the part of the farmer to provide a specific commodity in terms of quality and quantity as determined by the purchaser, and a commitment on the part of the company to support the farmer during production through quality inputs and other technical support. Various agriculture commodities, including perishable fruits and vegetables, are being produced under the contract farming system in different states. Twenty states have amended their APMC Acts to provide for contract farming, while the state of Punjab has prepared a separate Act on contract farming. These states, however, need to take further steps to amend the rules and simplify the registration and agreement process in contract farming.

National Agriculture Market (NAM)

5.44 Following the Budget announcements in July 2014 and 2015, the Government approved the scheme for setting up the National Agriculture Market (NAM) through the Agri-Tech Infrastructure Fund (ATIF) on 1 July 2015 with a budget of Rs 200 crores and to be implemented during 2015-16 to 2017-18.

5.45 The Scheme envisages the implementation of the NAM by setting up an appropriate common e-market platform that would be deployable in 585 regulated wholesale markets selected in states and union territories desirous of joining the e-platform. The Small Farmers Agribusiness Consortium (SFAC),

along with its strategic partner (SP) M/s Nagarjuna Fertilizers and Chemicals Ltd. in consortium with Techno Brain Global FZE, will implement the national e-platform and will cover 400 and 185 mandis during 2016-17 and 2017-18 respectively. The DAC&FW will meet expenses on software development and its customization for the states and provide it free of cost to the states and union territories. The DAC&FW will also give grant as a one-time fixed cost subject to the ceiling of Rs. 30 lakhs per mandi for related equipment/infrastructure for the installation of the e-market platform.

5.46 Integration of state APMCs with the NAM requires certain prerequisites in the state AMPC Acts, namely (i) a single licence to be valid across the state, (ii) single-point levy of market fee, and (iii) provision for electronic auction as a mode for price discovery. Only those states and union territories that have completed these three prerequisites will be eligible for assistance under the scheme.

5.47 Proposals from the following states have been considered for integration of their mandis with the NAM. The status is as follows.

Table 5.8: Approved Proposals under NAM

State/UT	No. of Mandis	Proposal Cost (Rs. in Crores)	Maximum Admissible Assistance (Rs. in Crores)	Funding from State/UT Own Resources (Rs. in Crores)	Sanction/Release Status
Gujarat	40	27.86	12.00	15.86	Approved on 03 November 2015. Released Rs.12 crores on 20 November 15.
Maharashtra	30	16.74	9.00	7.74	Approved in principle on 18 November 15. Certain inputs awaited to enable release.
Telangana	44	13.26	12.17	1.10	Approved on 18 November 2015. Released Rs. 12.165 crores on 30 December 2015.
Jharkhand	19	5.92	5.70	0.22	Approved on 19 December 2015. Released Rs. 5.70 crores on 15 January 2016.
Chhattisgarh	05	2.58	01.50	1.08	Approved in principle on 9 December 2015. Released Rs. 1.50 crores on 09 March 2016.
Madhya Pradesh	50	35.21	15.00	20.21	50% of admissible amount i.e., Rs.7.50 crore being released on 30 March 16.
Rajasthan	25	18.80	7.50	11.30	Approved in principle on 31 December 2015. Released Rs. 7.50 crores on 05 February 2016.
UT of Chandigarh	01	2.01	0.30	1.71	Approved in principle on 31 December 2015. Certain inputs awaited to enable release.

State/UT	No. of Mandis	Proposal Cost (Rs. in Crores)	Maximum Admissible Assistance (Rs. in Crores)	Funding from State/UT Own Resources (Rs. in Crores)	Sanction/Release Status
Haryana	54	38.62	16.20	22.42	Approved in principle on 19 February 2016. Certain inputs awaited to enable release.
Himachal Pradesh	19	5.70	5.70	0.00	Approved in principle on 19 February 2016. Certain inputs awaited to enable release.
Uttar Pradesh	66	32.94	19.80	13.18	Approved in principle on 19 February 2016. Certain inputs awaited to enable release.
Andhra Pradesh	12	3.88	3.60	0.28	Recast proposal Approved in principle on 19 February 2016. Certain inputs awaited to enable release.
Total	**365**	**203.52**	**108.47**	**95.18**	

5.48 Meanwhile, many other states and UTs like Karnataka, Uttarakhand, Punjab, Odisha, Tamil Nadu, Puducherry, Andaman and Nicobar Islands, Assam, Manipur, Arunachal Pradesh, Nagaland and Mizoram have expressed their willingness to join the NAM. The Detailed Project Reports (DPR) for the integration of mandis with NAM, including the setting up of soil testing laboratories, are awaited from these states.

5.49 The pilot of NAM is to be launched shortly on 14 April 2016 for 22 agri-commodities in 20 mandis of eight states.

Budget-Related Issues

5.50 So far, the proposals of 12 states for 365 mandis, involving grants of Rs. 108.465 crores, have been approved by the Project Appraisal Committee (PAC) for the NAM. Further, Rs. 5 crores have been released to the SFAC, while Rs. 45.96 crores have been approved for the strategic partner (Rs. 40.14 crores as cost + Rs. 5.82 crores as service tax at the rate of 14.50 per cent).

Table 5.9: The Funds Released to States

S. No.	State/UT	No. of Mandis	Release (Rs. in Crores)	Date of Release
1	Gujarat	40	12.00	20 November 2015
2	Telangana	44	12.17	30 December 2015
3	Jharkhand	19	5.70	18 January 2016
4	Chhattisgarh	05	1.50	09 March 16
5	Rajasthan	25	7.50	05 February 2016
6.	Madhya Pradesh	50*	7.50 (*50% of admissible amount being released on 30 March 2016)	30 March 2016
	Total	183	**46.37**	

Table 5.10: Pending Releases

S. No.	State/UT	No. of Mandis	Amount to be Released (Rs. in Crore)	Sanction/Release Status
1	Maharashtra	30	9.00	Approved in principle on 18 November 2015.Reply received.
2	Madhya Pradesh	50*	7.50	* 50% of admissible amount is being released on 30 March 2016. Balance will be released subject to furnishing certain information by MP.
3	UT of Chandigarh	01	0.30	Approved in principle on 31 December 2015. Certain inputs awaited to enable release.
4	Haryana	54	16.20	Approved in principle on 19 February 2016. Certain inputs awaited to enable release.
5	Himachal Pradesh	19	5.70	Approved in principle on 19 February 2016. Certain inputs awaited to enable release.
6	Uttar Pradesh	66	19.80	Approved in principle on 19 February 2016. Certain inputs awaited to enable release.
7	Andhra Pradesh	12	3.60	Recast proposal approved in principle on 19 February 2016. Certain inputs awaited to enable release.
	Total	**232**	**62.10**	

5.51 During 2016-17, an allocation of Rs.50 crores was made at the BE stage. Depending on pending claims and fund requirements, additional funds will be sought at the RE stage.

Incentivizing Development of Agricultural Marketing Infrastructure

5.52 The 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, the Ministry of Agriculture and Farmers Welfare has been implementing demand-driven plan schemes by providing assistance to entrepreneurs in the form of back-ended credit linked subsidy.

5.53 This Department implements the Integrated Scheme for Agricultural Marketing (ISAM), a sub-component of which is Agriculture Marketing Infrastructure (AMI), which provides assistance for the creation of agri-marketing infrastructure, including storage capacities between 25 MT to 30,000 MT. The storage component of the AMI sub-scheme (erstwhile Grameen Bhandaran Yojana (GBY)) has been under implementation since April 2001. Under the scheme, loan-linked back-ended capital investment subsidy is provided at the rate of 25 per cent to eligible beneficiaries from the general category, upto a ceiling of Rs. 2.25 crores, and at the rate of 33.33 per cent to candidates from special categories and special areas, upto a ceiling of Rs. 3 crores and Rs. 4 crores, respectively. As on June 2015, 35,226 godowns with a capacity of 55.51 million MT have been sanctioned since inception. Subsidy released for the same has been to the tune of Rs. 1,908.50 crores. Likewise, subsidy is also provided at the rate of 25

per cent to eligible beneficiaries from the general category upto a ceiling of Rs. 4 crores and at the rate of 33.33 per cent to special categories and special areas upto a ceiling of Rs. 5 crores 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 May 2015, 11,545 agri-marketing infrastructure projects other than storage have been sanctioned, and a subsidy of Rs 1,313.38 crores has been released. Largely, the scheme has been very successful, and the offtake 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 5 August 2014. The Scheme, however, continues to be implemented for promoters from special areas and special categories.

5.54 The Department also implements other capital investment schemes like Mission for Integrated Development of Horticulture (MIDH) and Rashtriya Krishi Vikas Yojana (RKVY). Under these schemes, various types of demand-based and need-based post-harvest and marketing infrastructure, including warehousing, cold storage, integrated value chains (IVC) and value addition facilities, are developed. In addition, under the RIDF/WIF, NABARD promotes the development of various types of marketing infrastructure, including warehouses and cold storage units. Since 2008-09, the Ministry of Food Processing Industries has been implementing a Central Sector Scheme of Cold Chain, Value Addition and Preservation Infrastructure for the setting up of an integrated cold chain and the preservation of infrastructure facilities for horticulture and non-horticulture produce without any break from the farm gate to the consumer.

Empowering Farmers with Market Information

5.55 Market information is an important tool in any agricultural marketing system. In order to provide regular and timely information on the prices of agricultural commodities prevailing in agricultural produce markets in the country, the Ministry of Agriculture launched the ICT-based Central Sector Scheme of Marketing Research and Information Network (MRIN) in the year 2000. The Scheme provides electronic connectivity to important wholesale markets in the country for collection and dissemination of price- and market-related information. Presently, 3,244 markets from all over the country have been linked to a central portal (http://agmarknet.nic.in). These markets report daily prices and arrivals for more than 300 commodities and 2,000 varieties from more than 2,700 markets covering nearly all the major agricultural and horticultural produce. State APMCs need to regularly upload data on price and arrivals on this portal. Some states, e.g., Bihar and Kerala, which do not have APMCs, also report price information through alternative arrangements, though in a limited manner.

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Standardization and Quality Certification

5.57 Grading of agricultural commodities has three main purposes: (i) to promote a common trade language and avoid the need for physical checking and handling at multiple points; (ii) to protect consumers by ensuring quality; and (iii) to protect the producer from exploitation by ensuring prices commensurate to the quality of the produce. Until date, the grade standards of 213 agricultural commodities have been notified in 105 Commodity Grading and Marking Rules. The grade standards notified under the provisions of the Agricultural Produce (Grading and Marking) Act, 1937 are popularly called 'AGMARK Standards'. Grading and marking under AGMARK is voluntary as per the provisions of the Act. However, certification of blended edible vegetable oils and fat spreads is mandatory under AGMARK as per the "Regulations" notified under the Food Safety and Standards Act, 2006. The quantity and value of agricultural commodities certified under AGMARK for domestic trade was 18.08 lakh MT during the year 2013-14, valued at Rs. 14,412.91 crores, and 19.12 lakh MT during the year 2014-15, valued at Rs.12,589.40 crores.

Farmer Producer Organizations (FPO)

5.58 Farmers, especially small producers, are confronted by many challenges such as the small size of landholdings, lack of access to financial and non-financial inputs and services and appropriate technologies and high transaction costs. Farmer producer organizations offer a form of aggregation which lets individual producers hold onto land titles while using the strength of collective planning for production, procurement and marketing to add value to members' produce. They serve as an important link in risk mitigation strategies to overcome the challenges brought about by climate change. Farmer producer organizations undertake input supply (seed, fertilizer and machinery), financial and technical support (credit, savings, insurance and extension), provision of marketing linkages (contract farming and procurement under MSP) and training and networking (HRD, policy advocacy and documentation). The SFAC has been engaged in the formation of FPOs since 2011. The project, which has been working across 29 states, has so far helped to mobilize approximately 4.91 lakh farmers in 381 FPOs. Another two lakh farmers are under mobilization under 306 FPOs, which are yet to be registered.

Agribusiness Development through Venture Capital Assistance (VCA)

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Capacity Building in Agri-Marketing Sector

5.60 The National Institute of Agriculture Marketing (NIAM), Jaipur provides training, research, education, extension and consultancy services for capacity building of stakeholders in the agri-marketing sector. In the Twelfth Five Year Plan, the NIAM has been entrusted with the goal of carrying out 41 surveys and research studies, 675 training sessions and

seminars and 44 project consultations. The NIAM also conducts a postgraduate diploma programme on agri-business management. The Government is supporting the NIAM through a grant-in-aid of Rs. 30 crores during the Twelfth Plan period.

Price Stabilisation Fund (PSF)

5.61 On account of various reasons (such as short falls in production, gaps in the supply chain, speculative activities by traders, inclement weather, etc.), the prices of some agri-horticultural commodities tend to be volatile. In order to control the spike in prices of commodities such as onion, potato and pulses, the ministry has launched a Price Stabilisation Fund (PSF) with a corpus of Rs. 500 crores.

5.62 The PSF advances interest-free loans to state governments, central agencies and PSUs/cooperatives under ministries to support their working capital needs and other expenses on domestic procurement/ imports and distribution interventions for such commodities. Initially, the Fund is being used for market intervention in respect of pulses, onion and potato only. In 2015-16, the following interventions were taken with support from the Fund.

(I) Imports: In view of the increasing prices of pulses in 2015, the Government imported 5,000 MT of tur dal through the Metals and Minerals Trading Corporation of India (MMTC). The imported unmilled tur dal was allocated to various states on demand at the rate of Rs. 69 per kg. (approx.) as under:

Table 5.11: Allocation of Imported Unmilled Tur Dal

Andhra Pradesh	1,872 MT
Tamil Nadu	1,000 MT
Delhi (through Kendriya Bhandar and Mother Dairy)	755 MT
Uttar Pradesh	500 MT
Telangana	500 MT
Total	**4,627MT**

(II) Onions: The SFAC and NAFED were provided interest-free advances from the PSF of Rs. 9.16 crores and Rs 8.75 crores, respectively, to undertake domestic procurement of onions. The SFAC and NAFED procured 6,011 MT of onions and sold it in Delhi during the lean season in 2015 and helped provide relief to consumers. The SFAC and NAFED regularly release the onion stocks held by them through different channels in Delhi to keep prices under check. Import of 2,000 MT of onions was also undertaken through the MMTC to control prices.

(III) Buffer Stock of Pulses:

(a) *Domestic Procurement:* The Government of India approved the proposal for buffer stocking of 1.5 lakh MT of pulses (arhar, urad, chana and masur) in 2015-16 on 9 December 2015. As per the proposal, if the prices of pulses are above the MSP, procurement will be done with assistance from the PSF. If prices are below MSP, procurement will be done as per the Price Support Scheme (PSS). Since the prevailing prices in the kharif marketing season (KMS) 2015-16 for urad and tur were above MSP, these pulses were procured by the FCI, SFAC and NAFED with the assistance of the PSF. The KMS was from 15 October 2015 to 29 February 2016 (extended from 15 February 2016). The average cost of procurement for urad by the three agencies was Rs 100-120 per kg and tur was Rs 85-90 per kg. The three agencies procured 4,891.66 MT of urad against the target of 5,000 MT, and 45,530.86 MT of tur against the target of 45,000 MT. During the Rabi Marketing Season (RMS) from 15 March 2016 until 15 July 2016, chana (80,000 MT) and masur (20,000 MT) is to be procured by the FCI, NAFED and SFAC.

(b) *Imports:* Simultaneously, for the buffer stock, the Government has also approved import of 5,000 MT urad and 20,000 MT of tur. Subsequently, additional imports have also been approved. As on 30 March 2016, the imports ordered through MMTC stand at 1,000 MT of tur at Rs. 8.60 crores, 5,000 MT of tur at Rs. 44.16 crores, 5,000 MT of tur at Rs. 40.99 crores and 2,500 MT of urad at Rs. 22.99 crores and 5,000 MT of urad at Rs. 41.94 crores. The total cost

of these imports [11,000 MT of tur and 7,500 MT of urad] is Rs. 158.68 crores.

(IV) Assistance to State PSF: In addition to the above, states and UTs have also set up their state-level PSF to undertake market intervention in respect to the onion, potato and pulses markets with assistance from the central PSF. Details of assistance provided to the state are in **Table 5.12.**

Table 5.12: Market Intervention Operations by States

State	Total Working Capital Advance from PSF to be Released (Rs. Crores)	Agri Commodity	Status
Telangana	9.15	Onion	Released
Andhra Pradesh	50.00	Onion, potatoes and pulses	Released Rs. 25 crores as first installment of GoI share
West Bengal	5.00	Onion	Released Rs. 2.50 crores as first installment of GoI share
Grand Total	**64.15**		**Rs. 32.075 crores released**

Challenges

5.63 Though the process of market reforms has been initiated by different states and union territories by the amendment of their respective APMC Acts on the lines of the Model Act circulated during 2003, some of them are yet to adopt all the provisions of the Model Act uniformly, and many of the other states and union territories are yet to adopt the same. The focus of the ministry has been to actively pursue with the states that have adopted reforms to notify the rules thereunder to implement the provisions so that actual progress can be achieved on the ground.

5.64 Under the Essential Commodities Act (1955) and under administrative orders, states have been imposing restrictions on the cross-border movement of specific commodities for trade purposes, thus hindering the development of interstate trade. States also notify various commodity-wise stock limits (edible oil and edible oilseeds, pulses, onion and potato), which do not encourage investment in storage facilities that is crucial to marketing infrastructure. There is a need to rationalize the levies on Government procurement and on stocking limits on private trade to allow the seamless movement of agri-commodities all over the country and to allow direct buying by processors and retailers from farmers to facilitate seamless marketing of agricultural produce across the country.

5.65 The present agricultural marketing system in the country is marked by a fragmented supply chain, which is dominated by multiple market players, resulting in high wastage. This adversely affects efficient marketing. To facilitate the creation of a transparent pricing system, and to enhance the producer's share in the consumer's rupee, it is necessary to ensure direct marketing, e-marketing and promotion of contract farming.

5.66 There is a large difference between wholesale and retail prices due to multiple intermediaries and high market fees or cess, ranging up to 14.5 per cent ad-valorem, apart from other market charges. These need to be rationalized, especially the commission charges, which should not exceed 2.0 per cent ad-valorem across commodities.

Way Forward

5.67 The development of alternative and competitive marketing channels is necessary to induce competition in the existing marketing systems and to facilitate the sale of farm produce at remunerative prices. There is a need for an efficient marketing system, including the creation of scientific storage nearer farm produce,

to avoid wastage and produce deterioration. It is also necessary to fulfil the institutional credit requirements of farmers through various instruments like pledge financing and a negotiable warehousing receipt system so that they are not compelled to sell the produce at distress prices. States like Bihar, which have no marketing regulations, need to put in place some sort of minimum developmental type of regulation to ensure orderly marketing in the state.

5.68 Improvement of marketing linkages, for both farm produce and inputs, necessitates a legislative policy framework and effective Government support services as well as strong private sector backing. Such services may include provisions of market infrastructure, supply of market information and agricultural extension services to advise farmers on marketing, capacity building in marketing and development of marketing linkages between farmers, agri-businesses and large retailers. Such linkages can be developed through cooperatives, contract farming or associations of stakeholders representing different interest groups like farmers, input suppliers, agricultural produce processers, etc., who join together in associations to promote their common goals. The Government can work as a catalyst for the formulation of such associations to improve agricultural productivity, processing, marketing, support services, farm market linkages, training and infrastructure.

International Cooperation

5.69 International cooperation in the agriculture sector aims at fostering mutually beneficial partnerships with other countries in a 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, memoranda of understanding (MoUs), agreements, protocols and work plans are signed and implemented for furthering cooperation in the agriculture and allied sector.

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

A. Multilateral Cooperations

Food and Agriculture Organization (FAO)

5.71 India is a founder-member of the FAO and has been taking part in all its activities. India has been availing services from the FAO from time to time in the form of training, consultancy services, equipment and material in the field of agriculture and allied sectors under its Technical Cooperation Programme.

World Food Programme (WFP)

5.72 The World Food Programme (WFP) was set up in 1963 jointly by the United Nations and the FAO. India is a founder-member of the WFP, which is mandated to provide emergency food supply in places facing acute food insecurity due to natural calamities as well as manmade causes. Currently, the Country Strategy Programme (CSP) 2015-2018 is under operation, which focuses on reducing hunger and malnutrition among women and children in vulnerable areas, the development of appropriate products to deal with malnutrition at early ages among children and the creation of livelihood opportunities for the poor. The first CPAC meeting was held on 24 August 2015 with all stakeholders of WFP CSP for 2015-18. The WFP has also made notable contributions through product innovations such as Indiamix and mapping of hunger in India through its food atlases, etc.

World Bank

5.73 Presently, there are five agriculture sector-related projects being implemented with the assistance of the World Bank. These projects are

related mainly to watershed development and soil and water conservation measures (natural resource management) as well as overall agricultural development related issues.

G-20 and BRICS

5.74 During 7-8 May 2015, at the meeting of the G-20 Agriculture Ministers in Turkey, a final communiqué was issued that showed the ministers' commitment to moving towards assuring a sustainable food system in all dimensions—economic, social and environmental. It also focused on minimizing food loss and waste and creating provisions for food security and nutrition. The G-20 Food Security and Nutrition Framework in 2014 was also endorsed by the G-20 Agriculture Ministers.

Others

5.75 India also has cooperation programmes with other multilateral organizations, such as the Japan International Cooperation Agency (JICA), German Technical Cooperation (GTZ), Asian Development Bank (ADB) and International Fund for Agriculture Development (IFAD).

B. Bilateral Cooperations

MoUs or Agreements or Work Plans

5.76 India has signed MoUs/agreements/work plans for agricultural cooperation with more than 50 countries. A review of the progress made so far in these MoUs and work plans is currently under way.

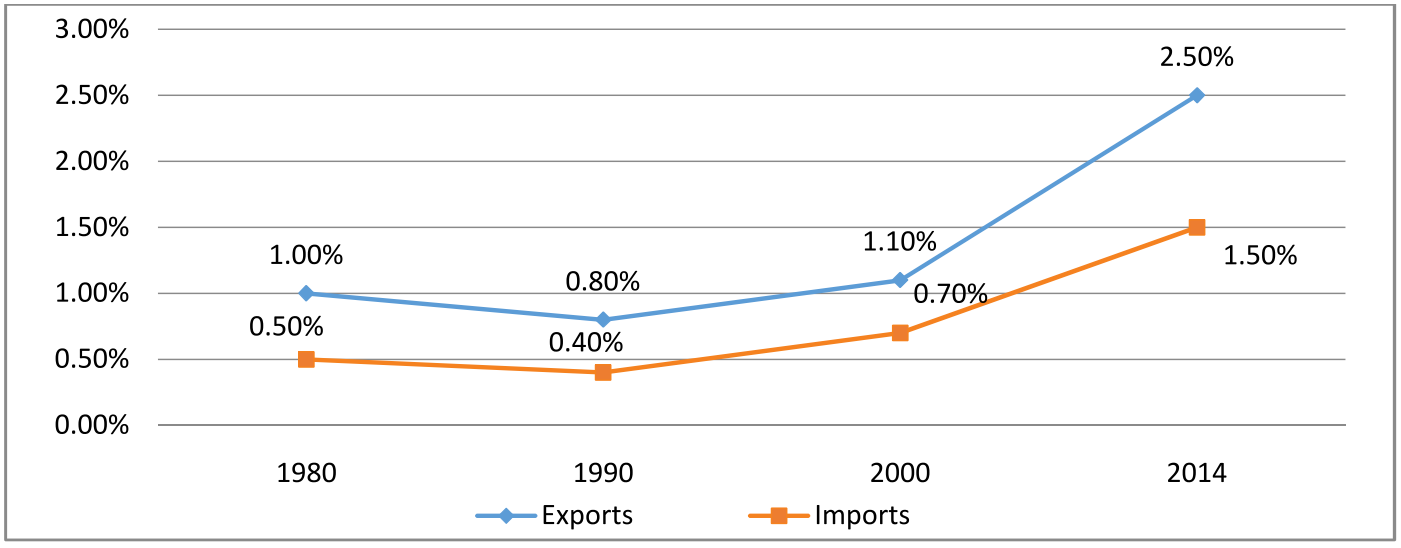
C. Strategic Groups

5.77 India is a member of multilateral groupings such as IBSA (India, Brazil and South Africa), BRICS (Brazil, Russia, India, China and South Africa), SAARC (South Asian Association for Regional Cooperation), ASEAN (Association of South East Asian Nations), BIMSTEC (Bay of Bengal Initiative for Multi-sectoral Economic and Technical Cooperation), etc.

India's Agriculture Trade

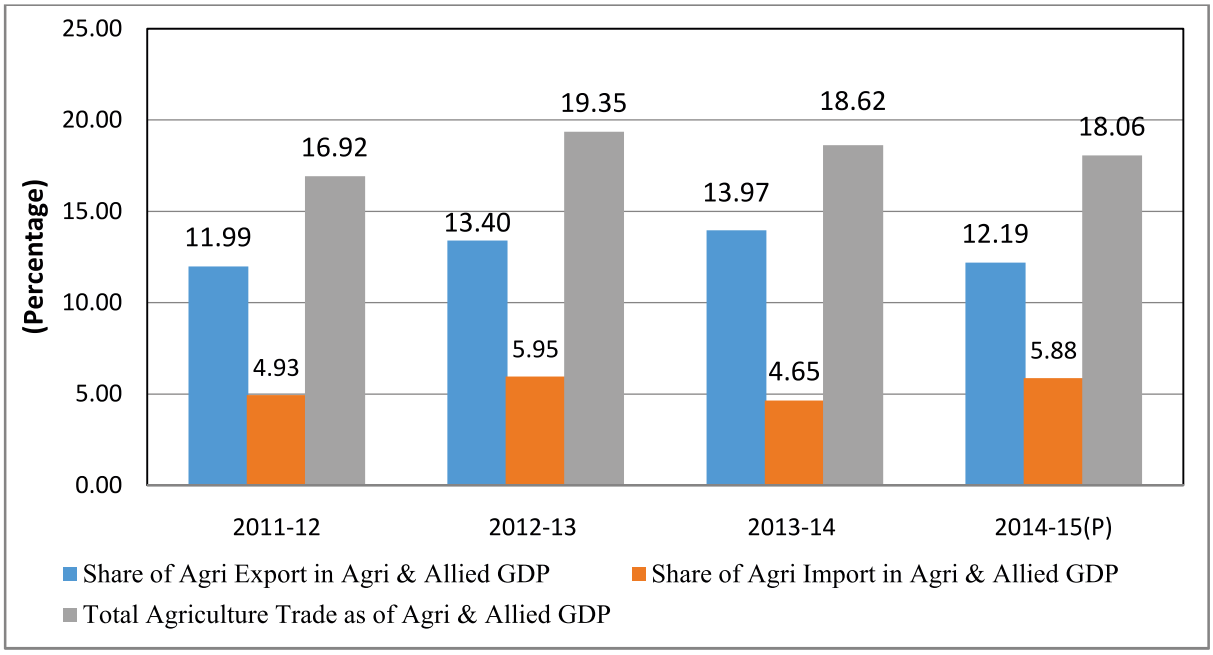
5.78 India is among the 15 leading exporters of agricultural products in the world. The country has emerged as a significant exporter of certain agri-items like cotton, rice, meat, oil meals, pepper and sugar. India has developed export competitiveness in certain specialized agriculture products like basmati rice, guar gum and castor. As per WTO Trade Statistics, India's share in agricultural exports and imports in the world in 2014 were 2.46 per cent and 1.45 per cent, respectively (**Figure 5.5**).Agricultural exports and imports as a percentage of agriculture GDP has also been increasing as shown in **Figure 5.6**.

Figure 5.5: Share of India's Agricultural Exports/Imports in World Exports/Imports



Source: ***International Trade Statistics 2015, World Trade Organization (WTO)***

Figure 5.6: Agriculture Trade as Percentage of Agriculture and Allied GDP



Source: Department of Commerce and CSO

Note: GDP estimates are at current prices (based on 2011-12 series)

Agricultural Exports and Imports

5.79 Agricultural exports increased from Rs 2,19,900 crores in 2012-13 to Rs 2,29,996 crores in the financial year 2014-15, registering a growth of nearly 4.6 per cent. The increase in the value of agricultural exports during 2014-15 over 2013-14 was primarily on account of higher exports of marine products, non-basmati rice and meat and meat preparations. The share of agricultural exports in total exports of the country decreased from 13.46 per cent in 2012-13 to 12.16 per cent in 2014-15.

5.80 India's top ten agricultural export commodities in terms of quantity and value during the last few years are given in **Table 5.13.**

Table 5.13: India's Top 10 Agricultural Export Commodities

Quantity: '000 tonnes
Value: Rs. Crores

S. No.	Commodity	2012-13		2013-14		2014-15		2015-16 (April-Dec)	
		Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
1	2	3	4	5	6	7	8	9	10
1	Marine products	965	18,841	1,001	30,627	1,073	33,685	779	24,571
2	Buffalo meat	1,076	17,409	1,366	26,458	1,476	29,283	1,009	20,623
3	Rice –basmati	3,460	19,409	3,754	29,292	3,702	27,599	3,069	17,587
4	Rice (other than basmati)	6,688	14,449	7,148	17,795	8,226	20,336	4,723	11,104
5	Spices	933	15,177	897	15,146	923	14,842	601	11,997
6	Cotton raw incld. waste	-	20,277	1,948	22,338	1,143	11,643	930	8,802

S. No.	Commodity	2012-13		2013-14		2014-15		2015-16 (April-Dec)	
		Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
7	Guargam meal	406	21,287	602	11,735	665	9,480	255	2,700
8	Oil meals	6,578	16,520	6,577	17,070	3,904	8,129	1,655	2,848
9	Cashew	104	4,067	121	5,095	135	5,566	81	3,844
10	Sugar	2,794	8,576	2,478	7,179	1,954	5,327	2,455	6,038

Source: ***DGCIS, D/o Commerce***

5.81 India's agricultural imports increased from Rs. 1,03,693 crores in 2012-13 to Rs 1,22,188 crores in 2014-15, registering a growth of nearly 17.8 per cent. The increase in the value of agricultural imports during this period was primarily on account of imports of vegetable oils, pulses, cashew nuts, spices, sugar and cotton. The share of agricultural imports in total imports increased from 3.88 per cent in 2012-13 to 4.47 per cent in 2014-15. During 2015-16 (Apr-Dec), agricultural imports are estimated at Rs 1,06,935 crores as compared to Rs 94,634 crores during the corresponding period in 2014-15.

