State of Indian Agriculture 2012-13






सत्यमेव जयते

Government of India
Ministry of Agriculture
Department of Agriculture & Cooperation
New Delhi

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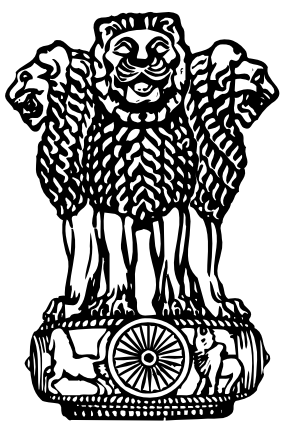

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List of Abbreviations/Acronyms

Abbreviation	Meaning
A.I.	Artificial Insemination
AAGR	Average Annual Growth Rate
AAS	Agro-Meteorological Advisory Service
ACA	Additional Central Assistance Scheme
ACABC	Agri-Clinics and Agri-Business Centres
ADB	Asian Development Bank
ADWDRS	Agricultural Debt Waiver and Debt Relief Scheme
AFC	Agricultural Finance Corporation
AGDP	Agriculture Gross Domestic Product
AIC	Agricultural Insurance Company
AICRP	All India Co-ordinated Research Project
AICVIP	All India Co-ordinated Vegetable Improvement Project
AIR	All India Radio
Al	Aluminium
AMDP	Accelerated Maize Development Programme
AMFUs	Agro-Met Field Units
AMIGS	Agricultural Marketing Infrastructure, Grading and Standardization Scheme
AMIS	Agricultural Market Information System
APMC	Agricultural Produce Marketing Committee
ARU	Audience Research Unit
ASEAN	Association of South East Asian Nations
ATMA	Agriculture Technology Management Agency
AU	Agricultural University
AWS	Automatic Weather Stations
BB	Bacterial Blight
BCM	Billion Cubic Meters
BGREI	Bringing Green Revolution in Eastern India
BIMSTEC	Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
BISA	Borlaug Institute of South Asia
BMC	Bulk Milk Cooler
BPD	Business Planning and Development (units)
BRICS	Brazil, Russia, India, China & South Africa

Bt	Bacillus thuringenesis
BTT	Block Technology Team
Ca	Calcium
CA	Controlled Atmosphere
CAA&A	Controller of Aid Accounts & Audit
CACP	Commission for Agricultural Costs & Prices
CAFTs	Centre of Advanced Faculty Training
CAGR	Compound Annual Growth Rates
CAV	Chicken Anaemia Virus
CAZRI	Central Arid Zone Research Institute
CBA	Capture Based Aquaculture
CCEA	Cabinet Committee on Economic Affairs
CDAP	Comprehensive District Agriculture Plan
CECA	Comprehensive Economic Cooperation Agreement
CEO	Chief Executive Officer
CEPA	Comprehensive Economic Partnership Agreement
CFBs	Corrugated Fibreboard Boxes
CFDO	Central Fodder Development Organization
CFSPF	Central Fodder Seed Production Farm
CGMS	Cytoplasmic Male Sterility
CIAE	Central Institute of Agricultural Engineering
CIB&RC	Central Insecticides Board & Registration Committee
CIFE	Central Institute of Fisheries Education
CIFRI	Central Inland Fisheries Research Institute
CIFT	Central Institute of Fisheries Technology
CIL	Central Insecticides Laboratory
CIMMYT	International Maize and Wheat Improvement Centre
CIPMCs	Central Integrated Pest Management Centers
CLRDV	Cotton Leaf Roll Dwarf Virus
CMTP	Central Minikit Testing Programme
CMU	Central Monitoring Unit
CORD-M	Centre for Organizational Research & Development in Management
CRICOT	Central Institute for Research on Cotton Technology
CRIDA	Central Research Institute for Dryland Agriculture
CRRI	Central Rice Research Institute
CSC	Central Seed Committee

CSO	Central Statistical Organisation
CSSRI	Central Soil Salinity Research Institute
CSTLs	Central Seed Testing Laboratories
CSWCRTI	Central Soil and water Conservation Research and Training Institute
CT	Computed Tomography
CV	Coefficient of Variation
CWWG	Crop Weather Watch Group
DAAPs	District Agriculture Action Plans
DAC	Department of Agriculture and Cooperation
DADF	Department of Animal Husbandry, Dairying & Fisheries
DAP	Di-ammonium Phosphate
DARE	Department of Agricultural Research and Extension
DCFR	Directorate of Coldwater Fisheries Research
DCFR	Directorate of Coldwater Fisheries Research
DDP	Desert Development Programme
DEDS	Dairy Entrepreneurship Development Scheme
DES	Directorate of Economics and Statistics
DFQF	Duty Free Quota Free
DG	Director General
DHA	Docosahexaenoic Acid
DIVA	Differentiation of Infected and Vaccinated Animals
DLC	District Level committees
DNA	Deoxyribo Nucleic Acid
DPAP	Drought Prone Area Programme
DPPQ&S	Directorate of Plant Protection, Quarantine & Storage
DPQS	Development and Strengthening of Infrastructure Facilities for Production and Distribution of Quality Seeds
DSS	Decision Support System
DVCF	Dairy Venture Capital Fund
DWM	Directorate of Water Management
DWSR	Directorate of Weed Science Research
EAPs	Externally Aided Projects
EDP	Entrepreneurship Development Programmes
EFTA	European Free Trade Agreement
EOI	Expression of Interest
EOU	Export Oriented Unit

EPA	Eicosapetaenoic Acid
EPCG	Export Promotion Capital Goods Scheme
EPD	Electronic Data Processing
ERFS	Extended Range Forecast System
ESVHD	Establishment and Strengthening of existing Veterinary Hospitals and Dispensaries
et al.	Et alii (and others)
ETT	Embryo Transfer Technology
EXIM	Export Import
F&V	Fruit and Vegetables
FAO	Food and Agriculture Organization
FASAL	Forecasting Agricultural Output using Space, Agro meteorology and Land based observations
FCO	Fertilizer Control Order
FDI	Foreign Direct Investment
Fe	Iron
FFDA	Fish Farmers Development Authority
FFSs	Farmers' Field Schools
FI	Financial Institution
FICCI	Federation of Indian Chambers of Commerce and Industry
Fig.	Figure
FLD	Frontline demonstration
FM	Frequency Modulation
FMD	Foot & Mouth Disease
FPI	Food Direct Investment
FPO	Farmer Producer Organizations
FPT	Field Progeny Testing
FPTC	Food Processing Training Centres
FQCL	Fertilizer Quality Control Laboratories
FTAs	Free Trade Agreements
FYM	Farm Yard Manure
FYP	Five Year Plan
GAPs	Good Agricultural Practices
GBPUAT	Govind Ballabh Pantnagar University of Agriculture and Technology
GCF	Gross Capital Formation
GDP	Gross Domestic Product

GHGs	Green House Gases
GHP	Good Hygiene Practices
GHP	Good Horticultural Practice
GIS	Geographical Information System
GM	Genetically modified
GME	Green Mussel Extract
GMP	Good Manufacturing Practices
GOI	Government of India
GPS	Ground Positioning System
GR	Gypsum Requirement
GSDP	Gross State Domestic Product
GTZ	German Technical Cooperation
HACCP	Hazard Analysis and Critical Control Points
HMNEHS	Horticulture Mission for North East & Himalayan States
HRD	Human Resource Development
HSADL	High Security Animal Disease Laboratory
HSIIC	Haryana State Industrial & Infrastructure Development Corporation Ltd.
HYVs	High Yielding Varieties
IBSA	India, Brazil, South Africa
ICAR	Indian Council of Agricultural Research
ICAR	India Council of Agricultural Research
ICAR RCER	ICAR Research Complex for Eastern Region
ICAR RCGOA	ICAR Research Complex for Goa
ICAR RCNEH	ICAR Research Complex for North Eastern Hill region
ICICI	Industrial Credit and Investment Corporation of India
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	Information and Communication Technology
ICT	Information and Communication Technology
IDA	International Development Agency
IDWG	Inter-Departmental Working Group
IFAD	International Fund for Agriculture Development
IFS	Integrated Farming System
IGPB	Indian Grape Processing Board
IICPT	Indian Institute of Crop Processing Technology
IIPR	Indian Institute of Pulses Research

IISS	Indian Institute of Soil Science
IMD	Indian Metrological Department
IPM	Integrated Pest Management
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
IPR	Intellectual Property Rights
IPRs	Intellectual Property Rights
IQR	Individual Quick Freeze
IRIWI	International Research Initiative for Wheat Improvement
ISO	International Organisation of Standardization
ISOPOM	Integrated Scheme of Oilseeds, Pulses, Oil palm and Maize
ITDP	Integrated Tribal Development Programme
ITDP	Institute of Transportation and Development Policy
IVF	In vitro Fetilization
IVLP	Institute Village Linking Programme
IVR	Interactive Voice Response
IVRI	Indian Veterinary Research Institute
IWDP	Integrated Wastelands Development Programme
IWM	Integrated Water Management
IWMP	Integrated Watershed Management Programme
JBE-SSD	Juvenile Bycatch Excluder cum Shrimp Sorting Device
JFMCs	Joint Forest Management Committees
JICA	Japan International Cooperation Agency
JRF	Junior Research Fellowship
K	Potassium
KCC	Kisan Call Centre/Kisan Credit Cards
kg	kilogram
KVASU	Kerala Veterinary and Animal Science University
KVK	Krishi Vigyan Kendra
LAMP	Loop Assisted Amplification
LPA	Long Period Average
LTFE	Long Term Fertilizer Experiment
LWO	Locust Warning Organization
MA	Modified Atmosphere
MANAGE	National Institute of Agricultural Extension Management
MAS	Molecular marker-assisted selection

MAS	Markers Assisted Selection
MBM	Meat-cum-Bone Meal
MF	Military Farms
MFPS	Mega Food Parks Scheme
Mg	Magnesium
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
mha	Million hectares
MIP	Market Intervention Price
MIS	Market Intervention Scheme
MMA	Macro Management of Agriculture
MNAIS	Modified National Agricultural Insurance Scheme
Mo	Molybdenum
MOA	Ministry of Agriculture
MOET	Multi Ovulation Embryo Transfer Technology
MOFPI	Ministry of Food Processing Industries
MOP	Muriate of Potash
MOU	Memorandum of Understanding
MPFD	Madhya Pradesh Forest Department
MRI	Magnetic Resonance Imaging
MRIN	Market Research Information Network
MRP	Mixed Recall period
MSN	Micro and Secondary Nutrients
MSP	Minimum Support Price/Minimum Standard Protocol
MT	Metric Tonnes
MTCs	Model Training Courses
N	Nitrogen
NAARM	National Academy of Agricultural Research Management
NAAS	National Academy of Agricultural Sciences
NABARD	National Bank for Agricultural and Rural Development
NABARD	National Bank for Agriculture and Rural Development
NABL	National Accreditation Board for Testing and Calibration Laboratories
NADRS	National Animal Disease Reporting System
NAE	Niche Area of Excellence
NAFED	National Agricultural Cooperative Marketing Federation
NAIP	National Agricultural Innovative Project

NAIS	National Agricultural Insurance Scheme
NAMA	Non Agricultural Market Access
NAPCC	National Action Plan on Climate Change
NARP	National Agricultural Research Project
NARS	National Agricultural Research System
NAS	National Accounts Statistics
NBAGR	National Bureau of Animal Genetic Resources
NBFGR	National Bureau of Fish Genetic Resources
NBSSLUP	National Bureau of Soil Survey and Land Use Planning
NBSSLUP	National Bureau of Soil Survey and Land Use Planning
NCAP	National Centre for Agricultural Economics and Policy Research
NCDC	National Cooperative Development Corporation
NCIPM	National Center for Integrated Pest Management
NCR	National Capital Region
NDC	National Development Council
NDDB	National Dairy Development Board
NE	North-East
NeGP-A	National e Governance Plan in Agriculture
NEPZ	North Eastern Plain Zone
NFSM	National Food Security Mission
NGO	Non-Governmental Organization
NHM	National Horticulture Mission
NIASM	National Institute of Abiotic Stress Management
NIC	Nation Informatics Centre
NIC	National Industrial Classification
NICRA	National Initiative for Climate Resilient Agriculture
NIFTEM	National Institute of Food Technology, Entrepreneurship & Management
NIPHM	National Institute of Plant Health Management
NISAGENET	National Information System on Agricultural Education Network in India
NLAs	National Level Agencies
NMAM	National Mission on Agricultural Mechanisation
NMPPB	National Meat and Poultry Processing Board
NMPS	National Mission for Protein Supplements
NMSA	National Mission for Sustainable Agriculture

NMSA	National Mission on Sustainable Agriculture
NPCBB	National Project for Cattle and Buffalo Breeding
NPIL	National Pesticides Investigational Laboratory
NPMSH&F	National Project on Management of Soil Health & Fertility
NPPTI	National Plant Protection Training Institute
NPRR	National Pesticide Reference Repository
NPSD	New Policy on Seed Development
NPV	Nuclear Polyhedrosis Viruses
NRC	National Research Centre
NRC	National Research Centre
NRCAF	National Research Centre for Agroforestry
NRCE	National Research Centre on Equines
NRM	Natural Research Management
NSC	National Seeds Corporation
NSRTC	National Seed Research and Training Centre
NSS	National Sample Survey
NSSO	National Sample Survey Organisation
NTIs	Nodal Training Institutes
NWDPRA	National Watershed Development Project for Rainfed Areas
NWPZ	North Western Plain Zone
OECD	Organization for Economic Cooperation and Development
OFT	On Farm Trial
OFT	On-Farm Trial
OPAE	Oil Palm Area Expansion
OPDP	Oil Palm Development Programme
OPex	Neutraceutical Oyster Peptide
OPP	Oilseeds Development Programme
OTS	One Time Settlement
P	Prosperous
PACS	Primary Agricultural Credit Societies
PAG	Pregnancy Associated Glycoprotein
PCP	Pentachlorophenol
PCR	Polymerase Chain Reaction
PCR	Polymerase Chain Reaction
PDADMAS	Project Directorate on Animal Disease Monitoring and Surveillance
PDC	Project Directorate on Cattle

PDFMD	Project Directorate on Foot and Mouth Disease
PDFSR	Project Directorate on Farming System Research
PDP	Professional Development Programme
PDS	Public Distribution System
PFDC	Precision Farming Development Centre
PG	Post Graduation
PHM	Post Harvest Management
PHTM	Post Harvest Technology and Management
PKS	Polyketide Synthase
PMTs	Project Management Teams
PNA	Peptide Nucleic Acids
PPP	Public Private Partnerships
PPR	Peste des Petits Ruminants
PPR	Peste des Petits Ruminants
PPRC	Paddy Processing Research Centre
PPV&FR	Protection of Plant Varieties and Farmers' Rights
PQSs	Plant Quarantine Stations
PRAP	Participatory Action Research Programme
PSCs	Phytosanitary certificates
PSS	Price Supports Scheme
PTAs	Preferential Trading Agreements
PUFAs	Polyunsaturated Fatty Acids
PZ	Peninsular Zone
QTL	Quantitative Trait Loci
R& D	Research and Development
R&D	Research and Development
RADP	Rainfed Area Development Programme
RBH	Rural Business Hubs
RC	Registration Committee
RDIMS	RKVY Database and Management Information System
RFID	Radio Frequency Identification
RIDF	Rural Infrastructure Development Fund
RKVY	Rashtriya Krishi Vikas Yojna
RPQS	Regional Plant Quarantine Stations
RPTLs	Regional Pesticides Testing Laboratories
RRBs	Regional Rural Banks

RSFP&D	Regional Stations for Forage Production and Demonstration
RTPCR	Rapid or Real Time Polymerase Chain Reaction
RT-PCR	Reverse Transcription Polymer Chain Reaction
RVP & FPR	Soil Conservation in the Catchments of River Valley Project & Flood Prone River
SAARC	South Asian Association for Regional Cooperation
SAMCs	State Meteorological Centres
SAMETI	State Agricultural Management & Extension Training Institutes
SAS	Statistical Analysis System
SAU	State Agricultural University
SAUs	State Agricultural Universities
SCH	Single Cross Hybrids
SDA	Scheduled Desert Area
Se	Selenium
SEWP	State Extension Work Plan
SFCI	State Farms Corporation of India
SHPIs	Self Help Promoting Institutions
Si	Silicon
SKUAS&T	Sher-e- Kashmir University of Agricultural Science and Technology
SKUAST	Sher-e- Kashmir University of Agricultural Science and Technology
SLC	State Level committees
SLSC	State Level Sanctioning Committee
SLUB	State Land Use Board
SME	Small and Medium Enterprises
SMI	Soil Moisture Indicator
SMS	Short Message Service
SNPs	Single Nucleotide Polymorphisms
SOC	Soil Organic Carbon
SRF	Senior Research Fellowship
SRI	System of Rice Intensification
SRR	Seed Replacement Rates
SSCAs	State Seed Certification Agencies
SSCs	State Seed Corporations
SSGs	States Specific Grants
SSM	Special Safeguard Mechanism
STCCS	Short Term Cooperative Credit Structure

STCR	Soil Test and Crop Response
STLs	Soil Testing Laboratories/Seed Testing Laboratories
SW	South West
TAR	Technology Assessment and Refinement
TERI	The Energy & Resources Institute
TFGs	Tenant Farmers Groups
TMNE	Technology Mission for Integrated Development of Horticulture in North Eastern States including Sikkim
TMO	Technology Mission on Oilseeds
TN	Tamil Nadu
TPDS	Targeted Public Distribution Scheme
TVEs	Town and Village Enterprises
UG	Under Graduate
UNESCAP	United Nation Economic and Social Commision for Asia and the Pacific
UP	Uttar Pradesh
URP	Uniform recall Period
UT	Union Territory
VAT	Value Added Tax
VMC	Vessel Management Cell
VNN	Viral Nervous Necrosis
WB	West Bengal
WBCIS	Weather Based Crop Insurance Scheme
WDPs	Watershed Development Programmes
WDPSCA	Watershed Development Project in Shifting Cultivation Areas
WFP	World Food Programme
WHO	World Health Organisation
WIGISAT	Wine Grape Insuring Structuring Automation Tool
WPI	Wholesale Price Index
WTO	World Trade Organisation
XDR	Special Drawing Rights

CHAPTER 1

Indian Agriculture: Performance and Challenges

1.1 India accounts for only about 2.4 % of the world's geographical area and 4 % of its water resources, but has to support about 17 % of the world's human population and 15 % of the livestock. Agriculture is an important sector of the Indian economy, accounting for 14% of the nation's GDP, about 11% of its exports, about half of the population still relies on agriculture as its principal source of income and it is a source of raw material for a large number of industries. Accelerating the growth of agriculture production is therefore necessary not only to achieve an overall GDP target of 8 per cent during the 12th Plan and meet the rising demand for food, but also to increase incomes of those dependent on agriculture to ensure inclusiveness.

Crop Production

1.2 During 2011-12, there was record production of foodgrains at 259.32 million tonnes, of which 131.27 million tonnes was during Kharif season and 128.05 million tonnes during the Rabi season. Of the total foodgrains production, production of cereals was 242.23 million tonnes and pulses 17.09 million tonnes. As per 2nd advance estimates for 2012-13, total foodgrains production is estimated at 250.14 million tonnes (124.68 million tonnes during Kharif and 125.47 million tonnes during Rabi seasons). The 6.59 million tonnes (about 5.02 per cent) decline in kharif production has been on account of late onset of monsoon and deficient rainfall in several states affecting kharif production in Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Maharashtra, Rajasthan, Tamil Nadu and West Bengal. The production of rice (both kharif and rabi) is estimated at 101.8 million tonnes, pulses at 17.58 million tonnes, oilseeds at 29.46 million tonnes, sugarcane at 334.54 million tonnes and cotton at 33.80 million bales (of 170 kg. each). Though, production of rice, sugarcane and cotton during kharif 2012-13 has been lower than that of the last year, these are better than the average production during the last five years. Production of coarse cereals has been severely affected by the deficient monsoon in Gujarat, Haryana, Karnataka, Maharashtra and Rajasthan, with the result that the overall production of Coarse Cereals has been lower by 3.95 million tonnes as compared to kharif 2011-12. Production of jute is estimated at 10.56 million bales (of 180 kg each) which is marginally lower than that of last year (10.74 million bales). Production of the major crops since 2007-08 till 2012-13 (second estimates) is given in Table 1.1.

1.3 The delayed onset and deficient first half of South-West monsoon in 2012 had adverse impact on Kharif crop area coverage and yields. There has been significant improvement in the rainfall situation in August and September, 2012, resulting in good soil moisture conditions and improved prospects for rabi crops for 2012-13. State/UT governments have been advised to take advantage of the good soil moisture and target for significantly higher rabi production so as to make good for the loss of production in the kharif season. ICAR has developed technology for high yielding and pest resistant varieties of crops suitable for different agro-climatic zones. States/UTs have been advised to use the high yielding and pest resistant varieties of crops and popularize the use of agricultural machinery in farm operations to overcome the problem of labour shortage. Further, integration of fodder component in the State Agricultural Plans, extension services through KVKs/ATMAs and allocation of at least 25% of the funds under RKVY to promote the livestock and fisheries sector has been recommended.

Table 1.1: Production of major crops during the recent years (million tonnes/bales)

Crop	Season	2007-08	2008-09	2009-10	2010-11	2011-12 Final Estimates	2012-13 2nd Adv Estimates
Rice	Kharif	82.66	84.91	75.92	80.65	92.75	90.69
	Rabi	14.03	14.27	13.18	15.33	12.56	11.11
	Total	96.69	99.18	89.10	95.98	105.31	101.80
Wheat	Rabi	78.57	80.68	80.80	86.87	94.88	92.30
Coarse Cereals	Kharif	31.89	28.54	23.83	33.08	32.46	28.51
	Rabi	8.86	11.49	9.72	10.32	9.58	9.96
	Total	40.75	40.03	33.55	43.40	42.04	38.47
Total Cereals	Kharif	114.55	113.45	99.75	113.73	125.21	119.19
	Rabi	101.46	106.45	103.70	112.52	117.02	113.37
	Total	216.01	219.90	203.45	226.25	242.23	232.56
Pulses	Kharif	6.40	4.69	4.20	7.12	6.06	5.48
	Rabi	8.36	9.88	10.46	11.12	11.03	12.09
	Total	14.76	14.57	14.66	18.24	17.09	17.57
Foodgrains	Kharif	120.96	118.14	103.95	120.85	131.27	124.68
	Rabi	109.82	116.33	114.15	123.64	128.05	125.47
	Total	230.78	234.47	218.10	244.49	259.32	250.15
Oilseeds	Kharif	20.71	17.81	15.73	21.92	20.69	19.45
	Rabi	9.04	9.91	9.15	10.56	9.11	10.01
	Total	29.75	27.72	24.88	32.48	29.80	29.46
Sugarcane		348.19	285.03	292.30	342.38	361.04	334.54
Cotton*		25.88	22.28	24.02	33.00	35.20	33.80
Jute & Mesta**		11.21	10.37	11.82	10.62	11.40	11.13
* (million bales of 170 kg each), ** (million bales of 180 kg each)							

Rates of Growth in Area, Production and Yield

1.4 Given the limitations in the expansion of acreage, the main source of long-term output growth is improvement in yield. A comparative picture in average annual growth rates of area, production and yield of different crops for two periods, 2002-03 to 2006-07 (the 10th Plan period) and 2007-08 to 2011-12 (the 11th Plan period) is given in Table 1.2. The area under jowar, bajra, small millets, ground nuts, rapeseed and mustard, sunflower and mesta has have witnessed a negative growth during the 11th Plan. Yields of all the major crops have recorded positive growth during the 11th Plan period. Average Annual Growth Rates in area, production and yields of major crops at all India level during 11th Plan and a comparison of annual average growth in yield rates during the 10th and 11th Plan periods are depicted in Fig. 1.1 (a) and 1.1 (b) respectively. Impressive rates of growth (more than 4 percent per annum) in production

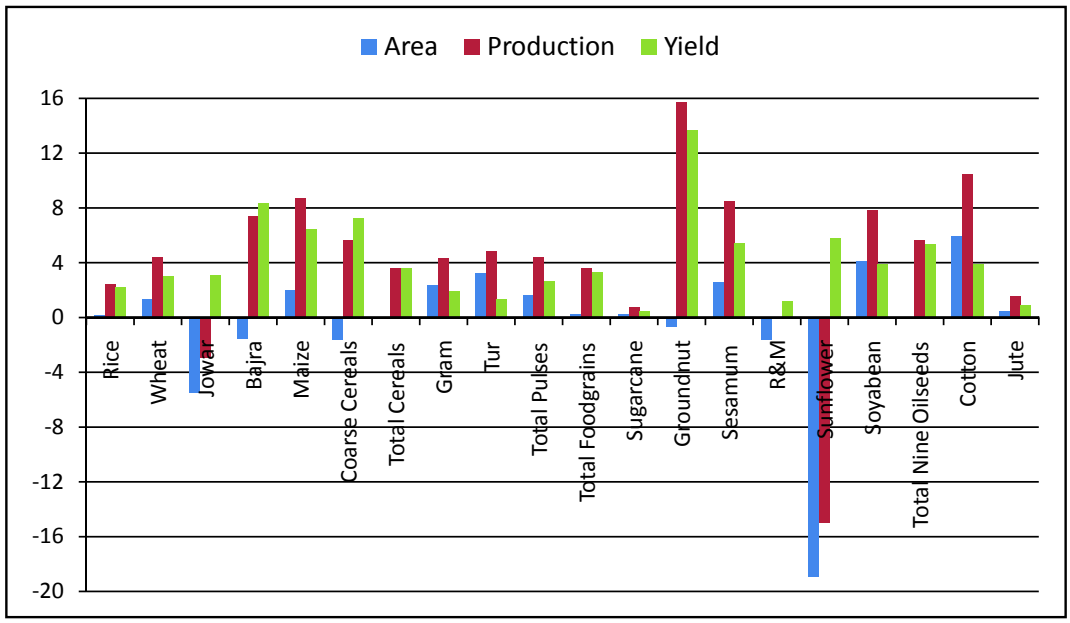
were observed in the case of wheat, bajra, maize, coarse cereals, gram, tur, total pulses, groundnut, sesamum, soyabean, total oilseeds and cotton. The increases in production in the case of wheat, bajra, maize, groundnut and total oilseeds can mainly be attributed to increase in yields, where as the growth in production in the case of gram, tur, total pulses, soyabean and cotton is driven by a combination of both expansion in area and increase in productivity/yield.

Table 1.2: All India Average Annual Growth Rates of Area, Production and Yield of Principal Crops

Crops	Average Annual Growth (%)			Average Annual Growth (%)		
	10th Plan (2002-03 to 2006-07)			11th Plan (2007-08 to 2011-12)		
	Area	Production	Yield	Area	Production	Yield
Rice	-0.39	1.25	1.17	0.18	2.69	2.41
Wheat	1.30	1.11	-0.32	1.31	4.64	3.29
Jowar	-2.84	-0.89	2.07	-5.71	-3.00	3.26
Bajra	1.67	17.12	7.28	-1.38	7.84	8.64
Maize	3.77	4.02	-0.15	2.16	8.90	6.47
Ragi	-5.52	-2.67	0.40	0.41	8.11	6.66
Small Millets	-5.03	-2.49	2.32	-4.42	-0.13	4.08
Barley	-0.28	-1.21	-0.90	0.61	6.32	4.64
Coarse Cereals	-0.26	2.55	1.75	-1.59	5.68	7.27
Total Cereals	**0.07**	**1.21**	**0.74**	**-0.03**	**3.79**	**3.76**
Gram	3.60	4.70	0.28	2.32	4.62	2.27
Tur	1.38	1.06	-0.41	3.13	4.84	1.51
Total Pulses	**1.31**	**2.66**	**0.65**	**1.36**	**4.28**	**2.78**
Total Foodgrains	**0.29**	**1.29**	**0.59**	**0.19**	**3.80**	**3.55**
Sugarcane	3.98	4.90	0.66	0.04	0.99	0.87
Groundnut	-1.65	3.61	4.32	-0.86	15.82	13.91
Sesamum	0.98	3.64	0.51	2.42	8.28	5.30
R&M	7.32	11.55	3.24	-1.69	-0.37	0.76
Sunflower	14.04	13.83	0.37	-18.74	-14.46	6.20
Soyabean	5.80	12.26	6.18	4.00	7.71	3.90
Total Nine Oilseeds	**3.55**	**7.99**	**3.53**	**-0.07**	**5.54**	**5.32**
Cotton	**0.57**	**20.01**	**19.40**	**5.97**	**10.46**	**3.93**
Jute	-1.82	-0.38	1.49	0.47	1.26	0.62
Mesta	-3.85	-2.44	1.45	-7.00	-5.94	0.80
Jute & Mesta	-2.15	-0.58	1.45	-0.59	0.62	1.12

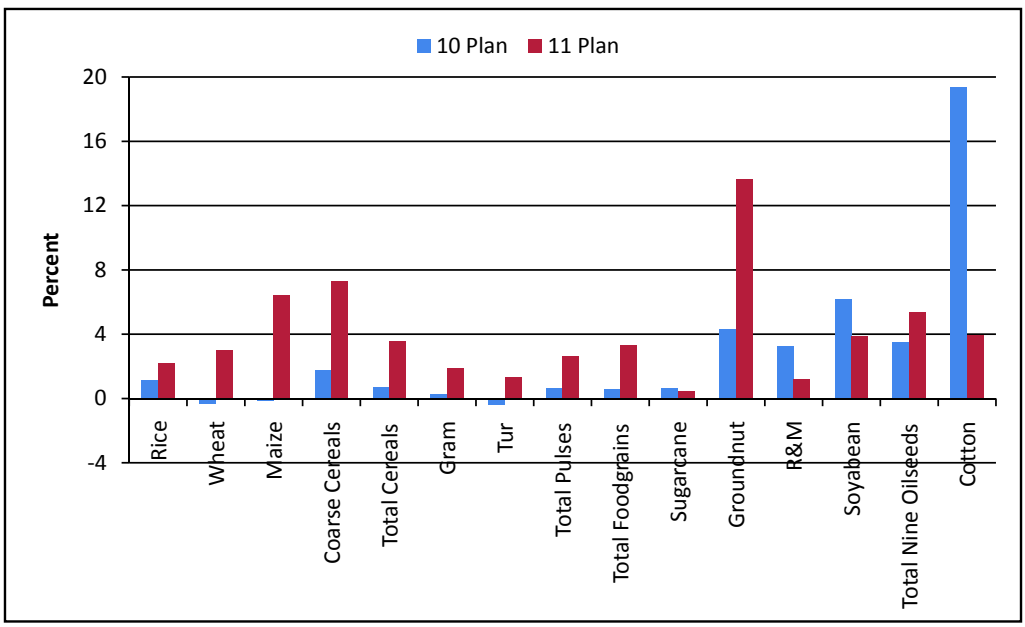
Source: Directorate of Economics & Statistics, Ministry of Agriculture.

Fig. 1.1 (a): All India Average Annual Growth Rates in Area, Production and Yield of major crops during the 11th Plan



A perusal of the rates of growth in yield reveals that most of the crops have recorded higher growth during the 11th Plan than that during the 10th Plan. However, sugarcane, and rapeseed & mustard, soybean and cotton recorded lower rates of growth in yield during the 11th plan than that of the 10th Plan. Growth in yields of sugarcane and rapeseed & mustard suggest that their yields seem to have attained the plateau and need renewed research to boost their productivity levels.

Fig. 1.1 (b): All India Average Annual Growth Rates in Yield of major crops during the 10th and 11th Plan



Horticulture

1.5 The horticulture sector has been a driving force in stimulating a healthy growth trend in Indian agriculture. India is currently producing 257.2 million tonnes of horticulture produce from an area of 23 million ha. Over the last decade, the area under horticulture grew by about 3.8% per annum but production rose by 7.6% per annum. The higher growth rate in horticulture was brought about by improvement in productivity of horticulture crops, which increased by about 28% between 2001-02 and 2011-12. The special thrust given to the sector, especially after the introduction of the Horticulture Mission for North East & Himalayan States (HMNEH) and the National Horticulture Mission (NHM) in the Xth Plan has borne positive results. Given the increasing pressure on land, the focus of growth strategy is on raising productivity by supporting high density plantations, protected cultivation, micro irrigation, quality planting material, rejuvenation of senile orchards and thrust on post harvest management, to ensure that farmers do not lose their produce in transit from farm gate to the consumer's plate.

Livestock Sector

1.6 The agriculture sector in India is predominantly part of a mixed crop-livestock farming system. The livestock sector supplements income of the farmers, provides employment, draught power and manure. The development of livestock sector is more inclusive and can result in a sustainable agriculture system. India is the largest producer of milk in the world, estimated production of milk in 2011-12 is 127.9 million tonnes and the second largest producer of fish in the world with estimated production of 8.85 million tonnes during 2011-12. The rate of growth in livestock sector has also been higher than that in the crop sector in the recent years.

Major Schemes for Accelerating Agricultural Production

1.7 In order to increase the agricultural growth rates, Rashtriya Krishi Vikas Yojana (RKVY), launched in August 2007, incentivizes the states to increase public investment in agriculture and allied sectors taking agro climatic conditions, natural resource issues and technology into account and integrating livestock, poultry and fisheries more fully while providing more flexibility and autonomy to the states in planning and execution of the schemes. It has become the principal instrument for increasing the states' investment in the agriculture sector which now includes several commodity specific measures namely Bringing Green Revolution to the Eastern Region of India (BGREI), Special Initiative for Pulses and Oilseeds, Accelerating Fodder Production, Creating Vegetable Clusters, Initiatives for Nutritional Security through Intensive Millet Promotion (INSIMP), Oil Palm Development, Protein Supplements, Rainfed Area Development Programme and the Saffron Mission. Beside RKVY, National Food Security Mission (NFSM) and the National Horticulture Mission (NHM) have also emerged as the path breaking interventions which have helped in achieving record production of cereals, pulses, oilseeds, fruits, vegetables and spices during 2010-11 and 2011-12. With the focused interventions under the National Food Security Mission supported by other programs and schemes and conducive price policy regime, target of 20 million tonnes of additional food grains production has been exceeded during the 11th five year plan. Not only has the demand been completely met particularly for the cereals, the buffer and strategic reserves are at levels that are more than double their set limit. There is a record export of cereals that has gained not only huge foreign remittance but has also stabilized global food economy through increased availability and reasonable price. To reduce over exploitation of natural resources in the north-west region and to increase the productivity of rice, wheat, maize and pulses, BGREI has started involving promotion of innovative production technologies and agronomical practices addressing the underlying key constraints of different agro-climatic sub regions. System of Rice Intensification (SRI), laser land leveling; hybrid rice technologies and line transplanting of rice seedlings etc. are being promoted under this initiative.

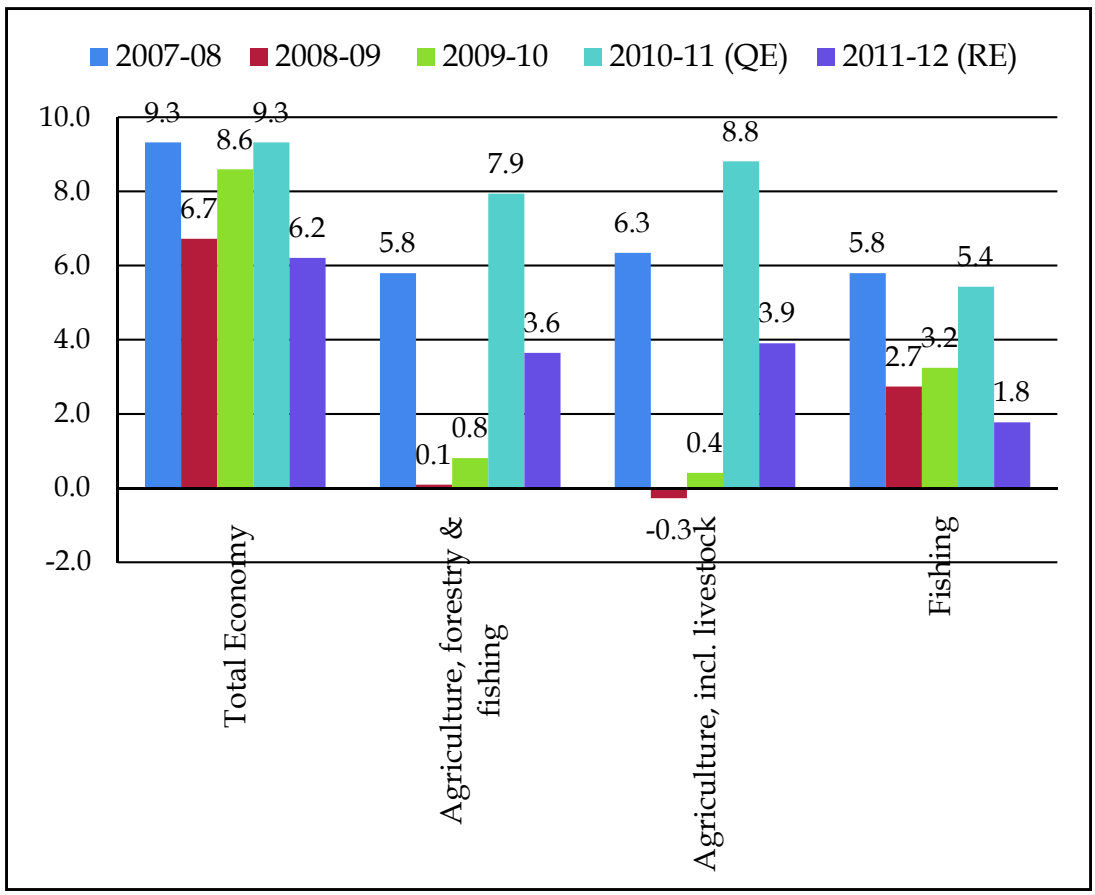
1.8 Apart from population pressure, notwithstanding recent surge in productivity and production of cereal crops, there is a need to bridge the yield gaps in low productivity regions by effective technology dissemination which can be combined with an efficient supply and service system, strengthening and reorienting agricultural R&D, reducing regional disparities, targeting rain fed areas and emphasizing development of high potential, resource rich states in eastern India.

1.9 Ensuring stability in food systems through optimal combination of food procurement, stocks and trade, in co-ordination with price movements needs to be given emphasis to improve economic conditions of farmers. Besides enhancing the production and productivity of our agriculture, there is a need to diversify into high value items – fruits, vegetables, milk and dairy products to meet the changing dietary preferences and to realize higher income for the farmers. Towards this end Government is giving special emphasis to the production of pulses, oil seeds and fruits and vegetables, in which we are short of our requirements.

Growth of Agriculture Sector

1.10 As per the Central Statistics Office (CSO) revised estimates (released on 31st January 2013 of Gross Domestic Product, agriculture and allied sectors grew at 3.6 per cent during 2011-12, recording an average rate of growth of 3.6 per cent per year during the 11th Plan (2007-12). Further, as per the advance estimates released by CSO on 7th February, 2013, agriculture and allied sectors are estimated to grow at 1.8 per cent during 2012-13 as against 3.6 per cent during the last year. The rates of growth of the economy and the agriculture and allied sectors since 2007-08 are given in Fig. 1.2.

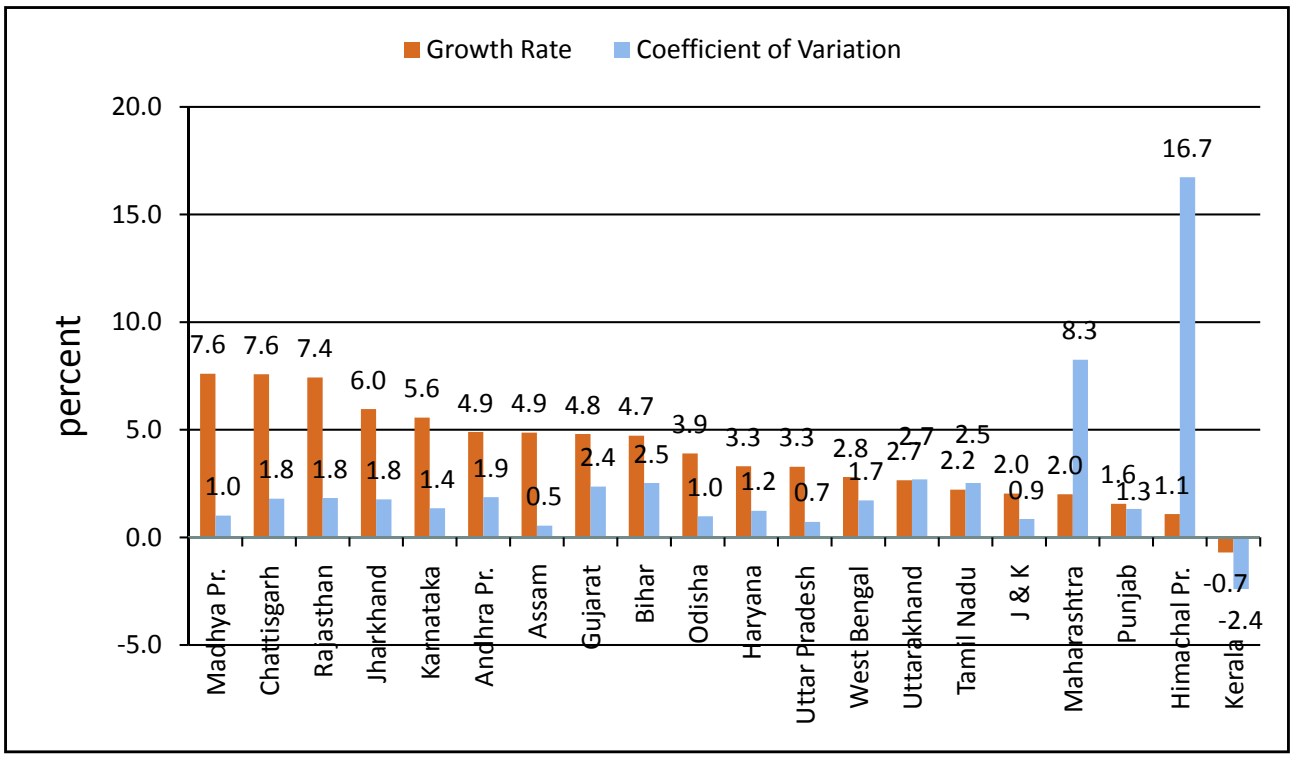
Fig. 1.2: Growth Rates (%) by Economic Activity



Regional Variations in Growth

1.11 The Indian Agriculture growth pattern has been very diverse at the state level. As agriculture is a state subject, the overall performance of the agriculture sector in India largely depends on what happens at the state level. There is a wide variation in the performance of different states. During the 11th Plan (i.e. 2007-08 to 2011-12) the growth performance of agriculture in Madhya Pradesh (7.6%), Chhatisgarh (7.6%), Rajasthan (7.4%), Jharkhand (6.0%) and Karnataka (5.6%), was much higher than that of Punjab (1.6%), Maharashtra (2.0%), Tamil Nadu (2.2%) West Bengal (2.8%), Uttar Pradesh (3.3%) and Haryana (3.3%). High coefficient of variation (>2) was observed in the case of Himachal Pradesh and Maharashtra. The average annual growth rates (percent) of gross state domestic product from agriculture during 2007-08 to 2011-12 (at 2004-05 prices) are given in Fig. 1.3.

Fig. 1.3: Annual Average Growth Rate (%) of Gross State Domestic Product from Agriculture 2007-08 to 2011-12 (at 2004-05 prices)



Source: Central Statistics Office, NAD.

Capital Formation in Agriculture

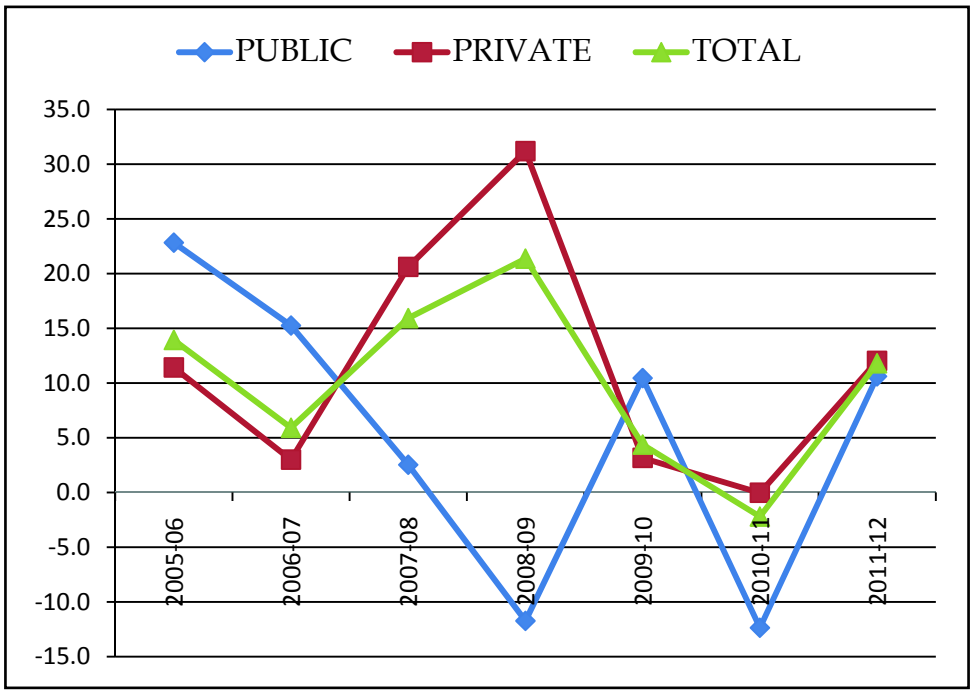
1.12 Investment or capital formation is one of the basic requirements for growth of any sector. Even though the Gross Capital Formation (GCF) in agriculture & allied sectors as percentage of agricultural GDP has increased from 14.9 per cent in 2006-07 to 19.8 per cent in 2011-12 (Table 1.3), when compared with the overall capital formation in the economy which is about 40 per cent of the GDP, capital formation in agriculture sector is much lower. Further, the share of public sector capital formation in agriculture & allied sectors has come down from 25 per cent in 2006-07 to about 15 per cent in 2011-12 where as that of private sector has gone up from 75 per cent to 85 per cent. In fact during the first four years of the 11th Five Year Plan, capital formation in public sector in agriculture as per cent of agricultural GDP has come down from 3.5 per cent in 2007-08

to 3.0 per cent in 2011-12. While a higher share of private sector investment in agriculture is a welcome feature, public sector investment is critical as it is generally found to accelerate private investment. However, from 2006-07 to 2010-11 an inverse relationship is observed between growth in public sector and private sector investment (Fig. 1.4). This may be partly due to the fact that some investment contributed by the public sector gets accounted for under the private sector due to the classification of capital formation under the National Accounts System on the basis of the ownership of the assets created or classified as financial transfers from the public sector if no assets have been created or classified under Public Administration such as the expenditure on soil & water conservation, watershed management etc. This calls for a detailed study about the nature and quality of investment in agriculture and its impact on agricultural GDP, the relationship between public and private investment in agriculture and their resource use efficiency. Investment in irrigation, rural roads, power, telecommunication, marketing infrastructure, research and extension services generally tend to result in high growth of the agricultural sector and reduction in poverty. Given scarce fiscal resources, agriculture investment strategy should be guided by efficient and equitable resource use with high pay offs.

Table 1.3: Gross Capital Formation in Agriculture & Allied Sectors at constant (2004-05) prices

Year	GDP from Agriculture & Allied Sectors at 2004-05 prices (Rs crore)	GCF in Agriculture & Allied Sectors at 2004-05 prices (Rs crore)			GCF in Agriculture & Allied Sectors as % of GDP from Agriculture & Allied Sectors		
		Public Sector	Private sector	Total	Public Sector	Private sector	Total
1	2	3	4	5	6	7	8
2004-05	565426	16187	59909	76096	2.9	10.6	13.5
2005-06	594487	19940	66664	86604	3.4	11.2	14.6
2006-07	619190	22987	69070	92057	3.7	11.2	14.9
2007-08	655080	23255	82484	105741	3.5	12.6	16.1
2008-09	655689	20572	106555	127127	3.1	16.3	19.4
2009-10	660987	22693	110469	133162	3.4	16.7	20.1
2010-11	713477	19918	111306	131224	2.8	15.6	18.4
2011-12	739495	22095	124483	146578	3.0	16.8	19.8
Source: Central Statistics Office, National Accounts Division							

Fig. 1.4: Rates of growth (%) in Gross Capital Formation in Agriculture (including Animal Hushandary) Sector



Land and Water

1.13 The progressive fragmentation of land holdings, degrading natural resource base and emerging concerns of climate change are escalating pressure on land and water. Land and water resources being finite, increased agricultural production and a diversified food basket to meet the requirement of the increasing population with higher per capita income, has to emanate from the same limited net sown area by increasing productivity with an optimal use of available water and land resources. Natural resources viz. arable land, water, soil, biodiversity (plant, animal and microbial genetic resources) are rapidly shrinking due to demographic and socio-economic pressures, monsoon disturbances, increasing frequencies of floods and droughts. Overuse of marginal lands, imbalanced fertigation, deteriorating soil health, diversion of agricultural land to nonagricultural uses, depleting aquifers & irrigation sources, salinization of fertile lands and water-logging are pressing challenges requiring urgent attention. For making agriculture sustainable to meet the country's food requirement, a prudent land use policy, water availability and soil health have to be maintained at levels that are conducive to pursue agricultural activities with higher level of productivity.

1.14 Land degradation is major threat to our food and environmental security. As per estimates of Indian Council of Agricultural Research (2010), out of total geographical area of 328.73 mha, about 120.40 mha is affected by various kind of land degradation resulting in annual soil loss of about 5.3 billion tonnes through erosion. This includes water and wind erosion (94.87 mha), water logging (0.91 mha), soil alkalinity/sodicity (3.71 mha), soil acidity (17.93 mha), soil salinity (2.73 mha) and mining and industrial waste (0.26 mha). Besides, water and wind erosions are wide spread across the country. As much as 5.3 billion tonnes of soil gets eroded every year. Of the soil so eroded, 29% is permanently lost to sea, 10% is deposited in reservoirs reducing their storage capacity and rest 61% gets shifted from one place to another. Significant increase in 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, and decline in soil bio-diversity and depletion of organic matter in soil are areas of concern requiring urgent attention.

1.15 Furthermore, climate change is likely to impact agricultural land use and production due to less availability of water for irrigation, higher frequency and intensity of inter and intra-seasonal droughts and floods, low soil organic matter, soil erosion, less availability of energy, coastal flooding etc. could impact agricultural growth adversely. For proper management of natural resources and to ensure sustainable agriculture growth in the country, there is need for a land use policy which should be integrated with all developmental programmes for the holistic development of rural areas, natural resource management and eco-restoration. Considering skewed ownership of land, it is necessary to strengthen implementation of laws relating to land reforms, with particular reference to tenancy laws and leasing, distribution of ceiling surplus land and wasteland, providing adequate access to common property and wasteland resources and consolidation of holdings. Computerization of land records, formulation of policy on diversion of agricultural land for non-agricultural uses, updating of land and soil survey maps, finalization of an enabling frame work for involvement of private sector in natural resource management, and encouraging Public Private Partnership in land and watershed development programmes are urgently required.

1.16 The land reforms agenda has not gone beyond the imposition of land ceilings even though the incidences of tenancy are too high in most parts of the country. Substantial chunks of scarce land remain untilled because of landowners' reluctance to lease out land for fear of losing its ownership. A significant per cent of the tenants are landless and marginal farmers. These tenants would benefit from leasing-in since it would help them to expand their miniscule holdings and allow better use of their labour resources. There is a need to urgently address the issue of legalizing land leasing.

1.17 Provisional results of Agriculture Census 2010-11, are available for all States/UTs. Details of number, area and average size of operational holdings in the country as per available data of various Agriculture Censuses are given in tables 1.4 & 1.5 respectively.

Table 1.4: Distribution of Number of Holdings and Area Operated in India as per Agriculture Census 2010-11

Sl. No.	Size Group	Number of holdings (in million)	Area operated (in million ha.)	Average operated area per holding (ha.)	Percentage of holdings to total holdings	Percentage of area operated to total area
1	Marginal (Below 1.00 ha.)	92.4	35.4	0.38	67.04	22.25
2	Small (1.00-2.00 ha.)	24.7	35.1	1.42	17.93	22.07
3	Semi-Medium (2.00-4.00 ha.)	13.8	37.5	2.71	10.05	23.59
4	Medium (4.00-10.00 ha.)	5.9	33.7	5.76	4.25	21.18
5	Large (Above 10.00 ha.)	1.0	17.4	17.38	0.73	10.92
All holdings		137.8	159.2	1.16	100.00	100.00

Note: Total may not tally due to rounding off.

Table 1.5: Size Group wise distribution of Average Holdings in the country

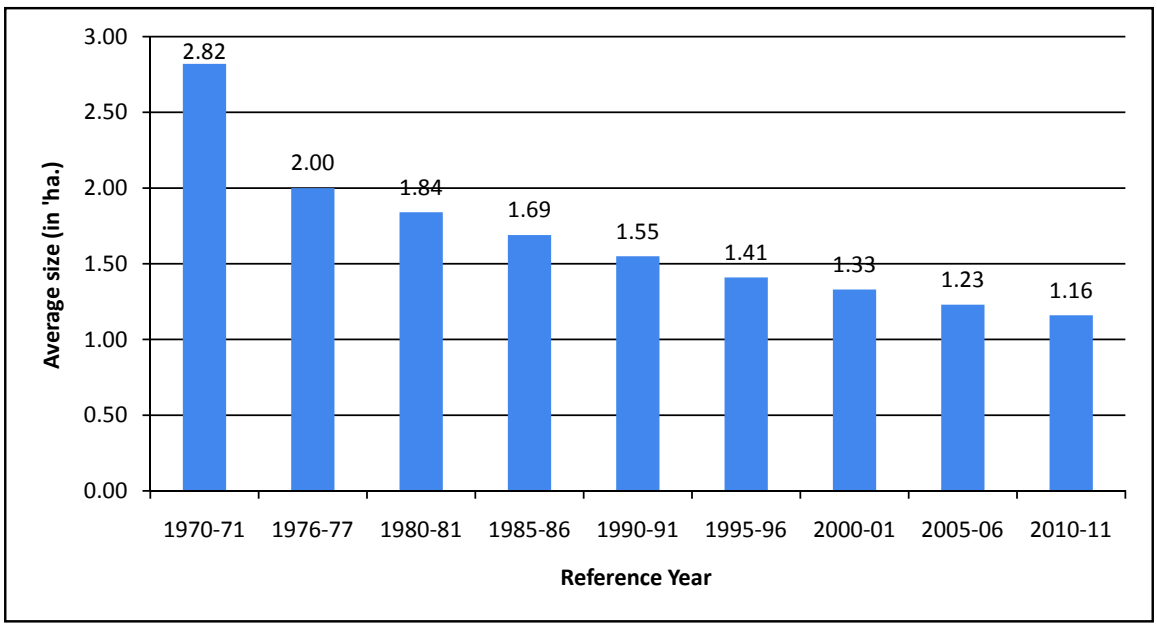
(Area in ha.)

Sl. No	Size Groups	1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01*	2005-06*	2010-11P
1	Marginal (Below 1 ha.)	0.40	0.39	0.39	0.39	0.39	0.40	0.40	0.38	0.38
2	Small (1-2 ha.)	1.44	1.42	1.44	1.43	1.43	1.42	1.42	1.38	1.42
3	Semi-Medium (2-4 ha.)	2.81	2.78	2.78	2.77	2.76	2.73	2.72	2.68	2.71
4	Medium (4-10 ha.)	6.08	6.04	6.02	5.96	5.90	5.84	5.81	5.74	5.76
5	Large (Above 10 ha)	18.1	17.57	17.41	17.21	17.33	17.21	17.12	17.08	17.38
All Size Classes		2.28	2.00	1.84	1.69	1.55	1.41	1.33	1.23	1.16

Note: Total may not tally due to rounding off. *excludes Jharkhand
P: Provisional.
Source: Agriculture Census 2010-11.

1.18 Increasing demand for industrialization, urbanization, housing and infrastructure is forcing conversion of agricultural land to non – agricultural uses; the scope for expansion of the area available for cultivation is limited. As per Agriculture Census 2010-11, small and marginal holdings of less than 2 hectare account for 85 per cent of the total operational holdings and 44 per cent of the total operated area. The average size of holdings for all operational classes (small & marginal, medium and large) have declined over the years and for all classes put together it has come down to 1.16 hectare in 2010-11 from 2.82 hectare in 1970-71 as can be seen from Fig. 1.5.

Fig. 1.5: Average size of operational holdings as per different Agriculture Censuses

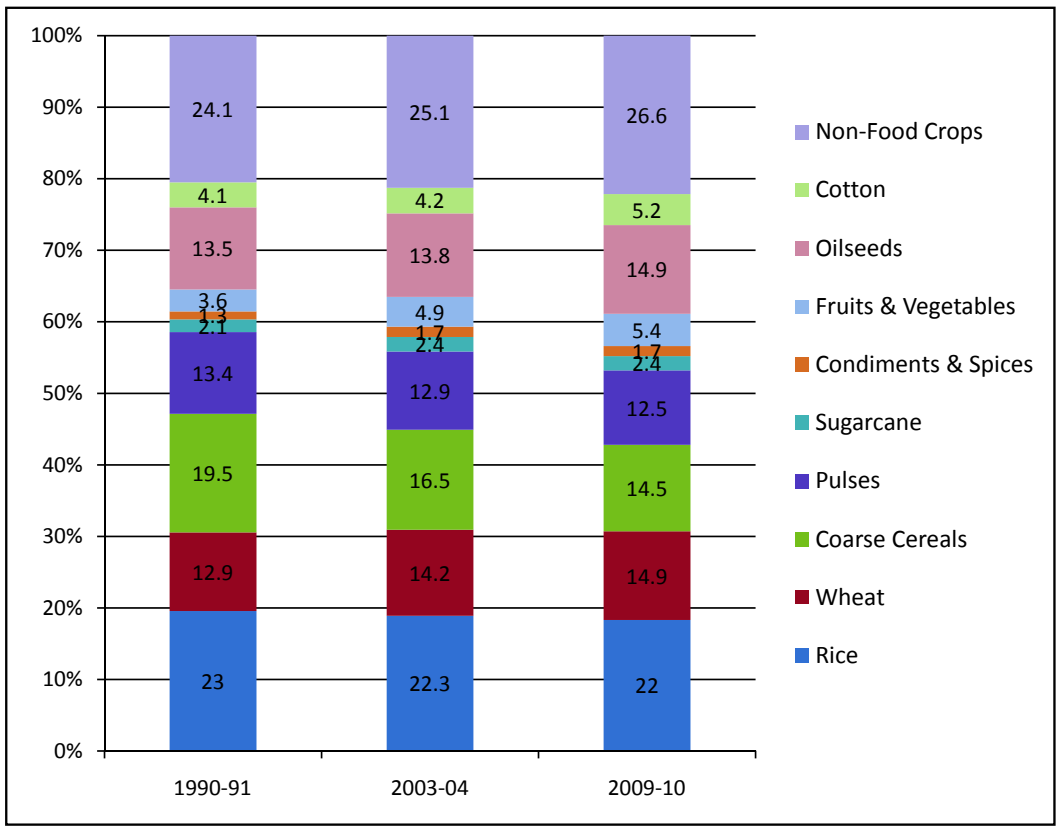


1.19 As per the land use statistics, the acreage under different crops and the cropping pattern during the last two decades is given in the following Table. While the net sown area has come down from 143 million hectares in 1990-91 to 140 million hectares in 2009-10, the gross cropped area has gone up by 6 million ha, from 186 to 192 million ha during the same period due to increase in the cropping intensity from 130 to 137 per cent. 22 per cent of the acreage is under paddy which has remained stable during the last two decades. Area under wheat has slightly increased from 13 per cent in 1990-91 to 15 per cent in 2009-10. Area under coarse cereals has come down significantly from 19.5 per cent to 14.5 per cent during this period.

Table 1.6: Cropping Pattern in India (Area in Million Hectares)

Years	1990-91	2003-04	2009-10(p)
Total Area Under Crops	185.74	189.67	192.20
Net area sown	143.00	140.71	140.02
Cropping Intensity (percent)	129.89	134.80	137.26
Area under Food Crops	141.03	142.12	141.06
Area under Non-Food Crops	44.71	47.55	51.14
Net Irrigated area	48.02	57.05	63.26
TOTAL/Gross Irrigated Area	63.20	78.04	86.42

Fig. 1.6: Crop-Wise Share (%) in Area



Irrigation and Water Use Efficiency

1.20 Water is a scarce natural resource, fundamental to life, livelihood, food security and sustainable development. Water demand is increasing rapidly due to population growth, urbanization and changing lifestyle. Owing to increasing demand of water for domestic, industrial and energy uses, there is a severe constraint in the availability of water for agriculture. Climate change might complicate further the existing temporal and spatial variation in availability of water. Extreme events like floods and droughts are occurring more frequently and affecting livelihood and food security. Low water use efficiency, poor maintenance of irrigation systems and poor recovery of water charges are some of the major problems associated with the management of water resources in the country. Inadequate and sub-optimal pricing of both power and water is promoting the misuse of groundwater. The decline in the water table across the country is a matter of serious concern. There is a need to promote participatory management of aquifers to ensure sustainable and equitable use of water. Promotion of micro-irrigation techniques, alignment of cropping pattern with the availability of water and greater involvement and empowerment of Water Users associations in the command areas could lead to improvement in water use efficiency.

1.21 The ultimate irrigation potential in the country is estimated at about 140 million hectares. Of this, about 58.5 million hectare is from major and medium irrigation sources, and 81.5 million hectare is from minor irrigation sources (about 64.1 million hectare from groundwater irrigation and 17.4 million hectare from surface water). Groundwater provides about 70 percent of irrigation and 80 per cent of the drinking water supplies. The widening gap (about 15 %) between irrigation potential created and that being utilized is also a matter of concern. This gap needs to be narrowed within the shortest possible time.

1.22 Inefficient water use in irrigation is also leading to environmental degradation via water logging and induced salinity. Micro-irrigation technologies like drip and trickle systems, surface and subsurface drip tapes, micro-sprinklers, sprayers, micro-jets, spinners, rotors, bubblers, etc. have great potential in improving water use efficiency. However, despite wide promotion, only about 0.5 million hectare are currently under micro-irrigation (NAAS 2009). Modern techniques such as micro-irrigation, watershed management, rainwater harvesting and groundwater recharging are vital in utilizing the existing resources and expanding the irrigation system in a viable manner. Major investment in research and development that enhance water use efficiency is required. Extension services that reach out to farmers to help boost the speed of technology-adoption as well as develop specialized skills and knowledge related to water application are necessary.

Inputs for Agricultural Growth

1.23 To enhance productivity, easy and reliable access to inputs such as quality seeds, fertilizers, pesticides, access to suitable technology tailored for specific needs, the presence of support infrastructure and innovative marketing systems to aggregate and market the output from large number of small holdings efficiently and effectively are necessary. Use of high yielding varieties/hybrids as in the case of Bt cotton and maize, economy in input use, and cost effective farming techniques such as System of Rice Intensification (SRI) are necessary to improve farm productivity.

Seed and Planting Material

1.24 Quality seeds and planting materials are the key agricultural inputs, which determine the productivity of the crops. The efficacy of other agricultural inputs such as fertilizers, pesticides and irrigation is largely determined by the quality of the seed used. It is estimated that quality of seed accounts for 20-25% of productivity. Hence timely availability of quality seeds at affordable prices to farmers is necessary for achieving higher agricultural productivity and production. The varied agro climatic conditions of the country are suitable for cultivation of large number of crops and varieties. This necessitates production of quality seeds and planting materials for a

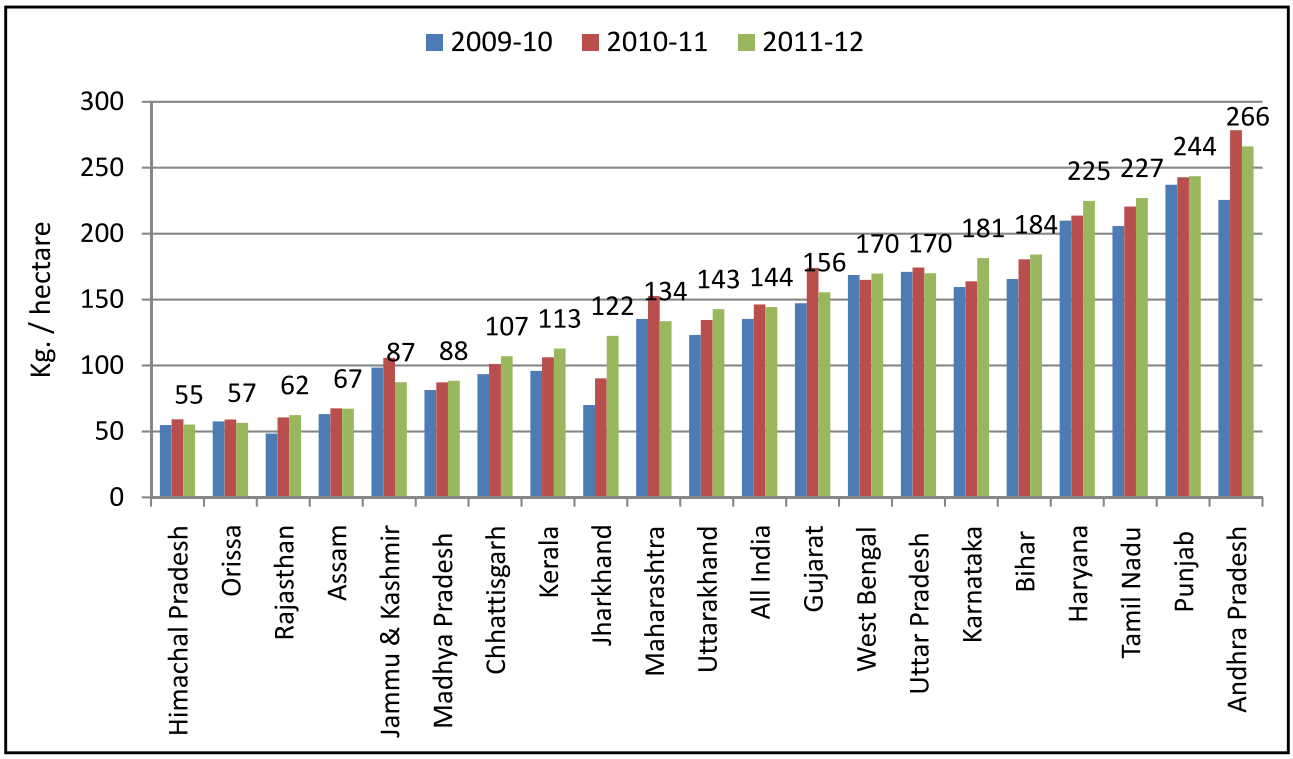
huge range of crops for achieving the targeted production. The organized sector comprising of both the private and public sector accounts for about 15 to 20% of the total seed distributed in the country. The remaining portion is contributed by the unorganized sector comprising mainly of farm-saved seeds. Prudent mechanism for seed certification, testing, labeling and enforcement is necessary to maintain seed quality. Varietal development, plant variety protection, seed production, quality assurance, creation of infrastructure for seeds, transgenics, import of planting material, export of seeds and promotion of domestic seed industry are necessary for a vibrant seed industry. An enabling environment for speedy trial and evaluation of imported seeds for the betterment of agriculture production in the country is necessary. The Seeds Bill, 2004 has been introduced in the Parliament to overcome the limitation of Seeds Act 1966, and provides for the regulation of seed quality and planting material of all agricultural, horticultural and plantation crops with the view to ensure availability of true to type seeds to Indian farmers; curb sale of spurious and poor quality seeds; protection of rights of farmers, increase private participation in seed production, distribution and seed testing; liberalize imports of seeds and planting material, and align with World Trade Organization (WTO) commitments and international standards, needs to be enacted with utmost urgency. The seed multiplication ratio from Breeder seed to Foundation seed and from Foundation seed to Certified seed needs to be addressed by all the seed producing agencies, both in public and private sectors. Comprehensive and authentic database on seed production and distribution in India by public and private sectors needs to be built for the benefit of all the stakeholders. There is need to ensure adequate and timely availability of seed through appropriate tie ups with NSC, SFCI, State Seed Corporations etc., popularize Good Agricultural Practices (GAP), enhance Seed Replacement Ratio to 20-25% in pulses and 20% in case of groundnut, popularize new farming techniques like ridge-furrow sowing, deep ploughing, zero seed drill and seed treatment for enhancing agricultural production in the country.

Integrated Nutrients Management (INM)

1.25 Chemical fertilizers are the immediate source of nutrients in soils. Consumption of nitrogenous (N), phosphatic (P) potassic (K) fertilizers has increased from 1.1 million tones in 1966-67, the year preceding the green revolution to 27.7 million tonnes in 2011-12. The all-India average consumption of fertilizers has increased from 105.5 kg per ha in 2005-06 to 144 kg per ha in 2011-12. However, our consumption is much lower than that in Bangladesh (118), Pakistan (205) and China (396). The world average consumption of fertilizer was 107 kg per hectare in 2009. Further, very high variability has been observed in fertilizer consumption across the states and crops. While per hectare consumption is 243.56 kg in Punjab and 266.11 kg in Andhra Pradesh, it is comparatively low in MP (88.36 kg/ha), Orissa (56.52 kg/ha), Rajasthan (62.35 kg/ha) and Himachal Pradesh (55.18 kg/ha) and below 5 kg/ha in some of the North Eastern States.

1.26 With a view to encourage balanced use of fertilizers, government introduced Nutrient Based Subsidy (NBS) policy from April 2010 where under a fixed rate of subsidy is announced on nutrients, namely, nitrogen (N), phosphate (P), potash (K) and sulphur (S). Price of urea is administratively decided whereas prices of other fertilizers are market determined. Consequently, price of urea is much lower than that of other fertilizers. This has resulted in excessive use of urea, thereby distorting the balanced norms of fertilizer application. Balanced fertilization would have ensured adequate availability of nutrients in soil to meet the requirement of plants at critical stages of growth. This calls for promoting soil test based balanced and judicious use of chemical fertilizers in conjunction with organic sources of nutrients to sustain and improve soil health and its productivity. Further, lack of awareness about soil testing and intensive agriculture is leading to widespread deficiency of micronutrients such as zinc, iron, manganese and boron. Similarly,

Fig. 1.7 : State wise Fertilizer consumption, Kg/Ha



imbalanced NPK application, rising multi nutrient deficiency and lack of application of organic manure are leading to reduction in carbon content in the soil. Soil Organic Carbon (SOC) is central to soil health as it influence soil structure, water retention, microbial activities, soil aeration and nutrient retention. Depletion in soil organic carbon is leading to poor fertilizer use efficiency (FUE) of the soil which on average is estimated to be 33% for N; 15% for P; 20% for K and micronutrients as against 50% for N; 30% for P and 50% for K with the best management practices. Intensive agriculture, while increasing food production, has at the same time caused second generation problems in respect of nutrient imbalance including greater mining of soil nutrients, depletion of soil fertility, emerging deficiencies of secondary and micronutrients, decline of the water table and quality of water, decreasing organic carbon content, and overall deterioration in soil health. Government is promoting Integrated Nutrient Management (INM), advocating soil test based balanced and judicious use of chemical fertilizers in conjunction with organic sources of nutrients for improving soil fertility. Introduction of customized fertilizers on the basis of soil testing and the agronomic multi-locational trials which are crop specific and area specific are recommended. Promotion of INM which includes soil test based balanced and judicious use of chemical fertilisers in conjunction with bio-fertilisers, and organic manures like FYM, compost, vermi-compost, green manure, Fruit and Vegetable Waste Compost, MSW compost etc.; use of complex fertilisers (NPK) and customized fertilisers which are considered to be agronomically better and more balanced fertilisers in place of straight fertilizers; use of fertilisers fortified with micro-nutrients; use of Bio-fertilisers - phosphate solubilizing bacteria; Azospirillum, Azotobacter, and Rhizobium; potash mobilizing biofertilizers which can supplement upto 20-25% of chemical fertilizers (NPK). In this context seed supplying agencies

may consider provision of bio-fertilisers and seed treating material along with seed packets.

Integrated Pest Management

1.27 The protection of crops from depredations of pests and diseases is a sine qua non for higher agricultural productivity, increased farm incomes and enhanced food security for the nation. This is especially significant for a nation like India which is faced with rising demand for food and agricultural produce for a growing population. In a scenario where agricultural productivity in India is below global bench marks and per capita availability of agricultural farm land is diminishing, risk of production loss upto 30% from incursion of pests and diseases needs to be averted. It is noteworthy that use of chemical pesticides in India is very low and estimated at only 381 grams per hectare (technical grade pesticide) when compared to the global average of 500 grams of technical grade pesticide per hectare. Information provided by State Governments reveal that around 90 million hectares of cropped area is within the ambit of pesticides usage leaving out significant swathes of agricultural land in the country where pesticides are not being applied to crops. Different estimates show that more than 50% of consumption of pesticides is garnered by insecticides, whereas herbicides and fungicides together contribute about 30-40% of total pesticide consumption. The usage of chemical pesticides which had fallen drastically since 1991 has witnessed a revival during the 11th Five Year Plan. Bio-pesticides usage has shown a steady increase in the last two decades to reach a consumption level of more than 6000 MTs during 2011-2012 as per information provided by the States. Among the crops, cotton, rice, vegetables and fruits account for the largest share of pesticide consumption in the country.

1.28 It is evident from the above that while spread and dosage of pesticide application in the country is low, yet in the context of rising concerns centered around hazards associated with pesticides residues in food and environment, there is a need to adopt strategies and practices that are consistent with principles of good agricultural practices. Recognizing the imperative of safe and judicious use of pesticides, the Government of India and the State Governments have been trying actively to promote Integrated Pest Management. IPM advocates adoption of cultural and mechanical tools and need based application of bio-control agents and bio-pesticides, while safe and judicious use of chemical pesticides is recommended only as a measure of last resort. IPM is being promoted by the Government of India and State Governments primarily through training and demonstrations in farmers field schools, capacity building programmes for extension personnel and support to State Governments for setting up of Bio-control and Bio-pesticides testing laboratory facilities.

1.29 Whereas efforts are being made to control pests and diseases in crops, it is equally important in the liberalized global trade environment to shore up our defences against introduction of exotic pests and diseases into the country through agricultural imports which have the potential to threaten agricultural/ horticultural crops and bio-security of the country. The quarantine regulatory framework is built around the Plant Quarantine Order 2003 which has laid down agricultural commodity and country specific phytosanitary treatments for imports into the country. The regulatory responsibilities are primarily discharged through Plant Quarantine Stations established in all regions of the country manned by technical personnel and equipped with laboratory facilities.

Mechanization

1.30 Availability of adequate farm power is very crucial for timely farm operations, increasing land and labour efficiency, increasing production and productivity and reducing crop produce losses. Farm mechanization can also address the issues of scarcity of farm labour during peak agricultural seasons like sowing and harvesting. It has been observed that farm power availability and foodgrain yield have a direct relationship. States with higher farm power availability have, in general, more productivity.

1.31 The tractor density in India is about 16 tractors for 1,000 hectares, as against the world average of 19 tractors and that in USA 27 tractors per one thousand hectare of cropped area. The increasing threat to natural resources, notably land and water, has further necessitated switching over to machine assisted resource-conservation techniques such as zero-tillage, raised-bed planting, precision farming, etc. Even though farm mechanization is increasing in India, it is mostly region specific. The decreasing trend in operational land holdings is an impediment in the growth of agricultural mechanization. Small and marginal farmers who cultivate about 85 per cent of the holdings and account for nearly 44 per cent of the total cultivates area cannot afford high cost agricultural machines. High cost of mechanization and lower credit worthiness results in the 'exclusion' of majority of small and marginal farmers in India from the benefit of farm mechanization The use of farm machinery is also dependent on the availability of other infrastructural services in the rural areas. Mechanization of small and non-contiguous group of lands is found to be against 'economies of scale' especially for activities like land preparation and harvesting, thereby making individual ownership of agricultural machinery uneconomical. In order to make farm equipments and machines available to the farmers at affordable cost, Farm Machinery Banks can be established to custom hire the machines and equipments to the farmers. This will, besides increasing the power availability, help in removing the disparity in availability the farm power among various states and reduce the drudgery associated with various farm operations.

1.32 Recognizing the need to spread the benefits of agricultural mechanization among all strata of farmers, Department of Agriculture & Cooperation is integrating the components of agricultural mechanization under various schemes and programmes through promotion of 'Custom Hiring Centre' for agricultural machinery.

1.33 It has been estimated that about 18 to 25% losses occur in the entire food supply–chain from production to consumption. A three pronged strategy involving (i) compression of the supply–chain by linking producers and markets; (ii) promoting processing in production catchments to add value before the produce is marketed; and (iii) developing small-scale processing refrigerated chambers or cold storage using conventional and non conventional sources is required to reduce post harvest losses. This would require greater attention to post-harvest engineering research and development.

Labour and Agricultural Wages

1.34 Agriculture is a labour intensive activity. Cost of cultivation data shows that labour accounts for more than 40 percent of the total variable cost of production in most cases. Therefore, availability of labour to work in agriculture is crucial in sustaining agricultural production. Agricultural wages have traditionally been low, due to low productivity, large disguised unemployment in agriculture sector, and lack of sufficient employment opportunities elsewhere. However, in recent years there has been a perceptible change in this trend due to economic growth and adoption of employment generation policy like the MGNREGA and increase in minimum wages under the Minimum Wages Act. The average daily wages for agricultural field labour for ploughing and harvesting at all India level have increased at the rate of 8.7 per cent and 9.2 per cent per annum during 2001-02 to 2010-11 respectively as against the average wages paid for industries covered under Annual Survey of Industries (ASI) at 6.3 per cent per annum. However, agricultural wages, in general, are still much lower than the industrial wages. With skill development this gap will narrow down, putting further pressure on availability and cost of agricultural labour. This further strengthens the necessity for agricultural mechanization in a manner that is inclusive and suitable for Indian conditions.

Agriculture Credit and Insurance

1.35 Agriculture Credit plays an important role in improving agricultural production, productivity and mitigating the distress of farmers. Government has taken several measures for improving agricultural credit flow to farmers.

As against the credit flow target of Rs.4,75,000 crore for the year 2011-12, achievement has been Rs.511029 crore, 107% of the target. The target of credit flow for the year 2012-13 has been fixed at Rs.5,75,000 crore and achievement as at end September, 2012 is Rs. 2,39,629 crore. Crop loans up to a principal amount of Rs.3 lakh are being provided effectively at 4 per cent per annum with an interest subvention of 4 per cent for timely repayment of loans. Further, the benefit of interest subvention has been extended to small and marginal farmers having Kisan Credit Card for a further period up to six month post harvest against negotiable warehouse receipt for keeping their produce in warehouses to avoid any distress sale. The limit of collateral free farm loan has been increased from Rs.50,000 to Rs.1,00,000. A Revival Package for Long Term Cooperative Credit Structure (LTCCS) is also under consideration of the Government in consultation with State Governments.

1.36 Over the years, there has been a significant increase in the share of formal financial institutions (commercial banks, RRBs and cooperatives) in the total credit availed by cultivator households. The formal financial institutions accounted for about 66 per cent of the total credit to cultivator households by the early 1990s. However, the share of formal institutional credit to agriculture witnessed some reversal during the period between 1991 and 2002 which was partly due to a contraction in rural branch network in the 1990s, and partly due to the general rigidities in procedures and systems of institutional sources of credit. The regional distribution of agricultural credit by commercial banks, both in terms of quantum of credit and the number of accounts, has been skewed. There is a significant concentration in the southern states (Andhra Pradesh, Karnataka, Kerala, Tamil Nadu) followed by the northern and western states. In contrast, the share of the eastern (Bihar, Jharkhand, Odisha and West Bengal) and the north-eastern states has been low. Further, nearly three quarters of the farmer households still do not have access to the formal credit system and have no means to insure themselves against income shocks. This leaves them vulnerable to the informal money lenders.

1.37 With a view to encourage the farmers to adopt progressive farming practices, high value inputs and higher technology and to stabilize farm incomes, insurance coverage in the event of failure of the notified crops as a result of natural calamities, pests and diseases, the National Agricultural Insurance Scheme (NAIS) has been introduced in the country from Rabi 1999-2000 season. Under the scheme, at present, 10% subsidy in premium is available to small & marginal farmers which is shared by the Central and respective State Government on 50 : 50 basis along with claims for normal sum insured & indemnity level for food and oilseed crops. To improve further and make the NAIS easier & more farmer friendly, Modified National Agricultural Insurance Scheme (MNAIS) has been implemented on pilot basis in 50 districts from Rabi 2010-11 season. Besides the NAIS and MNAIS, Pilot Weather Based Crop Insurance Scheme (WBCIS) and Pilot Coconut Palm Insurance Scheme (CPIS) are being implemented by the government. Despite the various schemes launched by the government from time to time, agriculture insurance coverage in terms of area, number of farmers and value of agricultural output insured is very small as compared to the total number of holdings/farmers (137.8 million as per agriculture census 2010-11), the total cultivated area (159.2 million hectares) and the value of agricultural output. A broader base both in terms of area covered and crops insured is necessary for the viability of the schemes.

Agricultural Extension Services

1.38 Over the years, extension system in the country has been exposed to multiple challenges. Farmers' needs in terms of information and technology support have become more complex due to rapid pace of developments in the field of agriculture. Climate-change, depleting natural resources, scarcity of labour and volatile market forces are some of the concerns that have put tremendous pressure both on the farmers as well as extension system in the context of increasing the productivity, profitability and sustainability of Agriculture. Rebuilding an agricultural extension system that is capable of adapting to

the changing agriculture scenario within the country and globally remains a big challenge. Efficacious extension services are being provided by organising farmers into groups (FIG, CIG, FACs, Producer Companies etc.); reaching out to the farmers directly by ensuring availability of dedicated functionaries under ATMA and establishing convergence not only between research & extension but also among extension functionaries under different schemes and putting in place extensive and integrated 5-tiered use of ICT tools & mass media. Quality of services being provided through Kisan Call Centres (KCCs) has been enhanced significantly with use of latest state of the art tools, dissemination of information about new schemes & programmes and effective supervision & greater involvement of State Governments. The success story on production of foodgrain, pulses, vegetables, and fruits during last three years is an eloquent testimony of the way extension machinery worked in tandem with other programmatic interventions (e.g. RKVY, NHM, NFSM, MMA etc.) and has succeeded in propagating technologies and providing timely information to farmers.

Agricultural Prices and Markets

1.39 Food and agricultural commodity prices in India are primarily determined by domestic demand and supply factors. Market micro infrastructure, the systems and procedures of commodities trading and players determine the market efficiency. It has been observed that there is wide spread imperfection in the agricultural produce markets. There is general opaqueness and poor price transmission mechanism. Consequently, there is a wide gap between the prices received by the farmers and the prices paid by the consumer. At times, the farmers are not able to receive a price to cover his cost of production while the consumers are paying an abnormally high price for the same commodity. This is a major concern for the policy makers. High food inflation with an inadequate supply response, aggravated by logistic and market-related constraints are other areas requiring attention. Imperfect market conditions, restrictions on the movement of agricultural commodities due to infrastructural constraints, transport bottlenecks and local taxes influence the retail prices trends across the major markets and consumption centres.

1.40 The principal factors behind the higher levels of inflation in the recent period are constraints in production and distribution especially in high value items such as pulses, fruits and vegetables, milk and dairy products, egg, meat and fish. Increase in prices can be attributed to both supply and demand factors. The per capita availability of some of the items such as cereals and pulses has been declining resulting in some pressure on their prices. In the case of fruits and vegetables, milk, egg, meat and fish, prices have gone up despite an increase in per capita availability. This is due to a changing pattern in the demand of the households for high value items with increasing income levels. Market imperfections also add to these trends by restricting the price transmission. These include lack of infrastructure facilities like efficient transport facilities, storage, processing, marketing and credit facilities. When growth picks up at low income levels the demand for food items would increase as income elasticity of demand for food is higher at lower levels of income. Thus, lower per capita availability of foodgrains and structural shortage of key agricultural commodities like oilseeds and pulses combined with the rising demand have kept food price inflation high. This process has got further accentuated by spikes in global food prices through international transmission. Rising international prices of oil also impacted the cost of production of agriculture through increase in input costs of fertilizers, transportation and a general rise in the cost of all other inputs and services. Increase in cost of production results in increasing the MSP of agricultural commodities which also influences market sentiments. The enduring solution to price inflation lies in increasing productivity, keeping the cost of production under control and removing market imperfections through reforms and infrastructure improvements. The wide variations in market fees, commission charges, lack of grading, standardization and packaging facilities are resulting in higher marketing transaction costs and low price realization by the farmers in regulated markets. This has resulted

into fragmented supply chains with large intermediations. Establishment of an effective system of grading and marking of agriculture produce is necessary for an electronic agricultural marketing exchange.

1.41 Contract farming has considerable potential in terms farmers' access to modern technology, quality inputs and marketing support through contractual agreement between processing and/or marketing firms for production support at predetermined prices. It is necessary that direct marketing and contract farming is promoted to facilitate enhanced share of producers in consumer's rupee. Development of agricultural marketing infrastructure is the foremost requirement for the growth of comprehensive and integrated agricultural marketing system in the country. The development of alternative and competitive marketing channels is necessary to induce competition in the existing marketing systems and to facilitate farmers to sell their produce at remunerative prices. Creation of scientific storage nearer to farm is necessary to avoid wastage and deterioration of the produce.

1.42 Many of the States are yet to adopt the model Agricultural Produce Marketing Committee (APMC) Act suggested by the Central government in 2003. The APMC Acts of non-reformed States do not allow the processor to directly buy the agricultural produce from agriculturists outside the market yard. This leads to long intermediation and high marketing cost, which result into lower share of farmers of the rupee paid by consumers and consumers also do not get fresh produce at reasonable prices. Many of the States that have amended their APMC Acts have not done so strictly on the lines of the Model law circulated by the Centre. Much needed provision for permitting the out-of-mandi transactions and the matter of exemption of market fee on horticultural perishables being pursued by the Department with States, do not find place in the amended statutes in several States. The Department is working towards an integrated nationwide market for agricultural produce.

1.43 Multiple intermediaries, high market taxes ranging from 13% to 15.5% ad-valorem besides other market charges, poor marketing infrastructure and access are some of the reasons for high retail prices and these need to be rationalized. States should waive off market fee on fruit and vegetables under the APMC Act to ensure unhindered trade in the perishable commodities. There is a need for a Central legislation to ensure barrier free movement of agriculture commodities across the country to develop an integrated national market.

1.44 In the context of foodgrains policy, concern has been raised about simultaneous occurrence of high food inflation and large foodgrains stocks in our granaries. The various commodity wise stocks limit notified also discourages investment in storage facilities. The stock limits and movement of agricultural commodities across the country need to be freed so as to facilitate an integrated national market for agricultural produce across the country. Besides improving storage facilities, there is a need to redesign the mechanics of procurement and release of foodgrains to the market to ensure that the impact on prices is substantial in the desired direction. In a large number of markets in several states, such as Bihar, eastern UP, Orissa, Assam, M.P. and Chhattisgarh where surpluses are emerging, there is a need to extend the price support mechanism for effective procurement operations and to strengthen the market infrastructure.

1.45 The Prime Minister's Economic Advisory Council (PMEAC) has also stressed in its recent Economic Outlook report the need for agricultural reforms. The areas that have been identified for urgent attention include the reduction and rationalization of input subsidies, ensuring glitch-free marketing of farm produce and liberalizing tenancy arrangements. The time schedule for rationalizing fertilizer subsidy through the nutrient-based subsidy regime calls for decontrolling the prices of urea, the most consumed fertilizer. Inefficiency in power generation and huge transmission losses are not letting to remove subsidies on power for agricultural purposes. The Council has also

recommended for removing subsidies on canal water to improve water use efficiency and called for encouraging involvement of consumers in water and power distribution.

The Way Forward

1.46 While there has been a significant increase in production of foodgrains and other agri-produce in the recent past, there are formidable challenges, e.g. a decline in the average size of land holding, dwindling water resources and inefficient water use, the adverse impact of climate change, shortage of farm-labour, poor and inefficient marketing infrastructure, and increasing costs and uncertainties associated with volatility in international markets. The main determinants of agriculture growth would be: (a) viability of farm enterprise and returns to investment that depend on productive infrastructure, such as soil and water conservation and expansion and improvement of irrigation systems, market access, prices and risk; (b) availability and dissemination of appropriate technologies that depend on quality of research and extent of skill development; (c) plan expenditure on agriculture and in infrastructure which together with policy must aim to improve functioning of markets and more efficient use of natural resources; and (d) governance in terms of institutions that make possible better delivery of services like credit, quality inputs like seeds, fertilizers, pesticides and farm machinery. In addition, certain regional imbalances must be clearly addressed. As the domestic supply of pulses, oilseeds and fruits and vegetables fall short of the demand, there is a need for crop diversification towards these high value crops. From the point of both food security and sustainability, extension of green revolution to low productivity areas in the Eastern Region where there is ample ground water and surplus labour needs much higher emphasis. Equally important would be the development of suitable technologies and crop varieties particularly for rain-fed area, as 55 per cent of cropped area is rain-fed.

1.47 Most of the smallholders sell their produce immediately after harvest, invariably realizing lower prices and later buy the commodities during the lean season at much higher prices. This is partly due to smallholders need for cash and partly due to lack of adequate technologies and facilities for post harvest handling, storage and processing. This coupled with poor market information and weak market integration, adds to supply distortion and price volatility. To increase and stabilize supplies and thereby mitigate price volatility, improved infrastructural services, particularly for transportation, storage and processing, pro-smallholder innovations in credit flow, organisation of producers and other stakeholders in the agriculture value chain with clear roles and responsibilities in cooperatives which can provide an array of services from provision of inputs to enhancing market access, financial services, technologies and information.

1.48 KCC is an innovative tool of credit delivery to meet the production credit requirement of the farmers in a timely and convenient manner. All eligible farmers should be brought within the umbrella of KCC in time bound manner and it should be made single product catering the all credit needs of farmers. The National Agricultural Insurance Scheme (NAIS) and modified NAIS (MNAIS) provide risk coverage of the crops on the basis of their yield. While the unit area for MNAIS is village/village panchayat, NAIS also allows notification of village as the unit area. However, many States notify a larger unit area such as Block, Taluk and Tehsil. The larger unit area does not cover the risk of individual farmers effectively because of larger variations in the yield in the unit area. The States are reluctant to notify a smaller unit area (such as a village) because of increased requirements of the minimum number of crop cutting experiments that has to be undertaken which is both costly and time consuming affair. The States need to deploy additional manpower and provide adequate training to the personnel engaged in the crop cutting experiments to ensure accurate and timely availability of yield data for effective implementation of the insurance schemes. Use of modern technology such as remote sensing through satellite imagery may be deployed to reduce the cost and improve the accuracy of crop cutting experiments.

1.49 To sum up, the thrust areas for the agriculture sector include enhancing public sector investment particularly in research and technology transfer along with institutional reforms to make it more accountable towards delivery, conservation of land, water and biological resources, development of rain fed agriculture, development of minor irrigation and water use efficiency, timely and adequate availability of inputs -seeds, fertilizers, pesticides, developing efficient marketing infrastructure, increasing flow of credit particularly to the small and marginal farmers.

1.50 Improved performance at farm level will result in improved food security and improved farm livelihoods only if other components in the value-chain such as infrastructure supporting agricultural upstream and downstream activities, including transport, storage, processing and marketing facilities for agricultural products are also developed simultaneously. Continuous innovation to improve productivity and competitiveness of the agriculture sector are necessary to create jobs, generate income and alleviate rural poverty. From the government's side, enabling policies and institutions in a variety of domains - from R&D to trade and markets, from natural resource governance to collective action by agricultural producers, agricultural extension and rural advisory services are necessary to bring knowledge, technologies, and services to farmers and entrepreneurs. Investment in relevant public goods which works both as a catalyst of, and complements to, private investment in agriculture is necessary.

CHAPTER 2

Natural Resource Management

2.1 Land, water resources, soil and biodiversity which are the natural resources for agriculture are under considerable strain. India's total gross cropped area is about 192.2 million hectares and the net sown area is 140 million ha. Over the last three to four decades, net sown area remains stagnant and possibility of increasing it is minimal due to increasing demand on land for other purposes. The ultimate irrigation potential of the country is estimated to be about 140 million ha out of which about 76 million ha is met by surface water and remaining 64 million hectare from ground water sources. Presently, about 63 million ha (45%) of cropped area, is reported to be irrigated.

2.2 The demand for meeting food and water for a growing population from a shrinking natural resource base has shifted focus to enhance agricultural production in a sustainable manner. The progressive fragmentation of land holdings, degrading natural resource base and emerging concerns of climate change will further escalate pressure on land and water. Land and water resources being finite, increased production has to come from the same restricted net sown area by increasing productivity. Thus, increase in agricultural production will mainly come from enhancement in farm productivity with optimal use of available water and land resources.

2.3 Agriculture production is mainly dependent on natural resources e.g. land, water, soil, biodiversity (plant, animal and microbial genetic resources), along with air and sunlight. But these natural resources are rapidly shrinking due to demographic and socio-economic pressures, monsoonal disturbances, increasing frequencies of floods and droughts etc. Overuse of marginal lands, imbalanced fertigation, deteriorating soil health, diversion of agricultural land to nonagricultural uses, misuse of irrigation water, depleting aquifers & irrigation sources, salinization of fertile lands and water-logging continue apace. During the last three decades while considerable emphasis has been laid on development of natural resources (land, water and perennial biomass), negligible attention towards sustainable socio-economic management of these resources have reached to unprecedented levels. For making agriculture sustainable, to meet country's food requirement, soil health and water availability are to be maintained at levels that would re-assure farmers to pursue agricultural activities with higher level of productivity.

Land & Land Use

2.4 Land use classification based on different type of uses indicate that a little more than half of total land mass of 328.73 million hectare in the country is used for agriculture. This includes 140.02 million ha net sown area under cultivation and 26.17 million ha for non-agricultural uses. Over the years there is a gradual increase in area under non-agricultural uses. During the last decade (1999-2000 to 2009-10), area under non-agricultural uses has increased by 2.57 million ha (11%). During the same period cultivable land has marginally declined by 1.4 million ha (0.8%) and net sown area has declined by 1.04 million ha (0.7%). As a normal process, of urbanization and development, while area under non-agricultural uses is increasing, measures taken by government, has reclaimed land for cultivation from degraded/culturable waste land category. The net cultivated area increased significantly by about 18% from 119 million ha in 1950-51

Box 2.1: Land Use in India

- Forest area: 70 million ha (21.2%)
- Non-agricultural uses: 26.17 million ha (8%)
- Barren & uncultivable: 16.78 million ha (5.1%)
- Culturable waste: 12.86 million ha (3.9%)
- Permanent pastures: 10.15 million ha (3.1%)
- Miscellaneous tree crops: 3.35 million ha (1%)
- Fallow land: 26.24 million ha (8%)
- Agricultural land: 182.46 million ha (55.5%)
- Net Sown Area: 140.02 million ha (42.6%)

Source: Directorate of Economics & Statistics

to 140 million ha in 1970-71 and since then it is more or less stable at 140 million ha, where as the cropping intensity has increased from 111% to 137% during the same period.

2.5 During 2010-2011, food grains accounted for the largest share of about 65% of gross cropped area. During the last decade (2000-2001 to 2010-2011) the area under cereals, pulses and oil seeds have increased by about 5.7 million ha, 6 million ha and 4 million ha respectively. However, during the same period the area under coarse cereals has declined by about 2.6 million ha. Analysis of the shift in area under various crops (in gross cropped area) reveals that share of jowar, bajra, ragi, barley has continuously declined, whereas area under pulses, rice, fodder, tobacco has more or less remained at the same level and share of maize, wheat, sugarcane, condiments and spices, fruits & vegetables, oilseeds, tea, coffee and fibers has increased when compared to 1950-51 levels. During the last 10 years there is no drastic change in cropping pattern, while year to year fluctuations are being observed. However there is a gradual increase in area under fruits and vegetables by about 1.6 million ha during the same period.

Challenges

2.6 **Land Fragmentation:** Increasing human and animal population has reduced availability of land over the decades. Per capita availability of land has declined from 0.89 hectare in 1951 to 0.32 hectare in 2001 and is projected to further slide down to 0.20 hectare in 2035. As far as agricultural land is concerned, per capita availability of land has declined from 0.5 hectare in 1951 to 0.18 hectare in 2001 and is likely to decline further. The average land holding size which was about 1.33 ha in 2000-01 has declined to 1.16 ha during 2010-11.

2.7 **Diversion of Agricultural Land:** There has been an increase in putting agricultural land into non agricultural uses to accommodate developmental activities like industries, housing, transport, irrigation, recreational facilities etc. It has been estimated that during the period 1950-51 to 2009-10, the percentage of land used for non agricultural purposes over reporting area has increased from 3.3 to 8.6%. During the last decade (1999-2000 to 2009-10), area under non-agricultural uses has increased by 2.57 million ha i.e. by 11%. Due to large demand of land for infrastructure, more and more fertile land is being diverted. States where proportion of land under non agricultural uses is higher than all India average(%) are West Bengal, Tamil Nadu, Bihar including Jharkhand, Sikkim, Assam, Tripura, Goa, Andhra Pradesh, Kerala, UP, Haryana and UTs like Chandigarh, Delhi, Pudduchery and Daman & Diu.

2.8 **Unwanted Crop Diversification:** Apart from the diversion of lands from cultivation to nonagricultural uses and damage due to industrial waste, pollution, water extraction by the industries, townships etc., there is a tendency for diversified intensive agriculture for higher economic gains based on market demands in areas not conducive to agro-climatic conditions. There is a need for shift in land use and cropping patterns in accordance to the climatic parameters, land characteristics and water availability scenarios.

2.9 **Climate Change:** Climate Change is likely to impact agricultural land use and production due to less availability of water for irrigation, higher frequency and intensity of inter and intra-seasonal droughts and floods, low soil organic matter, soil erosion, less availability of energy, coastal flooding etc. Observations of Inter Governmental Panel on Climate Change (IPCC) reaffirms that the adverse impact of climate change due to rising temperature and extreme weather events on the food production systems could impact agricultural growth adversely.

Policies & Programmes

2.10 National Policy for Farmers, 2007 (NPF, 2007) emphasizes on protection and improvement of land, water, biodiversity and genetic resources for sustained productivity. Reflection of NPF, 2007 is evident in the proposed draft Land Acquisition, Relief and Rehabilitation Bill, 2011 where in minimum acquisition of agricultural land for non-agricultural use is recommended.

2.11 Various Watershed Development Programmes (WDPs) are being implemented by Ministry of Agriculture and Ministry of Rural Development for development of degraded lands. These programmes are 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 Integrated Watershed Management Programme (IWMP). Under these WDPs, since inception till end of Eleventh Five Year Plan, an area of about 58 million ha has been developed.

Way Forward

2.12 **Incentivize Conservation Agriculture:** Conservation Agriculture can be ensured by incentivizing sustainable farm operations through power connectivity, additional input subsidy, low premium on crop insurance etc.

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

2.14 **Land Reform:** Considering skewed ownership of land, it is necessary to strengthen implementation of laws relating to land reforms, with particular reference to tenancy laws and leasing, distribution of ceiling surplus land and wasteland, providing adequate access to common property and wasteland resources and consolidation of holdings. Allaying the fears of a farmer regarding possible alienation from his own land because of leasing it out to the retailer/ processor requires the freeing up of land lease markets. Legalizing lease markets also protects the interests of the retailer/processor, and enables him to undertake larger investments. Registration of land deeds and the computerization of land records will bring about greater transparency and reliability, improve the marketability of land and enhance access of farmers to institutional credit that requires pledging of collaterals.

2.15 **Computerization of Land Records:** Land and soil surveys should be completed and inventory of land resources should be prepared in each State so that resource allocation is based on a reliable data base. A "soil to satellite" approach needs to be promoted along with computerization of land records for availability of easier, accurate and transparent information on land and land uses.

2.16 **Policy on Diversion and Fragmentation of land:** Productive agricultural land should not be diverted for industrialization or urbanization. In case of extreme national need, it could be stipulated that Industries who are provided with agricultural or other lands for development projects should compensate for treatment and full development of equivalent degraded/waste lands elsewhere. Considering the small size of land holding, it is not possible to reap the benefits of economies of scale. Hence, there is need for aggregation of land through contract farming, cooperative farming, collective farming etc. To achieve this farmer producer organization, farmer industry partnership, farmer-farmer partnership with enabling provisions in policies and reforms be encouraged to scale up input application, bringing in higher investment and reap the benefit of collective bargaining power of small and marginal farmers.

2.17 **Public Private Partnership:** In the present scenario Public Private Partnership in land and watershed development programmes is not only indispensable but also need of the hour. An enabling frame work is required for involvement of Private Sector in natural resource management.

Soil

2.18 Traditionally Indian soils are divided into four major groups namely: (1) red, (2) black, (3) alluvial, and (4) laterite. Based on depth, clay content and other soil parameters, a variety of soil types within these soil groups are available. The land surface in the country is predominantly covered with red soils (105.5 million ha), black soils (73.5 million ha), alluvial soils (58.4 million ha), laterite soils (11.7 million ha), desert soils (30 million ha) and hills & tarai soils (26.8 million ha).

Challenges

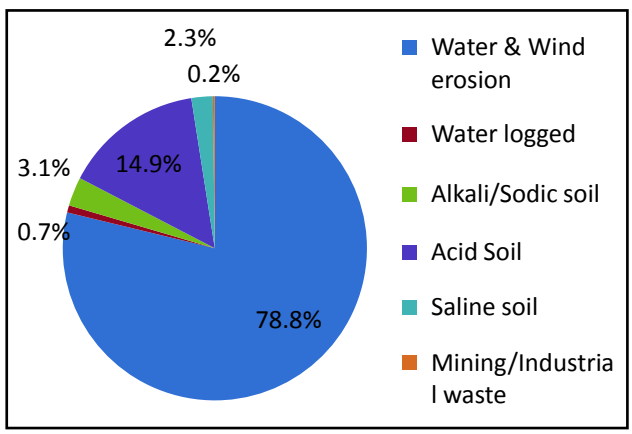
2.19 Soil health is fundamental for agricultural sustainability. State of soil health is governed by a number of physical, chemical and biological attributes/processes. Major issues of soil health are:

- Physical degradation caused by compaction, crusting, excessive cultivation or puddling, water logging and soil erosion
- Chemical degradation caused by wide nutrient gap between nutrient demand and supply, high nutrient turnover in soil plant system coupled with low and imbalanced fertiliser use, emerging deficiencies of secondary and micronutrients, poor nutrient use efficiencies, insufficient input of organic sources, acidification and aluminium toxicity in acid soils, salinity and alkalinity
- Biological degradation due to organic matter depletion and loss of soil fauna and flora, and;
- Soil pollution from industrial wastes, excessive use of pesticides and heavy metal contamination.

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

2.20 **Physical Degradation:** Land degradation is a major threat to our food and environmental security. As per estimates of Indian Council of Agricultural Research (2010), out of total geographical area of 328.73 million ha, about 120.40 million ha is affected by various kind of land degradation resulting in annual soil loss of about 5.3 billion tonnes through erosion. This includes water and wind erosion (94.87 million ha), water logging (0.91 million ha), soil alkalinity/sodicity (3.71 million ha), soil acidity (17.93 million ha), soil salinity (2.73 million ha) and mining and industrial waste (0.26 million ha). Water erosion is wide spread across the country, whereas wind erosion affects Rajasthan and J&K. Water logged areas are mostly found in Uttar Pradesh, Kerala, Bihar & Andhra Pradesh. Saline and alkaline tracts are mostly seen in Rajasthan, Uttar Pradesh and Maharashtra. Acid soils are prominent in MP, Chhattisgarh, Arunachal, Mizoram, Meghalaya, Bihar and Jharkhand.The details of soil fertility status of Indian soil, soil testing laboratories and measures to improve soil health are given in Chapter 3.

Fig. 2.1: Total Degraded Land (120.4 million)



Policies & Programmes

2.21 **Soil Survey:** Soil and Land Use Survey of India (SLUSI) under Deptt. of Agriculture and Cooperation, Ministry of Agriculture has been

Box 2.2: Soil Survey Status: SLUSI

Survey type	Achievement (million ha)
Rapid Reconnaisance Survey (1:50 K)	253.0
Detailed Soil Survey	
(1:5 K/8 K or larger)	13.5
Land Degradation Mapping (1:50 K)	45.0
Soil Resource Mapping (1:50 K)	45.9

engaged in conducting soil survey of the country since 1958 for National land based developmental programme. Soil survey aims at generating scientific database on soil and land resources for planning and implementation of soil and water conservation (through watershed programmes) for natural resource management. Database is being generated to meet the needs for planning at National/State/Basin/District/Catchment and Village/micro-watershed levels. Rapid Reconnaisance Survey (RRS) is to demarcate and identify priority watersheds in the catchment areas on 1:50K scale based on either sediment yield index or runoff generation potential index. Detailed Soil Survey (DSS) is to generate detailed information on soil and land characterization of the priority areas using cadastral map (1:4K/1:8K) or large scale aerial photograph/satellite images (1:10k to 1:20k) 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.

Water Resources

2.22 The average annual rainfall in the country has been estimated to be about 1170 millimeters (mm). The total of average annual rainfall, snowfall and glacier melt in terms of volume works out to about 4000 billion cubic meters (bcm). However, due to losses through evaporation and evapo-transpiration, water availability has been assessed to be about 1869 bcm. Even available water cannot be fully utilized due to topographical constraints and hydrological features and utilizable water is estimated to be about 1123 bcm (comprising of 690 bcm surface water and 433 bcm replenishable ground water. Large temporal and spatial variations are observed in rainfall and hence in the water availability. Most of the water is available during the monsoon period and that too, through a few spells of intense rainfall, resulting in floods in major river systems. Area irrigated through different sources of irrigation and per cent of irrigated area under different crops are given in the following figures. There is a need to bring more cropped area under assured irrigation to increase agriculture productivity and production.

Survey type	Achievement (million ha)
Annual Precipitation (Including snowfall)	4000 BCM
Average Annual Availability	1869 BCM
Estimated Utilizable Water Resources	1123 BCM
(i) Surface Water	690 BCM
(ii) Ground Water	433 BCM
Per Capita Water Availability (2001) in cubic meter	1820 CM
Source: Ministry of Water Resources	

Fig. 2.2(a): Irrigated Area and Sources of Irrigation

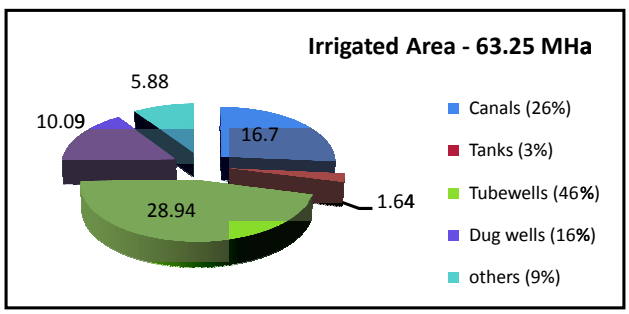
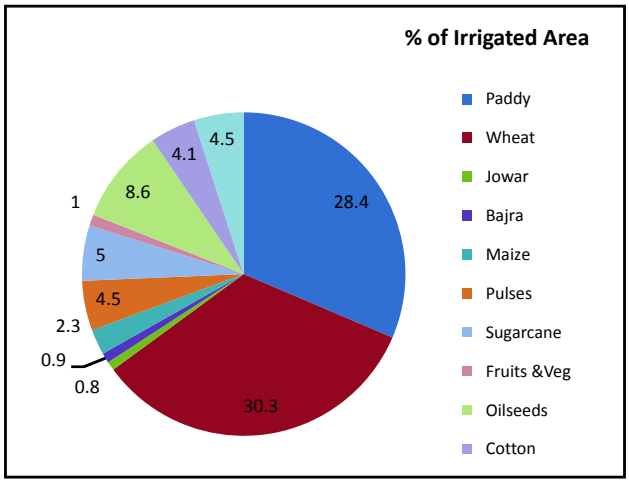


Fig. 2.2 (b): Per cent of irrigated area under different crops



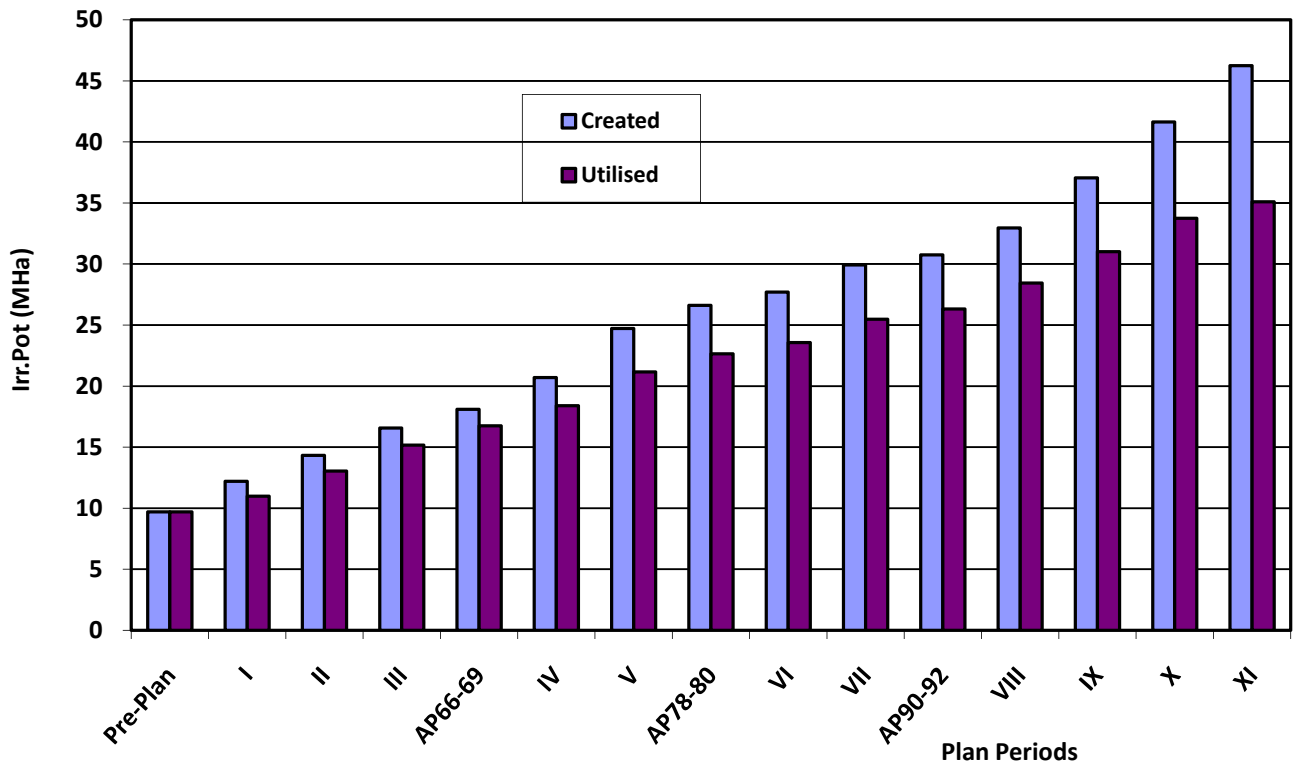
Source: Directorate of Economics & Statistics

Challenges

2.23 **Regional Imbalance:** There is huge temporal and spatial variation in rainfall and water availability in the country. Most of the water is available during monsoon period and that too, through few spells of intense rainfall, resulting in floods in major rivers. While average annual rainfall of the country is about 1170 mm, average rainfall in North East Region is as high as 10000 mm per year whereas some parts of Western Rajasthan receive annual rainfall of about 100 mm only. The basin wise availability of water is also quite varied as the Ganga-Brahmaputra river basin contributes to more than 50% of total annual water availability, whereas, about 15% each is only available in Southern and Western basins.

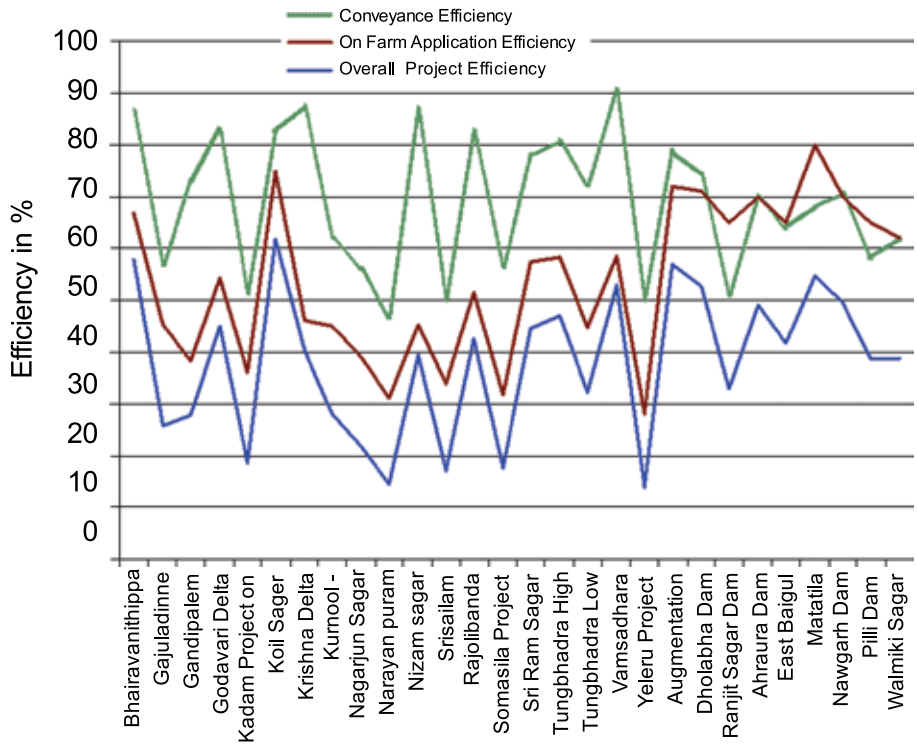
2.24 **Sub-optimal Utilization of Created Facilities:** The sub-optimal utilization of created facilities is another major challenge. Only about 85 per cent of created potential has been put into use. This gap has only been increasing over time. It is necessary to provide infrastructure for ensuring last mile connectivity in developed commands for optimal utilization of potential created.

Fig. 2.3: Potential created and utilized respect of major & medium project



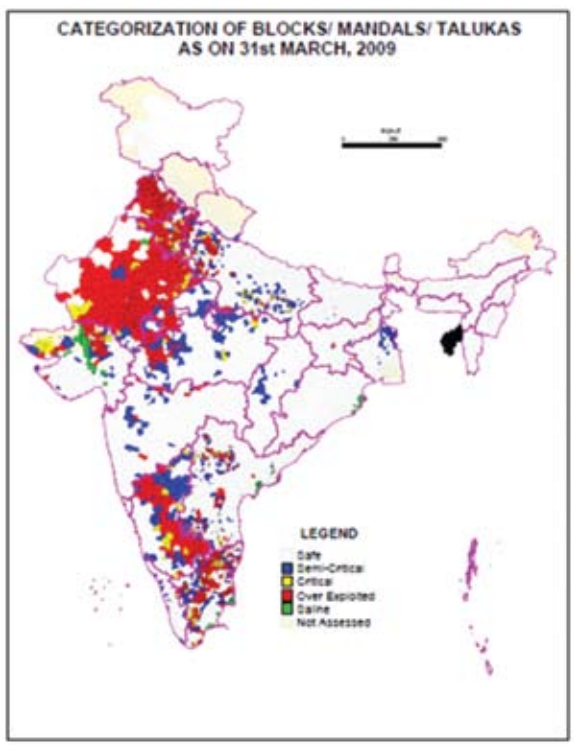
Source: Ministry of Water Resources

2.25 **Poor Water-use Efficiency:** The present level of efficiency of irrigation system in India is relatively low and there is considerable scope for improvement. It is observed that irrigation efficiencies from surface water sources varies in the range of 35 to 40% only, where as for ground water, it is about 65-75%.



Source: Ministry of Water Resources

2.26 **Ground Water Depletion:** Despite huge contribution of ground water in agriculture growth, it is heading for crisis and needs urgent attention. Due to unregulated use and heavy subsidies on power, there has been a tendency of excess withdrawal of this precious resource. Decline in water level is observed mostly in northern, north western and eastern parts of the country in the states of Uttar Pradesh, Rajasthan, Bihar, Jharkhand, West Bengal, Punjab and Haryana. Decline in water level has also been observed in parts of Tamil Nadu and Andhra Pradesh. Decline in water level of more than 2 m, which is considered to be significant is seen in parts of Rajasthan, Haryana, Punjab, and western Uttar Pradesh, western Andhra Pradesh and North West part of Tamil Nadu. Out of 5842 numbers of assessed administrative units (Blocks/Taluks/Mandals/Districts), 802 units are Over-exploited, 169 units are Critical, 523 units are Semi-critical.



2.27 **Competing Demand:** The demand for water for various purposes is increasing due to population growth, urbanization and industrialization. Presently agriculture sector is using about 83% of available water resources, but due to demand from other sectors availability may decline to 68% in 2050.

2.28 **Water Logging and Soil Salinity:** Another challenge relates to over-use of surface water which has resulted in drainage problems causing water logging in some areas. Problem of water logging is very often observed in canal irrigation system and also in areas of poor drainage resulting in accumulation of water.

2.29 **Climate Change:** Although precise quantitative assessment of 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.

Programmes & Schemes

2.30 **Accelerated Irrigation Benefit Programme (AIBP):** Major & medium irrigation projects are capital-intensive in nature. Accelerated Irrigation Benefits Programme (AIBP) was launched by MoWR, Government of India during 1996-97 to provide financial assistance to State Governments for accelerating the pace of irrigation development in the country. So far Irrigation potential created from major/medium projects and minor irrigation schemes is about 8 million ha.

2.31 **Command Area Development Programme (CADP):** The Centrally Sponsored Command Area Development (CAD) Programme was launched in 1974-75 by MoWR for development of adequate delivery system of irrigation water up to farmers' field with an objective to bridge the gap between potential created and utilised and to enhance water use efficiency and production and productivity of crops per unit of land and water for improving socio-economic condition of farmers. So far 314 projects with a CCA of 28.95 Million ha have been included under the programme.

2.32 **Repair, Renovation & Restoration (RRR) of Water Bodies:** Repair Renovation & Restoration of Water Bodies (RRR) were taken up under both domestic and external support (World Bank) with an outlay of Rs.1250 crore and Rs.1500 crore respectively during XI Plan by MoWR. The objective of the Scheme is to restore and augment storage capacities of water bodies, and to recover and extend their lost irrigation potential. Under the domestic support 3341 Water bodies were taken up against which 694 water bodies have been completed. The evaluation of the scheme indicates that the storage capacity in the tanks have been enhanced in the range of 50-85%.

2.33 **Artificial Recharge to Ground Water through dugwells:** Ministry of Water Resources launched a scheme on "Artificial Recharge to Ground Water through Dug Wells" in 6 States, namely, Maharashtra, Karnataka, Rajasthan, Tamil Nadu, Gujarat & Madhya Pradesh during XI Plan with the objective to recharge rain runoff generated in agricultural fields through existing dugwells in areas underlain by hard rock terrain and having majority of Overexploited, Critical and Semi-critical assessment units. By the end of 2010-11 about 95000 dugwell recharge structures have been completed.

2.34 **National Mission on Micro Irrigation:** National Mission on Micro Irrigation was launched in June 2010 as a continuation of the Micro Irrigation Scheme which was initiated in March, 2005-06. Drip and Sprinkler technologies are being promoted to supply water at the root zone as per requirements. Micro irrigation is instrumental in not only enhancing efficiency of water application but also in precision application of fertilizers & plant nutrients. By the end of 2011-12, about 3 million ha area has been covered under drip & sprinkler irrigation. Major impediments in the implementation of National Mission on Micro Irrigation (NMMI) are initial cost of installation of MI system and lack of awareness of benefits of the system. Most of the farmers in the country are small and marginal farmers. Inspite of subsidy provided by both Central and State Governments, they find it difficult to install the MI system because of high cost of equipment. Inspite of extension/

promotion activities undertaken as part of the implementation of NMMI scheme, farmers are not aware of the increase in the production and productivity and saving of water and power with the installation of MI system. Moreover, water and power in many states is provided free for agriculture activities. Hence, farmers are not impressed by the fact that installation of MI system leads to saving of power and water.

2.35 **Rashtriya Krishi Vikas Yojana (RKVY):** Rashtriya Krishi Vikas Yojana (RKVY) gives flexibility to state in taking up need-based interventions including infrastructure development for increasing production and productivity in agriculture sector. Substantial resources are being invested with special emphasis on water resource development and management by the States under RKVY. During XI Plan about 20% of the total cost has been invested for natural resource management and irrigation development.

The Way Forward

2.36 **Reducing Gap between Potential Created and Utilized:** The gap between irrigation potential created and utilized should be minimized through better on-farm water management, suitable agronomic measures like better cropping pattern and cropping alignment, participatory water management etc.

2.37 **Improving Water use Efficiency:** Micro-irrigation systems and laser leveling, have potential of enhancing 80 to 90 % irrigation and water use efficiency, are essential to derive maximum income, livelihood, employment and food security. Micro-irrigation needs to be expanded at a faster rate to increase water use efficiency. But looking into the difficulties of small and marginal farmers to afford the cost of equipments inspite of being subsidized, there is need for policy relook as far as subsidy for MI system to small and marginal farmers are concerned. There is also a need for policy relook towards free power supply by some states to agriculture sector.

2.38 **Addressing Problems of Over-exploitation of Ground Water:** Sustainable groundwater development and management in overexploited regions needs to be addressed by artificial recharge of groundwater and rainwater harvesting, conjunctive use of surface water and groundwater, management of poor/marginal quality groundwater, water conservation, regulation of groundwater development etc. Separation of feeders for domestic and agricultural purposes and its timely & regulated supply for irrigation could help in conserving groundwater use. A gradual withdrawal of water guzzling crops from overexploited regions of the country is need of the hour.

2.39 **Irrigation Development in Eastern & NE Region:** In East and North East India ground water resources are under-utilized to the tune of 58-82% and these regions are also blessed with sufficient rainfall. In Assam, Bihar, Chhattisgarh, Orissa, parts of Jharkhand, Eastern Uttar Pradesh and West Bengal, other coastal regions and pockets, a battery of shallow and deep tube-wells may be installed on priority basis for drawl of ground water during the *Rabi* season which will also act as a sink for subsequent floods.

2.40 **Creating Secondary Storages in Tail end of Canal Commands:** During monsoon period, reservoirs are at peak storage level. Availability of water in canal system is unrestricted and water is available in plenty even at tail end of the system. This water if stored in secondary storage structures constructed at feasible locations of tail end of canal system, would help in making water available during dry spells and also create additional storage thereby reducing impact of floods to a certain extent.

2.41 **Measures to Control Water Logging & Soil Salinity:** Apart from lining of canals, wherever

required there is a need for drainage development either through surface/sub surface/bio drainage or a combined approach followed by appropriate agronomic measures.

2.42 **Emphasis on Awareness Generation & Training:** Training and awareness of farmers towards proper use of irrigation water in critical stages of crop growth under different soil and environment conditions is very essential.

Climate Change

2.43 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. 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 recent decades. 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.

Challenges

2.44 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. 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. While in the short run impact might not be severe, most crops are likely to witness yield decline after 2020 when temperature threshold limit of many crops might get breached.

2.45 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 number of rainy days.

2.46 Crop specific simulation studies, though not conclusive due to inherent limitations, project a significant decrease in cereal production by the end of this century. Parts of western Rajasthan, southern Gujarat, Madhya Pradesh, Maharashtra, Northern Karnataka, Northern Andhra Pradesh, and Southern Bihar are likely to be more vulnerable in times of extreme events.

2.47 Irrigation requirements in arid and semiarid regions are estimated to increase by 10% for every 10°C rise in temperature. Rise in sea level is likely to have adverse effects on the livelihoods of fisher and coastal communities.

National Mission for Sustainable Agriculture (NMSA)

2.48 NMSA is one of the eight Missions under National Action Plan on Climate Change (NAPCC). It seeks to address issues on '*Sustainable Agriculture*' in the context of risks associated with climate change by devising appropriate adaptation and mitigation strategies for ensuring food security, enhancing livelihood opportunities and contributing to economic stability at National Level.

2.49 NMSA seeks to transform Indian agriculture into a climate resilient production system through suitable adaptation and mitigation measures in domains of both crops and animal husbandry. These measures would be mainstreamed in

research and development activities, absorption of improved technology and best practices, creation of physical and financial infrastructure and institutional frame work, facilitating access to information and promoting capacity building. While promotion of dryland agriculture would receive prime importance by way of developing suitable drought and pest resistant crop varieties and ensuing adequacy of institutional support, Mission for sustainable agriculture would also expand its coverage to rainfed areas for integrating farming systems with livestock and fisheries, so that agricultural production continues to grow in a sustainable manner.

2.50 NMSA indentifies 10 key dimensions for promoting suitable agricultural practices, which will be realized by implementing a Programme of Action (PoA) that covers both adaptation and mitigation measures through four functional areas, namely, **Research and Development, Technologies, Products and practices, Infrastructure and Capacity building**. While recognizing role of modern technologies and research in promoting sustainability of agriculture production this Mission also emphasizes on need to harness traditional knowledge and agricultural heritage for in-situ conservation of genetic resources.

2.51 Sustainable agricultural production shall continue to remain key to ensure food and livelihood security and would require a multi-functional/multi-tier institutional mechanism for ensuring convergence and establishing linkage at all levels. NMSA, therefore, proposes to formulate policies of national importance in consultation with the States in National Development Council. Similarly, for deliberating cross cutting issues with other Missions as well as Ministries/ Departments, an Inter Ministerial Coordination Committee, chaired by Cabinet Secretary is recommended. An intra-Ministerial Platform will function in Ministry of Agriculture and its collaborative efforts with relevant Departments, NGO's, Civil Society, Knowledge Institutions and other stakeholders would be coordinated by Secretary, Agriculture and Co-operation.

Drought management

2.52 The Department of Agriculture & Cooperation is the nodal department for coordination of relief efforts necessitated by drought. 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. A **Crisis Management Plan** is released annually to guide and formulate the Contingency Plan for all the sectors linked with the impact of drought to mitigate the impact of drought situation. State Governments are also advised to prepare district-wise contingency plans accordingly. The **Control Room** of the Department collects information on rainfall, drinking water, etc to monitor the drought situation and liaises with the Central Ministries/ Department & 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. Separate Minister-level and Secretary level committees are in place to tackle the situation.

2.53 There is a Crop Weather Watch Group (CWWG) representing concerned Central Ministries/Departments under DAC which meets on regular basis to take stock of rainfall, weather forecast, progress of sowing, crop health, level of water in the major water reservoirs in the country, etc. Deliberation of CWWG is coordinated by the National Crop Forecasting Centre (NCFC) in the Department of Agriculture & Cooperation. The inputs information received on rainfall and its forecast, water storage in reservoirs, pest control, inputs availability, crop sowing status and prices are shared among the members of the Group for formulating strategy to meet the contingencies. The findings of CWWG and IMD reports are deliberated and the requirements for agricultural and allied sectors are assessed and appropriate actions taken by the Central Government. The State Governments are also advised suitably and their efforts are supplemented from the Central resources, whenever the situation warrants

for immediate intervention for mitigating the hardships of agricultural sector.

Current Status

2.54 National Mission for Sustainable Agriculture (NMSA) was accorded '*in principle*' approval by PM's Council on Climate Change (PMCCC) on 23.09.2010. Ministry of Agriculture, has thereafter, initiated a process of restructuring its ongoing Schemes/Programmes for making Indian agriculture climate resilient by embedding and mainstreaming various adaptation measures identified in NMSA onto relevant programmes, converging programmes with identical goals and discontinuing programmes which have lost relevance.

2.55 NMSA as a restructured Mission for XII plan shall cater to 5 Mission Deliverables focusing areas like rainfed area development, resource conservation, water use efficiency and soil health management. Remaining Mission Deliverables will be addressed by other Missions/Schemes including those by DARE and DAHD&F. Planning Commission has accorded its *in-principle* approval for implementing/launching NMSA during XII Plan.

Way Forward

2.56 Long term drought proofing strategies and development plans to enable appropriate coping mechanism during extended dry periods, particularly in the rainfed areas, need to be formulated suitable to specific agro ecology, social factors and available infrastructure to minimize the risk. Apart from conserving moisture and creating water bodies to meet the life saving irrigation during critical dry spells, there is need to focus on safety nets, varietal improvement for drought tolerant crops/plants, water saving technologies, supplementary livelihood support activities like animal husbandry, agro-forestry, small scale agro-processing units etc to mitigate the risk of crop failure.

CHAPTER 3

Farm Inputs and Management

3.1 Agricultural production is essentially an outcome of the interplay of the natural resources such as land, water, soil, biodiversity; with the plant genetic material i.e. the seed and use of other agricultural inputs like chemical fertilizers, organic manure, pesticides, farm machinery and equipments, labour, credit and insurance; pricing policy and marketing infrastructure. Chapter two was devoted to natural resources. This chapter highlights the present state of agricultural inputs like seeds and planting materials, fertilizers, pesticides, farm machinery and equipment, credit etc, which determine agricultural productivity and production.

Seeds and Planting Material

3.2 Seed quality is an important aspect that determines the output of a variety. Seed quality is administered through seed certification, seed testing, seed labeling and seed law enforcement during the stages of production, processing and packaging of seeds. Presently, seed certification is carried out by 24 State Seed Certification Agencies. To ensure the quality of seeds, State Governments appoint Seed Inspectors under Seeds Act, 1966 and the Seeds (Control) Order, 1983. These inspectors draw the sample from seed packets being sold in the market and send the same to the notified seed testing laboratories for quality checking. If any seed is found sub-standard or any seed dealer contravenes the provisions of the Seeds Act or Seeds Rules, legal proceedings can be initiated against such seed dealers or distributors.

Hybrid Seeds

3.3 Hybrid seeds in cross pollinated crops give higher yield, hence, greater emphasis is given to hybrid seeds to improve crops productivity. The crop wise and State wise requirements, production and availability of hybrid seed during each of last three years and current year as reported by the State Governments is given in Table 3.1. It shows that availability has been by and large higher than the requirement all these years:

Table: 3.1: Requirement & Availability of Certified/Quality Seeds of Hybrids

(Quantity in million tonnes)

S. No.	Crop	2009-10		2010-11		2011-12		2012-13 (KHARIF-2012)	
		Req.	Av.	Req.	Av.	Req.	Av.	Req.	Av.
1	Paddy	2.9	5.3	9.8	10.9	9.9	9.2	28.8	28.8
2	Maize	62.7	61.1	75.4	92.2	101.7	142.1	73.7	77.0
3	Jowar	17.2	19.9	11.5	13.9	13.1	13.9	12.1	12.5
4	Bajra	22.4	19.7	21.9	26.0	24.6	28.4	23.0	25.9
5	Sunflower	4.0	6.4	5.8	6.3	7.0	9.6	2.5	2.7
6	Castor	3.7	5.0	2.5	3.1	3.4	4.5	4.0	4.3
7	Cotton	1.1	15.8	14.5	15.6	19.5	22.5	22.2	25.2
8	TOTAL	124.3	133.4	141.6	168.1	179.1	230.1	166.3	176.4

Req: Requirement Av. Availability

3.4 Certified/quality seeds accounts for about 30 percent of the total seeds used in the country. There are significant variations across crops and states in the proportion of certified/quality seeds used. Thus, there is a need to enhance the Seed Replacement Ratio. Further, presently, SRR has a major component of Truthfully Labelled seeds (TL). This Department has been giving high emphasis to Seed Replacement Ratio (SRR) of major crops. Besides strengthening of seed production chain, efforts are underway to enhance supply and use of certified seeds, particularly of oilseeds. Bt. cotton is the only transgenic crop in the country under commercial cultivation. Besides, an impressive improvement in the productivity of Bt. Cotton, by 15% to 30% as compared to Non-Bt. Cotton, there has been a significant reduction in the usages of insecticide, from 46% in 2001 to 21% during 2009 - 2010 due to the adoption of transgenic technology.

3.5 The varied agro climatic conditions of the country are suitable for cultivation of large number of crops and varieties. Though India produces quality seeds of a huge number of crops grown across the country during different seasons, its share of global seed market is less than 2%. The National Seed Policy envisages a 10% share of global market in the coming decade.

Planting Materials

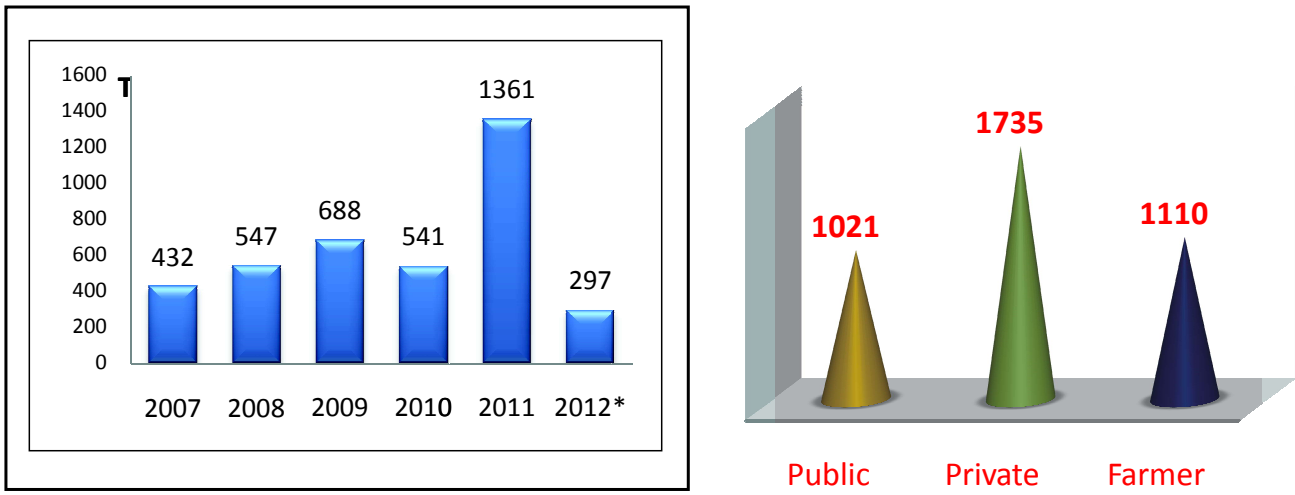
3.6 Productivity and quality of horticultural crops depends to a large extent on the availability and quality of planting material and rootstocks. With a view to boost the availability and quality of planting material, the Department of Agriculture and Cooperation has taken several initiatives, some of which are listed below:

- Establishment of strong nursery infrastructure for mass multiplication of varieties/rootstocks in commercial fruit crops.
- Establishment of mother blocks of improved varieties for mass multiplications of disease free quality planting material.
- Establishment of rootstocks bank to mitigate problems related to biotic and abiotic stress.
- Implementing agencies to procure planting material only from accredited nurseries.
- Import of polyembryonic/clonal rootstocks and planting material of improved varieties of fruit crops, especially for establishment of mother/scion/root stock blocks to enhance capability of production of adequate quantities of planting material required for new plantation.
- Tree Canopy Management to enhance production and productivity of horticulture crops
- Establishing clusters of excellence of horticultural crops all across the country.

Protection of Plant Varieties and Farmers' Rights

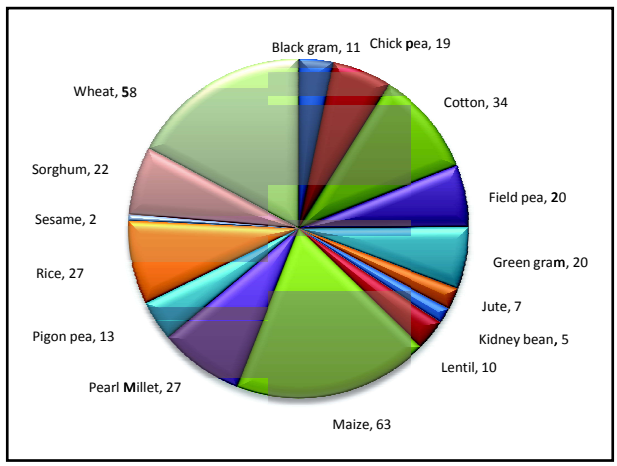
3.7 Legislation for Protection of Plant Varieties and Farmers' Rights was enacted in 2001, which provides for the establishment of s*ui generis* and an effective system for protection of plant varieties, the rights of farmers and plant breeders and to encourage the development of new varieties. PPV&FRA registers plant varieties to protect plant breeders' rights. It also provides for protection of rights of the farmers in respect of their contribution made in conserving, improving and making available plant genetic resources. A total of 57 crop species have been notified for registration purposes by the Authority. Linkage with private seed industry is very important and as of now 67 private companies has applied for registration for protection under the Act. Application received for registration of varieties – year wise and registration certificates issued crop-wise are given at Fig. 3.1 & 3.2, respectively.

Fig. 3.1: Applications Received for Registration of Varieties at PPV&FRA



Year-wise (2007-12)

Fig 3.2: Crop-wise - Registration Certificates issued



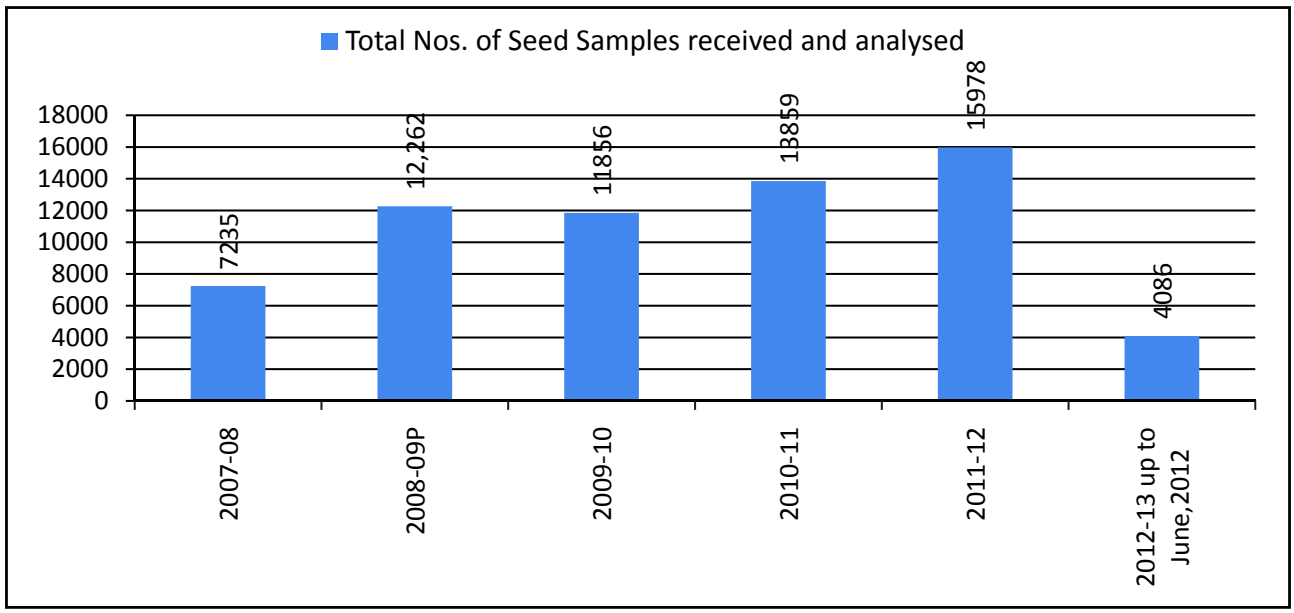
Box 3.1: Plant Genome Savior Community Awards

The Authority has instituted the "Plant Genome Savior Community Award/Reward and Recognition" as a national activity under the National Gene Fund constituted by the Government of India. Certificates have been awarded to the farmers/communities for their efforts in conservation and preservation of plant genetic resources. Five communities/farmers were recognised in 2007-08 and four in 2008-09. In 2009-10 this scope was broadened to support and reward farmers, communities of farmers, particularly the tribal and rural communities engaged in conservation, improvement and preservation of genetic resources of economic plants and their wild relatives, particularly in areas identified as agro-biodiversity hot spots. Accordingly, the "Plant Genome Savior Community Award" was instituted from 2009-10. For 2009-10 two farming Communities from Odisha and Karnataka and for 2010-11, four communities were conferred the "Plant Genome Savior Community Awards". Seven applicants were given certificates of recognition for their noteworthy work.

National Seed Research and Training Centre (NSRTC)

3.8 National Seed Research and Training Centre (NSRTC) located at Varanasi is the Central Seed Testing Laboratory (CSTL) under Seeds Act and also a Referral laboratory for courts in India. The Centre is responsible for testing the seed samples received from the Notified State Seed Testing Laboratories across the Country under 5% re-testing programme to maintain uniformity between results of Central Seed Testing Laboratory and Notified State Seed Testing Laboratories. Details of samples received and tested during 2007 to 2012 are shown below:-

Fig. 3.3: Nos. of seed samples received and analysed



Central Sector Scheme in Seed Sector

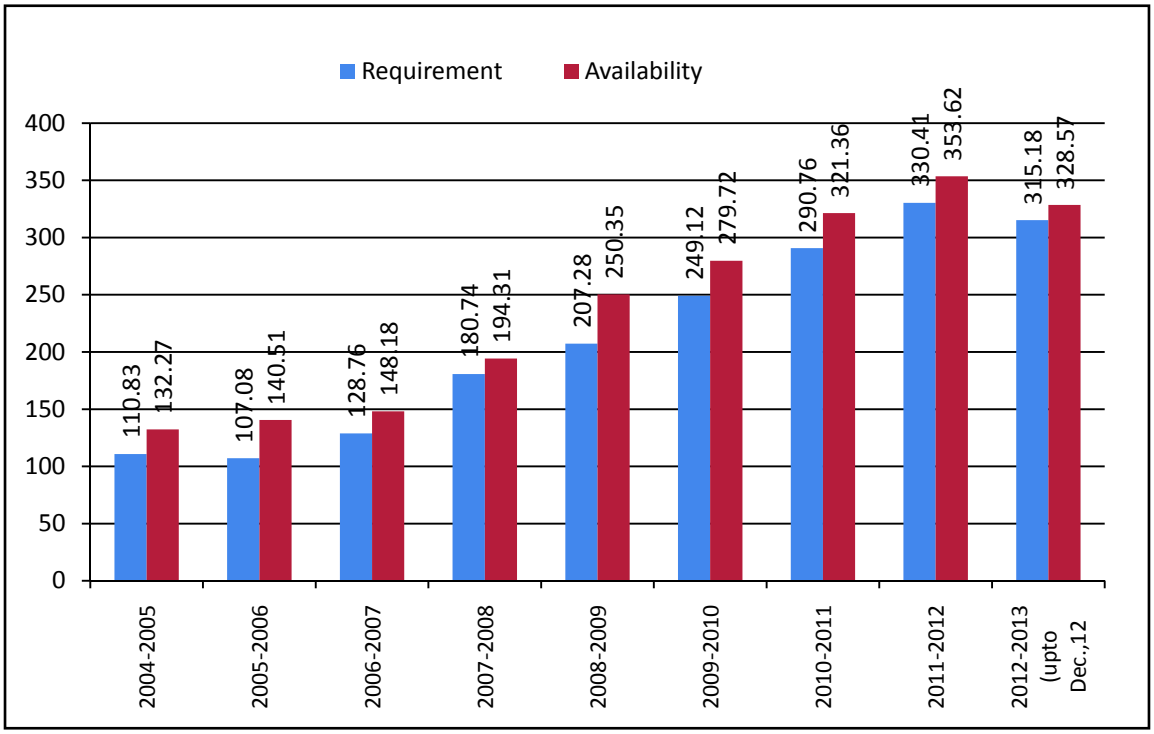
3.9 Since 2005-06, the Department of Agriculture & Cooperation is implementing a Central Sector Scheme "Development and Strengthening of Infrastructure Facilities for Production and Distribution of Quality Seeds" (DPQS) to address the gap in infrastructure and to increase availability of quality seeds for different crops through various interventions. The objective of the scheme is 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 an affordable prices. While the requirement of certified seeds has grown steadily for the last seven years, the availability has surpassed the requirement for the last seven years, as can be seen from Fig. 3.4.