5.82 India's top 10 agriculture commodities imported during the last few years are reported in **Table 5.14**.

Table 5.14: India's Top 10 Agricultural Import Commodities

Quantity: '000 tonnes

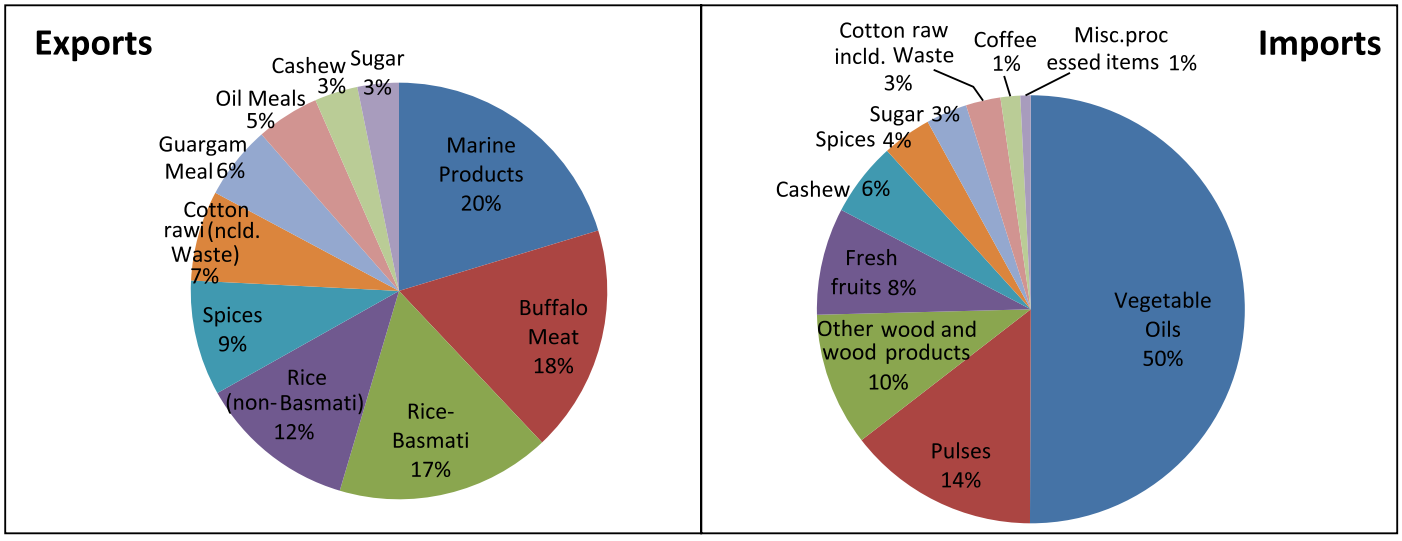
Value: Rs. Crores

S.No.	Commodity	2012-13		2013-14		2014-15		2015-16 (Apr-Dec)	
		Qty	Value	Qty	Value	Qty	Value	Qty	Value
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	Vegetable oils	9,606	53,562	7,943	44,038	11,548	59,094	12,066	52,549
2	Pulses	4,013	13,345	3,178	11,037	4,585	17,063	4,411	19,238
3	Other wood and wood products	-	11,439	-	12,500	-	11,888		7,886
4	Fresh fruits	802	6,180	769	7,716	858	9,544	619	8,647
5	Cashew	899	5,434	776	4,668	941	6,600	846	7,399
6	Spices	176	2,716	156	3,452	161	4,392	137	3,842
7	Sugar	1,122	3,094	881	2,287	1,539	3,668	1,390	2,778
8	Cotton raw incld. waste	233	2,467	181	2,376	259	3,101	194	2,135
9	Misc.processed items	-	1,268	-	1,474	-	1,749		1,271
10	Coffee	71	796	60	729	75	930	50	607

Source: ***DGCIS, D/o Commerce***

5.83 The share of top 10 exported and imported agri-commodities during 2014-15 is as follows.

Figure 5.7: Share of Top Exported and Imported Commodities



Foreign Trade Policy

Cereals

5.84 The export of cereals is currently free and imports are allowed through the FCI subject to some conditions. The import duty was raised from zero per cent to 25 per cent for wheat on 19 October 2015 and from 70 per cent to 80 per cent for rice. Rice from India is traded in two varieties—basmati and non-basmati. Wheat is traded as duram and other wheat.

Sugar and Cotton

5.85 In the case of sugar and cotton, exports are free without any quantitative restrictions. Import duty of 40 per cent is levied on sugar, while duty-free import is allowed for cotton.

Oilseeds and Oil

5.86 In the case of oil seeds, exports are free and imports are subject to a levy of 30 per cent duty. Vegetable oil export is permitted in consumer packs of 5 kg, subject to a Minimum Export Price (MEP) of US$ 900 per MT. Besides, there are no restrictions on the export of coconut oil and rice bran oil. Import duty is levied on crude oil at 12.5 per cent and on refined edible oils at 20 per cent.

Pulses

5.87 Pulses export is prohibited except for chick pea (kabuli chana) and organic pulses including lentils upto 10,000 MT per annum. Import is free.

Trade Policy as an Instrument of Price Stabilization

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

5.89 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, the

export of chick pea (kabulichana) was permitted considering that India is the largest producer of this commodity. In 2011, export of up to 10,000 MT per annum of organic pulses including lentils was also permitted.

5.90 Export of edible oils was banned in March 2008, and import duty was brought down to zero for crude and 7.5 per cent for refined edible oils in April 2008 as a price stabilization measure. Later, certain relaxations were made for the export of edible oils in consumer packs. In 2013, when the price of coconut fell below the MSP, restrictions on the export of coconut oil were 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.

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

5.92 The policy on the export of onion has seen frequent changes in the 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 away with in March 2014.

Trade Policy as an Instrument of Growth

5.93 The export of agricultural commodities has helped producers take advantage of the wider international market which, in turn, has incentivized their domestic production. Crops that are exported in significant quantities, such as cotton, soyabean and maize, have seen significant increases in area coverage and growth rate of production. The compound annual growth rate of cotton, maize and soyabean during the last 10 years (2003-04 to 2013-2014) has been 10.1 per cent, 4.9 per cent and 4.3 per cent, respectively, compared to the overall growth of foodgrains of 2.22 per cent during the same period.

5.94 Niche products such as basmati rice and organic pulses (10,000 MT per annum) have been allowed to be exported even in the event of a ban on the export of mass consumption produce such as non-basmati rice and pulses. A decision has been taken by the Government to allow the export of certain processed products such as cereal flour and milk products (except SMP) even in the event of a ban on the 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)

5.95 India has been negotiating free trade agreements (FTAs) for liberalized trade of agriculture goods to increase its trade. The main developments during the period under review are listed below.

(i) Negotiations on preferential trade agreements (PTAs) and free trade agreements (FTAs) continue to progress with the European Union, EFTA (Switzerland, Norway, Iceland and Liechtenstein), MERCOSUR (Brazil, Argentina, Paraguay, Uruguay), Chile, Israel, Indonesia, Australia, New Zealand and Thailand.

(ii) A trade in goods agreement between India and ASEAN (Brunei, Indonesia, Malaysia, Philippines, Singapore, Thailand, Cambodia, Lao PDR, Myanmar and Vietnam) was signed on 13 August 2009. This FTA became effective from 1 January 2010. The India–South Korea Partnership Agreement (CEPA) concluded on 7 August 2009 and came into force on1 January 2010.

(iii) Trade in goods agreements under the India–

Japan CEPA and India–Malaysia CECA were concluded during 2010-11 and have become effective from 1 August 2011 and 1 July 2011 respectively.

(iv) More tariff concessions has been provided to the SAFTA least developed countries (LDCs) (Bangladesh, Nepal, Bhutan, Afghanistan and Maldives) and Non-LDCs (Sri Lanka and Pakistan). The tariff on all agricultural products has been reduced to zero for SAFTA LDCs. Bangladesh is a major beneficiary of this liberalization.

Impact of FTA

5.96 After the implementation of the India–ASEAN FTA, India's exports of garlic, onions, turmeric, wheat and meslin, cane sugar, groundnuts, oilcake/ oilcake meal of soybean, oilcake/oilcake meal of rape/colza seed and millets (sorghum and bajra) to ASEAN have registered an increase. On the other hand, high growth of imports from Indonesia has been noticed for products such as black pepper, refined palm oil, mace, etc. India also imports crude palm oil and cotton from Malaysia; dog and cat food and other fresh fruit from Thailand; cashew kernel (whole), black pepper, anise seeds and starches from Vietnam; and chickpeas, red beans and kidney beans from Myanmar. However, no significant import under FTA has been noticed from the Philippines or Cambodia.

World Trade Organization (WTO) Negotiations

5.97 WTO Ministerial conference at Nairobi: The tenth WTO ministerial conference was held in Nairobi from 15-19 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 surges 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 honouring both 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 timeframe, distinct from the agriculture negotiations under the Doha Development Agenda (DDA).

(iii) All member countries have to eliminate export subsidies within a given time frame. 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 1 January2016.

Foreign Direct Investment (FDI) Policy in Agriculture

5.98 India's FDI policy aims to attract investment in technology, machinery, equipment, seeds and planting material, warehousing and cold storage and other components of infrastructure logistics. It complements the public and private investment necessary to bring knowledge, technologies and services to farmers. Hundred per cent FDI has been allowed in the development and production of seeds and planting material, floriculture, horticulture and cultivation of vegetables and mushrooms under controlled conditions, and in tea plantations, coffee plantations, rubber plantations, cardamom plantations, palm oil tree plantations and olive oil tree plantations.

5.99 Besides, FDI policy with regard to multi-brand retail trading (MBRT) provides that at least 50 per cent of the first tranche of US $100 million shall be invested in back-end infrastructure, which includes construction of warehousing and cold storage facilities.

Challenges

5.100 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 the massive imports of edible oils and pulses to meet the gap between domestic demand and production.

Edible Oils

5.101 India's self-sufficiency in terms of domestic production has come down, from 94 per cent in 1994-95 to 43 per cent in 2014-15. With the 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.

5.102 One way of promoting domestic production is calibrating the import duty structure such that the rate of import duty varies in a countercyclical manner with international prices. This measure would help in stabilizing the price of edible oils at reasonable levels and thereby incentivize better technology adoption by oilseed growers, and thereby reduce our dependence on massive imports. This would contribute towards enhancing food security in the edible oil sector.

Pulses

5.103 Import of pulses has been increasing over the years and now constitutes around 17 per cent of domestic demand. There were incidents in the past when the imported prices of urad, tur and gram were below the MSP, bringing down the domestic prices of these commodities below the remunerative price.

Quality Issues and Sanitary and Phytosanitary (SPS) Measures

5.104 Applying hygiene and safety standards for both domestic consumption and exports is becoming increasingly important. With the Food Safety and Standards Authority coming into being, food sanitary measures applied for international quality and competitive pricing will determine the course of trade.

Way Forward

Consistent Trade Policy for Agricultural Growth

5.105 A stable trade policy over the years has benefited the agriculture sector, which is reflected in the fast growth of exports and the positive trade balance. The trade policy will continue to focus on adequately incentivizing farmers to invest more in productivity increasing techniques, which will not only help the agriculture sector realize its true potential but also assist in meeting the domestic demand. Policies need to be formulated to reduce our huge import bills for imports of vegetable edible oils and pulses.

5.106 In India, the import policy for agriculture is often considered a price support and price stabilization tool. Increasing tariffs is recommended for agricultural products in response to declining prices on an ad hoc basis. In this

context, it is felt that import duties may be imposed on agriculture imports so that the landed cost of the imported product does not go below the prevailing MSP of that product. To ensure parity between the landed cost of the imported commodity and the 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 the respective items. This would help in maintaining a stable price regime for agri-products without compromising the interest of our farmers.

Product Development

5.107 Apart from basmati rice, several agricultural products have the potential to command a better price in the international market. For instance, among the 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 Pallimay command better prices (this is only an illustrative list). A large number of agricultural products have already been registered as geographical indication (GI) products but no further attempts have been made to promote and market them. To begin with, these products can have a distinct HS Code (eight digits) and separate schemes for their promotion and marketing can be formulated.

Food Processing and Value Addition

6.1 A strong and dynamic food processing sector plays a vital role in attaining higher value-addition, reduction in wastage of agricultural produce, enhancing shelf life of food products, promoting employment generation and increasing income of the farmers. The term "food processing" covers all the processes that food items go through right from the farm 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.

6.2 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. Ever-changing lifestyles, food habits and customer tastes have altered industry dynamics, and food production and consumption patterns are evolving with changes in customer needs. Food processing benefits all sections of society.

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 the Food Processing Sector

6.3 Growth in the food processing sector is also 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 possible in terms of the creation of supporting infrastructure and investment and, consequently, the overall growth of the sector.

6.4 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 market of over a billion people. India's large market size, with growing incomes and changing lifestyles, create incredible market opportunities for food producers, food processors, machinery makers, food technologists and service providers in this sector.

6.5 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 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). For foreign investment, automatic approval is given for up to 100 per cent equity for a majority of processed foods.

6.6 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 for setting up of mega food parks, cold chains, modernization of abattoirs, development of agri-export zones, skill development and R&D activities. Various state governments are also implementing their own food processing promotion policies and schemes.

6.7 The food processing sector has emerged as an important segment of the Indian economy in terms of its contribution to GDP, employment and investment. During 2014-15, the sector constituted as much as 9.0 per cent of GDP in the manufacturing sector and 10.1 per cent of GDP in the agriculture sector. While, the food processing industries sector has grown at a rate of 7.1 per cent during 2014-15, the agriculture and allied sector grew only at 0.2 per cent during the same period.

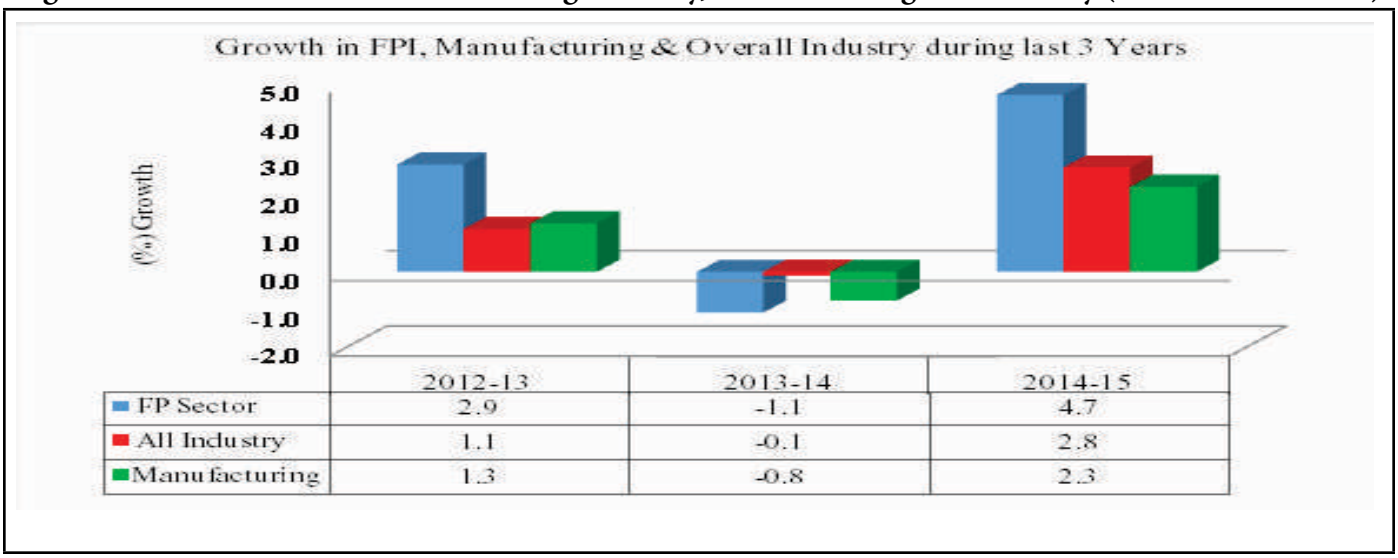
Table 6.1: Contribution of Food Processing Industries to Gross Domestic Product at 2011-12 Prices (Rs. Crores)

S. No.	Economic Activity	2011-12	2012-13	2013-14	2014-15
1	GDP-All India	81,95,546	85,99,224	91,69,787	98,27,089
2	GDP- Manufacturing	14,82,158	15,74,471	16,58,176	17,76,469
3	GDP-Agriculture, Forestry and Fishing	15,05,580	15,23,470	15,79,290	15,82,851
4	GDP- FPI	1,50,370	1,43,364	1,49,555	1,60,224*
(%) Growth					
	Economic Activity	**2012-13**	**2013-14**	**2014-15**	
5	GDP-All India	4.93	6.64	7.17	
6	GDP- Manufacturing	6.23	5.32	7.13	
7	GDP-Agriculture, Forestry and Fishing	1.19	3.66	0.23	
8	GDP- FPI	-4.66	4.32	7.13	
(%) Share of FPI					
	Economic Activity	**2011-12**	**2012-13**	**2013-14**	**2014-15**
9	GDP-All India	1.83	1.67	1.63	1.63
10	GDP- Manufacturing	10.15	9.11	9.02	9.02
11	GDP-Agriculture, Forestry and Fishing	9.99	9.41	9.47	10.12

Source: National Accounts Statistics-2015, CSO. *: GDP- FPI sector for 2014-15 is calculated on the basis of share of GDP-FPI in GDP-Manufacturing sector for 2013-14.

6.8 As the information on the growth of the food processing industry is available up to 2012-13, information for 2013-14 and 2014-15 may be seen in terms of the Index of Industrial Production (IIP) which gives some indication about the performance of the food processing sector.

Figure 6.1: Growth in the Food Processing Industry, Manufacturing and Industry (2012-13 to 2014-15)



Source: Index of Industrial Production (IIP), CSO.

6.9 As reflected in Table 6.1, during 2014-15, manufacturing of food products and beverages performed much better than the overall manufacturing sector as well as the industrial sector as a whole.

6.10 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 6.2** lists the number of registered food processing units by industry-wise.

Table 6.2: Industry-wise Number of Registered Food Processing Units

S. No.	Year	Meat, Fish, Fruits, Vegetables, Oils and Animal feed	Dairy Products	Grain Mill Products	Other Food Products	Beverages	Total Units
1	1998-1999	4,241	737	12,164	5,682	1,029	**23,853**
2	1999-2000	3,819	795	12,405	5,810	1,113	**23,942**
3	2000-2001	3,740	735	12,446	5,985	1,082	**23,988**
4	2001-2002	3,454	865	12,429	5,688	1,049	**23,485**
5	2002-2003	3,284	769	12,856	5,899	1,008	**23,816**
6	2003-2004	3,352	912	12,741	5,757	1,078	**23,840**
7	2004-2005	3,484	927	13,639	6,093	1,219	**25,362**
8	2005-2006	3,549	1,049	13,893	6,009	1,225	**25,725**
9	2006-2007	3,459	1,015	13,880	6,245	1,160	**25,759**
10	2007-2008	3,667	1,096	13,805	6,300	1,351	**26,219**
11	2008-2009	3,580	1,100	14,599	6,577	1,362	**27,218**
12	2009-2010	3,697	1,112	14,673	6,681	1,316	**27,479**
13	2010-2011	5,587	1,493	18,549	8,394	1,815	**35,838**
14	2011-2012	6,530	1,653	18,244	8,457	1,997	**36,881**
15	2012-2013	5,897	1,695	18,854	8,649	2,080	**37,175**

Source: Annual Survey of Industries, CSO.

6.11 Foreign direct investment (FDI) is permissible for all processed food products up to 100 per cent on the automatic route. **Table 6.3** lists FDI inflows in the food processing sector in the country for the last five years and during the current year.

Table 6.3: Foreign Direct Investment (FDI) Inflow in the Food Processing Sector

S. No.	Year (April- March)	FDI (Rs. Crore)	FDI (US $ Million)
1	2010-11	858.03	188.67
2	2011-12	826.16	170.21
3	2012-13	2193.65	401.46
4	2013-14	25,106.78	3,982.88
5	2014-15	3,159.36	515.86
6	2015-16 (April-September)	1,536.85	238.67

Source: Department of Industrial Policy and Promotion (DIPP)

6.12 The food processing industry is one of the major employment-intensive segments of industry, and constitutes 13.04 per cent of all employment generated in the registered factory sector in 2012-13. According to the Annual Survey of Industries (ASI), the total number of persons engaged in registered food processing industries during 2012-13 was 16.89 lakhs. During the last five years ending 2012-13, employment in the registered food processing sector has been increasing at an average annual growth rate of 2.41 per cent. The unregistered food processing sector supports the employment of 47.9 lakh workers, as per the NSSO 67th Round, 2010-11. The overall scenario of employment in food processing sector is given in **Table 6.4.**

Table 6.4: Employment in Food Processing Industry: Registered and Unregistered Units

Sector	Food Processing* Sector	Overall Industry	Share of Food Processing Sector (%)
Registered# (2012-13)	16.89 lakh	129.50 lakh	13.04
Unregistered (2010-11)	47.9 lakh	348.88 lakh	13.72

** Includes food products and beverages segments*

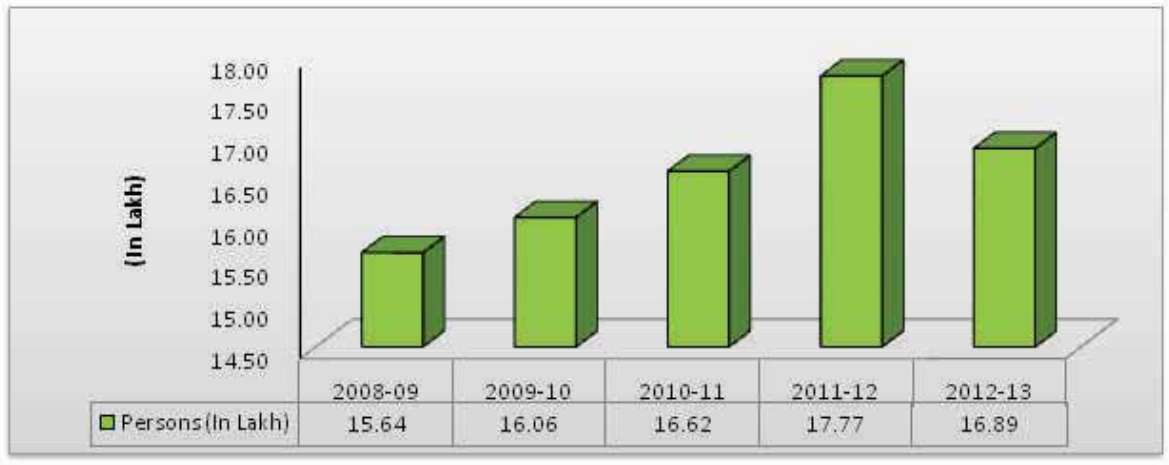
 # Factory registered under Sections 2m(i) and 2m(ii) Factory Act 1948

Table 6.5: Employment in registered food processing units (2008-09 to 2012-13)

Year	2008-09	2009-10	2010-11	2011-12	2012-13	AAGR*
Persons (in lakh)	15.64	16.06	16.62	17.77	16.89	-
Growth (%)	3.87	2.71	3.46	6.92	-4.94	2.41

*Source: Annual Survey of Industries, MOSPI; AAGR; *: Average Annual Growth Rate for 5 years.*

Figure 6.2: Persons Employed in Registered Food Processing Units



Source: Annual Survey of Industries, CSO.

6.13 In terms of investment in fixed capital, the registered food processing sector has been growing at an annual average of 18.47 per cent during the five years ending 2012-13. As per the ASI 2012-13, the fixed capital in the food processing industry stood at Rs. 1,58,865 crores.

Table 6.6: Fixed Capital in Food Processing Industries (Rs. Crore)

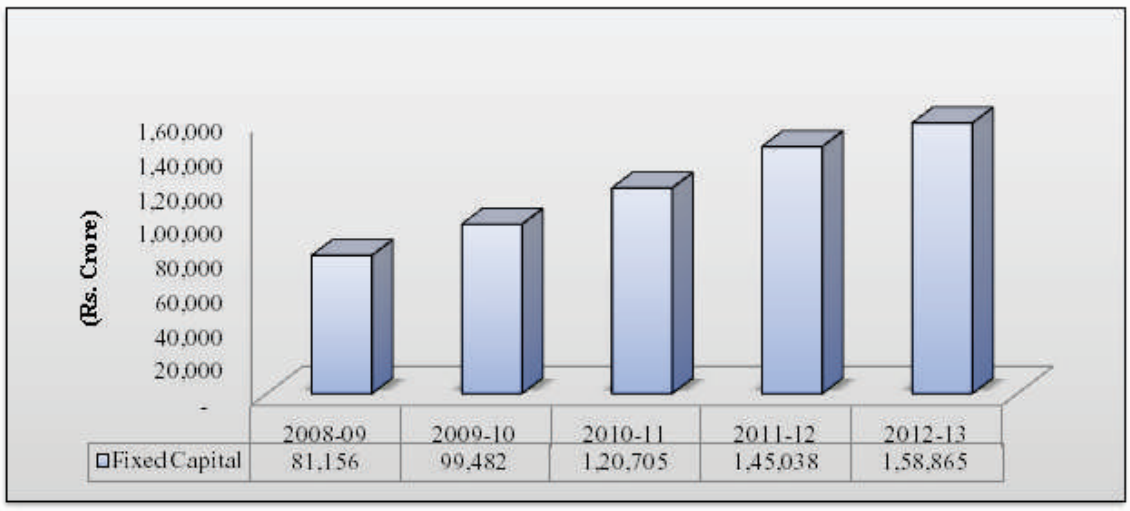
Year	2008-09	2009-10	2010-11	2011-12	2012-13	AAGR#
Fixed Capital	81,156	99,482	1,20,705	1,45,038	1,58,865	
Growth Rate	18.76	22.58	21.33	20.16	9.53	18.47

Source: Annual Survey of Industries, MOSPI

Note: Fixed capital: Depreciated value of Fixed Assets owned by factory.

#: Average Annual Growth Rate of 5 years.

Figure 6.3: Fixed Capital in Registered Food Processing Units



Source: Annual Survey of Industries, CSO

Note: Fixed capital: Depreciated value of Fixed Assets owned by factory.

Box 6.1: Major Initiatives to Promote the Food Processing Industry

- The Ministry of Food Processing Industries (MoFPI) has developed an "Investors' Portal" to disseminate information on state-specific resource potential, policy support and fiscal incentives for investors in the food processing sector. Both domestic and foreign investors can also seek guidance on specific issues by accessing the Investors' Portal (http://foodprocessingindia.co.in) or the Ministry's website (http://mofpi.nic.in).
- Excise duty on food processing and packaging machinery has been reduced from 10 per cent to 6 per cent. The Union Budget 2015-16 exempted from Service Tax the services of preconditioning, precooling, ripening, waxing, retail packing and labelling fruits and vegetables.
- Government had announced setting up of special fund of Rs 2,000 crores in the financial year 2014-15 in NABARD for extending affordable credit to designated food parks and the individual processing units in the designated food parks at concessional rates. The fund is being continued in 2015-16.
- Recently, 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.
- With a view to help investors and prospective entrepreneurs identify the raw material base in different parts of the country, the Hon'ble Minister, Ministry of Food Processing Industries released "Food Maps of India" at a function organized by Yes Bank on 18 December 2014. These food maps have been uploaded to the Ministry's website.

Major Plan Schemes

Scheme for Infrastructure Development

6.14 Integrated and holistic infrastructure is extremely important for the food processing sector. Towards this end, the Ministry of Food Processing Industries (MoFPI) has been supporting the creation of modern enabling infrastructure and efficient processing facilities, such as (i) mega food parks; (ii) cold chain, value addition and preservation infrastructure; and (iii) new abattoirs and modernization of existing abattoirs.

i. **Mega Food Parks Scheme:** The Mega Food Parks Scheme is a flagship programme of the Ministry of Food Processing Industries under implementation since the Eleventh Five Year Plan. The scheme aims to accelerate the growth of the food processing industry by facilitating the establishment of strong food processing infrastructure backed by an efficient supply chain. The Mega Food Parks Scheme provides a capital grant of 50 per cent of the project cost in general areas and 75 per cent in difficult and hilly areas (North East Region, including Sikkim, Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Indo Tibetan Border Police (ITDP) notified areas), subject to a maximum of Rs 50.00 crores per project. The grant is utilized towards the creation of common infrastructure in Primary Processing Centres (PPC) and Central Processing Centres (CPC) in the park. Each park is expected to have around 30-35 food processing units at a collective investment of Rs 250 crores, which is expected to lead, eventually, to an annual turnover of about Rs 450-500 crores, and to the creation of direct and indirect employment of about 30,000 persons. During the Eleventh and Twelfth Five Year Plans, the Government sanctioned 42 mega food parks. The Ministry has approved 39 mega food parks; 29 parks have been accorded final approval and 10 projects approved in principle. Out of 29 finally

approved projects, five projects are presently operational, and three more projects are likely to be operational by the end of 2015-16.

ii. **Scheme for Cold Chain, Value Addition and Preservation Infrastructure: A**pproved 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. The financial assistance envisaged under the Scheme is 50 per cent of the total cost of plant and machinery and technical civil works in general areas, and 75 per cent for the North East Region and difficult areas, subject to a maximum of Rs 10.00 crores per project. So far, a total of 138 projects have been approved for implementation. Of this, 70 projects have started commercial operation. The remaining projects are at various stages of implementation. Completion of all these projects would create capacity of 4.76 lakh MT of cold storage and deep freezer, 119 MT/hr individually quick frozen, 810 reefer carriers and 118 lakh litres per day milk processing capacity in the country.

iii. **Modernization of Abattoirs:** In 2009, the Government approved the scheme for setting up and modernizing abattoirs. The scheme envisages a grant of 50 per cent of the cost of plant and machinery and technical civil work and other eligible items in general areas, and 75 per cent of the cost of plant and machinery and technical civil work and other eligible items in difficult areas (North East states including Sikkim, Jammu & Kashmir, Himachal Pradesh, Uttarakhand and Integrated Tribal Development [ITDP] notified areas of the states) per abattoir, subject to a maximum of Rs. 15.00 crores. In the Eleventh Five Year Plan, the Ministry had approved the setting up of 10 projects; five projects have been completed—at Dimapur (Nagaland), Ahmednagar (Maharashtra), Kolkata (West Bengal), Shimla (Himachal Pradesh) and Hyderabad (Telangana)—and the remaining five projects are at various stages of implementation. These projects are located at Srinagar (Jammu & Kashmir), Jammu (Jammu & Kashmir), Patna (Bihar), Ranchi (Jharkhand) and Majhitar (Sikkim).