National Seed Mission

3.10 A need was felt, in the current scenario, to upgrade and expand the existing scheme 'Development and Strengthening of Infrastructure Facilities for Production and Distribution of Quality Seeds' (DPQS) into a National Mission with a focused, time bound and integrated approach to further improve the availability of quality seeds to the farmers. Hence, it is proposed to launch a Mini-Mission on "Seeds and Planting Material" under the new Centrally Sponsored Scheme "National Mission on Agricultural Extension and Technology" during Twelfth Five Year Plan. The Mission includes seed planning, seed production, varietal replacement, seed infrastructure, quality control, specific interventions for seed PSUs, contingency planning, assistance to private sector, international cooperation, etc.

Fig. 3.4: Requirement & availability of seeds in India

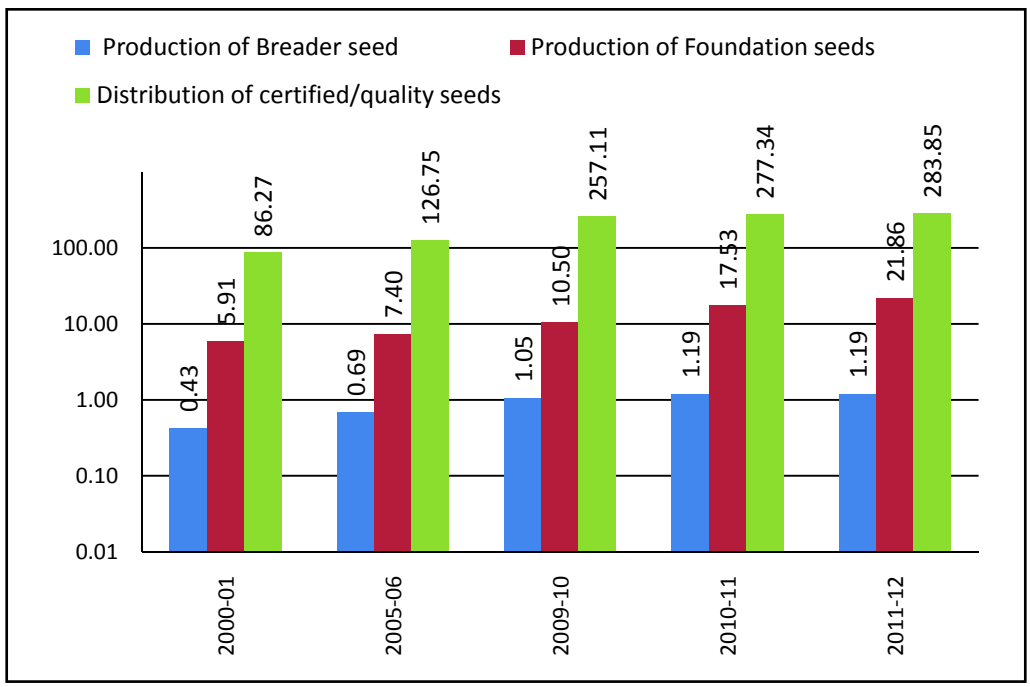
(Unit Lakh Qtl.)



Source: DAC, Seeds Division

Fig. 3.5: Production and Consumption of Seeds in India

(Unit lakh Qtls.)



Source: Directorate of Economics and Statistics, DAC

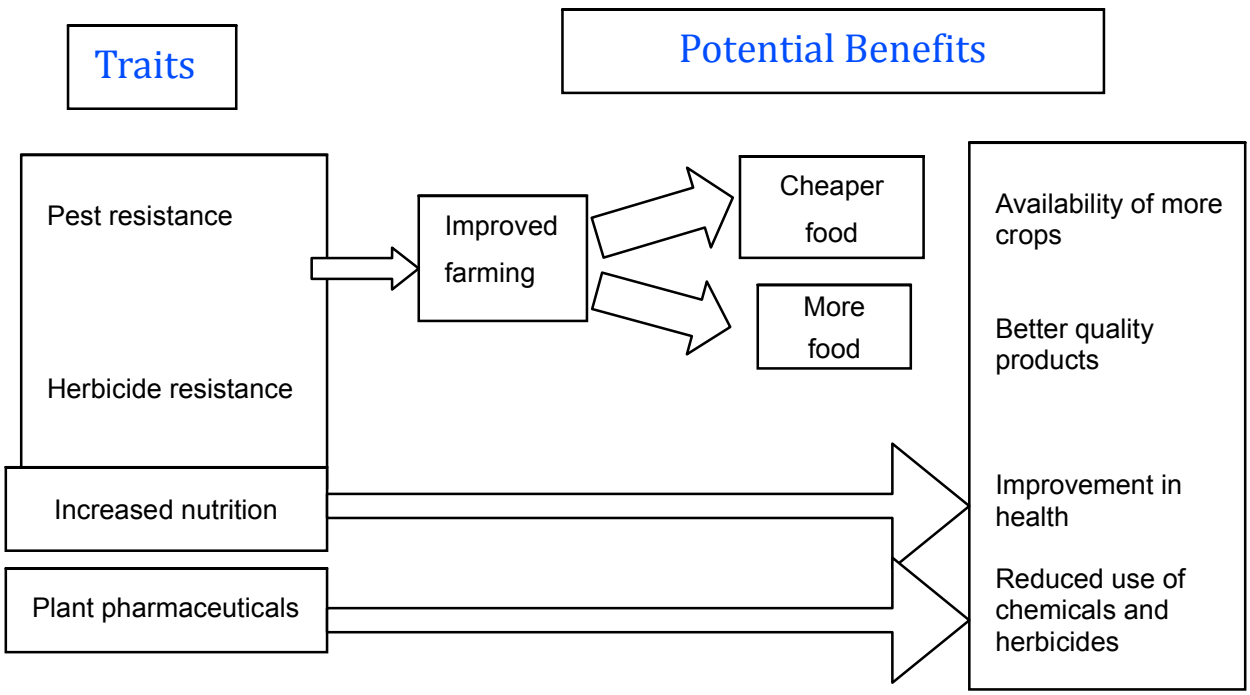
Genetic Modification in Agriculture

3.11 A Genetically Modified crop contains a gene or genes of a different species artificially inserted in its genome when the inserted gene sequence comes from an unrelated plant or from a completely different species, it is also known as transgene and the resulting GM crop as a transgenic crop.

3.12 Conventional plant breeding involves exchange of genes between two plants to produce a hybrid for a desired trait by crosspollination. GM technology is similar to conventional plant breeding in terms of the objective of generating more useful and productive crop varieties containing new combination of genes, but it expands the possibilities by enabling introduction of useful genes not just from within the crop species or from closely related plants, but from a wide range of other organisms. It allows the transfer of one or more genes, in a controlled and predictable way than is achievable in conventional breeding. GM crop plants can therefore incorporate the desired traits more quickly and more reliably than through conventional methods.

3.13 GM crops have been developed to incorporate various traits such as insect pest resistance, herbicide tolerance, disease resistance, altered nutritional profile, enhanced storage life etc. The benefits of their use include increased crop yields, reduction in farm costs and thereby increase in farm profit as well as protection of the environment. Research is focused on a second generation of GM crops that feature increased nutritional and/or industrial traits such as easy processability. These varieties are expected to bring in more direct benefits to consumer such as correction of dietary deficiencies. Figure 3.6 summarizes the potential benefits of various traits incorporated in the GM crops.

Fig. 3.6: Potential benefits of various traits incorporated in the GM crops



3.14 Genetically Modified Organisms (GMOs) and products thereof including GM crops are regulated products in India under the 'Rules for the Manufacture, Use/Import/Export and Storage of Hazardous Micro Organisms/ Genetically Engineered Organisms or Cells notified by the Ministry of Environment and Forests vide Notification No. 621 in Official Gazette of Govt. of India on December 5, 1989 under the provisions of the 'Environment

(Protection) Act', 1986. This has been done to ensure sound application of biotechnology making it possible to accrue benefits arising from modern biotechnology while minimizing the risks to environment and human health.

3.15 These rules and regulations commonly referred to as '**Rules 1989**' and cover areas of research as well as large scale applications of GMOs and its products. These rules and regulations are implemented by Ministry of Environment and Forests (MoEF), Department of Biotechnology (DBT) and State Governments. For the development of GM crops at the laboratory stage, confined multi-location trials for generation of biosafety data known as Biosafety Research Trials – I and Biosafety Research Trials-II (BRL-I and BRL-II) require prior approval of the RCGM and the GEAC set up under the Rules, 1989. The compliance of the regulatory procedures during GM crop field trials is monitored by the Monitoring–cum Evaluation Committee (MEC). The agronomic performance of the GM crops is also evaluated under the Indian Council of Agriculture & Research (ICAR) testing system. The GEAC takes into consideration the findings of the biosafety and agronomic studies as well as recommendations of the RCGM, ICAR and MEC before according approval for environmental release. Only those transgenic crops which are found to be safe for human consumption as well as the environment are approved for commercial release.Thus, release of GM crops and products is the mandate of the Ministry of Environment & Forests.

3.16 The global area under 25 GM crops in 2011 was 1600 lakh hectares cultivated by 29 countries, thus indicating farmer acceptance globally. Soybean is the leading GM crop occupying 754 lakh ha, followed by maize (510 lakh ha), cotton (247 lakh ha) and canola (82 lakh ha). Other prominent GM crops occupying less than 1.0 lakh ha area are Potato, sugar beet, alfalfa, papaya, squash, potato, tomato, poplar and sweet pepper. Among top ten countries, USA is leading by occupying 690 lakh ha cultivating eight GM crops (Maize, soybean, cotton, canola, sugar beet, alfalfa, papaya and squash) followed by Brazil (303 lakh ha – Soybean, maize, cotton), Argentina (237 lakh ha – Soybean, maize, cotton), India (106 lakh ha – Cotton), China (39 lakh ha – Cotton, papaya, poplar, tomato, sweet pepper), Canada (104 lakh ha – Canola, maize, soybean and sugar beet), Paraguay (28 lakh ha – Soybean), Pakistan (26 lakh ha-Cotton), South Africa (23 lakh ha-Maize, soybean, cotton) and Uruguay (13 lakh ha-Soybean, maize).

Status of GM in India

3.17 Bt. cotton is the only GM crop being cultivated in India. Considering the successful cultivation of Bt cotton in India, which resulted in more than 50% reduction of insecticide usage on cotton and about 30-60% increase in productivity over 10 years, a record export of 129 lakh bales worth about Rs.21, 000 crores and the absence of any credible scientific evidence of any negative bio-safety effects, a positive view is being taken for GM crop research and development for the country. The Government of India through Genetic Engineering Approval Committee (GEAC), Ministry of Environment and Forests approved commercial cultivation of Bt cotton in 2002 which confers resistance to Lepidopteron pests of cotton. Bt cotton was initially approved for the Central (Gujarat, Maharashtra & Madhya Pradesh) and South (Tamil Nadu, Andhra Pradesh & Karnataka) zone states in 2002 and later on in North Zone states (Punjab, Haryana & Rajasthan) from the year 2005-06. It may be mentioned that spread of cultivation of Bt cotton in India is outcome of farmers' spontaneous response to success of Bt cotton in controlling pest and diseases, enhanced yield resulting in higher economic return. . Introduction of Bt cotton has played a catalytic role in enhancing cotton production and productivity in India.

Challenges and Way Forward

3.18 The challenges confronting the seed sector is to make available quality seeds and planting materials having good genetic potential at an affordable price and across the country to the farmers to enable them harvest maximum yield under the given agro-climatic conditions. In pursuance to this challenge, effort is being made to produce quality seeds with the collective efforts

of Public and Private sector seed producing agencies, however, it cannot be said that enough is being done. There is need to develop better varieties/hybrids/planting materials, which will be able to manifest itself even under the challenging agro-climatic conditions. We have to adopt new technologies available for fast tracking the development of quality varieties/ planting materials like, Genetic Modification, Tissue Culture etc. to address this concern. These technologies enable development, production of planting materials, varieties/hybrids, with better genetic potential in the shortest possible time and maintain uniformity of quality across the production line.

3.19 Genetic Modification helps in attacking/ addressing multiple problems at the same time, like addressing the problems of productivity, stress tolerance, pests and disease tolerance simultaneously by combining genes responsible for higher productivity with genes responsible for stress tolerant and or genes responsible for disease/pests tolerance. Momentum for the development of GM technology in the country has somewhat slowed down due to opposition from certain quarters on safety issues, however, there is need to address these concerns through adoption of appropriate measures for safety and safeguards and move ahead with the technology for meeting the challenges facing the country.

3.20 It is also a fact that in many crops, the leading varieties being cultivated are more than 20 years old, though, every year new varieties are being released. This indicates that the concerns of the farmers are not being adequately addressed by R&D set up in the country. The State Agricultural Universities, ICAR and its Institutions and also the Private sector involved in development of new varieties/hybrids/planting materials, have to address this issue in a more concerted manner to make its impact pronounced on agricultural production.

3.21 The seed multiplication ratio from Breeder seed to Foundation seed and from Foundation seed to Certified seed, needs to be addressed by all the seed producing agencies, both in Public and Private Sector. Comprehensive and authentic database on seed production and distribution in India by public and private sectors needs to be built for the benefit of information of all the stakeholders. The seed chain and the norms for quality control have to be scrupulously followed by all the States/UTs to ensure maintenance of quality of seeds being sold to the farmers. The provision of subsidy for seeds for newer and older variety needs to be rationalized. The issue of seed certification and distribution of certified seeds is largely dependent on the sumptuous implementation of the provisions of Seed Act by the States. The seed certification agencies and seed inspectors have to be more vigilant to check sale of spurious seeds in the market. Accreditation of horticultural nurseries is gaining importance with the increasing demand for supply of quality planting materials of horticultural crops. Accreditation of nurseries therefore needs to be speeded up.

3.22 The States needs to prepare long term Seed Plan for the State keeping in mind the agro-climatic conditions, farmer's economic status and desire to adopt quality seeds, SRR of the crop, State's crop calendar, contingent situation arising, etc., in order to ensure availability of quality seed at the right time to the farmers. Often, it is seen that States do not have adequate Seed Plan, as a result of which the farmers are forced to fall back on 'farm-saved' seeds or Truthfully Labelled Seeds. This is not a viable option for enhancing productivity and production. Step has been taken in consultation with the State Governments to prepare Seed Plan for 5 years.

Integrated Nutrient Management

3.23 Chemical fertilizers are the immediate source of nutrients in soils. Consumption of nitrogenous (N), phosphatic (P), potassic (K) fertilizers has increased from 1.1 million tonnes in 1966-67, the year preceding the green revolution to 28.1 million tonnes in 2010-11, but in 2011-12 it came down to 27.7 million tonnes, a decline of 1.3 per cent over the previous year. It is observed that while consumption of urea has increased from 16.6 million tonnes in 2010-11 to 17.3 million tonnes in 2011-12, an increase of 4.5

per cent, consumption of both phosphatic and potassic fertilizers have declined during 2011-12 over the previous year, the decline was much steeper in case of potassic fertilizers. The obvious reason for this high uses of urea and lower uses of phosphatic and potassic fertilizers are the relative prices of these fertilizers. While urea continues to be under statutory price control and its price has been revised on 1st November, 2012 at Rs. 5360/- per MT, the other two are market determined and are experiencing much higher prices than that of urea. The all-India average consumption of fertilizers has also remained stable at 144 kg per ha in 2011-12 when compared with the previous year. Very high variability has however, been observed in fertilizer consumption among the states. While per hectare consumption is 243.56 kg in Punjab and 266.11 kg in Andhra Pradesh, it is comparatively low in MP (88.36 kg/ha), Orissa (56.52 kg/ha), Rajasthan (62.35 kg/ha) and Himachal Pradesh (55.18 kg/ha) and below 5 kg/ha in some of the North Eastern States.

Table: 3.2: Consumption of Fertilizers in terms of NPK nutrients in India

S. No		1991-92	2000-01	2005-06	2009-10	2010-11	2011-12
1.	Consumption of Fertilizers (Lakh Tones)						
	Nitrogenous(N)	80.46	109.2	127.23	155.8	165.58	173.02
	Phosphatic (P)	33.21	42.15	52.04	72.74	80.5	79.15
	Potassic(K)	13.61	15.67	24.13	36.32	35.14	25.25
	Total (N+P+K)	127.28	167.02	203.4	264.86	281.22	277.43
2.	Consumption of Fertilizer, (Kg/Ha)	69.84	89.63	105.5	135.76	144.14	144.35

Source: State Governments

Table: 3.3: Consumption of Fertilizers in India

S. No	Consumption of Fertilizers (lakh tones)	1991-92	2000-01	2005-06	2009-10	2010-11	2011-12
1.	Urea	140.04	191.86	222.97	266.73	281.12	295.65
2.	DAP	45.18	58.84	67.64	104.92	108.70	101.91
3.	MOP	17.01	18.29	27.31	46.34	39.32	30.29
4.	NPK Complex	32.21	47.80	66.94	80.25	97.64	103.95
5.	SSP	31.65	28.60	27.56	26.51	38.25	47.46

Source: State Governments

3.24 To ensure adequate availability of fertilizers, the Department of Agriculture and Cooperation (DAC) in consultation with Department of Fertilizers make 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.

3.25 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. The FCO provides for compulsory registration of fertilizer manufacturers, importers and dealers; the specification of all fertilizers manufactured or imported and sold in the country; regulation of the manufacture of fertilizer mixtures; packing and marking on the fertilizer bags; appointment of enforcement agencies; setting up of quality control laboratories and prohibition on the manufacture and import and sale of non-standard or spurious or adulterated fertilizers.

3.26 Government introduced Nutrient Based Subsidy (NBS) policy for phosphate (P) and potash (K) fertilizers with effect from April, 2010. Under NBS policy, a fixed rate of subsidy (on Rs. per kg. basis) is announced on nutrients, namely, nitrogen (N), phosphate (P) and potash (K) and sulphur (S) by the Department of Fertilizer on annual basis. Any variant of the fertilizers covered under the subsidy scheme with micronutrients namely Boron and Zinc, is eligible for a separate per tonne subsidy to encourage their application along with primary nutrients. At present, 21 grades of P&K fertilizers, namely, DAP, MAP, TSP, MOP, Ammonium Sulphate, SSP and 15 grades of N P K complex fertilizers are covered under the NBS policy. MRPs of P&K fertilizers have been left open and fertilizer manufacturers/ marketers are free to fix the MRP of P & K fertilizers.

Balanced Use of Fertilizers

3.27 Balanced fertilization 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 fertilization aims at ensuring adequate availability of nutrients in soil to meet the requirement of plants at critical stages of growth and thus ensuring adequate soil humus to improve physio-chemical and biological properties of the soil. An imbalanced use of fertilizers is one of the reasons for a decline in the crop response ratio. This calls for promoting soil test based balanced and judicious use of chemical fertilizers in conjunction with organic sources of nutrients to sustain and improve soil health and its productivity.

3.28 MRPs of DAP, MOP and various grades of complex fertilizers have risen sharply in last two years whereas MRP of urea has remained fixed. The impact of sharp rise in MRPs of P&K fertilizers has been the inclination of farmers to use more urea irrespective of the presence (deficiency/sufficiency) of nitrogen in the soil. This is leading to imbalance in the NPK ratio and a decline in the marginal response of agricultural productivity to additional usage of fertilizer in the country.

3.29 Soil testing capacity of various Mobile/ Static Soil Testing Laboratories is about one crore per year, however, number of land holding is about 13.8 crores, therefore, to deliver site specific recommendations for balanced use of fertilizers, there is a need to increase soil testing capacity in the country. Further, even though some farmers are getting their soil tested for nutrient availability/deficiency, but there still exists a lack of awareness on the part of farmers to go for the right composition of fertilizers based on soil requirements. Most of the soil testing is taking place as a result of the campaigns run by the State Government under various schemes.

3.30 Intensive agriculture is experiencing widespread deficiency of micronutrients particularly of Zinc followed by Iron, Manganese, Boron, etc. Hence, there is a greater need to redress the issue of micronutrient deficiency in the soil and its timely supply to the farmers.

3.31 Soil organic carbon is important for the function of ecosystems and agro-ecosystems having a major influence on the physical structure of the soil, the soil's ability to store water (water holding capacity), and the soil's ability to form complexes with metal ions and supply nutrients. Loss of soil organic carbon can, therefore, lead to a reduction in soil fertility. Further, due to depletion of soil organic carbon, microbial population in the soil also decreases which results into less fertilizer use efficiency (FUE) of the soil. Imbalanced NPK application, nutrient deficiency and non-application of organic manure also results in a reduction in soil carbon content.

Site Specific vs Area Specific Approach to Customized Fertilizers

3.32 Customized fertilizers are soil specific and crop specific. So far 31 such fertiliser has been notified. These fertilizers are formulated on the basis of soil test results and multi location trials. Owing to lack demand on the part of the farmers coupled with commercial and economical constraints particularly problem in the procurement of raw material, many manufacturers are not coming forward to produce customized fertilizers. On the other side, there is debate on the site specific vs area specific approach of customized fertilizers. Soil test based site specific nutrient management is aimed to ensure balance fertilization in the country. India, presently, has 13.8 crore land holdings and the fertility status varies even from plot to plot due to variation in types of crops grown and input used. It is not possible to analyze each and every farmers field for the purpose. Hence, fertilizers companies are preparing customized fertilizer grades based on nutrient indexing. In this approach, larger the area of nutrient indexing, higher will be the deviation from site specificity. While site specific recommendation based on nutrient indexing at village level may not be feasible presently, district level nutrient indexing, on the other hand, will also be equally erroneous. Indian Institute of Soil Science, Bhopal is generating geo-referenced soil fertility maps of different districts based on nutrient index values at block level. The district soil testing laboratories and fertilizer companies should generate such maps at regular interval to recommend customize grades at block and if possible at taluka level. While developing grades of customized fertilizers, one should consider the whole cropping system taking due cognizance of residuals effects on subsequent crop.

Strategies for Promotion of Balanced use of Fertilizers

Promotion of Soil Testing/Soil Health Cards

3.33 With average fertilizer consumption at 144.14 kg per hectare, India is using much less quantities of chemical fertilizers compared to other developing countries. But imbalanced use of chemical fertilizers coupled with low addition of organic matter and neglect of micro and secondary nutrients over the years has resulted in nutrient deficiency and deterioration of soil health in many parts of the country, particularly in the intensively cultivated Indo-Gangetic plains. Government is promoting Integrated Nutrient Management (INM) advocating soil test based balanced and judicious use of chemical fertilizers in conjunction with organic sources of nutrients for improving soil fertility. A National Project on Management of Soil Health & Fertility (NPMSH&F) was launched during 2008-09 to promote soil test based balanced and judicious use of fertilizers for improving soil health and its productivity. NPMSH&F provides assistance for setting up new static/mobile Soil Testing Laboratories (STLs), strengthening of existing STLs, training of STL staff/extension officers/ farmers, field demonstration on balanced use of fertilizers, promoting use of organic manure, soil amendments and micro nutrients etc. In addition similar funds are available under other flagship schemes of MoA such as RKVY.

Table: 3.4: Soil Testing Laboratories sanctioned under National Project on Management of Soil Health & Fertility

Sl. No	Component/year	2008-09	2009-10	2010-11	2011-12	Total
1.	New Static STLs	42	66	16	0	**124**
2.	New Mobile STLs	44	62	10	2	**118**
3.	Strengthening of existing STLs	39	107	9	15	**170**
4.	**Total**	**125**	**235**	**35**	**17**	**412**
5.	Under RKVY total No. STLs & MSTLs of laboratories					**407**
6.	**Total (4 + 5)**					**819**

STLs : Soil Testing Laboratories

3.34 Looking at the fact that there is lack of awareness for soil testing among farmers so it is imperative that we go for alternative strategies for dissemination of recommended dose of fertilizers. International Rice Research Institute (IRRI) has developed ICT tool for Nutrient Manager which is tailored for rice production in major rice growing countries or regions. Each Nutrient Manager tool provides a field specific fertilizers guidelines based on information obtained from the response to questions about rice growing conditions in the field like season of rice growing, method of rice establishment, type of variety, duration of crops, total yield of rice typically attainable, method to manage the crop residue at harvest of previous rice crops, soil texture, application of organic material etc. This is in advance stage of testing in Tamil Nadu. DAC will endeavor in the coming years to promote these types of alternative strategies.

Promotion of Customized and Fortified Fertilizers

3.35 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. Deficiency of micro nutrient is also prevalent in soil in many parts of the country. In order to encourage the use of micro nutrient and also the balance application of fertilizers, eleven grades of fortified fertilizers have so far been notified in the Fertilizer Control Order 1985. Under the NBS scheme government also provides assistance on fertilizers fortified with Zinc and Boron.

Increasing Soil Organic Carbon

3.36 Soil Organic Carbon (SOC) is central to soil health due to its influence on soil structure, water retention, microbial activities, soil aeration, and nutrient retention. It is the organic forms of C and not the source of nutrient which is important for soil-plant continuum. Hence, Bio-organic fertilizer merits consideration. Indian soils are, in general, poor in organic C, which is further going down with every intensification of agriculture. Incorporation of organic C in inorganic fertilizer formulation leads to this category of product. MSW, Farm Yard Manure, Press-mud, Peat, humic acid, molasses, gums, green manures etc. can be used in combination of inorganic formulations to provide both binding action as well as precious organic C to soil. Further, organic manure contains population of useful soil metabolites that in turn encourage growth of useful microorganisms present in the soil. This enables a better utilization of nutrients by the plant, and also better absorption of nutrients from chemical fertilizers. Further, increased C in soil also provide suitable atmosphere for the microbial activity in the soil. The microbial population can further be improved with the application of biofertilizers for NPK & Zn. Promotion of green manuring is essential and quick way to increase

organic carbon. Farmers should take at least one green manuring crop once in every two years. In all rice fields, cultivation of green manuring plants as an intercrop is highly recommended (like one row of sesbania after every 10-15 rows of rice which can be incorporated into field after 30-35 days) to achieve the best productivity. Use of crop straw and weed biomass as mulch-wheat and rice straw can also be used with dung and cattle urine to increase Organic Carbon.

Fertilizer Use Efficiency (FUE)

3.37 The fertilizer use efficiency on average is reported to be 33% for N; 15% for P; 20% for K and micronutrients. Even with the best management practices it has not been possible to achieve more than 50% for N; 30% for P and 50% for K. Rest of amount either get volatilized or get leached/ fixed in the soil in complex forms, hence resulting into to the economical loss.

3.38 Application of biofertilizers viz N fixing Rhizobium for legume crops, Azopirillum and Azotobacter for non-legminous crops; P Solubilizing bacteria for phosphorus solubilization, K mobilizing bacteria for K uptake and for secondary nutrient Zn, Zinc solubilising bacteria alongwith chemical fertilizers can increase the fertilizer use efficiency. Further, management practices such as split application, placement of fertilizers at crop root, use of sloe release N fertilizers and nitrification inhibitors, and inclusion of legume crops in crop rotation can enhance fertilizer use efficiency. Promotion of plantation of fertilizer trees on bunds is a long practice to conserve Nitrogen in the soil. There is a large pool of N-fixing trees which can be used as fertilizer trees on bunds without compromising on space and yields of crops. Encouraging mixed/ intercropping of pulses in intensively cultivated areas is another well established practice to enhance fertilizer use efficiency. ICAR and State Agricultural Universities need to come forward on making state specific/area specific package of practices, in form of consolidated and easily understandable handouts in local languages, to increase Fertilizer Use Efficiency (FUE).

3.39 Production of urea in granulated form or coated (with sulphur or neem)/fortified Urea/ Briquetted urea can also improve the efficiency in the use of urea. The use of naked prills needs to be discouraged and undersize prills (below 1.8 mm) should be prohibited. Being a key element for soil health, needs to be improved in the soil as C content, and its absolute amount applied may not be very significant considering fertiliser use pattern. However, being integrated with inorganic formulation, it improves microclimate at rhizosphere. While FYM/compost etc requires application rates in terms of tonnes per hectare, approach of micro-application of C at root zone caters to immediate need and one bag of urea along with four bags of compost can decrease the loses of nitrogen. Urea manufacturers need to produce 50% of neem coated urea and there is a need to increase R&D efforts on part of ICAR and State Agriculture Universities (SAUs) in this direction to develop these types of new products in collaboration with fertilizer industry.

Quality Control of Fertilizers

3.40 In order to check the quality of the fertilizers sold in the country, at present there are 74 Fertilizer Quality Control Laboratory working under the control of different State Governments. Since quality testing is a statutory requirement under the Fertilizer Control Order, 1985, it is imperative to maintain all the instruments and equipment and to ensure supply of quality chemicals and glass-wares for the analysis. Further, there should be adequate FQTL to ensure that all the dealers in the country are covered for fertilizer samples to be tested for quality checks. There is a need to develop or nominate reputed agencies as referral laboratories to improve quality of testing of fertilizers in the country.

Organic Farming

3.41 The benefits of organic produce in terms of health and nutrition are well known. Bringing more farmers/farmers' groups under organic farming, production of on-farm organic inputs and proper organic management of such farms need to be encouraged to increase the quantity and quality of the produce and bring down its prices. Further, proper marketing strategies need

to be explored to ensure remunerative prices to the farmers for their produce. ICAR and other research institutes should also undertake R&D for development of crop and area specific package of practices to be adopted by the farmers. Similarly, SAUs should develop courses on organic farming for its promotion and development.

Integrated Pest Management

3.42 Integrated Pest Management (IPM) is an eco-friendly approach which uses cultural, mechanical and biological tools and techniques for keeping pest population below economic threshold levels. This approach attaches a high premium on the efficacy of bio-control agents and bio-pesticides. However, need based and judicious use of chemical pesticides is permitted. With this objective, IPM helps in maximizing crop protection with minimum input costs, minimizing pollution in soil, water and air reducing occupational health hazards, conserving ecological equilibrium and reducing pesticide residue loads in food.

3.43 There are 31 Central Integrated Pest Management Centres (CIPMCs) located in 28 States and one Union Territory. CIPMCs undertake following activities:-

1. Surveillance and monitoring of insect pests and diseases.
2. Augmentation and conservation of natural enemies.
3. Production and releases of bio-control agents.
4. Human resources development through Farmers Field Schools (FFSs), season long training programmes etc.

3.44 During 2011-12, a total of 7.96 lakh hectares was covered for pest monitoring activity. Similarly, the area coverage for augmentation and conservation of 'friendly insects' during 2011-12 was 7.60 lakhs hectares. During the same period, 1760 million bio-control agents were released which was the highest during the 11th Plan period. Bio-pesticides usage has displayed a resolutely upward trend during the previous plan period as is evident from the table below:

Table 3.5: Bio-pesticides usage

Year	Bio-pesticides
2007-08	1873.00
2008-09	1459.00
2009-10	3366.00
2010-11	5151.00
2011-12	6506.00
Total	18355.00

Sources: Directorate of Plant Protection, Quarantine and Storage

3.45 During 2011-12, 724 Farmers Field Schools (FFS) have been organized during kharif and rabi seasons in different parts of the country in which 21720 farmers were given training and demonstration of the IPM approach. As of now, 77 Crop specific package of practices have been prepared to help farmers and extension functionaries adopt IPM approach to combat pests and diseases in an environmentally friendly manner. However, the challenge is in periodic updation and improvement of these package of practices so that prescription to farmers and extension functionaries are in tune with new knowledge and innovation. An important issue that confronts the sector relates to devising ways and means to enhance relevance and acceptability of package of practices among farmers in different agro-climate zones characterized by regional variations in farming traditions, practices and crop cycles. There is also a need to assure farmers that management solutions offered for control of pests and diseases conform to principles and standards of good Agricultural Practices.

3.46 IPM approach is being promoted at present chiefly through the centrally funded and managed CIPMCs and by State Governments under RKVY. However, the challenge is in promoting greater harmony and coordination among implementing agencies, expansion of coverage in a planned manner and establishment of long term commitments with farming communities to promote the entire gamut of activities that constitute an IPM approach.

3.47 It is evident that use of bio-control agents in combating pests is on the rise, yet significant

challenges posed by short shelf life, standardization and quality, storage and transportation need to be addressed by agricultural research institutions in the near future. Quality of bio-pesticides, particularly in relation to threat of lacing with chemical pesticides is an emerging problem in different parts of the country. Infrastructure for laboratory analysis of bio-pesticides remain inadequate in the country.

3.48 An import issue stems from inexact pest surveys, delays in transmission of pest sureveillance data and consequent advisories on adoption of mitigating measures. The time lag in providing advice is often responsible for non-recommended usage in terms of dosage, time period and schedule of applications, and type of pesticides to be used. This has implications on cost of cultivation , efficacy of treatment as also on residue status.

3.49 The Central Insecticides Board and Registration Committee constituted under the Insecticides Act of 1968 has been mandated to advise Central and State Governments on technical matters related to pesticides. The Registration Committee which is a statutory body under the Insecticides Act, 1968 receives applications for registration of pesticides for import, indigenous manufacture, exports, etc. The Registration Committee has granted registration to 241 active ingredients and 443 pesticide formulations. The Registration Committee has registered a total of 18 microbial bio-pesticides and three botanicals. During the 11th Plan period, the Registration Committee on an average have been issuing 3257 certificates of registration of pesticides each year. However, the year 2012-13 has seen an unprecedented number of applications for registration of pesticides in the country. The number of applications for registration up to November, 2012 during financial year 2012-13 alone is 10726 against an average receipt of 4019 applications every year during the 11th Plan period. This has caused enormous strain on the existing resources of the Registration Committee, often delaying introduction of newly invented, efficacious, low dose, safer pesticides into the country. Paucity of experts in toxicology has delayed swift evaluation of pesticides registration proposals. The Computerized Registration of Pesticides(CROP) which has been made operational recently requires further improvement and strengthening.

3.50 The Directorate of Plant Protection, Quarantine and Storage, Faridabad under the Department of Agriculture & Cooperation is the nodal agency for plant quarantine and export certification. To facilitate exports and imports of agricultural commodities, an important e-governance initiative has been undertaken with the launch of the Plant Quarantine Information System (PQIS) in April 2011. The PQIS aims to reduce lead time in processing of import permits, release orders for import consignments and phytosanitary certificates for exports. Since April, 2011, 61175 import permits, 160,628 import release orders and 452,395 phytosanitary certificates have been issued online using the PQIS. The Department of Agriculture & Cooperation is coordinating with the Customs Authorities in the integration of PQIS with the Electronic Data Interchange system being currently in use in the Customs Department to further facilitate imports and exports of agricultural commodities through a single window clearance system.

3.51 Qualitative and quantitative improvements in infrastructure and manpower is imperative at Plant Quarantine Stations in the country to curb possibility of detection quarantine pests and pesticides residues in Indian agriculture export consignments and wood packaging material. Technical audits and inspections of Pest Control Operation by licencing authorities under the Directorate of Plan Protection and Storage require greater attention.However, a far daunting challenge is in establishing an Export Quality Assurance System that links together farmers, exporters, logistic support providers, pest control operators, Plant Quarantine and Customs Officials.

3.52 With the gradual phasing out and abandonment of Methyl Bromide fumigation in many countries as a treatment option against pests of quarantine concern, agricultural imports into India may face increasing difficulties in the absence of equally effective alternatives

3.53 To ensure that only good quality pesticides are available to farmers, 68 State Pesticides Testing Laboratories (under the State Governments) and 2 Regional Pesticides Testing Laboratories at Chandigarh and Kanpur, and a Central Insecticides Laboratory at Faridabad (under the Department of Agriculture and Cooperation) have been established. The following table will shed some light on quality of pesticides available in the Indian markets:

Table 3.6: Quality of Pesticides available in the Indian markets

Year	No. of samples analyzed	Pesticides found mis-branded	Percentage of mis-branded samples
2008-09	47420	1839	3.8
2009-10	59005	1989	3.4
2010-11	59331	1742	2.9
2011-12	62092	2137	3.4

Source: Directorate of Plant Protection, Quarantine and Storage Faridabad.

3.54 So far, only 4 out of 68 State Pesticides Testing Laboratories have been accredited by the NABL. Both Regional Pesticides Testing Laboratories are accredited by NABL, whereas the Chemistry and Bio Assay Divisions of the Central Insecticides Laboratories have been accredited for testing of chemical pesticides and bio-pesticides respectively. Efforts are being made to improve standard of infrastructure and laboratory practices in remaining labs for them to be accredited in the near future. Lack of accredited and well-equipped laboratories in the States is an important issue which has a direct bearing on the quality of pesticides available to farmers. Infrastructure for testing quality and composition of bio-pesticides, particularly to investigate presence of chemical pesticides, is deficient in States. In cases of misbranding of pesticides, prosecutions in States also tend to take a long time.

Way forward

3.55 To assist farmers and extension workers in the adoption of Integrated Pest Management (IPM) approach, package of practices for 77 major crops have been developed so far. However, many of these package of practices need to be reviewed and updated regularly to accommodate new scientific knowledge and experiences. Recommendations to be credible and relevant to farmers in different agro-climatic zones with varying crop cycles and agronomic practices, there is a need to evaluate and incorporate scientific knowledge available with State Agricultural Universities (SAUs) in the package of practices. Efforts should be made for GAP certification for the package of practices for quality assurance of our agricultural produce in domestic markets and greater acceptability in foreign markets.

3.56 The law (The Insecticides Act of 1968) requires pesticides to be registered before its import, manufacture, distribution and sale is permitted in the country. The process of registration inter alia involves validation of claims on efficacy of the agrochemical against pests and diseases associated with specific crops. The statutory authority under the law while granting registration to a pesticide also approves a set of guidelines for usage and precautions to be followed. However, the prescription for usage are sometimes not adhered to by farmers resulting in non-recommended use of pesticides on crops for which information or evidence of technical evaluation for efficacy and pesticides residue is not available with the statutory registration authority. The issue of usage of pesticides in non-recommended crops needs to be examined in much greater detail, and in this venture SAUs and ICAR Institutes may be in a position to provide valuable insights.

3.57 Surveillance of crops to detect early signs of build up of pests and diseases is crucial for

the success of IPM. For timely and effective intervention in the face of an emerging pest/ diseases situation, it is necessary for the surveillance data to be interpreted by technical experts and advisories issued in real time. Delay in issuing an advisory could lead to a breach of the economic threshold level of the pest leading to loss in production and quality. To reduce the lead time between surveillance and intervention, a system of e-pest surveillance needs to be introduced. State Governments like Orissa and Maharashtra, besides some agricultural universities are already piloting various techniques and models which needs to be encouraged and scaled up.

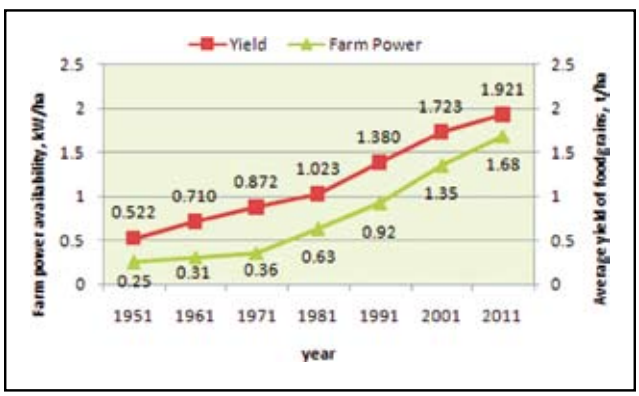
3.58 Pesticides play a significant role in agricultural production and as such farmers invest significant sums in management of pests. Therefore, it is imperative that the quality of pesticides is assured for which the system of collection of samples requires improvement, infrastructure for analysis of pesticides samples particularly bio-pesticides, plant growth regulators etc. need upgradation and accreditation, and prosecution agencies sufficiently sensitized for swift and effective action. A joint mechanism also needs to be developed with the Customs Department to facilitate sampling and analysis of pesticide consignments imported into the country.

Farm Machinery and Equipment

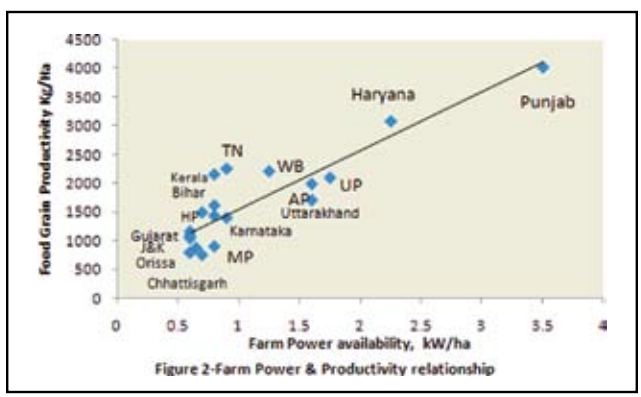
3.59 Farm mechanization and availability of adequate farm power are crucial for timely farm operations, handling the crop produce, increasing production and productivity and reducing post harvest losses. With the increase in intensity of cropping, the turnaround time is drastically reduced, which demands availability of adequate power for timely farm operations so that land is made available for subsequent crop. Similarly for precision farming, increasing area under irrigation, conservation tillage, straw management and diversification of agriculture, more power is required for water lifting and precision placement/application of agricultural inputs such as seed, fertilizer, irrigation water, plant protection chemicals etc. Greater degree of farm mechanization can also address the issues of scarcity of farm labour during peak agricultural seasons like sowing and harvesting that are now becoming predominant with the implementation of the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA).

3.60 A positive relationship has been observed between farm power availability and average yields of food grain as is evident from the figure 3.7. States with higher availability of farm power have, in general, higher productivity as compared to the others as shown in figure 3.7.

Fig. 3.7: Farm Power availability and average yield of foodgrains in India during 1951-2011



Source: FICCI-YES Bank-2009

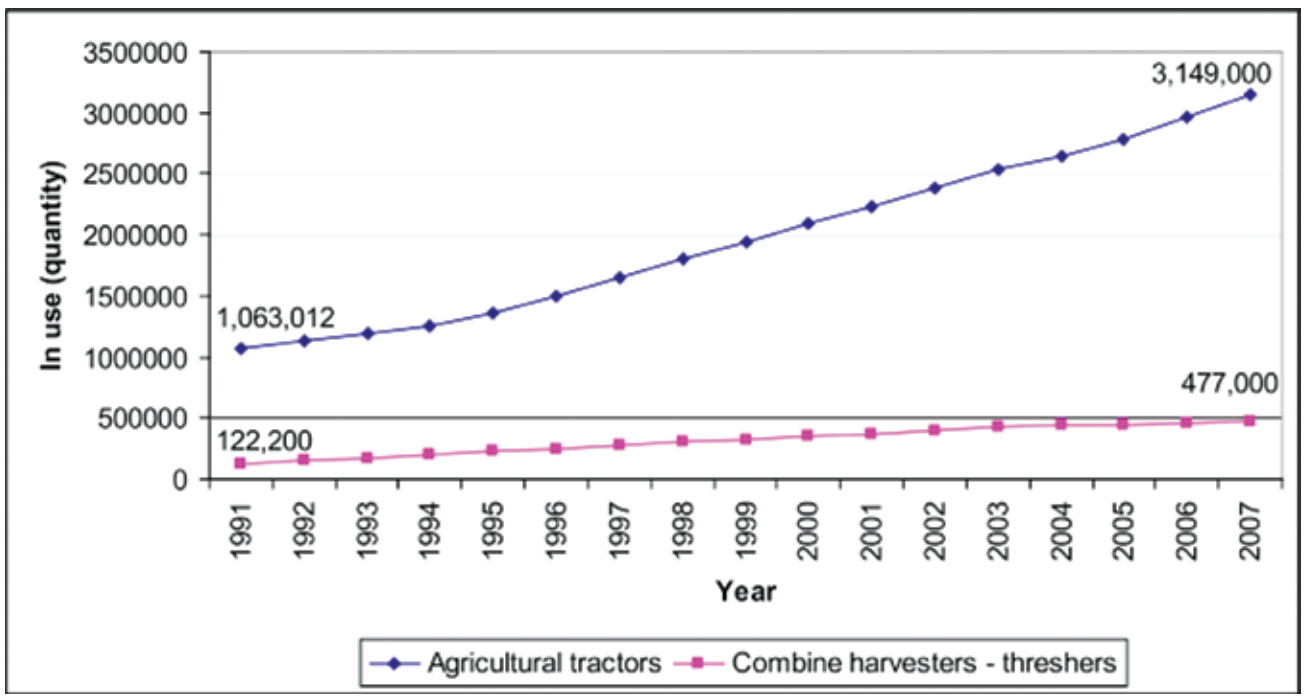


Source: ICAR

Growth in Farm Mechanization

3.61 The adoption of agricultural mechanization in India is increasing continuously. In 2007 India had 3.149 million agricultural tractors and 0.477 million combine harvesters and threshers. From Figure 3.8 it is clear that the country is experiencing rapid growth in the use of tractors while the use of combine harvesters and threshers is showing steady growth. This demonstrates an increasing awareness and popularity of mechanized farming in the country. At present in India tractors are being used for tillage on about 22.78% of the total cultivable area.

Fig. 3.8: Number of agricultural tractors and combine harvesters in India



Source : FAOSTAT

3.62 Presently, India is the largest manufacturer of tractors in the world in terms of numbers, (5,35,210 in 2011-12), accounting for about one-third of the global production. Power tillers are becoming popular in lowland flooded rice fields and hilly terrains. Steady growth has been observed in manually operated tools, animal operated implements, and equipments operated by mechanical and electrical power sources. In manually operated equipment, the number of sprayers has almost doubled since 1992. After liberalization and with development of prototypes of machines, manufacturing got a big boost particularly in Haryana, Punjab, Rajasthan, Madhya Pradesh and Uttar Pradesh. Some of the popular agricultural equipments are shown below:

Figure 3.9: Popular Agricultural Equipments

(a) Self Propelled Vertical conveyor

(b) Straw Baler reaper cum binder

(c) Self Propelled Power Weeder

(d) Aeroblast Sprayer

(e) Self Propelled Combine Harvester

(f) Power Tiller

Challenges and Constraints for Mechanizing Small Farms

3.63 Even though the adoption of farm mechanization is increasing in India, it is mostly region specific. Farm mechanization has a very low growth rate in regions such as hilly and sloppy land. The decreasing trend in operational land holding is also obstructing the growth of agricultural mechanization. High costs of machines and maintenance, non-availability of appropriate agricultural machines and equipment that cater to and suit the requirements of small scale farms, non-availability of and or difficulty in getting bank credit and small land holding are some of the factors that hinder farm mechanization and force farmers to follow the traditional ways of agricultural operations. The use of farm machinery is also dependent on infrastructure and services available in the rural areas.

3.64 Though, India is one of the top countries in agricultural production, in terms of farm mechanization, it is behind the world average. For instance, the tractor density of India is about 16 tractors for 1,000 hectares, while the world average is 19 tractors and that of USA is 27. Clearly, there is significant opportunity for mechanization of agriculture. However, this sector faces some key challenges such as:

- Indian agriculture requires customized farm machinery and equipment suiting to the requirements of different regions of the country which have highly diverse farm size & soil types.
- Skewed and seasonal usage of machines results in low economic viability of the machines and this call for innovative solutions for scaling up usage.

Farm Mechanization as Services

3.65 Farm mechanization saves time and labour, cuts down crop production costs, reduces post-harvest losses and boosts crop output and farm incomes. The current scenario of increasing threat to natural resources, notably land and water, has further necessitated switching over to machine assisted resource-conservation techniques such as zero-tillage, raised-bed planting, precision farming, etc. Farm mechanization has now become more imperative while mitigating the effect of climate change by readjusting crop sowing schedules. The climate change-driven early onset of summers in the northern states has often resulted in a decline in wheat yields. This loss can be averted by sowing wheat early, which is possible only if the previous paddy crop is harvested mechanically and wheat is planted with zero-till seed drills that do not require ploughing the land.

3.66 Mechanization small and non-contiguous group of lands is against 'economies of scale' especially in organizations like land preparation and harvesting. With continued shrinkage in average farm size, more and more farms will fall into the adverse category thereby making individual ownership of agricultural machinery progressively more uneconomical. Moreover, farm mechanization is capital intensive and thus it remains beyond the reach of small and marginal farmers. Custom Hiring Centres are the options to make farm equipments and machines available to the farmers within easy reach and at affordable cost. This will not only increase the power availability but also help in removing the disparity in availability of farm power among various states thereby increasing the productivity of farm besides reducing drudgery associated with various farm operations.

3.67 The custom hiring of agricultural machine is being practiced successfully through cooperative societies in Punjab, Kerala, Karnataka, Andhra Pradesh. The successful modes of custom hiring centres can be replicated in the other part of the country.

Ensuring Quality of Agricultural Machines and Equipments

3.68 To cope up with the ever increasing demand for testing of newly developed agricultural machines and equipments, in addition to four FMT&TI , the DAC has authorized 28 State Agricultural Universities (SAUs)/ICAR Institutions including 3 State

Agriculture Departments as Testing Centers for testing and certifying certain categories of agricultural machinery and equipments. Now the DAC is actively considering introduction of new and innovative systems by involving private sectors such as self certification in case of reputed manufactures, initially for tractors, combine harvesters and power tillers. Gradually this system will be introduced for all other agricultural machines and equipments.

Value Addition of Agricultural Produce

3.69 Post harvest processing is an emerging area of interest for mechanized operations. The present levels of post production losses are 2.8-10 % in durables, 6.8-12.5% in semi-perishables and 5.8-18% in perishable products (CIPHET Ludhiana). About 50% of these losses could be prevented using appropriate post harvest approaches. So there is still large scope for mechanization in post harvest processing of agricultural commodities

3.70 In India, agro-marketing is a largely unorganized and inefficient; as high as 18 to 25% loss occur in the entire food supply–chain from production to consumption. Markets for value-added and processed commodities are consistently increasing with increasing demands by consumers of these products. Low-cost improved technologies are required to unleash potential and market efficiency and remain competitive simultaneously. New opportunities have emerged with the opening of the trade, therefore, issues related to sanitary and phyto-sanitary measures would need to be addressed appropriately. A three–pronged strategy is needed to reduce post harvest losses-(a) compress supply –chain by linking producers and markets;(b) promote processing in production catchments to add value before being marketed ; and (c) develop small-scale processing refrigerated chambers or cold storage using conventional and non conventional sources. And these would require research for agro-commodities, especially post-harvest engineering. More focus would be given to primary and secondary levels of value –addition and processing.

Developing Low Cost, Light Weight Multi-purpose Farm Equipments

3.71 About 85% farmers are having less than 2 hectares cultivated land and their livelihoods depend on agriculture. Thus, it is necessary to focus on these small farmers by introducing & developing low cost, light weight, multi –purpose farm equipments. Precision farming in horticultural crops requires development for semi-mechanized nursery raising technology and improved horticultural tools.

Way Forward

3.72 Recognizing the need to spread the benefits of agricultural mechanization among all strata of farmers' especially small and marginal farmers, the Department of Agriculture & Cooperation is integrating the components of agricultural mechanization under various schemes and programmes aiming at catalyzing an accelerated but inclusive growth of agricultural mechanization in India by promoting 'Custom Hiring Centre' for agricultural machinery.

Labour and Agricultural Wages

3.73 Agriculture is a labour intensive activity. Cost of cultivation data shows that labour accounts for more than 40 percent of the total variable cost of production in most cases. Therefore, availability of labour to work in agriculture is crucial in sustaining agricultural production. Agricultural wages have been traditionally low due to low productivity, large disguised unemployment in agriculture due to lack of sufficient employment opportunities elsewhere. However, in recent years there is a perceptible change in this trend due to rapid economic growth and adoption of policies for employment generation including promotion of self employment opportunities. Wage levels in the agricultural sector have increased considerably during recent years. A table indicating the average daily wages for agricultural field labour for ploughing and harvesting at all India level and the average wages paid for industries covered under Annual Survey of Industries (ASI) is given below which

shows that percentage increase in average wage for agriculture (ploughing and harvesting) is higher than percentage increase in average wage for industrial workers covered by ASI during the decade 2001-2002 to 2010-11.

Table: 3.7: Wage Increase in Agriculture & Non-Agriculture Sector during 2001-11

(Wage in Rs. per day)

Occupation	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	CAGR during 2001- 2011
Ploughing	69.9	71.5	73.8	72.3	76.3	81.8	91.4	102.9	120.9	145.5	8.5%
Harvesting	56.3	58.0	60.1	62.0	65.0	68.5	75.2	87.1	102.8	122.5	9%
Non-Agriculture Sector (Industry Covered by ASI)	152.4	158.8	165.6	168.6	174.8	185.8	206.0	224.7	247.7	NA	6.3%

Source: Labour Bureau & CSO.

3.74 It is observed from the above table that average daily wages for agricultural field labour for ploughing and harvesting at all India level have increased at higher rates, (8.5 per cent and 9 per cent per annum respectively) during 2001-02 to 2010-11 as against the average wages paid for industries covered under Annual Survey of Industries (ASI) (6.3 per cent per annum). However, agricultural wages, in general, are still much lower than the industrial wages. With skill development, this gap will narrow down, putting further pressure on availability and cost of agricultural labour.

Agricultural Credit

3.75 Agriculture is a dominant sector of our economy and credit plays an important role in increasing agriculture production. Availability and access to adequate, timely and low cost credit from institutional sources is of great importance especially to small and marginal farmers. Along with other inputs, credit is essential for establishing sustainable and profitable farming systems. Experience has shown that easy access to financial services at affordable cost positively affects the productivity, asset formation, income and food security of the rural poor.

3.76 The Government of India has 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. Progress in regard to flow of agricultural credit is given below:

Table 3.8: Institutional Credit to Agriculture

(Rs. in Crore)

Year	Target	Short Term Credit	Long Term Credit	Total Credit
2004-05	105000	74064	51245	125309
2005-06	141000	105350	75136	180486
2006-07	175000	138455	90945	229400
2007-08	225000	183519	66066	254658
2008-09	280000	210461	91447	287149
2009-10	325000	276656	107858	384514
2010-11	375000	335550	132741	468291
2011-12	475000	396158	114871	511029

Major Initiatives to Increasing Flow of Credit

3.77 **Farm credit package:** Government of India in its Farm Credit Package announced in June 2004, advised banks to double credit to agriculture sector in three years, i.e., by 2006-07. In the annual budgets, Government of India announces targets for credit to agriculture to ensure adequate credit flow to the sector. The flow of agriculture credit since 2003-04 has consistently exceeded the target. Agriculture credit flow has increased from Rs.86981 crore in 2003-04 to Rs. 468291 crore in 2010-11. The target for the 2011-12 was fixed at Rs.475000 crore and achievement is Rs.511029 crore forming more than 107% of the target. The target of credit flow for the year 2012-13 has been fixed at Rs. 575000 crore and achievement as on September, 2012 is Rs. 239629 crore.

3.78 **Interest Subvention to Farmers:** Government of India announced an interest subvention scheme in 2006-07 to enable banks to provide short term credit to agriculture (crop loan) upto Rs.3 lakh at 7% interest to farmers. Further, to incentivise prompt repayment, in the Union Budget for 2009-10, Government of India announced an additional interest subvention of 1% to those farmers who repay their short term crop loans promptly and on or before due date. This was subsequently raised to 2% in 2010-11 and 3% in 2011-12 and 2012-13 also. Thus, farmers, who promptly repay their crop loans, are extended loans at an effective interest rate of 4% p.a.

3.79 **Extension of Interest Subvention Scheme to Post Harvest Loans:** In order to discourage distress sale by farmers and to encourage them to store their produce in warehousing against warehouse receipts, the benefit of interest subvention scheme has been extended to small and marginal farmers having Kisan Credit Card for a further period of upto six month post harvest on the same rate as available to crop loan against negotiable warehouse receipt for keeping their produce in warehouses.

3.80 **Collateral Free Loans:** The limit of collateral free farm loan has been increased from Rs.50,000 to Rs.1,00,000.

3.81 **Relief in Event of Occurrence of Natural Calamities:** Reserve Bank has put in place a mechanism to address situations arising out of natural calamities. The banks have been issued necessary guidelines for undertaking necessary credit relief measures in event of occurrence of natural calamities. The guidelines, inter alia, contain directions to banks to ensure that the meetings of District Consultative Committees or State Level Bankers' Committees are convened at the earliest to evolve a co-ordinated action plan for implementation of the relief programme in collaboration with the State/district authorities. Banks have been advised to provide conversion/

reschedulement of loans and consider moratorium period of at least one year in all cases of restructuring. To enhance awareness, the banks are also required to give adequate publicity to their disaster management arrangements, including the helpline numbers. Further, the banks have been advised not to insist for additional collateral security for such restructured loans.

3.82 **Interest Subvention for Loan Restructured in the Drought Affected States in 2012:** The standing guidelines of Reserve Bank of India (RBI) provide for rescheduling of short term crop loans upon declaration of natural calamity including drought. Such rescheduling of crop loans converts them into term loans for which normal rate of interest are applicable. Due to deficient rainfall this year in some parts of the country. The Government has decided that in cases where such loan are restructured due to drought, the interest subvention of 2% which is already available for short term crop loans will continue to be available for the current financial year on the full restructured amount.

3.83 **Kisan Credit Card Scheme :** Kisan Credit Card Scheme for farmers was introduced in 1998-99 to enable the farmers to purchase agricultural inputs such as seeds, fertilizers, pesticides, etc. The Kisan Credit Card Scheme is in operation throughout the country and is implemented by Commercial Banks, Coop. Banks and RRBs. The scheme has facilitated in augmenting credit flow for agricultural activities. The scope of the KCC has been broad-based to include term credit and consumption needs. All farmers including Small farmers, Marginal farmers, Share croppers, oral lessee and tenant farmers are eligible to be covered under the Scheme. The card holders are also covered under Personal Accident Insurance Scheme (PAIS) against accidental death/ permanent disability. Further, KCC scheme has been refined on the basis of suggestions made by a Working Group (Bhasin Working Group) and it has been decided to convert Kisan Credit Card **into a Smart Card cum Debit Card and revised guidelines have been issued by NABARD**. Some of the major features of the revised guidelines are as under:

- 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 time of first availment and 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 **Bringing Green Revolution in Eastern India (BGREI) : Financing Agricultural Investments in the Eastern Region – Concessional Refinance Support:** In order to support the banking system finance key investments, NABARD has introduced a concessional refinance scheme in the year 2011-12, with an objective to accelerate investments in agriculture to enhance production and productivity of crops in the Eastern region (Assam, Bihar, Jharkhand, Chhattisgarh, Odisha, West Bengal and Eastern Uttar Pradesh) by incentivising the banks. Under the scheme, NABARD provides 100% refinance to banks at a concessional rate of 7.5% p.a. provided certain minimum targets are achieved by the bank in financing these key investments. Four activities viz, Water Resources development, Land development, Farm Equipments (including

tractor financing on group mode basis) and Seed Production are covered.

3.85 **Revival Package for Short Term Cooperative Credit Structure:** The Government is implementing a package for revival of Short-term Rural Cooperative Credit Structure with financial outlay of Rs. 13,596 crore in the country. The Revival Package is aimed at reviving/ strengthening the Short-term Rural Cooperative Credit Structure (CCS) and make it a well-managed and vibrant medium to serve the credit needs of rural India, especially the small and marginal farmers. It seeks to (a) provide financial assistance to bring the system to an acceptable level of health; (b) introduce legal and institutional reforms necessary for their democratic, self-reliant and efficient functioning; and (c) take measures to improve the quality of management.

3.86 **SHG Bank Linkage-:** SHG-Bank Linkage model, continues to be the dominant model in the Indian micro finance context with nearly 7.96 million SHGs catering to 100 million households saving with the formal banking system to the tune of Rs.6,551 crore. Over the years, the SHG-Bank Linkage programme has emerged as a viable model for financial inclusion of hitherto un reached poor households particularly in rural hinterlands. Despite the achievements, there are issues like skewed growth, intra state variations in implementation, credit widening and deepening, role of Micro Finance Institute (MFIs), etc.

3.87 **Joint Liability Groups:** 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. During the year 2011-12, various banks had disbursed a loan of Rs.1,700.39 crore to 1,91,662 JLGs taking the cumulative loans disbursed to Rs.2,845.68 crore for 3,32,707 JLGs.

Concessional refinance is provided subject to condition of minimum 70% lending against credit potential for the identified activities assessed on the basis of projections made in the Potential Linked Plans. The commercial banks are required to achieve the minimum lending level of 70% while the RRBs and Co-operative Banks are required to achieve the minimum lending level of 50% of the Overall lending Target/Potential assessed. The norms were revised during 2011-12 being the first year of the scheme, to 50% in case of Commercial Banks and 25% in case of RRBs and Co-operative Banks. Support to the banks for (a) Forming and linking of Joint Liability Groups (JLGs) (b) Awareness programmes for promoting the scheme (c) Organizing sensitization meets for the branch officials of implementing banks and (d) Training and capacity building of identified entrepreneurs is also offered under the scheme. In partial modification of the Scheme, Tractor Financing under group mode to Self Help Groups (SHGs)/Joint Liability Groups (JLGs) were also considered for concessional refinance by the banks, provided tractors are financed to;

a) An existing Self Help Group (SHG) which is at least two years old

b) A new Joint Liability Group (JLG), provided the number of land owning farmers in the group is not less than five and every member is a Small Farmer (SF) or a Marginal Farmer (MF)

Table 3.9: Sources of credit to Agriculture Sector (per cent)

Sources of Credit	1951	1961	1971	1981	1991	2002
Non-Institutional	92.7	81.3	68.3	36.8	30.6	38.9
of which						
Money Lenders	69.7	49.2	36.1	16.1	17.5	26.8
Institutional	7.3	18.7	31.7	63.2	66.3	61.1
of which						
Cooperatives Societies/Banks	3.3	2.6	22	29.8	30	30.2
Commercial Banks	0.9	0.6	2.4	28.8	35.2	26.3
Unspecified	-	-	-	-	3.1	-
Total	100	100	100	100	100	100

3.88 Over the years, there has been a significant increase in the share of formal financial institutions (commercial banks, RRBs and cooperatives) in the total credit availed by cultivator households. The formal financial institutions accounted for about 66 per cent of the total credit to cultivator households by the early 1990s [Table 3.6]. However, the share of formal institutional credit to agriculture witnessed some reversal during the period between 1991 and 2002 which was partly due to a contraction in rural branch network in the 1990s, and partly due to the general rigidities in procedures and systems of institutional sources of credit. The regional distribution of agricultural credit by commercial banks, both in terms of quantum of credit and the number of accounts, has been skewed. There is a significant concentration in the southern states (Andhra Pradesh, Karnataka, Kerala, Tamil Nadu) followed by the northern and western states. In contrast, the share of the eastern (Bihar, Jharkhand, Odisha and West Bengal) and the north-eastern states has been low. Further, nearly three quarters of the farmer households still do not have access to the formal credit system and have no means to insure themselves against income shocks. This leaves them vulnerable to the informal money lenders.

Insurance

3.89 With a view to provide insurance coverage and financial support to the farmers in the event of failure of any of the notified crop as a result of natural calamities, pests and diseases, to encourage the farmers to adopt progressive farming practices, high value in-puts and better technology in agriculture and to help to stabilize farm incomes, particularly in disaster years, National Agricultural Insurance Scheme (NAIS) has been introduced in the country from Rabi 1999-2000 season in place of erstwhile Comprehensive Crop Insurance Scheme (CCIS) which was implemented from Kharif 1985 to Kharif 1999. The scheme is available to all the farmers – loanee and non-loanee - irrespective of their size of holding. Loanee farmers are covered on compulsory basis in a notified area for notified crops whereas for non-loanee farmers the scheme is voluntary.

3.90 The Scheme envisages coverage of all the food crops (cereals, millets and pulses), oilseeds and annual commercial/horticultural crops, in respect of which past yield data is available for adequate number of years. The premium rates are ranging between 1.5% and 3.5% per cent of sum insured for food and oilseed crops. In the case of commercial/horticultural crops and for higher sum insured & indemnity than that of normal, actuarial rates are being charged. Under the scheme, at present, 10% subsidy in premium is available to small & marginal farmers which is shared by the Central and respective State

Government on 50 : 50 basis along with claims for normal sum insured & indemnity level for food and oilseed crops.

3.91 The Agriculture Insurance Company of India Ltd. (AIC) is the Implementing Agency (IA) of the Scheme. It is a yield guarantee scheme operating on "Area Approach" basis. The implementing States/UTs can notify any unit area of insurance i.e. block, mandal, tehsil, circle, phirka, gram panchayat etc. keeping in view the availability of past yield data and capacity of the State to undertake requisite number of Crop Cutting Experiments (CCEs) in each notified areas for assessment of crop loss. The State Government/UT Administration is required to notify areas/crops well in advance of the crop season, issue the necessary notification/ instructions to all financial institutions and provide past yield data.

3.92 If the actual average yield per hectare of the insured crop for the defined area (on the basis of requisite number of Crop Cutting Experiments) in the insured season, falls short of specified Threshold yield, all the insured farmers growing that crop in the defined area are deemed to have suffered shortfall in their yield. The scheme provides coverage against such contingency. The indemnity claims are worked out by the Implementing Agency i.e. Agriculture Insurance Company (AIC) of India Ltd., on the basis of yield data, based on requisite number of Crop Cutting Experiments, furnished by the implementing State/UT. The claims are released to banks and the banks in turn credit the amount in the account of the beneficiary farmers and display the particulars of beneficiaries on their notice board.

3.93 Indemnity claims are worked out on the basis of the following formula:

$$\frac{\text{Shortfall in yield}}{\text{Threshold yield}} \times \text{Sum Insured for the farmer.}$$

Where shortfall = Threshold Yield – Actual Yield for the Defined Area.

3.94 Financial liabilities towards claims above 100% of premium in case of Food Crops & Oilseeds along with 10% premium subsidy to small and marginal farmers, Bank Service charges and 20% of administrative and operational expenses are borne by the Government and shared on 50:50 basis by the Central Government and the respective State Governments. All claims in case of annual horticultural/commercial crops and higher sum insured and indemnity levels for food crops and oilseeds are being paid by the implementing agency.

Progress of Crop Insurance Programme

3.95 At present, **NAIS** is being implemented by the 24 States and 2 Union Territories namely Andhra Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Orissa, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand, West Bengal, Andaman & Nicobar Islands and Puducherry.

3.96 Progress of the scheme can be measured in terms of farmers/area covered, sum insured, premium collected, claims paid and farmers benefited. During the last twenty five crop seasons (i.e. from Rabi 1999-2000 to Rabi 2011-12), 1930 lakh farmers have been covered over an area of 2915 lakh hectares insuring a sum amounting to Rs. 2555309 crore. Claims to the tune of about Rs. 24528 crore have become payable against the premium income of about Rs. 7698 crore benefiting about 505 lakh farmers. State-wise business statistics of NAIS are at **Annexure**.

3.97 The Modified NAIS has been implemented in 50 districts and 44 districts during Rabi 2011-12 and Kharif 2012 seasons respectively. From Rabi 2010-11 to Rabi 2011-12 (three seasons), 15.38 lakh farmers have been covered over an area of 16.57 lakh hectares insuring a sum amounting to Rs. 3865 crore. Claims to the tune of about Rs. 112 crore have become payable against the premium of about Rs. 323 crore benefiting about 1.45 lakh farmers. State-wise business statistics of Modified National Agriculture Insurance Scheme (MNAIS) are at **Annexure**.

3.98 The Weather Based Crop Insurance Scheme (WBCIS) is being implemented in 230 districts in

16 States. From Kharif 2007 to Rabi 2011-12, 243 lakh farmers have been covered over an area of 338 lakh hectares insuring a sum amounting to Rs. 42888.99 crore. Claims to the tune of about Rs. 117.91 crore have become payable against the premium of about Rs. 2291.75 crore benefiting about 122 lakh farmers. State-wise business statistics of WBCIS are at **Annexure**.

3.99 The Coconut Palm Insurance Scheme (CPIS) is being implemented on pilot basis in selected states/areas. From 2009-10 to 2012-13, 48715 farmers have been covered over an area of 25389 hectares, insuring 27.66 lakh palms for a sum amounting to Rs. 269.53 crore. Claims to the tune of about Rs. 153.23 lakh have become payable against the premium of about Rs. 146.45 lakh benefiting about 3385 farmers. State-wise business statistics of CPIS are at **Annexure**.

3.100 All the above said schemes are demand driven and no state-wise allocation/release is made under these schemes. Funds are released to the implementing agency who in turn settles the claims of farmers and provide premium subsidy as per provisions of the schemes.

The Way Forward – Yield Index Crop Insurance

3.101 The National Agricultural Insurance Scheme (NAIS) and modified NAIS (MNAIS) provide risk coverage of the crops on the basis of their yield. While the unit area for MNAIS is village/ village panchayat, NAIS also allows notification of village as the unit area. However, many States notify a larger unit area such as Block, Taluk and Tehsil. The larger unit area does not cover the risk of individual farmers that effectively because of larger variations in the yield in the unit area. The States are reluctant to notify a smaller unit area (such as a village) because of increased requirements of the minimum number of crop cutting experiments that has to be undertaken which is both costly and time consuming affair. The States need to deploy additional manpower and provide adequate training to the personnel engaged in the crop cutting experiments to ensure accurate and timely availability of yield data for effective implementation of the insurance schemes. Use of modern technology such as remote sensing through satellite imagery may be deployed to reduce the cost and improve the accuracy of crop cutting experiments.

3.102 Under the weather based insurance scheme, the crops are insured against adverse weather conditions. However, successful implementation of a weather based insurance product requires adequate number of automatic weather stations to be set up to capture the weather data accurately. At present, there are only about 3,000 automatic weather stations (including the weather stations set up by the private companies). However, about 10,000 automatic weather stations would be required to properly implement weather based crop insurance scheme in the entire country. India Meteorological Department (IMD), agricultural universities, the private sector and insurance companies need to work closely to set up required number of automatic weather stations in the country for successful implementation of the weather based crop insurance scheme.