During the Twelfth Five Year Plan, the Government permitted the setting up of 25 new abattoirs and the modernization of 25 existing abattoirs; 30 projects were approved during the first two years, i.e., 2012-13 and 2013-14. Project proposals received up to 31 March 2014 are under consideration with the Ministry. With effect from 1 April 2014, the scheme was transferred to state/union territory governments for implementation under the National Mission on Food Processing (NMFP). The NMFP has been delinked from Central Government support with effect from 1 April 2015, except for union territories. The recommendations of the 14th Finance Commission resulted in an increase of state resources; states may decide to continue the scheme (or not) out of their increased resources.

Challenges

6.15 One of the major challenges faced by the sector is the significant 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.

6.16 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. An issue often highlighted by food processers is the variation in the operation of the APMC Act in different states. Most states require food processors to register for direct marketing with the respective marketing committee at multiple locations, but some states allow single-point registration. Some states exempt food processors from paying mandi tax on agricultural produce purchased for inputs in other states; other

states charge mandi tax at the point of consumption. Some states exempt perishables from mandi tax. For the purpose of charging mandi tax, processed agricultural produce like ghee, besan, maida, etc. is being treated at par with primary agricultural produce, although these processed products are purchased by food processors from processing units like dal mill, flour mill, dairy, etc. 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.

6.17 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. There is a need to streamline the contract farming system for the benefit of both farmers and food processors.

6.18 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 cases 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 make it difficult for processing industries to plan their purchase of raw material. There is a need to distinguish between hoarding and stocking of goods by genuine processors/exporters.

6.19 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 processer 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 and 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.

Way Forward

6.20 The MoFPI incurred an expenditure of Rs 1597 crores on projects assisted under its various schemes during the Eleventh Five Year Plan, or around Rs 319 crores per annum. In the three years of the Twelfth Five Year Plan, there has been a significant step-up in the utilization of funds, to the tune of Rs 588 crores per annum. Given the huge need for value addition and for minimizing the reduction of wastage, and given the high employment potential of the sector, the allocation for the sector should be stepped up significantly.

6.21 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.

6.22 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. Addressing these issues is more challenging, as constraints of funding, technology and skill can be overcome relatively easily.

CHAPTER-7

Agricultural Research and Education

7.1 Agricultural research and education is an important part of the Government's strategy for meeting the challenge of feeding the increasing human and animal population and for meeting competing demands from other quarters. With the possibility of area expansion being limited, production can only be increased by focusing on agriculture research and education. More importantly, the evolution of an environmentally sustainable agricultural development strategy has to be well-founded on a strong research and education base.

7.2 The Indian Council of Agricultural Research (ICAR) institutes, state agricultural universities (SAU) and Krishi Vigyan Kendras (KVK) were set up for meeting the emerging research and education challenges. As an autonomous organization under the Department of Agricultural Research and Education (DARE), the ICAR is the apex body mandated for coordinating, guiding and managing research and education in agriculture, horticulture, fisheries and animal sciences in the country. For implementing its research policies and programmes, the ICAR has developed a strong network of 109 institutes, 78 all-India coordinated projects and networks and 642 KVKs spread across the country. There are 71 state agricultural, veterinary, horticultural and fishery universities and four general universities with agricultural faculty.

7.3 The DARE operates the Central Agricultural University at Imphal in the North East and Rani Laxmi Bai Central Agricultural University in Jhansi. The ICAR institutions and the agricultural universities are major components of the National Agricultural Research and Education System (NARES).

7.4 The scientific interventions of the ICAR have impacted the lives of millions of farmers and rural families by enhancing agricultural productivity, conserving natural resources, using farm inputs and energy efficiently, preventing food losses through processing and alleviating drudgery through mechanization, and have enabled a host of other improvements leading to enhanced security of livelihood, food and nutrition. In 2014-15, the ICAR made concerted efforts to minimize the adverse effects of the delayed monsoon and the destruction caused by the Hudhud cyclone and floods in some parts of India. During summer, there was a drought-like situation in many states as the monsoon was delayed. The Council took proactive action and formulated specific contingency plans for 580 districts in 23 states by joining hands with state departments, agricultural universities and developmental agencies in specific areas. Farmers were advised on alternative crops that required less water and could tolerate longer intervening spells of norain. Adequate stocks of seeds of alternative crops were arranged. Farmers were advised to take up *in situ* moisture conservation measures in view of their proven benefits under low rainfall situations. Special teams, including scientists, visited the cyclone-affected areas in Odisha and Andhra Pradesh to restore the horticultural plantations and help these recover from the damage caused by cyclone Hudhud.

Soil and Water Productivity

7.5 For ensuring enhanced soil and water productivity, strategies are being developed for the different agro-ecological regions of the country. Geo-referenced soil fertility maps were prepared for 173 districts depicting the major and micro-nutrients status in soil that could be used for soil fertility management and fertilizer prescription at the farm level. Micro-level soil resource maps and

land management unit maps were developed for Bali Island in Gosaba block, 24 Parganas (South) district of West Bengal. Land resource inventorization at a 1:10000 scale for scientific land use planning was initiated in 60 blocks in the country. A low-cost runoff sampler was developed for monitoring runoff and nutrient and carbon losses in different land use management practices. The technology developed for the removal of heavy metals from municipal solid waste could reduce the heavy metal load from mixed wastes and partially segregated wastes by 34-58 per cent to improve the quality of the compost prepared from municipal waste. CSR-Bio, an eco-friendly growth enhancer developed for tomato and banana, enhanced fruit yields by 22 and 15 per cent, respectively.

Farming System

7.6 A five-member family farming model, developed on a one-hectare plot comprising diversified cropping systems in the south Bihar alluvial plain zone, demonstrated the possibility of generating round-the-year income. An integrated farming system model for a one-hectare plot developed for the Vindhyan zone in the eastern Himalayan region comprised diversified cropping systems, horticulture, dairy, poultry and fisheries. Promotion of organic farming in niche locations, especially the low-nutrient-consuming tribal areas of the country, offers great potential to enhance soil and crop productivity along with the livelihood security for the people. "Swam Vaideh", the first ever variety of makhana (gorgon nut, *Euryale ferox*) was developed and released.

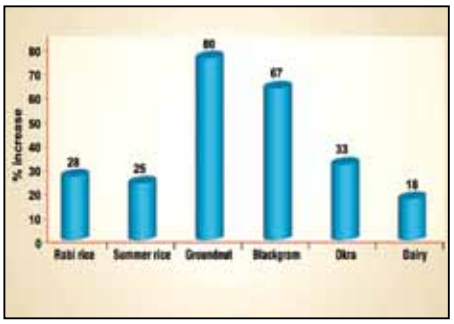
Box 7.1: Realizing a Respectable Revenue through the Farming System Approach

The All India Coordinated Research Projects (AICRP) on Integrated Farming Systems at the Dryland Agricultural Research Station, Chettinad (Tamil Nadu Agricultural University) adopted 60 farm households in the Sivagangai district of Tamil Nadu for on-farm farmer participatory research to develop farming systems that involved low and no cost interventions.

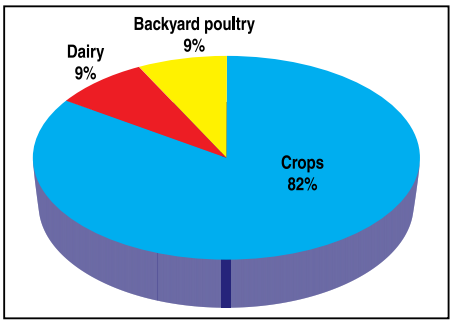
Production constraints were identified by the AICRP staff and improved system-based packages were advocated to resolve them, which included the introduction of high yielding varieties and hybrids (MDU 5 rice, VBN 5 blackgram, VRI 7 groundnut), soil test crop response (STCR) based fertilizer application for all crops, including foliar nutrition with Tamil Nadu Agricultural University (TNAU) Groundnut Consortia and TNAU Pulse Wonder during the 50 per cent flowering stage and pest surveillance based integrated pest management (IPM) strategies, which include traps and bio-inoculants. Seed drill sowing of rice (direct seeded rice as against transplanted rice), cultivation of blackgram and groundnut, and early post-emergence herbicides such as Bispyribac Sodium and Azimsulfuron and Imazethapyr and Quizalfop-ethyl in rice and pulses were demonstrated. Providing a year-round supply of green fodder for livestock with Bajra Napier Hybrid CO 5, supplementation of area and the use of a species-specific mineral mixtures, artificial insemination (AI) with Jersey and HF semen, and deworming at regular intervals resulted in additional milk yield of 0.9 U per animal per day, increased the lactation period (224 days) and reduced inter-calving intervals considerably (339 days). Dual purpose chicks, NKL (Namakkal) 1 and Giriraja, with proper vaccination, resulted in an additional income of Rs. 2,800 for the family. Azolla and vermicompost production were also integrated as additional options. Yield improvements in crops and dairy ranged from 18 per cent to 80 per cent. The household earned a net income of Rs. 11,94,701 per year with a net return of Rs. 1.51 per rupee invested. Crops contributed to the bulk of the income (82 per cent).

Figure 7.1 Impact of the Integrated Farming System Approach

Seed drill sowing of groundnut to maintain spacing



Improvement in yield of grain and milk due to constraint specific interventions



Post-intervention contribution of components of farming system to net income

Climate Change

7.7 A pilot study to reduce greenhouse gas emissions has been taken up in three villages of Warangal district, Telangana, to explore the possibilities of linking such activities to the Clean Development Mechanism (CDM). The effect of elevated CO_2 levels on the growth of rice was studied in open-top chambers. Elevated CO_2 levels significantly affected total leaf area, number of tillers per plant, net photosynthesis and transpiration in cultivated rice and weedy rice biotypes. A new technique for weed and crop seed preservation for long periods at ambient temperature was developed. To assess the consequences of global warming on the productivity of crops, changes in the simulated yield potential of soybean caused by changes in temperature, CO_2 levels and rainfall in the Bhopal region were investigated. The increase in CO_2 levels masks the yield by the adverse impact of the rise in temperature on crop growth.

Hailstorm Occurrence in India

7.8 Hailstorm data for 38 years have been used for frequency analysis (1972-2011; excluding 1977 and 1984, for which data are not available). More than 61 per cent of districts have experienced at least one hail event in this 38-year period. The highest frequency was noticed over districts in the northern parts of the Vidarbha region of Maharashtra adjoining the state of Madhya Pradesh.

Genetic Resources

7.9 A total of 30 explorations were undertaken wherein 1,591 accessions, including 620 accessions of wild species, were collected. About 334 herbarium specimens were added to the National Herbarium of Cultivated Plants and 40,879 accessions were imported from 38 countries. Promising introductions are wheat genetic stocks resistant to rusts and powdery mildew; rice stocks tolerant to lodging, shattering, heat and blast (from the Philippines); and maize showing resistance to maize streak virus, turcicum leaf blight, common rust and grey leaf spot with an excellent combining ability (from Mexico). Six phytosanitary certificates were issued for the export of 1,248 samples. About 24,824 accessions of different crops were characterized and evaluated, including wheat for terminal heat tolerance and rice for tolerance to submergence and drought.

7.10 Fifty-three genotypes of rice were found moderately resistant to sheath blight, and two were found resistant to brown spot, while 118 lines showed resistance to bacterial leaf blight. Brown plant hopper resistance was confirmed in nine farmers' varieties of brown rice (*Oryza rufipogan*). The complete genome sequence of the Indian isolate of the rice tungro spherical virus (RTSV) from Andhra Pradesh was deciphered and deposited in the National Center for Biotechnology Information (NCBI) database.

7.11 Some genotypes of Indian mustard *(Brassica juncea)*—NPJ 182, TM 101, RH1089, Pusa mustard 25 and BPR540-6—were rated thermo-tolerant, and other genotypes—DRMR1153-12, RGN 348, MCP 802, NPJ 182, DRMR 10-40 and NPJ 183—found suitable for drought tolerance. A total of 10,295 pulse crop accessions—including chickpea, lentil, mung bean, urd bean, pigeon pea, lathyrus, raj mash and field pea—were maintained. For breeding programmes, wild accessions of *Cicer*, *Vigna* and *Lens* species and pigeon pea, as well as Mediterranean landraces of lentil, were characterized. A total of 41 proposals related to agri- and horti-crops were approved for germplasm registration. The Microbial Culture Collection Database was developed to list the characteristics of microbes. Fifteen new agriculturally important species of insects were reported and described.

7.12 *Mangifera griffithi* and *M. andamanica*, two salt-tolerant mango accessions *(M. indica)*, were collected from tsunami-affected sites in Andaman. Indigenous mango cultivars, PRVRRN 3 and TMRM, having a high total carotenoid content, were collected. Farlang, a new guava variety, was introduced from Thailand. Trait-specific pomegranate accessions (132) were introduced, and more than 200 pomegranate accessions, representing both indigenous and exotic origins, were processed. An early, short, precocious and high-yield-promising chironji nut, CHES C 7, was identified at Bikaner. Mountain sweet thorn, a potential fruit crop, was collected and planted in the field gene bank at Bengaluru. More than 820 different vegetable accessions were collected and conserved. A unique, white multiplier onion accession (WM 514) was identified (yield of 20 tonnes per hectare) at Karimnagar in Telangana. A unique native cucumber, mat kachari (*Cucumis pubescens*), tinda and three dual-purpose cluster bean accessions were collected based on specific traits and were conserved. A monoecious muskmelon (AHMIBR 8) was identified for hybrid seed production. A promising cashew hybrid with jumbo size nuts (11-12 g per nut), H 126, was identified and is being evaluated.

7.13 Germplasm of tropical tuber crops (5,832) was conserved in the field gene bank at Thiruvananthapuram. One extra dwarf (35 cm) fennel was identified (average height 150 cm) and maintained through selfing. Dura oil palms, from Guinea Bissau and Zambia, having high tolerance to moisture stress, were utilized for the development of Dura×Dura and Dura×Pisifera hybrids. Distinctiveness, uniformity and stability descriptors were identified for 10 characters in the medicinal plant kalmegh (*Andrographis paniculata*). More than 210 unique mushroom accessions were collected from the forests of Himachal Pradesh, Mizoram, Arunachal Pradesh and Gujarat. Two scented species of orchids, *Dendrobium ovatum* (NOAC- 324) and *D. macrostachyum* (NOAC-329) were taxonomically identified.

7.14 The phenotypic characterization of Sanchori, Belahi and Manipuri cattle, Gojri buffalo and Harringhata black chicken was completed to register them as new breeds. The average daily milk yield of Sanchori cattle is 9.08±0.16 litres per day with peak milk yield of 6-18 kg per day over an 8-to-15-month lactation period. Under *exsitu* conservation, frozen semen doses of Tharparkar cattle, Osmanabadi sheep, Mehsana buffaloes, Assam hill goats, Zanskari horses, Marwari horses, French donkeys and Arunachali yaks were added to the repository in the National Gene Bank of National Bureau of Animal Genetic Resources, Karnal. A new instrument, Kalrump Scale, was designed for the digital quantification of dairy characters in buffaloes. The Leptin gene showed significant associations with protein percentage in the lactation period (24 weeks) in Murrah buffaloes. Four haplotypes, identified in the seminal acidic fluid protein gene from Murrah bulls, showed a good correlation with the conception rate, and are being investigated for establishment as markers for bull fertility. First-time male-specific yak genes were identified, and related six miRNAs were expressed in yak sperm that are likely to be associated with yak bull fertility. The whole genome of the Aseel bird was sequenced indicating the presence of approximately 23,000 genes.

7.15 New fish species *Plectranthia salcockii* and *Pempheris sarayu* were identified in the Arabian Sea, and *Labeoicarae* was identified in the freshwaters of Western Rajasthan. Genetic stock identification of silver pomfret revealed one stock along the western coast (Gujarat to Kerala) and two stocks along the eastern coast (West Bengal to Andhra Pradesh and Tamil Nadu). A DNA chip was developed to determine the loci associated with resistance to white spot syndrome virus and sex.

Crop Improvement

7.16 A total of 81 high-yielding field crop varieties and hybrids with good tolerance to various biotic and abiotic stresses were released for cultivation in different agro-ecosystems of the country. These include 19 varieties of rice, 12 of wheat, 6 of barley, 11 (hybrids) of maize, 9 millets, 7 oilseeds, 11 pulses (including 2 of green gram, 2 each of pigeon pea and field pea and 1 each of black gram, chickpea, lentil, horse gram and cowpea), 2 of sugarcane and 4 varieties and l hybrid of forage crops.

Box 7.2: New Varieties of Rice and Wheat

Heera—A High-Protein Rice Variety: A short-duration rice variety, Heera, was released in the early 1990s for rainfed uplands in the wet season and for irrigated fields in the dry season. The variety is an excellent source of vital nutrients (protein, iron and zinc) and has long, bold grains and a brown hull. The white milled kernel has 11.5 per cent protein, 5 ppm of iron and 23 ppm of zinc. Its cooking quality is also quite good as it has intermediate amylose content. Based on its potential for commercial cultivation as a nutrient-dense specialty rice, promotion of Heera in Odisha was initiated. The 107-5 variety (lET 22753) has also been released for cultivation in different agro-ecosystems.

HD 2967 Wheat: This high-yielding variety of wheat, which has resistance to brown rust, has good chapati and breadmaking quality and high zinc and iron content, and has been recommended for the irrigated timely sown conditions of eastern Uttar Pradesh, Bihar, Jharkhand, Odisha, West Bengal, Assam and the plains of the North East.

Box 7.3: Blueprint of Bread Wheat Genome Unveiled—The Last Step Before Sequencing of Full Genome

Earlier Indian scientists helped crack the genetic codes of rice and tomato as part of international consortia and decoded pigeon pea (arhar) and chickpea (chana) genomes on their own. Wheat was considered one of the hardest cropplants to decode, due to its huge genome size of 17,000 million base pairs and three sets of highly similar chromosomes in the genome. A chromosome-based draft sequence of the breadwheat genome has been published by scientists from the ICAR's National Research Centre on Plant Biotechnology (NRCPB), New Delhi, Punjab Agricultural University (PAU), Ludhiana, and Delhi University, South Campus in collaboration with the International Wheat Genome Sequencing Consortium (IWGSC). Recent technological advances, and the availability of specialized genetic stocks developed during the 1950s using the wheat variety "Chinese Spring", have made it possible to isolate individual wheat chromosomes for sequencing. The decoding of the wheat genome has led to the identification of more than 125,000 genes assigned to individual wheat chromosomes. The draft sequence is a major landmark towards obtaining a complete reference sequence of the hexaploid breadwheat genome. With a chromosome-based full sequence in hand, wheat breeders would have a high quality tool at their disposal to accelerate breeding programmes and to identify how genes control complex traits such as yield, grain quality, disease and pest resistance and tolerance to drought, heat and salt stresses. The draft sequence is providing new insights into the history

and evolution of the wheat genome and the genes involved in grain development and disease resistance. The genetic blueprint of wheat is an invaluable resource for plant science researchers and wheat breeders. They would be able to precisely locate specific genes in individual wheat chromosomes. It would provide thousands of markers for DNA fingerprinting, diversity analysis and marker-assisted breeding in wheat. The availability of the wheat genome will accelerate gene discovery efforts and fast-track the development of superior wheat varieties.

7.17 Breeder seeds (94,953 q), foundation seeds (144,369 q), certified seeds (163,466 q), truthfully labelled seeds (172,352 q) and planting materials (73,185 q) were produced during the year. Further, 155.59 lakh planting materials and 5.60 lakh tissue culture plantlets of field crops were also produced.

7.18 A chromosome-based draft sequence of the genome of bread wheat (one of the hardest cropplants to decode, due to its huge genome size and three sets of highly similar chromosomes in the genome), was published by the scientists of the ICAR's National Research Centre on Plant Biotechnology, Punjab Agricultural University and Delhi University, in collaboration with the International Wheat Genome Sequencing Consortium. The availability of the wheat genome will accelerate gene discovery efforts and fast-track development of superior wheat varieties. Eleven possible rice donors for super traits (heavy panicle, high spikelet number and long panicle) were evaluated for designing the next generation of rice. Co-expression network analysis divided the stress responsive genes into tightly co-expressed modules in rice. A new rice blast resistance gene was cloned, which confers a high degree of resistance against blast. Overexpression of Pi540f in two rice genotypes from *indica* and *japonica* backgrounds imparted enhanced resistance against highly virulent strains of the rice blast fungus *Magnaportheoryzae*.

7.19 A megaspore mother cell-specific promoter,"FM-l", was isolated from *Arabidopsis*, confirmed by sequencing and cloned into pCAMBIA 1305.2. The vector was transformed into the *Agrobacterium* strain EHA 105 and was used for transforming sorghum. Kunitz trypsin inhibitor-free soybean genotypes and high oleicacid soybean IC 210 were commercialized. The unique trait of histological fibre content was identified in jute, indicating scope for improving its fibre yield through selection.

7.20 A novel adult plant resistance (Apr) gene for leaf rust resistance was transferred from a wild relative of wheat *(Aegilopsmark grafii*), which helped in achieving a high degree of resistance to both leaf and stripe rust at the adult plant stage. A pathotype-specific Sequence Characterized Amplified Region (SCAR) marker was developed to identify existing as well as emerging pathotypes of the downy mildew-causing fungus *Sclerosporagraminicola* across the pearl millet growing regions of India. Fifteen independent putative transgenic events of *Brassica juncea* var. NRCDR 2 were developed. A marker was developed for specific and rapid detection of *Alternaria brassicicola*, which has caused 35-46 per cent yield losses in rapeseed mustard. The whole genome and transcriptome of the red rot pathogen of sugarcane was sequenced.

7.21 A mango hybrid, H 12, with 220-240 g fruit weight and 75-77 per cent pulp recovery was evolved by crossing Amrapali and Arka Anmol. A guava hybrid, H 3-29, with high lycopene and ascorbic acid, was developed for table and processing purposes. French plantain (banana) Njock Kon, an exotic accession with a semi-dwarf plant stature, recorded a higher bunch weight compared to the Nendran cultivar. A dwarf banana (NRCB Sel.-lO), similar to Karpoorvalli (ABB), but early (367 days after planting), was identified for high density planting. A promising accession of khoonphal (*Haematocarpusvalidus*), collected from a custodian farmer's field in the Andaman and Nicobar Islands, has commercial potential.

Figure 7.2 Disease-resistant H-369 Hybrid Tomato

Figure 7.3 Kufri Lalit Hybrid Potato (yields 25.5 tonnes per hectare)

7.22 A total of 13 varieties and hybrids of vegetable crops were identified for release. Hybrid-369 and Hybrid-371 of tomato with triple resistance to tomato leaf curl virus, bacterial wilt and early blight diseases, with high yield (80 tonne per hectare) and fInn fruits were developed. CIARI Brinjal l, with green, oblong fruits, 25-30 tonnes per hectare yield and inherently resistant to bacterial wilt was released for the island ecosystem. Arka neelachal prabha (CHCL 92), a high yielding chillie variety (493 g per plant equivalent to 109 q per hectare) was identified for cultivation in the east coast ecosystem. Arka atjun, a French bean variety resistant to the mungbean yellow mosaic virus, was identified for summer cultivation in South India.

7.23 Kufri lalit, a hybrid potato variety resistant to late blight, was identified for the Indo-Gangetic plains. Triploid cassava hybrids with high starch, sree athulya (34.8 per cent starch) and sree apoorva (33.3 per cent starch), were recommended for release in Tamil Nadu and Andhra Pradesh, and Tamil Nadu and Kerala, respectively. The CARl poi red, a multi-cut poi (*Basella alba*) variety with high yield and rich in anthocyanin was identified. A marigold variety, arka bangara, with yellow gold, petaloid sterile, medium size (5-6.5 cm diameter) and higher yield, first flowering at 40-45 days after transplanting (continues up to 65 -70 days), was identified for release. Three hybrids in orchids were released.

7.24 A nutmeg variety, IISR-Kerala shree, having bold nuts and being rich in sabinene and myrcene, developed through farmers' participatory breeding, was recommended for release. A high-yielding turmeric variety, Duggirala red, with improved rhizome quality (curcumin 4.1 per cent, oleoresin 8.8 per cent and dry matter 23.5 per cent), was recommended for cultivation in Andhra Pradesh, Telangana, Tamil Nadu and Bihar. High yielding arecanut varieties—Madhuramangala for Karnataka and Konkan; and Nalbari for Karnataka, North Bengal and the North East—were notified for cultivation. Vallabh isabgol-l, a new high-yielding isabgol (medicinal plant) with superior seed yield (24.5 per cent higher) and high mucilage recovery (9.21 g per kg of seed), was developed. A high-yielding variety of button mushroom, DMR-U3-54 (22-24 kg per l00 kg of compost), was developed at Solan.

Livestock Improvement

7.25 A female cloned buffalo calf named Lalima was produced through hand-guided cloning using a donor cell from the ear of a high yielding Murrah buffalo. A male cloned calf named Rajat was also produced using a donor cell from the frozen semen of a highly ranked progeny-tested Murrah buffalo bull. This was

the first time frozen semen was used for cloning a farm animal. Semen was collected from champion Murrah bulls, available with Haryana's progressive farmers, which became immensely popular among them. Prolific sheep development by crossing crossbreds of Garole×Malpura (GMM) with Pattanwadi sheep (P) (GMM×P) produced 25 per cent more lamb and 13 per cent more litter weight (kg) at three months of age over Malpura sheep. The Goat Improvement Programme helped in the conservation of threatened goat breeds, viz. sangernneri and surti, and their population in the breeding tract increased about fourfold. The strain cross from the Bengaluru centre recorded body weight of 1,532 and 1,988 g, at six and seven weeks of age respectively, with corresponding feed conversion ratio (FCR) of 2.22 and 2.40.

Box 7.4: Cloned Calf Named Lalima, Produced through Hand-Guided Cloning on 2 May 2014

A female cloned buffalo calf named Lalima, produced through hand-guided cloning, was born on 2 May 2014 at the National Dairy Research Institute (NDRI)Livestock Farm, weighing 36 kg at birth. The donor cell was taken from the ear of MU-5345, an elite Murrah buffalo, which produced 2,713 kg milk in a standard lactation period of 305 days, and 3,494 kg over a total lactation period of 471 days during her third lactation.

7.26 Minor carps (*Labeodaro*, *L. dyocheilus* and *Chagunius chagunio*) from the cold water regions of the country were induced for the first time to breed in captivity. This would help produce seeds en masse for ranching and aquaculture diversification in the coldwater sector. Surrogate brood fish, fry and fingerlings were produced for *Catla*, *Rohu* and common carp, confirming that donor-derived gametes can be produced in a related host species (carp to carp). Surrogate production would help in conservation and efficient utilization of genetic resources. A designer fish, an enriched human food source, was developed by feeding nano-Se and nano-Fe supplementation. The National Marine Fish Brood Bank was established at the ICAR-CMFRI Regional Centre, Mandapam, to hold brood stock of commercially important marine fishes and to supply quality eggs and newly hatched larvae.

Crop Management

7.27 INFOCROP-Wheat, a web-based decision support system to identify location-specific suitable varieties, the optimum sowing time and a suitable schedule for the wheat crop, was developed. A free air temperature increment (FATI) facility was developed to characterize the effects of global warming on crops. A phospho-compost, inoculated with the phytate-mineralizing fungal consortium, improved the availability of bicarbonate P in cattle manure and straw compost. Intercropping of wheat and lentils in 2:1 and 1:1 row ratio was superior to sole wheat and wheat and toria intercropping. In the groundnut cultivar TG37 A, the application of DAPG-producing fluorescent pseudomonads improved the pod yield and also reduced plant mortality. A fairly good crop of sugarcane could be obtained with 23 irrigations (75 per cent of total requirement) by adopting composted coir-pith application. CRIJAF Sona, an improved retting technology, was found suitable for quality fibre production in stagnant water.

7.28 A new packaging material, an insecticide-impregnated laminated bag, was found effective in maintaining insect infestations below 0.5 per cent for up to four months of storage under ambient conditions. A micro-array virus chip for all the known plant viruses and viroids was designed. A multiplex-PCR kit for the detection of viruses, viz., mung bean yellow mosaic India virus, mung bean yellow mosaic

virus, horse gram yellow mosaic virus, dolichos yellow mosaic virus and affecting legumes, was also developed. Soil treatment with *Trichoderma* and seed treatment of 5 g of *Trichoderma* per kg, imidacloprid and rhizobium and coriander intercropping and two foliar sprays, one of NSKE at flowering and the second of chlorantraniliprole at the podding stage, was the best IPM module for chickpea. A mechanized sett treatment unit for rapid delivery of fungicides to manage red rot, smut and wilt diseases among sugarcane was developed, which reduced sett treatment time and economized fungicides. Cane DES, a web-based expert system, was developed for the diagnosis and management of sugarcane disorders. Integrated pest management (IPM) technology was validated in rice crop cv. Pusa Basmati 1121 in an area of 200 ha in farmers' participatory mode; only one buprofezin spray instead of 2-4 sprays in farmers' practice enhanced levels of organic carbon content, increased natural enemy count, reduced pest population and increased yield. An economic impact analysis of the accelerated pulse production programme (A3P) indicated a significant reduction in the number of chemical pesticide sprays—4.27 in IPM plots vs. 7.34 in farmers' practice.

7.29 A new web portal, Indian Fauna of Pteromalidae, and a new web-based identification guide to the Indian genera of *Mymaridae* were hosted on the National Bureau of Agriculturally Important Insects website. In rice crop, burrow baiting with wax blocks of the rodenticide flocoumafen resulted in 60-74 per cent control success, whereas difenacoum achieved only 58-63 per cent control of rodents in Karnataka. Likewise, in coconut, both these rodenticides showed 80-100 per cent success in trials undertaken in Karnataka and Andaman. The spread of infection of Nosema disease due to *Nosema apis*, a fungus (which was earlier thought to be a protozoan), was managed by replacing the infected combs with fresh ones and avoiding confinement of the bees in the hive. The use of farmer-friendly pollen inserts in apple orchards that have a low proportion of pollinizer (10-15 per cent) increased fruit set by 2.5 times.