Extension Services

3.103 The process of technology transfer in India has been a mix of field extension carried out by line departments, anchored by frontline extension systems of the ICAR Institutes and SAUs, Commodity Boards, NGOs and voluntary organizations. Recently, Farmers' Consortiums under different nomenclature have also emerged with this mandate. But most of them have not been able to reach out to the broad spectrum of clientele, who need problem solving, relevant technologies and ground level advisories. These efforts have however not been sufficient in the context of food security concerns. New initiatives viz. ever increasing ICT interventions; growing emphasis on people's participation and democratic decentralization; increasing role of NGOs; growing thrust on entrepreneurship development and multiplicity of facilitating and consultancy services required by different stakeholders are bound to play a catalytic role. Realizing the fact that Public extension services in India need to be geared up, particularly in addressing the emerging technological and knowledge needs,concerted efforts have been

made in the recent past to strengthen the system by suitably revising and revamping the ongoing Schemes of the Department of Agriculture and Cooperation.

Support to State Extension Programmes for Extension Reforms

3.104 The Scheme is currently in operation in 614 districts of 28 states & 3 UTs. The scheme essentially focuses on institutionalizing key reforms. The extension support to farmers under the scheme is provided through a 'basket of activities' called the ATMA Cafeteria, 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, and (iv) Innovative Activities. 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. 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/Secretary (Agriculture) of the State. The State Extension Work Plan (SEWP) approved by IDWG is further put up to State Level Sanctioning Committee for approval and Government of India for release of funds.

3.105 The status of implementation of Extension Reforms Scheme is as under:

- Over 215.15 lakh farmers have been benefited so far since inception of the scheme through various extension activities viz.:
- Over 15.53 lakh farmers benefited through Exposure Visits;

- Over 49.55 lakh farmers through various training programmes at different levels;
- Over 22.92 lakh farmers through Demonstrations; and

Box 3.2: Innovative Steps: Farm Crop Management System (FCMS): Tamilnadu

To implement farm level interventions through micro level planning and execution by the Departments viz., Agriculture, Horticulture, Agricultural Engineering, Agricultural Marketing and TNAU, a specially developed software package "Farm Crop Management System" has been developed. FCMS is being implemented in six districts of TamilNadu on Pilot basis Viz; Trichy,Coimbatore, Erode, Vellore, Virudhunagar and Tiruvarur.

Personal Digital Assistants (PDA) are being distributed to collect detailed data base on field, inform availability of inputs such as seeds, fertilizers, pesticides, bio-pesticides etc., record biometric observations of crops at critical stages to arrive estimated yield, pest and disease outbreak, improved cultivation technologies, individual based insurance settlement and linkages for marketing of harvested crops. The data will be used to narrow down the yield gap and to facilitate the farmers for easy access to information like weather, input availability, farm based interventions, market intelligence and scheme benefits besides knowing details of their own farm plan and inputs requirement.

FCMS is being implemented in six districts of TamilNadu on Pilot basis Viz; Trichy, Coimbatore, Erode, Vellore, Virudhunagar and Tiruvarur.

- Over 115.72 lakh farmers through KissanMelas/Field days and Kissan Goshties.
- Over 1.10 lakh Farmers Interest Groups (FIG's) have been mobilized.
- Over 41,149 Farm Schools have been set up on the field of Progressive/Awardeesfarmers.

3.106 The Government has been trying its utmost to strengthen the institution of ATMA. In fact, National Mission on Agricultural Extension and Technology proposed to be launched during XII Plan which will focus on disseminating 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

3.107 Launched in 2002, the Scheme on Establishment of Agri-Clinics and Agri-Business Centres (ACABC) 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 agri-preneurship. 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 refinancing the agri-business loans granted by commercial banks to the trained graduates and release of subsidy thereon.

3.108 Ever since its launch in the year 2002, a total of 29,413 candidates have been trained under the scheme out of which 11009 have established their ventures August,2012. This shows that the scheme has invoked tremendous interest in the unemployed agriculture graduates towards entrepreneurship in the rural areas. UP, Maharashtra and Bihar have exhibited remarkable achievement in the numbers of candidates that enrolled for ACABC training. States like Rajasthan, Karnataka, Tamil Nadu, Andhra Pradesh, and J&K have also exhibited a modest progress. Overall progress in the establishment of agri ventures by trained graduates was 38% (approx.) since its inception. The previous year's success rate was 53 %. A higher success rate during coming years is anticipated.

3.109 Many factors contribute to the development of agripreneurs through ACABC Scheme including level of agricultural development in the State, awareness in prospective candidates about the ACABC scheme and infrastructure facilities available. Thus, the need for efficient support organizations to monitor the activities of small enterprises 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 were made in the Scheme during 2010-11 to accommodate these concerns.

3.110 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 agripreneurs under that scheme an element of refresher training has been introduced in the revised Scheme format. This training of about 3-5 days duration would be conducted in specialized Institutions like SAUs/ICAR Institutes/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% for general and 44% 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 lakh (plus 5 lakh for extremely successful individuals) for individual projects and project cost up to Rs.100 lakh 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 up to the Farmers

3.111 The Central Sector Scheme 'Mass Media Support to Agriculture Extension' has been launched during the Tenth Plan Period to enable a revamping of 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 and 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. Under this Scheme, the existing infrastructure of Doordarshan (DD) and All India Radio (AIR) is being utilized to make the farmers aware of modern technologies and researches related to agriculture and allied areas. A 30 minute programme is being telecast five to six 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 of change-setting technology and farming practices through the Saturday slot of Doordarshan's National Channel, DAC is producing films, which would consciously project inter-alia positive aspects of agriculture in India.

Focused Advertisement Campaign

3.112 The Department of Agriculture & Cooperation, Ministry of Agriculture has launched a 'Focused Advertisement Campaign' to create awareness of assistances available under various schemes. At the national level this is being implemented by way of short advertisements Audio & Video Spots of 30 – 60 seconds duration. The spots are broadcast/ telecast through AIR, DD and private channels operating at the national and regional level during news, serials, and entertainment programmes having maximum viewership.

3.113 Following Spots are currently being telecast.

- Farm School (Munim)
- Farm School (Sass Bahoo)
- Kisan Credit Card
- National Horticulture Mission
- Accelerated Pulse Production Programme (A3P)
- Judicious use of Fertilizers
- Poorvi Bharat Haritkranti.

- Kisna Call Centre (Husband & Wife)
- Kisan Call Centre (Sass Bahoo)
- 2 Audio spots on Kisan Call Centres

3.114 The spots have been telecast through DD National and 25 Regional Kendras of DD as well as 21 private channels operating at National & Regional level. To monitor the campaign, a soft ware has been developed with the help of NIC. All the Channels are uploading the prelogs (time band of 20 min) and post logs. IP TVs have also been installed to monitor the campaign. A 'Focused Publicity Campaign Committee' has been formed in DAC and regular meetings of the committee are being held to monitor the programme. A proposal has already been initiated to get the feedback of the campaign through Audience Research Unit (ARU) of Doordarshan.

Box 3.3: Kisan Call Centre (KCC)

The Kisan Call Centre (KCC) initiative aims to provide information to the farming community through toll-free telephone lines (telephone No. 18001801551). 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:

(a) Voice/Media Gateways (IPPBX based decentralized system).

(b) Dedicated MPLS leased line network with dedicated bandwidth.

(c) SMS to caller farmers providing a gist of advisories given to them on phone.

(d) 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.

ICT Interventions in Agriculture

Development of Portals

3.115 DAC has developed 80 portals, applications and websites 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 (RashtriyaKrishiVikasYojana), ATMA, NHM (National Horticulture Mission), INTRADAC, NFSM (National Food Security Mission) and APY (Acreage, Productivity and Yield).Direction have been issued getting online data entry done right from the District level, so as to expedite generation of requisite queries & reports in an efficient manner.

Box 3.4: Farmers' Portal

This portal aims to serve as One Stop Shop for all farmers for accessing information on agricultural activities. Besides giving links to appropriate pages of the 80 portals already developed so far, the Farmers' Portal links the location of the farmer (from his Block) with NARP (National Agricultural Research Project) Zone that he belongs to. Thereafter, all information related to the crops grown in that area (coupled with agro-climatic conditions in that region) is provided to the farmer using a graphical interface. Farmers can get information about package of practices; crop/ seed varieties; common pests; dealer network for seeds, fertilizers&pesticides; machinery and tools; agro-met advisories etc. Data for most States has been entered in one language, but the portal will be launched after the data is updated and entered both in English and in the vernacular language of the State.

National E-Governance Plan in Agriculture (NeGP-A)

3.116 The Mission Mode Project has been introduced during last phase of the 11th plan to achieve rapid development of agriculture in India through the use of ICT for ensuring timely access to agriculture related information for the farmers of the country. There are a number of current IT initiatives/schemes undertaken or implemented by DAC which are aimed at providing information to the farmers on various activities in the agriculture value chain. These initiatives will be integrated so that farmers would be able to make proper and timely use of the available information. Such information is intended to be provided to farmers through multiple channels including Common Service Centers, Internet Kiosks and SMSs. 12 clusters of services have been identified and the project has been sanctioned for implementation in 7 States i.e. Assam, Himachal Pradesh, Karnataka, Jharkhand, Kerala, Madhya Pradesh and Maharashtra. The services include Information on Pesticides, Fertilizers& Seeds, Soil Health; Information on crops, farm machinery, training and Good Agricultural Practices (GAPs); Weather advisories; Information on prices, arrivals, procurement points, and providing interaction platform; Electronic certification for exports & import; Information on marketing infrastructure; Monitoring implementation/ evaluation of schemes & program; Information on fishery inputs; Information on irrigation infrastructure; Drought Relief and Management; Livestock Management.

Agrisnet

3.117 Under this Scheme, funds are provided to State/UTs for computerization down to Block level. Funds to 26 states have been released under AGRISNET to achieve the objective of providing computers up to Block level. State specific software packages have been developed to disseminate information to the farmers. Availability of requisite hardware and locally suitable software packages has resulted in quick retrieval of data, dissemination of information to farmers and provision of farmer centric services to farmers.

Some Successful State Initiatives

e-Krishi Kiran Programme (Soil Health Card Project) of the State of Gujarat

3.118 The e-Krishi Kiran Programme (Soil Health Card Program) implemented by the Government of Gujarat is an online program of technology transfer with an individual farm condition in focus. It helps making transfer of technology more scientific, precise, easy, and need based. The Soil Health Card System is a web based information system designed to run on internet and intranet (Gujarat State Wide Area Network). This is a repository of agricultural information for the benefit of farmers, agricultural scientists and decision makers. The Soil Health Card System is a unique information initiative of its kind for the benefit of farmers at the grass-root level.

3.119 The system can generate recommendation of the fertilizers needed for a particular crop based on a nutrition status of farmer's soil on the basis of low, medium, high soil fertility rating. It can generate recommendation of the possible alternative crops to a farmer for better crop production based on his cropping practice and weather condition in his area considering the facts like moisture availability index, available water capacity, and length of growing period, surplus water and supplementary irrigation. The system can generate state wise district wise, *taluka* wise and individual farmer wise model action plans for crop production.

Agrisnet Project in the State of West Bengal

3.120 Some ICT Services provided by State of West Bengal are given below:

G2C Services

- Availability of Quality Fertilizer (Manufacturers/Dealer wise) with MRP
- Soil Health Card which includes fertilizer recommendation for the crops according to soil test result
- Information on Weather to the farmers (Data on daily weather forecast, rainfall,

temperature, evaporation, wind direction, dew etc.)

- Soil Survey and Soil Conservation related Statistics (Landuse, Landform, Soil Information – Basic information on the soil with soil classification based on approximation (a modern nomenclature of soil class).
- Availability of Pesticide (Maufacturer/ Dealer wise) with MRP
- Availability of farm mechanization equipment/tools in the locality

G2B Services

- Information on subsidy under various schemes (on seed, fertilizer. pesticides, farm mechanization etc.)
- District wise Sales Report of Fertilizer of each manufacturer for a duration
- Crop wise requirement of Fertilizer in coming Seasons (Rabi/Khariff)
- District wise sales reports of seeds (of different crops and variety).

Agrisnet: Odisha

3.121 Some of the important modules developed by State of Orissa are given below.

- **Farm Mechanisation**: This module provides the targets and achievements of farm implements and machinery distributed to the beneficiaries of Odisha with relevant details.
- **Pesticide Quality Control:** The software enables the Pesticide testing laboratory to test the quality of the drawn samples of pesticides received from different offices and also checks the percentage of required active ingredients and the expiry date of the pesticides, As a result, the sample is treated as standard or Non-standard.
- **Fertilizer Quality Control**: This module lays down the detailed procedure for sampling and chemical analysis of each Fertilizer sample drawn by Fertilizer Inspector from different district. Samples are also received from outside state as referee sample.
- **Fertilizer Input Management**: This module focuses on the demand and supply of fertilizers for a particular range of District from the Fertilizer Manufacturers. It also ensures that the allotted quantities of different fertilizers are made available within stipulated time.
- **Fertilizer Licensing System**: This module emphasizes on online FRC application. This application is meant for the selling and storage of all permissible fertilizers in Orissa for Manufacturer, wholesalers, Retail Dealers, Pool Handling Agencies, Importers etc. FRC is given to the applicant online.

Challenges

3.122 The Extension system in India is faced with multiple challenges in terms of its capacity, resources and outreach to cater to the fast emerging and diversified needs of Indian agriculture, particularly with respect to the following emerging issues

- Depleting soil and water resources
- Increasing climate variability
- Meeting food security with limited land and water resources
- Slackening growth in rainfed areas causing widespread distress.

3.123 Major challenges before the agricultural extension system in the country revolve around the following areas:

i. Understaffed extension

ii. Insufficient planning at district level and below

iii. Lack of integration of KVKs with ATMA

iv. Public sector technology generation often fails to take into account farmer's needs, perceptions and location –specific conditions for each crop

v. Feeding India's growing population, meeting diversified food basket and needs of food security

vi. Productivity of rainfed agriculture has lagged, causing widespread distress

vii. Lack of support to knowledge intensive alternatives for rain-fed farming.

viii. Inadequate efforts at linking small producers to markets though aggregation of produce through groups

The Way forward

3.124 There is an emergent need to restructure and strengthen the extension system in the country to meet the challenges highlighted above. However, this restructuring and strengthening of agricultural extension machinery has to be a judicious mix of extensive physical outreach of personnel, enhancement in quality through domain experts & regular capacity building, interactive methods of information dissemination, Public Private Partnership and pervasive & innovative use of ICT/Mass Media. The extension personnel not only need to be deployed, but it also needs to be ensured that they are physically present in their assigned Panchayats on due days and actually mingle with the farmers to provide customised solutions based on local needs. Entrepreneurs in private sector, agri-business companies and experts in NGOs also need to be involved in a big way.

3.125 The Extension approach therefore has to be a combination of strategies for augmenting the workforce to support the delivery of extension services to the farmers together with adopting innovative approaches for managing the extension system in the country. Salient strategies proposed are outlines below:

Augmenting Extension Workforce

- Positioning the dedicated manpower for extension supported by the Government of India to the extent of 90%for about 21000 posts under the modified ATMA Scheme 2010. Firm backward and forward linkages with the other staff in agriculture and allied departments through institution of Block Technology Team under ATMA.
- Supplementing the Extension workforce by augmenting the progress under Agri Clinics and Agri Business Centres (ACABC) Scheme and the **Diploma in Agricultural Extension Services for Input Dealers (DAESI) (being implemented** by MANAGE)
- Filling of the vacant posts in agriculture and allied areas by States and earmarking at least 30 % manpower exclusively for extension apart from converging the extension functionaries under different schemes of the GoI viz. NFSM, NHM, INSIMP,CROPSAP, NAIS etc. at district and block level with the manpower under ATMA for integrated extension delivery.
- Providing a display board in each village indicating the name of the extension worker assigned to the Panchayat and his/her contact number apart from details of main schemes (including their major components, eligibility, subsidy pattern etc.) applicable in that area.
- Close monitoring of farmer-oriented activities like Training & Exposure Visits (outside and within the State), Farm Schools, Demonstrations (agriculture and allied sectors), Mobilization & Capacity Building of Farmers' Interest Groups, Commodity Interest Groups etc., Extension Activities like KisanMela, Exhibitions, Field Days and Farmers-Scientists Interactions, skill training of rural youth etc.
- Bringing in Convergence between Research and Extension system strictly in keeping with joint initiatives of the Department of Agriculture and Cooperation (DAC) and the Department of Agricultural Research and Education (DARE).
- Greater involvement of Farmers' Advisory Committeesin from Block to State level in keeping with ATMA Guidelines. Moving to the regime of group based extension.

Extension Strategy

3.126 Apart from making efforts to ensure optimal strength of extension workers to have deep penetration and direct reach to the farmers, it would be appropriate to advert to the overall extension strategy. We need to adopt a multi-prolonged approach as given below:

5 Tiered Mass Media Campaign

i) TV/Radio

ii) Newspaper

iii) Pamphlets/Leaflets

iv) SMS/inward voice calls in Kisan Call Centres

v) Internet & Common Service Centres (fifth tier).

- Apart from augmenting the use of Mass Media in extension delivery through conventional resources of print and electronic media, providing support of innovative electronic resources viz. LCD or Pico Projectors (with laptop) at Block in the country for projection of short low cost short films focussed on specific themes.
- Bringing out low cost publications for the farmers in a farmer friendly manner preferably in local language and making them available up to village level.

  Path-breaking methods such as Kala Jathas, Extension Buses etc.,already tried successfully, to deliver the message effectively and informally in an interactive manner.

Innovative and Pervasive Use of ICT:

- Reaching out to the farmers, possibly through customised ICT services viz. SMS, IVRS and Voice Recognitiontailor made to the needs of a Commodity Interest Group or specific agro-climatic area. Dissemination of information has been firmly established in the States of Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu.
- Promoting the use of hand-held devices for on the spot data entry and its subsequent updation through innovative technologies like voice recognition for farm level planning and farmer empowerment. This experiment has been successfully tried in 6 districts of Tamil Nadu.
- Strengthening the Kisan Call Centres (KCC) Scheme with more number of agents to receive and answer farmers' calls and integration of innovative technologies and better management for ensuring quality of services.
- Integrated web-portal for farmers has been prepared.
- Promoting Community Radio Stations (CRS) in a big way to expand the reach of localised technologies to the farmers located within a radius of 20 to 50 Kilometres.
- National e-Governance Plan Agriculture is being implemented in Phase-1 in 7 seven States.

Induction Training & Refresher Courses for Extension Workers And Deployment of Domain Experts:

- Providing training and capacity building to extension workers at induction level and during service at periodic intervals as per technological developments and emerging needs of the farmers.
- Mainstreaming the alternative domain experts viz. retired scientists, department officials, agribusiness experts who have actually proved their specialization and acceptability to the farmers in a particular crop/enterprise. Institutionalising a system of **Certified Crop Advisors** who can evolve as Domain Experts.
- Ensuring proper mobility of the scientists along with extension workers for field visits for programme monitoring or extension activities.

Public Private Partnership

Strengthening the two modes of public-private partnership promoted through the existing Schemes on ACABC & DAESI as outlined in the para 4.1 above. The provision of **10% of the expenditure of activities to be done only through the non-Governmental sector as per Modified ATMA Guidelines** needs to be operationalized by all the States for harnessing the capacity available with private sector.

3.127 Some other measures which can strengthen the public extension services include the following:

- All the institutions involved in extension activities should better target their beneficiaries; characterize the requirements of each beneficiary group; and customize their extension services, so that they become total solution providers to target groups.
- Extension activities to emphasize sustainable natural resource management including indigenous knowledge systems.
- Documentation, rationalization and institutionalization and popularization of contemporary farmer innovations.
- Promote CIGs/SHGs in order to fill gaps in extension services at the village level and to further federate the ongoing CIGs/SHGs.
- The time-lag between technology generation and dissemination needs to be minimized by devising suitable mechanism.
- Strengthen media and e-resources through publications such as newsletters, books, manuals, leaflets, brochures, technology hand outs, etc.; media coverage of extension programmes; development of cyber extension platforms and extension portal; content development cyber extension, production of AV and interactive aids, etc.
- Strengthening market intelligence, EDP and consultation through EDP packages, project report preparations and consultancies, industry and enterprise relations and partnership, establishing local market network on prices, establishing value chain demonstration units, etc.
- Strengthening continuing education programmes through open and distance learning for farmers and entrepreneurs with online courses, conducting certificate courses for farmers, entrepreneurs input dealers, extension agencies, etc.

CHAPTER 4

Agricultural Production and Programmes

4.1 With about 2.5% of global land resources, 4% of water resources and 17% of global population living in India, achieving food security by increasing agricultural production has to be at the core of India's agricultural development strategy. Situation assumes greater significance with the increasing population and growing economic prosperity. The government has launched a number of programmes for increasing production of agricultural commodities. Many new initiatives have been taken to widen the food basket keeping in view the demand and nutritional requirements of the population. Higher attention to Eastern Region, millets, pulses and fodder crops, national mission on protein supplement, setting up of Peri urban vegetable production clusters are some of these initiatives taken up for implementation during the year.

Agricultural Production

4.2 Despite high dependence of Indian agriculture on monsoon rains (June to September), there has been a significant jump in production of food grains and other crops over the past five years. During 2011-12, there was a record production of foodgrains at 259.32 million tonnes, comprising of 131.27 million tonnes during Kharif season and 128.05 million tonnes during the Rabi season. Of the total foodgrains production, production of cereals was 242.23 million tonnes and pulses 17.09 million tonnes. As per 2nd advance estimates for 2012-13, total foodgrains production is estimated at 250.14 million tonnes which is 9.18 million tonnes or 3.54 per cent lower than that of of last year . The decline in kharif production (from 131.27 million tonnes in 2011-12 to 124.68 million tonnes in 2012-13) has been

on account of late onset of monsoon and deficient rainfall in several states affecting the production in Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Maharashtra, Rajasthan, Tamil Nadu and West Bengal. Production of coarse cereals has been severely affected by the deficient monsoon in Gujarat, Haryana, Karnataka, Maharashtra and Rajasthan. There was a significant improvement in the rainfall situation in September, 2012, signaling better soil moisture conditions and bright prospects for ensuing rabi crops. As per the 2nd advance estimates, foodgrains production during rabi season is estimated at 125.47 million tonnes. Though this is marginally lower than the final (rabi) estimate of 128.05 million tonnes during the last year, in the past improvements have been reported in subsequent estimates and it is expected that the country would finally harvest a higher production in the rabi season and bridge the shortfall in kharif production during 2012-13. Table 4.1 gives the details of production of foodrains in the recent years.

4.3 Krishi Karman Awards were given to the States (Box 4.1) by the President of India, Shri Pranab Mukherji on 15th January, 2013 in recognition of their commendable efforts in achieving the record production in 2011-12.

Box 4.1: Krishi Karman Awards

'Krishi Karman Awards' were instituted for the first time by the Ministry of Agriculture in different categories – Total Foodgrains for large, medium and small States, Wheat, Rice, Coarse Cereals and Pulses during the year 2010-11. During the year 2011-12, in addition to Krishi Karman Awards, **'Commendation Awards'** were also included for those States who achieved higher production and productivity over their previous five years highest but could not get Krishi Karman Award. Besides, **'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.

Krishi Karman Awards for foodgrains comprised cash prize of Rs. 2.00 crore for each State, a Trophy and Citation; for individual crop category Rs. 1.00 crore, a Trophy and Citation; and for Commendation Awardee States a Citation plus cash of Rs. 25.00 lakh for improvement of work environment to Agriculture Departments of Awardee States. Besides, Awardee Farmers were given a Citation plus cash award of Rs. 1.00 lakh to improve their infrastructure development.

Following awards were presented on 15th January, 2012 by the Hon'ble President of India:

(A) 'Krishi Karman Awards, 2011-12:

Total Foodgrains Production:

Category-I (> 10 million tonnes) – **Madhya Pradesh**.

Category-II (< 10 to 1 million tonnes) – **Tamil Nadu.**

Category-III (> 1 million tonne) – **Manipur and Nagaland**.

Individual Crops:

Rice - Bihar

Wheat - Haryana

Pulses – Jharkhand

Coarse cereals – Uttar Pradesh

(B) 'Commendation Awards:

Total Foodgrains:

Category-I - Punjab and Rajasthan.

Category-II - Gujarat and Uttarakhand.

Category-III - Tripura, Arunachal Pradesh and Mizoram.

Individual Crops:

Wheat - Himachal Pradesh.

Pulses - West Bengal and Assam.

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

Madhya Pradesh: Shri Gambhir Singh for **Wheat** and Smt. Radha Bai Dubey for **Gram**.

Tamil Nadu: Thiru P. Solaimalai and Thirumati T. Amalarani for **Rice**.

Manipur: Shri Nongmaithem Ibomcha Meetei and Smt. Nongmeikapam (O) Shyamashakhi Devi for **Rice**.

Nagaland: Shri Ghoshito and Smt. Kezhawetuou Yhome for **Rice**.

Bihar: Shri Sumant Kumar and Smt. Shanti Devi for **Rice.**

Haryana: Shri Ram Kumar and Smt. Anita for **Wheat.**

Jharkhand: Shri Damodar Chaudhary and Smt. Seemu Sardar for **Arhar**.

Uttar Pradesh: Shri Jhabbu Lal for **Maize** and Smt. Sharda Devi for **Bajra**.

Table 4.1: Production of Foodgrains in Recent years

(million tonnes)

Crop	Target	10th plan		11th plan						increase over base	
Add Prodn under NFSM		2006-07	10th Plan Ave.	2007-08	2008-09	2009-10	2010-11	2011-12	11th Plan Ave.	Tml year	10th Plan Ave.
Rice	10	93	86	97	99	89	96	105	97	12	11
Wheat	8	76	70	79	81	81	87	95	85	19	15
Pulses	2	14	13	15	15	15	18	17	16	3	3
Total Food Grains	20	217	202	231	235	218	245	259	238	42	36

Contribution of Eastern India

4.4 A heartening aspect of the production of food grains in 2011-12 is the contribution from the Eastern Indian States of Assam, West Bengal, Bihar, Jharkhand, Orissa, Eastern Uttar Pradesh and Chhattisgarh in which a new initiative, 'Bringing Green Revolution to Eastern India' has been started since 2010-11 with focused attention on improving the productivity of rice based cropping system. Table 4.2 gives details of the increase in production in the recent years as against the normal production of rice in the Eastern Indian States. Eastern states, in general have recorded much higher increases in production of rice than that witnessed in the all India average in the recent years. The increase in production is primarily on account of increase in yield.

Table 4.2: Production of Rice in the Eastern States.

(Lakh Tonnes)

State	Normal	2010-11	2011-12	% Difference	
			Final	Col. 3/2	Col. 4/3
1	2	3	4	5	6
Assam	29.31	47.37	45.16	61.62	(-) 4.66
Bihar	42.52	31.02	71.63	-27.05	130.90
Chhattisgarh	47.96	61.59	60.28	28.42	(-) 2.12
Jharkhand	25.84	11.10	31.31	-57.04	182.04
Odisha	62.37	68.28	58.07	9.48	(-) 14.95
Uttar Pradesh	115.59	119.92	140.22	3.75	16.93
West Bengal	102.45	130.46	146.06	27.34	11.96
Total	426.04	469.74	552.73	10.26	17.67
ALL-India	**940.20**	**959.80**	**1053.11**	**2.08**	**9.72**

Commodity Outlook

4.5 In the increasingly gloablized world, it is important to keep track of developments elsewhere in the world so as to guard against the excessive price volatility seen in global markets in recent times and seize an opportunity for the farmers to realize better returns for their produce through suitable trade policies that link them to the global markets. It is important therefore to look at the food situation in a holistic manner covering all aspects ranging from production, consumption, prices, stocks and trade. Towards this end a study has been commissioned by the Department of Agriculture and Cooperation to National Council of Applied Economic Research (NCAER) to develop **Agricultural Outlook and Situation Analysis** in the short and the medium terms.

4.6 Presently, main crop based food items: cereals (specifically rice, wheat, jowar, bajra, maize and overall coarse grains), pulses (gram, tur), selected fruits and vegetables (banana, potato, onion), sugarcane and edible oils (groundnut, rapeseed/ mustard, soybean) are monitored under the study with respect to their production, trade, stocks, prices and consumption both at national and global levels. Milk is also considered in the analysis. Two short term forecasts published so far under the study for the quarters ending June 2012 and September 2012 are available on the web site http://nfsm.gov.in.

Crop wise Situation

Rice

4.7 Rice is an important food crops of India in term of area, production and consumer preference. India is the second largest producer and consumer of rice in the world, accounting for 22.3% of global production. As a result of various initiatives such as introduction of better crop varieties, intensive application of inputs, irrigation and price support and procurement operation taken by the government, the production and productivity of rice has increased from 96.7 million tonnes and 2202 kg per hectare in 2007-08 to 105.31 million tonnes and 2393 kg per hectare respectively in 2011-12. Although yield differentials within the country are significant - yield of rice in Bihar has been less than half of the yield in Punjab, however, there have been significant improvements in the recent years. Rice yield in Bihar increased from 1.6 tonnes in 2009-10 to 2.2 tonnes per hectare in 2011-12. However, our paddy yield (3.38 tonnes/ ha) is much lower than that of our neighbors such as China (6.55 tonnes/ha), Bangladesh (4.18), Indonesia (5.01) and Vietnam (5.32) as per FAO estimates for 2010. Government is creating enabling environment for farmers to adopt suitable technologies and agronomic practices, incentivizing production of location specific hybrid rice seed and hazard tolerant varieties against abiotic and biotic stresses, and promoting infrastructural development for marketing.

4.8 Some of the technical innovative and economically viable interventions evolved by the research institutions are direct seeded rice method used in rainfed upland/lowland/irrigated areas, transplanted rice cultivation (TRC) in rainfed lowland/irrigated areas, Alternate Wetting and Drying (AWD) in irrigated areas with good water management practices, System of Rice Intensification (SRI) under leveled & well drained soil with assured source of irrigation, integrated crop management through seed treatment, low seed rate, seedlings age & no. per hill, wider spacing, need based nutrient application, weed management, Intermittent irrigation, IPM etc. and promotion of new varieties.

4.9 Several programmes such as National Food Security Mission (NFSM) launched during 2007-08, Bringing Green Revolution in Eastern India (BGREI) during 2010-11 are being implemented to increase the production and productivity of rice in the country.

Box 4.2: Best Practices in Rice Cultivation

System of Rice Intensification (SRI): About 1 million hectares of total rice planting is covered by SRI technique. System has been adopted with modifications in different areas and new developments are being researched for appropriate rice trans-planter.

Line Transplanting in Orissa and Eastern UP under BGREI: An area of 2.75 lakh ha is covered under BGREI program where under farmers have

achieved an average yield of 3.75 tonnes/ha which is double the normal yields in Orissa.

Boro Rice area in Assam: Boro rice area in Assam is increasing at the rate of almost 2 lakh ha every year. Unlike the ahu and Sali rice season, boro rice season is relatively risk free and farmers have a good control over water, which encourages them to adopt input-intensive rice production to obtained higher yield. The average productivity of Boro rice is 2.22 tonne/ha as against 0.9 and 1.52 tonne/ha for ahu and Sali rice respectively. Deep water areas can be brought under Boro rice

Hybrid Rice Area in Bihar, Jharkhand, Chhattisgarh and Uttar Pradesh: Yield gains are more in stress areas, with an average yield of 4.8 tonne/ha hybrid rice has potential to leap frog development in the Eastern Region.

Adoption of Direct Seeded Rice in Punjab and Haryana: Area in Punjab: 20, 000 ha, Average yield of Direct seeded 4.1 tonne/ha.

Area in Haryana: 10,000 ha, Average yield Direct seeded 4.3 tonne/ha.

Wheat

4.10 The area under wheat has increased from 27.99 million hectares in 2006-07 to 29.86 million hectares in 2011-12. The production of wheat in the country has increased from 75.81 million tonnes in 2006-07 to an all time record high of 94.88 million tonnes in 2011-12. The average annual growth rates in respect of area, production and yield during 1990-91 to 1999-2000 were 1.62%, 4.52% and 2.87%, respectively but declined to 0.57 per cent, 1.39 per cent and 0.73 per cent respectively during 2000-01 to 2010-11. The increase in production has been due to increase in area with irrigations facilities, seed treatment, better varieties, rust management and management of optimum time of sowing to escape terminal heat stress. The productivity of wheat which was 2602 kg/hectare in 2004-05 has increased to 3177 kg/hectare in 2011-12. The major increase in the productivity of wheat has been observed in the states of Haryana, Punjab, Madhya Pradesh and Uttar Pradesh. In order to sustain the present level of productivity and production, certain key areas such as increased seed replacement rate along with varietal replacement with rust resistant ones and resistance to different biotic and abiotic stresses including multi stress tolerant cultivars need to be addressed on priority basis. Technological interventions such as maintaining optimum sowing time, avoiding terminal heat stress period, avoiding early sowing in mid hills to break green bridge to contain rusts,

Box 4.3 :Best Practices in Wheat Cultivation

Managing Optimum sowing time & seed treatment	No early sowing in Oct in mid hills; Optimum sowing time in November; In summer season in Leh/Ladakh sowing to be maintained in March/April.
Managing spacing between rows	Reducing row to row spacing from 20 to 18 cm with same seed rate recommended in Haryana; 10% yield increase reported.
Adopting of Resource Conservation Technologies (RCT) & Conservation Agriculture; use of Zero Till Seed Drill and Laser Land Leveller.	Adoption of RCTs and CA practices led to reduced cost of cultivation,
Varietal replacement for rust management; special focus on rust management through immediate varietal replacement in higher hills of Northern India.	Replacement of varieties with rust resistant ones in NWPZ, NEPZ and CZ; In higher hills introduction of new varieties after testing under the supervision of the State Agriculture Dept & SAU.
Surveillance at regular intervals for rusts by DAC and DWR experts.	Surveillance at regular intervals in Higher and mid hills; Revisiting the matter of rust epidemiology change if any; Surveillance in plains of NWPZ and NEPZ at regular intervals by DAC & DWR (ICAR) experts; creating awareness. CZ & PZ are also being monitored by DAC & DWR experts at regular intervals.

cultivating rust resistant varieties like DPW-621-50, PBW-550, DBW-17 etc. in plains of NWPZ and testing & popularizing rust resistant varieties like HS-375 & VL-832 in higher hills in summer season cultivation, adoption of Conservation Agriculture Practices including Resource Conservation Technologies(RCT) including Zero tillage, revising rust epidemiology in higher hills, management of adequate spacing between rows to augment yield and weed & nutrient management are practiced.

Coarse Cereals

4.11 Coarse Cereals comprises crops like jowar, bajra, ragi, other small millets (kudo, kutiki, sanwa, foxtail) and maize, which have traditionally been the main components of the food basket of the poor in India. These crops are grown predominantly in the rainfed regions of Karnataka, Maharashtra, Tamil Nadu, Madhya Pradesh, Rajasthan, Haryana and Gujarat. There has been a decline in the area coverage under coarse cereals from 29.03 million hectares in 2004-05 to 26.42million hectares in 2011-12. However, the productivity of coarse cereals has increased significantly from 1153 kg per hectare in 2004-05 to 1591 kg per hectare in 2011-12. The increase in productivity has been observed in almost all the major coarse cereals producing States in the country. Total production of coarse cereals which was 33.46 million tonnes in 2004-05 increased to the so far highest level of 43.40 million tonnes in 2010-11 but declined marginally to 42.04 million tonnes in 2011-12 mainly on account of shift in area to other competing crops. The average annual growth rate of area under coarse cereals continues to be negative, though the decline in the last decade has been at a slower pace as compared to 1990s. The average annual growth rate of yield of coarse cereal during 2000-01 to 2011-12 has been significantly higher at 4.56% leading to considerable improvement in production.

4.12 **Millet** crops are grown in arid and semi-arid areas under low rainfall (200-600 mm), where fine cereals like wheat and rice cannot be grown profitably. Millets have more food, feed and fodder values. These crops are more environments friendly and resilient to climate changes. A majority of millet grains contain higher protein, fiber, calcium and minerals than wheat and rice. Therefore, these are now also being called as "Nutri-cereals".

4.13 **Maize** is the major coarse cereals accounting for a little more than half of the production of coarse cereals. In order to promote production of Maize, Accelerated Maize Development Programme (AMDP) a sub-scheme of Integrated Scheme of Oilseeds, Pulses, Oil palm and Maize (ISOPOM) is under implementation from 2004. There has been an increase in the area coverage under Maize from 7.89 million hectares in 2006-07 to 8.78 million hectares in 2011-12. Productivity of Maize has also increased significantly from 1912 kg per hectare in 2006-07 to 2478 kg per hectare in 2011-12. The total production of Maize has increased from 15.10 million tonnes in 2006-07 to 21.76 million tonnes in 2011-12.

4.14 Non-adoption of the recommended doses of inputs due to high risk under the rainfed agro-climatic regions, non-availability of high yielding varieties, quality seeds particularly of small millets, lack of assured procurement under MSP and poor resource base of the farmers who largely grow these crops are the limiting factors in increasing the area and production of coarse cereals. With a view to inhence the production and productivity of coarse cereals, interventions like promoting production of high yielding varieties/hybrid seeds through public and private sectors, organizing demonstrations with cluster approach and supplying subsidized inputs like fertilizers, bio-fertilizers, micro-nutrients and plant protection support including seed treatment up to two hectare per farmer; creation of institutional infrastructure for value addition, demonstration of technology and entrepreneurship development, setting up small processing units for value addition etc are promoted by the Government under Rashtriya Krishi Vikas Yojana (RKVY) through the "Initiative for Nutritional Security through Intensive Millets Promotion (INSIMP)". In order to meet the requirement of Refinement/Retrofitting and demonstration of post-harvest technologies, capacity building of entrepreneurs, market linkages between producer

and processors, two commodity–wise Centre of Excellence (CoE) for Sorghum and Pearl Millet have been operationalised at the Directorate of Sorghum Research (DSR), Hyderabad and CSS Hisar Agriculture University, Hisar. Third CoE for small Millet is being established at University of Agriculture Sciences, Bengaluru. These Centers have developed large number of bakery and other food products and organize consumer awareness campaigns and training programmers for the entrepreneurs.

Pulses

4.15 Being rich in protein, pulses not only form a vital part of the human diet, but also play a crucial role in balancing the dietary proteins. India holds the first rank in pulses production and consumption in the world. India grows the largest varieties of pulses in the world accounting for about 32% of the area and 23% of the world production. The important pulse crops are chickpea (48%), pigeon pea (16%), *urdbean* (9%), *mungbean* (7%), lentil (6%) and field pea (4%). The major pulse producing states are Madhya Pradesh (24%), Maharashtra (15%), Uttar Pradesh (12%), Rajasthan (12%) and Andhra Pradesh (9%), which together account for 72% of the total production. An estimated amount of 30 to 147 kg/ha Biological nitrogen is fixed by different pulse crops in the soils in which they are grown.

4.16 Pulses production has registered a remarkable increase from 14.76 million tonnes in 2007-08 to a record level of 18.24 million tonnes in 2010-11. The production of pulses is estimated marginally lower at 17.09 million tonnes in 2011-12. The increase in total production of pulses has been on account of improvement in production levels of *tur, urad* and *moong*. The average annual growth rate of area and production of pulses has been significantly higher during 2000-01 to 2010-11 as compared to the last decade. Productivity of pulses has increased from 625 kg per hectare in 2007-08 to 699 kg per hectare in 2011-12. A major increase in the productivity of pulses has been noticed in the states of Gujarat, Maharashtra, Rajasthan, Uttar Pradesh and West Bengal. However, the average productivity of pulses in India is less than the average productivity of 890 Kg/ha in world. Among the major pulses producing countries, the highest average yield of pulses has been recorded at 4219 Kg/ha in France, followed by 1936 Kg/ha in Canada and 1882 Kg/ha in USA in 2010.

4.17 Cultivation of pulses is mostly (85% of the area) under rainfed condition, on marginal lands, on low fertile soil by resource poor farmers. Non availability of High Yielding Variety, low Seed Replacement Rate (SRR), high susceptibility to pests especially *Helicover-pa armigera, inadequate* market linkage are the primary reasons for low yield of pulses. With a view to minimize the problem and ensure protective irrigation at the critical stage of plant development sprinkler set, mobile rain gun, pump set, etc. are distributed to farmers for efficient use of water from Dug well, Pond and Polythene lining pond. Further, the seed multiplication ratio (SRR) has been increased to 22.51% in 2010-11 from 10.41% in 2006-07. To provide proper market infrastructure, the market linked extension support through Small Farmers Agribusiness Consortium (SFAC) under 60000 Pulses village programme is being implemented. Moreover, the Minimum Support Prices (MSPs) of Pulses have been increased substantially to incentivize farmers to increase the production and productivity of pulses. Research institutes like ICAR, IIPR, SAUs besides ICARDA and ICRISAT are making efforts to evolve varieties resistant to *Helicoverpa*. Emphasis is also being given on area expansion through promoting pulses cultivation in rice fallows, intercropping of pulses with oilseeds, cotton, cereals etc., productivity enhancement through A3P demonstrations, INM, IPM & popularization/promotion of the high yielding varieties/hybrids.

4.18 Under the National Food Security Mission (NFSM) from Rabi 2007-08, Accelerate Pulses Production Programme (A3P) is being implemented to accelerate the production of Pulses, particularly Red gram, Green gram, Black gram, Chick pea and Lentil by promoting production and protection technologies. Integrated Development of 60000 Pulse Villages is implemented in selected watershed areas in major pulses growing states by

providing funds for in-situ moisture conservation, new farm ponds with polythene lining and or dug wells. The special plan to achieve 19+ Million Tonnes of Pulses production is also under implementation during Kharif 2012-13. Some of the best practices implemented during the 11th Plan are given in Box 4.4.

Box 4.4: Best Practices adopted in pulses

Distribution of certified seed	Distributed 28.00 lakh qtls of certified seeds of pulses.
Integrated Nutrient Management	Advocated balanced use of micro nutrients in 39.00 lakh ha.
Integrated Pest Management	Conducted IPM in about 23.00 lakh ha area.
Demonstration on latest production and protection technologies	Demonstrated about 18.00 lakh ha area under various pulses.
Capacity building (Farmers training)	Trained 15.00 lakh farmers.
Yield gains	Yield gain for different pulses crops were recorded upto three times the normal yields. A document detailing impact on yields as a result of the promotional program has been published for the year 2010-11. The publication is available at http://nfsm.gov.in.

Oilseeds

4.19 The consumption of edible oils is rising continuously, outstripping the domestic production resulting in huge imports. During 2011-12, the country imported about 9.2 million tonnes of edible oils which was about half of its domestic requirement. Edible oil demand is projected to reach 16.64 million tonnes by the terminal year (2016-17) of the XII plan. This would require 59 million tonnes of oilseeds production provided the proportion of different oilseeds remains constant in the coming years. Production of oilseeds during 2011-12 was 29.80 million tonnes which was slightly less than the 32.48 million tonnes recorded in 2010-11. Oilseed cultivation is undertaken across the country in about 26 million ha on marginal lands, dependent on monsoon rains, nearly 72% of area under oilseeds is rainfed and with low levels of input usage. Among the major oilseed growing States, highest yield in 2011-12 of oilseed crops was recorded by Tamil Nadu State (2479 kg/ha) followed by Gujarat (1608 kg/ha) and Haryana (1394 kg/ha). Similarly, States which are having lower yield levels of oilseed crops are Assam (557 kg/ha), Chhattisgarh (550 kg/ha) and Odisha (661 kg/ha).

4.20 An integrated approach involving introduction of new production technologies, better supply of inputs and extension service support for marketing, post-harvest technologies is adopted. Supply of quality seeds (certified) of improved cultivars, varietal replacements, increasing the area under irrigation and/or providing protective irrigation, improving water use efficiency by adopting improved irrigation techniques and sprinkler irrigation and water saving devices, infrastructure provision (shallow tube wells) for exploitation of ground water (high water table areas) using low cost equipment and technology, integrated nutrient management (INM) with emphasis on bio-fertilizers, sulphur and micro-nutrients based cropping system, integrated management of pests and diseases limiting oilseeds productivity in different agro-ecologies, selective mechanization (e.g., improved planters, groundnut digger and decorticator, safflower harvester, etc.) to improve efficiency and overcome drudgery in oilseeds production, effective transfer of technology to narrow the gap (30 to 70%) between realizable and realized yield gap are some of the initiatives being taken by the Government to increase the production and productivity of oilseeds in the country. Some of the best practices being undertaken in oilseeds are given in Box 4.5.

Box 4.5: Best Practices in Oilseeds Cultivation

Practices adopted	Results achieved
1) Use of sprinkler irrigation under irrigation	Increase in yield, saving of water, Increased area under crop with available existing water
2) Use of HDPE pie to increase the water use efficiency	Judicious use of water, save money, reduced labour cost for irrigation, yield advantage
3) Use of polythene mulch in groundnut cultivation in selected situations/ regions.	40% savings in water for irrigation, reduced weed intensity, reduced incidence of sucking pest and 23-50% increase in yield.
4) Use of Thiawan Sprayer	Reduced labour cost, efficient application of plant protection chemicals.
5) Organization of Farmers Field School (FFS)	Efficient transfer of improved cultivation practices for increasing the yield.
6) Use of Drip irrigation for Oil Palm	Increase in yield, saving of water, Increased area under crop with available existing water, reducing conveyance, percolation and evaporation losses compared to flood and basin irrigation methods.
7) Intercropping in Oil Palm	Generation of additional income during gestation period
8) Harvesting of fully ripen Fresh Fruit bunches of Oil Palm	Achievement of maximum oil extraction ratio.

Sugarcane

4.21 Sugarcane is the most important cash crop in India, which is widely cultivated in sub-tropical and tropical region. Tropical regions in Maharashtra, Tamil Nadu, Gujarat, Karnataka, Andhra Pradesh, Orissa and part of Madhya Pradesh account for about 45% of the total area and about 55% of the total sugarcane production in the country, with average productivity of about 83 tonnes per hectare . Sub-tropical region comprising of Uttar Pradesh, Uttarakhand, Haryana, Punjab, Bihar, West Bengal and North Eastern States account for about 55% of area and about 45% of the total sugarcane production with an average productivity of about 56 tonnes per hectare. Sugarcane contributes about 4.4% of the value of output from crop sector and it occupies about 2.4% of India's gross cropped area. Sugarcane is cultivated in about 5 million hectares and India holds the second position in production of sugar after Brazil.

4.22 The area under sugarcane has declined from 5.06 million hectares in 2007-08 to 4.17 ha in 2009-10 but increased thereafter and reached to 5.04 million hectares in 2011-12 . The increase in area coverage under sugarcane has been observed in the States of Uttar Pradesh, Maharashtra and Karnataka. Production of sugarcane after attaining a record level of 355.52 million tonnes during 2006-07, declined in the subsequent years but has started witnessing an increasing trend in recent years. The total production of sugarcane during 2011-12 was 361.04 million tonnes and is estimated at 334.541 million tonnes during 2012-13. Yield of sugarcane was recorded at 71.67 tonnes per hectares during the last year (2011-12). This year the yield is estimated (2nd estimate) at 66.08 tonne per hectare.

4.23 Development of high yielding varieties of sugarcane which are tolerant to biotic and a-biotic stress, strengthening of seed production and cluster approach to transfer of technologies with modern tools, propagation of micro irrigation system like drip irrigation/rain-gun sprinkler and adoption of improved method of irrigation i.e. furrow and skip furrow irrigation instead of flood irrigation, strengthening of seed production programme through tissue culture, single eye bud and poly bag technology, chip bud method, moisture conservation practices through trash mulching and foliar spray with urea & MOP, introduction of partial mechanization so as to

reduce cost of cultivation, Integrated Nutrient Management including organic, bio-fertilizer and micro elements, Integrated Pest management (IPM) enabling bio agents as well as wooly aphid managements, popularizing improved method of planting like trench method, paired row, ring pit, single bud plantation and ratoon management, are considered necessary for increasing the production and productivity of sugarcane.

4.24 Department of Agriculture is implementing Sustainable Development of Sugarcane Based cropping Systems Areas (SUBACS) to give more flexibility to States. The Programme is focusing on widening the quality cane seed availability to the cane growers locally by rearing of seed nurseries at the farmers field, establishment of tissue culture, bio-agent lab, transfer of technology like varietal performance, biotic and abiotic stress management, integrated insect- pest and disease management, integrated nutrient management, planting techniques through demonstration at the farmers field, promotion of mechanization in sugarcane, soil sustainability through micro-nutrients , drip irrigation , soil and seed treatment material through chemicals and heat therapy etc to increase the production and productivity of sugarcane in the country.

4.25 Further, best practices such as trench method and single bud plantation in Punjab, ring pit and trench method of planting in Haryana, trench method of planting in U.P., Bihar & Uttarakand, ratoon management in U.P., Uttarakhand, Maharashtra and Gujarat, and wider row spacing with paired row along with drip irrigation in Maharashtra and Karnataka are practiced.

Cotton

4.26 India is second largest cotton producer, consumer and exporter of cotton in the world. Punjab, Haryana, Rajasthan, Maharashtra, Gujarat, Madhya Pradesh, Andhra Pradesh, Tamil Nadu and Karnataka are the major cotton producing states. During the last decade the area, production and productivity of cotton have grown at 3.14%, 11.66% and 8.25% respectively. During 2011-12 a record area of 12.18 lakh hectare was sown, major increase in area were noticed in Andhra Pradesh, Maharashtra and Gujarat. Bt cotton area occupies 11.14 million hectares, 91.5% of the total area under cotton and seems to be the widely accepted technology among farmers. As per the 2nd advance estimate, cotton production during 2012-13 is estimated at 33.80 million bales (of 170 kg each) as against 35.20 million bales in 2011-12.Yield of cotton (590 kg lint/ha) in India is however, substantially below the world average of 745 kg lint/ha. Even in states like Punjab, Haryana and Rajasthan with 100% irrigation, better soil, Bt cotton hybrid seed and high input farming have not been able to boost yield comparable to international level. Considering the extent of area and the number of farmers involved in cotton cultivation, it is imperative to enhance productivity of cotton, to improve the socio-economic condition of the people engaged with the cotton cultivation.

4.27 Development of GM cotton varieties suitable for high density planting system, fabrication & validation of available cotton hand picker, increasing yield especially under rainfed conditions, revival of deshi and ELS cotton area and production, to maintain Bt resistance management, continuous follow up of on line pest monitoring and advisory services and creation of custom hiring centers are some of the issues requiring attention to increase the production and productivity of cotton.

4.28 In order to increase the production and yield of cotton, technical interventions such as front line demonstration of production technology, Integrated Pest Management, Insecticide Resistance Management (IRM), use of modern farm implements are under operation which have shown an impressive impact on yield of cotton.

4.29 Department of Agriculture is implementing the Technology Mission on Cotton (TMC). With a view to increase production, productivity and improve the quality of cotton. The TMC consists of Four Mini-Missions. MM-I on research which is being implemented by ICAR, MM-II for enhancing production and productivity of cotton which is being implemented by Department of Agriculture & Cooperation, MM-III on the development of market infrastructure and MM-IV on modernization of ginning/pressing factories are being dealt by the Ministry of Textiles.

4.30 Under Mini Mission II assistance is provided for various interventions, like production & distribution of certified seeds, training of farmers & extension officials, Farmers Field School, Front Line Demonstrations, supply of Pheromone traps/bio-agents/bio-pesticides/ drip/sprinkler/sprayers, Bt cotton management strategies, pest monitoring and surveillance, etc. Some of the best practices followed and the results thereof are listed in Box 4.6.

Box 4.6: Best Practices and Achievements in Cotton

Management of Bt refugea	Large scale awareness on importance of Bt refugea planting with same non Bt hybrid seeds, alternate crops like pigeon peas helped to maintain resistance development for last ten years.
Use of neem based pesticides, MSKE, bio-pesticides, organic chemicals, pheromone traps, bio-agents	Decline in pesticides spray from 15 to 6 numbers in north, 20 to 8 in south and 12 to 6 in Central zone.
Promotion of trap, boarder crops, eco feast crops, bird patches etc	This helped to increase the natural enemies of cotton pests in the field.
Adoption of Insecticide resistance management strategies	IRM-IPM program has resulted in a reduction in insecticide consumption by 30%, and reduced the number of sprays by 15%.
Large scale drip adoption in cotton	Drip/sprinkler set beneficiaries reported increasing number of irrigation and savings in water by more than 35% and increase in yield by 25%
On line pest monitoring	Farmers are getting weekly advisory & pest management alert through SMS
Intercropping cotton with pulses & oilseeds	Intercropping of green gram (moong) in cotton in 1:1, 1:2 or 2:1 ratios was found advantageous from yield and economic point of view in Punjab and Haryana. The net returns were higher due to additional yield of green gram (4qtl/ha) for intercropped cotton. In north western Rajasthan, intercropping of green gram in paired rows of cotton brought about higher net monetary returns over sole cotton crop

Jute

4.31 Jute is an important natural fiber crop next to cotton in India. Jute is mainly grown in eastern and north-eastern states namely West Bengal, Bihar, Assam, Orissa, Meghalaya, Nagaland and Tripura. India is the largest producer of Jute accounting for about 62.2 percent of world production and 59.3 per cent of the total area in the World.

4.32 With marginal fluctuations, the area under jute and mesta in the country has been hovering at around 0.90 million hectares during 2004-05 to 2011-12. However, there has been an increase in the productivity of jute and mesta from 2019 kg. per hectare in 2004-05 to 2268 kg. per hectare in 2011-12. The production of jute & mesta is estimated at 11.13 million bales (of 180 kg each) in 2012-13 (2nd estimate), which is marginally lower as compared to their production during 2011-12 (11.40 million bales).

4.33 The state of West Bengal contributes the maximum area to the tune of 74.6 per cent of the country's total jute area and about 81.6 per cent of the country's jute production. Mesta is grown in the country in about 12 states, but the major mesta growing states are Andhra Pradesh, Orissa, Bihar, Tripura, Meghalaya and West Bengal. Andhra Pradesh is the main mesta growing state sharing about 31.3 per cent of the country's total area which is about 1.14 lakh ha and nearly 41.5 per cent of the country's total production of 7.3 lakh bales.

4.34 Jute is grown mainly in the Eastern and North-Eastern States but Jute Seed is produced in

far off places like Andhra Pradesh, Maharashtra etc. Accordingly, very often timely availability of good quality seed at reasonable price becomes a problem. Drought at the early stage and flood at the later stage is a common feature in Jute areas. Therefore, there is a need to develop some more suitable location specific varieties to counter this adverse and erratic weather behavior. The existing retting facility is inadequate to get better quality fibre. Alternative method of retting is needed. Ribbon retting which has been tried on experimental basis requires further improvement for its acceptability by the farmers as it does not appear to be cost effective.

4.35 Production of Jute seed particularly of new varieties, line sowing need to be taken up in jute growing States. Use of herbicides for weed control to reduce the manual weeding operations should be adopted of jute needs to be adopted.

4.36 Realizing the problems of the jute economy and the need to make it more competitive, a Centrally Sponsored Scheme **JuteTechnology Mission (JTM)** was launched jointly by the Ministry of Textiles and Ministry of Agriculture (Department of Agriculture & Cooperation) in 2006-07. Out of four Mini-Missions, Mini-Mission-II to increase the productivity and to improve the quality of fiber is implemented by the Department of Agriculture & Cooperation (DAC) through Directorate of Jute Development (DJD) in seven States viz. Assam, Bihar, Meghalaya, Orissa, Tripura, Uttar Pradesh and West Bengal.

Box 4.7: Best Practices in Jute Cultivation

Use of high yielding new varieties	Increases both the production and productivity of the crop
Line sowing by seed drill	Increases the productivity of the crop.
Application of herbicides	Reduces the cost involved in weeding operations

Programmes and Special Initiatives in Crop Sector

National Food Security Mission (NFSM)

4.37 The National Food Security Mission is presently under **implementation in 482 Districts of 19 States** of the country with a view to enhance the production of Rice, Wheat and Pulses through area expansion and productivity enhancement; restoring soil fertility and productivity; creating employment opportunities; and enhancing farm level economy to restore confidence of farmers. The basic strategy of the mission is to promote and extend improved technologies i.e., seed, micronutrients, soil amendments, Integrated Pest Management, Farm Machinery and resource conservation technologies along with capacity building of farmers with effective monitoring and better management in the high potential districts in order to bridge the yield gaps. Implementation of Mission in the 11th Plan has not only achieved the targeted food grains production but has also widened the base of food grains production with significant contribution from low productivity Districts.

4.38 During the 12th Plan, it is proposed to include coarse cereals as well in the Mission. Emphasis would be on promotion of technologies adopting cropping system approach in identified clusters.

Initiative for Nutritional Security through Intensive Millet Promotion (INSIMP)

4.39 Millets crops comprising of bajra, Jowar, Ragi and small millets like Sanwa, Kodo, Kutki, Proso and foxtail are highly nutritious. Besides, these crops respond better both under adverse and favorable conditions and require less water in comparison to crop like paddy and wheat. The scheme provides support for supply of technology demonstration kits comprising of micro-nutrients, bio-fertilizers, DAP, urea, potash and pesticides including weedicides up to a maximum area of 2 ha/farmer, seed mini kits for 0.4 ha area for every one ha of area covered under scheme, seed production of new varieties/ hybrids which are released during last 5 years, hand holding and farmers training, installation of pre-processing and processing small units, awareness campaign and research needs. Scheme

also envisage provision for setting up Centre of Excellence on value addition in millet.

4.40 **Bringing Green Revolution in Eastern India (BGREI):** BGREI is under operation in seven states of UP, Jharkhand, Bihar, West Bengal, Assam, Orissa and Chhattisgarh with an objective to increase the productivity of rice based cropping system by intensive cultivation through promotion of recommended agriculture technology and package of practices by addressing the underlying constraints of different agro climatic sub regions. The activities carried out under the programme include demonstrations on Rice/Wheat; creation of asset building activities focusing on water management work such as construction of shallow tube wells, dug well/ bore wells and water pumpsets; promotion of farm implements such as drum seeder, zero till seed drills; and site specific activities.

4.41 **Accelerated Pulses Production Programme (A3P): A3P** has been initiated under National Food Security Mission from Kharif 2010, where in, farmers in one million hectares of potential pulses areas are involved in intensive promotion of pulses through village level block demonstration of production and protection technologies. It enable the farmers of the A3P areas to avail Seed Mini kits, Integrated Nutrient Management, Integrated pest management components free of cost up to 2 hectares of area of individual farmers.

4.42 **Sugarcane Based Cropping Systems (SUBACS):** Sustainable development of SUBACS is implemented in 22 States/Union Territories and provides higher flexibility to states to implement the programmes on the basis of their priorities and requirements. The main thrust of the scheme is on the transfer of improved technology to the farmers through field demonstration, training of farmers, supply of farm implements, enhancing seed production and pest management.

4.43 **Technology Mission on Cotton (TMC):** TMC was launched in 2000-2001 with the aim of increasing the production and productivity, and improving the quality of cotton. It consists of Four Mini-Missions. MM-I on research is being implemented by ICAR, while MM-II for enhancing production and productivity by Department of Agriculture & Cooperation. The MM-III is on the development of market infrastructure and MM-IV on modernization of ginning/pressing factories are being dealt by the Ministry of Textiles. Increasing availability of quality seeds, emphasis on production of extra long staples cotton, covering more area under hybrids, popularization of Integrated Pest Management (IPM) methods, efficient use of water through drip and sprinkler methods particularly in Central and Southern Zones, transfer of technology through field demonstrations and training of extension workers, dealers and farmers are some of the activities pursued under the Mission.

4.44 **Jute Technology Mission (JTM)**: JTM was launched in June 2006 for increasing production, productivity and quality of jute and allied fibers. It has four Mini Missions, Mini Mission-I on research, implemented by ICAR, Mini Mission-II on development/extension, implemented by Department of Agriculture & Cooperation, Mini Mission-III on marketing and Mini Mission-IV on processing, utilization and industrial aspects, implemented by Ministry of Textiles. Production and supply of hybrid seeds, transfer of technology through frontline demonstrations, training of farmers, extension workers and input dealers; establishment of seed de-linting plants, establishment/strengthening of bio-agent production units, plant protection measures like Insecticide Resistance Management (IRM), IPM demonstration, surveillance of diseases & pests and supply of sprayers/pheromones/bio-agents/ bio-pesticides, supply of water saving devices like sprinkler and drip irrigation equipment are some of the activities undertaken under the Mission.

4.45 **Integrated Scheme of Oilseeds, Pulses, Oilpalm and Maize (ISOPOM):** ISOPOM is being implemented from 1st April, 2004 for the production of oilseeds, pulses, oilpalm and maize. Pulses component of ISOPOM has been merged with the National Food Security Mission (NFSM) w.e.f.1.4.2010. The programme predominantly benefits small and marginal farmers, and stipulates benefits of 16.20% to SCP and 8% to STP and 30% to women farmers as per the policy of the government.

4.46 **Oil Palm Development Programme (OPDP):** Andhra Pradesh, Karnataka, Tamil Nadu, Kerala, Goa, Gujarat, Orissa, Maharashtra and Mizoram are implementing the Oil Palm Development Programme (OPDP) under ISOPOM with a view to augment the domestic supply of edible oils and bridge the gap between demand and supply. Under the scheme, assistance is provided towards the cost of planting material, cultivation inputs, installation of drip irrigation system, diesel pump sets, training, development of waste-land, extension and publicity, frontline demonstrations, leaf-nutrients analysis laboratories and testing of genotypes under various environmental conditions. The assistance provided under the scheme is shared on 75:25 basis between Government of India and State Governments except for the component of drip irrigation for which States' share is 10% for all states except the states of Assam, Tripura & Mizoram for which entire cost on installation of drip irrigation system in oil palm plantation is met by the Centre. Year-wise production of Fresh Fruit Bunches (FFBs) & CPO since inception of the ISOPOM is given in Annexure 4.

Oil Palm Area Expansion (OPAE) Sub-Scheme under RKVY

4.47 Oil Palm Area Expansion (OPAE) Programme for bringing 60,000 hectares in 8 identified states has been launched during 2011-12 under Rashtriya Krishi Vikas Yojana (RKVY). It is estimated that an area of 28,288 hectares has been achieved as fresh plantation under OPAE. OPAE includes state specific targets for area expansion, interventions, pattern of assistance, research and development components, institutional linkages, monitoring, initiatives for creating processing facilities in needy states to augment the production of palm oil after 4-5 years.

4.48 Major constraints **re**ported in oil palm plantations are as under:

- Availability of planting material in the country. The State Governments are importing planting material from different oil palm growing countries.
- In India cultivation of oil palm is carried out in small holdings and mostly dependent on tube wells for irrigation.
- Lack of proper package of practice for specific sites, i.e. oil palm being exotic and new crop, very little data/management practices are available for its cultivation in various agro-climatic conditions of the country.
- Synchronization of area expansion under oil palm vis-à-vis creation of processing facilities.
- Variation in import duty on edible oils on year to year basis results in major fluctuations in oil palm FFBs prices in the domestic markets.
- Oil Palm cultivation involves gestation period of 4-5 years and, therefore, farmer's risk for cultivation of this crop is more than the conventional agricultural and horticultural crops. Further, pricing of FFBs being linked to the landed cost of CPO, it is advisable to have a long term pricing policy with counter cyclic duty structure to encourage farmers to go for cultivation of this crop.

4.49 Oil Palm is comparatively a new crop and in the highest oil yielding perennial crop with good planting material and irrigation facility. With proper management, there is a potential of 20-30 MT fresh fruit bunches (FFBs) per ha after attaining age of 5 years. This in turn is capable of yielding 4-5 MT of palm oil and 0.4-0.5 MT palm kernel oil (PKO). In comparative terms yield of palm oil is 10-15 times the yield of edible oil obtainable from traditional oilseeds. The emphasis is required to be laid on the following parameters to achieve success in implementation of the programme.

- Area expansion of oil palm in potential States and enhanced assistance for planting material, irrigation systems and critical inputs for cultivation of oil palm.
- Pursuance with the States for enactment of oil palm Act to ensure marketing of oil palm FFBs (Presently AP, Tamil Nadu, Mizoram and Goa have enacted Oil Palm Act)
- Establishment/maintenance of seed gardens for smooth production and availability of oil palm seed/sprouts within the country.

- Support for technology advancement under Research and Development especially for lowering gestation period of the crop for developing dwarf and water resistant varieties, curtailing transplanting period to shorten gestation period and mechanization for cultivation and harvesting, to develop new hybrids through use of tissue culture techniques etc
- Water harvesting/water conservation and irrigation systems including fertigation to oil palm in different agro-ecological zones.
- Development of location specific inter/ mixed cropping and other farming systems to ensure return during gestation period of the crop.
- Organic and Integrated Plant Nutrient Management (IPNM) by regulating plantation wastes in oil palm plantation.
- Establishment of more Leaf Analysis Labs to assess suitability of the areas for cultivation of the oil palm in the state.
- Emphasis on in country and abroad trainings for staff as well as of farmers.
- More infrastructural irrigation facilities to be provided for bringing areas recovered through Wasteland Development under this crop.
- Increase in number of demonstration plots for popularization of oil palm crop.
- Publicity among the farming community.
- Ensure remunerative prices for oil palm FFBs.

4.50 Department of Agriculture has launched a Mission on Oilseeds and Oil Palm during XII Plan to strengthen and focus on oilseeds production so as to minimize the gap between demand and supply of edible oils by way of improving productivity of major oilseeds, harnessing potential in niche areas, enhancing on farm investment, resource conservation, speedy introduction of new varieties and hybrids, supply of quality seeds, to increase Seed Replacement Rate (SRR) and Varietal Replacement Rate (VRR), training and demonstrations, bring more area under oil palm cultivation besides efforts to maximize output from tree borne oilseeds.

Rashtriya Krishi Vikas Yojana (RKVY)

4.51 Rashtriya Krishi Vikas Yojana (RKVY) was launched in the XIth Plan against a backdrop of faltering agriculture growth in the previous decades. It was designed as a State Plan Scheme with complete flexibility to the States to choose projects specifically tailored to their conditions for generating growth in agriculture and allied sectors.

4.52 RKVY has two strategic objectives - first, to encourage States to allocate more funds for agriculture and allied sectors and second, to incentivize States to generate additional growth in agriculture and allied sectors by better planning and undertaking appropriate growth oriented projects, as a result of which, States' allocation to agriculture and allied sectors rose from Rs.8770 crore (4.88% of total plan expenditure) in the base year of 2006-07, to Rs.29413 crore (6.82% of States total plan expenditure) in the year 2011-12 (RE). Increase in overall growth in agriculture and allied sectors during the XIth plan period is a testimony of the scheme's contribution to stimulating growth by capitalizing agriculture sector.

4.53 Assistance extended to the States under RKVY has witnessed tremendous increase over the years. Initiated with a relatively small allocation of Rs. 1489.70 crore in the first year, i.e., 2007-08, allocation for the Scheme has been increasing year on year and in 2012-13, Rs. 9217.00 crore has been provided under the Scheme.

4.54 In the XI Five year Plan, Rs 27447 crores has been sanctioned under RKVY for taking up 5768 projects across various sectors. Activity wise share in value of projects and no. of projects are shown in the following figure (Fig: 4.1). Details of projects, including their progress, and targets, expected outputs and outcomes, along with actual achievements can be seen at www.rkvy.nic.in.

Fig. 4.1: Share in value of projects, Total value Rs. 27447 crore

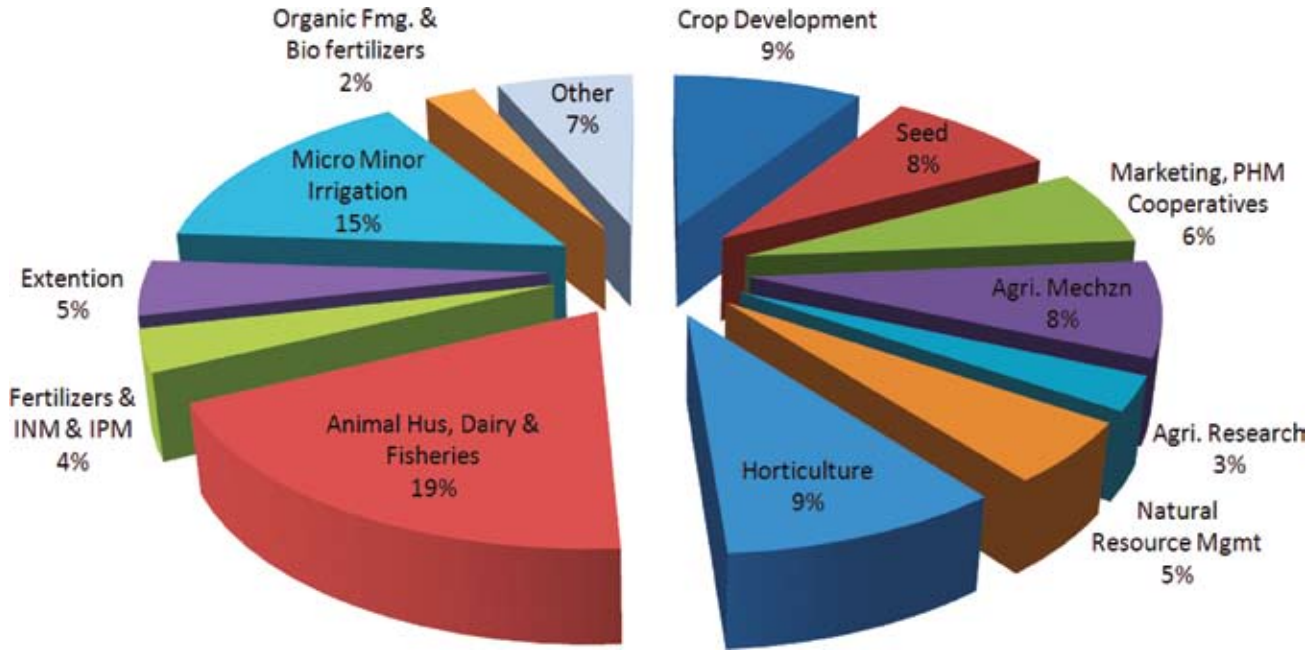
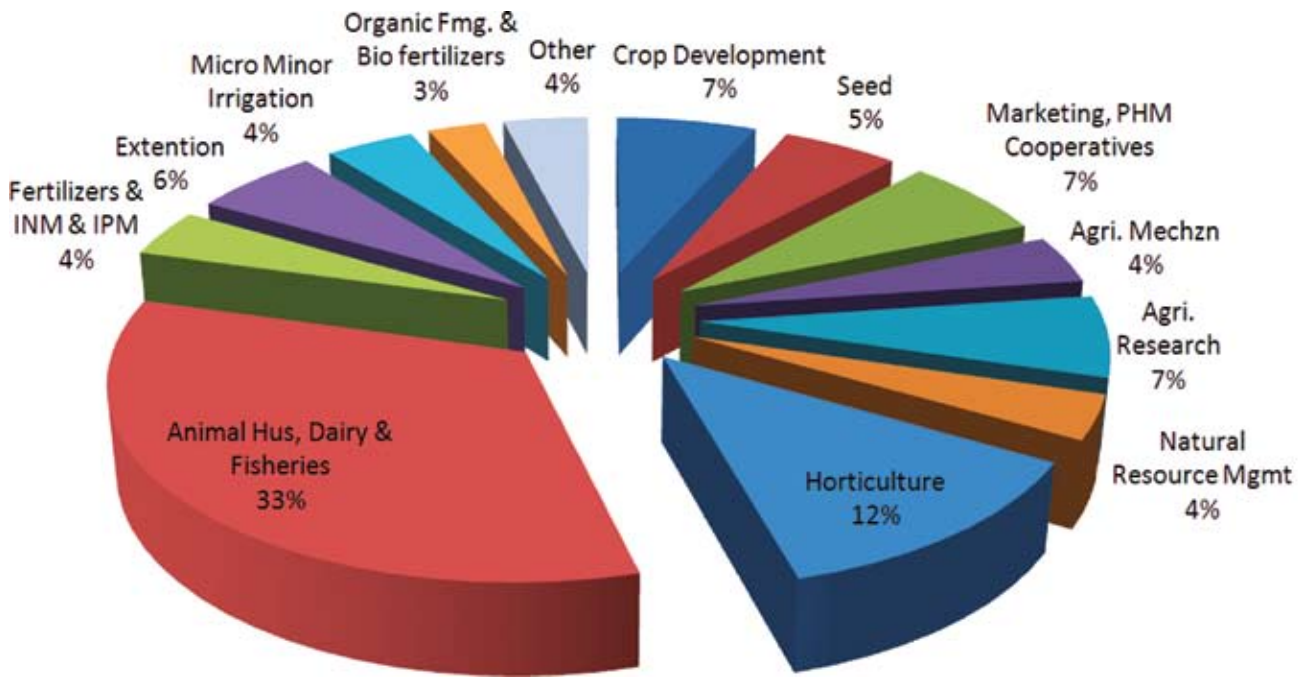


Fig. 4.2: Share in projects, Total Projects - 5768



4.55 RKVY has managed to infuse agriculture and allied sectors with steadily increasing public investment. RKVY is a quantum jump in evolution from the variegated schematic approach to a completely new approach with emphasis on regionally differentiated agricultural planning. It envisages States to prepare comprehensive District and State Agriculture Plans for taking up projects which are best suited to local conditions to catalyse existing production scenario for achieving higher production in agriculture and allied sectors, by ensuring required flexibility to the States.