7.30 Artificial diets and mass multiplication protocols were developed for *Chrysomyamegacephala*, an important pollinator in mango. Complete nucleotide sequences of DNA-A of 10 chilli leaf curl-causing begomovirus isolates were determined. An entomopathogenic fungus, *Isaria jarinosa*, which causes natural epizootics in whitefly- infested crop in polyhouses, was characterized. Formulations of *Chaetomium* sp. were developed for the biological management of early blight in tomato through induced systemic resistance. Molecular characterization of begomovirus and tobamovirus infecting chilli and tomato, respectively, was completed. Encapsulation of a plant growth-promoting rhizobacterium (IISR GRB 35-*Bacillus amyloliquejaciens*) in gelatin capsules was an effective form of delivering plant growth-promoting rhizobacteria (PGPR) for growth promotion and rhizome rot disease management in ginger.

7.31 To manage late blight in potato, a forecasting model (JHULSACAST for West Bengal), a web-based decision support system (for western Uttar Pradesh) and Indo-Blight cast (applicable pan India) were developed. Two bio-inoculants, kera probio (a talc formulation of *Bacillus megaterium*) and cocoa probi (containing *Pseudomonasputida*), were developed to help raise robust and healthy coconut seedlings. For subduing rhinoceros beetle incursions in coconut, a botanical cake in tablet form was developed for effective field delivery and for sustained release of active ingredients.

Livestock Management

7.32 The Indian Livestock Feed Portal, made available online for various stakeholders, will play a vital role in refining the management of feed resources and the planning of livestock development schemes. Based on methane production potential (MPP) values, livestock census and feeding practices, district-wise methane production data was generated for Karnataka. Incorporation of rumen bypass fat (RBF) in the ration (4 per cent) of growing lambs enhanced body weight by 12 per cent at 6 months and increased FCR by 13.56 per cent. The tree

leaves of Indian willow (*Salix tetrasperma*) could replace 50 per cent of the local grass (*brachiaria* and *setaria*) in the diet of growing gaddi goats with no adverse effects. The leaves can be fed to goats during the winter, when there is fodder scarcity in the region.

Box 7.5: Specialized Integrated Farming System for Landless and Marginal Farmers

Forty-two villages of the Barabanki and Rae Bareli districts of Uttar Pradesh constitute nearly 67 per cent of the rural population of these two districts. A specialized integrated farming system (SIFS) was developed, which included the opening of a small dairy with low initial cost, rural poultry production integrating *in situ* azolla production as an alternative source of protein for feeding, a mass infertility control programme, a prevention and therapeutic strategy for control of mastitis, and a plant bio-growth enhancer for increasing production and improvement in soil health. About 5,940 farmers were covered directly under the various interventions, and a large number of farmers adopted the technologies horizontally. The average annual income was Rs 14,750 for landless farmers and Rs 26,500 for marginal farmers. The survey showed that the average annual income of landless farmers increased to Rs 88,560 per acre of landholding and that the income of marginal farmers increased to Rs. 1.8 lakhs per acre of landholding. In the pre-intervention period, farmers spent 71.4 per cent of their income on food and clothing, 1.2 per cent on education, 5 per cent on health and 22.4 per cent on household expenses, and borrowing was a regular feature. After the intervention, the expenditure on food and clothing, education, health and household expenses was 23.2, 10, 12.8 and 21.7 per cent, respectively. Families were able to spend 32.3 per cent of their income on infrastructure like house, farm machinery etc., which was not possible earlier. Children who had dropped out of school due to financial constraints were readmitted.

7.33 Frieswal bulls having less scrotal skin fold thickness (<4.5 mm) showed a significantly higher sperm concentration per ml, a higher initial progressive sperm motility per cent and a higher total sperm yield per ejaculate as compared to bulls having thicker scrotal skin folds (≥ 4.5 mm). One of the IFN-τ stimulated genes (ISG) in peripheral blood leucocytes and its serum protein levels indicated a distinguishing pattern during early pregnancy, opening a potential new avenue for early diagnosis of pregnancy in buffaloes.

7.34 Two divergent lines of sheep (resistant or susceptible to *Haemonchus contortus*) were developed through selection. Amniotic fluidmesenchymal stem cells and umbilical cord bloodmesenchymal stem cells were differentiated into tenocytes, which could be exploited for regeneration of ruptured or damaged tendons in race horses. A surface plasmon resonance-based biosensor assay was developed for detecting serum cancer biomarkers associated with canine mammary cancer.

7.35 In diagnostics, a new real time PCR assay for porcine circovirus-2 detection and loop mediated isothermal applications for detection of *Babesia gibsoni* infection in dogs were developed. A methodology was developed for assaying the risk of introduction of notifiable avian influenza in India. Whole genome sequences of three classical swine fever vaccine strains, peste des petits ruminants virus (PPRV) Sungril 96 vaccine strain and F vaccine strain of Newcastle disease virus (NDV), were deciphered. The foot and mouth disease (FMD) vaccine strain O/INDR211975, currently in use, provides near optimal antigenic coverage for field isolates. RNA transfection using lipofectamine to rescue the FMD virus from clinical materials was optimized to help in the transportation of clinical materials without the application of cold chain. This innovation is of immense significance for FMD surveillance and diagnosis programmes in India.

Box 7.6: Vermiculture Technology for Recycling of Animal and Farm Waste

Livestock and crop production activities in India generate about 300 crore tonnes of solid biowaste. The safe disposal of agrowaste within short periods is a major concern at the national and international levels. Traditional methods of recycling animal and farm waste take six months and yield low-quality organic manure. The exotic earthworm species, *Eiseneafoetida* and *Eudrilus eugeniae*, used for vermicomposting generally, cannot survive in high temperatures and humidity and have low fecundity and poor vermicast quality. There is an indigenous earthworm species, *Perionyx ceylensis,* that

(i) thrives on cow dung and crop residue;

(ii) adapts to a wide range of temperatures (0°-44°C);

(iii) multiplies beneficial soil and fermentation microorganisms; and

(iv) is highly prolific.

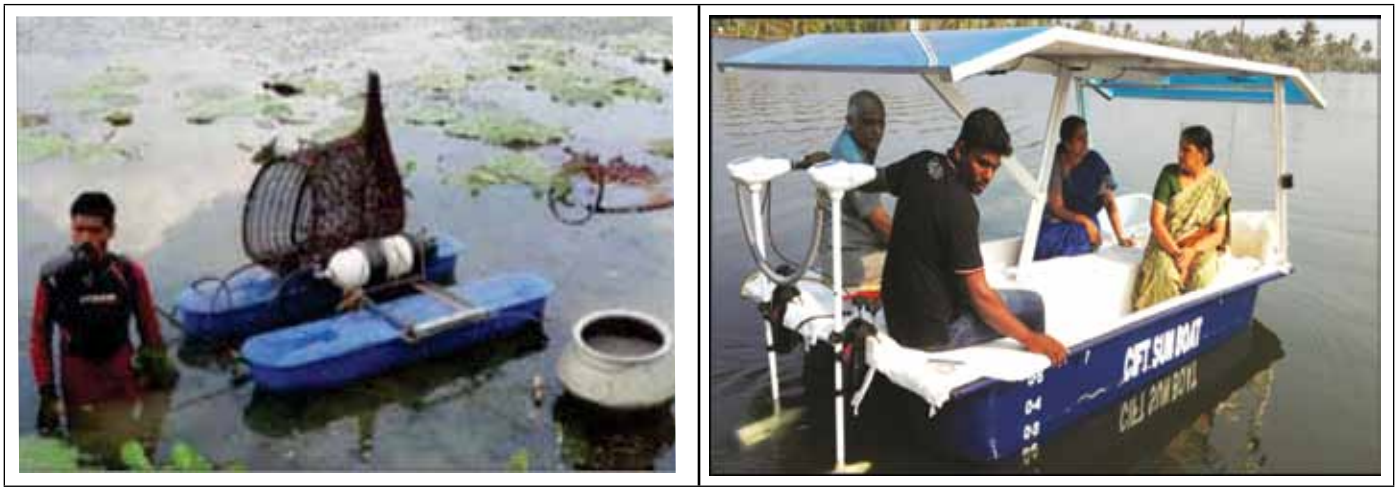
The vermiculture of this species is very rich in microorganisms and is beneficial for the soil and fermentation. This earthworm species has been given the name "Jai Gopal" and this technology is known as "Jai Gopal Vermiculture Technology". The vermiculture technology was commercialized and transferred to 16 entrepreneurs, universities, institutes, NGOs, KVKs and government agencies spread across the country. Farmers in Uttar Pradesh, Uttarakhand, Bihar, Madhya Pradesh, Haryana, Gujarat, Rajasthan, Himachal Pradesh and Assam were benefited by this technology. This technology, besides being low-cost, is pro-poor, pro-women, pro-nature and beneficial to agriculture and industry.

7.36 The short-neck clam *(Paphia malabarica)* in half fishery of Ashtamudi Lake has become the first eco-labelled fishery of India, a milestone in the Marine Stewardship Council (MSC) certification for the country. The certification enhances conservation and resource sustainability and provides greater economic benefits. The ICAR-CIBA was affirmed for the accurate diagnosis of seven fish and shellfish viruses of regional concern. Demonstrations of cage culture of striped catfish in Karnataka and pen culture of Indian major carps in Uttar Pradesh helped promote a prototype model that would enhance the livelihood security of fish farmers.

Mechanization and Energy Management

7.37 Improved machines, implements and equipment were developed for improving the efficiency of farm operations and resource conservation, in addition to renewable energy technologies and gender-friendly, drudgery-reducing tools developed for women farm workers. These include sugarcane bud chip planting equipment to replace the manual method of sugarcane planting; rotary-assisted raised bed former-cum-seeder to provide sufficient bed height for more intact and smooth bed; three-row rice transplanter for women workers based on anthropometric data and strength parameters; universal tractor-mounted ultrasonic sensor-based pomegranate spraying system; axial flow multi-crop thresher for threshing cowpea, soyabean, black gram, paddy and wheat crops; hydraulically operated cone penetrometer for measuring soil cone indices, etc. Tractor-operated equipment developed includes fertilizer dibbler for ratoon sugarcane, turmeric rhizome planter, turmeric digger and cassava harvester. Animal power-operated equipment that was developed include garlic planter-cum-fertilizer applicator and garlic digger. Equipment developed for protection and safety and for reducing drudgery and health risks include protocol for appropriate diving gear for makhana harvesting and hand protection devices for workers shelling cashew nut. Kalparasa, a device for collection fresh hygienic coconut inflorescence sap, was refined and the technology was commercialized. An improvised butter melter system was also designed.

Figure 7.4: Personal Protective Equipment for Makhana Sunboat—Solar-Powered Boat Harvesting in Ponds



Post-harvest Management and Value Addition

7.38 Novel products and technologies were developed for the reduction of post-harvest losses, utilization of by-products and the creation/generation of employment opportunities, besides enhancing farmers' income. These include a compact fruit grader that causes minimum fruit damage; a bael/wood apple pulper machine; a funnel-shaped collector for the conversion of nanofibers into twisted yarn; a mechanical moringa leaf stripper to separate leaves from tree branches; a cabinet dryer with a gravel bed heat storage system for drying tomato; an automatic pala doffing system to separate the fine particulate matter from cotton gin during the ginning process; suitable bamboo-framed shade nethouses for the cultivation of vegetables; process protocols for multi-nutrient snack bars; process for regeneration of frying cotton seed oil for reuse; online moisture measurement system for jute processing; exploitation of potential varieties of ber for lac culture in case of lac crop failure; and a model chicken retail outlet within the food safety parameters outlined by the Food Safety and Standards Authority of India (FSSAI). Solar drying saved 29, 31 and 28 per cent of total drying time for cinnamon, clove and black pepper, respectively.

Box 7.7: Enhancement of Profit of Lac Manufacturer

A young entrepreneur's keenness to learn and innovate, coupled with hard work, has enabled him to set new landmarks in the production of aleuritic acid, a value-added product isolated from lac resin and used mainly in the perfumery industry to develop musk-based perfumes. He used to manufacture only conventional products, like seed lac and shellac. When he came across an improved method for manufacturing aleuritic acid from lac resin, published in the newsletter of the Indian Institute of Natural Resins and Gums (IINRG), Ranchi, he trained himself in manufacturing aleuritic acid on a pilot plant scale. Initially, he established the manufacturing plant with one filter press using the new technique, which gave decent profits. Later, he added two more filtering units and started manufacturing three tonnes of aleuritic acid, and earned a net profit of Rs 24 lakh per annum. Besides consuming all the seed lac produced by his plant, he is also procuring seed lac from others to manufacture aleuritic acid for higher profits; his profit margin increased more than 1.75 times by shifting from seed lac to manufacturing aleuritic acid.

Box 7.8: Quality Assurance and Clean Milk Production

Separate strips for detection of neutralizers, urea, glucose and hydrogen peroxide in milk were developed and validated. The test involves dipping the strip in milk samples followed by studying the colour of the strip. The colour of the strip changes to deep red when it is dipped in milk that contains neutralizers (immediately) and in milk that contains urea (after two minutes).However, when the strip is dipped in pure milk samples, the strip retains its dark yellow colour. For detecting glucose and hydrogen peroxide in milk, the test involves putting a drop of milk on the strip followed by studying the change in colour of the strip. The colour changes to deep pink immediately in the case of milk adulterated with hydrogen peroxide while response time is 2-3 minutes for milk that contains glucose. In negative samples, only a light pink colour appears. The sensitivity of these strips was ascertained—it is 0.04 per cent for neutralizers, 0.06 per cent for added urea, 0.03 per cent for glucose and 0.02 per cent for hydrogen peroxide. The tests are rapid and results are available within five minutes.

7.39 Methods were developed to isolate DNA from animal fat and milk fat; detect *Listeriamonocytogenes* in milk in a single day at a tenth of the cost; detect any mixing of non-food items into food; and prepare an aloe vera-supplemented probiotic lassi and a functional milk beverage with extracts of *Terminalia arjuna* (which is good for heart patients). Healthier chevon nuggets were developed through standardization of the PUFAISFA ratio. A hand sanitizer based on an amphiphilic succinyl chitosan polymer was developed that does not contain synthetic antibacterial compounds and hence is suitable for workers in the fish processing industry. A solar-powered boat, the Sunboat, was designed and developed; it can achieve a speed of about 4.0 knots in one hour and can run for 2-3 hours once completely charged.

Agricultural Human Resource Development

7.40 Strengthening and upgrading higher agricultural education continued to be the major focus during the year. Financial assistance was provided for infrastructural development, niche area of excellence (25 units) and experiential learning (21 new units). To achieve excellence in agricultural education and research, capacity building courses were undertaken for faculty through summer-winter schools, Centre of Advance Faculty Training, National Professor Schemes and National Fellow Schemes and Emeritus Scientist Schemes; four agricultural universities were accredited to ensure the quality of agricultural education in the country; and senior research fellowships were awarded to 183 students pursuing PhDs in agricultural universities. Also, to globalize agricultural education, 203 students from 29 countries were encouraged to join different agricultural universities under different fellowship programmes and as self-financed candidates.

7.41 The accelerated growth of Indian agriculture is broad-based, and technology and diversification to include high-value crops are important factors of this growth. The rising total factor productivity growth suggests that the recent growth in agriculture is sustainable, as it is based on improved technology and efficiency. Fresh estimates of the optimal mix of various nutrients were prepared. The deficits in the use of fertilizer nutrients and the imbalance in fertilizer application in terms of relative use of the NPK nutrients need immediate attention. The returns on investment in public extension systems were quite attractive, as users of information realized 12 per cent higher net returns over non-users. Implementation of MIS and FMS systems was initiated at ICAR headquarters and ICAR institutes to provide high availability, quick scalability, secure access, efficient management and optimal utilization of resources to deliver unified communication to 25,000 ICAR personnel.

National Agricultural Innovation Project (NAIP)

7.42 The council implemented the National Agricultural Innovation Project (NAIP), a venture funded jointly by the World Bank and the Government of India that became operational in September 2006 and after an extension of 18 months, concluded in June 2014. The NAIP ushered important innovations into the system, like scenario planning with the full involvement of clients, business planning and development through incubation and technology commercialization, information and communications technology (ICT) applications in agricultural research and education, an integrated farming systems approach for livelihood improvement in disadvantaged regions of the country and an emphasis on post-project sustainability. The ICAR has considered internalizing, sustaining and promoting these new initiatives. The project was implemented through 203 sub-projects, 856 consortium partners including ICAR institutes (40.9 per cent), state agricultural universities (24.5 per cent), central universities and organizations (9.1 per cent), state universities and organizations (4.4 per cent), CGIAR centres (1.9 per cent), private industries (8.5 per cent) and NGOs (10.6 per cent). For the first time in the history of Indian agriculture, a diverse group of partners worked together under one project.

7.43 There have been several important achievements: ASHOKA, the first advanced super-computing hub for OMICS agricultural knowledge for biotechnological research was established at IASRI, New Delhi; a Central Data Centre (CDC) has been set up, and 15 pilot plants under the value chain for selected commodities; 331 licences for commercial technologies were filed, as were 186 patent applications; 58 technologies were commercialized to 80 licensees; over 30 successful and economically viable value chains were developed; online knowledge resources were made available to the entire NARES network on an unprecedented scale by providing individuals access to over 3,000 professional and scientific journals, a database of 7,627 PhD theses, Krishikosh, 425 online e-courses (http://ecourses.iasri.res.in) and an e-publishing portal (http://epubs.icar.org.in/ejournal) having 20 scientific journals; integrated farming system (IFS) models were developed for enhancing livelihoods; and potential fishing zone (PFZ) advisories were created.

National Agricultural Science Fund (NASF)

7.44 The National Agricultural Science Fund (NASF), the erstwhile National Fund for Basic Strategies and Frontier Application Research in Agriculture (NFBSFARA), was established for basic, strategic and cutting-edge application research in agriculture. It has so far funded 102 projects, mostly as part of a consortium. During the year, the NFBSFARA initiated the processing of 50 concept notes. Important projects include the generation of pod borer-resistant transgenic pigeon pea and chickpea; construction of dominant nuclear male sterility to produce hybrid rice seeds; comparison and deciphering of the behaviour of non-adopted pathogens *Puccinia graminis tritici* and *Magnaporthe oryzae* on wheat and rice; development of biofuel from whey through stress-tolerant metabolically engineered yeast; supplementation of selected amino acids and vitamins for reducing high temperature stress in *Catla catla*; identification of nucleo polyhedro-viruses to control *Helicoverpa armigera*; production of a putative parthenogenetic embryo from a goat for further investigations; production of microbial ethanol from agricultural biomass; detection and quantification of adulterants and contaminants in fruit juices and milk; development of green fishing systems for tropical seas; identification of the plant and nematode genes involved in disease development; and development of jute-based biocomposites.

Technology Assessment, Refinement and Transfer

7.45 As an effective outreach arm of the ICAR, the network of Krishi Vigyan Kendras (KVKs)

was involved in the assessment, refinement and demonstration of agricultural technologies while aiding capacity building for farmers and extension personnel. During the year, KVKs conducted 28,615 on-farm trials and 92,940 frontline technology demonstrations in farmers' fields to illustrate the application of agricultural technologies. The KVKs also organized 54,415 training programmes to enhance the knowledge and skill of farmers and extension personnel and created awareness on improved technologies among 91.47 lakh farmers and other stakeholders through 5.55 lakh extension programmes and 1.33 lakh items covered in print and electronic media.

7.46 The KVKs also produced 3.44 lakh quintals of seeds, 203.36 lakh planting materials and 136.80 lakh fish fingerlings, and analysed 3.64 lakh samples of soil, water, plants and manure. In addition, the Kisan Mobile Advisory provided 3.57 lakh short text messages to 16.28 lakh farmers on various aspects of agriculture, horticulture and animal husbandry. The Agricultural Technology Information Centre provided technological solutions to 6.31 lakh visiting farmers.

Box 7.9: Mitigating Cyclone in Eastern and Southern Coastal Area

Cyclone Hudhud occurred in five districts of Odisha and three districts of Andhra Pradesh on 12 October 2014. This resulted in heavy crop damage due to high speed cyclonic winds (100-130 km/h) followed by heavy to very heavy rainfall. In Odisha, the major crops affected were rice and maize, whereas in Andhra Pradesh, paddy, cotton, banana and coconut were the most severely damaged crops. The KVKs of these districts provided alert messages before the cyclone and remedy messages after the destruction; made diagnostic visits to assess the damage; and diffused information on contingent measures through telecast. In the affected districts of Odisha, KVK specialists introduced contingent crops like sesame, groundnut, green gram, blackgram and cowpea in the place of rice and maize. Similarly, in Andhra Pradesh, several technological interventions like the application of a booster dose of fertilizer for paddy crops, crown treatment of plantation crops and management of banana orchards with appropriate fertilizer regimes resulted in meaningful impact.

Box 7.10: Rainwater Harvesting: A Boon for the Resource-Poor Farmer

Shri Taju Khan, one of the residents of Patherly village in Pali district, was growing only kharif crops in 30 acres of undulating land, besides rearing four goats. Motivated and guided by the KVK in Pali, he constructed a temporary rainwater harvesting structure on his farm that measured 30 m × 20 m × 3 m. This endeavour was a big success for Taju Khan, as he utilized the harvested water for ber plantation and for raising rabi crops for the first time. He then approached the Government of Rajasthan and acquired grants to construct a concrete rainwater storage structure (40 m × 40 m × 3.5 m), which helped him increase the number of ber plants and reap an yield of 72 tonnes and a net return of Rs 1.38 lakh. At present, he earns Rs2.8 lakh annually by selling his farm produce, mainly ber (Rs1.38 lakh), greengram (Rs56,000), chickpea (Rs32,000) and fishes (Rs34,000), which he cultivates in a rainwater harvesting pond by employing all his family members. He is becoming a role model for others in his village and nearby areas for generating on-farm employment, increasing production, ensuring food security and earning a handsome income throughout the year by using the rain water harvesting system.

Empowering Women in Agriculture

7.47 Conceptual frameworks for developing new gender-related indices for measuring different dimensions of women empowerment in agriculture, farming systems and gender-friendly technologies were prepared. A multi-storey cropping model for a coconut orchard was developed for efficient resource use and to enhance women's participation. The income-generating potential of the second storey (banana, papaya and guava) and ground-storey intercrops (cowpea, turmeric, elephant foot yam and pineapple in the interspaces of the main crop), cultivated by women, was Rs. 4,14,000 as against Rs. 48,000 in a sole crop. The All India Coordinated Research Projects (AICRP) on Home Science focused on food and nutrition security in selected farming systems, drudgery assessment and mitigation, mitigating occupational health hazards, and on capacity development of youth engaged in agriculture and empowerment of women. The highest number of SHGs was found in Andhra Pradesh (about 16.60 lakh), followed by Karnataka (2.2 lakhs) and Maharashtra (2 lakhs).

Research for Tribal and Hill Regions

7.48 Technologies were developed and new varieties evolved for the difficult terrains of the Himalayas and island and coastal areas by three ICAR institutions—Vivekananda Parvatiya Krishi Anusandhan Sansthan (Almora), ICAR Research Complex for North Eastern Hills Region (Umiam) and Central Island Agricultural Research Institute (Port Blair). Vivek Maize Hybrid 47, VL Dhan 157 and VL Mandua 352 were developed for the west Himalayas. Korgut, a traditional rice landrace from Goa, was registered as a unique germplasm for tolerance to salinity stress at the seedling stage. Cashew selections, viz. Tiswadi 3, Ganje 2 and KN 2/98, were found suitable for commercial cultivation in Goa. About 64 molluscan species were identified and catalogued *in situ* in the Nancowrie Islands and 53 species in the Great Nicobar Islands.

7.49 Under this Tribal Sub-Plan (TSP) and the North Eastern Hill Region (NEH) Plan, tribals were made aware of the latest technological interventions through training-cum-sensitization programmes to improve production, income and quality of life. To develop the road map for improvement of yak husbandry as well as to initiate the socio-economic upliftment of yak herdsmen of Ladakh, an interface meeting was organized in collaboration with the Ladakh Autonomous Hill Council wherein farmers, researchers and development workers participated. A complete feed block technology for yaks was demonstrated in Ladakh. A trout farming programme in Leh was also initiated. The KVKs also facilitated the distribution of vegetable seed kits, goats, chicks, pigs, ice boxes, deep freezers, life jackets and ring buoys among the tribal farmers of Car Nicobar under the TSP. Yanadi tribal families in Andhra Pradesh were trained to undertake crab culture.

Box 7.11: Food and Nutritional Security of Tribals of Car Nicobar

Considering the remoteness, dietary intake, limited land availability and lack of market for farm produce, a small-scale homestead-based IFS model—comprising a home garden (400 square metres), backyard poultry (25 in number), goatery (3 in number) and composting—was evaluated in farmers' fields at Car Nicobar on a participatory approach basis. In the home gardens, seasonal vegetables were grown in an area of 100 square metres; fruit crops were grown in an area of 100 square metres; and tuber crops, in addition to fruit trees and border trees, were grown in an area of 150 square metres. Compost tanks were constructed in a corner of the homestead garden for composting crop residue and farm waste. There was an increase in the frequency of consumption of food items—greens, vegetables, fruits, meat, poultry and egg—by the farm family. Also, the system generated 80 man-days of employment throughout the year.

Information, Communication and Publicity Services

7.50 The Directorate of Knowledge Management in Agriculture (DKMA) acts as a hybrid clearinghouse of agricultural information in print as well as online form. Special updates developed by ICAR institutes and subject matter divisions were posted during the deficient monsoon and the cyclonic storm, Hudhud. The website also hosts the e-publishing platform (http://epubs.icar.org.in/ejournal) of the council, which includes *The Indian Journal of Agricultural Sciences*, *The Indian Journal of Animal Sciences*, *Indian Journal of Fisheries*, *Indian Farming* and *Indian Horticulture,* along with the journals of 15 related professional and academic societies. In sync with the open access policy of ICAR, the website also hosts various other publications and reports in open access mode, such as *ICAR Reporter*, *ICAR News*, *ICAR Mail*, *ICAR Chitthi* (Hindi), *Agbiotech Digest* and *India-ASEAN News on Agriculture and Forestry*. Nearly 30,000 pages, covering nearly 230 publications, were published during the period.

7.51 On the occasion of the visit of the Hon'ble Prime Minister of India on the 86th ICAR Foundation Day and Award Ceremony, a special showcasing of agricultural technologies and products was designed and organized in which the prime minister took keen interest. Live telecast, broadcast and webcast were also arranged on the occasion.

Figure 7.5: 86th ICAR Foundation Day and Award Ceremony

Intellectual Property and Trade Mark

7.52 Over the year, 60 patent applications from 27 research institutes were filed, taking the cumulative figure to 925 applications from 68 ICAR institutes. The Indian Patent Office granted four patents, i.e., IN257958 for a PCR-based method of differentiating cow and buffalo milk, IN260553 for a process for commercial manufacture of kradi, IN257783 for a lab-scale process for preparing low-cholesterol ghee and IN262113 for a thermal insulation value tester, taking ICAR's cumulative number of granted patents to 167. Six copyright applications were also granted. ICAR institutes filed for 81 copyrights, 20 design applications and 53 trademark applications (of which 19 applications were registered).

Partnership and Linkages

7.53 Memoranda of Understanding (MoU) were signed between ICAR and the Government of UK, Oman, Australia and the USA. Joint Working Group meetings on agriculture were held between India and Surinam and Mexico to finalize work plans. Collaborative projects were finalized with New Zealand, Hungary, Tanzania, Bangladesh, Indonesia, Malaysia, Myanmar, Sri Lanka, Thailand, UK, USA, Switzerland, Australia, Brazil and six Indian Ocean countries (Australia, South Africa, Madagascar, Mozambique, France and Union of Comoros). The six bureaus and institutes under the ICAR system were designated by the Ministry of Environment, Forests and Climate Change to act as repositories under the Biodiversity Act 2002 for different categories of biological resources.

AgrInnovate India Limited

7.54 AgrInnovate India Limited has finalized a technology-licensing agreement with a private firm for a diagnostic assay that can differentiate infected animals from vaccinated ones. Also, AgrInnovate motivated veterans (ex-servicemen) to select protected cultivation technology for transfer to their villages considering the potential opportunities for growing high-priced vegetables in the extreme

weather conditions of North India. A project for preparation of feasibility report on establishment of tractor assembling plant and farm equipment manufacturing unit in Tanzania was initiated.

New Initiatives

7.55 On the occasion of the 87th ICAR Foundation Day, the Hon'ble Prime Minister, Shri Narendra Modi, launched the following programmes at Patna.

i) ***Farmer FIRST (Farmer, Innovation, Resources, Science and Technology):*** This is an ICAR initiative to move beyond production and productivity and to privilege the complex, diverse and risk-prone realities of most farmers by enhancing contact between farmers and scientists through multi-stakeholder participation. Farmer FIRST aims at enriching the farmer-scientist interface for technology development and application. The programme aims to investigate the technical, socio-economic and environmental impact of the project to develop a database on the performance of the technologies of the National Agricultural Research Systems (NARS); famers' perception of the technologies; agriculture as a profession in rural settings; migration; etc.

ii) ***Student READY (Rural Entrepreneurship and Awareness Development Yojana):*** This is a novel programme to integrate skill building and business modules into agricultural education to provide students with the necessary skills to emerge as agri-entrepreneurs. A one-year composite programme in agricultural education was designed with three components-experiential learning, RAWE (rural agricultural work experience) and in-plant training or industrial attachment.

iii) ***ARYA (Attracting and Retaining Youth in Agriculture):***This is an innovative programme to retain rural youth in agriculture; respond to the needs of the country; and build capacity among rural youth through special programmes and projects, including a "learn while you earn" programme. The programme shall develop a comprehensive policy for the development of youth in rural areas; involve youth in policymaking processes from design to implementation; and monitor, evaluate and recognize the requirements of new age farmers and endeavour to fulfil the same. Overall, the programme aims to check the rural migration of youth on the one hand and unviable holdings on the other that will have a wider impact on food security within the context of the ever-growing population.

iv) ***Mera gaon, Mera gaurav:*** The programme brings together agricultural experts from agricultural universities and ICAR institutes to enable effective and deeper diffusion of information on scientific farming in villages. A group of experts will be associated with one particular village to create awareness and help in adopting new technologies, including those that address farm investment, loans and availability of inputs and marketing.

CHAPTER-8

Animal Husbandry, Dairying and Fisheries

8.1 Increasing per capita income and rapid urbanization, and changing tastes and preferences, have led to dietary changes that reflect in the growing demand for milk, meat, egg and fish. On the supply side, the livestock sector is vital for the livelihood security of farmers, as it supplements their income and provides employment, draught power, manure, etc. Development of the livestock sector is, therefore, considered more inclusive, and can play a crucial role in achieving a sustainable agriculture system.

Production Performance

8.2 The estimated production of milk, meat, wool, egg and fish and its growth rates for the year 2014-15 are given below.