Wayside Market in Arunachal Pradesh

4.56 The range of interventions under RKVY is varied keeping in view diverse needs and requirements of the States. Therefore, while Sikkim, Arunachal Pradesh and other North East States have taken up projects on piggery, enhancing market accessibility to farmers by developing wayside market sheds, and area expansion through land terracing and promotion of off-season vegetable cultivation, Maharashtra has been successful in managing onion price fluctuations by promoting low cost onion storage structures and tackling water stress by investing extensively in farm ponds. Tamil Nadu, West Bengal, Bihar, Jharkhand and Tripura have been promoting System of Rice Intensification (SRI) for increased productivity of paddy, while several States like Andhra Pradesh have promoted vegetable cultivation through pandals and trellises. States like Haryana and Punjab have concentrated on laying underground pipe lines for irrigation to promote more efficient water management and better animal husbandry practices like promoting elite breed of murrah buffaloes and better community animal housing.

An Elite Murrah Buffalo

4.57 While Jharkhand chose to increase cropping intensity by creating water conservation structures like loose boulder and pucca check dams along with lift irrigation systems, Gujarat has preferred to check salinity ingress in coastal areas and reclaiming almost 70,000 ha of land for cultivation. Kerala has addressed its labour shortage by setting up custom hiring centres for farm mechanization while Karnataka has set up Telemetric Weather Stations at Taluka level for rainfall forecast and farmer advisories.

4.58 RKVY format has also enabled launch of new schemes/programmes keeping States' flexibility and authority intact. Since 2010-11, several sub-schemes have been introduced with specific focus on promoting rice based cropping system in Eastern India (Bringing Green Revolution in Eastern India (BGREI), increasing vegetable production and availability through Vegetable Clusters, Coarse Cereals, Rainfed Area Development Programme (RADP), Accelerated Fodder Development Programme (AFDP) etc. In all, nine special Programme/schemes are being implemented as sub-schemes of RKVY, which have very focused objectives and are under implementation in States best suitable for these, in the current financial year with a total allocation of Rs.2675 crore.

4.59 While RKVY has many positive facets which have enhanced focus on agriculture and allied sectors by according required flexibility to

the States for initiating innovative schemes, ease of expenditure, ability to address local needs etc., implementation of the scheme over the last five years has also brought to the fore certain shortcomings which need to be addressed.

4.60 Rashtriya Krishi Vikas Yojna (RKVY) has greater acceptance among states as it provides flexibility to formulate state-specific strategies. However, RKVY has not effectively addressed specific issues arising out of substantial and growing share (about 83%)of small and marginal land holdings in the country. Small land holdings create adverse economies of scale necessitating aggregation of farm produces through appropriate institutional linkages at remunerative rates, integrating agricultural marketing value chain and creation of post-harvest & storage facilities. While, fast growing sectors like Animal Husbandry, Dairying & Fisheries (19%), Micro Irrigation (15%) and Horticulture (9%) would account for 43% of total XI Plan outlay under RKVY, allocation in Marketing, Post Harvest Management & Cooperatives remained a mere 6% during the same period. Besides, share in project allocation in other key sub- sectors viz. Natural Resource Management (5%), Seed (8%), Nutrient and Pest Management (4%) etc. were also marginal during XI Plan period.

Check Dam in Jharkhand

4.61 Evaluation conducted by National Institute of Rural Development (NIRD) reveals that notwithstanding flexibility and relative large financial outlay, States have not been able to invest adequately in agricultural infrastructure development projects. Many a time projects proposed under RKVY are not in tune with priorities and developmental gaps identified in Comprehensive District Agriculture Plan (C-DAP) and State Agricultural Plan (SAP).

4.62 A project under RKVY had an average allocation of about Rs. 4.75 crore during XI Plan Period. It is stated that flexibility to undertake any project under RKVY is leading to thin spread of resources supplemented by extended support to existing central/state schemes, missing priorities and continued prevalence of covering maximum sub-sectors under this scheme.

4.63 Further, drawbacks were noticed in lack of effective monitoring & evaluation of the projects, weak linkages with Comprehensive District Agriculture Plans (C-DAPs) and State Agriculture Plans (SAPs), excessive expenditure on "brick and mortar" instead of "soil and water", poor quality of Detailed Project Reports (D PRs), minimal scrutiny of projects at State Level Sanction Committee (SLSC) level, etc. In order to address these and other shortcomings, it is proposed to reorient RKVY during the XIIth Plan period.

4.64 Accordingly, in the XII Plan, the entire RKVY budget is proposed to be divided in three streams viz. Production Growth, Infrastructure & Assets, and Special schemes of national importance in the ratio of 40:40:20. This is expected to provide a more focussed and planned approach to creation of infrastructure in agriculture and allied sectors and attract private investment as well. With substantial funds being invested for capitalizing agriculture and allied sectors under RKVY, it is felt that a continuous process of concurrent monitoring and evaluation needs to be ensured by the States. This would provide an in-built mechanism that provides continuous feedback on the performance of schemes and provide valuable inputs/insights to implementing agencies as well as policy makers for mid-course correction and calibration to help States maximise returns and benefits from RKVY projects and investments.

4.65 RKVY model has received tremendous response from the States and for the XII Plan

period, an allocation of Rs.63246 crore has been made for RKVY which is nearly 50% of the total allocation of Department of Agriculture. This in itself is a pointer towards the importance that Government of India (GoI) attaches to RKVY.

Macro Management of Agriculture (MMA)

4.66 The Macro Management of Agriculture (MMA) Scheme, a Centrally Sponsored Scheme, was formulated in 2000-01 with the objective to propagate specific interventions for uniform development of agriculture in the States. Initially, MMA consisted of 27 Centrally Sponsored Schemes covering Cooperatives, Crop Production, Watershed Development, Horticulture, Fertilizers, Mechanization and Seeds Production Programmes. With the launch of National Horticulture Mission (NHM) in 2005-06, schemes pertaining to horticulture development were taken out of the purview of MMA Scheme. The component relating to State Land Use Board (SLUB) was also discontinued w.e.f. 1st August, 2009.

4.67 In the year 2008-09, MMA was restructured to improve its efficacy in supplementing/ complementing the efforts of the States towards enhancement of agricultural production and productivity. The role of the scheme was redefined to avoid overlapping and duplication of efforts and to make it more relevant to the present agricultural scenario to achieve the twin objectives of food security and improvement of livelihood system for rural masses. At present the Revised MMA scheme comprises 11 sub-schemes relating to crop production and natural resource management. In the XI Plan under Macro Management Scheme 12.07 lakh ha in watershed areas, 10.25 lakh ha in river valleys and flood prone rivers, and 0.79 lakh ha of alkali/acidic soils were developed and 15.17 lakh agricultural implements were distributed. The scheme is proposed to be merged with RKVY during XII Five Year Plan.

Box 4.8: Salient Features of the Revised MMAScheme

- The practice of allocating funds to States/UTs on historical basis was replaced by an allocation criteria based on gross cropped area and area under small and marginal holdings. Assistance is provided to the States/UTs as 100% grant.
- Subsidy structure was rationalized to make the pattern of subsidy uniform under all the schemes implemented by Department of Agriculture & Cooperation. The revised subsidy norms indicate the maximum permissible limit of assistance. States may either retain the existing norms, or increase them to a reasonable level provided that the norms do not exceed the revised upper limits specified.
- Two new components were added namely, (a) Pulses and oilseeds crop production programmes for areas not covered under the Integrated Scheme of Oilseeds, Pulses, Oil Palm and Maize (ISOPOM), and, (b) "Reclamation of Acidic Soil" along with the existing component of "Reclamation of Alkali Soil".
- The permissible ceiling for new initiatives was increased from 10% to 20% of the allocation.
- At least 33% of the funds are earmarked for small, marginal and women farmers.
- Active participation of the Panchayati Raj Institutions (PRIs) of all tiers is to be ensured in the implementation of the Revised MMA scheme including review, monitoring and evaluation at district/sub-district levels.

Challenges

4.68 The declining land-base for agricultural operations, diminishing water tables, shortage of farm-labour, increasing costs of inputs and uncertainties associated with prices/realisation which impact the viability of farming are some of the formidable challenges the agriculture sector faces. Resource use efficiency to improve factor productivity and ensuring natural resources sustainability are necessary to reconcile the conflicting demands of farmers and consumer. While the country is presently self-sufficient in cereals, it meets its domestic requirements for pulses and edible oils through imports. The working group for the 12th Five Year Plan has also projected that the deficit between the domestic demand and supply in the cases of pulses and edible oils would continue even by the end of the 12th Plan. Despite the various efforts being made, there is no technological breakthrough in pulses,

the yields are still hovering around 600 Kg per hectare. Pulses continue to be grown by small and marginal farmers on marginal lands under rainfed conditions. There is high variability in their prices. On the prices front, even though substantial increases have been made in the MSP, due to weak procurement/price support mechanism, farmers' response in terms of increase in acreage under pulses is lukewarm. Nearly half of our domestic requirement of edible oils is met through imports. Developing oil palm, which have high oil contents, on large track of lands suitable for its cultivation, can bridge the gap between demand and supply of edible oils.

The Way Forward

4.69 Viability of farm enterprise is an important issue. Resource use efficiency to obtain more with the available resources and significant breakthroughs in production technologies are required to cope with increasing demands particularly of pulses, oilseeds, fruits and vegetables. Diversification of agricultural production must be emphasised both through input assistance and price support policies. Although MSP for pulses and oilseeds have been increased substantially in recent years, farmers are still not encouraged enough to put in the effort and resources required for the scale of production that is required to do away with the current imports of these commodities.

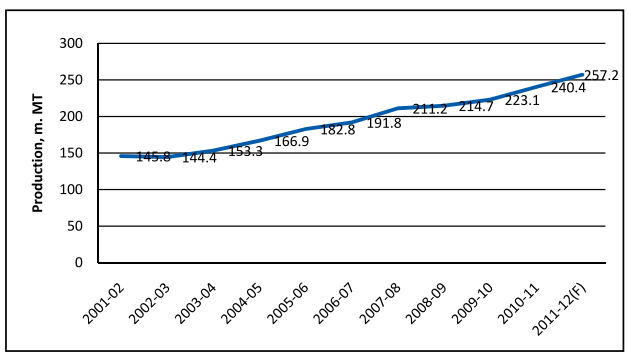
4.70 The regional imbalances in productivities must be clearly addressed. There is a need for more attention and resources to extend green revolution to areas of low productivity in the Eastern Region where there is ample ground water, fertile land and surplus labour. Equally important are rain-fed areas. Farm incomes are central to sustaining agricultural growth. Diversification towards higher value crops and livestock can improve farm incomes and accelerate agricultural growth.

4.71 Agriculture Census 2010-11 reveals that the average size of an operational holding has come down to 1.16 hectares. Small and marginal farmers with farm sizes of less than 2 hectares comprise 85% of all holdings and 44% of total area. This vast majority of farmers has to be the focus of our agricultural development policy.

Horticulture: The Growth Driver of Indian Agriculture

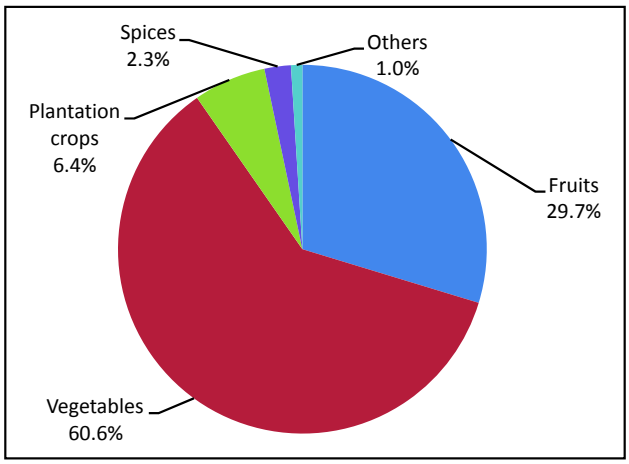
4.72 The horticulture sector, with a wide array of crops – ranging from fruits and vegetables to orchids and nuts, mushrooms and honey - has been a driving force in stimulating a healthy growth trend in Indian agriculture. India is currently producing 257.2 million tonnes of horticulture produce from an area of 23 million ha. What is significant is that over the last decade, the area under horticulture grew by about 3.8% per annum but production rose by 7.6% per annum. The noteworthy feature is that higher growth rate in horticulture was brought about by improvement in productivity of horticulture crops, which increased by about 28% between 2001-02 and 2011-12. This goes on to show that the special thrust given to the sector, especially after the introduction of the Horticulture Mission for North East & Himalayan States (HMNEH) and the National Horticulture Mission (NHM) in the Xth Plan has borne positive results. Given the increasing pressure on land, the focus of growth strategy is on raising productivity by supporting high density plantations, protected cultivation, micro irrigation, quality planting material, rejuvenation of senile orchards and thrust on post harvest management, to ensure that farmers do not lose their produce in transit from farm gate to the consumer's plate. The growth trend of horticulture crops during past 10 years is depicted in Fig. 4.3 below:

Fig. 4.3. Growth Trend in Horticulture Production



Share in production of horticulture crops is depicted in Fig. 4.4.

Fig.4.4.Share in Production (% of 257.2 million MT)



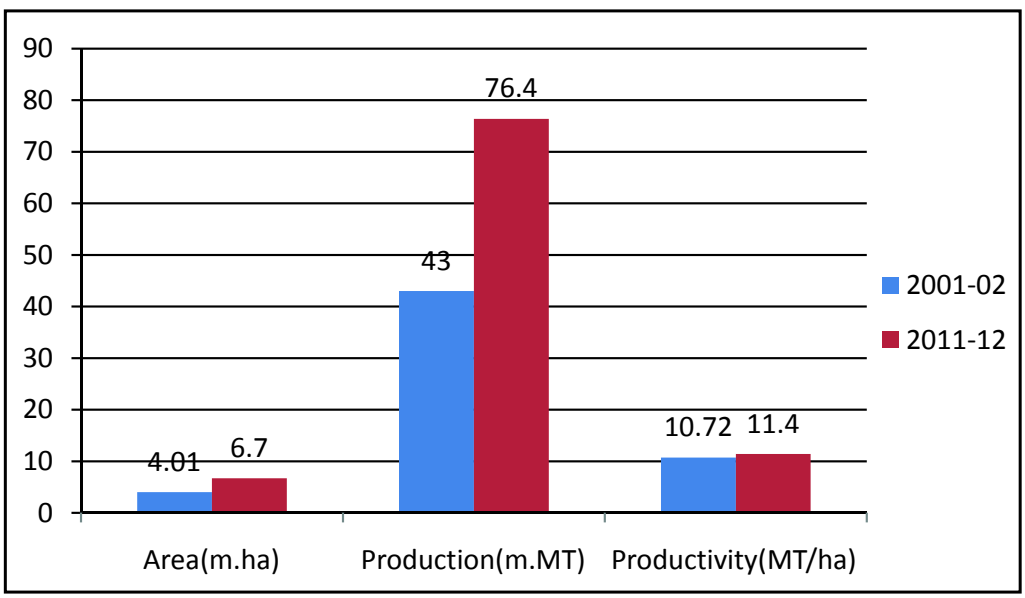
Fruits

4.73 With a production of 76.4 million tonnes, fruits accounts for about 30 per cent of the total production of horticulture crops. The area under fruit crops during 2011-12 was 6.7 million ha, which is almost 29 per cent of area under horticulture in India. The area under fruit crops has increased from 4.0 million ha in 2001-02 to 6.7 million ha in 2011-12 with corresponding increase in production from 43.0 to 76.4 million tonnes. A large variety of fruits are grown in India. Of these, banana, mango, citrus, papaya, guava, grape, sapota, pomegranate, pineapple, aonla, litchi, pear, plum, walnut, etc are important. India accounts for 13 percent of the total world production of fruits and leads the world in the production of mango, banana, papaya, sapota, pomegranate, acid lime and aonla.

4.74 The leading fruit growing states are Maharashtra which accounts for 16.0 per cent of production followed by Andhra Pradesh (13.0%), Gujarat (10.0%), Karnataka (9.0%), Uttar Pradesh (8.0%), Tamil Nadu (7.0%) and Bihar (5.0%), which altogether contributes for about 68.0 percent of the total fruit production in the country. Banana is the major fruit accounting for 35 per cent of total production followed by mango (21%), citrus (11%), papaya (6%), guava (3.3%), grapes (3%), apple (3%) and others (17.7%) in the country. It may also be mentioned that in the Himalayan states of Himachal and Jammu & Kashmir, the GDP from apples, plums, pears and stone fruits exceeds that of GDP from cereal crops.

4.75 Area, Production and Productivity of fruit crops has registered significant increase during the last ten years, as depicted in **Figure. 4.5.**

Fig. 4.5: Growth in area, production and productivity of fruits



Vegetables

4.76 Vegetables are also an important constituent in horticulture sector which are mostly low gestation and high income generating crops. Many vegetables are now grown under protected cultivation like green houses and shade net houses with a scope for 'off –season' production, which fetches remunerative prices. Vegetables occupied an area of 8.9 million ha during 2011-12 with a total production of 155.9 million tonnes having average productivity of 17.4 tonnes/ha. Vegetable production registered a quantum jump of 77 per cent between 2001-02 and 2011-12.

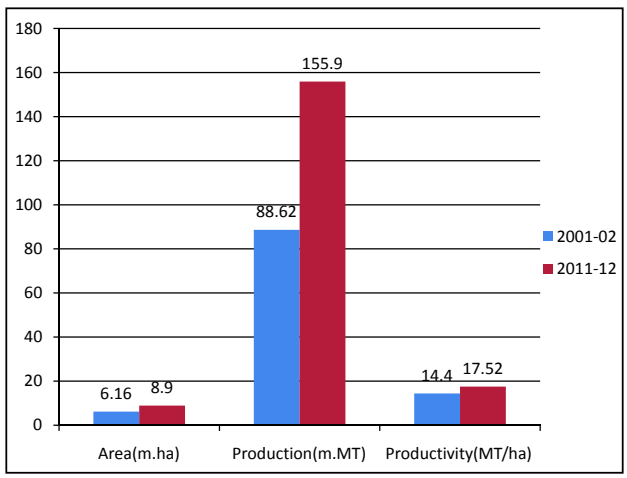
Box No. 4.9: Protected Cultivation

Protected cultivation involves the production of crops under protective cover such as green house, shade net houses, plastic tunnels, use of plastic mulch etc. which enable to enhanced productivity of crop per unit area. The Ultra-violet stabilized cladding material on green houses help to harness sunlight energy inside green houses which result in good crop vigour and growth, hence yield. Protected cultivation is being promoted as a thrust area during XII Plan.

4.77 More than 40 kinds of vegetables belonging to different groups are grown in India in tropical, sub tropical and temperate regions. Important vegetable crops grown in the country are potato, tomato, onion, brinjal, cabbage, cauliflower, peas, okra, chillies, beans, melons, etc. The leading vegetables growing states are West Bengal which accounts for 15% of production followed by Uttar Pradesh (12%), Bihar (10%), Andhra Pradesh (8%), Madhya Pradesh (6.5%), Gujarat (6.4%), Tamil Nadu (5.8%), Maharashtra (5.7%), Karnataka (5.0%) and Haryana (3%), which altogether contributes about 83.4% of the total vegetable production in the country. Among vegetables, potato is the major vegetable accounting for 27.0% followed by tomato (12%), onion (11%), brinjal (8%), cabbage (5.4%), cauliflower (4.7%), okra (4%), peas (2.5%) and others (25.4%) in the country. India is the second largest producer of vegetables after China and is a leader in production of vegetables like peas and okra. Besides, India occupies the second position in production of brinjal, cabbage, cauliflower and onion and third in potato and tomato in the world. Vegetables such as potato, tomato, okra and cucurbits are produced abundantly in the country.

4.78 The trend in area, production and productivity of vegetables are depicted in the **Figure 4.6** below:

Fig.4.6: Growth in area, production and productivity of vegetables



Spices

4.79 India is the largest producer, consumer and exporter of spices and spice products in the world. Over 100 plant species are known to yield spices and spice products among which around 50 are grown in India. India is known as the home of spices, producing a wide variety of spices like black pepper, chillies, ginger, turmeric, garlic, cardamom and a variety of tree and seed spices. Major spice, producing states are Andhra Pradesh (19%), Gujarat (15%), Rajasthan (14.7%), Karnataka (8%), Madhya Pradesh (7.7%) and Tamil Nadu (7%). The spice production in India is currently estimated at 5.95 million tonnes from an area of about 3.21 million ha.

4.80 The production of spices in the country has registered a substantial increase over the last ten years with average annual growth of 5.8%. Chilli is the major spice crop occupying about 25% of area under cultivation and contributing 22%

of total spice production in the country. Garlic accounts for 8.0% of area with 21.0% share in production, while turmeric accounts for 6.8% of area with 19.6% share in production.

Flowers

4.81 India has made noticeable advance in the production of flowers, particularly cut flowers, which have a good potential for exports. During 2011-12, floriculture covered an area of 0.32 million ha with a production of 2.1 million tonnes of loose flowers and 7507 million numbers of cut flowers. This sector is generating higher income and employment opportunities especially for women.

4.82 While India has been known for growing traditional flowers such as jasmine, marigold, chrysanthemum, tuberose and aster, the commercial cultivation of cut flowers like roses, orchids, gladiolus, carnation, gerbera, anthurium and lilium has become popular in recent times. The important flower growing states are West Bengal, Karnataka, Maharashtra, Andhra Pradesh, Tamil Nadu, Odisha, Uttar Pradesh, Jammu & Kashmir, North East, etc. Major area is devoted to production of marigold, jasmine, roses, chrysanthemum, tuberose, etc. The area under cut flowers having stems has increased manifold. Orchids, anthurium, lilium, gerbera and seasonal bulbous flowers are increasingly being grown both for domestic and export markets.

Plantation crops

4.83 The term 'plantation crops' refers to 'commercial crops' which are cultivated on an extensive scale in contiguous area. The leading plantation crops covered in this report are coconut, cashewnut, arecanut and cocoa as these are mainly grow on the fields of small and marginal farmers. This is in sharp contrast to tea, coffee and rubber which are grown in large plantations owned by corporates. Major plantation crops producing states are Tamil Nadu (28%), Karnataka (26%), Kerala (25.5%), Andhra Pradesh (8%) which all together contributes about 87.5% of the plantation crops production in the country.

Growth in Exports

4.84 Not only have these impressive production figures ensured a steady supply for the domestic market, they have also made Indian horticulture exports globally competitive. Over the last decade, there has been a significant improvement in export earnings in horticulture.

Table 4.3: Value of Export of Horticulture Commodity

Sl. No.	Commodity	Value (Rs in crore)		% Change
		2001-02	2010-11	
1.	Fresh Fruits & Vegetables	987.61	3944.46	299.4
2.	Floriculture	115.39	296.04	156.6
3.	Spices	1833.50	6840.71	273.1
4.	Cashew	2741.00	2809.00	2.5
	Total	**5677.50**	**13792.20**	**142.9**

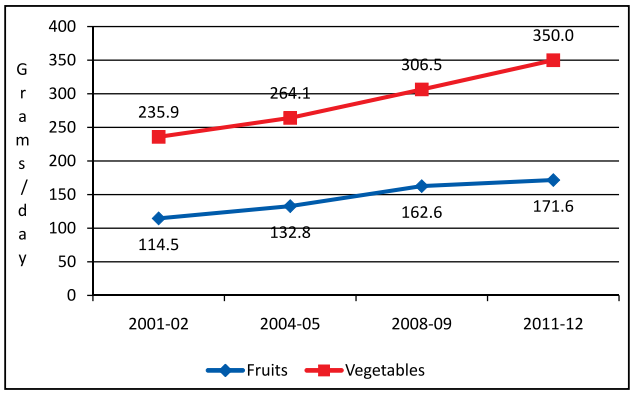
4.85 The horticulture division is working closely with Agricultural & Processed Food Export Development (APEDA) and State Governments to ensure that infrastructure and institutional support for export is available so that farmers' can leverage export markets for higher incomes. Of the 60 agri export zones in the country 52 are focusing on horticultural crops.

Horticulture's share in consumer spending

4.86 While production of horticulture crops is growing, the 'demand' side is also witnessing a marked growth. As incomes rise and consciousness about 'healthy foods' increases, there is a significant change in the consumption basket of consumers. Households are spending significantly higher amounts of their expenditure on food to the F&V category. However, it is important to note that the availability of fruits and vegetables has kept pace with the growing demand. In the case of fruits, the per capita availability increased from 114 grams/day in 2001-02 to 172 grams/day in 2011-12. Similarly, the per capita availability of vegetables increased

from 236 grams/day to 350 gram/day during this period. Trend in per capita available of Fruits and Vegetables is given Fig. 4.7 below:

Fig. 4.7: Per capita availability of F & V



Towards Sustainable and Inclusive Growth in Horticulture

4.87 The major challenge for horticulture is to sustain this growth in a manner which ensures higher incomes for the primary producer by ensuring better intuitional support mechanisms, 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, new and adaptive varieties, the major challenge for the DAC is to ensure higher returns to the farmer by ensuring that what is produced is not lost in transit on account of poor handling, perishability and that the farmer is part of the value chain.

Institutional support from ICAR

4.88 The Horticulture Division of the Indian Council of Agricultural Research (ICAR) under Department of Agricultural Research & Education (DARE) addresses the research and education related aspects of horticulture through its Central Institutes, Directorates, National Research Centres (NRCs), Directorate of Research (DR) and All India Coordinated Research Projects (AICRP). These include the NRC for Citrus, Nagpur, NRC for Pomegranate, Sholapur, DR for Cashew, Puthur, NRC for Orchids, DR for Grape which are involved in crop specific R & D. NRC, Citrus is implementing a Technology Mission on Citrus with NHM funding for addressing the problems of citrus growers in Vidharbha region of Maharashtra. NRC, Pomegranate is addressing the problem of tackling bacterial blight disease.

Linking farmers with markets

4.89 The Planning Commission Committee on the subject, headed by Dr Saumitra Chaudhry recommended strengthening intuitional linkages between producers and consumers, recognition of the role of market intermediaries and supporting their efforts in backward integration, policy changes in APMC Acts to break the monopoly of the existing players and fiscal incentives to encourage investments in the sector.

Institutional Support and Market Linkages

4.90 Three major initiatives of the DAC have the potential to impact farmer's incomes in a positive manner. These include the Vegetable Initiative for Urban Clusters (VIUC), support to Farmer Interest Group (FIGs) and Farmer Producer Organization (FPOs) for better integration with markets and input suppliers and the Public Private Partnership in Agriculture Development (PPP IAD) for Intensive agricultural Development. The salient feature of these is discussed below.

4.91 **VIUC:** Under the VIUC farmers living in peri-urban areas are encouraged to take up vegetable production in clusters to ensure primary level aggregation and better co-ordination with wholesalers and retailers. The idea is to support farmers with all essential inputs – from credit to seeds to soil nutrients – and assist them in primary level aggregation, grading, sorting, packaging and transport to the wholesale, and wherever possible retail points as well. It encourages farmers to have direct linkages with the large aggregators or retailers so that the farmers get a better value for their produce. The Small Farmers Agribusiness Consortium (SFAC), an agency supported by the DAC is assisting the NHM division in implementing this initiative. It has become so popular that many state governments are requesting for additional cities to be brought under its ambit.

4.92 **FPOs:** VIUC encouraged the formation of Farmer Interest Groups and Farmer Producer Organizations by encouraging the formation of cluster level Farmer Interest Groups (FIGs) which were organized into FPOs. This strategy was based on the clear understanding that given the fragmented land holding pattern among primary producers, it was necessary to adopt the cluster based approach to achieve the economies of scale and scope. The task was also assigned to the SFAC.

4.93 **PPP IAD for IAC**: Another imitative which complimented this effort was the initiative to encourage partnerships with the corporate sector in the agricultural sector. The core idea here was to facilitate large scale integrated projects, led by private sector players in the agriculture and allied sectors, with aggregation of farmers, and integration of agricultural supply chain.

APMC Reforms

4.94 APMC reforms are critical to the development of a value chain in horticulture produce, especially perishables. While production has increased manifold- both in terms of volume and value, the number of intermediaries has remained 'constant' on account of the provisions of the APMC Acts, most of which prescribe ownership of a premises in the market yard as a pre –condition to apply for a license. Many state governments have agreed, in-principle, to amend the Act and also introduce electronic auctions, besides allowing the establishment of terminal markets and electronic auction platforms. A snap shot of reforms status, especially with reference to horticulture produce is shown below:

Table 4.4: Status of APMC Acts Reforms with respect to Horticulture Produce

Status	States
i. APMC Act mended.	Arunachal Pradesh, Assam, Andhra Pradesh, Goa, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Rajasthan, Sikkim, Uttarakhand
ii. Partially Modified	Chattisgarh, Delhi, Karnataka, Meghalaya, Mizoram, Nagaland, Odisha, Punjab, Tamil Nadu, Tripura, West Bengal.
iii. Amendment under process	Haryana,
iv. To be carried out	Jammu & Kashmir, Uttar Pradesh
v. No APMC Act	Andman & Nicobar Islands, Bihar, Dadar and Nagar Haveli, Daman & Diu, Kerala, Lakshadweep, Manipur

Fiscal Incentives

4.95 The Report of planning commission recommended that government continue the Fiscal incentives for the horticulture sector to signal the support for the sector. These include:

i. **Enhanced Subsidy :** DAC has modified its NHM/HMNEH/NHB schemes w. e. f. 1.4.2010, by upward revision of credit linked back ended subsidy from 25% to 40% of the capital cost of a project in general areas and from 33.33% to 55% in case of Hilly & scheduled areas, in respect of units which adopt new technologies.

ii. **Rural Infrastructure Development Fund (RIDF) for warehousing:** The RIDF window has been opened to the cold chain and warehousing sectors. State government.

iii. **Reduction of Excise Duty on Import of Cold Storage Equipments:** With effect from 2011-12 full exemption from excise duty has been extended to air-conditioning equipment and refrigeration panels for cold chain infrastructure; including conveyor belts.

iv. **External Commercial Borrowing (ECB):** External Commercial Borrowing (ECB)

can be raised for investments in new projects, modernization/expansion of existing production units in real sector – industrial sector including infrastructure sector for creating cold storages or cold room facility, including farm level pre-cooling, for preservation or storage of agricultural/horticultural and allied produce

Support for Cold Chain Development

4.96 The Planning Commission report also reiterated the need to strengthen the cold chain infrastructure in the country to address post harvest losses which ranged from 6 to 18 percent as per the CIPHET report on the subject. Likewise a study by the NSE had pointed out the gap in cold storage capacity to the extent of 37 m. MT. Moreover the distribution of cold storages was skewed – both in terms of its concentration in UP, Punjab, West Bengal, and that nearly 80% capacity was for potato storage. To address the issue of holistic development of the cold chain sector in the country, the NCCD was established with an initial corpus of Rs 25 crore from the government in 2011-12 in PPP mode. 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 DAC, its members include growers association, FPCs, co-operatives, corporate engaged in the sector- including equipment suppliers, logistics companies, industry bodies, resource institutions, regulatory and development agencies, apex intuitions, PSUs, state governments and Ministry of Food Processing Industries (MoFPI). NCCD has established four technical committees, viz. (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 & Logistics for Post Harvest Management & Marketing.

4.97 It is significant to mention that government's thrust to this sector has yielded positive outcomes. It may be mentioned that of the 30 million MT capacity, nearly 14 million MT has been created between 2000 to 2011 on account of interventions by HMNEH, National Horticulture Board (NHB), APEDA, MoFPI and Department of Animal Husbandry, Dairying and Fisheries (DAHD&F).

Support for Horticulture Development

4.98 The major planned activities taken up under NHM and HMNEH 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, promotion of INM/IPM, which are basically aimed at productivity improvement. Organic farming and Good Agricultural Practices (GAP) were promoted to enable chemical residue free horticulture produce, besides addressing environmental concerns of soil and land degradation. Horticulture mechanization was promoted to bring in efficiency in horticulture production and harvesting operations. Production and productivity improvement programmes were supplemented with creation of infrastructure facilities for post harvest management, processing and marketing.

Box 4.10: Salient achievements under NHM & HMNEH

- Area Expansion in 27 lakh ha additional area.
- Setting of 3730 new nurseries for producing quality planting material.
- Rejuvenation of 5 lakh ha of old and unproductive orchards
- Construction of 5,55,000 Community tanks for providing life saving irrigation.
- Setting up of 9100 units for post harvest management.
- Setting up of 850 Markets for marketing of horticulture produce.
- Setting up 91 food processing units for value addition

Challenges

4.99 In consonance with increase in horticulture production, sustaining the growth rate will be a challenge which calls for various interventions

aimed at productivity enhancement, availability of quality planting material of improved high yielding varieties, reducing post harvest losses of perishable commodities, particularly fruits and vegetables and creation of effective supply chain. Developmental programmes on horticulture are proposed to be continued during XII Plan by subsuming the existing schemes of NHM, HMNEH, NHB, Coconut Development Board (CDB), Central Institute of Horticulture (CIH) and National Bamboo Mission (NBM) under the overall umbrella of NHM.

The Way Forward

4.100 Production and supply of quality planting material will continue to be a high priority area for horticulture development during XII Plan. In this context, special emphasis will be laid for establishment of Hi-tech nurseries having provision for mother/scion blocks of improved varieties, good quality rootstock banks and hi-tech green house. Besides, the following steps will be taken:

- Establishment of crop based Centre of Excellence will be encouraged in each state to server as a hub for supply of planting material and dissemination of technology to farmers.
- Area expansion programme will be linked to 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 & chillies. High density planting and tree canopy management of orchards, right from establishment stage, will be given focus to derive better yield. Besides, an integrated approach will be encourage for taking up drip irrigation/mulching and other support systems required for cultivation of fruit and plantation crops.
- Rejuvenation of old and unproductive orchards will continue to be a focus area for enhancing productivity, profitability and sustainability.
- Major thrust will be on protected cultivation, particularly of high value crops, in green house, shade net house, plastic mulching etc.
- Creation of infrastructure for post harvest managements and value addition will also continue to be a high priority area with focus on creating cold chain networks.
- Setting up of markets infrastructure will be linked with reforms in APMC Act, for permitting direct marketing of horticulture produce.
- Mobilization of farmers into producer groups/organizations is another priority area aimed at strengthening their negotiating power, besides functioning as viable farmer groups involved in production and marketing of horticulture produce.
- Human resource development will be given thrust for capacity building of farmers, horticulture entrepreneurs/supervisors and field functionaries.

CHAPTER 5

Agricultural Prices and Markets

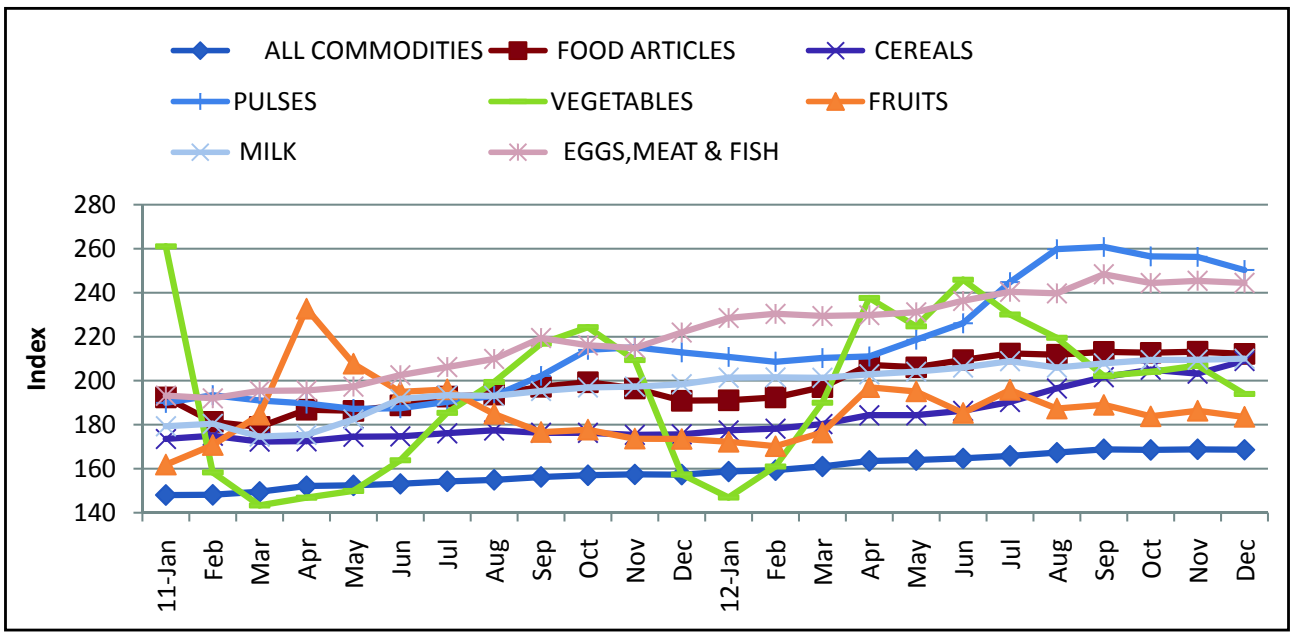
Agricultural Prices

5.1 Agricultural Prices mirror the health of agriculture sector. Food and agricultural commodity prices in India are primarily determined by domestic demand and supply factors. The nature of markets facing the agricultural commodities and imperfections in these markets influence the price transmission and the final consumer prices. Inflation of food items have become a major concern for policy makers worldwide. In India, the recent food inflation is largely due to an inadequate supply response particularly of pulses, fruits & vegetables, milk, egg, meat and fish due to increasing demand, aggravated by various logistic and market-related constraints.

Food Articles

5.2 Data on wholesale prices show by and large a continuous increase in Wholesale Price Index (WPI) of food articles during the period January 2012 to December, 2012. Indices of prices of pulses, cereals and egg, meat and fish have shown a substantial increase since March, 2012 as can be seen from Fig. 5.1. Prices of vegetables as expected have been subjected to high fluctuation due to seasonal factors.

Fig. 5.1: Wholesale Price Index (WPI) of food articles (January to December, 2012)



Food Articles have a weight of 14.34 in the wholesale price index. In food inflation, the contribution of foodgrains (cereals and pulses) is 28.5 percent, milk 22.6 percent and fruit & vegetables 26.8 percent. Details are given in Table 5.1.

Table 5.1: Contribution of different groups Food in Inflation (all segments)

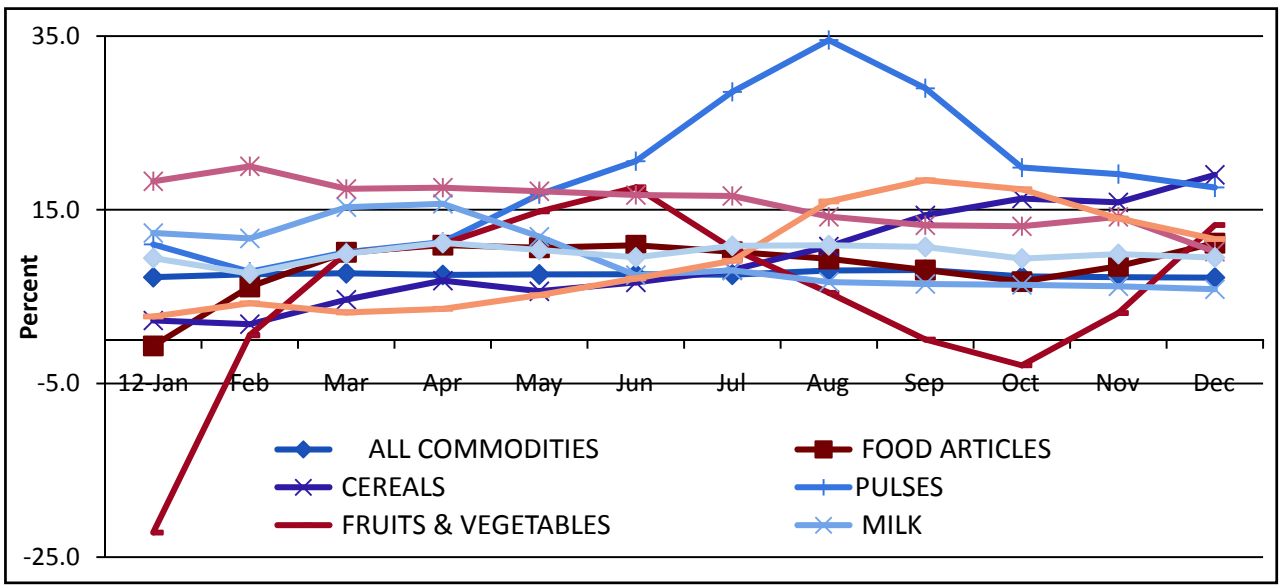
Items	Weight	Weight in Percent in food group
Food Grains (Cereals + Pulses)		
Cereals	3.37	23.5
Pulses	0.72	5.0
Vegetables	1.74	12.1
Fruits	2.11	14.7
Milk	3.24	22.6
Eggs, Meat & Fish	2.41	16.8
Condiments & Spices	0.57	4.0
Other Food Articles	0.18	1.3
Total Food Articles	14.34	100.0

5.3 The rate of inflation in food articles was hovering around 10% during March to July, 2012. Thereafter it declined to a low of 6.7% in October, 2012 and have started increasing thereafter. In December, 2012, rate of inflation in food articles was recorded at 11.2%. Cereals, pulses, vegetables and egg, meat and fish have recorded inflation in double digit in December, 2012. as can be seen from Fig.5.2.

5.4 Food products which comprise dairy, canning, grain mills, sugar, edible oils etc account for 9.97 per cent of the weight in the Wholesale Price Index, have also been witnessing high rate of inflation, close to 10 per cent since July, 2012. Rate of inflation in sugar, khandsari & gur has continuously been increasing since March 2012 and stood at 12.2 per cent in December, 2012.

5.5 The rise in per capita GDP by an average of 6 percent in the last five years implies an increase in demand given that the income elasticity of

Fig. 5.2: Trend in Inflation in Food Articles



demand is usually more than unity for items such as fruits and vegetables, milk and dairy products, egg, meat and fish. Production would have to catch up with demand growth to keep the price rise in check. Small decline in supplies can lead to sharp fluctuations in prices of these commodities.

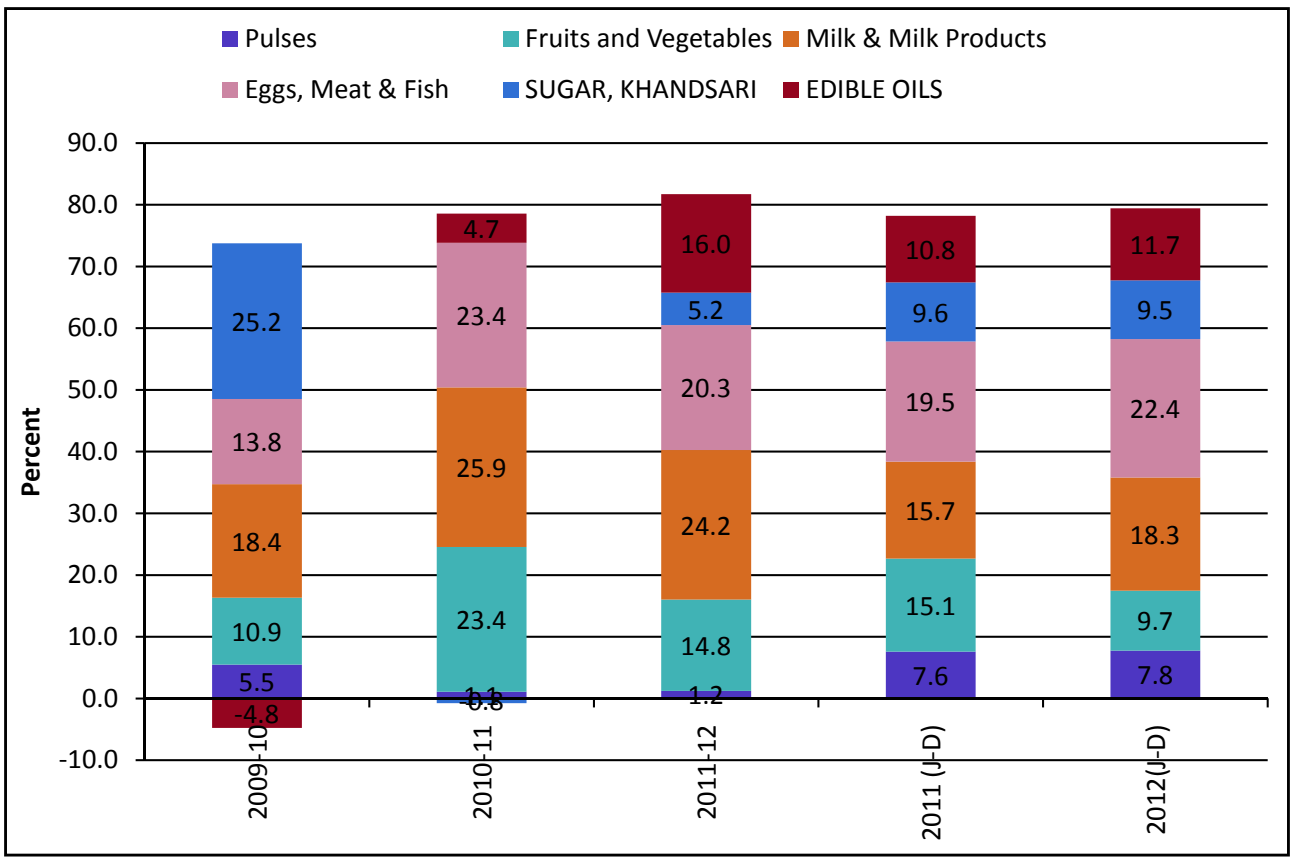
5.6 There is a strong linkage between high rates of overall inflation in India and high rates of food price inflation. The latter is inevitably linked to shortages of supply caused by the vagaries of the weather and other factors such as logistics that cause a mismatch between the supply and demand. On the demand side there

is strong evidence to show that economic growth in India especially in the rural areas has raised employment and incomes. The higher disposable income amongst the wage earning section of rural India has possibly boosted demand for primary food, creating pressure on prices. High rates of food inflation have been followed by an increase in inflation in non-food manufactured goods primarily due to a rise in money wages.

5.7 Recent inflation and price rise of food items is the effect of a complex interplay of demand and supply forces conditioned by domestic and international policies and market conditions. Though short run supply shocks are responsible for price rise the impact of long run demand growth and relative inelasticity of long term production due to low investments in production capacity enhancement are equally responsible for the current situation.

5.8 Food articles and food products together have a weight of 24.31 per cent in the Wholesale Price Index. During the period January to December 2011, total food (articles plus products) inflation accounted for 23.3 per cent of the overall inflation. Protein items comprising of pulses, milk and milk products, egg, meat and fish, and fruits and vegetables accounted for 57.9 per cent of the total food inflation during 2011 (January - December). During the calendar year 2012 (January– December), share of food inflation in total inflation is 29.8 per cent and proteins account for 58.2 per cent of the total food inflation as can be seen from Fig.5.3.

Fig. 5.3: Per cent Share of Protein Foods, Sugar and Edible oils in total Food (Articles plus Products) Inflation



Challenges

5.9 In comparison to wholesale prices, retail prices in different items display divergent trends in different markets. Due to regional differences in consumption patterns and supply conditions, prices and their movements vary across the major markets. Imperfect market conditions, restrictions on the movement of agricultural commodities due to infrastructural constraints, transport costs and local taxes, etc. influence the retail price trends across the major markets and consumption centres. Differences in tastes and in varieties consumed across the centres also pose problems for comparison of retail prices.

5.10 The principal factors behind the higher levels of inflation in the recent period are constraints in production and distribution especially in high value items such as pulses, fruits and vegetables, milk and dairy products, egg, meat and fish. Increase in prices can be attributed to both supply and demand factors. The per capita availability of some of the items such as cereals and pulses have been declining resulting in some pressure on their prices. In the case of fruits and vegetables, milk, egg, meat and fish, prices have gone up despite an increase in per capita availability. This is due to a changing pattern in the demand of the households for high value items with increasing income levels. Supply constraints are important in influencing the recent price rise both globally and domestically. Supply constraints are long term and short term in nature. Long-term supply constraints include for example: inelastic supply of land; water; inadequate investments in key areas like irrigation; land development; and R&D.

5.11 Short-term constraints are weather fluctuations, lack of timely availability of inputs like fertilizers, quality seed, credit and policy environment, etc. Both long-term and short-term factors have influenced the production of agricultural output in the recent period. Market imperfections also add to these trends by restricting the price transmission. These include lack of infrastructure facilities like efficient transport facilities, storage, processing, marketing and credit facilities.

5.12 The Population of India increased from 1.03 to 1.21 billion during 2001-2011. Increasing population in the face of a relatively constrained supply of agricultural output has brought down the per capita net availability of food grains from 510 grams per day in 1991 to 438.6 grams per day in 2010. This is an indicator of constrained supply in the face of increasing demand exerting pressure on the prices of food commodities.

5.13 Substantial funds are being spent on various welfare and employment oriented programmes and the same are likely to increase significantly in the near future. These programmes have infused substantial amounts of liquidity and purchasing power generating increased demand for food items.

5.14 When growth picks up at wage earning section of the population, the demand for food items would increase as income elasticity of demand for food is higher at lower levels of income. Thus, lower per capita availability of food grains and structural shortage of key agricultural commodities like oilseeds and pulses combined with the rising demand have kept food price inflation high. This process has got further accentuated by spikes in global food prices through international transmission.

5.15 Rising international prices of oil also impacted the cost of production of agriculture through increase in input costs of fertilizers, transportation and a general rise in the cost of all other inputs and services. Increase in cost of production results in increasing the MSP of agricultural commodities which also influences market sentiments.

5.16 In the recent years, particularly since the commodity price hike of 2007-8, markets have become highly volatile. International stocks of key food items like cereals and animal feedstock are reduced due to shocks in major producing regions of Europe, Canada and Australia as also due to rising demand in developing countries putting upward pressure on prices. To some extent, speculative activities in the commodity markets also influence prices.

Agricultural Price Policy and MSP

5.17 The Government fixes the Minimum Support Prices (MSPs) of various agricultural crops on the recommendations of the Commission for Agricultural Costs & Prices (CACP), the views of concerned State Governments and Central Ministries/Departments as well as other factors considered relevant for fixing MSP. MSP is in the nature of a minimum guaranteed price for the farmers offered by the Government for their produce in case the market prices fall below that level. If the market offers higher price than MSP, the farmers are free to sell at that price.

5.18 The Government has announced the Minimum Support Prices (MSPs) for 2012-13 Seasons. The MSP of Paddy (Common) has been fixed at Rs. 1250 per quintal and of Paddy (Grade A) at Rs. 1280 per quintal, which represents an increase of Rs.170 per quintal over the last year's MSPs. MSPs of Cotton (Medium Staple) and Cotton (Long Staple) have been raised by Rs. 800 per quintal and Rs. 600 per quintal and fixed at Rs. 3600 per quintal and Rs. 3900 per quintal respectively. MSP of wheat has been raised from Rs.1285 per quintal during 2011-12 to Rs.1350 per quintal during marketing session 2012-13. MSPs of the major crops for 2012-13 seasons have been announced by the government. The details are given at Annexure. MSPs of some of the major crops are as follows:

Table 5.2: Minimum Support Prices of some of the Major Crops for 2012-13

Commodity	Variety	2011-12	(#) increase in MSP 2011-12 over 2010-11	2012-13	(#) increase in MSP 2012-13 over 2011-12
PADDY	Common	1080	80 (8.0)	1250	170 (15.7)
	Grade 'A'	1110	80 (7.8)	1280	170 (15.3)
COTTON	Medium Staple	2800[a]	300 (12.0)	3600	800 (28.6)
	Long Staple	3300[aa]	300 (10.0)	3900	600 (18.2)
WHEAT		1285	165 (14.7)	1350	65 (5.05)
JUTE		1675	100 (6.3)	2200	525 (31.3)
SUGARCANE		145.00*	5.88 (4.2)	170.00*	25 (17.2)

Figures in brackets indicate percentage increase.
• Fair and remunerative price.

5.19 Apart from its recommendations on support prices for agricultural commodities, the Commission, as per its Terms of Reference, also gives **non price recommendations** in its Price Policy Reports. In its 2012-13 Price Policy Report for kharif crops while pointing out about the trade distorting high taxes, mandi fees, commission and cess levied by various States, the Commission has highlighted about the need to rationalize these on basic commodities like paddy/rice. The Commission is of the view that uniformity in the State level tax structure in agricultural commodities is pre-requisite to promote market efficiencies and a unified and integrated national market free from any *de facto* restrictions on movement of goods across the States.

5.20 In its Price Policy Report for Rabi Crops of 2012-13 season the Commission has emphasized about the need to impose an import tariff of 10 percent on oilseeds and also review the present duty structure on oilseeds, raw and refined oils and levy it as per economic rationality. The Government has already approved to defreeze the tariff values of all edible oils and notify their tariff values on the basis of their prevailing

international prices which will have a positive impact on the duty collected from import of edible oils and also provide an even-field to the domestic refining industry. Accordingly, the Government has approved for enhancing import duty on crude edible oil from zero to 2.5 percent.

Market Intervention and Price Support Schemes

5.21 The Department of Agriculture & Cooperation implements the Market Intervention Scheme (MIS) for procurement of horticultural commodities which are perishable in nature and are not covered under the Price Support Scheme. The objective of intervention is to protect the growers of these commodities from making distress sale in the event of a bumper crop during the peak arrival period when the prices tend to fall below economic levels and cost of production. The condition is that there should be either at least a 10 percent increase in production or a 10 percent decrease in the ruling market prices over the previous normal year. The Market Intervention Scheme (MIS) is implemented at the request of a state/UT government which is ready to bear 50 percent of the loss (25 percent in case of North-Eastern States), if any, incurred on its implementation. The extent of total amount of loss to be shared on a 50:50 basis between the central government and the state government is restricted to 25 percent of the total procurement value which includes cost of the commodity procured plus permitted overhead expenses. Under the Scheme, in accordance with MIS guidelines, a pre-determined quantity at a fixed Market Intervention Price (MIP) is procured by NAFED as the Central agency and the agencies designated by the state government for a fixed period or till the prices are stabilized above the MIP whichever is earlier. The area of operation is restricted to the concerned state only.

5.22 During the year 2011-12, the MIS has been implemented in 6 States covering arecanut (Karnataka for 12,000 MTs), apple (Himachal Pradesh – 50,600 MTs), onion (Karnataka – 54,000 MTs), Turmeric (Karnataka – 12,400 MTs) and potato (Uttar Pradesh – 1.00 lakh MTs). Further, during the current year 2012-13 (as on 21.11.2012), the MIS is implemented in 3 States covering garlic (Rajasthan – 60,000 MTs), chilly (Andhra Pradesh – 52,000 MTs) and turmeric (Tamil Nadu – 35,000 MTs).

Price Supports Scheme (PSS)

5.23 The Department of Agriculture & Cooperation implements the PSS for procurement of oil seeds, pulses and cotton, through NAFED which is the Central nodal agency, at the Minimum Support Price (MSP) declared by the government. NAFED undertakes procurement of oil seeds, pulses and cotton under the PSS as and when prices fall below the MSP. Procurement under PSS is continued till prices stabilize at or above the MSP. Losses, if any incurred by NAFED in undertaking MSP operations are reimbursed by the central government. Profit, if any, earned in undertaking MSP operations is credited to the central government.

5.24 Under the PSS during 2011-12 procurement was made for milling copra in Andaman & Nicobar for 343 MT (valuing Rs.182.76 lakh), gram in Rajasthan for 6344 MTs (valuing Rs.1449.6 lakh) and urad in Rajasthan for 1.568 MTs (valuing Rs.0.62 lakh). Further, during the current year 2012-13 (as on 21.11.2012), procurement is made for milling copra in Tamil Nadu, Lakshadweep, Kerala, Andhra Pradesh and Andaman Nicobar Ireland for 54,864 MTs (valuing Rs.27980.73 lakh), ball copra in Kerala and Karnataka for 7866 MTs (valuing Rs.4219.09 lakh), special grade milling copra in Andhra Pradesh for 49 MTs (valuing Rs.21.44 lakh) and urad in Maharashtra, Andhra Pradesh, Uttar Pradesh, Madhya Pradesh & Rajasthan for 9265 MTs (valuing Rs.3983.86 lakh).

5.25 The Price Support Scheme (PSS) is implemented by the Government of India to ensure a minimum support price of the produce to the farmers. The Government has notified various agencies such as FCI, NAFED, CWC, SFAC, etc., for this purpose. However, in some places, the market prices of agricultural produce remains below the MSP for variety of reasons. These include weak infrastructure of procurement agency, inadequate number of procurement centres, restrictive trade policies

and lack of adequate processing and marketing facilities for the produce. The State Governments need to actively collaborate with these agencies to address these problems effectively. In case of certain commodities like Copra, there is a need to remove restrictions on export of coconut oil, strengthen drying facilities and include supply of coconut oil under the Public Distribution System.

Procurement of Foodgrains

5.26 The main objectives of food management are procurement of foodgrains from farmers at remunerative prices, distribution of foodgrains to consumers, particularly the vulnerable sections of society at affordable prices and maintenance of buffer stock for food security and price stability. 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 the public procurement agencies at the Minimum Support Price (MSP) inclusive of bonus announced, if any. The farmers have the option to sell their produce to FCI/State Agencies at the MSP or in the open market as is advantageous to them. The Government procurements of (i) wheat and (ii) paddy during the last few years are shown in Figures 5.4 (a) & 5.4 (b) below.

Fig. 5.4 (a): Production, Procurement and procurement as % of production of wheat

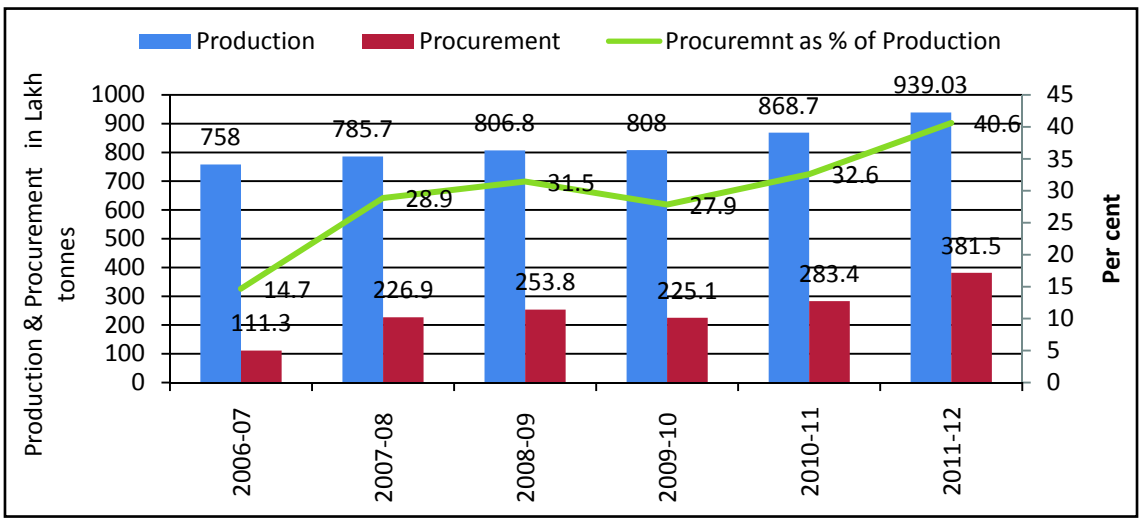
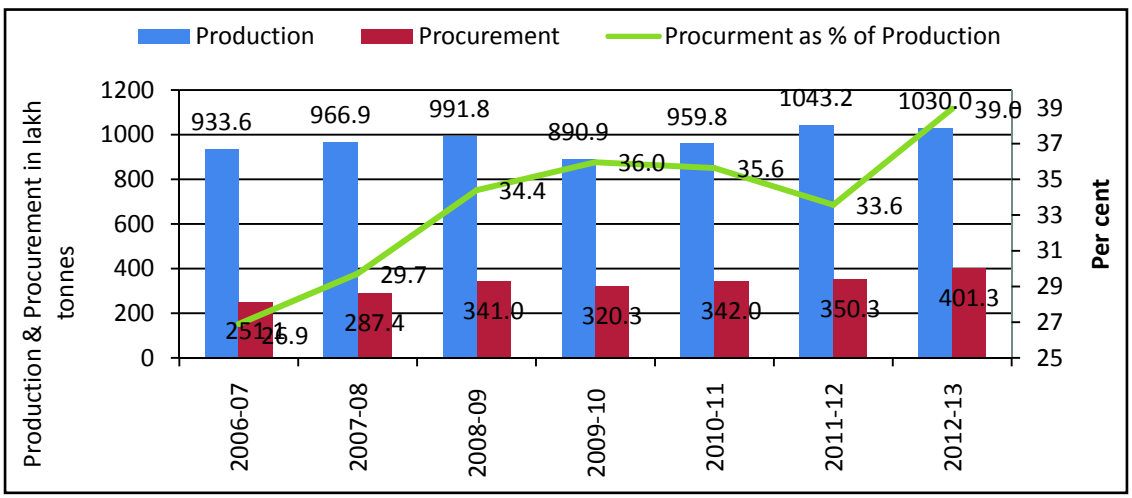


Fig. 5.4 (b): Production, Procurement and procurement as % of production of Rice



5.27 In recent years there has been a high procurement as percentage of production of rice and wheat mainly because of high production and surpluses of several agricultural commodities even in deficit states like Bihar, Assam, Eastern U.P. which have started generating surpluses of certain cereals. The excessive built up of stocks with FCI has been posing problems of storages which have high carrying costs. The excessive procurement by government has also not letting the private trade to play its role particularly in respect of two major cereals, namely wheat and rice that account for over 75 per cent of total food grain production in the country. Under the present mechanism of procurement at MSP, prices of these major agricultural commodities are to a large extent exogenously determined defying the market forces to bring equilibrium in the market. Active participation by the private trade in terms of volume and outreach is necessary. Further, procurement is essentially undertaken of paddy and wheat that too in a few states namely, Punjab, Haryana, Western Uttar Pradesh, Chhattisgarh, Andhra Pradesh and to some extent in Madhya Pradesh and Rajasthan. There have been reports from the eastern states particularly Eastern Uttar Pradesh, Bihar, Orissa and West Bengal that in the absence of effective procurement mechanism, market prices of paddy and wheat have ruled below the MSP during the peak marketing session.

5.28 So far as coarse grain is concerned, state governments/agencies procure the coarse grains at the MSP on behalf of the FCI/Government of India and retain the quantity procured to the extent of their requirement for the PDS and the balance is delivered to the FCI by the State Govt. In case there is a demand for coarse grains in some other States, based on allocations issued by the Department of Food & Public Distribution, FCI moves this required quantity to that State. In case there is no such requirement, it is disposed of by FCI "as is where is basis" by open auction/tender. The difference between the economic cost and disposal/issue price is paid as subsidy to the State Governments.

Storage of Foodgrains

5.29 Total Storage capacity available with FCI as on 30.09.2012 was 375.25 lakh MTs. However, total storage capacity available with FCI and State agencies for storage of Central Pool Stocks is about 717 lakh MTs.

Constructions of godowns under Private Entrepreneurs Guarantee (PEG) Scheme of FCI

5.30 Due to the increased procurement of foodgrains and to reduce the storage in Cover and Plinth (CAP), the Government formulated a Scheme for construction of storage godowns through private entrepreneurs, Central Warehousing Corporation (CWC) and State Warehousing Corporations (SWCs). Assessment of additional storage needs under the scheme is based on the overall procurement/consumption and the storage space already available. For the consuming areas, storage capacity is to be created to meet four month's requirement of PDS and Other Welfare Schemes in a State. For the procurement areas, the highest stock levels in the last three years are considered to decide the storage capacity required. Later this scheme was extended to Decentralised Procuring (DCP) States in 2009. FCI has already sanctioned a total storage capacity of about 128.5 lakh tonnes out of which a capacity of about 94 lakh tonnes has been sanctioned to the private entrepreneurs. CWC and SWCs have been sanctioned 6.6 lakh tonnes and 27.9 lakh tonnes respectively. A capacity of about 60 lakh tonnes is under construction. At present, about 31 lakh MTs have been completed out of which 20.55 lakh MTs has been taken over and the balance is expected to be taken over shortly. It is expected that by March 2013, a cumulative capacity of 73 lakh MTs will be completed and taken over under the scheme.

Warehousing Development and Regulatory Authority (WDRA)

5.31 Warehousing Development and

Regulatory Authority (WDRA) has been set up by the Government of India under the Warehousing (Development & Regulation Act), 2007 with the objective of development and regulation of warehouses including registration and accreditation of the warehouses intending to issue negotiable warehouse receipts in the country. The authority has so far notified 40 commodities for the purpose of Negotiable Warehouse Receipts (NWRs) and 75 more commodities including cereals, pulses, oil seeds, spices, rubber, tobacco, coffee etc. and 26 perishable commodities for cold storage and under process for being notified. So far 302 warehouses have been accredited out of which 271 warehouses have been registered with 10.55 lakh MTs storage capacity of Central Warehousing Corporation, State Warehousing Corporation and Private Organization.

Distribution of Foodgrains under Public Distribution System (PDS)

5.32 The Department of Food & Public Distribution makes allocations of food grains under Targeted Public Distribution System (TPDS) for 6.52 crore Below Poverty Line (BPL) families including 2.43 crore Antyodaya Anna Yojana (AAY) families on the basis of 1993-94 poverty estimates of the Planning Commission and March 2000 population estimates of Registrar General of India. Allocation of foodgrains for Above Poverty Line (APL) category are made depending upon the availability of foodgrains in the Central Pool and past offtake. Presently, these allocations range between 15 kg to 35 kg per family per month in different States/UTs.

Central Issue Prices of Rice and Wheat

5.33 Wheat and rice are issued to the State Governments/UT Administrations from the Central Pool at the uniform Central Issue Prices (CIP) for distribution under TPDS. The CIPs of wheat and rice are subsidized and have remained unchanged for BPL families since July, 2002. The Central Issue Prices of wheat and rice are as under:

Table 5.3: Central Issue Prices of foodgrains

(Rs. per quintal)

Effective from	Foodgrains-wise	Scheme-wise		
		BPL	APL	AAY
1.7.2002 to till date	Wheat	415	610	200
1.7.2002 to till date	Rice	565	830	300
27.11.2007 till date	Coarse grains	300	450	150

Export of Rice & Wheat

5.34 Export of wheat and non-basmati rice on private account was banned w.e.f. 09.02.2007 and 01.04.2008 respectively. However, export of rice and wheat has been allowed on diplomatic considerations and humanitarian ground. The Government, on 08.09.2011, permitted export of non-basmati rice and 20 lakh tonnes of wheat under Open General Licence (OGL) by private parties out of privately held stocks through EDI ports. As on 19.11.2012, a quantity of 77.25 lakh tones of non-basmati rice and 35.95 lakh tones of wheat have been exported under OGL. In view of record production of foodgrains in the recent years and comfortable stock position of wheat and non-basmati rice in the Central Pool far in excess of buffer norms/strategic reserve and also to offload the excess stocks of wheat due to constraints in storage space with FCI/State Agencies, the government has on 03.07.2012 approved export of 2 million tonnes of wheat from Central Pool Stocks through CPSUs of the Department of Commerce at the cost to be determined by individual tender subject to floor price of US$228 per metric ton. The Government has approved on 29.11.2012, the continuation of the unrestricted export of wheat and non-basmati rice, in view of the adequate availability of wheat and non-basmati rice in the domestic market. Further, with effect from 26.03.2012, export of 6.5 lakh tonnes of flour (Maida), Samolina (Rava/ Sooji), Whole meal Atta and resultant Atta on private account allowed in the year 2009 has been put on OGL up to 31.03.2012.

Agriculture Marketing

5.35 Organised marketing of agricultural commodities has been promoted in the country through a network of regulated markets to ensure reasonable gains to the farmers and consumers by creating 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 103 sq km. in Punjab to 11215 sq km. in Meghalaya. Such low density of market spread in the States creates problem of market access for small and marginal farmers. Moreover, these state controlled regulated markets do not have required facilities/amenities available therein due to resource constraint.

5.36 There are wide variations of market fee ranging 0.50% to 2.0% across states which are levied from the buyers/traders on the sale of notified agricultural produce for the services provided by APMCs. In addition to this, commission charges paid to the commission agents vary from 1% to 2.5% in foodgrains, and 4% to 8% in case of fruit and vegetables, resulting in higher marketing transaction costs and low price realization by the farmers in regulated markets. This has resulted into fragmented supply chains with large intermediations.

5.37 Large post-harvest losses of the produce particularly of perishable produce such as fruits and vegetables have remained a key concern, though these have come down in the last decade. A Study conducted by ICAR (2010) reveals that the post-harvest losses of various commodities are now lower as compared to that indicated by Millennium Study (2004) and ranges from 3.9-6.0% of the value of output for cereals, 4.3-6.1% for pulses, 5.8-18.0% for fruits and 6.8-12.4% for vegetables. The ICAR Report indicates that total post-harvest losses of agriculture commodities have been estimated at about Rs 44,000 crore at 2009 wholesale prices.

Market Reforms Initiatives

5.38 Agriculture Marketing is a State subject. In order to bring reforms in the sector, the Ministry of Agriculture prepared a model Agricultural Produce Marketing Committee (Development and Regulation) (APMC) Act in 2003 and circulated to all States and UTs for adoption. The model Act, inter-alia, provides for direct marketing, contract farming, establishment of markets in private and cooperative sectors, etc. So far, 16 State Governments have amended their respective APMC Acts. The State-wise status of APMC reforms are indicated in Box 5.1.