Milk

8.3 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. During the year 2014-15, the annual output of milk was 146.3 million tonnes, a growth of 6.26 per cent over the 137.68 million tonnes recorded in 2013-14. The per capita availability of milk reached the level of 322 grams per day during the year 2014-15, which is more than the world average of 294 grams per day. This represents a sustained growth in the availability of milk and milk products for the growing population.

Meat

8.4 Total meat production from cattle, buffalo, sheep, goat, pig and poultry at the all-India level increased from 4.01 million tonnes in 2007-08 to 6.70 million tonnes in 2014-15 (provisional). 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 7.3 per cent in 2014-15 over the previous year.

Wool

8.5 At the national level, wool production in 2014-15 was estimated at 48.1 million kg (provisional); it represents a growth of about 0.48 per cent over the 47.9 million kg produced in 2013-14.

Egg

8.6 Egg production has shown an upward trend over the geats for the year 2014-15, production is estimated at 78.5 billion as compared to 74.7 billion during 2013-14, an increase of 4.99 per cent.

Fish

8.7 India is the second largest producer of fish in the world; it contributes 5.68 per cent 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 2014-15 (provisional) was 10.1 million metric tonnes; the contribution from the inland sector was 6.60 million metric tonnes, and from the marine sector was 3.40 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 per cent projected during the Twelfth Five Year Plan.

Table 8.1: Production of Milk, Egg, Wool and Meat
(Compound Annual Growth Rates (CAGR), all-India, %)

	1980-81 to 1989-90	1990-91 to1999-00	2000-01 to 2009-10	2010-11 to 2013-14	1980-81 to 2013-14
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****

Source: Department of Animal Husbandry, Dairying & Fisheries.

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.

Plan Schemes

Livestock Health

8.8 Growth in the livestock sector is seriously 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 is estimated to be more than Rs 20,000 crores per annum (NCAP, Preliminary Report 2010). The Department of Animal Husbandry, Dairying & Fisheries (DADF) initiated National Control Programmes through state governments to prevent and control foot-and-mouth disease, peste des petits ruminants and brucellosis. Initially, in 2003, the foot-and-mouth disease control programme was started in 54 districts; it has now been expanded to 351 districts, and will further be expanded to cover the entire country in a phased manner depending on the availability of vaccines and funds. Similar programmes are being implemented to control peste des petits ruminants and brucellosis. Further, from 2014-15, a programme to control classical swine fever has been started; initially, it will focus on the North Eastern states.

Veterinary Support Services

8.9 As on 1 April 2014, India had a total of 11,101 veterinary hospitals and polyclinics and 22,745 veterinary dispensaries; most have poor infrastructure and equipment. Further, the technical manpower is inadequate to support health programmes for the massive livestock population (the estimated requirement of veterinarians in the government sector is about 67,000, but there are only 25,000 veterinarians). 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 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.

8.10 A web-based information technology system known as National Animal Disease Reporting System (NADRS) for reporting the diseases from the field level is being implemented. It is a part of the Centrally Sponsored Scheme, "Livestock Health and Disease Control" (now renamed as Veterinary Services and Animal Health) and being executed 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 and speedy manner. NADRS involves a computerized network, linking each block, district and the state/UTs headquarters in the country to the Central Project Monitoring Unit in the Department of Animal Husbandry, Dairying and Fisheries at New Delhi.

8.11 To analyse the animal disease data received through the NADRS, the Central Project Monitoring Unit (CPMU) has been established at New Delhi. The Department has made improvements in the system based on inputs received from stakeholders.

Challenges

8.12 The main challenges confronting the animal health sector include inadequate veterinary hospitals, dispensaries and technical manpower; cold storage infrastructure; and availability of vaccines.

Way Forward

8.13 The following measures will strengthen the animal health sector.

- Development of adequate and immediate veterinary disease diagnosis, surveillance and monitoring, hospital infrastructure and trained manpower.
- Development of a strong programme for the supply of sufficient veterinary vaccines with long-duration immunity.

Cattle and Buffalo Breeding

8.14 The National Programme for Bovine Breeding and Dairy Development (NPBBD) was initiated in February 2014 by merging four ongoing schemes of the Department of Animal Husbandry, Dairying and Fisheries in the dairy sector, viz., National Project for Cattle and Buffalo Breeding (NPCBB), Intensive Dairy Development Programme (IDDP), Strengthening Infrastructure for Quality & Clean Milk Production (SIQ & CMP) and Assistance to Cooperatives (A-C). This has been done to integrate milk production and dairying activities in a scientific and holistic manner, so as to attain higher levels of milk production and productivity, to meet the increasing demand for milk in the country. The Scheme has two components: (a) National Programme for Bovine Breeding (NPBB) and (b) National Programme for Dairy Development (NPDD).

8.15 The National Programme for Bovine Breeding component focuses on extending the Field AI Network through "MAITRI", or the "Multipurpose AI Technician in Rural India" programme, and by monitoring the AI programme, developing and conserving indigenous breeds, streamlining the storage and supply of liquid nitrogen, procuring disease-free bulls with high genetic merit for AI, supplying breeding bulls of high genetic merit for natural service, strengthening bull mother farms and establishing Breeders' Associations and Societies to encourage the conservation and development of recognized indigenous breeds. An allocation of Rs 1,200 crores has been made available for the implementation of the scheme during the Twelfth Plan Period.

Status of Implementation

8.16 The actual implementation of the National Programme for Bovine Breeding and Dairy Development was initiated from 2014-15. Upto March 2015, 24 projects from states, with the total project cost of Rs 923.80 crores have been approved; out of this amount, Rs 159.01 crores has been released.

Evaluation of Semen Stations

8.17 To attain qualitative and quantitative improvement in semen production, the Department constituted the Central Monitoring Unit (CMU) on 20 May 2004 to evaluate and grade semen stations once in two years. The CMU has since undertaken evaluation on five occasions. **Table 8.2** presents the improvement in grading of semen stations after the constitution of the CMU. At present, there are 45 A and B graded semen stations in the country.

Table 8.2: Improvement in Grading of Semen Stations

Grades	2004-05	2008-09	2010-11	2012-13
A	2	12	20	30
B	12	15	17	15
C	12	7	3	-
NG	33	13	7	5
NE	-	2	2	2
Total	**59**	**49**	**49**	**52**

Minimum Standard Protocol (MSP) for Semen Production

8.18 In order to produce frozen semen of uniform quality, a Minimum Standard Protocol (MSP) for semen production was developed in consultation with experts from BAIF, NDDB, NDRI (Karnal) and CFSPTI. The MSP was made effective from 20May 2004. Keeping in view recent developments in semen processing technology, the MSP for semen production has been updated in 2013-14 and made available to all the semen stations in the country.

ISO Certification of Semen Stations

8.19 At present, 44 semen stations are ISO-certified. Seven semen stations are also HACCP-certified; these are located at Mattupatty, Dhoni, Kulathupuzha (Kerala), Haringhata (West Bengal), Salboni, Beldanga (West Bengal) and Bhadbhada (Madhya Pradesh).

Training and Capacity Building

8.20 The most important reasons for the low conception rate is lack of access to good training facilities and ill-trained government AI workers. During 2014-15, 2327 MAITRIs, 3794 existing AI technicians and 361 professionals were trained at reputed training centres in the country.

Accreditation of Artificial Training (AI) Training Institutes

8.21 Artificial Insemination Training Institutes (AITI) operate under the umbrella of state governments, cooperatives, NDDB, NGOs and private agencies across the country. As AI training is one of the most important tools for the delivery of AI services to dairy farmers in the country, the quality of training imparted by AITI is essential in order to produce technicians with desired skill and competencies to undertake artificial insemination services successfully. The quality of AI training varies across organizations because there is no uniform training module, standard protocol or mechanism to ensure that training institutes implement it effectively.

8.22 A MSP has been developed for AITIs and made effective in 2014. For effective implementation of MSP for AITIs, a Central Monitoring Unit has been constituted for accreditation and evaluation of AI training institutes. Upto December 2014, 37 AI training institutes had been evaluated.

Development and Conservation of Indigenous Breeds

8.23 Indigenous bovine breeds of India are robust and possess the genetic potential to play a crucial role in the national economy. In the absence of a programme to develop and conserve 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, the following initiatives have been taken by the Government.

Rashtriya Gokul Mission

8.24 The "Rashtriya Gokul Mission" has been launched by the Government for conservation and development of indigenous breeds in a focused and scientific manner. The Mission also envisages the establishment of integrated cattle development centres, or "Gokul Grams", to develop indigenous breeds including up to 40 per cent nondescript breeds.

8.25 The Mission is a focused project under the National Programme for Bovine Breeding and Dairy Development, with an outlay of Rs 500 crore during the last three years of the Twelfth Five Year Plan.

Objectives

8.26 The Rashtriya Gokul Mission is being implemented with the objectives of a) the development and conservation of indigenous breeds; b) instituting a breed improvement programme for indigenous cattle breeds to improve their genetic make-up and increase the stock; c) enhancement of milk production and productivity; d) upgradation of

nondescript cattle using elite indigenous breeds like Gir, Sahiwal, Rathi, Deoni, Tharparkar, Red Sindhi; and e) distribution of disease-free bulls with high genetic merit for natural service.

Present Status

8.27 Twenty-four project proposals received from 23 states have been approved at an allocation of Rs. 494.80 crores. Out of this, a sum of Rs. 105.11 crores is released to the state.

National Kamdhenu Breeding Centre

8.28 Most of the countries in the world at the national level have a National Breeding Centre. For the holistic and scientific development, conservation and preservation of indigenous breeds, "National Kamdhenu Breeding Centres" are being set up as centres of excellence. An allocation of Rs 50.00 crores has been made to establish two National Kamdhenu Breeding Centres, one each in the northern and southern region of the country. A nucleus herd of all the indigenous bovine breeds (39 cattle and 13 buffaloes) will be conserved and developed to enhance their productivity and upgrade genetic merit.

8.29 Besides being a repository of indigenous germplasm, the National Kamdhenu Breeding Centre will also be a source of certified genetics 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 institutes and trusts maintaining indigenous breeds.

8.30 The National Kamdhenu Breeding Centre is being implemented to

- conserve and preserve indigenous bovine breeds;
- enhance production and productivity;
- upgrade genetic merit;
- supply certified elite germplasm; and
- protect threatened breeds from extinction.

8.31 To establish a National Kamdhenu Breeding Centre in both the northern and southern regions of the country, an amount of Rs 25 crores has been released to Madhya Pradesh and Andhra Pradesh each.

Dairying

8.32 Dairying has become an important secondary source of income for millions of rural families, and has assumed a most important role in providing employment and income-generating opportunities, particularly to women and marginal farmers. Most of the milk in the country is produced by small and marginal farmers and landless labourers. About 15.46 million farmers have been brought under the ambit of 1,68,000 village-level dairy corporative societies up to March 2015. The cooperative milk unions have procured an average of 39.2 million kgs of milk per day during the year 2014-15, as compared to 34.2 million kgs in the previous year, recording a growth of 14.6 per cent. The sale of liquid milk by the cooperative sector has reached 29.9 million litres per day during the year 2014-15, as compared to 28 million tonnes, registering a growth of 6.8 per cent over the previous year.

8.33 The efforts of the Department in the dairy sector are concentrated on the promotion of dairy activities, including non-operation flood areas. The emphasis is on the building up of cooperative infrastructure, revitalization of sick dairy cooperative milk unions and creation of infrastructure in states for production of quality milk and milk products. The National Dairy Development Board (NDDB) continues its activities for the overall development of the dairy sector in Operation Flood areas. The brief details of Dairy Development Schemes being implemented by this Department are as follows.

National Programme for Dairy Development (NPDD)

8.34 The National Programme for Dairy Development (NPDD) component of the restructured National Programme for Bovine Breeding & Dairy Development (NPBBDD) will focus on creating infrastructure related to production, procurement, processing and marketing of milk and milk products by the State Implementing Agency (SIA) (State Milk Marketing Federations/District Cooperative Milk Producers' Union), and on manpower development activities, including training milk producers associated with dairy cooperative societies.

8.35 The Twelfth Plan makes a budgetary provision of Rs 1,800 crores for the implementation of the NPBB&DD, and an amount of Rs 150 crores has been allocated for the year 2015-16 under the NPBB&DD. Out of it, an amount Rs 74 crores has been allocated for the year 2015-16 under the NPDD Component. Under it, 15 new projects in four states have been approved, with a total outlay of Rs 142.84 crores until March 2015. A total sum of Rs 89.97 crores, including Rs 41.52 crores for new projects, has been released for the implementation of projects approved under the scheme during the year 2014-15.

Dairy Entrepreneurship Development Scheme (DEDS)

8.36 The Scheme was launched in September 2010 to promote private investment in the dairy sector to increase milk production in the country and create self-employment opportunities and, therefore, help in reducing poverty. This scheme is being implemented through NABARD, which provides financial assistance to commercially bankable projects with loans from commercial, cooperative, urban and rural banks. There is a back-ended capital subsidy of 25 per cent of the project cost to beneficiaries of the general category and 33.33 per cent of the project cost to SC and ST beneficiaries. The Scheme is being continued with certain modifications and a budget provision of Rs 1400 crores during the Twelfth Plan. An amount of Rs 127 crores has been allocated for the year 2015-16.

8.37 Since inception, an amount of Rs 842.92 crores has been disbursed by NABARD as back-ended capital subsidy to the beneficiaries for the setting up of 2,28,346 dairy units up to 31 March 2015.

National Dairy Plan Phase-I

8.38 The National Dairy Plan Phase I (NDP-I) was approved in March 2012 by the Government of India, for implementation from 2011-12 to 2016-17. The total investment is about Rs 2,242 crores, comprising Rs 1,584 crores as IDA credit, Rs 176 crores as the share of the Government, Rs 282 crores as the share of End Implementing Agencies (EIAs) and Rs 200 crores as the NDDB'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 crores) for the scheme on 15 March 2012.

8.39 The NDP-I envisages to meet the projected national demand of 150 million tonnes of milk by 2016-17 and around 200 million tonnes by 2021-22. To meet this growing demand, it is necessary to maintain annual growth at over 4 per cent for the next 15 years. It is, therefore, imperative that a scientifically planned multi-state initiative is launched to increase productivity in existing herds through a focused programme of breeding and feeding. The NDP has been envisaged with a 15-year horizon, considering that three to five years are required to produce more productive animals, and the time required to develop and expand systems to increase milk production. The first phase of the NDP, to be financed largely by the World Bank, is being implemented over a period of six years, with the following objectives:

a) increase the productivity of milch animals and thereby increase milk production to meet the rapidly growing demand for milk; and

b) provide rural milk producers greater access to the organized milk processing sector.

8.40 Given the rapidly increasing demand for milk, initially, the NDP-I was started in areas with higher potential in the 15 major milk-producing states that contribute about 90 per cent of the country's milk

production. These include Uttar Pradesh, Punjab, Haryana, Gujarat, Rajasthan, Madhya Pradesh, Bihar, West Bengal, Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Telangana (newly created), Odisha and Kerala. The operational area of NDP-I has been extended to Uttarakhand, Jharkhand and Chhattisgarh. The benefits accruing from the NDP-I will be distributed across the country by making superior quality semen available. An amount of Rs 300 crores has been allocated for the year 2015-16.

8.41 Up to March 2015, 315 sub-projects from 16 states have been approved. The total outlay is Rs 1786.14 crores, which includes 29 projects of project management and learning with total outlay of about Rs 25.79 crores. Out of the total approvals, Rs 1497.42 crores would be grant assistance and Rs 288.72 crores would be contributed by EIAs.

Livestock

8.42 India has the world's largest livestock population, accounting for about half its population of buffaloes and a sixth of its goat population. Such a large livestock population presents a challenge wherein existing productivity levels are sustained by the application of modern science and technology, incentives and policies.

National Livestock Mission

8.43 The National Livestock Mission was launched in 2014-15 during the Twelfth 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.

8.44 The Mission broadly covers all the activities required to ensure quantitative and qualitative improvement in livestock production systems and capacity building of all stakeholders. The major outcomes of the Mission envisaged are :

- mainstreaming of livestock rearing as business models and linkages for successful business ventures to achieve 5-6 per cent annual growth rate;
- optimal utilization of scarce nutritional resources;
- a reduction of the gap between demand and availability of fodder;
- conservation and improvement of indigenous breeds;
- higher productivity and production in a sustainable, environment-friendly manner;
- enhanced livelihood opportunities, especially in rainfed areas and for landless, small and marginal farmers;
- increased awareness;
- improved risk coverage;
- better availability of quality animal products to consumers; and
- overall socio-economic upliftment of livestock rearers.

Sheep and Goat Development

8.45 According to the Livestock Census 2012, there are about 65.07 million sheep and 135.2 million goats in the country, and about five million households are engaged in rearing small ruminants (sheep and goats) and other allied activities.

Status of Wool Production

8.46 At the beginning of the Twelfth Plan (2012-13), wool production was 46.1 million kg; it increased to 47.9 million kg in 2013-14. The annual growth rate in 2013-14 was 4.03 per cent.

Central Schemes

Conservation of Threatened Breeds

8.47 A Centrally Sponsored Scheme for the conservation of threatened breeds of livestock (whose population is below 10,000) and of indigenous poultry/ducks (whose population is below 1,000) was started during the Tenth Five Year Plan with an outlay of Rs 15.00 crores. During the Tenth Plan, conservation was taken up for 27 threatened breeds.

8.48 During the Eleventh Plan, the outlay of this scheme was enhanced to Rs 45.00 crores, and 14 breeds of livestock and poultry were conserved.

8.49 During 2014-15, the Conservation of Threatened Breed scheme was subsumed under the National Livestock Mission (Component (V)– Conservation of Livestock breeds under the Sub-Mission on Livestock Development).

8.50 During 2014-15, two projects on the conservation of threatened breeds were undertaken in Arunachal Pradesh. These were "Establishment of Nucleus Breeding Farm for Yak" and "Establishment of Pony Breeding Farm", for which releases to the tune of Rs 25.00 lakh and Rs 32.41 lakh were sanctioned respectively.

Integrated Development of Small Ruminants and Rabbits

8.51 This Central Sector Scheme was approved in April 2009 for implementation during the Eleventh Plan at an allocation of Rs134.825 crores. Allocation under the scheme during 2012-13 was Rs15.00 crores. The scheme envisages the setting up of intensive small ruminant development clusters with venture capital through NABARD as well as infrastructure development and institutional restructuring through the State Implementing Agency.

8.52 During 2014-15, the Integrated Development of Small Ruminants scheme was subsumed under the National Livestock Mission (Component (III)—Integrated Development of Small Ruminants and Rabbits under the Sub-Mission on Livestock Development).

8.53 During 2014-15, three state goat farms and one state sheep breeding farm were assisted to strengthen and modernize their set-up and infrastructure. These farms include Goat Farm at Haringhata, West Bengal, Goat Farm at Hisar, Haryana, Goat Farm at Nagaland and State Sheep Breeding Farm, Odisha. Funds to the tune of Rs 35.40 lakhs, Rs 115.50 lakhs, Rs 40.00 lakhs and Rs 24.75 lakhs, respectively, has been released for the modernization and development of breeding infrastructure of these farms.

Central Sheep Breeding Farm

8.54 The Central Sheep Breeding Farm, Hisar is mandated to produce acclimatized exotic/crossbred superior quality rams. During 2014-15, the farm supplied 783 rams and 131 bucks to different state agencies and farmers. In addition, a total of 783 farmers were trained in sheep management and production, while another 171 farmers were trained in machine shearing techniques.

Way Forward for the Development of Small Ruminants

8.55 A national workshop on "Strengthening Small Ruminant-Based Livelihoods" was organized jointly by the South Asia Pro-Poor Livestock Policy Programme (SAPPLPP), a joint initiative of the FAO of the UN and of the National Diary Development Board (NDDB), India and the Department of Animal Husbandry, Dairying and Fisheries (DADF), Ministry of Agriculture and Farmers Welfare (MoA&FW), Government of India (GoI) at New Delhi on 16-17 January 2015.

8.56 The workshop aimed to facilitate multi-stakeholder interaction and understanding of the issues and challenges in the development of goat- and sheep-based livelihoods. It aimed also to facilitate an exchange of experiences and good practices, and deliberation on a way forward for the integration of demonstrated good practices within the functioning of State Animal Husbandry Departments.

8.57 Workshop participants included delegates from State Animal Husbandry Departments, knowledge

and development partners, NGO practitioners, donor representatives and community health workers.

8.58 As per the recommendation of the National Workshop on Small Ruminants, it has been decided to organize regtional workshops during the following six months in the states of Punjab, Karnataka, Odisha, Assam, Madhya Pradesh and Rajasthan.

Poultry Sector

8.59 Poultry is one of the fastest growing sub-sectors of animal husbandry; the annual growth rate of eggs is around 6 per cent. The provisional estimate of total egg production for the year 2014-15 was 78.5 billion. Growth in egg production in 2014-15 was about 4.99 per cent over the previous year.

8.60 The achievements and growth rates are being sustained despite the ingress of avian influenza, which was a severe setback for the industry. This shows the resilience of the poultry sector and the perseverance of the private sector and that the Government had made timely interventions. General Guidelines for Bio-security on Poultry Farms have been compiled and circulated to all states so that they may take preventive measures against ingress of diseases.

8.61 The National Livestock Mission covers the following poultry-related components.

I. Modernization and Development of Breeding Infrastructure

i. **Central Farms: Central Poultry Development Organizations (CPDOs)*:*** The CPDOs located at four regions (viz. Chandigarh, Bhubaneswar, Mumbai and Hessarghatta) have been playing a pivotal role in implementing Government policies with respect to poultry. The mandate of these organizations has specially been reoriented to focus on improved birds, which lay on an average 180-200 eggs per annum, and have vastly improved feed conversion ratio in terms of feed consumption and weight gain. In these CPDOs, training is also imparted to farmers to upgrade their technical skills. The CPDO and Training Institute, Hessarghatta is also imparting trainers' training to in-service personnel from within the country as well as overseas. Analytical livestock and poultry feed testing is also conducted at the CPDOs. The CPDOs are also promoting diversification with species other than poultry, like ducks, Japanese quail, etc. The Central Poultry Performance Testing Centre (CPPTC), Gurgaon is entrusted with the responsibility of testing the performance of layer and broiler varieties. This Centre gives valuable information relating to different genetic stock available in the country.

   During the year 2014-15, the CPDOs supplied around 0.80 lakh parent chicks and 14.4 lakh commercial chicks. Around 3,027 farmers and trainers were trained and 5,223 feed samples were analysed. During the first quarter of the current year 2015-16, CPDOs supplied around 6000 parent chicks and 1.25 lakh commercial chicks. Around 388 farmers and trainers have been trained and 1,359 feed samples analysed.

ii. **Strengthening of Breeding Infrastructure of State/University Farms:** It aims at strengthening existing state poultry farms to enable the flow of suitable germplasm from research institutions/laboratories to the grassroots, along with other technical services through capacity building of state poultry farms. It also aims at developing and implementing a package of practices at the ground level for different types of poultry systems, including family poultry systems, for supplementary income generation and family nutrition. The assistance provided is 75 per cent of the Central share to all states and union territories. A one-time operational/revolving fund is provided to these farms for smooth operations maintenance to ensure long-term sustainability. During the year 2014-15, 11 state poultry farms have been assisted under this component.

iii. **Rural Backyard Poultry Development:** This component is envisaged to cover beneficiaries

from BPL families to enable them to gain supplementary income and nutritional support. Entrepreneurs and SHGs/NGOs may take up mother unit activity, under which they procure day-old chicks, from either state poultry farms or from private hatcheries, and rear the birds until they are 4 weeks old. This Scheme component aims at supporting BPL beneficiary families with tapering assistance, wherein 4-week-old chicks, suitable for rearing in the backyard, reared at the "mother units", are further distributed to them in batches. Further, there is the provision to raise the birds in a bio-secure manner for night shelters, etc. Under this programme, during the year 2014-15, funding has covered around 1.45 lakh BPL beneficiaries.

Piggery Sector

8.62 There has been persistent demand from the North Eastern States 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. The sub-mission strives to forge synergies of research and development organizations through appropriate interventions, as required for holistic development of pigs in the North Eastern Region, including genetic improvement and health cover.

Entrepreneurship Development and Employment Generation

8.63 Animal farming constitutes the livelihood of the rural poor, who belong to the lowest socio-economic strata and have no means to undertake scientific animal farming with improved foundation stock, proper housing, feeding and management. Therefore, suitable schemes to popularize scientific animal breeding-cum-rearing of meat-producing animals with adequate financial provisions are necessary to modernize the Indian meat industry and to improve the productivity of small sized rural farms. The Entrepreneurship Development and Employment Generation (EDEG) component of the National Livestock Mission (NLM) encourages commercial rearing of poultry, small ruminants and pigs by the adoption of scientific methods and the creation of infrastructure.

8.64 During 2014-15, a total number of 14,488 units of poultry, small ruminants and pigs have been assisted for the above activities under the NLM. During 2015-16, 5547 units have been assisted during the first quarter.

Fodder and Feed Development

8.65 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.

8.66 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 two years. For the production of certified seeds from foundation seeds, the Department has introduced the "Fodder Seed Procurement and Distribution"component. After the foundation seeds are produced at all the 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.

8.67 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 coarse 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

Fishery Sector

8.68 Allocations made for the development of the fisheries sector through Centrally Sponsored Schemes and Central Sector Scheme are utilized for the implementation of both development and welfare-oriented schemes through the respective states and union territories. In addition to the allocations made through CSS and CS, assistance is provided through other flagship programmes like Rashtriya Krishi Vikas Yojana (RKVY) and the National Mission for Protein Supplements (NMPS).

National Fisheries Development Scheme

8.69 The National Fisheries Development Board (NFDB) was established by the Government in 2006 as a special purpose vehicle for the accelerated, sustainable development of fisheries and aquaculture. It aimed to achieve such development through the upgradation of production technologies, management and utilization of resources and establishment of infrastructure for post-harvest operations and markets. During the Eleventh Plan Period, the NFDB invested nearly Rs 400.00 crores in various developmental activities. It is proposed that all Centrally Sponsored Schemes aimed at growth and enhancement of production and productivity in the NFDB be merged during the Twelfth Plan and beyond to provide fishery development and management greater focus and an integrated approach.

Marine Fisheries Development Scheme

8.70 During the Eleventh Five Year Plan, the Marine Fisheries Development Scheme made provisions for the development of 13 fishing harbours and four fish landing centres. These were taken up for implementation while four existing fishing harbours (FH) were repaired and renovated. In addition, 53 projects of post-harvest infrastructure like ice plants and retail outlets were taken up. Besides, 8843 traditional craft were motorized; 3516 safety appliances were provided; 40,993 KL of HSD provided to fishers with rebate; three deep-sea resource-specific fishing vessels were promoted; introduction of 88 intermediate craft was taken up; and one new private fishing harbour was funded under a build, operate and transfer (BOT) package.

8.71 During the past three financial years of the ongoing Twelfth Plan, 14 new fishing harbour projects and 15 fish landing centre projects have been taken up for development. Supply of 4,234 safety kits to fishing vessels and motorization of 16,860 traditional fishing boats and introduction of 123 intermediate craft have been taken up. Besides, 16 ice plants, 34 insulated trucks and 100 retail outlets were taken up during the ongoing Twelfth Plan under the Central Plan Scheme.

Inland Fishery Development Scheme

8.72 Under the scheme, since inception, 8,77,916 ha of freshwater and 45,976 ha of brackish water have been covered for aquaculture; 14,73,637 fish farmers were benefited for freshwater aquaculture, and 40,456 fish farmers for brackish water aquaculture.

Fishermen Welfare Scheme

8.73 During 2014-15, under the scheme, funds were released for insurance coverage of 48.02 lakh fishermen, the construction of 4,794 houses and a savings-cum-relief scheme that benefit 4.21 lakh fishermen.

Agricultural Statistics in India

9.1 Agricultural statistics are the foundation on which policies for the development of the sector are built. For sound policy and planning, it is vital that the system of generation of relevant data for the agriculture 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. These 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 seasonal 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. The Government of India has evolved statistically sound systems for obtaining reliable data on all the above parameters.

Area, Production and Yield of Agricultural Crops

9.2 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. State governments prepare their estimates on the basis of area enumeration in a sample of 20 per cent 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 union territories is normally carried out by the staff of Department of Revenue/Agriculture. A fresh sample of 20 per cent 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.

9.3 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 as under.

i) The First Advance Estimates are released in 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. The second advance

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.

9.4 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 policy decisions on the import, export, procurement, etc., of agricultural commodities. Although the estimates are periodically revised, the variation is not significant.

Forecasting Agricultural Output using Space Agro-meteorology and Land-based Observations (FASAL)

9.5 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. This 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 andrabi); (iii) maize; (iv) bajra; (v) jute; (vi) ragi; (vii) cotton; (viii) sugarcane; (ix) groundnut (kharif andrabi); (x) rapeseed and mustard; and (xi) wheat.

9.6 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.

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

9.7 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

9.18 Fruits and vegetables account for nearly 90 per cent 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, 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.

9.19 In view of the above difficulties, several research studies were taken up by agricultural scientists in the past. The Central Sector Plan Scheme, namely, Crop Estimation Survey of Fruits & Vegetables (CES-F&V)—a component of the Improvement of Agricultural Statistics Scheme—was initiated in 1982-83 and was implemented by central funding through the DAC&FW. The scheme envisaged the generation of area and productivity estimates using sampling and estimation methodology evolved by the Indian Agricultural Statistics Research Institute (IASRI). The scheme was implemented in 11 states (Andhra Pradesh, Gujarat, Haryana, Himachal Pradesh, Karnataka, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu and Uttar Pradesh). It covered seven fruit crops (apple, mango, citrus, pineapple, grapes, banana and guava) and seven vegetable crops (potato, cabbage, cauliflower, onion, tomato, ginger and turmeric). However, the National Statistical Commission (NSC) has identified the following major flaws in the Scheme.

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 of the Indian Agricultural Statistics Research Institute (IASRI), Directorate of Economics and Statistics, Ministry of Agriculture & Farmers Welfare (DES), Field Operations Division of National Sample Survey Organization (NSSO) and from one or two major states that grow horticultural crops.

iii. The alternative methodology should be tried out on a pilot basis before actually implementing it on a large scale.

9.20 Accordingly, the Scheme has been discontinued from the year 2013-14. A new, alternative methodology has been developed by the IASRI, which is much simpler, and easy to implement. As per the recommendations of the NSC, this new alternative methodology is now being tried out on a pilot basis in six states under the CHAMAN project of the DAC&FW.