Box 5.1: Reforms in Agricultural Produce Markets Committee (APMC) Act

No.	Stage of Reforms	Name of States/Union Territories
1.	States/UTs where reforms to APMC Act has been done.	Andhra Pradesh, Arunachal Pradesh, Assam, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Maharashtra, Mizoram, Nagaland, Odisha, Rajasthan, Sikkim, Tripura and Uttarakhand.
2.	States/UTs where reforms to APMC Act has been done partially.	a) Direct Marketing: NCT of Delhi, and Madhya Pradesh, Chhattisgarh, b) Contract Farming: Chhattisgarh, Haryana, Madhya Pradesh, Punjab and Chandigarh.
3.	States/UTs where there is no APMC Act and hence not requiring reforms.	Bihar (repealed on 1.9.2006), Kerala, Manipur, Andaman & Nicobar Islands, Dadra & Nagar Haveli, Daman & Diu, and Lakshadweep.
4.	States/UTs where APMC Act already provides for the reforms	Tamil Nadu
5.	States/UTs where administrative action is initiated for the reforms	Meghalaya, Haryana, J&K, West Bengal, Puducherry, NCT of Delhi and Uttar Pradesh.

5.39 In order to accelerate the pace of market reforms, the Ministry of Agriculture has set up a Committee of State Ministers in-charge of Agricultural Marketing in 2010, with members from the States of Maharashtra, Gujarat, Haryana, Uttarakhand, Bihar, Assam, Odisha, Andhra Pradesh, Karnataka, Madhya Pradesh and Punjab. The Committee has been deliberating on various issues of marketing reforms and has held seven meetings so far. The Committee has submitted its "First Report" to the Government in September, 2011, which has been circulated to all States and UTs for implementation of its recommendations. There is a strong need for taking pro-active measures by the States to reform their existing marketing systems.

Emerging Marketing Channels

5.40 In order to provide a higher share of consumer prices to the farmers, there is a need to reduce the multiple layers of intermediation by providing alternative marketing channels. Several States have taken the initiatives in this regards. Farmers' markets, like, 'Apni Mandi' (Punjab), 'Kisan Mandi' (Rajasthan), 'Hadaspur Vegetable Market' (Pune), 'Rythu Bazaars' (Andhra Pradesh), Uzhawar Santhai (Tamil Nadu) and 'Krushak Bazaars' (Orissa) have been established as part of this initiative. The establishment of such farmers' markets has helped both consumers and farmers.

Fig. 5.5: Uzhawar Santhai in Tamil Nadu

5.41 Contract farming has considerable potential in our country where small and marginal farmers can have access to modern technology, quality inputs and marketing support through contractual agreement between processing and/or marketing firms for production support at predetermined prices. It stipulates a commitment on the part of the farmers to provide a specific commodity in terms of quality & quantity as determined by the purchaser and commitment on the part of company to support the farmer for production through quality inputs and other technical support. Various agriculture commodities including perishable fruits and vegetables are being grown under contract farming system in different States. The model APMC Act has the provision to promote and to facilitate contract farming.

5.42 Electronic mode of marketing of agriculture produce is being promoted by National Spot Exchange of India Ltd., where the farmers and traders can sell farm produce, while upcountry buyers, processors, exporters, and end-users can buy the commodities electronically through competitive bidding. It is a compulsory delivery based platform, which enables the farmers and traders to sell their produce electronically and to realize the best possible price. However, success of electronic trading depends on establishing an effective system of grading and marking of agriculture produce which requires special attention of the States.

Empowering Farmers with Market Information

5.43 Market information is an important tool in agricultural marketing system. In order to provide regular and timely information of 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, more than 3,000 markets from all over the country have been linked to a central portal (**http://agmarknet.nic.in**). These markets report the daily prices and

arrivals for more than 300 commodities and 2000 varieties from more than 1800 markets covering nearly all the major agricultural and horticultural produce. The States' 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 are not able to report this information for which alternative arrangements are required to be made.

5.44 The information available on the portal is in the public domain and can be instantly accessed from anywhere in the world. Farmers and stakeholders are accessing this information throughout the country. Many agencies are using the information to generate market intelligence and making it available to various stakeholders to support them in appropriate decision making. Organizations like Reuters, Nokia, IKSL are disseminating market price information through SMS and voice based system.

Incentivizing Development of Agricultural Marketing Infrastructure

5.45 Development of agricultural marketing infrastructure is the foremost requirement for the growth of comprehensive and integrated agricultural marketing system in the country. For the purpose, the Ministry of Agriculture is implementing demand driven Plan Schemes by providing assistance to entrepreneurs in the form of back ended credit linked subsidy.

5.46 Considering the immediate need for creation of storage capacities in rural and remote areas, the 'Grameen Bhandaran Yojana' was launched in 2001 to provide assistance for creation of scientific storage godowns with allied facilities. Since inception of the scheme, 28,744 godown projects having a capacity of 328.97 lakhs tonnes with a subsidy release of Rs.966.05 crore have been sanctioned by NABARD and NCDC all over the country up to 31st July, 2012. The cost norms have been revised under the Scheme from 20 October 2011 to encourage the creation of additional warehousing capacity.

5.47 Though the scheme is being implemented across the country, it is unevenly spread with higher capacity creation in Madhya Pradesh, Andhra Pradesh, Maharashtra, West Bengal and Karnataka and low capacity creation in Tamil Nadu, Rajasthan, Orissa, Bihar, Kerala and North Eastern States. The ceiling for creation of storage capacity of 18 lakh MT in a State/UT during XI Plan also proved hurdle in expansion of the scheme, which needs to be addressed in XII Plan, along with other issues like rates of subsidy particularly in North Eastern States, mandatory requirement of loan from bank for State Agencies, implementing procedures, etc.

5.48 With a view to induce large investment in the development of marketing infrastructure in the country; the Ministry launched the scheme of "Development/Strengthening of Agricultural Marketing Infrastructure, Grading and Standardization" in 2004. Under the scheme, investment subsidy is provided on the capital cost of general or commodity specific infrastructure for marketing of agricultural commodities and for strengthening and modernization of existing agricultural markets including wholesale, rural and periodic markets. The scheme is reform linked and is being implemented in only those States/UTs which have amended the State APMC Act by allowing setting up of agricultural markets in private and cooperative sectors. Under the scheme, back ended subsidy @ 25% of capital cost of the project is provided. However, subsidy is given @ 33.3% in case of NE States, hilly areas and SC/ST entrepreneurs. Under the Scheme 7853 projects have been sanctioned as on 31.07.2012 with subsidy of Rs. 842.64 crore.

5.49 Since the scheme is reform linked, the scheme is not being implemented in non-reformed States which include major States like Haryana, Uttar Pradesh and West Bengal. The non-reformed States, therefore, needs to be persuaded to make necessary reforms in their States to enable them to avail assistance under the scheme. The scheme has not been received very well by cooperative sector in the country, except Gujarat. Moreover, the assistance is not being availed under the Scheme by North Eastern States. These issues including some other issues like rates of subsidy, implementing procedures, emphasis on grading and standardization, etc. needs to be addressed in XII Plan.

Standardization and Quality Certification

5.50 Grading of agricultural commodities has three main purposes, namely, (a) to promote common trade language and avoid need for physical checking and handling at many points; (b) to protect consumers by ensuring quality of products he/she purchases; and (c) to protect the producer from exploitation by ensuring prices commensurate to the quality of produce. The Agricultural Produce (Grading & Marking) Act, 1937 provides for grading and marking of agricultural commodities. Grade standards of various agricultural commodities are framed and notified in appropriate Grading and Marking Rules for specific commodity. Till date, Grade standards of 212 agricultural commodities have been notified in 105 Commodity Grading and Marking Rules. The Grade standards notified under the provisions of the said Act 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 Spread is mandatory under AGMARK as per the provisions of 'Regulations' notified under Food Safety and Standards Act, 2006. The quantity and value of agricultural commodities certified under AGMARK for domestic trade during the year 2011-12 were 12.35 lakh MTs, valued at Rs. 12289.18 crore.

Challenges

5.51 Though the process of market reforms have been initiated by different State Governments by bringing amendments in the present APMC Act on the lines of Model Act circulated during 2003, but still many of the States are yet to adopt the same and even those of the reformed states are yet to adopt all provisions of Model Act uniformly. It is therefore, necessary to complete the process of market reforms early to provide the farmers an option for alternate competitive marketing channel for transaction of their agricultural produce at remunerative prices. There is a need for framing amended APMC Rules by all the States/UTs for implementation of the provisions of the Act.

5.52 Under the Essential Commodities Act, 1955 and also by administrative orders, the States have been imposing restrictions on cross border movement of specific commodities for trade purpose, thus, hindering development of inter-state trade for matching demand-supply. States also notify various stock limits commodity-wise, which do encourage investment in storage facilities which is a crucial marketing infrastructure. The stock limits and movement of agricultural commodities across the country need to be freed so as to facilitate a common National Market of agricultural produce across the country.

5.53 The present agricultural marketing system in the country is marked by fragmented supply chain which is dominated by multiple market players resulting into high wastages thus, adversely affecting efficient marketing. It is necessary that direct marketing and contract farming is promoted to facilitate enhanced share of producers in consumer's rupee.

5.54 There is a large difference between the prices at retail level and those at wholesale level due to multiple intermediaries and high taxes - 13% to 15.5% advalorem apart from other Market Charges which need to be rationalized. It is also necessary that States may waive off market fee on fruit and vegetables under the APMC Act to ensure unhindered trade in those commodities. There is a need to create an integrated national market ensuring barrier free movement of agriculture commodities from one state to another.

The Way forward

5.55 The development of alternative and competitive marketing channels is necessary to induce competition in the existing marketing systems and to facilitate sale of farm produce at remunerative prices. There is a need for efficient marketing system including creation of scientific storage nearer to farm so that wastage and produce deterioration are avoided. It is also necessary to provide institutional credit requirement of the farmers through various instruments like pledge financing, negotiable warehousing receipt

system so that they are not compelled to sell the produce at distress price. The present system of agricultural marketing needs to evolve towards establishment of unified national market for sale of agricultural produce throughout the country efficiently without any undesirable barriers.

5.56 Improvement of marketing linkages for both farm produce and inputs necessitates a strong private sector backed up by appropriate policy and legislative frameworks and effective government support services. Such services may include provision of market infrastructure, supply of market information, and agricultural extension services to advise farmers on marketing, capacity building in marketing; development of marketing linkages between farmers, agribusinesses 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. to join together in associations to promote their common goals. 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.

5.57 With the help of Rural Infrastructure Development Fund (RIDF), cold storage of adequate capacity may be created in all the 660 district headquarters so that any perishable item produced in the District can be stored there without forcing a distress sale on the farmer and not subjecting the product to perish.

India in Global Agricultural Trade

5.58 Despite substantial degree of economic liberalisation since 1991, export of agricultural products has remained highly regulated. Policies on export of agricultural products have seen frequent changes mostly to protect interest of domestic consumers and industries. Indication of increase in prices of agricultural products has in many instances led to export restrictions to the detriment of farmers in the absence of other alternatives. The implication of such ambivalent trade policy has to be carefully considered in view of the legitimate interest of the Indian farmers, our increasing integration with world trade and our commitment to international organizations like the WTO.

5.59 Frequent changes in export policy measures create a situation of uncertainty and undermine credibility of the country as a reliable source of agricultural produce for exports. Once a market is created, a sudden declaration of ban erodes such a reputation making it difficult to regain the market developed by the exporters. Often there are very small windows of opportunity in terms of time and price for exports in today's competitive world commodity market. Uncertainty in policy prevents realisation of such opportunities.

5.60 Such a restrictive export policy amounts to penalising farmers and subsidising the consumers. With more than required availability of agricultural products, the time has come to do away with *ad hoc* control measures, which harm the interests of farmers including those who are aimed to be protected through such measures.

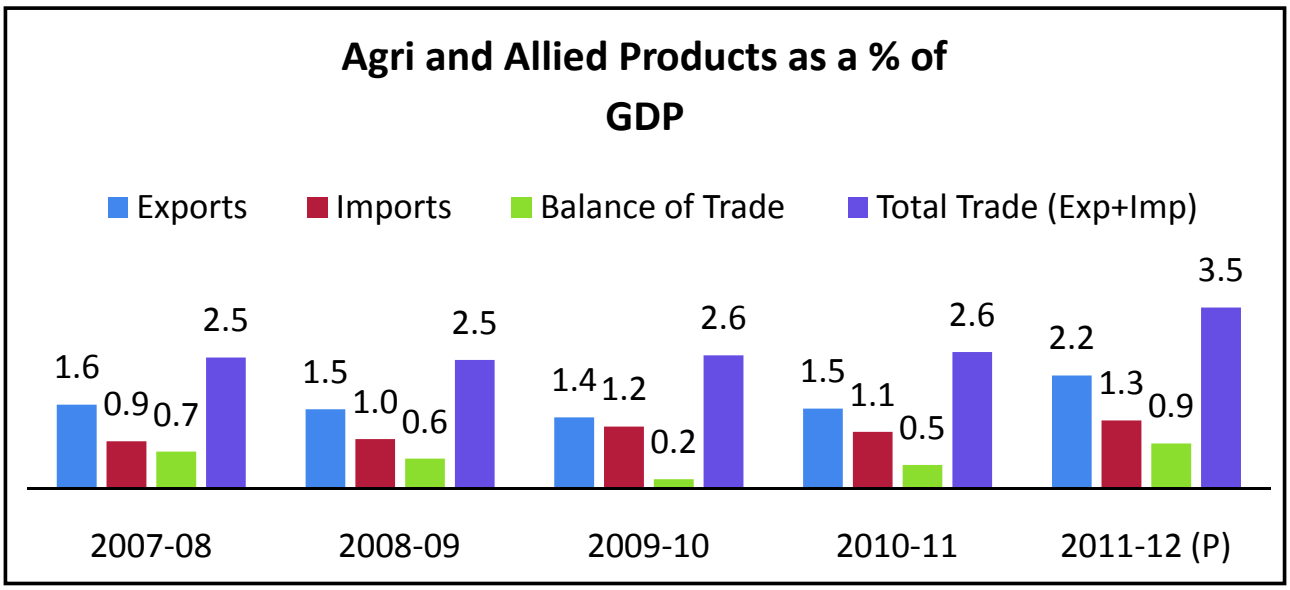
5.61 A consistent policy environment is necessary to adequately incentivise farmers to invest more in productivity increasing techniques, which will not only help the agriculture sector to realise its true potential but also assist in meeting the domestic demand. A stable trade policy on agricultural commodities will provide the right price signal and sufficient time to farmers to respond to that.

5.62 Despite policy uncertainties, over the years India has developed export competitiveness/ niche for certain specialized products like basmati rice, oil meals, cotton, maize etc. India is among the 15 leading exporters of agricultural products in the world and has also emerged a significant exporter having share of more than 5% of global exports in certain crops like cotton, rice, eggs and oil meals. As per United Nations Commodity Trade Statistics Database (UNCOMTRADE) 2010, the global agricultural export trade was USD 994.95 billion, out of which India's share was 1.63% at USD 16.26 billion. India's share in global agriculture trade is 1.48%.

Trade in Agriculture

5.63 The Agricultural Exports as a percentage of GDP increased from 1.6 percent in 2007-08 to 2.2 percent in 2011-12. The Agricultural imports as a percentage of GDP also increased from 0.9 percent to 1.3 percent during the same period. The share of India's total Agricultural Exports and Imports as a percentage of GDP improved from 2.5 percent to 3.5 percent during this period.

Fig. 5.6: Agricultural Trade as percent of GDP



Agricultural Exports and Imports

5.64 Agricultural exports increased from Rs. 120 thousand crore in 2010-11 to Rs.187 thousand crore in financial year 2011-12 registering a growth of nearly 55%. Increase in value of agricultural exports during 2011-12 was primarily on account of higher exports of cotton, marine products, guar gum meal, basmati & non-basmati rice, meat & meat preparations, spices, and oil meals. During the same period export of tobacco, dairy& poultry products, sugar and molasses registered a decline. In 2011-12 over 2010-11the share of agricultural exports in total exports increased from 10.47% to 12.81%.

5.65 India's top 10 agricultural export commodities in terms of quantity and value for the year 2009-10, 2010-11 and 2011-12 is given in the Table 5.6.

Table 5.4: Top 10 Agricultural exports

Qty. '000' tonnes, Value: Rs. In crores.

S. No.	Item	2009-10		2010-11		2011-12	
		Qty.	Value	Qty.	Value	Qty.	Value
1	Cotton Raw incl. waste	1358	9537	1258	12981	2013	21623
2	Marine products	710	9999	801	11548	1032	16588
3	Guargum Meal	218	1133	403	2806	707	16357
4	Rice Basmati	2017	10890	2186	10582	3212	15450
5	Meat & Preparations		6286		8776		14111

6	Spices	663	6157	749	7870	931	13176
7	Oil Meals	4671	7832	6798	10846	7436	11762
8	Sugar	45	110	3241	10339	2747	8779
9	Rice (other than Basmati)	140	365	96	220	4099	8668
10	Other cereals	2892	2973	3188	3596	4072	5479

Source: DG CI & S, Department of Commerce.

5.66 Compared to agricultural exports India's agricultural imports increased from Rs. 56 thousand crore in 2010-11 to Rs 85 thousand crore in 2011-12 registering a growth of nearly 50%. Increase in value of agricultural imports during this period was primarily on account of imports of Vegetable oils, pulses, cashew nuts raw, fruits and nuts, milk & cream and spices. Share of agricultural imports in the total imports increased from 3.53% in 2010-11 to 3.63% in 2011-12.

5.67 India's top 10 agriculture import commodities for the year 2009-10, 2010-11and 2011-12 is given in the table below:

Table 5.5: Top 10 Agricultural imports

Qty. '000' tonnes, Value: Rs. in crores.

S. No.	Item	2009-10		2010-11		2011-12	
		Qty.	Value	Qty.	Value	Qty.	Value
1	Vegetable Oils fixed edible	8034	26483	6905	29860	8429	46242
2	Pulses	3510	9813	2591	6980	3308	8767
3	Cashew Nuts	756	3048	504	2480	809	5338
4	Fruits & Nuts (excl. Cashew nuts)		2873		3684		4519
5	Sugar	2551	5966	1198	2787	997	3138
6	Spices	153	1432	108	1359	124	2102
7	Cotton raw & waste	171	1241	56	604	78	1059
8	Milk & Cream	8	78	37	492	63	1038
9	Jute, raw	63	149	75	273	181	449
10	Cereal Preparation	41	188	37	226	46	300

Source: DGCI & S, Department of Commerce.

Regional Free Trade Agreements

5.68 India has been negotiating Free Trade Agreements including liberalized trade in agriculture goods to increase its trade. The main developments during period under review have been:

(i) Negotiations on PTAs/FTAs continued to mark progress with European Union, EFTA (Switzerland, Norway, Iceland and Liechtenstein). MERCOSUR (Brazil, Argentina, Paraguay, Uruguay), Chile, Israel, Indonesia, Australia, New Zealand and Thailand.

(ii) ASEAN (Brunei, Indonesia, Malaysia, Philippines, Singapore, Thailand, Cambodia, Lao PDR, Myanmar and Vietnam) Trade in Goods Agreement

was signed on 13th August 2009. This FTA became effective from 1st January 2010. India –South Korea Partnership Agreement (CEPA) was concluded on 7th August 2009.

(iii) Trade in goods agreements under India-Japan CEPA and India-Malaysia CECA were concluded during 2010-11 and have become effective from 1st August 2011 and 1st July 2011 respectively.

(iv) Recently more tariff concession has been provided to SAFTA LDCs (Bangladesh, Nepal, Bhutan and Maldives) and Non-LDCs (Sri Lanka and Pakistan). Tariff on all agricultural products has been reduced to zero for SAFTA LDCs. Bangladesh will be major beneficiary of this liberalization. Tariff on most of the agricultural products has been reduced to Non-LDCs of SAFTA. Pakistan will be benefitted from this liberalization.

Multilateral Negotiations

5.69 India is a founder Member of the World Trade Organization (WTO). As a Member, India has to abide by WTO rules, including the rules for agricultural trade as contained in the General Agreement on Tariffs and Trade, the Agreement on Agriculture and relevant provisions of other WTO agreements.

5.70 The Agreement on Agriculture (AOA) applies to basic agricultural products such as wheat, milk and live animals; products derived from them such as bread, butter and meat; and all processed agricultural products. It also applies to wines and spirits, tobacco products and fibers. It does not apply, however, to fish and fish products or forestry products. India's commitments and obligations are governed by these rules and its schedule of commitments notified to the WTO in 1995 after the Uruguay Round of trade negotiations.

5.71 The rules and commitments relate, *inter alia*, to tariffs, tariff quotas, domestic support to farmers (such as market price support) and export subsidies, and measures used to restrict exports and imports. India has to file annual notifications of its domestic support and export subsidies and *ad hoc* notifications of any interim measures. Tariffs on agricultural products have to be kept within the 'bound' or ceiling levels committed in India's schedule of commitments to the WTO. While no subsidies are prohibited under the AOA, Members have to ensure that these are within the limits to which they are entitled and are in accordance with criteria specified in the Agreement for various types of support.

Agriculture in the Doha Round of Trade Negotiations

5.72 Agriculture is one of the subjects covered in the Doha Round of trade negotiations in the WTO which is underway since 2001. Other areas are market access for non-agricultural products, services, trade-related aspects of intellectual property rights, rules (covering anti-dumping and subsidies), trade facilitation, etc. These are part of a 'single undertaking' which means that nothing is agreed until everything is agreed.

5.73 The three main elements or "pillars" of the Agreement on Agriculture (AOA) and the negotiations are: (i) market access, (ii) domestic support and (iii) export competition. The negotiations are aimed at: substantial improvements in market access; reductions of, with a view to phasing out, all forms of export subsidies; and substantial reductions in trade-distorting domestic support. Special and differential treatment for developing Members is also intended to be an integral part of the modalities.

5.74 The objective of the agriculture negotiations is to reduce/cap/eliminate trade-distorting domestic support and export subsidies and increase market access through a reduction of tariffs. The proposals being negotiated also include special and differential treatment provisions for developing countries that would, *inter alia*, allow them to take minimal tariff cuts on sensitive tariff lines so as to safeguard their food and livelihood security and rural development needs. There is also a proposal for a special safeguard mechanism to enable developing countries to protect their

farmers from the effects of import surges or price dips.

5.75 Doha Round of trade negotiations in the World Trade Organization (WTO), launched in November 2001, is essentially on hold currently. The negotiations in the 'Special Session' of the WTO's Committee on Agriculture take place on the basis of draft texts on modalities that are brought by the chairperson of the Committee from time to time. The version that is currently being discussed was issued on 6 December 2008. Since then hardly any progress has been made. Ten issues- Blue box support for US, Cotton, Sensitive Products, Tariff Capping for Non-Sensitive Products, Tariff Quota Creation for Sensitive Products/Non-Sensitive Products beyond 100% duties, Tariff Simplification, Tropical Products & Diversification Products and Preservation of Long Standing Preferences have been in square brackets or otherwise annotated in the modalities since December 2008.

The Way Forward

5.76 The FTAs and Multilateral Trade Agreements need to be revisited after careful analysis of their impact on the agriculture sector.

5.77 There is need to ensure an increased consistency in our trade policy. Measures such as export ban etc. should be the last recourse. International markets once developed must be protected and cultivated. Further, we need to ensure that our imports do not adversely impact the domestic production and returns to the farmers.

CHAPTER 6

Post-Harvest Management And Value Addition

6.1 While increased productivity is an essential component of a vibrant agricultural sector, improved post-harvest handling and processing is essential to ensure value addition, reduction in wastage and good quality products reach the markets. Too often, even when the yields are high, producers lose income due to poor post-harvest practices.

Food Processing Sector

6.2 Food processing aims to make food more digestible, nutritious and extend the shelf life. Due to the seasonal variations high levels of wastage or shortages can arise if adequate measures are not taken to preserve and store the foods. Food processing covers all the processes that food items go through from the farm to the time it arrives on the consumer's plate. It includes basic cleaning, grading and packaging as in case of fruits and vegetables and also alteration of the raw material to a stage just before the final preparation. Value addition processes to make ready-to eat food like bakery products, instant foods, flavored and health drinks, etc. are also included in this definition.

6.3 Food processing offers an opportunity for the creation of sustainable livelihoods and economic development for rural communities. Food processing has come a long way in the last few decades. The ever changing lifestyles, food habits and tastes of customers' globally have altered the dynamics of the industry. The world food production and consumption patterns are evolving with a change in the needs of the customer. Food processing benefits all the sections of the society. It helps the:

Farmers–get better returns, higher yield, and lower the risks drastically,

Consumers-have access to a greater variety, better prices and new products,

Economy-gets benefitted with new business opportunities for the entrepreneurs and the work force gets employment.

6.4 With a huge production base, India can easily become one of the leading food suppliers to the world while at the same time serving the vast growing domestic market of over a billion people. India's large market size with growing incomes and changing life styles also creates incredible market opportunities for food producers, food processors, machinery makers, food technologists and service providers in this sector.

6.5 Growth in 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 are yet to be tapped in the areas of supply chain management, cold storages, financing, retailing and exports. Historically, agriculture and FPI have been plagued by factors such as low public investment, poor infrastructure, inadequate credit availability and high levels of fragmentation. However, in the last few years there have been significant improvements on almost all the fronts. The Indian food processing sector's higher rate of growth as compared to the agriculture growth rate is indicative of its low base, the increased availability of surpluses, changing life styles, tastes and higher disposable income with consumers.

6.6 Food processing sector which has been identified as a thrust area for development needs huge investments in logistics for supporting the value chain from farm to plate. The enabling rules of the game and policy regime will determine the performance of the sector. Most food processing enterprises have been exempted from industrial licensing under the Industries (Development and Regulation) Act, 1951 with the exception of beer and alcoholic drinks and items reserved for the small scale sector. For foreign investment, automatic approval is given even up to 100 percent equity for a majority of processed foods.

6.7 Effective post-harvest management allows not only the minimization of losses but also increases the value of the marketed agricultural products by transforming the agricultural raw materials. Good processing enables preservation of product quality at every stage of the marketing process. Attractive packaging makes the product more appealing to consumers who are therefore willing to pay more if the product offered is of good quality and easy to use. The policy initiatives of the government also include assistance for opening up of Mega Food Park, Cold Chain and development of Agri- export zones, skill development and R&D activities. Apart from the various schemes from the central government, various state governments are implementing their own food processing promotion policies and schemes.

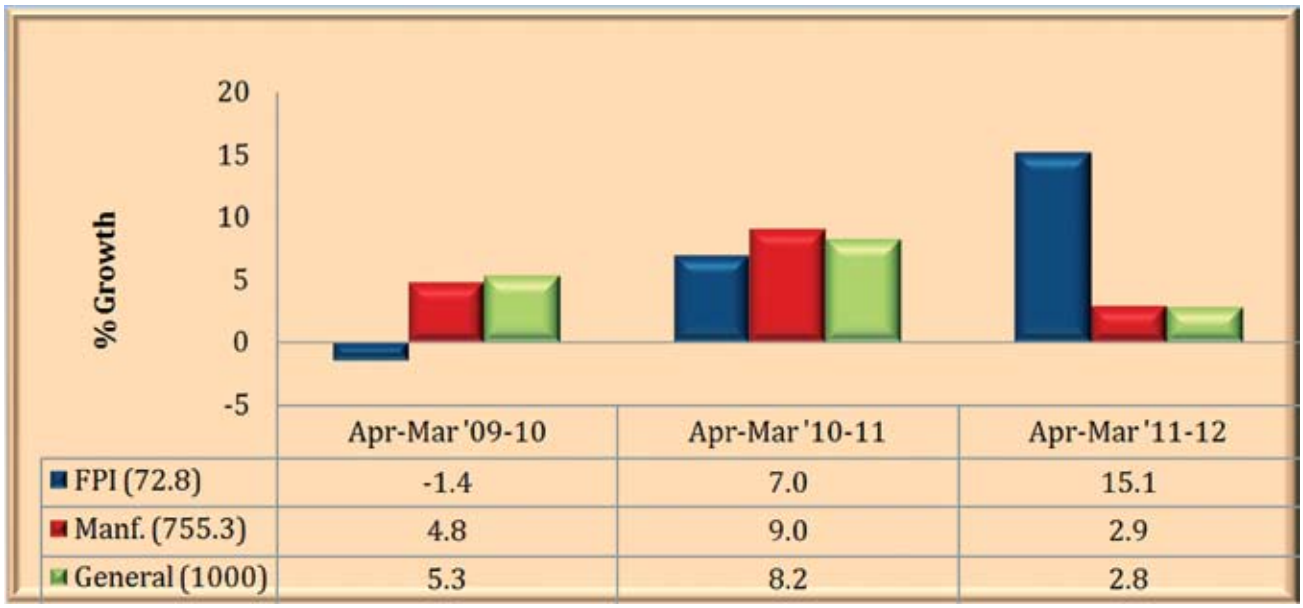
6.8 Food Processing Sector forms an important segment of the Indian economy in terms of its contribution to GDP. The sector contributes as much as 9.0 to 10.0 per cent of GDP in Agriculture and Manufacturing sector. During the last 5 years ending 2010-11, FPI sector has been growing at an Average Annual Growth Rate (AAGR) of around 6 per cent as compared to around 4 per cent in Agriculture and 9 per cent in Manufacturing. Contribution of food processing sector in the recent years has been significant as may be gauged from the Table below:

Table 6.1: Contribution and growth of Food Processing Industries:

Contribution and Growth of FPI sector (GDP in Rs Crore)							
S. No.	**Description**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**	
	GDP at Factor Cost, Of which…..	**35,64,364**	**38,96,636**	**41,58,676**	**45,07,637**	**48,85,954**	
1	GDP Agriculture*	5,54,395	5,89,383	5,88,757	5,93,696	6,38,301	
2	GDP Manufacturing	5,70,458	6,29,073	6,56,302	7,19,728	7,74,162	
3	GDP - FPI	52,164	57,320	60,379	58,753	62,933	
Growth (per cent)							**AAGR$**
4	GDP at factor cost	9.6	9.3	6.7	8.4	8.4	8.5
5	GDP Agriculture*	4.3	6.3	-0.1	0.8	7.5	3.8
6	GDP manufacturing	14.3	10.3	4.3	9.7	7.6	9.2
7	GDP FPI	9.4	9.9	5.3	-2.7	7.1	5.8
Share (per cent)							**Average**
8	GDP FPI as a share of GDP in Agriculture*	9.4	9.7	10.3	9.9	9.9	9.8
9	GDP FPI as a share of GDP in Manufacturing	9.1	9.1	9.2	8.2	8.1	8.7
Source: National Accounts Statistics, MOSPI							
* Includes Milk, Egg, Fish but excludes Forestry &Logging, AAGR$: Five year Average Annual Growth Rate							

6.9 Performance of this sector has improved significantly in the recent years. Manufacturing sector was generally growing at a higher rate than FPI till 2009-10. Performance of FPI improved substantially in 2010-11; almost at par with manufacturing sector. In 2011-12, as per the Index of Industrial Production (IIP), FPI has out-performed Manufacturing; while FPI grew at 15.1 per cent, manufacturing growth was close to 3.0 per cent.

Fig. 6.1: Growth in FPI, Manufacturing & General Index (Cumulative) during 2010-2012



(Source: Index of Industrial Production)

Table 6.2: Sector-wise Number of Registered Food Processing Units

S. No.	Year	Meat, Fish, Fruits, Vegetables and Oils	Dairy Products	Grain Mill Products	Other Food Products	Beverages	Total
1	1998-1999	4241	737	12164	5682	1029	23853
2	1999-2000	3819	795	12405	5810	1113	23942
3	2000-2001	3740	735	12446	5985	1082	23988
4	2001-2002	3454	865	12429	5688	1049	23485
5	2002-2003	3284	769	12856	5899	1008	23816
6	2003-2004	3352	912	12741	5757	1078	23840
7	2004-2005	3484	927	13639	6093	1219	25362
8	2005-2006	3549	1049	13893	6009	1225	25725
9	2006-2007	3459	1015	13880	6245	1160	25759
10	2007-2008	3667	1096	13805	6300	1351	26219
11	2008-2009	3580	1100	14599	6577	1362	27218
12	2009-2010	3697	1112	14673	6681	1316	27479
13	2010-2011(P)	4910	1493	18549	9071	1815	35838

(Source: Annual Survey of Industries), P: Provisional Results

Table 6.3: Foreign Direct Investment in Food Processing Sector from April 2007 to May 2012

S. No.	Year (Apr-Mar)	FDI in Rs crore	FDI in US$ million
1	2007-08	279.01	70.17
2	2008-09	455.59	102.71
3	2009-10	1,314.23	278.89
4	2010-11	858.03	188.67
5	2011-12	826.16	170.21
6	2012-13 (Apr-August)	336.10	66.12

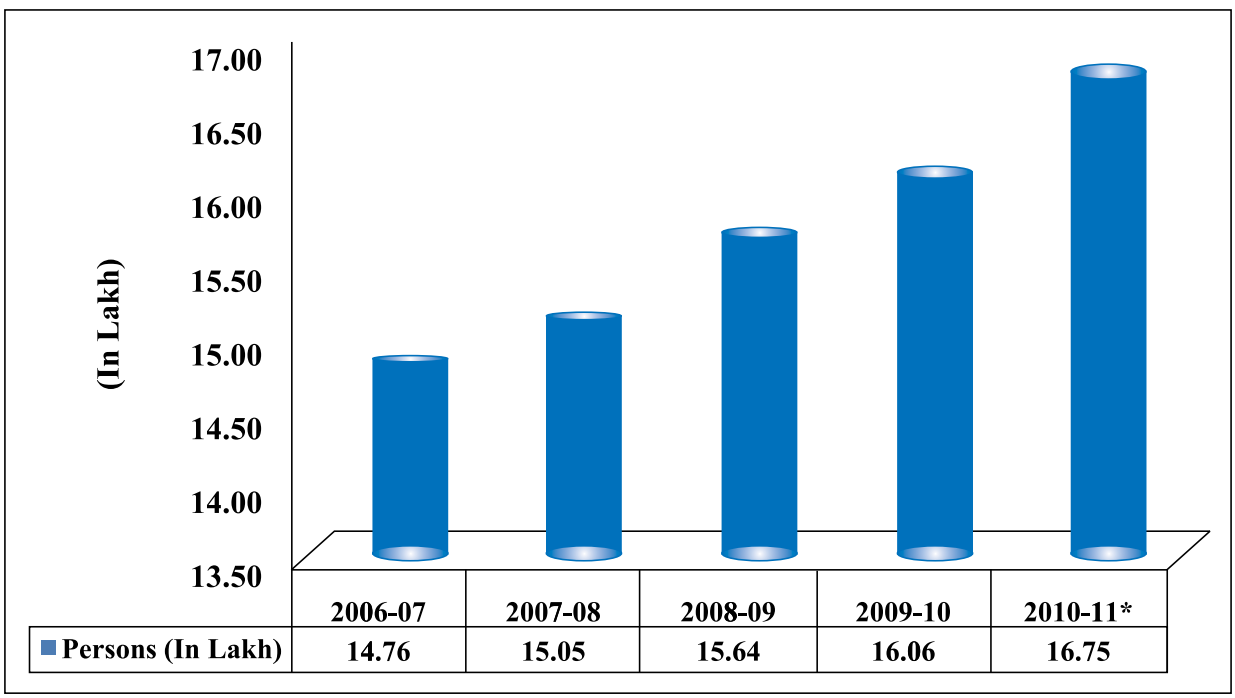
(Source: Department of Industrial Policy and Promotion)

6.10 Foreign Direct Investment (FDI) is permissible for all the processed food products up to 100% on automatic route except for beer/ alcoholic drinks and items reserved for Micro and Small Enterprises (MSEs). For manufacture of items reserved for MSEs, FDI is permissible under automatic route up to 24 per cent.

Table 6.4: Persons Employed under Registered Food Processing Industries

Year	2006-07	2007-08	2008-09	2009-10	2010-11(P)	AAGR $
Persons (In Lakh)	14.76	15.05	15.64	16.06	16.75	
Growth (%)	6.09	1.96	3.87	2.71	4.30	3.79

Source: Annual Survey of Industries, MOSPI; P: Provisional Results; $: Average Annual Growth Rate.



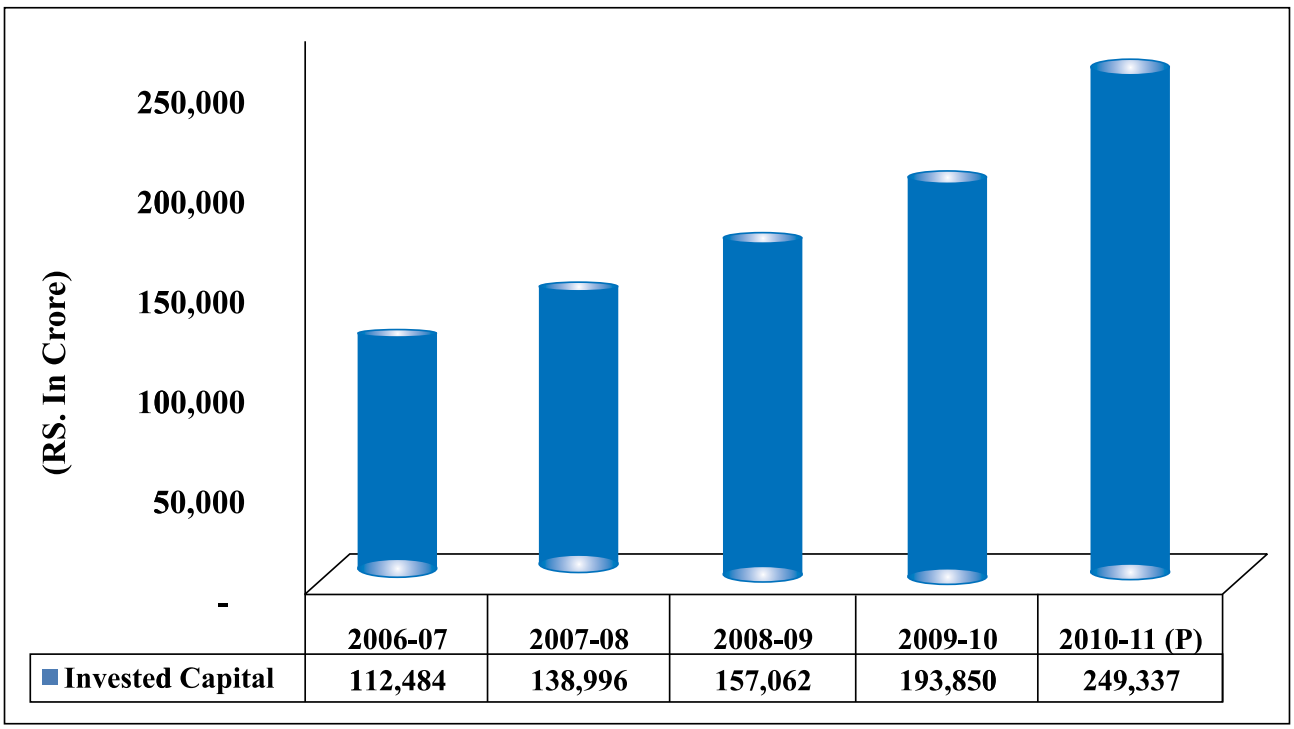
Source: Annual Survey of Industries, MOSPI. *: Provisional Results

6.11 In terms of Investment, FP sector has registered a positive growth in terms of Capital Invested (fixed capital and physical working capital). As per the ASI 2010-11(P), the Invested Capital in FP Industry stood at Rs. 2,49,337 crore growing at an AAGR of 22.17 per cent during five years ending 2010-11.

Table 6.5: Capital Investment* in Registered Food Processing Industries

Year	2006-07	2007-08	2008-09	2009-10	2010-11 (P)	AAGR
Invested Capital (Rs. crore)	1,12,484	1,38,996	1,57,062	1,93,850	2,49,337	
Growth Rate	22.21	23.57	13.00	23.42	28.62	22.17

*Total of Fixed capital and Physical working capital. P: Provisional Results
Source: Annual Survey of Industries, MOSPI



Source: Annual Survey of Industries, MOSPI. *: Provisional Results

Plan Schemes

Scheme for Infrastructure Development

6.12 The creation of integrated and holistic infrastructure is extremely important for the food processing sector. Towards achieving this end the Ministry of Food Processing Industries (MOFPI) has been implementing a scheme for the creation of modern enabling infrastructure that can facilitate the growth of food processing and an integrated cold chain mechanism for handling perishable produce. The MOFPI initiatives include launch of a number of schemes for strengthening infrastructure in agro and food processing sector. This includes Mega Food Parks Scheme, the Scheme for Cold Chain, Value Addition and Preservation Infrastructure and the Scheme for Construction and Modernization of Abattoirs.

Mega Food Parks Scheme (MFPS)

6.13 The Mega Food Parks Schemeaims to accelerate the growth of the food processing industryinthecountrybyfacilitatingestablishment of strong food processing infrastructure backed by an efficient supply chain. Under this scheme, capital grant of 50 percent of the project cost is provided in general areas and 75 per cent in difficult & ITDP notified areas (with a ceiling of Rs 50 crore). The grant is utilized towards creation of common infrastructure in Central Processing Centre (CPC) and Primary processing Centres (PPCs) in the park. Such facilities are expected to complement the processing activities of the units proposed to be set up at the CPC in the Park. Each Mega Food Park takes about 30-36 months to be completed.

6.14 Out of 30 Mega Food Parks proposed during the eleventh five year plan, the Ministry has taken up 15 projects under the Scheme so far. Among these, final approval has been accorded to 15 Mega Food Parks in the states of Andhra Pradesh, Punjab, Jharkhand, Assam, West Bengal, Uttarakhand, Tamil Nadu, Maharashtra, Gujarat, Uttar Pradesh, Madhya Pradesh, Tripura, Orissa, Bihar and Karnataka. The total assistance from the government to these projects is estimated at Rs.750 crore. In addition to these, 15 new Mega Food Parks have been recently approved by the Government. The process of selection of 15 newly approved Mega Food Parks is at an advance stage of finalization.

Scheme for Cold Chain, Value Addition and Preservation Infrastructure

6.15 TheSchemeforColdChain,ValueAddition, and Preservation Infrastructure was approved in 2008 with an objective to provide integrated and complete cold chain, value addition and preservation infrastructure facilities without any break, for perishables from the farm gate to the consumer. The assistance under the Scheme includes financial assistance (grant-in-aid) of 50 percent of the total cost of plant and machinery and technical civil works in General areas and 75 percent for the NE region and difficult areas subject to a maximum of Rs 10 crore. In the first phase, the Ministry has approved 10 integrated cold chain projects in 2008-09, which are already being implemented in different parts of the country. Out of the 10 projects, 9 have started commercial operation. Substantive value addition, reduction in wastage and enhancement in farmers' income is evident from concurrent evaluation of the projects. In the second phase, 28 projects have been approved. In the 3rdup scaled plan of the scheme, 25 projects were approved. Further 146 new proposals have been received, which are under evaluations.

Modernization of Abattoirs

6.16 The Ministry has approved 10 projects in first phase which are at various stages of progress. Two projects have been completed. A proposal for up-scaling the scheme is under consideration.

Scheme for Technology Upgradation, Establishment, Modernization of Food Processing Industries

6.17 Under the Scheme for Technology Upgradation, Establishment, Modernization of Food Processing Industries, financial assistance is provided in the form of grants-in-aid for the setting up of new food processing units as well as Technological Upgradation and Expansion of existing units in the country. The Ministry extends financial assistance in the form of grant-in-aid to entrepreneurs at 25 percent of the cost of Plant & Machinery and Technical Civil Works subject to a maximum of Rs. 50 lakhs in general areas or 33.33 percent subject to a maximum of Rs. 75 lakhs in difficult terrains. The implementation process of the Scheme has been made more transparent and decentralized from 2007 onwards. Earlier all the applications for such grants were received by the Ministry through the State Nodal Agencies. These applications were then centrally processed and grants disbursed directly by the Ministry. From 2007-08, the receipt of applications, their appraisal, calculation of grant eligibility as well as disbursement of funds has been completely decentralized. Under the new procedure, an entrepreneur or applicant can file an application

with the neighborhood Bank branch or Financial Intuition (FI). The Bank or FIs would then appraise the application and calculate the eligible grant amount as per the detailed guideline given to them by the Ministry. The Banks and FIs appraise the project and its recommendation for the release of grant is transmitted to the Ministry through an e-portal established for this purpose. After the recommendation and requisite documents are received from the Bank or FIs, the Ministry sanctions the grant and transfers the funds through the e-portal itself. This has resulted in a faster sanction procedure and enlarged the outreach of the Scheme.

6.18 In the Eleventh Five Year Plan, a total allocation of Rs. 600 crore was provided. The Ministry has utilized almost the entire budget allocated under this scheme (excluding NERegion) and has assisted 3229 Food Processing Units during the Eleventh Plan. This scheme has added a huge capacity to the food processing industry which in turn has resulted in significant reduction of wastages. The Scheme has since been transferred to the states with the launching of National Mission on Food Processing (NMFP) on 1.4.2012.

Quality Assurance, Codex Standards and Research and Development and Promotional Activities

6.19 In the global market today, quality and food safety gives a competitive edge which is an important factor for the enterprises producing processed foods and providing services. Apart from domestic standards for food products, processes and management practices, Codex prescribes international standards for safety and quality of food as well as codes of good manufacturing practices, which are accepted worldwide. Further, equal emphasis is required to be accorded to R&D activities for the development of innovative products, cost effective processes and efficient technologies for the food processing sector. The scheme for Food Safety Codex and R&D has been successful in making a dent in this area in the country.

Box 6.1: Components of Food Safety Schemes

(i) Setting up/Up gradation of Food Testing Laboratories (29 projects assisted in XI Plan).

(ii) Implementation of HACCP/ISO/GMP/ GHP/Safety Management system in food processing units (maximum grant Rs 15.00 Lakhs/Rs 20.00 Lakhs per project in general area/difficult area, respectively). (20 Projects assisted in XI Plan).

(iii) Research & Development in Food Processing Sector. (50 projects assisted in XI Plan). In order to promote R&D activities, the Ministry of Food Processing through FICCI is holding regular Workshops for bringing together experts who are involved in research, development, and innovation in food products and technologies, with the aim of industry-academia collaboration on best practices in open innovation, product design and commercialization

Human Resource Development

6.20 The human resource development is very critical for sustained growth in the sector. Extensive training and entrepreneurship development is given top priority. (Box 6.2)

Box 6.2: Human Resource Development in Food Processing Sector

i. Creation of infrastructural facilities for running degree/diploma courses in food processing (maximum grant Rs. 75.00 lakh per project). (34 projects approved in XI Plan).

ii. Entrepreneurship Development Programmes (EDP) (maximum grant Rs. 2.00 lakh per Programme) (994 EDPs assisted during 11th Plan).

iii. Setting up of Food Processing Training Centres (FPTC) (maximum grant Rs. 4.00 lakh/Rs. 15.00 lakh per project for single line/multi line products). (159 Centres assisted in XI Plan).

iv. Training at recognized national/state-level institutes, etc. sponsored by MOFPI or other training programme.

Strengthening of Institutions

Indian Institute of Crop Processing Technology (IICPT) - A National Institute with International Repute

6.21 Indian Institute of Crop Processing Technology (IICPT) formerly known as Paddy Processing Research Centre (PPRC), Thanjavur is an autonomous organization under the administrative control of MOFPI. It has been in existence for the last three decades. As other commodities such as millets, pulses and oil seeds are gaining importance; it was decided in 2001 to expand the mandate of this Institute to include the above commodities also. In the Budget Speech of 2006-07, the Hon'ble Union Finance Minister announced the intention of the Government to upgrade PPRC to a National Institute. The institute is being upgraded to a national level institute at a cost of Rs 88.49 crores.

Box 6.3: Achievements of IICPT

- IICPT has created World Class NABL Accredited Food Testing Laboratory and High-tech research laboratories viz. Food Microbiology Laboratory, Food Product & Development Laboratory,Food Packaging & Storage Laboratory and State of the art teaching laboratories
- A Hi-tech, state of the art food processing incubation cum training center with sales outlet has been created. Equipments and machinery are given on rental basis to stake holders.
- The Institute began offering formal degree courses at bachelors, masters and doctoral levels in food process engineering from 2009-10 academic years. In B. Tech program 40 students are admitted every year, 10 students in students in the M. Tech program and 5 in the Ph. D programs.
- The Institute has signed MOUs with 12 National and 10 International Institutions so far that include University of Nebraska, Colorado State University, McGill University andIllionois Institute of Technology, Chicago.
- In the last 3+ year IICPT organized 25 National and 3 International Seminars/Conferences/ Workshops, 25 Food Processing Expos, 276 Training Programs, 300+ Outreach Activities.

National Meat and Poultry Processing Board (NMPPB)

6.22 The Government of India established the National Meat and Poultry Processing Board on 19 Feb 2009. The Board is an autonomous body and would initially be funded by the Government of India for 2 years and would be managed by the industry itself. This industry-driven institution has been launched to work as a National hub for addressing all key issues related to the Meat and Poultry processing sector for its systematic and proper development. The Board serves as a single window service provider for producers, manufacturers and exporters of meat and meat products, for promoting the meat industry as a whole.

Box 6.4 : Achievements of the NMPPB

- The Board has setup a Food Testing Laboratory at New Delhi. The Laboratory is equipped with modern equipments to carry out physio-chemical analysis of food, water and any organic samples.
- The Board has so far conducted over 43 training Programme in the year 2010-11 and 32 training programmes in the year 2011-12 around the country to train Butchers, Meat Workers & Supervisors.
- The Board has organized 9 Industry meets viz. at Meerut, Kanpur, Aligarh, Moradabad, Agra, Kochi, Kolkata, Murshidabad and Hyderabad.
- NMPPB has organized first, second, third and fourth "Mayor's Conference" on June 07, 2011, November 02, 2011, January 17-18, 2012, at New Delhi and on 5th and 6th October 2012 at Ahmednagarrespectively. The objective of the Conference is to make the Mayors, Municipal Commissioners and other Government officials aware of the hygienic and safe techniques of production, processing and sale of meat and poultry products for domestic consumption.

Indian Grape Processing Board

6.23 The Union Government in 2009 gave its approval for the establishment of the Indian Grape Processing Board (IGPB) at Pune, Maharashtra which is close to the principal grape growing and processing areas in the country.

Box 6.5: Functions and Objectives of the IGPB

- To focus on Research & Development, Extension, and Quality upgradation, market research and information, domestic and international promotion of Indian wine.
- To foster sustainable development of Indian Wine Industry
- To formulate a vision and action plan for the growth of Indian Wine Sector including research and development for quality upgradation in new technologies/processes.

6.24 During three years of its existence, the Board has focused on the promotion of "Wines of India" in the domestic as well as international market by participating in important and relevant exhibitions, fairs, consumer awareness & training programmes, undertaking advocacy work with the various state governments/central ministries on various issues related to taxes/levies and promotion aspects.

6.25 IGPB is going to implement a traceability programme "wine-net" for standards and quality in wine sector. The board has also successfully conducted its election to the new executive committee in February 2012.

National Institute of Food Technology, Entrepreneurship & Management (NIFTEM)

6.26 For developing a vibrant food processing sector, India needs not only world-class food technologists to undertake R&D in frontier areas, develop new products, processes, technologies and machineries, set food standards and protocol testing, but also business leaders & managers well versed with the requisite mix of food technologies, management and entrepreneurship who can exploit major opportunities in the expanding global food trade.

6.27 In the emerging global scenario, there was a need for setting up of an institution of global excellence, which could cater to the needs of the booming food processing sector , various stakeholders such as entrepreneurs, industry, exporters, policy makers, Government and other research institutions. NIFTEM was conceived by MOFPI to create an international Center of Excellence in the field of Food Sciences & Food Technology. NIFTEM will grow into an apex world class Institute to promote cooperation and networking among existing institutions both within the country and International bodies. It has been set up to achieve the above objectives. The Institute will offer high quality educational, research and management programme specific to the food industry, provide referral advise on food standards, disseminate knowledge on the food sector and provide business incubation facility.

6.28 On 31st August, 2006 Government had approved setting up of NIFTEM at Kundli, Sonipat (Haryana) at a cost of Rs.244.60 crore. NIFTEM has acquired 100 acres of land from HSIIDC at a cost of Rs. 36.10crore. In April, 2011 Government has approved the revision of the cost estimates to Rs.479.94 crore.

Mandate of NIFTEM

6.29 NIFTEM would work as Sector Promotion Organization of the food processing sector. Major objectives of NIFTEM drawn from its mandate are:

- Working as a 'One Stop Solution Provider' to all the problems of the sector.
- Working for Skill Development and Entrepreneurship Development for the sector.
- Facilitating business incubation services with its ultra-modern pilot plant for processing of fruits and vegetables, dairy, meat and grain processing.
- Conducting Frontier Area Research for development of the Sector.
- Developing world class managerial talent with advanced knowhow in food science and technology.
- Providing intellectual backing for regulations which will govern food

safety and quality and at the same time foster innovation.

- Functioning as a knowledge repository in food processing domain such as product information, production and processing technology, market trends, safety and quality standards, management practices among others.
- Working for up gradation of SME food processing clusters.

6.30 NIFTEM has signed an MOU with Wageningen University, The Netherlands on 08.11.2011 on mutual cooperation in the field of faculty/students exchange programme, research and other subjects of common interest. It has signed an MOU with Kansas State University, USA on 29.08.2012 on mutual cooperation in the field of faculty/students exchange Programme, research and other subjects of common interest. So far NIFTEM has conducted 19 Short Term Training Programmes from July, 2011 to October, 2012. The process of conducting such short term programmes is on. The Institute has commenced first academic session with B. Tech. (Food Technology & Management) and M. Tech. (Food Technology & Management) w. e.f. 16.08.2012.

National Mission on Food Processing (NMFP)

6.31 India enjoys a competitive advantage in Food Processing sector given its huge production base of a number of agricultural, dairy, fishing and horticultural items. To ensure that this sector gets the stimulus it deserves, Ministry of Food Processing Industries (MOFPI)has been implementing a number of schemes for Infrastructure development, technology up-gradation & modernization, human resources development and R&D in the Food Processing Sector. In the context of the 12th Five Year Plan, it is felt that there is a need to decentralise the implementation of schemes through involvement of the states/UTs for better outreach, supervision, monitoring and ensuring job creation. Accordingly, National Mission on Food Processing(NMFP) was launched as a centrally sponsored scheme on 1st April, 2012.

6.32 Besides continuing existing components/ schemes such as Technology Up-gradation/ Establishment/Modernisation of Food Processing Industries, Cold Chain, Value Addition and Preservation Infrastructure for Non-Horticultural Products, Modernization of Abattoirs, Human Resource Development (HRD), Creation of Infrastructure Facilities for Running Degree/Diploma/Certificate Courses in Food Processing Technology, Entrepreneurship Development Program (EDP), Food Processing Training Centre (FPTC), Promotional Activities, Organizing Seminar/Workshops, Conducting Studies/Surveys, Support to Exhibitions/ Fairs, Advertisement & Publicity etc., the new Components/Schemes proposed during the 12th Plan are Creating Primary Processing Centres/ Collection Centres in Rural Areas, Modernization of Meat Shops and Reefer vans.

Funding Pattern

6.33 NMFP is implemented as a new centrally sponsored scheme with financial contribution of Government of India and States/UTs in the ratio of 75:25, except for North Eastern States, where the ratio is 90:10. Further, in UTs administered by Government of India it is funded 100% by Government of India. This funding pattern is applicable to all components of the scheme.

6.34 The NMFP contemplates establishment of a National Mission as well as corresponding Missions in the State and District level. The proposed structure would be a three-tier structure at National, State and District levels. However, States would be at freedom to have mission structure at District levels or otherwise. Funds are to be transferred to the State Governments for implementation of the schemes through the State Missions. State Governments would be given flexibility so that the schemes can be tailored to the different requirements of different regions in the country.

Challenges

6.35 The most important challenges among others in the sector include avoidance of the significant wastage at every level and in value addition. High food inflation, high post-harvest wastage particularly in fruits and vegetables, low level of processing etc are the main challenges in the food processing sector. Addressing these core concerns by reducing wastage of food, increasing shelf life and enhancing value of agricultural produce are some of the objectives of the food processing industry. In terms of employment, the contribution of the sector is significant. According to the latest Annual Survey of Industries (ASI) for 2010-11 (Provisional Results), the total number of persons employed in the food processing sector was about 16.75 lakhs. The National Manufacturing Policy announced on 4th November 2011 seeks to give special attention to food processing industries to ensure job creation. To promote industrial growth along with the objective of inclusive growth the food processing sector will get higher attention from the Government.

The Way Forward

6.36 MoFPI incurred an expenditure of Rs 1596 crore on infrastructure and related projects during XI plan which comes to around Rs 319 crore per annum. Given the need for wastage reduction, value addition and the high employment potential of the sector, there is a need to substantially step up the allocations given the importance of the sector in terms of its contribution to the economy. There is also a need for greater involvement of state governments for better outreach, supervision and monitoring. Keeping this in view, government has already launched centrally sponsored National Mission on Food Processing on 1.4.2012. There is a need for greater emphasis on creation of infrastructure with full participation of state governments and private sector. The main infrastructure schemes are for setting up Food Parks and Cold Chains are at present closed ended. This should be open ended permitting the Ministry to fund all the viable projects proposals received under these schemes rather than limiting the number of projects.

CHAPTER 7

Agricultural Research and Education

Natural Resource Management

7.1 The Indian Council of Agricultural Research is engaged in developing technologies for conservation, management and sustainable utilization of the natural resources to ensure food, nutritional and environmental security in the country. The research programmes are being carried out within the perspective of different themes, viz; Soil Inventory and Characterization, Soil-Water-Nutrient Management, Watershed Management, Resource Conservation Technologies, Cropping/farming System, Agroforestry including Bio fuel Crops and Climate Change on agriculture. Several location specific cost effective NRM technologies (suiting soil and climate) like crop diversification, resource conservation technologies (zero tillage, bed planting, laser leveling, SRI), soil reclamation/ amelioration measures, integrated soil-water-nutrient management, water harvesting and conservation, participatory watershed models, micro irrigation, integrated farming system and agroforestry models etc have been developed to boost agricultural production and productivity in the country.

7.2 Extension activities based on NRM technologies are being popularized among the farmers throughout the country through IVLP programme, KVKs, State extension agencies etc. Also conducting Front Line Demonstrations (FLDs) on relevant technologies, imparting trainings to farmers, Subject Matter Specialists of *Krishi Vigyan Kendras* (KVKs), State Line Departments/NGOs etc.; publishing popular articles and technical bulletins in local languages and organizing regional workshops etc.

7.3 Several NRM technologies like water harvesting and recycling, construction/ renovation of water bodies, watershed management, agroforestry/afforestation, vermicomposting/enriched composting etc, are being taken up under MGNREGA for generation of rural livelihoods through creation of employment generation. An extensive programme on 'More crop and income per drop of water " under central scheme on 'Participatory Action Research Programme' (FPRAP) funded by Ministry of Water Resources in participatory mode was under operation for the conservation and better utilization of rain water in rainfed areas. During 1st phase (2009-11), the technologies for improving water use efficiency were demonstrated in 7 districts (Balangir, Kalahandi, Sonepur, Boudh, Ganjam, Jagatsingpur, Kendrapara) of Odisha on 478 farmers' fields covering 160 ha area and during second phase (2011-12) in 5 districts (Balasore, Mayurbhanj, Dhenkanal, Puri and Khurda) at 100 locations covering 5 agro-climatic zones in Odisha. Also organised 22 one-day farmers' trainings (2040 farmers) during 2009-2012. A special programme on scaling up of water productivity in Agriculture for livelihood through teaching cum demonstration has also been taken up during XI Plan period and 101724 farmers and 5824 trainers were trained all over the country.

7.4 The Council is strengthening its mechanisms of agro-advisories by setting up of Automatic Weather Stations (AWS) in KVKs located in 100 vulnerable districts under National Initiative on Climate Resilient Agriculture (NICRA). Yet another 150 AWS has been planned for the XII Plan. The ICAR is preparing district level contingency plans (300 districts completed) to provide an action plan to the states in event of extreme climatic events like drought, floods, heat & cold wave. During 2011-12, 67 farmers' awareness programme and 41 trainers' training programme have been organized under NICRA. A District Level Atlas of Climate Change Vulnerability for the entire country for prioritizing investments in R&D during XII Plan for climate resilient agriculture have been finalized.

7.5 To address future challenges, sustainable management of natural resources is vital as agricultural development with positive growth

and long term sustainability cannot thrive on a deteriorating natural resource base. Confronted with widespread land degradation, ground water imbalances, impaired soil health and contamination of food and environmental pollution etc., the situation is getting further compounded with the recent climate change impacts on agriculture. To have a holistic solution to these emerging problems, the ICAR has set priority research on abiotic stress management (droughts, cold waves, floods, salinity , alkalinity, acidity and nutritional disorders etc), climate resilient agriculture, conservation agriculture including organic farming, bio-industrial watersheds, solid waste management, utilization of waste/poor quality water and applications of nanotechnology to enhance nutrient and water use efficiency and development of bio-censors for soil quality assessment etc.

Challenges

7.6 **Land Degradation:** Major problems are loss of fertile soil and siltation of reservoirs and rivers. Challenges lie in rehabilitation of degraded land. ICAR institutes involved in research on the above are CSWCRTI, Lucknow, CAZRI, Jodhpur, NBSSLUP, Nagpur and NRCAF Jhansi.

7.7 **Deterioration of Soil Health**: Emergence of multi-nutrient deficiencies, low nutrient use efficiencies and nutrient response ratios are the major problems which can be resolved through enhancement of higher soil and crop productivity. IISS, Bhopal including AICRPs on STCR, MSN, LTFE and Network on Biofertilizers are involved in countering this challenge.

7.8 **Low farm productivity & Profitability of Small Land Holdings:** Resource poor farmers with lack of irrigation facilities, low input use efficiencies are encouraged to implement methods for developing IFS for Enhancing productivity, profitability and livelihood for small & marginal farmers. PDFSR, Modipuram; ICAR- RCNEH, Barapani; ICAR- RCGOA; ICAR RCER Patna; CRIDA Hyderabad; CAZRI Jodhpur, ICAR RC Goa, NRCAF Jhansi, AICRP on IFS and Network on organic farming are engaged in this endeavor.

7.9 **Low Water Productivity:** challenges of low water use and irrigation efficiency, decline in water table, secondary salinization, contamination of ground water are met by augmenting water productivity through IWM, ground water recharge, multiple use of water and use of poor quality water. DWM, Bhubaneswar including AICRPs on Water Management and Ground water utilization, CSSRI, Karnal, ICAR RCER Patna; Project on Scaling up of water productivity are involved in research in this area..

7.10 **Productivity of Rainfed/Dryland Agriculture:** High risk farming due to low and erratic rainfall, resource degradation are mitigated through enhancing productivity through alternate agriculture, supplementary irrigation, judicious use of various inputs and stress tolerant cultivars. CRIDA Hyderabad, including AICRPs on Agro-metrology, Dryland farming, CAZRI Jodhpur, NRCAF Jhansi including AICRP on Agroforestry, CAZRI Jodhpur are the major centres involved in this research aspect.

7.11 **Declining Factor Productivity of Intensive Agriculture:** Indiscriminate and imbalance use of inputs are countered by sustaining higher agriculture productivity through conservation agriculture. PDFSR, Modipuram and DWSR Jabalpur are addressing this challenge.

7.12 **Impact of Climate Change on Agriculture:** Untimely/delayed rainfall, heat & cold waves, cyclone, Tsunami and other forces of nature are creating increasing challenges for existent agricultural practices. The way towards meeting these challenges by developing appropriate technologies for climate resilient agriculture are undertaken through Contingent Plans and Agro-advisories by CRIDA Hyderabad and NICRA project.

7.13 **Abiotic Stresses**: Droughts, water logging, salinity, alkalinity, acidity and nutritional disorders etc are being addressed by developing viable technologies for abiotic stress management. At the new institute NIASM Baramati, CSSRI Karnal and CRIDA Hyderabad.

Box 7.1: Multiple use of water for increasing water productivity – a Case study

Multiple use of water in the water harvesting structures in terms of pisciculture in the pond, on-dyke horticulture, vegetable cultivation, poultry farming and honey bee culture on participatory basis in Dhenkanal district of Orissa showed positive impact on rural livelihood. The yield of paddy within the command area was enhanced by 120 % in comparison to 2.2 Mg/ha outside the command area. The benefit cost ratio of the system was 1.52 and overall water productivity of the system was enhanced by 136 % over the farmers' practices of 3.3 Rs/m^3 water.

Multiple use of water in water harvesting structure

Box 7.2: Rapeseed mustard in rice fallow in Manipur - A success story

Cropping intensity of Rice-fallow system in Manipur could be increased by introducing zero till rapeseed cultivation (M-27) in rabi using residual soil moisture. During 2009-2010, a total area of 40 ha was covered under zero tillage rapeseed cultivation by 100 farm families followed by 165 farm families in 65 ha during 2010-2011, yielding 7.1 to 10.80 q/ha.

Rapeseed mustard in rice fallow in Manipur

Crop Science

7.14 The All India Coordinated Research Projects and various institutes of the ICAR strived to develop new crop varieties which had specific traits that improve yield and nutritional quality and form part of the food security mission of the country. These crop varieties along with crop production technology for their cultivation had inherent tolerance to various key pests and diseases. The tolerance to drought, salinity and acidity/alkalinity of soils was also imparted in many of them.

Crop Variety Development

7.15 Five wheat varieties, viz., **Pusa Suketi** (HS 507) for timely sown, irrigated and rain fed condition of Northern Hills Zone, **Pusa Prachi** (HI 1563) for high fertility, irrigated, late sown conditions of North Eastern Plains Zone (Eastern U.P., Bihar, Jharkhand, plains of West Bengal and North-Eastern States), **Pusa Gaurav** (HI 8691) for high fertility, irrigated, timely sown conditions of Madhya Pradesh, **Pusa Basant** (HD 2985) for cultivation under late and very late sown conditions of North Eastern Plains Zone (NEPZ), **Pusa Bahar** (HD 2967) for cultivation under conditions of rainfed and restricted irrigation in Peninsular Zone (PZ) and **HD 3043** for restricted irrigated conditions of North Western Plains Zone (NWPZ) have been released and notified during 2012. Their seed multiplication and breeders seed production of these six varieties are taken up.

7.16 Single cross **maize hybrid 17l** with yellow, semi-dent grain with 21.93% for cultivation in Zone-I (Uttarakhand, Himachal Pradesh, Jammu & Kashmir and North Eastern Hill region) was released. **Vivek Maize Hybrid 39**, single cross, extra-early (85-90 days) for cultivation in Uttarakhand, Himachal Pradesh, Jammu & Kashmir and North Eastern Hill region with yellow, semi-flint grain; **Vivek Maize Hybrid 43**, extra-early maturing (85-90 days), eastern Uttar Pradesh and eastern states and in Central Western India have been notified for cultivation.

7.17 Improvement of the elite Basmati was continued to attain specific characteristics that are in global demand.

7.18 Moderately wilt resistant **Pusa 5023** *Kabuli* Chickpea, early maturing (135-140 days) variety for Delhi state and NCR region extra bold seeded (50g for 100 seeds), yield 2.5 t/ha, high protein and good hydration capacity and thus easy to cook; moderately wilt resistant **Pusa 5028**, for Delhi state and NCR region, first *desi* extra bold variety (41g for 100 seed), yield of 2.7t/ha, early maturing variety (135-140 days), large brown bold seeds having high protein content and is fast to cook with faster hydration capacity.

7.19 VL Masoor 514, moderately resistant to wilt and rust diseases, for rainfed hills of Uttarakhand, bold seeded (100 seed weight 3.05 g), brown seed coat with minute spots and globose flat seeded 21.13% protein content. **VL Masoor 133** Small seeded variety of lentil having 22.28% higher yield over VL Masoor 125 and 27.12% over PL 05 over three years of testing in Uttarakhand hills under organic conditions. It has 24.06% protein content, and was found resistant to wilt and moderately rust diseases.

7.20 High-yielding medium-tall field pea variety, **VL Matar 47** with 142-155 days maturity, for timely sown rainfed areas of Uttarakhand hills with 21.04% protein content and resistant to powdery mildew and moderately resistant to rust diseases. **Vivek Matar 11**, the garden pea variety, attractive long green curved pods with high number of sweet and bold seeds per pod and highly resistant to powdery mildew, 132-155 days maturity, suitable for cultivation in Uttarakhand hills and also for Himachal Pradesh and Jammu & Kashmir.

7.21 Mustard varieties such as **Pusa Mustard 26** (NPJ 113) with an yield of 1.6 t/ha, matures in 126 days, 37.6% oil in seeds and is tolerant to high temperatures and salinity; for multiple cropping systems particularly in rice and cotton belts of Eastern UP and Eastern states of the country and Central Western India; **Pusa Mustard 27** (EJ 17) matures in 118 days with seed yield of 1.53 t/ lha and 41.7% oil, moderately tolerant to high temperatures at seedling as well as maturity stage. It is suitable for multiple cropping systems and can successfully fit in between the harvest of *kharif* crops and sowing of wheat, vegetables and sugarcane. It is a good substitute for *toria* crop. **Pusa Mustard 28** (NPJ-124) matures in 107 days, yield 1.99 t/ha, 41.5% oil and possesses high temperature tolerance at seedling and grain filling stage. It fits well in multiple cropping systems. The work on '00' lines in *Brassica* and low glucosinolate content is in progress.

7.22 A total of 36 national explorations were undertaken in 15 states and 2,713 accessions, including 570 of wild species, were collected. In the National Herbarium of Cultivated Plants, 321 herbarium specimens were added, making specimens' holdings total to 20,560. Germplasm for long-term storage to the National Genebank comprised 4,302 accessions of the orthodox seed-species, 24 cryo-stored non-orthodox species, and 29 added to *in- vitro* Genebank. A total of 10,334 accessions were characterized and evaluated. Two high-protein rice cultivars (crude grain protein content, 15-16.41%),ARC 10063 and ARC 10075, identified from the stock of Asom Rice Collections of the CRRI Rice Gene Bank have been found to have an additional slow moving globulin band. Three glutelin bands are highly expressed in the high protein cultivars. They showed higher activity of Nitrate Reductase (NR) and Glutamic Dehydrogenase (GDH) at seedling (one-week-old) and maximum tillering stages (three-week-old). Forty-one clones of *Saccharum spontaneum*, *Erianthus rufipilus, E. elephantinus* and *E. arundinaceus* were collected from West Bengal. *S. spontaneum* clones were assembled from different habitats and also from many morphotypes, excepting very tall types. *S. spontaneum* accession IND101568 collected from the hill slope at 1,270 msl near Kurseong is with thick cane and broad leaves.

7.23 Microbial Genomic Resource Repository possesses a total of 1,231 genomic DNA isolates from bacterial, fungal, cyanobacterial and actinomycetes cultures; 64 different cloning, gene-silencing, Expression vectors and 92 gene sequences. In addition to this, 188 environmental samples, 6720 clones from genomic library of *Mesorhizobium cicero* Ca 181 strain and different strains of *E. coli* competent cells(DH5a, XL1 Blue, JM107, JM109) and *Agrobacterium* spp. have been preserved.

7.24 During the current year, 623 tonnes of nucleus seed, 13038 tonnes of breeder seed, 10120 tonne of foundation seed, 13084 tonnes of certified seed and 25141 tonnes of truthfully labelled seeds were produced. Under the participatory seed production programme 142 tons of quality seed of different wheat varieties were produced. Besides, 5240 tons, 396 lakhs of planting material and 0.38 lakh of tissue culture plants of field crops were produced. The hybrid seed production technology for the first-ever Indian mustard hybrid NRC *Sankar Sarson* (NRCHB 506) has been standardized and seed yield of 2.4tonnes/ ha could be produced.