Coordinated Programme on Horticulture Assessment and Management using Geoinformatics (CHAMAN)

9.21 The DAC&FW under the Mission for Integrated Development of Horticulture (MIDH) has launched a project called CHAMAN (Coordinated Programme on Horticulture Assessment and Management using Geoinformatics). The project aims to develop and firm up the scientific methodology for estimating the area and production under horticulture crops. It has two main components, namely, (I) remote sensing (RS) technology and (II) sample survey (SS) methodology for estimating the area and production of horticultural crops.

I. Remote Sensing: Proposed Programme and its Objectives

The programme is being implemented by the Mahalanobis National Crop Forecast Centre (MNCFC), and will have the following components.

- **Area and production assessment** of seven major horticultural crops in major states.
- **Remote sensing for developmental studies** like site suitability and post-harvest infrastructure development
- **Detailed, scientific, field-level research studies** for developing technology for crop identification, yield modelling and disease assessment for other horticulture crops.

Area Assessment: 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, as mentioned in **Table 9.2**. Accordingly, the following crops and study area are being proposed. 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 the absence of the availability of Indian satellite data during crop growth, foreign satellite data will also be explored.

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

Production Assessment: For production forecasting, yield modelling has to be carried out. The India Meteorological Department, under the 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 the IMD will continue to be under the FASAL project.

Horticultural Development Studies: 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.

Research Studies: Crop discrimination within vegetable crops, yield modelling and stress detection (disease and nutrient) are still research issues. It is proposed that two or three sites of major vegetable-growing areas (e.g. Malerkotla in Punjab, Gurgaon, Salt Lake Area in Kolkata, etc.) be chosen, where multi-level (ground, airborne, satellite-based) remote sensing data will be collected. The analysis

will result in improving remote sensing applications for horticulture.

Implementation Plan

First Year (2014-15):
Pilot and scientific studies along with onion and potato estimation

Second Year (2015-16):
Estimation of seven major crops in all states in pilot mode, developmental and research studies

Third Year (2016-17):
Estimation of seven major crops in all states in operational mode, developmental and research studies (continued)

II. Estimation of Area and Production of Main Horticulture Crops using Sample Survey Techniques

This component is being implemented by the Indian Agricultural Statistics Research Institute (IASRI) as a "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 per cent of all the districts, covering about 70-80 per cent of the total area under fruits and vegetables in the entire state, and two of the rest of the districts, covering about 20-30 per cent of the total area under fruits and vegetables in the entire state.

Objectives of the Study

- To test the developed alternative methodology for estimation of acreage under each major fruit and vegetable crop
- To test the developed alternative methodology for estimation of yield rates and total production of major fruit and vegetable crops grown in the state
- 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

- The sampling design to be adopted for the survey will be stratified multistage 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 per cent 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 per cent of the total number of districts, and two districts from stratum two, will be selected by simple random sampling without replacement (SRSWOR).
- 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 per cent of the total area under fruits and vegetables of the district; the rest of the taluks/tehsils fall under low productive taluks/tehsils.
- A sample of two taluks/tehsils will be selected by SRSWOR from both the groups after rejecting taluks/tehsils contributing less than 5 per cent 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.

- 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.

- 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.

- 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.

Proposed Estimation Procedure: In case of fruits, the developed estimation 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 estimation 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.

Implementation Plan: Broadly, the implementation plan of the IASRI is as under.

2014-15: Initial preparatory works by IASRI and states for the survey

2015-16: Conduct of fieldwork in all eight states for area and production assessment

2016-17: Fieldwork to be continued, validation and analysis of data collected and submission of report

This study will be completed by 2016-17.

Cost of Cultivation

9.22 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 per cent 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.

9.23 Under the scheme, field data are collected on the Cost Accounting Method by 16 implementing agencies from 8,100 sample holdings spread over 20 states. The sampling design of the scheme is 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.

9.24 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.

9.25 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, which are being used by the CACP to recommend minimum support prices for agricultural commodities. The Report of the Committee is being examined by the Government.

9.26 Besides, as the current software has various limitations, the Department is also in the process of developing the web-based FARMAP software application, with the technical support of the NIC. The new software application will be helpful in reducing the time lag between data collection and generation of cost estimates. It will provide a comprehensive, web-based, scalable solution for managing the data for the department, and for generating the desired output and making it accessible through an easy-to-use interface on the internet/intranet and mobiles/tablets.

Land Use Statistics

9.27 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), an attached office of the Department of Agriculture, Cooperation & Farmers Welfare (DAC&FW), is 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 union territory 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
- the 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.

9.28 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.

9.29 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 available data from 1998-99 to 2012-13 (latest available) has been posted on the website of the DES.

Agriculture Census

9.30 The Department of Agriculture, Cooperation& Farmers Welfare has been conducting the Agriculture Census quinquennially since 1970-71. The reference period for the Agriculture Census is the same as the agricultural year (July-June). Being the ultimate unit for taking agriculture-related decisions, operational holding has been taken as the statistical unit at micro-level for data collection.

9.31 Following a census-cum-sample survey approach, the Agriculture Census is conducted in three distinct phases. During Phases I and II, data on the primary and other characteristics of operational holdings, such as the number and area of operational holdings, land use, cropping patterns, irrigation status, dispersal of holdings, etc. are collected. Phase III of the Agriculture Census (referred to as the Input Survey) is conducted as a follow-up survey to the Agriculture Census (the reference year is the next agriculture year to that of the Agriculture Census) to collect data on the input use pattern of operational holdings in the country. Eight Agriculture Censuses have been conducted since 1970-71, and the current Agriculture Census (2010-11) is nearing completion. Preparatory activities for the next Agriculture Census (reference year 2015-16) are in progress.

Agriculture Census 2010-11

9.32 The results of Phases I and Phase-II of the Agriculture Census 2010-11 have been released and are available on the Department's website at http://agcensus.nic.in. The results of Phase III of the Census (Input Survey 2011-12) for various states and union territories have also been finalized and will be released shortly.

9.33 The number, area and average size of operational holdings for various size groups is presented below in **Tables 9.3** and **9.4**. The distribution of net irrigated area and net area sown by size group according to the Agriculture Census 2010-11 is presented in **Table 9.5.**

Table 9.3: Number of Holdings, Operated Area and Average Size of Holdings as per Agriculture Census, 2010-11

Sl. No.	Size Classes of Holdings	Number of operational Holdings (in '000)	Operated area (in '000 ha.)	Average size of holdings (in ha.)
1	Marginal	92826	35908	0.39
2	Small	24779	35244	1.42
3	Semi medium	13896	37705	2.71
4	Medium	5875	33828	5.76
5	Large	973	16907	17.38
All Size Classes		**138348**	**159592**	**1.15**

Note: ***Total may not tally due to rounding off.***

Table 9.4: Average Size of Operational Holdings in Various Agriculture Censuses

Sl. No.	Size Groups	Average size of holding (in ha.)								
		1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01*	2005-06*	2010-11
1	Marginal	0.40	0.39	0.39	0.39	0.39	0.40	0.40	0.38	0.39
2	Small	1.44	1.42	1.44	1.43	1.43	1.42	1.42	1.38	1.42
3	Semi-Medium	2.81	2.78	2.78	2.77	2.76	2.73	2.72	2.68	2.71
4	Medium	6.08	6.04	6.02	5.96	5.90	5.84	5.81	5.74	5.76
5	Large	18.10	17.57	17.41	17.21	17.33	17.20	17.12	17.08	17.38
All Sizes		2.28	2.00	1.84	1.69	1.55	1.41	1.33	1.23	1.15

** excluding Jharkhand.*

Table 9.5: Distribution of Net Irrigated Area and Net Area Sown by Size Groups of Holdings as per Agriculture Census 2010-11

(Area in '000 ha.)

Sl. No.	Major size classes of holdings	Net Irrigated Area		Net Sown Area		Percentage of Net Irrigated Area to Net Area Sown
		Area	per cent to Total	Area	per cent to Total	
1	Marginal	16835	26.07	32219	22.81	52.25
2	Small	14263	22.09	31976	22.63	44.61
3	Semi-medium	14995	23.22	33778	23.91	44.39
4	Medium	13266	20.55	29442	20.84	45.06
5	Large	5209	8.07	13864	9.81	37.57
	Total	64567	100.00	141279	100.00	45.70

Note: Total may not tally due to rounding off.

Annexures

Annexure 2.1: Land Use Classification—All India

(Million Hectares)

Year	Forests	Not available for cultivation		Other uncultivated land excluding fallow land			Fallow lands		Net area Sown	Total cropped area/ Gross cropped area	Agricultural land/culti-vable land/ culturable land/arable land	Cultivated land	Cropping Intensity	% of gross irrigated area over gross/ total cropped area
		Area under non-agr -cultural uses	Barren and unculturable land	Permanent pastures & other grazing lands	Land under miscell aneous. tree crops and groves (not included in net area sown)	Culturable waste land	Fallow lands other than current fallows	Current fallows						
1950-51	40.5	9.4	38.2	6.7	19.8	22.9	17.4	10.7	118.7	131.9	189.6	129.4	111.1	17.1
1960-61	54.1	14.8	35.9	14.0	4.5	19.2	11.2	11.6	133.2	152.8	179.7	144.8	114.7	18.3
1970-71	63.8	16.5	28.1	13.3	4.4	17.5	8.7	10.6	140.9	165.8	182.1	151.5	117.7	23.0
1980-81	67.5	19.6	20.0	12.0	3.6	16.7	9.7	14.8	140.3	172.6	185.2	155.1	123.1	28.8
1990-91	67.7	21.2	19.5	11.4	3.8	15.0	9.7	13.8	142.9	185.7	185.2	156.7	130.0	34.0
2000-01	69.8	23.8	17.5	10.7	3.4	13.6	10.3	14.8	141.3	185.3	183.5	156.1	131.1	41.1
2001-02	69.7	23.9	17.4	10.5	3.4	13.5	10.5	15.3	140.7	188.0	183.6	156.1	133.6	41.7
2002-03	69.8	24.1	17.5	10.5	3.4	13.7	12.0	22.5	131.9	173.9	183.5	154.4	131.8	42.0
2003-04	70.0	24.5	17.5	10.5	3.4	13.2	11.3	14.5	140.7	189.7	183.1	155.2	134.8	41.1
2004-05	70.0	24.8	17.5	10.5	3.4	13.3	10.9	14.8	140.6	191.1	182.9	155.4	135.9	42.4
2005-06	70.0	25.0	17.3	10.4	3.4	13.2	10.7	14.2	141.2	192.7	182.7	155.4	136.5	43.7
2006-07	70.0	25.4	17.3	10.4	3.4	13.3	10.5	15.5	139.8	192.4	182.5	155.3	137.6	45.1
2007-08	70.0	25.9	17.0	10.4	3.4	13.0	10.3	14.6	141.0	195.2	182.4	155.7	138.4	45.1
2008-09(p)	70.0	26.2	16.9	10.3	3.3	12.7	10.3	14.2	141.9	195.3	182.5	156.1	137.7	45.5
2009-10(p)	70.0	26.2	17.2	10.3	3.2	12.9	10.8	16.0	139.2	189.0	182.2	155.2	135.8	45.0
2010-11(p)	70.0	26.4	17.2	10.3	3.2	12.6	10.3	14.3	141.6	197.6	182.0	155.8	139.6	45.0
2011-12(p)	70.0	26.3	17.2	10.3	3.2	12.6	10.7	14.5	141.0	195.6	182.0	155.5	138.8	46.9
2012-13(p)	70.0	26.5	17.3	10.2	3.2	12.6	11.0	15.3	139.9	194.4	182.0	155.2	138.9	47.6

 # : In 2002-03, there was significant decline in total cropped area and net area sown due to decline in net area sown in the states of Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, West Bengal and Haryana. This was due mainly to deficient rainfall.

@: In 2009-10, there was significant decline in total cropped area and net area sown due to decline in net area sown in the states of Andhra Pradesh, Bihar, Jharkhand, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. This was due mainly to deficient rainfall.

Source: Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare

Annexure 2.2: Agriculture Land by Use in India

	Area in Million Hectares							(%) to the Geographical Area						
	1990-91	2003-04	2008-09 (P)	2009-10 (P)	2010-11 (P)	2011-12 (P)	2012-13 (P)	1990-91	2003-04	2008-09 (P)	2009-10 (P)	2010-11 (P)	2011-12 (P)	2012-13 (P)
I.Geographical Area	328.7	328.7	328.7	328.7	328.7	328.7	328.7							
II.Reporting area for land utilization statistics	305.0	305.6	305.8	305.8	305.9	305.8	305.9							
1.Forests	67.7	70.0	70.0	70.0	70.0	70.0	70.0	20.60	21.28	21.29	21.29	21.30	21.31	21.30
2. Not available for cultivation	40.7	42.0	43.1	43.3	43.6	43.5	43.7	12.39	12.77	13.10	13.18	13.26	13.24	13.31
(A) Area under non-agricultural uses	21.2	24.5	26.2	26.2	26.4	26.3	26.5	6.46	7.46	7.97	7.96	8.03	8.00	8.05
(B) Barren and unculturable land	19.5	17.5	16.9	17.2	17.2	17.2	17.3	5.93	5.31	5.13	5.23	5.22	5.24	5.26
3. Other unculti-vated land excluding fallow land	30.2	27.1	26.4	26.5	26.2	26.1	26.0	9.19	8.25	8.04	8.06	7.96	7.94	7.90
(A) Permanent pastures and other grazing lands	11.4	10.5	10.3	10.3	10.3	10.3	10.2	3.47	3.19	3.15	3.15	3.13	3.14	3.12
(B) Land under mis-cellaneous crops and groves not included in net area sown	3.8	3.4	3.3	3.2	3.2	3.2	3.2	1.16	1.03	1.02	0.98	0.97	0.96	0.96
(C) Culturable waste land	15.0	13.2	12.7	12.9	12.6	12.6	12.6	4.56	4.03	3.87	3.94	3.85	3.84	3.83
4. Fallow lands	23.5	25.8	24.5	26.8	24.6	25.2	26.3	7.15	7.85	7.45	8.17	7.48	7.66	8.00
(A) Fallow lands other than current fallows	9.7	11.3	10.3	10.8	10.3	10.7	11.0	2.94	3.44	3.13	3.30	3.14	3.24	3.35
(B) Current fallows	13.8	14.5	14.2	16.0	14.3	14.5	15.3	4.21	4.41	4.32	4.87	4.34	4.42	4.65
5. Net area sown	142.9	140.7	141.9	139.2	141.6	141.0	139.9	43.46	42.80	43.17	42.34	43.06	42.88	42.57
6. Total cropped area	185.7	189.7	195.3	189.0	197.6	195.6	194.4	56.50	57.70	59.42	57.50	60.10	59.51	59.14
7. Area sown more than once	42.9	49.0	53.4	49.8	56.0	54.7	54.5	13.04	14.89	16.25	15.16	17.04	16.63	16.57
8. Cropping intensity	130.0	134.8	137.7	135.8	139.6	138.8	138.9							
III. Net Irrigated area	48.0	57.1	63.6	61.9	63.7	65.7	66.1							
IV. Total/gross irrigated area	63.2	78.0	88.9	85.1	88.9	91.7	92.6							

Source: Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare

Annexure 2.3: Crops Covered Under the Multilateral System
(Annex 1 of International Treaty on Plant Genetic Resources for Food and Agriculture)

A. Food crops (35)		
Crop	**Genus**	**Observations**
Breadfruit	*Artocarpus*	Breadfruit only
Asparagus	*Asparagus*	
Oat	*Avena*	
Beet	*Beta*	
Brassica complex	*Brassica et al.*	Genera included are *Brassica, Armoracia, Barbarea, Camelina, Crambe, Diplotaxis, Eruca, Isatis, Lepiclium, Raphanobrassica, Raphanus, Rorippa and Sinapis*. This comprises oilseed and vegetable crops such as cabbage, rapeseed, mustad, cress, rocket, radish and turnip. The species *Lepidium-meyennii (maca)* is excluded.
Pigeon Pea	*Cajanus*	
Chickpea	*Cicer*	
Citrus	*Citrus*	Genera *Poncirus* and *Fortunella* are included as root stock.
Coconut	*Cocos*	Major aroids include taro, cocoyam, dasheen and tannia
Major Aroids	*Colocasis Xanthosoma*	
Carrot	*Daucus*	
Yams	*Dioscorea*	
Finger Millets	*Eleusine*	
Strawberry	*Fragaria*	
Sunflower	*Helianthus*	
Barley	*Hordeum*	
Sweet Potato	*Ipomoea*	
Grass Pea	*Lathyrus*	
Lentil	*Lens*	
Apple	*Malus*	
Cassava	*Manihot*	*Manihot esculenta only*
Banana/Plantain	*Musa*	Except *Musa*Textilis
Rice	*Oryza*	
Pearl Millet	*Penniseum*	
Beans	*Phaseolus*	Except *Phaseolus polyanthus*
Pearl Millet	*Pisum*	
Rye	*Secale*	
Potato	*Solamum*	Section tuberosa included, except *Solanumphureja.*
Eggplant	*Solamum*	Section melongena included.
Sorghum	*Sorghum*	
Triticale	*Triticosecale*	
Wheat	*Triticum et al.*	Including *Agropyron. Elymus and Secale*
Faba Bean.Vetch	*Vicia*	
Cowpea Et Al	*Vigna*	
Maize	*Zea*	Excluding *Zeaperennis, Zeadiplopernnis and Zealuxurians.*

B. Forages (29)	
Genera	**Species**
Legume Forages	
Astragalus	*Chiensis.cicer, arenarius*
Canavalia	*ensiformis*
Coronilla	*varia*
Hedysarum	*coronarium*
Lathyrus	*cicera, ciliolatus, hirsutus, ochrus, odoratus, sativus*
Lespedeza	*cuneata, striata, stipulacea*
Lotus	*corniculstus, subbiflorus, uliginosus*
Lupinus	*albus, angustifolius, luletus*
Medicago	*arborea, falcata, sativa, scutellata, rigidula, truncatula*
Melilotus	*albus, officinalis*
Onobrychis	*viciifolia*
Ornithopus	*sativus*
Prosopis	*affinis, alba, chilensis, nigra, pallida*
Pueraria	*phaseoloides*
Trifolium	*alexandrium, alpestra ambigumn, angustifolium. Arvense, agrocicierum, hybridum, incarnattum, pratense, repens, resupinatum, rueppellianum, semipilosum, subterraneun, vesiculosum*
Grass Forages	
Andropogon	*gayanus*
Agropyron	*cristaum, desertorum*
Agrostis	*stlonifera, tenuis*
Alopecurus	*pratensis*
Arrhenatherum	*elatius*
Dactylis	*glomerata*
Festuca	*arundinaea, giguntea, heterophylla, ovina, pratensis, rubra*
Lolium	*hybridum, multiforum, perenne, rigidum, temulentu,*
Phalaris	*aquatica, arundinacea*
Phleum	*pratense*
Poa	*alpina, annua,pratensis*
Tripsacum	*laxum*
Other Forages	
Atriplex	*halimus, mummularia*
Salsola	*vermiculata*

Note: The DAC & FW has exempted a total of nine crops (shown under the shaded area).

Annexure 2.4 : Cumulative Rainfall Distribution of Deficient Districts (1 June 2015 to 30 September 2015)

				ACTUAL	NORMAL	% DEP
S.No.	State Name	Met-Sub-division	District-name	(mm)	(mm)	
1	Arunachal Pradesh	Arunachal Pradesh	Changlang	1270.6	1632.1	**-22**
2	Arunachal Pradesh		Tawang	1149.0	2485.2	**-54**
3	Arunachal Pradesh		Tirap	1270.8	2385.5	**-47**
4	Assam	Assam & Meghalaya	Baksa	1834.0	2441.0	**-25**
5	Assam		Golaghat	719.0	1049.6	**-32**
6	Assam		Nagaon	570.4	1124.9	**-49**
7	Meghalaya	Meghalaya	Jaintia Hills	2981.8	4667.5	**-36**
8	Meghalaya		Ri-Bhoi	910.7	1479.5	**-38**
9	Nagaland	NMMT	Mon	538.5	823.9	**-35**
10	Mizoram		Saiha	803.0	1622.6	**-51**
11	West Bengal	Sub-Himalayan W.B.	Cooch Behar	2087.4	2737.6	**-24**
12	West Bengal		North Dinajpur	1088.1	1394.5	**-22**
13	West Bengal		South Dinajpur	702.7	1185.9	**-41**
14	Orissa	Odisha	Angul	887.9	1109.4	**-20**
15	Orissa		Bolangir	857.9	1174.1	**-27**
16	Orissa		Dhenkanal	918.8	1144.4	**-20**
17	Orissa		Kandhamal	774.1	1122.3	**-31**
18	Orissa		Keonjhargarh	830.4	1056.5	**-21**
19	Orissa		Khurda	783.0	1088.0	**-28**
20	Orissa		Puri	790.5	1021.5	**-23**
21	Orissa		Sonepur	877.5	1243.4	**-29**
22	Jharkhand	Jharkhand	Bokaro	822.8	1048.2	**-22**
23	Jharkhand		Chatra	713.0	1031.3	**-31**
24	Jharkhand		Dhanbad	760.7	1122.3	**-32**
25	Jharkhand		Garhwa	607.6	927.8	**-35**
26	Jharkhand		Khunti	821.7	1251.1	**-34**
27	Jharkhand		Koderma	715.6	929.6	**-23**
28	Jharkhand		Palamau	729.4	974.5	**-25**
29	Jharkhand		Ranchi	733.2	1160.2	**-37**
30	Jharkhand		Seraikela Kharsawan	813.2	1135.5	**-28**
31	Jharkhand		West Singhbum	799.5	1088.4	**-27**
32	Bihar	Bihar	Araria	805.2	1347.0	**-40**
33	Bihar		Darbhanga	720.7	924.6	**-22**
34	Bihar		Gaya	631.3	878.7	**-28**
35	Bihar		Gopalganj	672.1	989.9	**-32**
36	Bihar		Jamui	732.7	951.8	**-23**
37	Bihar		Katihar	820.9	1109.9	**-26**
38	Bihar		Kishanganj	1404.7	1755.5	**-20**
39	Bihar		Madhepura	702.5	1153.5	**-39**

Cont.....

S.No.	State Name	Met-Sub-division	District-name	ACTUAL (mm)	NORMAL (mm)	% DEP
40	Bihar		Madhubani	569.0	1059.5	**-46**
41	Bihar		Muzaffarpur	503.2	981.1	**-49**
42	Bihar		Nalanda	582.2	876.8	**-34**
43	Bihar		Nawada	632.0	896.6	**-30**
44	Bihar		Patna	558.8	941.3	**-41**
45	Bihar		Purnea	565.6	1313.3	**-57**
46	Bihar		Saharsa	702.8	1408.1	**-50**
47	Bihar		Saran	599.8	973.5	**-38**
48	Bihar		Sheohar	733.8	1084.4	**-32**
49	Bihar		Sitamarhi	481.7	1084.4	**-56**
50	Bihar		Siwan	549.6	1004.2	**-45**
51	Bihar		Supaul	724.2	1055.6	**-31**
52	Bihar		Vaishali	603.3	1021.6	**-41**
53	Bihar		West Champaran	846.3	1275.0	**-34**
54	Uttar Pradesh	East U.P.	Allahbad	412.8	808.7	**-49**
55	Uttar Pradesh		Azamgarh	631.7	952.7	**-34**
56	Uttar Pradesh		Bahraich	740.3	993.8	**-26**
57	Uttar Pradesh		Ballia	499.3	827.2	**-40**
58	Uttar Pradesh		Balrampur	617.2	1071.7	**-42**
59	Uttar Pradesh		Banda	476.9	840.4	**-43**
60	Uttar Pradesh		Barabanki	448.4	930.5	**-52**
61	Uttar Pradesh		Basti	610.1	943.6	**-35**
62	Uttar Pradesh		Chandauli	513.2	846.1	**-39**
63	Uttar Pradesh		Deoria	387.3	950.9	**-59**
64	Uttar Pradesh		Faizabad	457.8	989.7	**-54**
65	Uttar Pradesh		Farukhabad	346.9	743.4	**-53**
66	Uttar Pradesh		Ghazipur	685.5	883.0	**-22**
67	Uttar Pradesh		Gonda	514.9	1027.2	**-50**
68	Uttar Pradesh		Gorakhpur	563.9	1175.5	**-52**
69	Uttar Pradesh		Hardoi	524.4	787.9	**-33**
70	Uttar Pradesh		Jaunpur	473.7	874.1	**-46**
71	Uttar Pradesh		Kannauj	326.5	776.7	**-58**
72	Uttar Pradesh		Lucknow	336.5	772.5	**-56**
73	Uttar Pradesh		Mirzapur	571.4	901.1	**-37**
74	Uttar Pradesh		Pratapgarh	488.0	851.8	**-43**
75	Uttar Pradesh		Sant Kabir Nagar	535.5	990.7	**-46**
76	Uttar Pradesh		Sant Ravidas Nagar	555.8	846.1	**-34**
77	Uttar Pradesh		Shrawasti Nagar	668.5	993.8	**-33**
78	Uttar Pradesh		Sidharth Nagar	636.0	1009.9	**-37**
79	Uttar Pradesh		Sitapur	497.7	864.8	**-42**

Cont.....

S.No.	State Name	Met-Sub-division	District-name	ACTUAL (mm)	NORMAL (mm)	% DEP
80	Uttar Pradesh		Sonbhadra	575.3	916.9	**-37**
81	Uttar Pradesh		Sultanpur	399.7	840.7	**-52**
82	Uttar Pradesh		Unnao	342.9	790.3	**-57**
83	Uttar Pradesh		Varanasi	722.6	923.5	**-22**
84	Uttar Pradesh	West U.P.	Aligarh	394.1	655.7	**-40**
85	Uttar Pradesh		Badaun	575.1	758.0	**-24**
86	Uttar Pradesh		Baghpat	326.6	545.3	**-40**
87	Uttar Pradesh		Bareilly	663.7	853.8	**-22**
88	Uttar Pradesh		Bulandshahr	459.9	670.7	**-31**
89	Uttar Pradesh		Etah	275.3	615.3	**-55**
90	Uttar Pradesh		Etawah	373.9	728.0	**-49**
91	Uttar Pradesh		Firozabad	436.1	676.3	**-36**
92	Uttar Pradesh		Gautam Buddha Nagar	404.0	572.8	**-29**
93	Uttar Pradesh		Ghaziabad	370.5	641.7	**-42**
94	Uttar Pradesh		Hamirpur	324.1	796.9	**-59**
95	Uttar Pradesh		Jalaun	334.5	774.9	**-57**
96	Uttar Pradesh		Jhansi	389.9	837.9	**-53**
97	Uttar Pradesh		Jyotiba Phule Nagar	529.1	783.0	**-32**
98	Uttar Pradesh		Kanshiram Nagar	471.0	701.5	**-33**
99	Uttar Pradesh		Mahamaya Nagar	270.3	625.4	**-57**
100	Uttar Pradesh		Mathura	401.9	579.9	**-31**
101	Uttar Pradesh		Meerut	384.5	778.5	**-51**
102	Uttar Pradesh		Muzaffarnagar	592.9	736.8	**-20**
103	Uttar Pradesh		Saharanpur	550.6	804.6	**-32**
104	Uttar Pradesh		Shahjahanpur	509.1	859.2	**-41**
105	Uttarakhand	Uttarakhand	Almora	630.0	858.4	**-27**
106	Uttarakhand		Champawat	1062.0	1319.7	**-20**
107	Uttarakhand		Dehradun	1267.1	1802.1	**-30**
108	Uttarakhand		Garhwal Pauri	778.6	1213.5	**-36**
109	Uttarakhand		Garhwal Tehri	562.5	1047.1	**-46**
110	Uttarakhand		Hardwar	761.0	961.9	**-21**
111	Uttarakhand		Pithoragarh	827.5	1687.9	**-51**
112	Uttarakhand		Rudraprayag	1016.4	1671.1	**-39**
113	Uttarakhand		Udham Singh Nagar	732.0	1119.9	**-35**
114	Uttarakhand		Uttarkashi	861.4	1148.6	**-25**
115	Haryana	Haryana	Ambala	459.7	916.6	**-50**
116	Haryana		Bhiwani	177.6	348.5	**-49**
117	Haryana		Hissar	192.8	325.1	**-41**
118	Haryana		Jhajjar	310.1	417.3	**-26**
119	Haryana		Jind	267.3	415.6	**-36**

Cont.....

S.No.	State Name	Met-Sub-division	District-name	ACTUAL (mm)	NORMAL (mm)	% DEP
120	Haryana		Kaithal	182.4	384.0	**-52**
121	Haryana		Karnal	449.9	577.0	**-22**
122	Haryana		Kurukshetra	261.1	563.0	**-54**
123	Haryana		Mahendragarh	175.1	395.4	**-56**
124	Haryana		Mewat	392.2	501.8	**-22**
125	Haryana		Palwal	257.3	446.9	**-42**
126	Haryana		Panchkula	422.1	950.4	**-56**
127	Haryana		Panipat	365.5	521.7	**-30**
128	Haryana		Rewari	296.2	435.8	**-32**
129	Haryana		Sirsa	176.6	242.1	**-27**
130	Haryana		Sonepat	348.2	534.3	**-35**
131	Haryana		Yamuna Nagar	608.3	892.1	**-32**
132	Chandigarh	Chandigarh	Chandigarh	**548.3**	**844.2**	**-35**
133	Delhi	Delhi	Central Delhi	470.0	636.2	**-26**
134	Delhi		East Delhi	437.0	636.2	**-31**
135	Delhi		North East Delhi	412.0	636.2	**-35**
136	Punjab	Punjab	Amritsar	376.6	537.6	**-30**
137	Punjab		Barnala	233.1	355.6	**-34**
138	Punjab		Bhatinda	252.2	321.0	**-21**
139	Punjab		Hoshiarpur	421.7	717.9	**-41**
140	Punjab		Moga	228.8	354.0	**-35**
141	Punjab		Muktsar	222.0	311.8	**-29**
142	Punjab		Nawanshahar	589.1	788.6	**-25**
143	Punjab		Patiala	349.8	615.2	**-43**
144	Punjab		Ropar	569.7	728.5	**-22**
145	Punjab		Sangrur	344.1	436.8	**-21**
146	Punjab		Tarn Taran	180.2	336.8	**-47**
147	Himachal Pradesh	Himachal Pradesh	Chamba	763.9	1406.4	**-46**
148	Himachal Pradesh		Kinnaur	140.1	264.2	**-47**
149	Himachal Pradesh		Sirmaur	805.9	1324.6	**-39**
150	Jammu & Kashmir		Samba	651.5	860.5	**-24**
151	Jammu & Kashmir	Jammu & Kashmir	Udhampur	751.3	1377.2	**-45**
152	Rajasthan	East Rajasthan	Alwar	339.6	555.3	**-39**
153	Rajasthan		Banswara	669.1	831.8	**-20**
154	Rajasthan		Bharatpur	396.2	557.6	**-29**
155	Rajasthan		Dausa	310.3	612.1	**-49**
156	Rajasthan		Dholpur	399.3	650.0	**-39**
157	Rajasthan		Jaipur	356.1	524.6	**-32**
158	Rajasthan		Karauli	369.3	637.4	**-42**
159	Rajasthan		Sawai Madhopur	443.8	664.0	**-33**

Cont.....