7.25 Many invasive pest species were a threat to the country. Preparedness for the invasion of Ug99 strain of black rust of wheat is complete by introducing resistant genes into all the cultivated wheat varieties for north-western plain zone in addition to that in peninsular zone. Yellow rust monitoring and management could reduce its impact, in spite of its presence in certain pockets. Cotton leaf roll dwarf virus (CLRDV) of Luteovirideae family was identified for the first time in Haryana and parts of Punjab. Eucalyptus gall wasp, *Leptocybe invasa* was accidentally introduced into India, and is a serious pest on eucalyptus, threatening Indian paper industry. Parasitoids *Quadrastichus mendeli* and *Selitrichodes kryceri* (Eulophidae: Hymenoptera) were imported from Israel for its biocontrol. *Q. mendeli* could be established in all released areas of eucalyptus plantations in Karnataka, Andhra Pradesh, Odisha, Gujarat, Haryana and Punjab. The mitigation of Papaya mealy bug invasion using the introduced exotic insect parasitoids as well as those native ones have come up in huge population due to conservation of agri-biodiversity was complete in all the seven affected states. The impact of utilization of the exotic parasitoids of Papaya mealy bug in the last two years, making the nation to save about Rs 1500 crores by avoiding severe crop loss due to this invasive pest. Accelerate pulse production programme of the government was ably supported by effective surveillance and electronic reporting so as to contain them at initiation itself.. Integrated pest management using new generation chemical synthetic pesticides along with biological control agents (insects, nematodes, microbial pathogens and antagonists) have provided support to the nation in achieving the targeted food and commodity production.

7.26 National Institute on Biotic Stress Management at Raipur, Chhattisgarh and Indian Institute of Agricultural Biotechnology at Ranchi, Jharkhand are approved by the government the plan and would be launched during this plan period.

7.27 A winnower cum grader for threshed paddy crop has been designed and fabricated and mounted on castor wheels to make it movable. Provision has been made for control of feed rate and air-flow depending on the impurity level in the harvested crop, so as to improve its cleaning efficiency. Its performance has bee standardised.

7.28 A seed drill for sowing *berseem* seeds was developed using fine fluted roller for metering of *berseem* seeds. Spring loaded tines were used to open furrow for sowing the seeds. The seed rate for *berseem* seed was variable in the range of 4 to 30 kg/ha. Depth of sowing was controlled by the hydraulic device of the tractor.

7.29 Small sized manually operated cotton planter was developed for planting cotton seed and an adjustable cultivator was designed and developed for intercultural operation for narrow spaced cotton crop and a fertilizer applicator has been modified for equal distribution of fertilizer from both tubes. Field efficiency of manually operated small hand picker varied from 56 % to 100 % of the human labour.

7.30 In order to mechanize this labour intensive operation, a tractor operated paired row sugarcane cutter planter was designed and developed at Indian Institute of Sugarcane Research. With the help of this equipment, all the operations involved in cane planting were accomplished in a single pass of the equipment. The novel feature of the newly developed planter is its sett cutting mechanism. This mechanism facilitates free fall of the cut setts without gaps.

7.31 Irrigation scheduling is one of the activities that aim at effective and efficient utilization of water. In most of the farmers' fields in India, irrigation scheduling based on soil moisture is not in practice. A simple and farmer-friendly electronic soil moisture-indicating gadget which has been named as 'Soil Moisture Indicator (SMI)' is developed.

7.32 Research for tribal and hill region caters to the agricultural research needs of the north-western Himalayan states of Uttarakhand, Himachal Pradesh and Jammu & Kashmir. Cold tolerant phosphate solubilizing bacteria RT5RP2 and RT6RP were isolated from rhizoplane of wild grass grown at 3100 & 3800 msl, respectively. Eight cold tolerant bacterial strains have been selected among the twelve elite strains for the development of eight bacterial consortia were developed.

7.33 Two patents, an improved process for the enrichment of *babchi* drug from seeds of *Psoralea corylifolia*, and the other process enabling simultaneous detection of transgene 5-enol pyruvylshikimate-3-phosphate synthase (*cp4epsps*) gene and CaMV 35S promoter in maize utilizing novel primers in multiplex PCR, have been granted.

Challenges

Efficiency of Natural Resource Utilization for Optimized Cost of Production

7.34 Responsive crop varieties to enhance resource utilization efficiency is the major option for reducing cost of cultivation. Indigenous on farm resources along with application of soil-test based nutrients are required to support the optimized production from such crop cultivars. The production technologies of all newly released and notified crop varieties are directed in this manner. Crop productivity is challenged by the need for quality agricultural inputs such as seeds, fertilizers and other agrochemicals. The states have to ensure the availability of quality agrochemical inputs for various agro-ecologies so as to increase crop productivity. Soils of various crop ecologies are analysed for all major, minor, secondary and micronutrients and crop varieties are grown in these to assess their demand as well as potential to yield higher than existing varieties.

Enhanced Plant Protection Tools and Techniques for Prevention of Crop Loss

7.35 RNAi technologies for management of various crop diseases including nematodes, molecular-marker assisted detection of crop resistant genes against key pests (insect/mites/diseases/nematodes etc.), exploitation of conserved agro-biodiversity to enhance food-chain linked pest suppression strategies, classical biological control by introduction of exotic natural enemies to suppress invasive pests as well as inundative biological control to reduce pests in crops are

Post-harvest Management of Commodities Including Fodder

7.36 Securing of the high crop productivity by efficient post-harvest storage of commodities and processed products of food and fodder crops is to be major priority. The ICAR has taken up research in this direction in their crop institutes.

New Initiatives

7.37 The government has approved the establishment of i) National Institute for Biotic Stress Management at Raipur (Chhattisgarh) and ii) Indian Institute for Agricultural Biotechnology at Ranchi (Jharkhand). These are being taken up in XII Plan period.

Multitier Rice-Fish–Horticulture based Farming System in Odisha

7.38 The Central Rice Research Institute, Cuttack, Odisha, has developed a viable multitier rice-fish–horticulture based farming system model of about 0.8 ha area for enhancing farm productivity and income in substantial part of 4 million ha of deep water areas (50-100 cm, maximum 150cm, of water depth) in the country,

particularly in 3 m ha areas in the eastern India. This technology includes field design and land shaping and package of practices for different components. Multitier rice-fish-horticulture based farming system can annually produce about 14-15 tonnes (t) of food crops, 1 t of fish and prawn, 0.5-0.8 t of meat, 10,000-12,000 eggs in addition to flowers and 3-5 t of animal feed from one hectare farm area. the productivity of food crops further increases to 16-17 t besides, 10-12 t of fibre/fuel wood from eighth year onwards due to addition of produce from perennial fruit crops and agro-forestry components. The net income in this system is around Rs 1,00,000/ha in the first year. This will increase to Rs 1,50,000 or more from the eighth year onwards. This is a bankable technology supported by NABARD in the state.

Soil Moisture Indicator: a Handy Device to save irrigation water

7.39 Irrigation scheduling is one of the activities that aim at effective and efficient utilization of water. In most of the farmers' fields in India, irrigation scheduling based on soil moisture is not in practice. Sugarcane Breeding Institute, Coimbatore has developed a simple and farmer-friendly electronic soil moisture-indicating gadget which has been named as 'Soil Moisture Indicator (SMI)'.

SMI - Soil Moisture Indicator

Horticulture

7.40 Horticulture research and development has made rapid strides in the last two decades in terms of increased production, productivity, availability and export of horticultural produce. In many of the states horticulture has emerged as a prime mover of economy. However production challenges have to be met which includes production for food, nutrition and health care for growing population in the scenario of declining water, land and increasing pressure of biotic and abiotic stresses.

Challenges

7.41 Genetic resource management and development of improved varieties/hybrids of fruits, vegetables, plantation crops, spices, cashew and oil palm with high production potential, biotic and abiotic resistance and export value need to be undertaken, as also standardization of techniques for rapid propagation of planting material, agro-techniques, water management, integrated plant nutrient management system and integrated disease and pest management for horticultural crops. Appropriate horticultural based cropping systems for different agro climatic areas have to be evaluated. Suitable post harvest handling, storage and processing system, product diversification and value addition have to be developed.

7.42 Major challenges include production of more for increasing population, tackling declining land and water in the environment of climate change, effective conservation of natural resources and investment of more capital for appropriate research and development.

Way Forward

7.43 Consumer preference determines the economics of flower, fruit and spice production. Therefore, there is a need to prioritize action outlining the research, development and extension, to make this sector a key driver in rural

and regional economic development. Demand for high value produce is growing both in domestic and overseas market at the same time, competition is also increasing. New changes in retailing participation of corporate sector means that retailing will depend upon strategic alliance and supply chain management. Strengthened research on impact assessment of climate change on horticultural crops using controlled environmental facilities and simulation models, analysis of past weather data and integration with productivity changes (including extreme events) is essential. Production, demand and supply of commodities, economics and trade, sensitive stages and process during crop development, diversity and dynamics of major insects, microbes and pathogens, intensification of studies on pest, disease and weather relationships etc is required. Therefore, sustainability will depend upon improving competitiveness, reducing impact on environment, quality assurance and food safety and capability of communities engaged in this sector to manage change.

Animal Science

Animal Genetic Resource Management

7.44 Whole-genome mapping of Indian water buffalo (*Bubalus bubalis*) was carried out and assembly with more than 90 GB DNA sequence data generated. 6 new breeds viz. four cattle breeds (Binjharpuri, Ghumsuri, Khariar Motu cattle) and two of buffalo breeds (Banni, Chilka buffalo) were registered . Phenotypic characterization and evaluation of hill cattle as well as Bundelkhandi goat and goats of Uttrakhand was completed so also for Spiti donkey. Genotypic characterization of Indian horse breeds and phylogenetic tree were prepared. The microsatellite genotyping of 50 individuals in each of the Bikaneri, Jaisalmeri, Kachchhi and Mewari breed was carried out and phylogenetic tree constructed.

7.45 A heat shock protein of 70 kDa (HSP70) was detected in lymphocytes of control and heat exposed broiler birds and four new proteins with molecular weight of 35, 55, 173, 189 kDa were found in heat exposed broiler birds. National FMD Virus Repository was upgraded with latest/new virus isolates and a total of 25 virus isolates were added to the repository. At present the National FMD virus Repository holds a total of 1712 isolates (O-1102, A-276, C-15 and Asia 1-319).

Animal Production

7.46 Indian Livestock Feed Portal having sequential information on livestock feeds and feeding to serve single window reference was developed. *In vitro* studies revealed that IGF-I improves progesterone production from luteal cells, thus improving embryonic survivability. Using longer wavelength lights (red spectrum) than incandescent lighting was found to improve egg production in commercial layer flocks by about 6.33%. Supplementation of protected fat to high yielding dairy cows improved milk yield (19.0lit vs 17.8 lit/cow/day), reproductive efficiency and was found to be economical to farmers. Areca sheath can be considered an alternate source of dry fodder for livestock. Improved varieties of ducks for egg purpose, integrating with aquaculture in farmers' pond and community ponds were introduced. Dietary supplementation of a combination of organic chromium (chromium picolinate) 1 mg/kg and *Spirulina* 2 g/kg was found effective in reducing egg cholesterol content by about 20%. Collection of semen from male ducks was standardized. Hen housed egg production increased up to 72 wks of age in IWN and IWP layers strains and was found to be 309.63 and 297 eggs, respectively. Out of the four new heavy crosses (HC-1, HC-2, HC-3and HC-4) developed utilizing rural and broiler germplasm, the HC-3 and HC-4 weighed 1000 and 1100g, respectively at 7 wks of age and crossed 2kg at 12 wks of age, which seemed to be promising for backyard poultry. Quality protein maize-based layer diet produced 3.3% higher egg production and recorded 4.9% improvement in feed conversion compared to normal maize in White Leghorn layer chicken.

Animal Health

7.47 Loop Assisted Amplification (LAMP) was developed for detection of FMD and *Pasteurella multocida.* PCR for amplification of OMP 31 of *Brucella* using self designed primers was

standardized and successfully used on field isolates. Real time PCR based sensitive diagnosis for several diseases has been developed. A diagnostic kit for diagnosis of *Haemonchus contortus* infection was developed. Databank on diseases was updated after suitable validation.

Post Harvest Management and Value-addition

7.48 On line system for monitoring Aflatoxin M1 in milk using spore inhibition based - enzyme substrate assay (SIB-ESA) was developed so also a simple and Rapid Method for Cholesterol Estimation in Ghee using *o*-Phthaldehyde (OPA) Reagent. Method for Cholesterol Estimation in Milk Fat using Enzymatic Diagnostic Kit was developed. Fermented Butter Milk Drinks with Enhanced Health Benefits and cheese based functional foods using oats were developed. Functional chicken meat pellets were prepared incorporating 15% levels of processed soya nuggets. The products can be safely stored till 3 months of frozen (-18 ^{o}C) storage. New meat products like mutton soup, mutton pickle and enrobed eggs from meat of sheep were developed. Goat milk and cream based biscuits containing higher amount of medium chain fatty acids were developed using pure goat milk, goat milk cream, herbs, plant fibres and grains. Cured and smoked products as restructured mutton blocks and mutton ham were developed. Value added products such as emulsion stuffed capsicum, emulsion stuffed *samosa,* emulsion *bonda* and emulsion omelet etc produced from spent hen meat. Chocolate barfi, milk peda from camel milk *mawa and* Lyophilized skim milk powder and Rasogolla by mixing camel and buffalo milk (1:1; 1.5:1 ratios) were prepared.

Technology Assessment, Refinement and Transfer

7.49 More than 1.8 lakhs chicks (day/6 weeks old) were produced and provisioned to farmers and development agencies. 1182 breeding broiler rabbits were supplied to 64 clients of Karnataka, Tamil Nadu, Kerala and Puducherry states and 837 rabbits in Rajasthan, Haryana and Punjab. More than 800 piglets were produced and provisioned to farmers and development agencies. Testing of suitable temperate grasses and legumes for highland pasture in collaboration with IGFRI, Jhansi and the State Departments of Animal Husbandry for supporting Yak Husbandry practices was initiated.

Partnership and Linkages

7.50 Full technical was extended and scientific/ laboratory support provided to the FMD Control Programme being run by the Department of Animal husbandry, Dairying and Fisheries, GOI. Diagnostic Reagents to the regional centres/ network units and vaccine manufacturing companies were produced, standardized and supplied.

Challenges

7.51 Genetic improvement and conservation of indigenous cattle and buffaloes for higher milk production are seen as major research issues so also the establishment of open nucleus herds for important indigenous breeds in their native tracts. Genomics and marker assisted selection in cattle and buffaloes, mechanization of equipments for indigenous dairy products for small scale sector, development of climate resilient housing and shelters for improved dairy production, improving buffalo productivity by assisted reproductive and biotechnology tools and specific dairy products (functional/nutraceutical/value added) are seen as future challenges. Intensive Buffalo broiler, fat lamb, goat fattening for higher meat production, backyard and small scale pig, poultry and broiler rabbit for meat production, effective disease control and health management, epidemiology and landscape genetics of infectious diseases, disease forecasting models and economic impact analysis in relation to disease control strategies, evaluation of various non-conventional feed and fodder resources including tree leaves for livestock and precision livestock farming are also issue to be addressed. Quality milk, meat, wool and other products with value addition, development of cold chain for proper biological product transport and safer food products from livestock and poultry, development of newer nutraceuticals and safer health foods and epidemiology and landscape genetics of infectious diseases, disease forecasting models and economic impact analysis in relation to disease control strategies also are to be catered to.

Way Forward

7.52 In the field of Dairy production, processing and value addition, genetic improvement and conservation of indigenous cattle and buffaloes for higher milk production, establishment of open nucleus herds for important indigenous breeds in their native tracts genomics and marker assisted selection in cattle and buffaloes, mechanization of equipments for indigenous dairy products for small scale sector, development of climate resilient housing and shelters for improved dairy production, improving buffalo productivity by assisted reproductive and biotechnology tools and specific dairy products (functional/nutraceutical/ value added) are seen as researchable areas.

New Inititatives

7.53 New Network Programmes of Brucellosis, tuberculosis, paratuberculosis and leptospirosis, neonatal mortality, emerging infectious diseases and zoonosis, clinical nutrition for management of important diseases of livestock and poultry, nutritional interventions for control of infertility and reproductive disorders in bovines and veterinary Diagnostic imaging have made a beginning.

7.54 Buffalo Genomics, Diagnostics & vaccines and value addition projects will be taken up in platform mode. A Directorate on Companion Animal Research is being initiated. Further, up-gradation/restructuring/renaming of institutes is being undertaken as under:

- Up gradation of HSADL, Bhopal to Institute of Bio-security and Agri-Defence
- Two Regional Centers for NBAGR
- Merging CARI and PD-Poultry to Institute of Poultry Sciences
- Upgradation of NRC on Pigs to Directorate on Pig Research
- Upgradation of PDC Meerut to Institute on Cattle Research
- Upgradation of PDADMAS to Indian Institute Veterinary Epidemiology and Disease Informatics
- Up gradation of Bangalore campus to Central Laboratory on FMD under administrative control of PDFMD.

Successful spread of Artificial Insemination in pig in Assam

7.55 The National Research Centre on Pig, Rani, Guwahati, Assam has developed technology for preservation of boar semen for extended period (up to 7 days at 15O C). This has been done to enable transport of semen from institute for Artificial Insemination (AI) at far away villages.

The first successful delivery of a Ghungroo sow was recorded on May 16th 2012. This happened with the birth of 13 piglets in Goskata village in Kokrajhar district of Assam, located about 220 kms from the institute. This feat was accomplished in collaboration with the KVK, Gosaigaon under Assam Agricultural University. Earlier, the institute rendered AI services within the vicinity

of 65 Km radius, producing 1448 piglets at farmers' field. The highest litter size at birth of 19 piglets was observed under field conditions. It is expected that increased number of superior piglets born out of AI will increase the income of pig farmers. The crossbred piglets produced through AI are in great demand due to their better growth rate. Recently, the Assam State Institute of Rural Development has procured AI born piglets from the villages adopted by NRC-Pig for distribution among the farmers. The AI is becoming popular among the farmers and the technology developed by NRC on Pig can be transferred to the farmers' field in collaboration with state veterinary departments, KVks and NGOs.

Athulya (ILM-1990) Layer Chickens - New Hope for Poultry Farmers

7.56 The scientists of All India Coordinated Research Project (AICRP) Unit on Poultry Breeding under Indian Council of Agricultural Research at Mannuthy, Kerala have developed high producing heat tolerant Athulya strain (ILM-90) cross of IWN and IWP lines of layer chicken with desirable egg weight at Mannuthy in coordination with Directorate on Poultry, Rajendranagar, Hyderabad. The beneficiary of these chicks could get more eggs per bird and a premium price (Rs. 4-5 more per 100 eggs) for the larger eggs laid by the hens even from the early laying period itself. The mortality was also low during the laying period.

Conservation and Propagation of Elite Murrah Germplasm Available as Champion Bulls with Farmers

7.57 Out of approximately 55 million breedable buffaloes in India, hardly 15% are bred through Artificial Insemination (AI). This requires over 100,000 bulls for natural service and 5000-6000 bulls for frozen semen production. It is difficult to find quality superior bulls to meet this demand. Genetic improvement programme warrants quality frozen semen production from genetically superior bulls and adoption of AI at large scale. Such bulls are rare, isolated and scattered in the field with few progressive farmers/NGOs and used to the limited extent with natural service in the vicinity. This poses the threat that in due course this invaluable germplasm may get deleted from the gene pool.

The Central Institute for Research on Buffaloes, Hisar undertook a novel exercise in conservation and propagation of such superior Murrah bulls through semen collection and cryopreservation. Besides obtaining history of pedigree and dam's production potential, a general examination of bull for breed characteristics and breeding soundness is made. Bulls are tested for infectious diseases and those found fit/negative are subjected to collection of semen at farmers' doorsteps. The collected semen is examined for its normalcy and is processed for freezing, tested for post-thaw evaluation and stored frozen in semen

straws. This semen is made available to farmers interested in improvement of their buffaloes. The owner is paid remuneration or half the frozen doses as per his consent. The program was started in June 2008 with a National Champion Murrah bull named 'Gholu' from village Didwadi in Panipat, Haryana. So far, the semen from the 13 elite bulls, located in various parts of Haryana and Punjab, has been collected, frozen stored and sold to farmers.

First Embryo Transfer Mithun Calf (Bharat)

7.58 World's first ever mithun calf through embryo transfer technology was born at the National Research Centre on Mithun, Jharnapani, Nagaland on March 27, 2012. Embryo transfer technology (ETT) being one of the best tools for faster multiplication of quality germplasm, the scientists were working to standardize the techniques for mithun since last five years. Mithun (*Bos frontalis*), a rare bovine of South-east Asia is mainly confined in four different States viz., Arunachal Pradesh, Nagaland, Manipur and Mizoram of North-eastern Hill region of India. Presently, the free range system of mithun rearing in its natural habitat (forest) results in inbreeding as well as crossbreeding with the local cattle, thereby resulting in loss of quality mithun germplasm. To address the issue of inbreeding and crossbreeding, the scientists of Animal Physiology section of the institute have successfully applied the Artificial Insemination (AI) technique both at farm and the field (Khonoma village of Nagaland) level and produced AI-born calves.

Fisheries

Marine Fisheries and Mariculture

7.59 In the year 2011, Marine Fisheries Census 2011 was completed. Resource map of stock structure of key species was documented. A model for chlorophyll based forecasting of fish and potential yield was completed. A National Fisheries Grid to strengthen National Marine Information System was established. Development of harvesting strategies for oceanic natural resources like tuna, large pelagics and squids was outlined. Pop up satellite tagging of yellowfin tunas for the first time was conducted in Indian waters. Adoption of combination of chumming with live bait and use of artificial lures and fresh baits and concerned efforts aimed at deep swimming tunas has resulted in increase of this fishery. Broodstock development, induced breeding and larval production of the marine finfish Cobia, *Rachycentron canadum* was achieved for the first time in India. Successful breeding and seed production of nine marine Ornamental fishes .*Amphiprion ocellaris, A. percula*, *A. sebae*, *A. nigripes, A. frenatus*, *Premnas biaculeatus, Pomacentrus ocaerulus*, *Chrysiptera cyanae* and *Dascyllus aruanus* was continued. Tissue culture technology for *in vitro* production of pearls from blacklip oyster *Pinctada margaritifera* was further developed. Large scale spat production of clams *Paphia malabarica, Meretrix meretrix, Crassostrea madrasensis and Pinctada margaritifera* was achieved in hatcheries. Open sea cage farming of seabass, cobia and lobster were demonstrated. Green Algal extract (Cadalmin™ GAe) developed and launched. This is 100% vegetarian nutraceutical from green algae for joint pains and arthritis. Green Mussel extract (GME), another nutraceutical from green mussel for joint pains was developed.

Brachishwater Aquaculture

7.60 Major achievements were the technology of sea bass breeding and culture which has been standardized and commercialized through Rajiv Gandhi Centre for Aquaculture, Myladthurai, Tamil Nadu. Another breakthrough was in breeding of pond reared Cobia, *Rachydentrum*

canadum. Seabass feed under the brand name of BHETKI AHAR has been standardized and commercialized. Breakthrough in breeding of pond reared Cobia, *Rachydentrum canadum.* Shrimp feed technology (Starter, grower and Finisher) for *Penaeus monodon* and *Fenneropenaeus indicus* was commercialized through M/s Bismi Feeds Ltd., Perunthottam, Tamil Nadu. Organic Shrimp farming of *Penaeus monodon with* organic inputs was also standardized for the production levels of 1.5 t/ha/crop. An immunodot blot test for WSSV "CIBA IMMUNODOT" was developed for early detection of WSS virus in shrimp. Nine patents have been applied for various diagnostic kits and methods. A molecular diagnostic kit based on reverse transcriptase polymerase chain reaction (RT-PCR) for early detection of betanodavirus, the causative agent of viral nervous necrosis (VNN) in finfish was developed.

Inland Fisheries

7.61 In 2011, digital map of inland water bodies of the country using remote sensing satellite data for the water bodies of 0.5 ha and above were completed for 7 states. Software was developed for catch estimation using visual basic and MS Access. Fish stock characterization is in progress along river Ganga, Brahmaputra and Narmada by digital truss images for morphometery and DNA sequencing. Impact of climate change in inland open waters suggest that out of 14 major river systems , four rivers are predicted to lose more than 7% of fish species under climate warming scenario as determined from the model predicted. Elevated temperature showed Indian Major Carps maturing and spawning as early as March .Isolation of nine bacterial strains resistant to and capable of degrading dichlorophenol, trichlorophenol and pentacholoropheno l(PCP) was achieved. Out of 9 strains tested, 5 were strongly degrading PCP and may have potential application in bioremediation. Three strains could be identified.

Cold water Fisheries

7.62 Development of GIS based decision support system for aquaculture in Kumaon region of Uttarakhand was completed. Assessment of Mahseer fishery resources along Assam, Himachal Pradesh, Arunachal Pradesh, Uttrakhand, Maharashtra and J&K were done using Truss network and molecular markers. Phylogenic tree of population structure of cold water fishes was constructed. Population genetic analysis and genetic variability of common and economically important Snow trout, *Salmo richardsonii* is underway. 57 microsatellite markers were developed, out of which 27 were validated in different populations. Genetically improved strain of mirror carp and Ropsa scale carp were successfully bred after 2 yrs of transplantation and release as Champa 1 and Champa 2 along hill region of Arunachal Pradesh, Sikkim and Meghalaya. Feasibility studies of growing Hungarian strain of common carp and Chocolate mahseer in hilly regions in mono and polyculture systems were conducted. Seed production of golden mahseer, *Tor putitora* was upgraded for commercialization. Water requirement for maintenance of broodstock , grow out culture of trout and exotic carps in culture system observed t 5lps water for rainbow trout and 1lps for carps were studied. 10 % of Trout stock in farms of Arunachal Pradesh and Sikkim and 2% of Mahseer stock in Uttrakhand (DCFR) were found to be infected by pathogenic fungi, *Saprolegnia parasitica* and *S. diclina.* The growth of fungi was found to be inhibited by use of extract of *Kali sarson* and lemon grass.

Fisheries Technology

7.63 The institute developed a large mesh size purse seine for small mechanized/trawl fishery and a large mesh gillnets for large pelagic for Lakshadweep. Rubber wood was introduced as alternate material for traditional craft construction. A juvenile Bycatch Excluder cum Shrimp Sorting Device (JEE-SSD) was developed. Isolation of bioactive and industrially compounds from fish and fishery wastes was achieved. Nutraceutical Oyster Peptide t (OPex) from edible oyster (*Crassostrea madrasensis*) extracted was found to have anti-inflammatory, anti-oxidant and anti-bacterial properties.Technology for control of biofilm formation by pathogenic bacteria in food processing environment was developed. Design and development of effluent treatment plants for seafood processing units was conducted. A Solar

Fish Dyers of different capacities for different products was designed. Different value added products, canned products, Vacuum packed and modified atmospheric packed steaks was developed.

Fish Genetic Resources

7.64 The database on 2358 indigenous finfishes with respect to their taxonomic, genetic information, and biological data was developed. 'Fish Karyobank" containing information on karyomorphology, molecular markers and nucleotide sequences of selected fish species was developed. 1500 DNA Barcodes for more than 400 marine and freshwater fish species was developed. DNA Barcoding was used for forensic application to detect adulteration in fish products to resolve legal dispute. Sperm cryopreservation protocol was developed for 26 fish species and validated in 18 fish species. A tissue bank was established with over 13.000 accessions from different fish species. Live gene bank has been established in Lucknow and Guwahati. Cell lines were developed from 5 fresh water and 2 marine fish sp. Establishment of National Fish Museum was initiated. Monoclonal antibody for three commercially important fish for Sero-survellance of pathogens was achieved. *CbCystatin* in a hypoxia tolerant Indian Catfish, *Clarias batrachus* was identified.

7.65 The constraints/challenges affecting growth of sector are as under:

- Investment in deep sea fishing required as this resource is estimated to hold 7% of the marine fish resources and exploitation is insignificant so far
- Policy decision and implementation mechanism regarding deep sea fishing to be put in place by the Govt.
- Investment in Sea cage culture and simultaneous proper legislation to come into effect regarding site and number of culture units (cages) to be established along coastal belt so as not to create pollution and other legal hazards in near future
- Non availability of National multi-species brackishwater Shrimp and finfish broodstock center/hatchery. To attain production target of 4, 00,000 tones from coastal aquaculture by 2020-21 as per NFDB by horizontal expansion to 3,00,000 ha and compound growth rate of 6.13%, the sector needs research support In the formation of two specified Farms
- Absence of proper environmental flow in Indian rivers for sustenance of river ecosystem
- Near absence of proper water harvesting mechanism and water recirculatory system in hilly regions.
- Non availability of Vessel Management cell (VMC), which could look after the upkeep of departmental Vessel. A separate Vessel Management Cell (VMC) at the Institute level is needed to take care of repair and maintenance of research vessels.
- The sector needs a centre for advanced studies in policy planning and fishery management which can undertake research in social Science as livelihood, socio-economic and trade issues and act as advisory on policy planning. Development of business models and total factor productivity in fishery sector. Assist state departments of fisheries in formulation of comprehensive fisheries and aquaculture policy.

7.66 Some of the new initiatives to enhance the productivity and production of the fisheries sector are listed below:

- Demonstration of Capture based aquaculture (CBA), wherein the juveniles of wild fishes caught are reared to marketable sizes in captivity.
- The fishermen society '*Sampradayaka Meenugara Sangha, Byndoor Valaya*' of Upunda village located at Byndoor participated with the researchers from CMFRI, Mangalore in **community based** activity and earned a farm gate price of ~Rs75,000 per cage by harvesting the product during July, when the mechanized fishing is banned.

- Introduction of Banana Shrimp *Fenneropenaeus merguiensis* in Gujarat.
- Introduction of low density farming system for *Litopenaeus vannamei* as diverse candidate for Shrimp farming.
- Estimation of environmental flow for sustenance of river ecosystem.
- Population structure, migratory behavior and development of breeding protocol for Hilsa.
- Initiation of bringing medium carp, Pengba (*Oesteobrama belangeri*), endangered fish of Manipur into cultural fold.
- Successful breeding of minor carp *Labeo dero* present in foot hills, in captivity.
- Public aquarium to showcase rich fish bio-diversity established at NBFCR, Lucknow.
- Developmental of ornamental fish villages.
- National brood bank development initiated.

Box 7.3: Breeding of high value marine tropical finfish, silver pompano, *Trachinotus blochii*

Successful breeding of silver pompano can be considered as a milestone towards the development of pompano aquaculture in the country. The farming of pompano can be successfully carried out in ponds, tanks and floating sea cages. The species is able to acclimatize and grow well even at a lower salinity of about 10 ppt and hence it is suited for farming in the vast low saline and brackish waters of our country besides its potential for sea cage farming. In the Indian domestic market the current price of pompano is about Rs.200/-per kg.

Silver pompano *Trachinotus blochi*

Pompano cannulation for breeding in captivity

21-45 days fingerlings of Pompano

Box 7.4: Introduction of Trout farming in Sikkim

DCFR, Bhimtal in association with Department of Fisheries, Sikkim under the project entitled "Sustainable Utilization of Mountain Fishery Resources: A Partnership Mode"; made three (3) trout breeding units functional for production of sufficient rainbow trout seed. On farm training programme on brood stock management, seed production and transportation of green-eyed ova have been organized since last four years. Seed technology has been adopted by 199 private farmers

Brood Stock at State Trout Farm, Uttaray

during 2011-12 against only one private farmer during 2008-09. 700 more farmers are schedule to take seed production in coming years Seed thus produced will be utilized in Farms as well as for ranching in natural resources.

Breeding at Private Farm, Kuokhola

Box 7.5: Fish based production system in seasonally flooded wetlands

CIFRI implemented fish based production system in seasonally flooded wetlands of West Bengal. It suggested for stocking of 6000 fingerlings/ha with supplementary feeding in these wetlands during flood period. The practices improved the water productivity from 183 g/m32008-09 to 209 g/m^3 by 2010-11 and the fish yield from 2540 kg/ha in 2008-09 to 3771 kg/ha

Fish haul from the seasonally flooded wetland

Agricultural Engineering

Farm Mechanization and Energy Management

7.67 Farm mechanization has played a critical role in improving agricultural production as well as productivity through timeliness of field operations and by enabling proper and efficient use of inputs. A number of successful farm machineries have been developed and commercialized during the past two decades through the sustained efforts of R&D institutions and industry. However, individual ownership of farm machinery by small and marginal farmers, which constitute the core of Indian agriculture, often proves to be uneconomical, especially in operations like land preparation and harvesting. With continued shrinkage in average farm holding size, custom hiring of farm machinery is being increasingly practised. It implies the use of various improved farm tools and equipment to reduce drudgery and to enhance overall productivity and production with the lowest cost of production. The equipment and technologies developed for aiding mechanisation of Indian agriculture are given in Box 7.6.

Box 7.6: Equipment and Technologies developed for aiding Mechanisation

- Precision planter-cum-herbicide applicator
- Seed-cum-fertilizer drill for hilly regions
- Tractor-operated rear-mounted onion harvester
- Animal-drawn farmyard manure spreader
- Power-operated ribboner for jute
- Tractor-operated 7-row multi-crop planter for seed spices
- Needle type tray seeder for vegetable nursery
- Power weeder for rice SRI cultivation
- Pedal-operated maize dehusker sheller
- Power tiller-operated zero-till drill for hilly region
- Palmyra tree climber
- Hand-operated rotary areca nut peeler
- Test rig for tractor roll-over protective structures
- Solar-assisted heat pump dryer for high-value crops
- High solid biogas plant
- Peeler for dehydrated garlic flakes
- Cashew nut drum roasting machine
- Automated flyer spinning machine
- Rotating flat system for CIRCOT Minicard
- Axial Flow Cotton Pre-cleaner
- RFID Technology for Cotton Bale Tagging
- Fibre segregator machine for coconut fibres
- Digital radiography, CT and MRI
- Groundnut kernel de-skinner
- Continuous feed type Aloe vera gel extractor
- Copra drier

Challenges

7.68 Farm mechanization is an issue that requires immediate attention if the problems of human labour shortage, drudgery in farm operations, efficiency of input-use, tools and implements suited to women farm workers, and climate resilience are needed to be resolved expeditiously. The challenges ahead are mechanization for horticultural and livestock sectors, conservation agriculture, hill agriculture and site-specific input applications. Another set of challenges in farm mechanization relates to enhancing the availability of high quality farm machines through extensive manufacturing, testing, and marketing, especially, to mechanization-deficit regions.

7.69 Energy management in agriculture is another major issue. Optimization of inputs, including farm operations, should lead to minimizing the energy intensity of Indian agriculture. An important challenge is to ensure proper matching of farm implements with prime-movers for greater energy efficiency. The prime-movers themselves need to be operated optimally. Another challenge is to reduce the dependence of Indian agriculture on conventional fuels through substitution of conventional energy sources with renewable sources for long term sustainability. While the available solar technologies need to be utilized to meet energy needs in agricultural production and post harvest operations, the surplus biomass needs to be efficiently converted into biofuels to meet fuel needs of agricultural operations. Algal fuels may hold the key to making Indian agriculture energy neutral.

7.70 On-farm processing and value addition is an issue that is associated with reduction in post harvest losses and better farm income realization. The challenges include creation of infrastructure for conditioning, cleaning, grading, packaging, and storage in production catchments and transportation from production catchments to market destinations. Available technologies now permit primary and secondary processing of agricultural produce in production catchments, thereby, permitting the farm families and other rural workers to enhance their employment and income. The challenge is to adopt biorefinary approach for processing the whole agricultural produce so as to derive the maximum benefit including the environmental sustainability.

Way Forward

7.71 During the recent past, there has been a spurt in seeking engineering inputs in agriculture for reducing the cost of production, climate resilience and enhanced farm income and rural employment. Agricultural mechanization and post harvest value addition are the major engineering interventions sought by the stakeholders. Besides, the needs for equipment for efficient utilization of natural resources and energy management have also been realized. CIAE has formulated comprehensive programmes on *Farm Mechanization and Precision Farming* and *Energy Management in Agriculture*.

Expected Outcome/change in scenario

- Reduced cost of agricultural production
- Increased farm productivity
- Successful models for custom hiring, rural workshops for fabrication, repair and maintenance activities at village/cluster level.
- Increased farmers' income
- Increased cropping intensity
- Conservation of natural and input resources
- Environmental sustainability
- Greater climatic resilience of Indian agriculture
- Conservation of non renewable energy in farm operations
- Increased use of renewable energy in agriculture
- Conservation of natural and input resources
- In-house capacity created for research and human resource development
- Environmental sustainability
- Greater climatic resilience of Indian agriculture

Ongoing schemes

- Post-harvest technology for production of contamination free clean cotton and standardization of ginning process and machines
- Mechanical processing, fibre utilization and product development
- Enhancement of quality and characterization of cotton and other natural fibres, yarns and textiles.
- Use of Environment friendly agents & water, energy and chemical conserving technologies for cotton and blended textiles
- Value addition to natural fibres based biomass and byproducts
- Entrepreneurship in cotton technologies and human resource development

Success Stories

Novel Flexi Check Dam using Technical Textile

7.72 A novel flexible check dam made of rubber-textile composite has been developed for application across watersheds and small rivulets.

Flexi dams, commonly known as rubber dams are a special group of geo-system, and made from technical textiles specially prepared from tailor made textile-rubber composites as per the design need. Rubber-fabric composite has been shaped into a suitable water-proof and wrinkle-free dam structure as per the size of each check dam. A low cost inflation–deflation mechanism for the rubber dam has also been developed along with an appropriate installation method on concrete structure. It has been successfully installed at small watersheds in Odisha at five locations, and shown that control of water flow and timely storage of water by the rubber dam resulted in increased crop production by 60% in the *kharif* (monsoon), and 45% in *rabi* (winter) seasons.

Entrepreneurship on Briquetting Plant for Agro-residues

7.73 Shri Gandhi has successfully established the biomass briquetting plant (500 kg/h capacity) at Mandideep, Bhopal district under the technical guidance of CIAE, Bhopal. Presently he produces about 3000 kg biomass briquettes per day basis and sells to local industries for thermal application using agro residues such as soybean straw and pigeon pea stalk, lantana weed stalk and other such weeds. This helps in gain of additional money to farmers of nearby villages, who were otherwise burning surplus agro-residues in the field.

Intensive *kusmi* lac cultivation on *semialata* for sustained lac cultivation

7.74 Shri Santosh Nirmal Horo raised a plantation of *semialata* in an area of 0.2 ha with 2000 plants in Kharsidag village, Ranchi dist.

with technical support from IINRG, Ranchi. 35.0 kg of *kusmi* broodlac was inoculated in July 2008 on about 1264 *semialata* plants. 241 kg broodlac and 15 kg scrapedlac was harvested from 1084 plants giving an output: input ratio of 6.89. Subsequently, 40.0 kg of *kusmi* broodlac was inoculated in July on 1202 *semialata* plants. A very good crop (333 kg broodlac and 45 kg scraped lac) was harvested giving a broodlac output: input ratio of 8.325. This has improved farmers return.

Agricultural Extension

7.75 The ICAR has created a network of 630 *Krishi Vigyan Kendra to* assess, refine and demonstrate new technologies and products developed by the National Agricultural Research System (NARS). The KVKs are playing the role of intermediary institutions to fine tune the research conducted, often under controlled conditions, before its adoption in farmer's field. With the objective of developing location specific technology modules, the entire process is carried out in participatory mode involving the farmers. The process of Technology Assessment and Refinement (TAR) uses a tool known as On-Farm Trial (OFT). The major thematic areas under which OFTs were carried out in crop husbandry include for example Varietal Evaluation, Integrated Nutrient Management, Integrated Crop Management, Integrated Disease Management, Integrated Pest Management, Resource Conservation Technologies, Weed Management, Integrated Farming Systems, Post-Harvest Technology and Value Addition, Improved Tools and Farm Machinery, Seed and Planting Material Production, and Improved Storage Techniques; whereas in the case of livestock Production and Management were Disease Management, Breed Evaluation, and Nutrition Management; and while in case of other enterprises were sericulture, mushroom production, vinegar production, vermin-composting and market led extension.

7.76 Frontline demonstration (FLD) is another major mandated activity of KVKs, which aims at demonstrating the production potential of crops, livestock and other allied enterprises.

7.77 In order to create awareness among farmers and other stakeholders on improved agricultural technology, the KVKs organize large number of extension programmes like field days, exhibitions, *kisan mela*, *kisan ghosthi* and film shows, besides other extension programmes like scientists visits to farmers fields, group meetings and discussions, workshops, lectures and use of mass media for wider dissemination of farm technologies.

7.78 Kisan Mobile Advisory is another initiative in using Information and Communication Technology for dissemination of need-based and timely information to the farmers. The KVKs also conducted programmes for capacity building of farmers and extension personnel of district line departments to update their knowledge and skills and orient them on frontier areas of technological developments. The other major contributions of KVKs included: production and supply of technological products; innovative technology delivery mechanisms; following an institutional approach for technology adoption through FIGs, Farmer Clubs, etc.; special emphasis on women empowerment; production of inputs at site like

seed and planting materials; emphasis on rural entrepreneurial development like piggery rearing, low cost mushroom production, bee keeping, etc.; promotion of eco-friendly technologies like IPM, Zero tillage, etc.; and promotion of resource conservation technologies like laser leveling, agro-forestry mode, etc.

7.79 In addition to these, there are several success stories of KVKs covering paddy task force- a solution to farm labour shortage, quality protein maize, innovative approach in sericulture, sweet potato based feeding system for pig, and protected cultivation of vegetables in net-house.

Challenges

7.80 It has been observed that younger generation is not interested in taking up agricultural and allied enterprises as a livelihood option. Therefore, it is a matter of concern how to inculcate interest in agriculture and catch them young to retain in the agriculture sector. Besides, the other issues being faced are listed here under:

- Acute shortage and exorbitant prices of recommended Agro-inputs affecting the technology transfer and applications
- In the changing agricultural scenario, marketing problems are dominating over the production problems. Marketing support to farmers for primary processing, storage, grading, packing, certification, transportation etc. is equally important for successful technology transfer, adoption and benefits to farmers at large.
- KVKs are finding it difficult to up-scale the assessed and refined technologies which are found fit for adoption by farmers on large scale.
- Meeting the increasing expectations of stakeholders with the existing manpower and available infrastructure.
- Provision of uninterrupted power supply for E-connectivity and solving bandwidth problems are necessary for the use of ICTs by KVKs and other outreach programmes of NARS.
- Adequacy and continuity of staff in KVKs is emerging as a bottleneck to sustained progress.

Way Forward

7.81 The important measures that needs to be strengthen KVKs are:

- Strengthening communication and knowledge sharing through establishment and maintenance of technology museums, mobile field services, village adoption programmes, farmer field schools, Tele-Advisory services, online agri video channel, SMS based agri-advisory service, information kiosks, disaster management interventions, organising exhibitions, field days, exposure visits, etc.
- Strengthening KVKs with provision of additional subject matter specialists in the field of agri-business management, conservation agriculture, agricultural processing and value addition and knowledge management.
- Provision of additional building, laboratory facilities and demonstration units as per emerging requirements.
- Strengthen media and e-resources through publications such as newsletters, books, manuals, leaflets, brochures, technology hand outs, etc., media coverage of extension programmes, development of cyber extension platforms and extension portal, content development cyber extension, production of audio visual and interactive aids, etc.
- Strengthening market intelligence, EDP and consultation through EDP packages, project report preparations and consultancies, industry and enterprise relations and partnership, establishing local market network on prices, establishing value chain demonstration units, etc.
- Strengthening continuing education programmes through open and distance

learning for farmers and entrepreneurs with online courses, conducting certificate courses for farmers, entrepreneurs, input dealers, extension agencies, etc.

- Strengthening the monitoring and coordination mechanism of KVKs by establishing more number of Zonal Project Directorates and Zonal Scientific Advisory Panels.
- Impact assessment of KVK activities on regular basis so that necessary changes can be made in the ongoing programmes for the benefit of farming community.

Agricultural Education

7.82 **Niche Area of Excellence (NAE):** This programme is aimed at creating global competitiveness in agricultural education and research through excellence in teaching, research, consultancy and other services in specific field. Financial support to 30 ongoing sub-programmes was provided in the year 211-12 and 20 new Niche Area of Excellence were sanctioned in the year 2011-12.

7.83 Some of the important initiatives/main highlights being undertaken are as under:

- In the centre on *Integrated Centre for Drought Resistance and Management : Genetic Engineering for Developing Crops-resistant to Drought*, seven genes for protein turnover and folding, 8 transcriptional activators and 8 genes related to oxidative stress have been validated. Novel genes have been characterized and technology for creating double haploids has been developed.
- Under the programme, *Microbial Biotechnology for Imparting Resistance in Plants against Insect Pests and Pathogens*, transgenic tomato plants with resistance to leaf curl virus through transformation with RNAi technology have been developed.
- In the centre on the Development of Agro-based Nutraceuticals for Health, agro-based neutraceuticals viz. maltodextrin-enriched ice-cream, lycopene-enriched whey fruit juice beverage, curcumin-enriched flavored milk, noni natural juice and concentrate have been formulated. Functional fermented dairy products with synbiotics have been developed with prolonged shelf life have been evaluated in another centre at AAU, Anand.
- In the centre on *Conservation, Cultivation, Processing and Quality Evaluation of Medicinal and Aromatic Plants*, eco-friendly low-cost post-harvest processing technology for storage, packaging of raw drug material of different medicinal aromatic plants has been standardized for medicinal and aromatic plants. Large scale commercial production of quality seed/planting material true to the type of medicinal and aromatic plants have been produced and sold to the farmers and growers.
- In the sub-programme on *Animal Biotechnology – Molecular Diagnostics For Emerging Avian Viral Diseases and their Immunopathogensis*, diagnostics kits for avian viral diseases have been developed and validation of chicken anemia virus antibody detection kit has been completed. For Marek's disease diagnosis kit is being validated.
- Under two different programmes, *Quality Production in Fishes for Sustainable Farming* (GBPUAT, Pantnagar) and *Utilization of Inland Saline and Sodic Soil for Aquaculture* (CIFE, Mumbai), technology for production of major freshwater fishes for sustainable farming has been standardized. The breeding season of Indian major and exotic carps has been prolonged by improved water quality and feeding management. Inland saline water resources are being used for aquaculture and standardized technology for the commercial farming of tiger shrimp *(Penaeus monodon)* using inland-saline water has been developed.

7.84 A few technologies have been commercialized. These are commercial utilization of waste inland-saline areas and saline water

where crop productivity is very poor. The following technologies were adopted by the farmers: i. Latex agglutination based kit for detecting chicken anaemia virus (CAV) infection, ii. Latex agglutination based kit for detecting Marek's disease virus infection.

Entrepreneurship Development

7.85 Experiential learning is a novel courseware aimed at promoting entrepreneurship, knowledge and marketing skills through meaningful hands on experience and working in project mode, through end to end approach in product development. The Council has provided financial support for the establishment of 351 experiential learning units in various agricultural universities. Out of these, 110 units were sanctioned in the last year. This sub-programme would help in transcending the mere knowledge-imparting education with limited practical training to experience-based behavioral change through comprehensive practice sessions involving all aspects of an agricultural enterprise, from production to consumption.

National Information System on Agricultural Education Network in India (NISAGENET)

7.86 In the NISAGENET system, all the 61 AUs have been added and the system has been made operational to enter/update and upload data from their respective university/colleges. To expedite data management activities from AUs, 3 Sensitization cum Training Workshops for the Nodal Officers of the NISAGENET were organized. A Reference Guide for Data Management has been prepared and made available on website and also distributed to the participants in the workshops. The system is rich in many layers of information. Many universities are also maintaining online cells in their websites.

Box 7.7: National Academy of Agricultural Research Management (NAARM)

The National Academy of Agricultural Research Management (NAARM) was established by the Indian Council of Agricultural Research (ICAR) at Hyderabad in the year 1976, as the Central Staff College of Agriculture. Initially its primary role was to impart Foundation Training to the new entrants of the Agricultural Research Service of ICAR. In 1979, it acquired its present name, and over the years, it has grown as a full-fledged Academy with a wider mandate to enhance the capacities of the institutions under NARS at all levels in agricultural research and education management, and carry out research to provide policy support in critical areas of organizational reform. In the Eleventh Plan period, the Academy added a new dimension of Post Graduate education in Agricultural Management and Technology Management to develop a new generation of leaders for meeting the challenges of agricultural development in the 21st century.

National Agricultural Innovation Project

7.87 NAIP is a World Bank and Govt. of India funded project being implemented by the ICAR contributes to the sustainable transformation of Indian agricultural sector from an orientation of primary food self-sufficiency to one in which a market orientation is equally important for poverty alleviation and income generation. The project is implemented through four components involving 191 consortia leaders and 646 consortia partners, adding up the number of participating institutions to 837. The project is granted extension till June, 2014.

7.88 With a view to create an enabling environment for the management of change in NARS, 43 sub-projects are taken up in component 1.Through the ten Business Planning and Development Units (BPDs), 336 entrepreneurs have been incubated, 83 technologies developed by NARS have been commercialized and a total revenue of Rs. 13.22 crore has been generated. Some of the achievements in ICT are operationalization of an online e-publishing system for ICAR research journals, development of a knowledge management platform - Agropedia for aggregation and dissemination of information, rice knowledge management portal for providing complete rice information from a single portal, Consortium for e-Resources in Agriculture (CeRA) facilitating 24×7 online access with approximately 3000 scholarly journals from 7 major publishers and catering to 134 institutions under NARS, creation of

group catalog "AgriCat" (http://www.agricat.worldcat.org) of 12 major libraries for online access by the researchers and students, implementation of a general purpose statistical software package (SAS) with all modules for the NARS, creation of a new platform KVKnet (http://agropedialabs.iitk.ac.in/extension/) and vKVK (http://www.vkvk.in) as a knowledge network for KVK scientists, starting of seven e-courses for the Bachelor's degree programmes in the discipline of Agriculture, Horticulture, Veterinary Science, Home Science, Fishery Science, Agricultural Engineering and Dairy Technology, creation of meta data & abstracts of 7486 and full text of 6000 of Ph. D. theses and setting up of nine media cells in different parts of the country for improving outreach and enhancing the brand image and visibility of the ICAR/NAIP.

7.89 Total of 182 commodity price forecasts for 36 commodities were disseminated for the benefit of farmers across the country. The impact study has revealed that due to timely pre-harvest forecast communications, the beneficiary turmeric and cotton farmers additionally earned Rs. 100 crore. A carbon tool kit for sustainable agro forestry CDM projects has been developed.

7.90 A total of 361 scientists from NARS were deputed for international trainings to global institutions in frontier areas of sciences. Besides, 258 scientists have been trained abroad in the consortia based programmes. An interactive meeting with the scientists trained abroad has paved the way for effective utilization of the trained man power. Out of 88 national trainings in frontier area of agricultural sciences, 63 have been completed. Trained manpower is being used to develop a center of excellence in respective discipline besides being a Course Director/ Resource person for further training in India.

7.91 Research on production to consumption system is covered by 51 consortia working across the sub-sectors of Indian agriculture. Some of the value chains identified include medicinal and aromatic plants, bio-fuel crops, poultry, fruits and vegetables, fisheries, food grains and oilseeds, plantation crops, livestock products, natural dyes and agro forestry. A good number of consortia have developed market driven technologies, process protocols and products which have shown positive impact in terms of income and employment generation, value addition and strengthening of weak chains. Some of them are: **i.** Pashmina goat kid "Noori" (born on 9th March 2012) developed by transfer of cultured embryos in blastocyst stage to the recipient goats through hand guided technique is the first report in the world, **ii.** Clinical trials of foxtail millet diabetic food on diabetic volunteers revealed blood glucose reduction by 14-18%, triglycerides and cholesterol reduction 8-10%, LDL cholesterol reduction by 5% and HDL cholesterol increase by 2-3%, **iii.** Process for virgin coconut oil production by intermediate moisture method, **iv**. Technologies for utilization of defatted dried coconut meal using cold and hot extruders, **v.** Anthocyanin-rich black carrot (IPC 126) and beta-carotene + lycopene rich red carrot (IPC 56) varieties identified for mass multiplication and distribution to the farmers, **vi.** Off season production technology of carnation for sub-temperate conditions, **vii.** Standardization of technology for production of natural eco-powders and production of 2000 kg of consumer preferred 5 colours namely orange, pink, yellow, blue and green, using basic sources Annatto, beet root, marigold and indigo, **viii.** Identification of *Melia dubia* and *Dalbergia sissoo* as potential indigenous and fast growing pulp wood species due to their high pulp recovery and acceptable basic density, **ix.** A new method for production of clarified sweet sorghum juice using filter aid and vacuum filtration system, **x**. Process for preparation of handmade/quality papers and Micro Crystalline Cellulose Powder from banana fibre, **xi.** Technology for production of cooked and smoked pork sausage with the addition of fermented bamboo shoot, **xii.** Development and commercialization of the value added product "Shelf stable sheep rumen crackles" from sheep by-products and **xiii.** Dipstick based detection kits for detection of Potato viruses viz. PVX, PVS, PVM and PVY.

7.92 Sustained improvement in the incomes and well-being of farm families mainly in disadvantaged areas which have so far been left behind in development is aimed in component 3 through 33 consortia operating in 102

disadvantaged districts out of 150 in the country. Significant achievements are: **i.** Publication on 'Selected livelihood options for disadvantaged regions of India' wherein the major interventions described are: Integrated Rice-Fish-poultry system, Rice-fish-vegetable system, Poultry-fish-vegetable system, Pig- fish-vegetable system, Fish- singhara - makhana system, Hybrid maize in tribal districts of Rajasthan and Gujarat, Utilization of upland fallows for maize cultivation in Bastar, Cultivation of transplanted redgram in Bidar, Maize based intercropping in Jhabua, Conservation and strengthening of local high value poultry race Kadaknath, Tuber crop cultivation, Lac cultivation in Jharkhand, Maharashtra and Madhya Pradesh, Mushroom cultivation, Pig rearing, Interventions on goat, Vermi compost and Water resource development, **ii.** Recommendation of IFS models viz., Specialized Integrated Farming System (SIFS) Model, Rice – Groundnut- Livestock: model for small farmers, Livestock- Vegetables model for landless community, Integrated Redgram and Bengalgram – Vermicomposting-*Azolla* - and Poultry Farming System for Bidar district, Sustainable Farming System Models for Prioritized Micro-Water Sheds In Rainfed Areas of Jharkhand, **iii.** Horizontal expansion of Integrated Pig-Fish-Vegetable IFS module Integrated Rice-Fish-Vegetable IFS module in Assam, Rice –Fish -Poultry Farming System for Wetland Clusters in Tamil Nadu and Livelihood Security through cultivation of vegetables and spices, **iv.** Selected interventions viz.,Geographical Indication Registration, Organic Farming Certification Program, Livestock population growth, Desilting of minor irrigation tanks for increasing storage and improving soil fertility, Replacement of *Lantana* with bamboo, Understand the nature and go with proper technology – A success story of Sokham Gaon, Natural Hatching of Kadaknath Eggs, Impact of Mechanisation, Mitigating Water Logging through Bio-drainage with Sugarcane and Innovative way of raising vegetable nursery under saline water situation, **v.** Through an innovative service called 'm-Krishi-Fisheries', **vi.** Land shaping for the low lying coastal areas to farm pond, furrow and ridge, and paddy-cum-fish culture, **vii.** Biodiversity survey for plant, animal and fish landraces was undertaken in the districts of Chamba, Udaipur and Adilabad and seed chain of distinct landraces was identified and developed, **viii.** Synergy with other organizations, **ix**. Marketing and **x.** Sustainability of Post Project Activities.

7.93 Sixty one sub-projects are operating in frontier areas of basic and strategic research like allele mining, genomics, bio-sensors, soil organic carbon dynamics, abiotic stress, cryo-preservation, climate change, off-season flowering and fruiting in mango, input use efficiency, ethnic and fermented foods, etc.

7.94 Overall, the project progress is satisfactory as revealed through the performance indicators, viz. development of 91 public private partnerships, piloting of 50 rural industries, filing of 51 patent/ intellectual property protection applications, publication of 181 research papers in high impact peer reviewed journals, international training of 361 scientists in frontier areas of sciences and 258 scientists in the consortia, establishment of ten BPDs, development of 69 production technologies, 80 processing technologies and 181 novel tools/ protocols/methodologies for research and commercialization of 31 technologies.

Pashmina goat kid "Noori" born through hand guided technique of transfer of cultured embryo

National Fund for Basic, Strategic and Frontier Application Research in Agriculture

Salient achievements

- An autoclavable microencapsulation system

with multistage break up two fluid nozzle has been developed for microencapsulation of sensitive food components which are prone to contamination (microorganisms and their products) including bacteriocins. Microencapsulation of the probiotic species, of yeast, *Lactobacillus casei,* and pediocin, nisin, xylanase, pectinase and amylase has been done.

- A Patent has been obtained on Fermentation vessel for conducting rumen gas production studies *in vitro*.
- Indigenous lab scale design and fabrication of atmospheric pressure cold plasma reactor with and without cooling system has been developed for environment friendly treatment of cotton fabrics for effective dyeing and other qualities. Generation of atmospheric pressure cold plasma could also be achieved.
- *Argulus siamensis* has been identified as the most prevalent species followed by A. *japonicus* causing the highly damaging parasitic disease, argulosis, in Indian aquaculture systems. A PCR based marker for identification of the two species has been developed.
- Stem cell culture has been established using pig bone marrow MSC lines. These cell lines will be used for producing transgenic pluripotent cells which in turn can be used for development of transgenic pigs
- A transgenic with the constitutive expression of signaling gene BjEll1 available in the plant itself in mustard substantially reduced aphid infestation. A transgenic with a similar gene BjEll2 showed resistance to Alternaria blight, a fungal disease.
- Level of expression of 5 genes, BMP 15, GDF 9, MATER, ZAR 1 and IGFBP 1, were identified as the markers for development competence for oocytes to be used for *in vitro* embryo production in buffaloes and help in improving the *in vitro* production protocol.
- A gene Lef-8 gene has been identified as a marker for quick and correct identification of insecticidal Nuclear Polyhedrosis Viruses (NPVs) specific to different insect species.
- Autotransgenic (that is with a gene of self) fish of the species , *Clarias batrachus* (Indian catfish magur), has been made with excess production of growth hormone and faster growth in confinement
- Endrometrial epithelial, stromal and luteal cell cultures of buffalo were established which can be used to study prostaglandin and progesterone production in buffalo. Insulin, IGF 1 and nitric oxide were found to be related to luteal functioning and success of pregnancy. Pregnancy Associted Glycoprotein 1 (PAG 1) gene, and, Oxytocin, Estrogen & progesterone receptor genes have been cloned. PAG 7 and PAG 11 proteins have been purified which may be useful in developing pregnancy diagnostics.
- Ovule-specific promoter FM 1 has been cloned from Arabidopsis and presence of expression has been validated in sorghum. Methodologies for screening the ovary development process in transgenics was developed. An unique target sequence of the SERK 1 gene (on chromosome 6) for RNAi silencing has been subcloned in an appropriate vector and is being used in transforming sorghum plants.

Intellectual Property and Technology Management

IPR Portfolio

7.95 IPR portfolio of ICAR has increased in terms of number of ICAR institutes undertaking IPR protection activities, the number of forms of IPR secured, and the number of IPR grants to ICAR. While a total of 34 IPR protection applications (33 patents and 1 trademark) were filed by 11 ICAR institutes in 2001, the corresponding figures have risen by September, 2012 to 1621 IPR applications (707 patents, 868 plant varieties, 21 Trademarks, 3 Designs, and 22 copyrights). A total of 143 patents (including 6 international patents), registration of 298 plant varieties of notified crops, 21 trademarks, 22 copyrights and 3 designs have been granted to ICAR for IP protection.

CHAPTER 8

Animal Husbandry, Dairying and Fisheries

8.1 The animal production system in India is predominantly part of a mixed crop-livestock farming system vital for livelihood security of the farmers. In such systems, the livestock sector supplements income of the farmers, provides employment, draught power and manure etc. The livestock production system assumes special significance in the present context of sustained economic growth, rising income, increasing urbanization, changes in taste and preference that have led to dietary changes reflecting the growing demand for milk, meat, egg and fish. The development of livestock sector is more inclusive and can result in a sustainable agriculture system.

Dairying and Livestock Production

Milk

8.2 India continues to be the largest producer of milk in the world. The estimate of milk production in 2011-12 is 127.9 million tonnes compared to 121.8 million tonnes in 2010-11and 53.9 million tonnes in 1990-91. Per capita availability of milk at national level has increased from 176 grams per day in 1990-91 to 290 grams per day in 2011-12. Growth in milk production in 2011-12 was about 5% over the previous year.

Meat

8.3 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 5.5 million tonnes in 2011-12. Poultry meat production from commercial poultry farms were included in the production estimates of meat from 2007-08 onwards. Growth in meat production achieved in 2011-12 was about 13.25% over previous year.

Wool

8.4 The estimated wool production at the national level has increased to 44.7 million kg. in 2011-12 in comparison to 41.2 million kg. in 1990-91. Growth in wool production in 2011-12 was about 4% over the previous year.

Egg

8.5 The estimate of total egg production for the year 2011-12 was 66.4 billion numbers as compared to 21.1 billion during 1990-91. Growth in egg production in 2011-12 was about 5.44% over the previous year.

Fish

8.6 India is the second largest producer of fish in the world, contributing about 5.54 per cent of global production. The total fish production during 2011-12 is provisionally estimated at 8.85 million tonnes compared to 8.4 million tonnes in 2010-11 with a growth of about 5.3% per annum. More than 60% of fish production is contributed by the inland fisheries, the rest being from the marine sector. The Gross Domestic Product from the fisheries sector at current prices during 2010-11 was Rs. 62,594 crore which is 4.93 per cent of the total GDP of agriculture & allied sectors.

8.7 During 2011-12, the volume of fish and fish products exported was about 8,62,000 tonnes worth about Rs.16,597.23 crore i.e. about US $ 3 billion. The export of fish and fish products has more than doubled during the Eleventh Plan period.

8.8 Growth in fishery sub-sector is next only to poultry. The policy for fishery development emphasizes inland fisheries, particularly aquaculture in recent years, which has been instrumental in increasing production, enhancing exports and reducing the poverty of fishermen. The four components of production, nutrition, health and management in these sub-sectors are supported through various schemes of the Government.

Table 8.1: Compound Annual Growth Rates (CAGRs) in Production of Milk, Egg, Wool and Meat at All-India Level (%)

	1980-81 to 1989-90	1990-91 to 1999-00	2000-01 to 2010-11	1980-81 to 2010-11
Milk	5.6	4.2	4.2	4.6
Eggs	8.06	4.2	5.6	6.3
Wool	3	1.7	-1.2	1.0
Meat	-	-	7.0 *	-

Note: *CAGR for meat production is for the year 2007-08 to 2010-11 Meat production data from 2007-08 is not comparable with the previous years data as poultry meat production from commercial poultry farms was included from 2007-08 onwards.

8.9 India has the world's largest livestock population, accounting for about half the population of buffaloes and 1/6th of the goat population. Such a large population of livestock presents a challenge wherein existing productivity levels are sustained by application of modern science and technology, incentives and policies.

Plan Schemes

Livestock Health

8.10 High prevalence of various animal diseases like Foot & Mouth Disease (FMD), Paste des Petit Ruminants (PPR), Brucellosis, Classical Swine Fever and Avian Influenza etc. is a serious impediment to growth in the livestock sector. The economic loss on account of FMD is estimated to be more than Rs.20,000 crore per annum (NCAP, Preliminary Report 2010). Most of these animal diseases can be prevented through timely immunization. The Department of Animal Husbandry, Dairying & Fisheries (DADF) has initiated National Programmes for prevention and control of FMD, PPR and Brucellosis through the State Governments. The FMD control programme initially started in 54 districts in 2003 has been expanded to 221 districts and will be expanded to cover the entire country in a phased manner. Similar programmes have been initiated to control PPR and Brucellosis. Shortages of vaccines and lack of proper cold chain facility are among the major hindrances to a faster implementation of these programmes.

Veterinary Support Services

8.11 India has a total of 10,094 veterinary hospitals and polyclinics and 19,531 veterinary dispensaries as on 01.04.2012. Most of these have poor infrastructure and equipment. Further, the technical manpower is inadequate (with about 25,000 veterinarians in government sector as against the estimated requirement of about 67,000) to support health programmes for the massive livestock population. DADF has initiated a programme for "Establishment and Strengthening of existing Veterinary Hospitals and Dispensaries (ESVHD)" to strengthen the veterinary services at the field level. There is a need to strengthen veterinary hospital facilities for timely diagnosis and treatment of animal diseases. Emphasis also needs to be given to strengthen the mobile veterinary services to ensure door-step veterinary support, particularly in inaccessible areas.

8.12 The present system of disease reporting is slow. A computerized National Animal Disease Reporting System (NADRS) linking Taluka, Block, District and State Headquarters to a Central Disease Reporting and Monitoring Unit at the DADF in New Delhi has been initiated in 2010-11. The software for the system is being developed by NIC to ensure faster and reliable disease reporting and processing of data which will facilitate timely intervention for prevention and containment of animal diseases.

Challenges

8.13 The main challenges confronting the animal health sector include:

- Veterinary hospitals, dispensaries and technical manpower are inadequate.
- The disease reporting is neither timely nor complete which delays proper interventions.
- Inadequate availability of vaccines and lack of cold storage infrastructure.

The Way Forward

8.14 The following measures will strengthen the animal health sector:

- Adequate veterinary disease diagnosis, epidemiology, hospital infrastructure and manpower need to be developed.
- A strong programme for supply of sufficient veterinary vaccines is necessary.
- Expeditious operationalization of NADRS

Cattle and Buffalo Breeding

8.15 The objective of the scheme of 'National Project for Cattle and Buffalo Breeding (NPCBB)' is to promote genetic upgradation of bovines mainly through Artificial Insemination. Semen production in the country has increased from 22 million straws in 1999-2000 to 63 million straws in 2011-2012 and number of Artificial Insemination (AI) from 21.8 to 54 million per annum. Conception rate increased from 20% to 35%. The numbers of animals in milk has increased from 62 million during 2000 to 81.8 million during 2011-12. Crossbred cattle population has increased from 20 million (1997) to 34 million (2007). 21,700 breeding bulls with high genetic merit have been inducted for natural service in the areas out of the coverage of AI services. About 36,385 Government stationary AI centres have been assisted and equipped to function as mobile AI centres and about 21,753 private mobile AI centres have been established for delivery of AI services. 11,615 Government stationary AI centres are also operating. The dairy cooperatives are also operating about 14,000 mobile AI centres. In addition, the NGOs like BAIF and JK Trust are operating about 6,000 mobile AI centres.

8.16 In order to improve the quality of semen production a Minimum Standard Protocol (MSP) for semen production has been implemented in all semen stations and 49 frozen semen bull stations have been strengthened as per this MSP. A central Monitoring Unit (CMU) has been constituted for evaluation of one semen station in two years. Thirty four semen stations in the country have acquired ISO certification against 3 during 2004. MSP for progeny testing and standard operating procedures for AI technicians has also been formulated.

Challenges

8.17 The challenges facing the dairy sector include:

- Small herd size and poor productivity
- Inadequate availability of credit
- Poor access to organized markets deprive farmers of proper milk price
- Poor AI service net-work
- Shortage of manpower and funds
- Limited availability of quality breeding bulls
- Disease outbreaks: mortality & morbidity
- Induction of crossbred animals in areas poor in feed resources
- Majority of grazing lands are either degraded or encroached
- Diversion of feed & fodder ingredients for industrial use

The Way Forward

8.18 Continuous support to the States is essential for further genetic upgradation programmes to meet the increasing demand for milk in the country. There is further need to consolidate and improve the breeding infrastructure created under NPCBB and take up scientific programmes like Embryo Transfer Technology (ETT), Multi Ovulation Embryo Transfer Technology (MOET), Markers Assisted Selection (MAS), development of semen sexing technology and use of sexed semen for faster propagation of elite germplasm

and for increasing bovine productivity. There is a need to upgrade the skill of the AI workers to enable them to deliver livestock extension services to the farmers apart from the AI service.

Dairying

8.19 Dairying is an important source of income for millions of rural families and has assumed an important role in providing employment and income generating opportunities. The Government of India and State Governments are making strong efforts to increase the productivity of milch animals and increase the per capita availability of milk to meet the requirement. The Department of Animal Husbandry, Dairying and Fisheries (DADF) has supported building up cooperative infrastructure, revitalization of sick dairy cooperative federations and extended support for creation of infrastructure for production of quality milk and milk products. An important scheme being implemented by the Department during 2012-13 is the Intensive Dairy Development Programme (IDDP) for this purpose. Through IDDP scheme, assistance is provided to Dairy Milk Unions/Federations for increasing milk production, procurement, preservation, transportation and processing of milk by developing dairy infrastructure at the village and district level. This section highlights the efforts made by the Government of India through its schemes to increase production of milk.

Strengthening Infrastructure for Quality & Clean Milk Production

8.20 The scheme, introduced during October, 2003 aims at improvement of the quality of raw milk produced at the village level by creating awareness among dairy farmers and providing basic testing and measurement equipments at the Dairy Cooperative Society level for assisting in collection and testing of milk based on which payments are made to the farmers. Under the scheme, there is a provision for training of farmers on good milking practices, setting up of Bulk Milk Cooler (BMC) at Dairy Cooperative Society level and strengthening of laboratories for testing of milk.

Assistance to Cooperatives

8.21 The central sector scheme started in 1999-2000, aims at revitalizing the sick dairy cooperative unions at the district level and cooperative federations at the State level. The rehabilitation plan is prepared by the National Dairy Development Board (NDDB) in consultation with the concerned State Dairy Federation and District Milk Union. Since inception, Department has approved 42 rehabilitation proposals of Milk Unions so far in Madhya Pradesh, Chhattisgarh, Haryana, Karnataka, Uttar Pradesh, Kerala, Maharashtra, Assam, Nagaland, Punjab, West Bengal and Tamil Nadu at a total outlay of Rs.310.91 crore and with a central share of Rs.155.64 crore, against which an amount of Rs 116.49 crore of Central share has been released under the scheme till 31st March, 2012.

Dairy Venture Capital Fund (DVCF)/Dairy Entrepreneurship Development Scheme (DEDS)

8.22 The Dairy/Poultry Venture Capital Fund scheme was started in December, 2004. The scheme DVCF was closed on 31.08.2010. Under DVCF an amount of Rs 144.99 crore was released to NABARD as revolving fund, against which an amount of Rs 174.39 crore was disbursed as Interest Free Loan by NABARD for sanctioning 18,184 dairy units till 31.08.2010.

8.23 The DVCF scheme was modified and renamed as Dairy Entrepreneurship Development Scheme (DEDS) from 1st September, 2010. Since inception of DEDS an amount of Rs. 270.40 crore has been released to NABARD, against which NABARD has sanctioned 58,278 Dairy Units and released back ended capital subsidy of Rs.238.32 crore till 30.09.2012

National Dairy Plan

8.24 National Dairy Plan-Phase I (NDP-I) has been approved by Government of India for implementation from 2011-12 to 2016-17 with a total investment of about Rs.2242 crore comprising Rs.1584 crore as IDA credit, Rs.176 crore as Government of India share, Rs.282 crore as share of End Implementing Agencies (EIAs)

that will implement the project in participating States and about Rs.200 crore as the share of NDDB and its subsidiaries for providing technical and implementation support to the project. The Board of the World Bank approved the IDA credit of $350 million (Rs 1584 crore) for the scheme on 15.3.2012. The Administrative approval of the scheme has been issued by the DADF on 16th March 2012. An outlay of Rs.130 crore has been provided under the budget of DADF for 2012-13.