S.No.	State Name	Met-Sub-division	District-name	ACTUAL (mm)	NORMAL (mm)	% DEP
160	Madhya Pradesh	West M.P.	Bhind	399.9	685.5	**-42**
161	Madhya Pradesh		Datia	536.8	775.8	**-31**
162	Madhya Pradesh		Morena	423.4	708.2	**-40**
163	Madhya Pradesh		Sheopur	431.5	727.4	**-41**
164	Madhya Pradesh	East M.P.	Anuppur	630.6	1174.8	**-46**
165	Madhya Pradesh		Balaghat	888.6	1334.6	**-33**
166	Madhya Pradesh		Chhatarpur	620.6	985.0	**-37**
167	Madhya Pradesh		Damoh	726.8	1071.0	**-32**
168	Madhya Pradesh		Jabalpur	822.2	1090.3	**-25**
169	Madhya Pradesh		Katni	578.9	1051.3	**-45**
170	Madhya Pradesh		Mandla	951.4	1245.8	**-24**
171	Madhya Pradesh		Narsingpur	839.4	1067.1	**-21**
172	Madhya Pradesh		Panna	589.9	1072.1	**-45**
173	Madhya Pradesh		Rewa	610.2	971.7	**-37**
174	Madhya Pradesh		Sagar	640.7	1088.1	**-41**
175	Madhya Pradesh		Seoni	786.4	1038.4	**-24**
176	Madhya Pradesh		Shahdol	575.6	994.7	**-42**
177	Madhya Pradesh		Sidhi	574.8	1016.4	**-43**
178	Madhya Pradesh		Singrauli	576.7	832.3	**-31**
179	Madhya Pradesh		Tikamgarh	540.0	853.2	**-37**
180	Madhya Pradesh		Umaria	847.1	1093.9	**-23**
181	Gujarat	Gujarat Region	Ahmedabad	400.7	602.6	**-34**
182	Gujarat		Anand	452.6	788.9	**-43**
183	Gujarat		Baroda	421.4	942.8	**-55**
184	Gujarat		Broach	437.8	786.2	**-44**
185	Gujarat		Dahod	426.8	853.3	**-50**
186	Gujarat		Dangs	1039.2	1961.7	**-47**
187	Gujarat		Kheda	503.5	811.6	**-38**
188	Gujarat		Narmada	650.2	1099.8	**-41**
189	Gujarat		Navsari	1022.8	1803.3	**-43**
190	Gujarat		Panchmahal	479.8	912.1	**-47**
191	Gujarat		Surat	884.2	1253.6	**-29**
192	Gujarat		Tapi	879.8	1484.9	**-41**
193	Gujarat		Valsad	1434.8	1951.3	**-26**
194	Gujarat		Daman	1022.2	2316.9	**-56**
195	Gujarat	Saurashtra & Kutch	Junagarh	598.9	787.2	**-24**
196	Gujarat		Porbandar	399.3	672.7	**-41**
197	Gujarat		Surendranagar	373.0	499.8	**-25**
198	Dadara & Nagar Haveli	Dadara & Nagar Haveli	Dadara & Nagar Haveli	1667.4	2316.9	**-28**

Cont.....

S.No.	State Name	Met-Sub-division	District-name	ACTUAL (mm)	NORMAL (mm)	% DEP
199	Goa	Goa	North Goa	2331.8	3154.9	**-26**
200	Maharashtra	Maharashtra	Mumbai City	1604.8	2142.4	**-25**
201	Maharashtra		Raigad	2054.7	3117.7	**-34**
202	Maharashtra		Ratnagiri	2142.8	3261.5	**-34**
203	Maharashtra		Sindhudurg	2055.4	3021.8	**-32**
204	Maharashtra		Thane	1698.5	2428.3	**-30**
205	Maharashtra	Madhya Maharashtra	Ahmednagar	333.6	437.6	**-24**
206	Maharashtra		Jalgaon	415.8	641.8	**-35**
207	Maharashtra		Kolhapur	803.4	1737.6	**-54**
208	Maharashtra		Nashik	729.0	912.2	**-20**
209	Maharashtra		Pune	582.2	861.0	**-32**
210	Maharashtra		Sangli	299.9	508.1	**-41**
211	Maharashtra		Satara	455.7	723.8	**-37**
212	Maharashtra		Sholapur	231.8	474.2	**-51**
213	Maharashtra	Marathwada	Beed	287.4	569.4	**-50**
214	Maharashtra		Hingoli	570.4	849.1	**-33**
215	Maharashtra		Jalna	444.2	606.4	**-27**
216	Maharashtra		Latur	372.0	752.5	**-51**
217	Maharashtra		Nanded	484.8	816.4	**-41**
218	Maharashtra		Osmanabad	336.3	623.4	**-46**
219	Maharashtra		Parbhani	344.9	757.2	**-54**
220	Maharashtra	Vidarbha	Washim	655.2	825.6	**-21**
221	Maharashtra		Yeotmal	663.3	855.0	**-22**
222	Chhattisgarh	Chhattisgarh	Dhamtari	833.4	1050.6	**-21**
223	Chhattisgarh		Janjgir	928.1	1201.9	**-23**
224	Chhattisgarh		Jashpur	927.3	1348.6	**-31**
225	Chhattisgarh		Koriya	692.2	1138.9	**-39**
226	Chhattisgarh		Raipur	828.4	1047.0	**-21**
227	Chhattisgarh		Rajnandgaon	734.5	1076.6	**-32**
228	Chhattisgarh		Surguja	832.4	1195.1	**-30**
229	Andhra Pradesh	Rayalseema	Kurnool	330.4	460.2	**-28**
230	Andhra Pradesh	Telangana	Hyderabad	359.7	643.5	**-44**
231	Andhra Pradesh		Mahabubnagar	328.4	559.7	**-41**
232	Andhra Pradesh		Medak	355.8	743.9	**-52**
233	Andhra Pradesh		Nizamabad	469.1	920.1	**-49**
234	Andhra Pradesh		Rangareddy	385.2	653.7	**-41**
235	Tamil Nadu	Tamil Nadu	Ariyalur	263.1	392.0	**-33**
236	Tamil Nadu		Cuddalore	290.3	383.1	**-24**
237	Tamil Nadu		Kanchipuram	345.0	490.8	**-30**

Cont.....

S.No.	State Name	Met-Sub-division	District-name	ACTUAL (mm)	NORMAL (mm)	% DEP
238	Tamil Nadu		Madurai	263.7	335.9	**-22**
239	Tamil Nadu		Nagapattinam	186.9	286.1	**-35**
240	Tamil Nadu		Pudukottai	227.6	350.6	**-35**
241	Tamil Nadu		Salem	348.3	440.6	**-21**
242	Tamil Nadu		Thanjavur	209.7	318.4	**-34**
243	Tamil Nadu		Tiruvarur	218.4	296.4	**-26**
244	Tamil Nadu		Toothukudi	59.9	74.9	**-20**
245	Tamil Nadu		Trichy	197.3	293.9	**-33**
246	Tamil Nadu		Viluppuram	288.6	408.3	**-29**
247	Tamil Nadu		Virudhunagar	154.4	196.8	**-22**
248	Pondicherry	Pondicherry	Karaikal	200.3	293.1	**-32**
249	Pondicherry		Pondicherry	307.5	385.0	**-20**
250	Karanataka	Coastal Karanataka	Dakshina Kannada	2577.7	3351.6	**-23**
251	Karanataka		Uttar Kannada	1832.2	2720.9	**-33**
252	Karanataka	North Interior Kar.	Belgam	353.2	574.1	**-38**
253	Karanataka		Bidar	437.1	694.9	**-37**
254	Karanataka		Bijapur	310.9	436.0	**-29**
255	Karanataka		Dharwad	321.5	484.0	**-34**
256	Karanataka		Gadag	289.3	368.3	**-21**
257	Karanataka		Gulbarga	411.1	620.5	**-34**
258	Karanataka		Haveri	396.9	495.1	**-20**
259	Karanataka		Yadgir	340.1	610.8	**-44**
260	Karanataka		Chikmagalur	1159.5	1657.3	**-30**
261	Karanataka		Shimoga	1218.0	1514.0	**-20**
262	Kerala	Kerala	Alapuzha	1137.1	1745.9	**-35**
263	Kerala		Ernakulam	1566.2	2065.0	**-24**
264	Kerala		Idukki	1701.6	2276.2	**-25**
265	Kerala		Kasargod	2032.0	3007.5	**-32**
266	Kerala		Kollam	993.5	1332.3	**-25**
267	Kerala		Kozhikode	1995.4	2603.1	**-23**
268	Kerala		Malappuram	1532.3	2060.4	**-26**
269	Kerala		Palakkad	1153.9	1572.7	**-27**
270	Kerala		Pathanamthitta	1172.6	1715.7	**-32**
271	Kerala		Thrissur	1677.3	2197.5	**-24**
272	Kerala		Wynad	1592.6	2632.1	**-39**

D-DEFICIENT (-20% TO -59%); NMMT: Nagaland, Manipur, Mizoram and Tripura; No. of districts that received deficient rainfall : 272

Source: Department of Agriculture, Cooperation & Farmers Welfare.

Annexure 2.5: Cumulative Rainfall Distribution of Scanty Districts (1 June 2015 to 30 September 2015)

S.No.	State Name	Met-Sub-division	District-name	ACTUAL (mm)	NORMAL (mm)	% DEP
4	Arunachal Pradesh	Arunachal Pradesh	East Kameng	403.6	1246.3	**-68**
2	Nagaland	NMMT	Kephire	222.8	1386.1	**-84**
3	Nagaland		Mokokchung	555.0	1676.1	**-67**
4	Nagaland		Phek	349.0	1308.0	**-73**
5	Mizoram	NMMT	Kolasib	272.0	1692.5	**-84**
6	Mizoram		Lunglei	673.0	1866.3	**-64**
7	Bihar	Bihar	Bhojpur	371.8	924.4	**-60**
8	Uttar Pradesh	East U.P.	Ambedkar Nagar	118.0	904.8	**-87**
9	Uttar Pradesh		Fatehpur	97.7	812.5	**-88**
10	Uttar Pradesh		Kanpur City	272.1	696.8	**-61**
11	Uttar Pradesh		Kanpur Dehat	164.0	765.0	**-79**
12	Uttar Pradesh		Kaushambi	141.5	765.6	**-82**
13	Uttar Pradesh		Kushi Nagar	245.9	1158.4	**-79**
14	Uttar Pradesh		Maharajganj	435.2	1214.1	**-64**
15	Uttar Pradesh		Mau	381.2	1004.7	**-62**
16	Uttar Pradesh		Rae Bareilly	231.8	750.3	**-69**
17	Uttar Pradesh		Sahuji Maharajnagar	340.9	885.9	**-62**
18	Uttar Pradesh	West U.P.	Agra	213.2	687.2	**-69**
19	Uttar Pradesh		Auriya	232.7	700.0	**-67**
20	Uttar Pradesh		Lalitpur	321.3	939.3	**-66**
21	Uttar Pradesh		Mahoba	251.8	776.4	**-68**
22	Uttar Pradesh		Mainpuri	237.9	655.3	**-64**
23	Uttar Pradesh		Pilibhit	364.8	988.6	**-63**
24	Uttar Pradesh		Rampur	335.5	915.5	**-63**
25	Haryana	Haryana	Fatehabad	114.1	283.0	**-60**
26	Haryana		Rohtak	194.5	508.0	**-62**
27	Punjab	Punjab	Ferozepur	110.4	352.3	**-69**
28	Punjab		Jalandhar	182.9	551.5	**-67**
29	Punjab		Mansa	85.5	334.8	**-74**
30	Himachal Pradesh	Himachal Pradesh	Lahaul & Spiti	158.5	458.2	**-65**
S-SCANTY (-60% TO -99%); NMMT: Nagaland, Manipur, Mizoram and Tripura; No. of Districts that Received Scanty Rainfall: 30						

Source: Department of Agriculture, Cooperation & Farmers Welfare.

Annexure 3.1: State-Wise Soil Testing Laboratories, Analysing Capacity and Utilisation (2013-14)

Sl. No.	State	Number of Soil Testing Laborotories				Total			Annual Analyzing Capacity in '000'	Sample Analyzed in'000'	Capacity Utilization (%)
		State Govt.		Fert. Industry							
		Static	Mobile	Static	Mobile	Static	Mobile	Total			
I	**South Zone**										
1	Andhra Pradesh	55	5	27	1	82	6	88	413.00	345.785	83.73
2	Karnataka*	56	0	6	2	62	2	64	295.66	194.81	65.89
3	Kerala	14	11	1	0	15	11	26	218.00	134.68	61.78
4	Tamil Nadu	30	16	1	1	31	17	48	5796.72	4823.54	83.21
5	Puducherry*	2	0	0	0	2	0	2	4.00	4.41	110.25
	Total	**157**	**32**	**35**	**4**	**192**	**36**	**228**	**6727.38**	**5503.23**	**81.80**
II.	**West Zone**										
6	Gujarat	132	2	4	1	136	3	139	1412.00	1199.13	84.92
7	Madhya Pradesh	50	7	2	4	52	11	63	378.00	346.52	91.67
8	Maharashtra*	123	23	8	4	131	27	158	2241.35	967.27	43.16
9	Rajasthan	34	22	1	2	35	24	59	536.00	402.69	75.13
10	Chhattisgarh	7	5	1	0	8	5	13	105.00	116.02	110.50
11	Goa	2	0	0	0	2	0	2	23.00	14.96	65.04
	Total	**348**	**59**	**16**	**11**	**364**	**70**	**434**	**4695.35**	**3046.59**	**64.89**
III	**North Zone**										
12	Haryana	35	3	2	0	37	3	40	365.00	247.89	67.92
13	Punjab*	54	12	2	3	56	15	71	631.50	282.11	44.67
14	Uttarakhand	13	3	0	0	13	3	16	106.54	95.23	89.38
15	Uttar Pradesh	255	18	5	3	260	21	281	4159.50	3404.58	81.85
16	Himachal Pradesh	11	4	0	0	11	4	15	125	124.38	99.50
17	J&K *	8	5	0	0	8	5	13	52.00	43.61	83.87
18	Delhi	1	0	0	0	1	0	1	5.00	0.46	9.20
	Total	**377**	**45**	**9**	**6**	**386**	**51**	**437**	**5444.54**	**4198.26**	**77.11**
IV	**East Zone**										
19	Bihar	39	0	0	0	39	0	39	230.00	248.71	108.13
20	Jharkhand	8	0	0	0	8	0	8	40.00	10.67	26.68
21	Orissa	17	6	1	0	18	6	24	270.00	255.06	94.47
22	West Bengal	10	8	0	2	10	10	20	112.40	60.43	53.76
	Total	**74**	**14**	**1**	**2**	**75**	**16**	**91**	**652.40**	**574.87**	**88.12**

Cont.....

Sl. No.	State	Number of Soil Testing Laborotories				Total			Annual Analyzing Capacity in '000'	Sample Analyzed in'000'	Capacity Utilization (%)
		State Govt.		Fert. Industry							
		Static	Mobile	Static	Mobile	Static	Mobile	Total			
V	**NE Zone**					0	0	0			
23	Assam *	7	4	0	0	7	4	11	84.00	60.76	72.33
24	Tripura	2	4	0	0	2	4	6	35.00	17.54	50.11
25	Manipur	4	4	0	0	4	4	8	40.00	1.37	3.43
26	Meghalaya	3	3	0	0	3	3	6	30.00	27.65	92.17
27	Nagaland	3	0	0	0	3	0	3	45.00	14.30	31.78
28	Arunachal Pr.	5	3	0	0	5	3	8	9.00	7.86	87.33
29	Sikkim	4	2	0	0	4	2	6	37.00	39.87	107.76
30	Mizoram	3	3	0	0	3	3	6	27.00	25.00	92.59
	Total	**31**	**23**	**0**	**0**	**31**	**23**	**54**	**307**	**194.35**	**63.31**
	Grand Total	**987**	**173**	**61**	**23**	**1048**	**196**	**1244**	**17826.67**	**13517.30**	**75.83**

Information/correct information not provided; previous year's progress has been taken

Source: Department of Agriculture, Cooperation & Farmers Welfare.

Annexure 3.2: State-Wise Fertilizer Quality Control Laboratory

Sl. No.	Name of State	Number of laboratories	Location of laboratories
1	Assam	1	Ulubari
2	Bihar	1	Patna
3	Jharkhand	1	Ranchi
4	Orissa	3	Bhubaneshwar
			Sambalpur
			Rayagada
5	West Bengal	3	Kolkata
			Berhampur
			Midnapur
6	Mizoram	1	Aizawal
7	Gujarat	3	Gandhinagar
			Junagarh
			Bardoli
8	Madhya Pradesh	4	Jabalpur
			Bhopal
			Gwalior
			Indore
9	Chhatisgarh	1	Raipur
10	Maharashtra	5	Pune
			Amravati
			Aurangabad
			Nasik
			Kolhapur
11	Rajasthan	4	Jaipur
			Jodhpur
			Udaipur
			Bharatpur
12	Haryana	3	Karnal
			Hissar
			Rohtak
13	Himachal Pradesh	3	Sundernagar
			Hamirpur
			Shimla
14	Punjab	3	Ludhiana
			Faridkot
			Gurdaspur
15	Jammu & Kashmir	2	Srinagar
			Jammu

Sl. No.	Name of State	Number of laboratories	Location of laboratories
16	**Uttar Pradesh**	5	Meerut
			Varanasi
			Lucknow
			Rehmankhera
			Soil Testing Laboratories
17	**Uttrakhand**	2	Rudrapur
			Dehradun
18	**Andhra Pradesh**	5	Hyderabad
			Warangal
			Anantpur
			Bapatala
			Tadepalligudam
19	**Karnataka**	7	Bangalore
			Belthangudy
			Dharwad
			Gangavathi
			Davanagere
			Mandya
			Belgaum
20	**Kerala**	2	Thiruvananthapuram
			Pattambi
21	**Puducherry**	1	Pondicherry
22	**Tamil Nadu**	14	Coimbatore
			Kovilpatti
			Madurai
			Tiruchirapalli
			Paramkudi
			Kancheepuram
			Dindigul
			Villupuram
			Salem
			Dharampuri
			Kumbakonam
			Thiruvarur
			Nagarcoil
			Udhagamandalam
23	**Central Government Laboratories**	4	Faridabad
			Chennai
			Navi Mumbai
			Kalyani
Total All India		**78**	

Source: Department of Agriculture, Cooperation & Farmers Welfare.

Annexure 3.3 Courses Conducted at Farm Machinery Training and Testing Institutes to Develop Farm Mechanization Skills

Course Name	Course Details	Duration (weeks)
User-level course (U1 to U12)	These course are designed for providing training on using improved agricultural implements to progressive farmers tractor and farm machinery owners, operator's and related technical personnel from Govt. / semi-Govt / SAUs / NGOs etc. desirous of taking training on tractors, agricultural machineries, irrigation pumps, plant protection equipments, threshing and harvesting machineries. This course is also for those farmers who need information about operational techniques, maintenance, adjustment & management on, package of agricultural machinery on specific crop.	1 week to 6 weeks
Technician-level course (T1 to T9)	These course are designed for mechanics, electricians, ITI's students, technical personnel from Govt. / semi-Govt / SAUs / NGOs etc. desirous of taking training on overhauling repairing and workshop maintenance of tractors, power tiller thresher, harvester, electric motors, irrigation pumps, land leveling and development machineries.	2 weeks to 6 weeks
Management-level course (M1 to M4)	These course are designed for Engineers and officers sponsored by Government departments, tractor industry which needs training on Agricultural machinery management, testing and instrumentation.	1 week to 4 weeks
Academic-level course (A1 and A2)	This Course is carried out for sponsored students of Agricultural Engineering/ mechanical Engineering / Polytechnic/ and 10+2 student of vocational education for giving them practical exposure of IC engines, tractors, agricultural machinery.	4weeks
Awareness through multimedia system	This course is carried out for giving information about centrally sponsored schemes for subsidy on Agricultural Machinery, Agri-Business and Agri-clinics, Straw Management in Agriculture, Central Motor Vehicle Rules for Tractors, Dangerous Machines Regulation Act in Agricultural Machinery ,Safety in Agricultural Machinery, Adaptation of new technology machinery and awareness regarding financing agricultural machinery	One to two days
Technology transfer camps	The main objective of this course is familiarization and demonstration of improved/modern Agricultural Machines, energy conservation & safety in farm machinery	One to two days
Training programme for Foreign national	The candidates are sponsored through international agencies like ILO, FAO, ITEC, SCAAP etc	10 & 18 weeks
Need based training programme	The nominations are received through Employer of the organization/Competent authority of the Govt., University, Banks, and NGO etc for giving special training as per need of the trainees.	1 week to 4 weeks

Source: Department of Agriculture, Cooperation & Farmers Welfare.

Annexure 3.4: Course wise trainees trained at FMTTIs

Institute	User's level	Technician's level	Management level	Academic level	Need based training	Tech. transfer/ AW	Total
Year 2010-11							
CFMT & TI Budni	345	622	168	785	23	-	1943
NRFMT & TI Hisar	408	50	2	784	376	266	1886
SRFMT & TI Garladinne	175	84	0	263	683	401	1606
NERFMT & TI Biswanathcharialli	511	19	0	85	97	99	811
Total	**1439**	**775**	**168**	**1917**	**1179**	**766**	**6246**
Year 2011-12							
CFMT & TI Budni	320	568	465	668	37	0	2058
NRFMT & TI Hisar	284	81	42	942	312	225	1886
SRFMT & TI Garladinne	189	104	0	304	784	211 +181	1662
NERFMT & TI Biswanathcharialli	357	171	0	167	119	0	816
Total	**1150**	**924**	**507**	**2081**	**1252**	**617**	**6422**
Year 2012-13							
CFMT & TI Budni	212	391	476	724	248	-	2051
NRFMT & TI Hisar	340	77	40 + 32 foreign nationals	1030	137	270	1926
SRFMT & TI Garladinne	91	100	0	353	784	41+297	1666
NERFMT & TI Biswanathcharialli	439	139	0	193	28	0	802
Total	**1082**	**707**	**548**	**2300**	**1197**	**608**	**6445**
Year 2013-14							
CFMT & TI Budni	143	458	348	647	574	-	2170
NRFMT & TI Hisar	572	59	0	1008	32	319	1990
SRFMT & TI Garladinne	77	57	0	338	924	25+262	1683
NERFMT & TI Biswanathcharialli	267	196	0	204	159	0	829
Total	**1059**	**770**	**348**	**2197**	**1689**	**596**	**6672**
Year 2014-15							
CFMT & TI Budni	291	455	680	643	157	-	2226
NRFMT & TI Hisar	560	57	0	934	143	223	1917
SRFMT & TI Garladinne	95	41	5	339	1227	0	1707
NERFMT & TI Biswanathcharialli	458	142	0	206	17	0	823
Total	**1304**	**695**	**685**	**2122**	**1544**	**223**	**6673**
Year 2015-16 till NOV.2015							
CFMT&TI Budni	203	193	345	412	43	0	1196
NRFMT&TI Hisar	339	42	0	672	204	97	1354
SRFMT&TI Garladinne	275	71	0	265	703	0	1314
NERFMT & TI Biswanathcharialli	487	39	0	191	57	2	776
Total	**1304**	**345**	**345**	**1540**	**1007**	**99**	**4640**

Source: Department of Agriculture, Cooperation & Farmers Welfare.

Annexure 3.5: Physical Targets and Achievements during 12th Five Year Plan (2014-15 onwards)

				PHYSICAL PROGRESS			
Sl. No.	**Name of Scheme/Programme**	**Name of Components**	**Projected Outcome**	**Targets (2014-15)**	**Achievements 2014-15**	**Targets (2015-16)**	**Achievements as on date (31.12.2015)**
1	**2**	**3**	**4**	**5**	**6**	**5**	**6**
1	Sub Mission on Agricultural Mechanisation (SMAM)	Promotion & Strengthening of Agricultural Mechanisation through Training Testing & Demonstration	Quality control ,performance testing and field demonstrations of farm machines and equipments , Capacity building of Stake Holders	i) Training of 11000 persons	11649	i) Training of 11275 persons	6532
				ii) Testing of 165 machines	199	ii) Testing of 165 machines	169
				iii) Covering 37500 ha on demonstrations	3024	iii) Covering 14504 ha on demonstrations	3024
2		Demonstration, Training and Distribution of Post Harvest Technology and Management (PHTM)	Reduction of Post harvest Losses ,management and value addition of agricultural produce at farm level	iv) Establishment of PHT Units - NA	Not Implemented	iv) Establishment of PHT Units - 25 Nos.	Reports Awaited
				v) Strengthening of testing Institutes - 5 Nos.	5	v)Strengthening of testing Institutes - 1 Nos.	1
3		Financial Assistance for Procurement of Agriculture Machinery and Equipment	Promoting agricultural mechanization by enabling individual users to own appropriate agricultural machinery & equipment.	1218784 machines/implements to be distributed as per norms	1776432 machines/ implements distributed	2353904 machines/ implements distributed	1826832 machines/ implements distributed.
4		Establish Farm Machinery Banks (FMB) for Custom Hiring	Providing suitable financial assistance to establish Farm Machinery Banks for Custom Hiring for appropriate locations and crops.	550 nos. Custom Hiring Centers (CHC)	568	269 CHC	143 CHC
5		Establish Hi-Tech, High Productive Equipment Hub for Custom Hiring	Providing financial assistance to set up hi-tech machinery hubs for high value crops like sugarcane, cotton etc	20 nos. Custom Hiring Centers	41	13 CHC	Reports Awaited
6		Promotion of Farm Mechanization in Selected Villages	Providing financial assistance to promote appropriate technologies and to set up Farm Machinery Banks in identified villages in low mechanised states.	350 Farm Machinery Banks	356 FMB	219 Farm Machinery Banks	164 FMB
7		Financial Assistance for Promotion of Mechanized Operations/hectare Carried out Through Custom Hiring Centres (CHC)	Provides financial assistance on per hectare basis to the beneficiaries hiring machinery/equipments from custom hiring centers in low mechanized areas.	i) Demonstration by CHC :NIL	NIL	Demonstration by CHC :400 Ha	Reports awaited
				ii) Operational charges :NIL	NIL	Operational charges :634 ha	Reports awaited
8		Promotion of Farm Machinery and Equipment in North-Eastern Region	Extends financial assistance to beneficiaries in high-potential but low mechanised states of north-east	i) Financial assistance to beneficery:380	77	800	152
				ii) Farm Machinery Banks (FMB):32 nos.	12	18 – FMB	Reports awaited

Source: Department of Agriculture, Cooperation & Farmers Welfare.

Annexure 3.6: Target, Acheivement and Number of accounts for ground level credit flow.

(Rs. & No. in crore)

Name of Agencies	2010-2011			2011-2012			2012-2013			2013-2014				2014-15		2015-16 (Apr-Dec.)		
	Target	Achvt.	No. of A/c	Target	Achvt.	No. of A/c	Target	Achvt.	No. of A/c	Target	Achvt.	No. of A/c	Target	Achvt.	No. of A/c	Target	Achvt.	No. of A/c
Cooperative Banks	55000	78,121	2.42	69500	87,963	3.09	84000	111,203	3.11	125000	119964	3.79	140,000	138,470	2.27	140,000	113,358	2.27
Commercial Banks	280000	345877	2.34	355000	368616	2.55	420000	432491	3.07	475000	509005	3.21	540,000	604,376	2.48	590,000	430,925	2.48
Regional Rural Banks	40000	44293	0.74	50500	54450	0.83	71000	63681	0.85	100000	82652	0.99	120,000	102,483	0.85	120,000	85,961	0.85
Total	375000	468291	5.50	475000	511029	6.47	575000	607375	7.03	700000	711621	7.99	**800,000**	**845,328**	**8.54**	**850,000**	**630,244**	**8.54**

Achvt.: Achievement

Source: Department of Agriculture, Cooperation & Farmers Welfare (Credit Division).

Annexure 3.7: All Schemes-All Companies - Statewise Business Statistics from Rabi 1999-2000 to Kharif 2015 i.e. for 32 seasons

S.No.	STATE	NO. OF FARMERS COVERED	AREA INSURED (In Hec.)	Rs. (In Lakhs)									No. Of FARMERS BENEFITTED
				SUM INSURED	GROSS PREMIUM	TOTAL SUBSIDY	STATE SHARE IN SUBSIDY	GOI SHARE IN SUBSIDY	CLAIMS REPORTED	AIC SHARE IN CLAIMS	STATE SHARE IN CLAIMS	GOI SHARE IN CLAIMS	
1	ANDHRA PRADESH	35752245	53755554	8705851	410326	148203	74102	74102	660068	303967	178050	178050	9566040
2	ASSAM	495795	354996	115620	4626	1281	640	640	3169	2676	246	246	90765
3	BIHAR	22999769	24629727	5412877	367651	220819	110410	110410	564130	259336	152397	152397	14183803
4	CHHATTISGARH	12639302	24975095	1803471	76795	25728	13599	12129	71915	43097	14409	14409	2555962
5	GOA	8470	13710	385	7	2	1	1	2	0	1	1	702
6	GUJARAT	15989354	35605230	4943450	204784	24895	16910	7985	701534	181728	259903	259903	5308908
7	HARYANA	1257853	1817750	458523	25376	15517	8694	6822	15942	12752	1595	1595	423456
8	HIMACHAL PRADESH	622244	2882951	170446	12951	6404	3464	2940	11052	9655	698	698	306206
9	JHARKHAND	7525794	4838554	573818	23741	8504	4252	4252	60493	15562	22465	22465	2715592
10	KARNATAKA	16517998	25556454	2526311	121843	41402	20700	20701	238058	88408	74887	74763	6468567
11	KERALA	634820	557913	134749	5889	2795	1510	1285	5533	3486	1023	1023	182358
12	MADHYA PRADESH	42010051	98361916	9276290	287581	35685	17843	17843	561376	190998	185182	185182	8670413
13	MAHARASHTRA	51162636	41260591	4349301	238694	85767	60673	25094	541865	184175	178861	178861	16719483
14	MANIPUR	32820	52781	13462	335	18	9	9	957	198	379	379	22418
15	MEGHALAYA	35483	35567	7102	310	42	21	21	68	40	14	14	3600
16	MIZORAM	633	622	123	7	3	2	2	21	10	5	5	631
17	ORISSA	20391496	19885870	3670462	97018	14325	7178	7147	233931	89888	72022	72022	3645711
18	PUNJAB	67	338	48	5	4	2	2	1	1	0	0	50
19	RAJASTHAN	67942061	98507954	6996118	599934	362405	181203	181203	658873	441159	110825	106889	31501886
20	SIKKIM	1924	1362	268	4	1	0	0	1	0	1	1	86
21	TAMILNADU	7810973	9978790	2277996	71555	37362	29713	7649	324186	83669	120259	120259	3136081
22	TELANGANA	1673098	2107216	851323	30726	8096	4048	4048	10104	10104	0	0	190151
23	TRIPURA	20507	13490	3120	86	9	5	5	58	28	15	15	3432
24	UTTAR PRADESH	28294978	36283533	4725234	180192	70291	35139	35153	240492	178420	31036	31036	6564784
25	UTTARAKHAND	730535	657933	193645	8830	3186	1592	1594	13764	11005	1379	1379	252598
26	WEST BENGAL	16060830	7999664	2305105	132545	75123	55473	19650	167419	83197	42111	42111	3531891
27	A & N ISLANDS	4630	7214	2259	65	62	51	11	121	70	26	26	1128
28	PUDUCHERRY	41578	58051	10879	210	69	54	14	317	101	108	108	7269
29	JAMMU & KASHMIR	50429	69804	11363	260	39	20	20	181	84	48	48	5856
GRAND TOTAL		**350708373**	**490270629**	**59539598**	**2902345**	**1188035**	**647307**	**540728**	**5085631**	**2193816**	**1447947**	**1443886**	**116059827**

Source: Department of Agriculture, Cooperation & Farmers Welfare (Credit Division).

Annexure 3.8: Agriculture Insurance Company of India Limited
All Schemes - All India Yearwise / Seasonwise Business Statistics Since Rabi 1999-2000 to Kharif 2015

S.No.	SEASON	NO. OF FARMERS COVERED	AREA (hec)	Rs. (In Lakhs)									No. Of FARMERS BENEFITTED
				SUM INSURED	GROSS PREMIUM	TOTAL SUBSIDY	STATE SHARE IN SUBSIDY	GOI SHARE IN SUBSIDY	CLAIMS REPORTED	AIC SHARE IN CLAIMS	STATE SHARE IN CLAIMS	GOI SHARE IN CLAIMS	
1	**Rabi 1999-00**	579940	780569	35641	542	166	83	83	769	259	255	255	55288
2	**Kharif 2000**	8409374	13219829	690338	20674	4740	2370	2370	122248	20332	50958	50958	3635252
3	**Rabi 2000-01**	2091733	3111423	160268	2779	824	412	412	5949	2107	1921	1921	526697
	Total 2000-01	10501107	16331252	850607	23452	5563	2782	2782	128197	22439	52879	52879	4161949
4	**Kharif 2001**	8696587	12887710	750246	26162	4762	2381	2381	49364	18119	15622	15622	1741906
5	**Rabi 2001-02**	1955431	3145873	149751	3015	778	389	389	6466	1821	2323	2323	453325
	Total 2001-02	10652018	16033583	899997	29177	5540	2770	2770	55829	19939	17945	17945	2195231
6	**Kharif 2002**	9768711	15532349	943169	32547	4486	2243	2243	182439	30149	76145	76145	4297155
7	**Rabi 2002-03**	2326811	4037824	183755	3850	673	336	336	18855	3403	7726	7726	926408
	Total 2002-03	12095522	19570173	1126924	36397	5159	2580	2580	201294	33552	83871	83871	5223563
8	**Kharif 2003**	7970830	12355514	811413	28333	2445	1222	1222	65268	14486	25391	25391	1712270
9	**Rabi 2003-04**	4421287	6468663	304949	6406	624	312	312	49710	5433	22141	22141	2098125
	Total 2003-04	12392117	18824177	1116362	34739	3069	1534	1534	114978	19919	47532	47532	3810395
10	**Kharif 2004**	12687104	24273394	1317062	45894	2009	1005	1005	103833	32495	35675	35675	2674743
11	**Rabi 2004-05**	3531045	5343244	377421	7585	412	206	206	16059	6190	4996	4872	772779
	Total 2004-05	16218149	29616638	1694482	53480	2422	1211	1211	119891	38685	40672	40547	3447522
12	**Kharif 2005**	12673833	20531038	1351910	44995	2044	1022	1022	108645	27461	43208	37976	2687605
13	**Rabi 2005-06**	4048524	7218417	507166	10482	523	262	262	33830	9355	11590	12886	980748
	Total 2005-06	16722357	27749455	1859076	55477	2567	1283	1283	142475	36815	54798	50862	3668353
14	**Kharif 2006**	12934060	19672280	1475936	46729	2655	1593	1062	177622	36372	70625	70625	3131511
15	**Rabi 2006-07**	4977980	7632882	654221	14288	1138	769	368	51597	15298	18149	18149	1391554
	TOTAL 2006-07	17912040	27305162	2130158	61017	3793	2362	1431	229219	51670	88774	88774	4523065
16	**Kharif 2007**	13442612	20804821	1706097	53135	3227	1710	1517	92060	30882	30589	30589	1627138
17	**Rabi 2007-08**	5678651	8405410	920555	30003	11554	6223	5332	91058	22388	34335	34335	1769278

S.No.	SEASON	NO. OF FARMERS COVERED	AREA (hec)	Rs. (In Lakhs)									No. Of FARMERS BENEFITTED
				SUM INSURED	GROSS PREMIUM	TOTAL SUBSIDY	STATE SHARE IN SUBSIDY	GOI SHARE IN SUBSIDY	CLAIMS REPORTED	AIC SHARE IN CLAIMS	STATE SHARE IN CLAIMS	GOI SHARE IN CLAIMS	
	TOTAL 2007-08	19121263	29210230	2626652	83138	14782	7933	6849	183118	53270	64924	64924	3396416
18	**Kharif 2008**	13175753	17857389	1601718	54811	6028	3533	2494	239385	43950	97718	97718	4327950
19	**Rabi 2008-09**	6402295	9118744	1168504	34125	10670	8011	2659	154324	34103	60110	60110	2100509
	TOTAL 2008-09	19578048	26976133	2770221	88936	16698	11545	5153	393710	78053	157828	157828	6428459
20	**Kharif 2009**	19414127	27300600	2973241	107496	20865	11427	9439	469534	92012	188761	188761	8873565
21	**Rabi 2009-10**	6882673	9790852	1386549	52723	25397	15475	9922	76759	37802	19478	19478	1640995
	TOTAL 2009-10	26296800	37091452	4359790	160219	46262	26902	19360	546293	129815	208239	208239	10514560
22	**Kharif 2010**	17599026	24502130	2938779	131729	47268	25641	21627	183372	71849	55762	55762	4043265
23	**Rabi 2010-11**	9709803	13007900	2033799	103935	63541	35469	28072	111673	67116	22279	22279	3711973
	TOTAL 2010-11	27308829	37510030	4972578	235664	110809	61110	49700	295044	138964	78040	78040	7755238
24	**Kharif 2011**	18918549	26228422	3518460	186587	82202	41864	40339	218747	114086	52331	52331	5542303
25	**Rabi 2011-12**	10760331	14161329	2315248	123761	76689	41858	34830	137862	105856	16003	16003	4142020
	TOTAL 2011-12	29678880	40389750	5833708	310348	158891	83722	75169	356609	219942	68333	68333	9684323
26	**Kharif 2012**	20719922	29057751	4496654	273780	133969	70363	63606	428537	234452	97043	97043	9266058
27	**Rabi 2012-13**	12697000	16434227	2852044	156640	96403	56531	39872	316720	168247	74236	74236	6719497
	TOTAL 2012-13	33416922	45491978	7348698	430420	230371	126894	103478	745257	402699	171279	171279	15985555
28	**Kharif 2013**	20962252	27678659	4945420	308824	155273	83223	72050	515089	268101	123494	123494	10602379
29	**Rabi 2013-14**	12273389	15060746	2985671	165534	73049	42476	30574	239208	167697	35755	35755	5586993
	TOTAL 2013-14	33235641	42739405	7931090	474358	228323	125699	102624	754297	435798	159250	159250	16189372
30	**Kharif 2014**	23750272	28181645	4712085	335134	152625	78585	74039	477291	301724	87783	87783	12629178
31	**Rabi 2014-15**	13175160	17216710	3435291	159050	71763	42728	29035	325550	194462	65544	65544	6218559
	TOTAL 2014-15	36925432	45398355	8147376	494184	224388	121313	103074	802841	496187	153327	153327	18847737
32	**Kharif 2015**	28073308	29252288	5836238	330797	129233	67586	61647	15809	15809	0	0	172801
KHARIF SEASONS TOTAL		**249196320**	**349335816**	**40068766**	**2027627**	**753832**	**395767**	**358065**	**3449242**	**1352278**	**1051104**	**1045873**	**76965079**
RABI SEASONS TOTAL		**101512053**	**140934812**	**19470832**	**874718**	**434204**	**251540**	**182663**	**1636389**	**841538**	**396843**	**398014**	**39094748**
GRAND TOTAL		**350708373**	**490270629**	**59539598**	**2902345**	**1188035**	**647307**	**540728**	**5085631**	**2193816**	**1447947**	**1443886**	**116059827**

Source: Department of Agriculture, Cooperation & Farmers Welfare (Credit Division).

Annexure 4.1: Statewise Allocation and Release of funds under Normal RKVY

Sl. No.	Name of the States	Normal RKVY		Sub Schemes							
		Allocation Normal RKVY	Release Normal RKVY	BGREI		Crop Diversification		NMPS		Saffron Mission	
				Allocation	Release	Allocation	Release	Allocation	Release	Allocation	Release
1	Andhra Pradesh	246.95	233.43					11.37	11.37		
2	Arunachal Pradesh	15.83	7.92					10.00	5.00		
3	Assam	360.53	174.71	106.00	76.00			11.00	11.00		
4	Bihar	391.73	391.73	151.00	151.00			15.82			
5	Chhattisgarh	204.56	201.12	161.00	120.75			9.88	9.88		
6	Goa	22.13						2.50			
7	Gujarat	577.05	288.53					13.50			
8	Haryana	226.03	183.02			124.00	58.10	10.00	5.00		
9	Himachal Pradesh	73.79	73.79					9.32	9.32		
10	Jammu & Kashmir	32.50	16.25					12.00	6.00	100.00	50.00
11	Jharkhand	216.66	108.33	77.00	38.50			13.28	6.32		
12	Karnataka	860.89	625.38					15.28			
13	Kerala	301.40	280.70					11.00	11.00		
14	Madhya Pradesh	522.55	496.47					17.00	11.31		
15	Maharashtra	830.99	747.09					17.50	17.50		
16	Manipur	36.85	36.85					4.15	4.15		
17	Meghalaya	64.77	56.64					3.00	3.00		
18	Mizoram	103.42	103.42					8.50	8.50		
19	Nagaland	43.75	43.75					6.50	6.50		
20	Odisha	290.93	268.87	184.00	184.00			15.20	15.20		
21	Punjab	248.71	248.71			250.00	155.00	10.00	10.00		
22	Rajasthan	716.55	683.28					12.00	6.00		
23	Sikkim	11.48	5.74					4.00	2.00		
24	Tamil Nadu	279.95	279.95					14.00	14.00		
25	Telangana	180.89	165.27					8.13	8.13		
26	Tripura	72.27	72.27					7.00	7.00		
27	Uttar Pradesh	463.93	431.97	148.00	110.00	75.00	37.50	10.00	3.83		
28	Uttarakhand	90.39	79.70					4.00			
29	West Bengal	401.54	390.77	171.00	165.50			14.07	14.07		
30	Other Expenditure on sub-schems/Savings			2.00		51.00					
	Total	7889.02	6695.66	1000.00	845.75	250.00	250.60	300.00	206.07	100.00	50.00
31	Administrative Expenses		77.97		0.09						
	Grand Total	7889.02	6773.63	1000.00	845.84	# 250.00	250.60	300.00	206.07	100.00	50.00

Rs. 6.00 Crore Allocation for Delhi. # Allocaton adjusted additional fund of Rs. 250.00 crore will be asked at a later stage.

Rs. 100.00 crore under the AFDP will be meet from overall saving of the Normal and Sub-Schemes.

Source: Department of Agriculture, Cooperation & Farmers Welfare.

and Sub-schemes for 2014-15 as on 09.12.2015 (Release as on 31.03.2015)

(Rs. in Crore)

						Total Allocation and Release					Utilization		
VIIDP		VIUC		AFDP #		Total Allocations for Sub Schemes	Total Allocation (Normal +Sub Schemes + Adm. Exp.)	Total Release (Sub-Schemes)	Total Release (Normal +Sub Scheme)	% of Release	UC Rcvd	% of Utilization	UC Pending
Allocation	Release	Allocation	Release	Allocation	Release								
		8.75	8.75	10.00	10.00	20.12	267.07	30.11	263.54	98.68%	263.54	100.00%	0.00
		2.00	1.00			12.00	27.83	6.00	13.92	50.02%	13.92	100.00%	0.00
		6.00	6.00			123.00	483.53	93.00	267.71	55.37%	175.69	65.63%	92.02
		6.00	3.00			172.82	564.55	154.00	545.73	96.67%	403.20	73.88%	142.53
		10.00	10.00			180.88	385.44	140.63	341.75	88.66%	341.75	100.00%	0.00
		1.00				3.50	25.63	0.00	0.00	0.00%	0.00	0.00%	0.00
		3.00	1.50			16.50	593.55	1.50	290.03	48.86%	254.45	87.73%	35.58
		12.00	6.00	5.12	2.56	146.00	372.03	71.66	254.68	68.46%	152.50	59.88%	102.18
		3.00	3.00			12.32	86.11	12.32	86.11	100.00%	86.11	100.00%	-0.00
		6.00	6.00			118.00	150.50	62.00	78.25	51.99%	31.79	40.63%	46.46
						90.28	306.94	44.82	153.15	49.90%	96.59	63.07%	56.56
		8.00	3.00	7.68	3.84	23.28	884.17	6.84	632.22	71.50%	543.07	85.90%	89.15
		9.00	9.00			20.00	321.40	20.00	300.70	93.56%	287.31	95.55%	13.39
		8.00	4.00			25.00	547.55	15.31	511.78	93.47%	444.47	86.85%	67.31
150.00	150.00	15.00	15.00	12.50	12.50	182.50	1013.49	195.00	942.09	92.96%	312.57	33.18%	629.52
		2.00	2.00			6.15	43.00	6.15	43.00	100.00%	43.00	100.00%	0.00
		1.00	1.00			4.00	68.77	4.00	60.64	88.18%	34.19	56.38%	26.45
		2.00	2.00			10.50	113.92	10.50	113.92	100.00%	113.92	100.00%	0.00
		2.50	2.50			9.00	52.75	9.00	52.75	100.00%	52.75	100.00%	0.00
		14.00	14.00			213.20	504.13	213.20	482.07	95.62%	462.64	95.97%	19.43
						260.00	508.71	165.00	413.71	81.33%	156.13	37.74%	257.58
		12.00	6.00			24.00	740.55	12.00	695.28	93.89%	687.24	98.84%	8.04
		3.50	1.75			7.50	18.98	3.75	9.49	50.00%	7.94	83.67%	1.55
		5.00	5.00			19.00	298.95	19.00	298.95	100.00%	298.95	100.00%	0.00
		6.25	6.25			14.38	195.27	14.37	179.64	92.00%	179.64	100.00%	0.00
		1.00	1.00			8.00	80.27	8.00	80.27	100.00%	62.83	78.27%	17.44
		8.00	4.00	4.33	2.17	241.00	704.93	157.50	589.47	83.62%	439.67	74.59%	149.80
		1.00	1.00			5.00	95.39	1.00	80.70	84.60%	71.24	88.28%	9.46
		12.00	12.00			197.07	598.61	191.57	582.34	97.28%	475.24	81.61%	107.10
		6.00				59.00		0.00	0.00				0.00
150.00	150.00	174.00	134.74	39.63	31.07	1974.00	9864.02	1668.23	8363.89	84.79%	6492.34	77.62%	1871.55
		1.00	1.25			1.00	90.00	1.34	79.31	88.12%			
150.00	150.00	175.00	135.99	39.63	31.07	1975.00	9954.02	1669.57	8443.20	84.82%	6492.34	76.89%	1950.86
							Total Release		84.82%				

Annexure 4.2: Statewise Allocation and Release of funds under Normal

Sl. No.	Name of the States	Normal RKVY		BGREI		Crop Diversification		Saffron Mission		VIIDP	
		Allocation Normal RKVY	Release Normal RKVY	Allocation	Release	Allocation	Release	Allocation	Release	Allocation	Release
1	Andhra Pradesh	187.51	83.10			7.87					
2	Arunachal Pradesh	31.55	15.77								
3	Assam	75.07	67.60	53.00	26.50						
4	Bihar	88.69	73.45	75.50	37.75	0.67					
5	Chhattisgarh	68.65	38.35	80.50	40.25						
6	Goa	43.40	21.70								
7	Gujarat	174.55	108.20			7.54					
8	Haryana	93.35	46.68			49.75	24.88				
9	Himachal Pradesh	28.30	14.15								
10	Jammu & Kashmir	24.72	12.36					50.00	25.00		
11	Jharkhand	49.18	40.63	38.50	19.25						
12	Karnataka	341.44	170.72			6.00					
13	Kerala	91.86	56.52								
14	Madhya Pradesh	263.60	131.80								
15	Maharashtra	363.00	181.50			0.11				75.00	37.50
16	Manipur	20.46	10.23								
17	Meghalaya	16.52									
18	Mizoram	16.61	19.39								
19	Nagaland	25.25	12.63								
20	Odisha	193.18	96.59	92.00	46.00	0.09					
21	Punjab	140.94	70.47			75.00	37.50				
22	Rajasthan	337.63	168.82								
23	Sikkim	24.35									
24	Tamil Nadu	259.74	129.87			0.20					
25	Telangana	129.91	64.96			0.39					
26	Tripura	21.54	13.55								
27	Uttar Pradesh	280.81	86.99	74.00	37.00	1.43					
28	Uttarakhand	40.03	20.02								
29	West Bengal	199.06	99.53	85.50	42.75	0.70					
	Total States	3630.90	1855.58	499.00	249.50	149.75	62.38	50.00	25.00	75.00	37.50
30	Andman & Nicobar	4.70									
31	Chandigarh	0.31									
32	D & N Haveli	5.43									
33	Daman & Diu	0.94									
34	Lakshadweep	0.63									
35	Delhi	1.50									
36	Puducherry	1.51									
	Total Uts	15.02									
	National Level/Yet to be allocated(BGREI)	29.08	0.10	1.00	0.17	0.25					
	Grand Total (States+Uts+Other)	3675.00	1855.68	500.00	249.67	150.00	62.38	50.00	25.00	75.00	37.50

Note : Rs.50.00 crore for AFDP. (State-wise break-up of AFDP will be provided by the concerned Division's)

Source: Department of Agriculture, Cooperation & Farmers Welfare.

RKVY and Sub-schemes for 2015-16 as on 08.12.2015

(Rs. in Crore)

AFDP		Allocation Total		Release Total			UC Recvd	UC Pending	% of Utilization	Total Unspent of State (2007-08_to_2014-15)
Allocation	Release	Sub-Schemes	Total	Sub-Schemes	Total (Sub-Scheme + Normal RKVY)	% of Release against allocation				
		7.87	195.38	0.00	83.10	42.53%	0.00	83.10	0.00%	19.14
		0.00	31.55	0.00	15.77	49.98%	0.00	15.77	0.00%	-0.00
		53.00	128.07	26.50	94.10	73.48%	0.00	94.10	0.00%	104.42
		76.17	164.86	37.75	111.20	67.45%	0.00	111.20	0.00%	163.04
		80.50	149.15	40.25	78.60	52.70%	52.90	25.70	67.30%	7.88
		0.00	43.40	0.00	21.70	50.00%	0.00	21.70	0.00%	5.54
		7.54	182.09	0.00	108.20	59.42%	0.00	108.20	0.00%	35.58
		49.75	143.10	24.88	71.56	50.01%	0.00	71.56	0.00%	103.88
		0.00	28.30	0.00	14.15	50.00%	0.00	14.15	0.00%	-0.00
		50.00	74.72	25.00	37.36	50.00%	0.00	37.36	0.00%	53.08
		38.50	87.68	19.25	59.88	68.29%	0.00	59.88	0.00%	69.90
12.50	6.25	18.50	359.94	6.25	176.97	49.17%	0.00	176.97	0.00%	89.91
		0.00	91.86	0.00	56.52	61.53%	0.00	56.52	0.00%	14.77
		0.00	263.60	0.00	131.80	50.00%	69.18	62.62	52.49%	67.31
		75.11	438.11	37.50	219.00	49.99%	0.00	219.00	0.00%	629.52
		0.00	20.46	0.00	10.23	50.00%	0.00	10.23	0.00%	-0.00
		0.00	16.52	0.00	0.00	0.00%	0.00	0.00	0.00%	26.48
		0.00	16.61	0.00	19.39	116.74%	0.00	19.39	0.00%	-0.00
		0.00	25.25	0.00	12.63	50.02%	0.00	12.63	0.00%	0.00
		92.09	285.27	46.00	142.59	49.98%	83.34	59.25	58.45%	34.56
		75.00	215.94	37.50	107.97	50.00%	0.00	107.97	0.00%	257.58
		0.00	337.63	0.00	168.82	50.00%	69.16	99.66	40.97%	14.33
		0.00	24.35	0.00	0.00	0.00%	0.00	0.00	0.00%	1.54
		0.20	259.94	0.00	129.87	49.96%	52.49	77.38	40.42%	0.00
		0.39	130.30	0.00	64.96	49.85%	27.55	37.41	42.41%	0.00
		0.00	21.54	0.00	13.55	62.91%	0.00	13.55	0.00%	17.44
		75.43	356.24	37.00	123.99	34.81%	0.00	123.99	0.00%	185.39
		0.00	40.03	0.00	20.02	50.01%	2.11	17.91	10.54%	33.12
		86.20	285.26	42.75	142.28	49.88%	0.00	142.28	0.00%	107.10
50.00	6.25	823.75	4454.65	380.63	2236.21	50.20%	356.73	1879.48	15.95%	2041.52
			4.70							
			0.31							
			5.43							
			0.94							
			0.63							
			1.50							
			1.51							
			15.02							
		1.25	29.08	0.17	0.27		0.00	0.27		
50.00	6.25	825.00	4500.00	380.80	2236.48	49.70%	356.73	1879.75		2041.52

Annexure 5.1 : Minimum Support Prices
(According to crop year)

(As on 12.11.2015)
(Rs. per quintal)

Sl. No.	Commodity	Variety	2011-12	2012-13	2013-14	2014-15	(#) increase in MSP 2014-15 over 2013-14	2015-16	(#) increase in MSP 2015-16 over 2014-15
	KHARIF CROPS								
1	PADDY	Common	1080	1250	1310	1360	50(3.8)	1410	50(3.7)
		Grade 'A'	1110	1280	1345	1400	55(4.1)	1450	50(3.6)
2	JOWAR	Hybrid	980	1500	1500	1530	30(2.0)	1570	40(2.6)
		Maldandi	1000	1520	1520	1550	30(2.0)	1590	40(2.6)
3	BAJRA		980	1175	1250	1250	-	1275	25(2.0)
4	MAIZE		980	1175	1310	1310	-	1325	15(1.1)
5	RAGI		1050	1500	1500	1550	50(3.3)	1650	100(6.5)
6	ARHAR(Tur)		3200¶	3850	4300	4350	50(1.2)	4425^	75(1.7)
7	MOONG		3500¶	4400	4500	4600	100(2.2)	4650^	50(1.1)
8	URAD		3300¶	4300	4300	4350	50(1.2)	4425^	75(1.7)
9	COTTON	Medium Staple	2800[a]	3600	3700	3750	50(1.4)	3800	50(1.3)
		Long Staple	3300[aa]	3900	4000	4050	50(1.3)	4100	50(1.2)
10	GROUNDNUT IN SHELL		2700	3700	4000	4000	-	4030	30(0.8)
11	SUNFLOWER SEED		2800	3700	3700	3750	50(1.4)	3800	50(1.3)
12	SOYABEEN	Black	1650	2200	2500	2500	-	-	-
		Yellow	1690	2240	2560	2560	-	2600$$	40(1.6)
13	SESAMUM		3400	4200	4500	4600	100(2.2)	4700	100(2.2)
14	NIGERSEED		2900	3500	3500	3600	100(2.9)	3650	50(1.4)
	RABI CROPS								
15	WHEAT		1285	1350	1400	1450	50(3.6)	1525	75(5.2)
16	BARLEY		980	980	1100	1150	50(4.5)	1225	75(6.5)
17	GRAM		2800	3000	3100	3175	75(2.4)	3425**	250(7.9)
18	MASUR (LENTIL)		2800	2900	2950	3075	125(4.2)	3325**	250(8.1)
19	RAPESEED/MUSTARD		2500	3000	3050	3100	50(1.6)	3350	250(8.0)
20	SAFFLOWER		2500	2800	3000	3050	50(1.7)	3300	250(8.2)
21	TORIA		2425	2970	3020	3020	-		
	OTHER CROPS								
22	COPRA	Milling	4525	5100	5250	5250	-	5550	300(5.7)
	(Calender Year)	Ball	4775	5350	5500	5500	-	5830	330(6.0)
23	DE-HUSKED COCO-NUT (Calender Year)		1200	1400	1425	1425	-	1500	75(5.3)
24	JUTE		1675	2200	2300	2400	100(4.3)	2700	300(12.5)
25	SUGARCANE*		145.00	170.00	210.00	220.00	10(4.8)	230.00	10(4.5)

Figures in brackets indicate percentage increase.
* Fair and remunerative price.
¶ Additional incentive at the rate of Rs. 500 per quintal of tur, urad and moong sold to procurement agencies was payable during the harvest/arrival period of two months.
[a] Staple length (mm) of 24.5 - 25.5 and Micronaire value of 4.3 - 5.1
[aa] Staple length (mm) of 29.5 - 30.5 and Micronaire value of 3.5 - 4.3
^ Bonus of Rs. 200 per quintal is payable over and above the Minimum Support Price .
$$ Single Minimum Support Price has been fixed irrespective of the variety.
** Bonus of Rs. 75 per quintal is payable over and above the Minimum Support Price .

Source: Department of Agriculture, Cooperation & Farmers Welfare.

Annexure 5.2: Details of MIS implemented during 2013-14, 2014-15 and 2015-16 (as on 16.11.2015)

S.No.	Year	Commodity	MIP (Rs. Per MTs)	State	Sanctioned Qty. (in MTs)
1	2013-14 (01.08.2013 to 21.10.2013)	C-grade apple	6500/-	Himachal Pradesh	27,000
2	2013-14 (01.08.2013 to 31.08.2013)	Pineapple	8,500/-	Nagaland	12,675
3	2013-14 (20.02.2014 to 20.03.2014)	Potato	3,750/-	Uttar Pradesh	100,000
4	2014-15 (01.05.2014 to 16.06.2014)	Chilli	4,200/-	Mizoram	2,850
5	2014-15 (15.08.2014 to 15.10.2014)	'C' grade apple	6,500/-	Himachal Pradesh	27,000
6	2014-15 (25.11.2014 to 25.12.2014)	Ginger	9,050/-	Nagaland	32,000
7	2015-16 (20.05.2015 to 20.06.2015)	Potato	4,250/-	Uttar Pradesh	100,000

Source: Department of Agriculture, Cooperation & Farmers Welfare .

Annexure 8.1: 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	1832	27.5	-	752
1955-56	19	1908	27.5	-	839
1960-61	20	2881	28.7	-	1160
1968-69	21.2	5300	29.8	-	-
1973-74	23.2	7755	30.1	-	1958
1979-80	30.4	9523	30.9	-	2340
1980-81	31.6	10060	32	-	2442
1981-82	34.3	10876	33.1	-	2444
1982-83	35.8	11454	34.5	-	2367
1983-84	38.8	12792	36.1	-	2506
1984-85	41.5	14252	38	-	2801
1985-86	44	16128	39.1	-	2876
1986-87	46.1	17310	40	-	2942
1987-88	46.7	17795	40.1	-	2959
188-89	48.4	18980	40.8	-	3152
1989-90	51.4	20204	41.7	-	3677
1990-91	53.9	21101	41.2	-	3836
1991-92	55.7	21983	41.6	-	4157
1992-93	58	22929	38.8	-	4365
1993-94	60.6	24167	39.9	-	4644
1994-95	63.8	25975	40.6	-	4789
1995-96	66.2	27198	42.4	-	4949
1996-97	69.1	27496	44.4	-	5348
1997-98	72.1	28689	45.6	-	5388
1998-99	75.4	29476	46.9	1.9	5298
1999-2000	78.3	30447	47.9	1.9	5675
2000-2001	80.6	36632	48.4	1.9	5656
2001-2002	84.4	38729	49.5	1.9	5926
2002-2003	86.2	39823	50.5	2.1	6200
2003-2004	88.1	40403	48.5	2.1	6399
2004-2005	92.5	45201	44.6	2.2	6305
2005-2006	97.1	46235	44.9	2.3	6572
2006-2007	102.6	50663	45.1	2.3	6869
2007-2008	107.9	53583	43.9	4	7127
2008-2009	112.2	55562	42.8	4.3	7616
2009-2010	116.4	60267	43.1	4.6	7998
2010-2011	121.8	63024	43	4.8	8231
2011-2012	127.9	66450	44.7	5.5	8666
2012-2013	132.4	69731	46.1	5.9	9040
2013-2014	137.7	74752	47.9	6.2	9574
2014-2015(P)	146.3	78484	48.1	6.7	10072

- Not Available (P) = Provisional
Note: Meat Production from Commercial Poultry Farm is included from 2007-08.

Source: Department of Animal Husbandary, Dairying and Fisheries.

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