8.25 NDP–I envisages to contribute to meeting the projected national demand of 150 million tonnes of milk by 2016-17 from domestic production through productivity enhancement, strengthening and expanding village level infrastructure for milk procurement and providing the producers with greater access to markets. It is also envisaged that the project would provide livelihood opportunities for the farmers on terms that are fair and reasonable. The main objectives of NDP-I are:

a) To launch a focused scientifically planned multi-state initiative to lay the path for new processes, supported by appropriate policy and regulatory measures leading to increasing the productivity of milch animals and thereby increase milk production to meet the rapidly growing demand for milk; and

b) To provide rural milk producers with greater access to the organised milk-processing sector. Given the rapidly increasing demand for milk, priority in NDP-I would be given to areas with higher potential in the 14 major milk producing States contributing about 90% of the country's milk production; i.e., like Uttar Pradesh, Punjab, Haryana, Gujarat, Rajasthan, Madhya Pradesh, Bihar, West Bengal, Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Orissa and Kerala.

8.26 Fourteen major milk producing States in the country will be eligible for funding under various components based on the eligibility criteria which will comprise geographical, technical, financial and governance parameters. The benefits accruing from NDP-I will be however across the country through availability of superior quality semen.

Feed and Fodder for Livestock

8.27 Availability of adequate quantity of quality feed and fodder for livestock is essential for sustaining the livestock productivity. Due to increasing pressure on land for growing food grains, oil seeds, and pulses, fodder production generally gets lower priority. With about 2.29% share of the land area of the world, India is maintaining about 10.71% world's livestock. Further, on account of diversified use of agriculture residues, the gap between the demand and supply of fodder is increasing. The NABCONS, and the National Institute of Animal Nutrition and Physiology, Bangalore have estimated shortages of feed and fodder in the country to be around 35 per cent or so. Availability of feed resources also varies from area to area. At present, fodder is being cultivated only on 4% of grossed cropped area, which is not adequate to meet the requirement of the livestock.

8.28 In order to bridge the gap in demand and availability of fodder and feed, the DADF is implementing a 'Centrally Sponsored Fodder and Feed Development Scheme (CSFFDS)' during 2012-13. The CSFFDS includes 9 different components under varying subsidy patterns for assisting the States in practically all activities pertaining to fodder development. Taking into account the prevailing drought situation in some states, a new component of "Establishment of Fodder Banks" has been added for the year 2012-13 to procure surplus fodder from the farmers in areas where rainfall has been satisfactory or where irrigation facility is available and convert the same to silage or fodder blocks for storage and supply on cost plus basis to the deficient areas. A relaxation has also been granted to the Cooperatives, Milk Unions/Federations, and the State Governments by enhancing the central share for establishment of fodder block making units to 75% of cost for these agencies for the year 2012-13.

Challenges

8.29 The main challenges in providing adequate and quality feed and fodder for the livestock include:

(i) While the number of livestock is increasing, the grazing lands are diminishing. The area available for fodder cultivation is also limited.

(ii) The production and availability of improved fodder seeds is inadequate in the country compared to the requirement.

(iii) Diversion of crop residues for other industrial use aggravates the situation. Diverse uses of agriculture crop residues (paper industry, packaging, etc.) which can be used as feed/fodder have widened the gap between demand and supply of feed and fodder.

(iv) There is lack of authentic data on availability of feed and fodder.

(v) Lack of specific extension machinery with specialized manpower for popularization of good fodder varieties and for more efficient use of crop residues is another constraint.

(vi) The area under coarse cereals which are also used as feed has declined since last 30 years. Less coverage of area under high yielding varieties of coarse cereals is another reason for less availability of coarse grains.

(vii) A substantial amount of crop residues is burnt by the farmers after harvesting main crops like wheat and paddy.

Steps taken by the Government

8.30 Besides revising the Centrally Sponsored Scheme on Fodder and Feed Development in 2010, the DADF has taken several steps in assisting the States for augmenting the availability of feed and fodder. Certain areas have been identified requiring immediate interventions like increasing the area under fodder using quality fodder seeds, increasing availability of quality seeds and to develop common property and development of waste land/grazing land etc. for production of fodder using resources available under ongoing programmes. States have also been assisted for various post-harvest management interventions to reduce the wastage of crop residues and its enrichment in quality. Detailed advisories have been issued to the States to increase availability of fodder.

The way forward

8.31 The measures which can contribute to increasing availability of fodder and feed include:

(i) Optimum utilisation of cultivable land and wasteland is required to grow fodder as per the requirement of the farmers. The forest department can play a major role in augmenting fodder production in the country. The degraded forest areas, mostly under the Joint Forest Management Committees (JFMCs), can be used for assisting growth of indigenous improved fodder varieties of grasses, legumes, and trees under area-specific silvi-pastoral systems. While the JFMCs may first meet their own requirements, the surplus can be stored by converting to silage or fodder blocks for supply to deficient areas.

(ii) Production of high yielding fodder seeds and seeds for dual purpose crops need to be upscaled by incentivizing production of such seeds by having a buy-back arrangement with the farmers, mainly with the help of organized/cooperative sector.

(iii) Wastage and alternative use of crop residues may be discouraged through a well laid out system of incentives and disincentives.

(iv) There is a need for undertaking an effective extension campaign for efficient uitlisation and enrichment of crop residues, growing fodder crops, and post harvest interventions like fodder densification, fodder and feed

enrichment, Azolla production, etc. Effective dovetailing with ongoing schemes like MGNREGA and RKVY will be useful.

(v) It is necessary to popularize scientific practices for management of feed like ration balancing, utilization of wasted crop residues as fodder and use of feed supplements like Azolla and area specific mineral mixture etc. to improve quality of nutrition for the livestock.

(vi) There is a need to have a mechanism in place for collection of reliable data on feed and fodder particularly for cultivated fodder production and production of crop residues.

Meat and Poultry Sector

8.32 India has around 141 million goats and 71.6 million sheep. In terms of population, India ranks second in the world in goats and third in sheep. Poultry sector in India is broadly divided into two sub-sectors; (i) highly organized commercial sector and (ii) the unorganized sector which generates supplementary income and provides nutrition to the rearers. Further, small and medium farmers are mostly engaged in contract farming system under larger integrators. Needs of organized and unorganized sectors of poultry are different.

8.33 Under Centrally Sponsored Scheme, 'Poultry Development', the following three components are funded by the Department:

(i) **Assistance to State Poultry Farms**

One time assistance is provided to strengthen farms in terms of hatchery, brooding and rearing houses, laying houses for birds with provision for feed mill and their quality monitoring and in-house disease diagnostic facilities and feed analysis laboratory. Till date, 233 farms have been assisted under the scheme since inception.

(ii) **Rural Backyard Poultry Development**

This component envisages supply of backyard poultry to beneficiaries from Below Poverty Line (BPL) families to enable them to gain supplementary income and nutritional support. Assistance to States have been provided to cover over 3 lakh BPL beneficiary families between 2009-10 and 2011-12.

(iii) **Poultry Estates**

Entrepreneurship skills are to be improved through an exploratory pilot project, 'Poultry Estates' in two States. It is meant primarily for educated, unemployed youth and small farmers with some margin money, for making a profitable venture out of various poultry related activities in a scientific and bio-secure cluster approach.

Poultry Venture Capital Fund

8.34 The scheme provides finance through NABARD for components like establishment of poultry breeding farm with low input technology birds, establishment of feed go-down, feed mill, feed analytical laboratory, marketing of poultry products, egg grading, packing and storage for export capacity, retail poultry dressing unit, egg and broiler carts for sale of poultry products and central grower unit, etc. This scheme is implemented on back-ended Capital Subsidy mode at the rate of 33.3% for SC/ST beneficiaries and for North East States and 25% for others.

Central Poultry Development Organizations & Central Poultry Performance Testing Centre

8.35 The four centres of the Central Poultry Development Organizations are located at Chandigarh (Northern Region), Bhubaneswar (Eastern Region), Mumbai (Western Region) and Bangalore (Southern Region) while one Central Poultry Performance Testing Centre is at Gurgaon, Haryana. These centres are promoting the development of poultry through the following measures:

- Availability of quality chicks of identified low-input technology poultry stocks.
- Diversification into rearing of Duck, Emu and Turkey (Southern Region), Japanese Quail (Northern and Western region) and Guinea fowl (Eastern region).

- Training of trainers, farmers, women beneficiaries, various public and private sector poultry organizations, NGOs, Banks, Cooperatives and foreign trainees etc.
- Regular testing of various stocks available in the country to assess their performance.

Challenges

8.36 The challenges facing the meat and poultry sector include:

- Availability of feed ingredients like maize and soyabean is a major challenge, as poultry feed constitutes nearly 70% of the cost of production and availability of these feed ingredients at a reasonable cost is essential for sustaining the growth rate.
- Pathogenic and emerging diseases namely Avian Influenza often causes heavy losses both in domestic market and international trade.
- There is a need for realistic national marketing intelligence to bridge the gap between supply and demand of poultry & poultry products.
- To meet the growing demand of sustainable and safe production there is a huge demand for trained and skilled manpower in poultry sector.
- Large size of target population to be improved in terms of productivity with application of science and technology pose a formidable challenge.
- Low level of processing and value addition in animal products.

The Way Forward

8.37 The following measures are necessary to strengthen the meat and poultry sector for accelerated and sustainable growth:

- Long-term sustainable production measures have to be looked into to increase the production of maize and soyabean. Alternative feed resources have to be explored.
- Active surveillance, monitoring and control in case of any outbreaks in rapid manner.
- Network for a realistic national and global poultry database and marketing intelligence may be developed.
- Sufficient trained manpower should be developed in the existing institutions.
- With growing urbanization and increasing quality consciousness, the market for scientifically produced meat products is expected to grow rapidly. The market is growing for ready-to-eat and semi-processed meat products because of a changing socio-economic scenario and increase in exports to neighboring countries, especially the Middle East.
- The mechanized slaughter houses produce huge quantities of offal and digesta from the slaughtered animals which could be profitably utilized for production of value added products, like Meat-cum-Bone Meal (MBM), Tallow, Bone Chips, Pet Foods and methane as a source of energy for value addition in most of the modern plants.
- There is a need to support pig rearing in order to improve sow productivity, growth rate of piglets and feed conversion efficiency.
- It is important to encourage proper utilization of by-products of livestock slaughter for higher income of livestock owners. The environmental pollution and spread of livestock diseases need to be prevented.

Fisheries Sector

8.38 Allocations made for the development of fisheries sector through the Centrally Sponsored Schemes and Central Sector Schemes are utilized for implementation of both development and welfare oriented schemes through the respective states and UTs. In addition to the allocations made through these schemes, assistance is provided to States through other flagship programmes like Rashtriya Krishi Vikas Yojana (RKVY) including the National Mission for Protein Supplements (NMPS).

National Fisheries Development Board

8.39 National Fisheries Development Board (NFDB) has been established by the Government in 2006 as a special purpose vehicle for accelerated development of the fisheries and aquaculture in a sustainable manner through upgradation of production technologies, management and utilization of resources, establishment of infrastructure for post-harvest operations and markets. NFDB has during the Eleventh Plan Period invested nearly Rs.400 crore for various developmental activities. It is proposed to merge all Centrally Sponsored Schemes aimed at growth and enhancement of production and productivity in NFDB during Twelfth Plan to provide greater focus and an integrated approach to the development of fisheries and aquaculture in the country.

Marine Fisheries Development Scheme

8.40 During Eleventh Five Year Plan, the Marine Fisheries Development Scheme made provision for development of 13 fishing harbors and 4 fish landing centres, 4 fishing harbors were repaired and renovated. In addition, 43 units of post harvest infrastructure like ice plants, retail outlets were created; 8,342 traditional crafts motorized; 3,921 safety appliances provided; 40,993 KL of HSD provided to fishers with rebate; 3 deep sea resource-specific fishing vessels were promoted; introduction of 88 intermediate crafts was taken up and one new private fishing harbor was funded under a Build, Operate and Transfer (BOT) package.

Inland Fishery Development Scheme

8.41 Under the scheme, 99,689 ha area of fresh water and 39,750 ha area of brackish water were covered for aquaculture and 1,69,907 fish farmers were provided assistance for freshwater aquaculture and 28,171 fish farmers for brackish water aquaculture during Eleventh Plan period.

Fishermen Welfare Scheme

8.42 Under the scheme, during Eleventh Plan Period funds were released for coverage of 38 lakh fishers for insurance, construction of 31,400 houses, benefit of 4 lakh fishers under Saving-cum-relief scheme and training of 31,648 fishers in various fish farming and post harvest activities.

Database Scheme

8.43 Under the scheme, inland water bodies are surveyed and mapped in the States. Through a pilot project, mapping of smaller water bodies has been completed in the State of West Bengal. Marine Fisheries Census was completed in all maritime states and islands. Registration of fishing vessels in all the coastal States and UTs has been initiated and development of database is under progress.

Challenges

8.44 The main challenges facing the fisheries sector include:

- Shortage of quality and healthy fish seeds and other critical inputs.
- Lack of resource-specific fishing vessels.
- Inadequate awareness about nutritional and economic benefits of fish.
- Inadequate extension staff for fisheries and training for fishers and fisheries personnel.
- Low utilization and productivity of water bodies.

The Way Forward

8.45 The following measures will help to further strengthen the fisheries sector:

- Schemes of integrated approach for enhancing inland fish production and productivity with forward and backward linkages right from production chain and input requirements like quality fish seeds and fish feeds and creation of required infrastructure for harvesting, hygienic handling, value addition and marketing of fish.
- Existing Fish Farmers Development Authority (FFDAs) need to be revamped and cooperative sectors, SHGs and youths be actively involved in intensive aquaculture activities.

- Large scale adoption of culture-based capture fisheries and cage culture in reservoirs and larger water bodies are to be taken up.
- Sustainable exploitation of marine fishery resources especially deep sea resources and enhancement of marine fish production through sea farming, mariculture, resource replenishment programme like setting up of artificial reefs etc. need to be taken up.

Measures taken to address Inflation in Animal Products

8.46 Food inflation in the last two years has been impacted largely by increase in prices of animal products like milk, fish, meat and eggs. Inflation for the broad group "eggs, meat and fish" has generally been in double digits during 2011-2012. It has shown signs of moderation with inflation at 13.28% for period ending October, 2012. Inflation of milk has been largely in double digits during 2011-12 but has shown downward trend during the current year, recording 6.35% for period ending October, 2012.

8.47 The increase in inflation of protein rich animal products was mainly due to increase in their consumption on account of rising incomes and also shifts in consumer preferences. This is also reflected in per capita increase in their consumption.

8.48 Government has taken various measures during 2011-12 to increase production and to moderate inflation in animal products. The National Mission on Protein Supplements (NMPS) has been launched as a component of RKVY in 2011-12 for taking up activities to promote production of animal based protein through livestock development, dairy farming, pig and goat rearing and fisheries. The allocation for NMPS was Rs. 300 crore in 2011-12, which has been increased to Rs. 500 crore during 2012-13. To improve productivity in dairy sector, National Dairy Plan – Phase I with an outlay of Rs. 2242 crore has been launched during March 2012 for implementation during twelfth Five Year Plan with the assistance of the World Bank. The State Governments are also being requested to provide greater allocation under RKVY for taking up activities for promoting animal husbandry, dairying and fisheries.

Annexure. 1.1: Plan-wise Growth Rates (%) by Economic Activity

(at 2004-05 prices)

Year	Five Year Plan	Total Economy	Agriculture, forestry & fishing	Agriculture, incl. livestock	Forestry & logging	Fishing
1951-52	**First Plan (1951-56)**	2.3	1.5	1.6	-0.2	6.2
1952-53		2.8	3.2	4.2	-5.4	5.5
1953-54		6.1	7.7	9.0	-3.2	2.1
1954-55		4.2	2.9	2.8	3.8	7.5
1955-56		2.6	-0.9	-1.5	4.0	8.1
	Average	**3.6**	**2.9**	**3.2**	**-0.2**	**5.9**
1956-57	**Second Plan (1956-61)**	5.7	5.4	6.0	-0.7	11.1
1957-58		-1.2	-4.5	-5.1	0.4	2.3
1958-59		7.6	10.1	11.2	-0.2	4.3
1959-60		2.2	-1.0	-1.5	3.5	0.9
1960-61		7.1	6.7	7.3	1.1	6.9
	Average	4.3	3.3	3.6	0.8	5.1
1961-62	**Third Plan (1961-66)**	3.1	0.1	-0.3	4.0	2.8
1962-63		2.1	-2.0	-2.1	0.2	-5.1
1963-64		5.1	2.3	1.9	5.8	9.3
1964-65		7.6	9.2	10.3	-1.7	10.0
1965-66		-3.7	-11.0	-13.5	13.4	0.0
	Average	**2.8**	**-0.3**	**-0.7**	**4.3**	**3.4**
1966-67	**Annual Plan (1966-67)**	1.0	-1.4	-2.3	4.9	3.6
1967-68	**Annual Plan (1967-68)**	8.1	14.9	17.1	-0.4	4.3
1968-69	**Annual Plan (1968-69)**	2.6	-0.2	-0.3	0.4	6.0
	Average	3.9	4.4	4.8	1.6	4.7
1969-70	**Fourth Plan (1969-74)**	6.5	6.4	7.2	-0.3	2.4
1970-71		5.0	7.1	7.4	4.9	2.6
1971-72		1.0	-1.9	-2.7	4.4	6.4
1972-73		-0.3	-5.0	-5.6	-0.9	2.7
1973-74		4.6	7.2	8.4	-2.8	2.9
	Average	3.4	2.8	3.0	1.1	3.4
1974-75	**Fifth Plan (1974-79)**	1.2	-1.5	-2.8	8.7	7.6
1975-76		9.0	12.9	14.2	2.8	6.1
1976-77		1.2	-5.8	-6.1	-3.3	-3.3
1977-78		7.5	10.0	12.5	-11.5	0.0
1978-79		5.5	2.3	2.0	5.4	4.8
	Average	**4.9**	**3.6**	**4.0**	**0.4**	**3.1**

1979-80	**Annual Plan (1979-80)**	-5.2	-12.8	-13.4	-8.9	-0.7
1980-81	**Sixth Plan (1980-85)**	7.2	12.9	14.4	-1.5	1.8
1981-82		5.6	4.6	4.8	2.8	0.9
1982-83		2.9	-0.3	-0.1	-1.9	-1.1
1983-84		7.9	10.1	10.8	-3.2	19.6
1984-85		4.0	1.6	1.5	0.4	6.8
	Average	**5.5**	**5.8**	**6.3**	**-0.7**	**5.6**
1985-86	**Seventh Plan (1985-90)**	4.2	0.3	0.2	0.6	3.3
1986-87		4.3	-0.4	-0.4	-1.2	0.5
1987-88		3.5	-1.6	-1.7	-1.8	2.7
1988-89		10.2	15.6	16.8	-0.6	9.1
1989-90		6.1	1.2	0.4	9.9	11.4
	Average	**5.7**	**3.0**	**3.1**	**1.4**	**5.4**
1990-91	**Annual Plan (1990-91)**	5.3	4.0	4.3	-1.3	4.8
1991-92	**Annual Plan (1991-92)**	1.4	-2.0	-2.3	0.8	3.6
	Average	3.4	1.0	1.0	-0.3	4.2
1992-93	**Eighth Plan (1992-97)**	5.4	6.7	7.1	-2.3	8.5
1993-94		5.7	3.3	3.2	-0.5	11.2
1994-95		6.4	4.7	4.7	2.7	6.3
1995-96		7.3	-0.7	-1.0	-0.4	5.2
1996-97		8.0	9.9	10.4	1.5	8.1
	Average	**6.5**	**4.8**	**4.9**	**0.2**	**7.9**
1997-98	**Ninth Plan (1997-2002)**	4.3	-2.6	-3.0	2.5	1.7
1998-99		6.7	6.3	7.1	1.2	-5.0
1999-00		7.6	2.7	2.4	4.4	7.0
2000-01		4.3	0.0	-0.6	2.7	4.7
2001-02		5.5	6.0	6.5	3.1	5.0
	Average	**5.7**	**2.5**	**2.5**	**2.8**	**2.7**
2002-03	**Tenth Plan (2002-07)**	4.0	-6.6	-8.1	0.7	4.1
2003-04		8.1	9.0	10.8	-1.1	3.6
2004-05		7.0	0.2	0.1	2.1	-2.0
2005-06		9.5	5.1	5.5	1.8	5.9
2006-07		9.6	4.2	4.1	3.3	6.6
	Average	7.6	2.4	2.5	1.3	3.6
2007-08	**Eleventh Plan (2007-12)**	9.3	5.8	6.3	1.4	5.8
2008-09		6.7	0.1	-0.3	1.9	2.7
2009-10		8.6	0.8	0.4	2.9	3.2
2010-11 (QE)		9.3	7.9	8.8	2.2	5.4
2011-12 (RE)		6.2	3.6	3.9	2.4	1.8
	Average	**8.0**	**3.7**	**3.8**	**2.1**	**3.8**

Annexure 1.2: Plan-wise GDP Share (%) to Total Economy by Economic Activity

(at 2004-05 prices)

Year	Five Year Plan	Agriculture, forestry & fishing	Agriculture, incl. livestock	Forestry & logging	Fishing
1950-51	**First Plan (1951-56)**	51.9	41.8	14.3	1.0
1951-52		51.4	41.5	14.0	1.0
1952-53		51.6	42.1	12.9	1.0
1953-54		52.4	43.2	11.7	1.0
1954-55		51.7	42.6	11.7	1.0
1955-56		50.0	41.0	11.9	1.1
	Average	51.4	42.1	12.4	1.0
1956-57	**Second Plan (1956-61)**	49.9	41.1	11.1	1.1
1957-58		48.2	39.5	11.3	1.2
1958-59		49.3	40.8	10.5	1.1
1959-60		47.8	39.3	10.6	1.1
1960-61		47.6	39.4	10.0	1.1
	Average	48.6	40.0	10.7	1.1
1961-62	**Third Plan (1961-66)**	46.3	38.1	10.1	1.1
1962-63		44.4	36.5	9.9	1.0
1963-64		43.2	35.4	10.0	1.1
1964-65		43.9	36.3	9.1	1.1
1965-66		40.5	32.6	10.8	1.2
	Average	43.7	35.8	10.0	1.1
1966-67	**Annual Plan (1966-67)**	39.6	31.5	11.2	1.2
1967-68	**Annual Plan (1967-68)**	42.0	34.2	10.3	1.1
1968-69	**Annual Plan (1968-69)**	40.9	33.2	10.1	1.2
	Average	40.8	33.0	10.5	1.2
1969-70	**Fourth Plan (1969-74)**	40.9	33.4	9.4	1.1
1970-71		41.7	34.2	9.4	1.1
1971-72		40.5	32.9	9.7	1.2
1972-73		38.6	31.2	9.7	1.2
1973-74		39.5	32.3	9.0	1.2
	Average	40.2	32.8	9.4	1.2
1974-75	**Fifth Plan (1974-79)**	38.5	31.1	9.7	1.3
1975-76		39.9	32.5	9.1	1.2
1976-77		37.1	30.2	8.7	1.2
1977-78		38.0	31.6	7.2	1.1
1978-79		36.8	30.6	7.2	1.1
	Average	38.1	31.2	8.4	1.2
1979-80	**Annual Plan (1979-80)**	33.9	27.9	6.9	1.1

1980-81		35.7	29.8	6.3	1.1
1981-82		35.3	29.6	6.2	1.0
1982-83	**Sixth Plan (1980-85)**	34.2	28.7	5.9	1.0
1983-84		35.0	29.5	5.3	1.1
1984-85		34.2	28.8	5.1	1.1
	Average	**34.9**	**29.3**	**5.7**	**1.1**
1985-86		32.9	27.7	4.9	1.1
1986-87		31.4	26.4	4.6	1.1
1987-88	**Seventh Plan (1985-90)**	29.9	25.1	4.4	1.1
1988-89		31.3	26.6	4.0	1.1
1989-90		29.9	25.2	4.1	1.1
	Average	31.1	26.2	4.4	1.1
1990-91	**Annual Plan (1990-91)**	29.5	24.9	3.9	1.1
1991-92	**Annual Plan (1991-92)**	28.5	24.0	3.8	1.1
	Average	**29.0**	**24.5**	**3.8**	**1.1**
1992-93		28.9	24.4	3.6	1.2
1993-94		28.2	23.8	3.3	1.2
1994-95	**Eighth Plan (1992-97)**	27.8	23.5	3.2	1.2
1995-96		25.7	21.7	3.0	1.2
1996-97		26.2	22.1	2.8	1.2
	Average	**27.4**	**23.1**	**3.2**	**1.2**
1997-98		24.5	20.6	2.8	1.2
1998-99		24.4	20.7	2.6	1.0
1999-00	**Ninth Plan (1997-2002)**	23.3	19.7	2.6	1.0
2000-01		22.3	18.8	2.5	1.0
2001-02		22.4	18.9	2.5	1.0
	Average	**23.4**	**19.7**	**2.6**	**1.1**
2002-03		20.1	16.7	2.4	1.0
2003-04		20.3	17.1	2.2	1.0
2004-05	**Tenth Plan (2002-07)**	19.0	16.0	2.1	0.9
2005-06		18.3	15.5	1.9	0.9
2006-07		17.4	14.7	1.8	0.9
	Average	**19.0**	**16.0**	**2.1**	**0.9**
2007-08		16.8	14.3	1.7	0.8
2008-09		15.8	13.4	1.6	0.8
2009-10	**Eleventh Plan (2007-12)**	14.6	12.3	1.5	0.8
2010-11		14.5	12.3	1.4	0.7
2011-12 (RE)		14.1	12.0	1.4	0.7
	Average	**15.2**	**12.9**	**1.5**	**0.8**

Annexure 1.3: Plan-wise and Year-wise Share (%) of Public & Private Sector in Gross Capital Formation (GCF)

(2004-05 prices)

Plan Period	Year	(%) Share of Public & Private GCF in GCF of Agriculture & Allied Sectors		(%) Share of Public & Private GCF in GCF of Agriculture Sector incl. livestock		(%) Share of Public & Private GCF in GCF of Forestry & logging Sector		(%) Share of Public & Private GCF in GCF of Fishing Sector	
		Public	Private	Public	Private	Public	Private	Public	Private
Third Plan (1961-66)	1959-60	NA							
	1960-61	44.6	55.4	44.0	56.0	97.7	2.3	0	100
	1961-62	39.7	60.3	39.1	60.9	105.2	-5.2	0	100
	1962-63	44.0	56.0	42.9	57.1	103.2	-3.2	0	100
	1963-64	42.1	57.9	41.3	58.7	98.5	1.5	0	100
	1964-65	38.9	61.1	38.2	61.8	96.1	3.9	0	100
	1965-66	41.3	58.7	40.7	59.3	96.4	3.6	0	100
Average		41.2	58.8	40.4	59.6	99.9	0.1	0	100
Annual Plan (1966-67)	1966-67	32.7	67.3	32.0	68.0	98.2	1.8	0	100
Annual Plan (1967-68)	1967-68	27.9	72.1	27.0	73.0	95.1	4.9	0	100
Annual Plan (1968-69)	1968-69	29.0	71.0	28.5	71.5	96.7	3.3	0	100
Average									
Fourth Plan (1969-74)	1969-70	28.4	71.6	27.8	72.2	105.2	-5.2	0	100
	1970-71	32.4	67.6	31.7	68.3	98.3	1.7	0	100
	1971-72	32.6	67.4	31.9	68.1	98.2	1.8	0	100
	1972-73	39.8	60.2	39.5	60.5	98.1	1.9	0.0	100.0
	1973-74	35.9	64.1	35.6	64.4	98.0	2.0	0.2	99.8
Average		33.8	66.2	33.3	66.7	99.6	0.4	0.0	100.0
Fifth Plan (1974-79)	1974-75	32.7	67.3	32.4	67.6	98.4	1.6	0.4	99.6
	1975-76	35.3	64.7	34.9	65.1	98.7	1.3	0.7	99.3
	1976-77	40.2	59.8	39.7	60.3	98.7	1.3	0.7	99.3
	1977-78	41.9	58.1	41.5	58.5	100.8	-0.8	0.6	99.4
	1978-79	38.8	61.2	38.2	61.8	98.6	1.4	0.6	99.4
Average		37.8	62.2	37.4	62.6	99.1	0.9	0.6	99.4
Annual Plan (1979-80)	1979-80	40.4	59.6	39.8	60.2	98.6	1.4	0.6	99.4
Sixth Plan (1980-85)	1980-81	49.2	50.8	48.5	51.5	99.0	1.0	1.3	98.7
	1981-82	54.7	45.3	54.0	46.0	99.2	0.8	1.5	98.5
	1982-83	51.2	48.8	50.3	49.7	99.1	0.9	1.6	98.4
	1983-84	48.1	51.9	46.7	53.3	98.9	1.1	2.6	97.4
	1984-85	49.5	50.5	48.3	51.7	98.9	1.1	3.8	96.2
Average		50.5	49.5	49.6	50.4	99.0	1.0	2.2	97.8
Seventh Plan (1985-90)	1985-86	46.6	53.4	45.6	54.4	99.7	0.3	2.4	97.6
	1986-87	43.8	56.2	42.6	57.4	98.7	1.3	3.4	96.6
	1987-88	35.8	64.2	35.0	65.0	98.0	2.0	1.8	98.2
	1988-89	35.8	64.2	34.7	65.3	98.2	1.8	0.9	99.1
	1989-90	31.0	69.0	29.5	70.5	98.3	1.7	0.9	99.1

Average		38.6	61.4	37.5	62.5	98.6	1.4	1.9	98.1
Annual Plan (1990-91)	**1990-91**	20.6	79.4	19.1	80.9	98.2	1.8	0.7	99.3
Annual Plan (1991-92)	**1991-92**	26.0	74.0	24.4	75.6	98.4	1.6	0.6	99.4
Average									
Eighth Plan (1992-97)	**1992-93**	22.0	78.0	20.8	79.2	98.2	1.8	0.1	99.9
	1993-94	27.0	73.0	26.1	73.9	98.0	2.0	0.4	99.6
	1994-95	31.2	68.8	30.6	69.4	98.1	1.9	0.2	99.8
	1995-96	31.5	68.5	31.0	69.0	98.0	2.0	0.2	99.8
	1996-97	27.9	72.1	27.3	72.7	97.9	2.1	0.1	99.9
Average		27.9	72.1	27.2	72.8	98.0	2.0	0.2	99.8
Ninth Plan (1997-2002)	**1997-98**	22.1	77.9	21.2	78.8	97.4	2.6	0.1	99.9
	1998-99	20.7	79.3	19.8	80.2	97.0	3.0	0.3	99.7
	1999-00	15.0	85.0	14.6	85.4	95.2	4.8	-0.1	100.1
	2000-01	15.2	84.8	14.8	85.2	95.5	4.5	0.0	100.0
	2001-02	14.4	85.6	14.3	85.7	94.3	5.7	0.0	100.0
Average		17.5	82.5	16.9	83.1	95.9	4.1	0.1	99.9
Tenth Plan (2002-07)	**2002-03**	14.0	86.0	14.2	85.8	94.6	5.4	0.0	100.0
	2003-04	18.1	81.9	17.6	82.4	95.9	4.1	0.0	100.0
	2004-05	21.3	78.7	22.1	77.9	95.9	4.1	0.0	100.0
	2005-06	23.0	77.0	23.8	76.2	94.6	5.4	0.0	100.0
	2006-07	25.0	75.0	25.9	74.1	96.5	3.5	0.0	100.0
Average		20.3	79.7	20.7	79.3	95.5	4.5	0.0	100.0
Eleventh Plan (2007-12)	**2007-08**	22.0	78.0	22.9	77.1	97.0	3.0	0.0	100.0
	2008-09	16.2	83.8	16.6	83.4	92.2	7.8	0.0	100.0
	2009-10	17.3	82.7	18.0	82.0	94.6	5.3	0.0	100.0
	2010-11	15.1	84.9	15.7	84.3	93.9	6.1	0.0	100.0
	2011-12								
Average (first four years)		17.7	82.3	18.3	81.7	94.4	5.6	0.0	100.0

Annexure 1.4: Plan-wise and Year-wise share (%) of GCF/Investment

(2004-05 prices)

Plan Period	Year	(%) Share of GCF in Agriculture & Allied Sectors to GCF in the total Economy			(%) Share of Agriculture & Allied Sectors GCF to GDP in Agriculture & Allied Sectors	(%) Share of GCF in total Economy to GDP in total Economy
		Public	Private	Total		
First Plan (1951-56)	1950-51			23.5	7.3	16.1
	1951-52			25.2	7.5	15.3
	1952-53			26.6	6.7	13.0
	1953-54			28.8	6.4	11.6
	1954-55			24.3	6.5	13.7
	1955-56			23.6	7.4	15.7
Average				25.7	6.9	13.9
Second Plan (1956-61)	1956-57			21.0	7.9	18.9
	1957-58			19.8	7.6	18.6
	1958-59			21.6	6.6	15.0
	1959-60			15.1	5.4	17.2
	1960-61	14.5	18.7	16.6	6.2	17.8
Average				18.8	6.8	17.5
Third Plan (1961-66)	1961-62	13.7	19.8	16.8	6.7	18.5
	1962-63	13.1	19.4	16.0	7.1	19.6
	1963-64	12.0	21.0	15.9	7.7	20.8
	1964-65	11.7	20.4	15.8	7.7	21.5
	1965-66	12.0	19.6	15.6	8.7	22.6
Average		12.5	20.0	16.0	7.6	20.6
Annual Plan (1966-67)	1966-67	11.5	21.2	16.7	9.6	22.9
Annual Plan (1967-68)	1967-68	12.9	24.2	19.5	10.2	22.0
Annual Plan (1968-69)	1968-69	14.5	26.7	21.5	11.2	21.4
Average		13.0	24.0	19.2	10.4	22.1
Fourth Plan (1969-74)	1969-70	14.3	24.1	20.2	10.5	21.2
	1970-71	14.6	20.7	18.2	8.6	19.7
	1971-72	14.1	19.6	17.4	9.4	21.9
	1972-73	15.2	21.8	18.6	10.4	21.6
	1973-74	14.3	19.9	17.4	9.6	21.7
Average		14.5	21.2	18.4	9.7	21.2
Fifth Plan (1974-79)	1974-75	14.6	18.0	16.7	9.9	22.9
	1975-76	14.1	22.9	18.8	9.0	19.1
	1976-77	16.1	23.6	19.9	11.5	21.5
	1977-78	16.9	19.6	18.4	11.0	22.8
	1978-79	17.1	21.2	19.4	12.6	23.9
Average		15.8	21.0	18.6	10.8	22.0
Annual Plan (1979-80)	1979-80	17.0	23.0	20.2	14.4	24.2

Sixth Plan (1980-85)	1980-81	17.0	20.0	18.4	11.6	22.5
	1981-82	13.3	13.4	13.3	9.3	24.8
	1982-83	11.9	15.9	13.6	9.8	24.8
	1983-84	12.3	18.2	14.8	9.8	23.2
	1984-85	11.0	15.0	12.7	9.0	24.1
Average		13.1	16.5	14.6	9.9	23.9
Seventh Plan (1985-90)	1985-86	9.5	12.9	11.1	8.5	25.3
	1986-87	8.5	14.4	11.1	9.1	25.7
	1987-88	9.4	17.7	13.5	11.2	24.8
	1988-89	8.1	13.6	11.0	9.0	25.6
	1989-90	7.0	13.8	10.6	8.9	25.2
Average		8.5	14.5	11.4	9.3	25.3
Annual Plan (1990-91)	1990-91	6.6	19.9	14.1	12.8	26.9
Annual Plan (1991-92)	1991-92	6.0	15.2	10.9	9.1	23.9
Average		6.3	17.6	12.5	11.0	25.4
Eighth Plan (1992-97)	1992-93	6.5	16.1	12.2	11.0	26.1
	1993-94	6.7	14.9	11.2	9.1	23.1
	1994-95	6.3	10.9	8.9	8.1	25.3
	1995-96	6.7	7.8	7.4	8.1	28.0
	1996-97	6.8	9.9	8.8	7.9	23.6
Average		6.6	11.9	9.7	8.8	25.2
Ninth Plan (1997-2002)	1997-98	5.8	8.8	7.9	8.6	26.8
	1998-99	5.7	9.8	8.5	9.2	26.4
	1999-00	5.4	12.6	10.5	13.1	29.1
	2000-01	5.1	12.4	10.2	11.9	26.0
	2001-02	6.0	14.3	11.9	14.6	27.5
Average		5.6	11.6	9.8	11.5	27.1
Tenth Plan (2002-07)	2002-03	5.7	12.2	10.5	14.2	27.2
	2003-04	6.3	10.0	9.0	12.4	27.8
	2004-05	6.7	7.3	7.2	13.5	35.8
	2005-06	7.1	7.0	7.0	14.6	38.0
	2006-07	7.1	6.4	6.6	14.9	39.3
Average		6.6	8.6	8.1	13.9	33.6
Eleventh Plan (2007-12)	2007-08	6.1	6.5	6.4	16.1	42.5
	2008-09	4.8	9.3	8.1	19.4	37.8
	2009-10	5.1	7.8	7.1	19.8	40.8
	2010-11	4.5	8.1	7.2	20.1	40.4
	2011-12					
Average (first four years)		5.1	7.9	7.2	18.8	40.4

Annexure. 1.5: All India Average Annual Growth Rates of Area, Production and Yield of Principal Crops

Crops	Average Growth (%)			Average Growth (%)		
	11th Plan (2002-03 to 2006-07)			12th Plan (2007-08 to 2011-12)		
	Area	Production	Yield	Area	Production	Yield
Rice	-0.39	1.25	1.17	0.16	2.48	2.23
Wheat	1.30	1.11	-0.32	1.34	4.42	3.05
Jowar	-2.84	-0.89	2.07	-5.50	-2.93	3.09
Bajra	1.67	17.12	7.28	-1.55	7.40	8.36
Maize	3.77	4.02	-0.15	1.99	8.72	6.46
Ragi	-5.52	-2.67	0.40	0.95	8.86	6.90
Small Millets	-5.03	-2.49	2.32	-4.78	12.76	17.60
Barley	-0.28	-1.21	-0.90	0.79	6.19	4.29
Coarse Cereals	-0.26	2.55	1.75	-1.63	5.67	7.30
Total Cereals	0.07	1.21	0.74	-0.04	3.61	3.59
Gram	3.60	4.70	0.28	2.36	4.34	1.91
Tur	1.38	1.06	-0.41	3.28	4.83	1.33
Total Pulses	1.31	2.66	0.65	1.61	4.41	2.66
Total Foodgrains	0.29	1.29	0.59	0.24	3.65	3.35
Sugarcane	3.98	4.90	0.66	0.24	0.79	0.48
Groundnut	-1.65	3.61	4.32	-0.69	15.75	13.65
Sesamum	0.98	3.64	0.51	2.57	8.52	5.40
R&M	7.32	11.55	3.24	-1.63	0.05	1.18
Sunflower	14.04	13.83	0.37	-18.96	-14.98	5.82
Soyabea	5.80	12.26	6.18	4.14	7.82	3.88
Total Nine Oilseeds	3.55	7.99	3.53	0.02	5.67	5.36
Cotton	0.57	20.01	19.40	5.97	10.46	3.93
Jute	-1.82	-0.38	1.49	0.48	1.57	0.90
Mesta	-3.85	-2.44	1.45	-5.56	-5.43	-0.26
Jute & Mesta	-2.15	-0.58	1.45	-0.42	0.94	-0.26

Source: Directorate of Economics & Statistics, Ministry of Agriculture.

Annexure. 2.1: Land Use Classification

(Area in thousand ha.)

Year	Geo-graphical Area	Agri. Land/ Cultivable land/ Culturable land/ Arable land	Forests	Not available for cultivation		Other uncultivated land excluding fallow land			Fallow Lands		Total cropped area
				Area under non-agri-cultural uses	Barren and un-culturable land	Permanent pastures & other grazing lands	Land under Misc. tree crops & groves (not incl. in net area sown) Permanent pastures & other grazing lands	culturable waste land	Fallow lands other than current fallows	Current fallows	
1950-51	328726	189641	40482	9357	38160	6675	19828	22943	17445	10679	131893
1960-61		179689	54052	14840	35911	13966	4459	19212	11180	11639	152772
1970-71		182056	63830	16478	28128	13261	4367	17500	8728	10598	165791
1980-81		185156	67460	19596	19958	11989	3578	16744	9720	14826	172630
1990-91		185177	67805	21087	19389	11404	3818	14995	9662	13703	185742
1991-92		185000	67866	21465	19270	11299	3761	14994	9941	14672	182242
1992-93		184875	67981	21771	19122	11096	3781	14589	9672	14188	185618
1993-94		184734	68277	22210	18694	10966	3696	14409	9834	14376	186595
1994-95		184173	68603	22556	18463	11034	3732	14262	9969	13250	188053
1995-96		183623	68817	22362	19009	11064	3481	14098	10016	13831	187471
1996-97		184121	69103	22554	17964	10880	3655	14021	10192	13323	189502
1997-98		183972	69245	23138	17461	10845	3730	13943	10078	14275	189988
1998-99		184024	69215	23348	17524	10896	3679	13899	10106	13587	191649
1999-00		183873	69164	23598	17536	10845	3725	13742	10289	15053	188396
2000-01		183455	69843	23752	17483	10662	3445	13631	10267	14777	185340
2001-02		183551	69720	23912	17417	10528	3453	13520	10534	15344	188286
2002-03		183449	69821	24118	17520	10450	3443	13651	11967	22337	174108
2003-04		183132	69968	24513	17469	10484	3383	13241	11313	14487	189669
2004-05		182946	69960	24757	17471	10452	3364	13272	10878	14790	191119
2005-06(p)		182685	69994	24989	17334	10444	3391	13225	10696	14211	192756
2006-07(p)		182508	70002	25436	17290	10414	3364	13271	10516	15509	192408
2007-08(p)		182691	70020	25711	16990	10198	3413	13059	10329	14512	195138
2008-09(p)		182514	70034	26064	16798	10177	3356	12752	10286	14191	195357
2009-10(p)		182466	70042	26171	16783	10149	3351	12857	10484	15753	192197

(p) : Provisional except Geographical Area.

: In 2002-03 there is 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 mainly due to deficient rainfall.

Annexure 2.2: Agriculture Land by use in India

		Area in Million Hect.				(%) to the reported Area			
		1990-91	2003-04	2008-09 (p)	2009-10 (p)	1990-91	2003-04	2008-09 (p)	2009-10 (p)
I.	Geographical Area	328.73	328.73	328.73	328.73				
II.	Reporting area for land utilisation statistics	304.86	305.57	305.59	305.61				
1.	Forests	67.81	69.97	70.03	70.04	22.24	22.90	22.92	22.92
2.	Not available for cultivation	40.48	41.98	42.86	42.95	13.28	13.74	14.03	14.06
(A)	Area under non-agricultural uses	21.09	24.51	26.06	26.17	6.92	8.02	8.53	8.56
(B)	Barren and unculturable land	19.39	17.47	16.80	16.78	6.36	5.72	5.50	5.49
3.	Other uncultivated land excluding fallow land	30.22	27.11	26.28	26.36	9.91	8.87	8.60	8.62
(A)	Permanent pastures & other grazing lands	11.40	10.48	10.18	10.15	3.74	3.43	3.33	3.32
(B)	Land under Misc. tree crops & groves not included in net area sown	3.82	3.38	3.36	3.35	1.25	1.11	1.10	1.10
(C)	culturable waste land	15.00	13.24	12.75	12.86	4.92	4.33	4.17	4.21
4.	Fallow lands	23.37	25.80	24.48	26.24	7.66	8.44	8.01	8.58
(A)	Fallow lands other than current fallows	9.66	11.31	10.29	10.48	3.17	3.70	3.37	3.43
(B)	Current fallows	13.70	14.49	14.19	15.75	4.49	4.74	4.64	5.15
5.	Net area sown	143.00	140.71	141.93	140.02	46.91	46.05	46.44	45.82
6.	Total cropped area	185.74	189.67	195.36	192.20				
7.	Area Sown more than once	42.74	48.96	53.43	52.18				
8.	Cropping intensity	129.89	134.80	137.64	137.26				
III.	NET Irrigated area	48.02	57.05	63.74	63.26				
IV.	TOTAL/ Gross Irrigated Area	63.20	78.04	88.87	86.42				

Annexure: 2.3: Trends in Cropping Pattern in India

(%) Share Crop-wise

Years	1990-91	2003-04	2008-09(p)	2009-10(p)
Total Area Under Crops	**185742**	**189669**	**195357**	**192197**
Crop-wise Share in Area				
Rice	23.0	22.3	23.1	22.0
Jowar	7.6	5.0	3.9	4.1
Bajra	5.8	5.8	4.5	4.7
Maize	3.2	3.8	4.2	4.3
Ragi	1.2	0.9	0.8	0.7
Wheat	12.9	14.2	14.3	14.9
Barley	0.5	0.4	0.4	0.3
Other Cereals & Small Millets	1.3	0.6	0.5	0.4
Total Cereals & Millets	55.5	53.0	51.6	51.4
Gram	4.0	3.7	4.1	4.2
Arhar	1.9	1.8	1.7	1.8
Other Pulses	7.4	7.3	6.4	6.5
Total Pulses	13.4	12.9	12.2	12.5
Total Foodgrains	68.9	65.9	63.8	63.9
Sugarcane	2.1	2.4	2.5	2.4
Total Condiments & Spices	1.3	1.7	1.6	1.7
Total Fruits & Vegetables	3.6	4.9	5.2	5.4
Other Food Crops	0.1	0.1	0.1	0.1
Total Food Crops	75.9	74.9	73.2	73.4
Groundnut	4.5	3.3	3.2	2.9
Castor Seed	0.5	0.4	0.4	0.4
Sesamum	1.3	1.0	1.0	1.2
Rapeseed & Mustared	2.8	2.7	3.1	2.8
Linseed	0.5	0.2	0.2	0.2
Coconut	0.8	1.0	1.0	1.0
Other Oilseeds	3.2	5.2	6.4	6.4
Total Oilseeds	13.5	13.8	15.2	14.9
Cotton	4.1	4.2	4.8	5.2
Jute	0.4	0.5	0.4	0.4
Other Fibres	0.2	0.1	0.1	0.1
Total Fibers	4.7	4.8	5.3	5.7
Indigo	0.0	0.0	0.0	0.0
Opium	0.0	0.0	0.0	0.0
Tobacco	0.2	0.2	0.2	0.3
Tea	0.2	0.3	0.3	0.3
Coffee	0.2	0.2	0.2	0.2
Fodder Crops	4.5	4.6	4.4	3.9
Other Non-Food Crops	0.8	1.1	1.2	1.4
Total Non-Food Crops	24.1	25.1	26.8	26.6

Annexure. 3.1: All-India Consumption of Fertilisers in Terms of Nutrients (N, P & K)

(Thousand Tonnes)

Year	N	P	K	Total
1	2	3	4	5
1950-51	58.7	6.9	-	65.6
1955-56	107.5	13.0	10.3	130.8
1960-61	210.0	53.1	29.0	292.1
1965-66	574.8	132.5	77.3	784.6
1970-71	1487.0	462.0	228.0	2177.0
1975-76	2148.6	466.8	278.3	2893.7
1980-81	3678.1	1213.6	623.9	5515.6
1985-86	5660.8	2005.2	808.1	8474.1
1986-87	5716.0	2078.9	850.0	8644.9
1987-88	5716.8	2187.0	880.5	8784.3
1988-89	7251.0	2720.7	1068.3	11040.0
1989-90	7386.0	3014.2	1168.0	11568.2
1990-91	7997.2	3221.0	1328.0	12546.2
1991-92	8046.3	3321.2	1360.5	12728.0
1992-93	8426.8	2843.8	883.9	12154.5
1993-94	8788.3	2669.3	908.4	12366.0
1994-95	9507.1	2931.7	1124.7	13563.5
1995-96	9822.8	2897.5	1155.8	13876.1
1996-97	10301.8	2976.8	1029.6	14308.1
1997-98	10901.8	3913.6	1372.5	16187.9
1998-99	11353.8	4112.2	1331.5	16797.5
1999-00	11592.7	4798.3	1678.7	18069.7
2000-01	10920.2	4214.6	1567.5	16702.3
2001-02	11310.2	4382.4	1667.1	17359.7
2002.03	10474.1	4018.8	1601.2	16094.1
2003-04	11077.0	4124.3	1597.9	16799.1
2004-05	11713.9	4623.8	2060.6	18398.3
2005-06	12723.3	5203.7	2413.3	20340.3
2006-07	13772.9	5543.3	2334.8	21651.0
2007-08	14419.1	5514.7	2636.3	22570.1
2008-09	15090.5	6506.2	3312.6	24909.3
2009-10	15580.0	7274.0	3632.4	26486.4
2010-11	16558.2	8049.7	3514.3	28122.2
2011-12	17300.3	7914.3	2525.5	27740.0

Note : Figures upto 1982-83 relate to Feb-.Jan. and onwards to April-March.
Source: Department of Agriculture & Cooperation

Annexure. 3.2: Fertiliser Consumption per Hectare in Agricultural Land in Selected Countries

(Kg./Hectare)

Country	2008				2009			
	N	P2 Os	K2 O	Total	N	P2 Os	K2 O	Total
1	2	3	4	5	6	7	8	9
Africa								
Egypt	321.6	50.9	15.5	388.1	323.4	40.7	10.8	375.0
Morocco	21.7	12.4	5.1	39.2	22.1	12.5	5.2	39.8
South africa	27.4	12	7.4	46.8	27.1	11.8	7.2	46.1
N & C America								
Canada	34.8	11	3.4	49.3	36.8	12.1	5.2	54.1
Mexico	37.6	6.5	7.2	51.2	45.1	5.4	6.1	56.6
USA	62.3	17.1	16.8	96.3	66.7	22.5	24.7	113.9
South America								
Brazil	36.4	46.5	53.7	136.6	37.3	49	46	132.3
Chile	148.7	62.3	51.7	262.6	150.6	62	52.1	264.6
Asia								
Bangladesh	140.0	9.5	6.0	155.5	134.4	35.0	18.9	188.3
China	271.2	85.7	38.2	395.1	270.3	90.1	35.7	396.0
India	89.1	38.4	19.6	147.1	91.9	42.9	21.4	156.1
	(77.3)	(33.3)	(17.0)	(127.7)	(79.9)	(37.3)	(18.6)	(135.8)
Indonesia	66.8	10.3	23.2	100.3	69.3	12.9	18.8	101
Japan	90.8	75.6	54	220.4	83.3	66.3	65.1	214.6
Korea Rep	172.7	51.5	57.2	281.5	175.4	50.1	58.5	284
Malaysia	66.1	23.3	92.7	182.2	68.8	30.3	92.3	191.4
Nepal	3.2	3.2	0.4	6.9	3.4	3.4	0.4	7.1
Pakistan	142.6	30.6	1.2	174.4	163.4	40.4	1.1	204.9
Sri Lanka	75.1	22.7	31.7	129.5	78.3	20.7	23	122.1
Thailand	49.2	15.7	19.3	84.2	64.6	12.6	8.7	86
Turkey	46.2	13.4	3.6	63.3	58.1	23.8	2.6	84.5
Vietnam	100.5	63.8	39.4	203.8	123.6	62.3	31.2	217
Europe								
Belarus	98.2	41.1	137.1	276.4	93.6	41.3	129.5	264.3
Denmark	78.9	7.1	13.3	99.3	78.8	7.0	14.4	100.1
France	108.1	15.2	20.1	143.5	106.7	20.9	21.5	149.0
Gemany	127.8	14.4	14.8	156.9	129.2	19.4	29.9	178.4
Netherlands	224.1	29.9	32.7	286.8	224.8	32.1	30.3	287.2
Poland	81.0	31.6	31.6	144.2	76.1	27.2	32.4	135.7
Russian Fedn.	11.5	4.1	2.7	18.3	12.1	4.3	2.8	19.2
Spain	42.4	9.1	10.9	62.4	47.2	18.8	15.9	81.9
UK	151.7	21.8	34.3	207.8	166.6	29.4	43.2	239.2
Ukraine	22.0	5.2	4.7	31.9	21.0	5.7	2.2	28.9
Oceania								
Australia	18.8	18.4	4.8	42.1	17.9	13.5	3.3	34.7
New Zealand	565.1	560.2	196.7	1322.0	607.4	605.4	179.5	1392.3
World	**64.4**	**22.2**	**15.3**	**101.9**	**66.7**	**24.6**	**15.6**	**106.9**

( ) = Fertiliser Consumption per hectare of gross cropped area for 2008-09 and 2009-10

Source: 'Fertiliser Statistics - 2010-11' The Fertiliser Association of India, New Delhi.

Annexure. 3.3: Consumption of Electricity for Agricultural Purposes

Year	Consumption for Agricultural Purposes (GWh)	Total Consumption (GWh)	% Share of Agricultural Consumption to Total Consumption
1	2	3	4
1982-83	17817	95589	18.64
1983-84	18234	102344	17.82
1984-85	20960	114068	18.38
1985-86	23422	122999	19.04
1986-87	29444	135952	21.66
1987-88	35267	145613	24.22
1988-89	38878	160196	24.27
1989-90	44056	175419	25.11
1990-91	50321	190357	26.44
1991-92	58557	207645	28.20
1992-93	63328	220674	28.70
1993-94	70699	238569	29.63
1994-95	79301	259630	30.54
1995-96	85732	277029	30.95
1996-97	84019	280206	29.98
1997-98	91242	296749	30.75
1998-99	97195	309734	31.38
1999-00	90934	312841	29.07
2000-01	84729	316600	26.76
2001-02	81673	322459	25.33
2002-03	84486	339598	24.88
2003-04	87089	360937	24.13
2004-05	88555	386134	22.93
2005-06	90292	411887	21.92
2006-07	99023	455748	21.73
2007-08	104182	501977	20.75
2008-09	107776	527564	20.43
2009-10	119492	569618	20.98

Source: Central Electricity Authority, New Delhi.

Annexure. 3.4: State-wise Consumption of Electricity for Agriculture purpose in 2009-10

Region	State/UT	Consumption for Agriculture Purpose (GWh)	Total Energy Sold (GWh)	% Share of Consumption for Agriculture
1	**2**	**3**	**4**	**5**
Northern	Haryana	9190.03	22809.23	40.29
	Himachal Pradesh	36.82	5814.51	0.63
	Jammu & Kashmir	204.88	3538.71	5.79
	Punjab	10469.31	31291.49	33.46
	Rajasthan	12072.59	30622.78	39.42
	Uttar Pradesh	7340.72	41625.1	17.64
	Uttrakhand	298.10	6249.21	4.77
	Chandigarh	1.02	1237.58	0.08
	Delhi	39.67	19295.84	0.21
	Sub-Total	**39653.14**	**162484.45**	**24.40**
Western	Gujarat	12813.60	49777.64	25.74
	Madhya Pradesh	5985.65	22323.67	26.81
	Chhattisgarh	1751.60	11311.42	15.49
	Maharashtra	13264.22	77660.62	17.04
	Goa	110.76	2657.63	4.17
	Daman & Diu	2.49	1452.25	0.17
	D. & N. Haveli	3.00	3329.74	0.09
	Sub-Total	**33931.52**	**16813.17**	**20.11**
Southern	Andhra Pradesh	18825.020	59677.44	31.54
	Karnataka	12384.770	36198.33	34.21
	Kerala	266.00	13967.15	1.90
	Tamil Nadu	11951.00	57722.33	20.70
	Lakshadweep	73.80	1920.96	3.84
	Pondicherry	0.00	25.48	0.00
	Sub-Total	**43500.59**	**169511.69**	**25.66**
Eastern	Bihar	794.01	6067.22	13.09
	Jharkhand	65.72	13082.67	0.50

Region	State/UT	Consumption for Agriculture Purpose (GWh)	Total Energy Sold (GWh)	% Share of Consumption for Agriculture
1	**2**	**3**	**4**	**5**
	Orissa	149.57	12227.86	1.22
	West Bengal	1322.97	31455.00	4.21
	A.& N. Islands	0.74	176.89	0.42
	Sikkim	0.00	301.50	0.00
	Sub-Total	**2333.01**	**63311.14**	**3.68**
North Eastern	Assam	32.00	3257.00	0.98
	Manipur	0.71	220.65	0.32
	Meghalaya	0.63	898.42	0.07
	Nagaland	0.00	225.00	0.00
	Tripura	39.73	494.46	8.04
	Arunachal Pradesh	0.00	311.00	0.00
	Mizoram	0.50	191.33	0.26
	Sub-Total	**73.57**	**5597.86**	**1.31**
	Total (All India)	**119491.83**	**569618.31**	**20.98**

GWh: Giga Watt-hour

Source: Central Electricity Authority, New Delhi.

Annexure. 3.5: State-wise Number of Kisan Credit Cards issued up to 31st March 2012

Sr. No.	State/UT	Cooperative Banks	Regional Rural Banks	Commercial Banks	Total
1	2	3	4	5	6
1	Andhra Pradesh	4174481	2492510	11975335	18642326
2	Assam	21555	276559	601327	899441
3	Arunachal Pradesh	980	3368	27215	31563
4	Bihar	867574	1576268	2418418	4862260
5	Gujarat	1380880	296685	1885499	3563064
6	Goa	5661		14731	20392
7	Haryana	1298501	450755	1050678	2799934
8	Himachal Pradesh	216528	86379	309506	612413
9	Jammu & Kashmir	54619	42267	25126	122012
10	Karnataka	2098737	1508086	3259689	6866512
11	Kerala	1713377	544295	1815367	4073039
12	MadhyaPradesh	4174101	729573	2215845	7119519
13	Maharashtra	5719704	384068	4192079	10295851
14	Meghalaya	12116	23095	60270	95481
15	Mizoram	2255	10018	22685	34958
16	Manipur	13532	2082	32095	47709
17	Nagaland	3470	1841	33828	39139
18	Orissa	4182847	824902	1622269	6630018
19	Punjab	958837	187976	1634445	2781258
20	Rajasthan	3528806	674592	2392440	6595838
21	Sikkim	3476		10542	14018
22	Tamil Nadu	1936258	395691	5259695	7591644
23	Tripura	30087	109090	98541	237718
24	Uttar Pradesh	6987941	4805204	8341164	20134309
25	West Bangal	1693611	719307	1946905	4359823
26	A & N island	4258		3821	8079
27	Chandigarh			8302	8302
28	Daman & Diu			1790	1790
29	New Delhi	2303		27186	29489
30	D & N Haveli			3413	3413
31	Lakshdweep			1331	1331
32	Pondicherry	7781	133	78312	86226
33	Jharkhand	281079	488978	714272	1484329
34	Chhattisgarh	1418490	427263	379184	2224937
35	Uttarakhand	383388	62838	413514	859740
36	Other States			47	47
	Breakup not available			188005	188005
	for CBs (1998-99)				0
	Total	**43177233**	**17123823**	**53064871**	**113365927**

Source : Department of Agriculture and Cooperation, Credit Division.

Annexure. 3.6: Production and Consumption of Seed, Fertilizer and Pesticides in India

	Programme	Unit	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	**Seeds**														
(i)	Production of Breeder Seeds	Thousand Qtls	51.13	42.69	45.54	48.42	61.82	66.46	68.64	73.83	91.96	94.41	105.00	119.21	119.21
(ii)	Production of Foundation Seeds	Lakh Qtls.	4.66	5.91	5.44	6.14	6.50	6.90	7.40	7.96	8.22	9.69	10.50	17.53	21.86
(iii)	Distribution of Certified/ Quality Seeds	Lakh Qtls.	87.98	86.27	91.80	98.03	108.59	120.26	126.75	155.01	179.05	215.81	257.11	277.34	283.85
2.	**Consumption of Chemical Fertilisers**														
	Nitrogenous (N)	Lakh Tonnes	115.92	109.20	113.10	104.74	110.77	117.13	127.23	137.73	144.19	150.91	155.8	165.58	173.00
	Phosphatic(P)	Lakh Tonnes	47.99	42.15	43.82	40.19	41.24	46.24	52.04	55.43	55.15	65.06	72.74	80.50	79.14
	Potassic(K)	Lakh Tonnes	16.78	15.67	16.67	16.01	15.98	20.61	24.13	23.35	26.36	33.12	36.32	35.14	25.26
	Total (N+P+K)	Lakh Tonnes	180.69	167.02	173.60	160.94	167.99	183.98	203.40	216.51	225.70	249.09	264.86	281.22	277.40
	Per Hectare	Kg.	94.94	89.63	91.13	91.45	88.05	94.52	105.50	111.76	115.27	127.21	135.27	146.32	144.33
3.	**Consumption of Pesticides**														
	(Technical Grade Material)	Thousand Tonnes	46.20	43.58	47.02	48.30	41.00	40.67	39.77	41.51	43.63	43.86	41.82	55.54	50.58
4.	**Area Covered Under**														
	Soil Conservation (Cumulative)	Lakh Hactares	-	4.36	4.70	4.30	5.55	7.37	8.67	11.41	7.34	6.82	5.28	7.49	4.72

Sources: 1) Department of Agriculture & Cooperation, New Delhi.
2) States/Uts Zonal Conference, Kharif & Rabi.

Annexure. 3.7: State-wise Consumption of Fertilizers

(Thousand Tonnes)

Sl. No.	State/Zone	2009-10				2010-11				2011-12			
		N	P	K	Total	N	P	K	Total	N	P	K	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14
South Zone													
1	Andhra Pradesh	1707.12	875.87	478.38	3061.37	1966.63	1031.98	498.18	3496.79	1977.29	1043.02	322.04	3342.35
2	Karnataka	962.90	629.85	465.73	2058.48	1016.21	696.17	398.05	2110.43	1215.94	786.76	332.85	2335.55
3	Kerala	112.75	58.18	93.96	264.89	117.68	69.00	96.86	283.54	135.54	66.16	99.63	301.33
4	Tamil Nadu	608.54	263.70	324.61	1196.85	643.18	279.91	306.10	1229.19	684.56	316.39	263.96	1264.91
5	Pondicherry	19.37	5.04	6.35	30.76	19.14	4.81	5.43	29.38	14.61	3.90	3.06	21.57
6	A&N Islands	0.31	0.27	0.13	0.71	0.39	0.33	0.19	0.91	0.37	0.37	0.17	0.91
7	Lakshadweep	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Sub-Total (South Zone)	**3410.99**	**1832.91**	**1369.16**	**6613.06**	**3763.23**	**2082.20**	**1304.81**	**7150.24**	**4028.31**	**2216.60**	**1021.71**	**7266.62**
West Zone													
8	Gujarat	1101.60	491.66	206.46	1799.72	1241.22	518.00	179.94	1939.16	1183.30	417.02	132.74	1733.06
9	Madhya Pradesh	941.82	605.63	113.72	1661.17	998.30	741.11	128.33	1867.74	1061.75	750.76	79.47	1891.98
10	Chhattisgarh	315.83	162.32	58.99	537.14	321.99	171.19	68.99	562.17	356.40	177.33	61.84	595.57
11	Maharashtra	1478.60	1016.51	570.35	3065.46	1657.29	1126.37	671.68	3455.34	1610.91	1011.76	399.48	3022.15
12	Rajasthan	721.96	316.50	34.75	1073.21	870.39	413.30	34.95	1318.64	913.49	416.11	26.18	1355.78
13	Goa	3.25	3.14	2.71	9.10	3.32	2.27	1.79	7.38	3.06	2.67	1.89	7.62
14	Daman & Diu	0.31	0.13	0.02	0.46	0.42	0.16	0.03	0.61	0.06	0.01	0.00	0.07
15	D&N Haveli	0.72	0.45	0.04	1.21	0.72	0.53	0.03	1.28	0.60	0.41	0.00	1.01
	Sub-Total (West Zone)	**4564.09**	**2596.34**	**987.04**	**8147.47**	**5093.65**	**2972.93**	**1085.74**	**9152.32**	**5129.57**	**2776.07**	**701.60**	**8607.24**
North Zone													
16	Haryana	961.88	333.16	60.65	1355.69	974.04	335.95	47.63	1357.62	1020.90	369.62	37.53	1428.05
17	Punjab	1358.19	433.60	73.83	1865.62	1402.91	435.17	73.43	1911.51	1416.56	448.65	52.85	1918.06
18	Uttar Pradesh	2898.83	1039.17	323.50	4261.50	2951.01	1097.49	267.39	4315.89	3067.10	1024.23	116.42	4207.75
19	Uttarakhand	115.40	29.65	10.26	155.31	111.92	30.91	14.03	156.86	123.78	32.31	10.34	166.43
20	Himachal Pradesh	31.32	10.90	11.02	53.24	32.59	10.73	11.81	55.13	32.80	9.70	8.93	51.43
21	Jammu & Kashmir	74.50	24.18	12.99	111.67	72.82	37.30	11.15	121.27	66.13	28.65	5.29	100.07
22	Delhi	1.86	0.36	0.13	2.35	0.37	0.05	0.00	0.42	0.35	0.22	0.01	0.58
23	Chandigarh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sl. No.	State/Zone	2009-10				2010-11				2011-12			
		N	P	K	Total	N	P	K	Total	N	P	K	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Sub-Total (North Zone)	**5441.98**	**1871.02**	**492.38**	**7805.38**	**5545.66**	**1947.60**	**425.44**	**7918.70**	**5727.62**	**1913.38**	**231.37**	**7872.37**
East Zone													
24	Bihar	894.43	247.44	167.99	1309.86	907.28	289.59	155.84	1352.71	967.78	297.01	115.36	1380.15
25	Jharkhand	94.03	53.84	19.48	167.35	79.08	38.11	9.01	126.20	118.02	42.01	11.34	171.37
26	Orissa	292.29	148.59	78.46	519.34	294.72	153.97	89.15	537.84	323.41	135.48	55.80	514.69
27	West Bengal	730.69	467.34	446.53	1644.56	712.37	495.58	363.87	1571.82	831.99	476.17	309.04	1617.20
	Sub-Total (East Zone)	**2011.44**	**917.21**	**712.46**	**3641.11**	**1993.45**	**977.25**	**617.87**	**3588.57**	**2241.20**	**950.67**	**491.54**	**3683.41**
North East Zone													
28	Assam	127.25	48.75	66.27	242.27	142.76	59.51	74.79	277.06	151.05	49.08	75.52	275.65
29	Tripura	8.10	3.03	3.07	14.20	8.01	4.47	3.46	15.94	10.42	5.49	2.73	18.64
30	Manipur	10.67	1.01	0.36	12.04	5.10	1.10	0.30	6.50	6.59	0.97	0.44	8.00
31	Meghalaya	2.50	0.83	0.35	3.68	3.03	1.52	0.48	5.03	3.27	1.24	0.25	4.76
32	Nagaland	0.47	0.31	0.16	0.94	0.77	0.48	0.17	1.42	0.75	0.49	0.20	1.44
33	Arunachal Pradesh	0.51	0.22	0.09	0.82	0.52	0.22	0.09	0.83	0.55	0.10	0.03	0.68
34	Mizoram	2.00	2.41	1.06	5.47	2.05	2.43	1.12	5.60	0.92	0.21	0.06	1.19
35	Sikkim	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Sub-Total(North East Zone)	**151.50**	**56.56**	**71.36**	**279.42**	**162.24**	**69.73**	**80.41**	**312.38**	**173.55**	**57.58**	**79.23**	**310.36**
	All India	**15580.00**	**7274.04**	**3632.40**	**26486.44**	**16558.23**	**8049.71**	**3514.27**	**28122.21**	**17300.25**	**7914.30**	**2525.45**	**27740**

Source: Department of Agriculture and Coopration, INM Division.

Annexure. 3.8: State-wise Estimated Consumption of Fertiliser per Hectare

(Kgs./Hectare)

Sl. No.	State/Zone	2009-10				2010-11				2011-12			
		N	P	K	Total	N	P	K	Total	N	P	K	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14
South Zone													
1	Andhra Pradesh	125.83	64.56	35.26	225.65	156.58	82.16	39.66	278.41	157.43	83.04	25.64	266.11
2	Karnataka	74.58	48.85	36.12	159.55	78.94	54.08	30.92	163.94	94.46	61.12	25.86	181.43
3	Kerala	40.84	21.07	34.03	95.94	44.09	25.85	36.29	106.23	50.78	24.79	37.33	112.90
4	Tamil Nadu	104.65	45.35	55.82	205.82	115.43	50.24	54.94	220.60	122.86	56.78	47.37	227.01
5	Pondicherry	553.43	144.00	181.43	878.86	598.13	150.31	169.69	918.13	456.56	121.88	95.63	674.06
6	A&N Islands	22.14	19.29	9.29	50.71	22.94	19.41	11.18	53.53	21.76	21.76	10.00	53.53
7	Lakshadweep	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average (South Zone)		**97.21**	**52.24**	**39.02**	**188.47**	**111.58**	**61.74**	**38.69**	**212.01**	**119.44**	**65.72**	**30.29**	**215.46**
West Zone													
8	Gujarat	90.12	40.22	16.89	147.23	111.44	46.51	16.16	174.10	106.24	37.44	11.92	155.60
9	Madhya Pradesh	46.13	29.66	5.57	81.37	46.63	34.61	5.99	87.23	49.59	35.06	3.71	88.36
10	Chhattisgarh	54.95	28.24	10.26	93.45	57.90	30.78	12.41	101.09	64.09	31.89	11.12	107.10
11	Maharashtra	65.27	44.87	25.18	135.32	73.29	49.81	29.70	152.81	71.24	44.74	17.67	133.65
12	Rajasthan	32.51	14.25	1.56	48.33	40.03	19.01	1.61	60.64	42.01	19.14	1.20	62.35
13	Goa	19.12	18.47	15.94	53.53	20.75	14.19	11.19	46.13	19.13	16.69	11.81	47.63
14	Daman & Diu	155.00	65.00	10.00	230.00	105.00	40.00	7.50	152.50	15.00	2.50	0.00	17.50
15	D&N Haveli	26.67	16.67	1.48	44.82	30.00	22.08	1.25	53.33	25.00	17.08	0.00	42.08
Average (West Zone)		**54.69**	**31.11**	**11.83**	**97.63**	**61.63**	**35.97**	**13.14**	**110.73**	**62.06**	**33.59**	**8.49**	**104.13**
North Zone													
16	Haryana	148.94	51.59	9.39	209.92	153.37	52.90	7.50	213.76	160.75	58.20	5.91	224.85
17	Punjab	172.58	55.10	9.38	237.05	178.15	55.26	9.32	242.73	179.88	56.97	6.71	243.56
18	Uttar Pradesh	116.29	41.69	12.98	170.96	119.17	44.32	10.80	174.28	123.85	41.36	4.70	169.91
19	Uttarakhand	91.51	23.51	8.14	123.16	95.99	26.51	12.03	134.53	106.16	27.71	8.87	142.74
20	Himachal Pradesh	32.26	11.23	11.35	54.83	34.97	11.51	12.67	59.15	35.19	10.41	9.58	55.18
21	Jammu & Kashmir	65.70	21.32	11.46	98.48	63.60	32.58	9.74	105.91	57.76	25.02	4.62	87.40
22	Delhi	42.27	8.18	2.95	53.41	8.04	1.09	0.00	9.13	7.61	4.78	0.22	12.61
23	Chandigarh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average (North Zone)		**127.55**	**43.85**	**11.54**	**182.94**	**131.16**	**46.06**	**10.06**	**187.29**	**135.47**	**45.25**	**5.47**	**186.19**

Sl. No.	State/Zone	2009-10				2010-11				2011-12			
		N	P	K	Total	N	P	K	Total	N	P	K	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14
South Zone													
East Zone													
24	Bihar	113.08	31.28	21.24	165.60	121.12	38.66	20.80	180.58	129.19	39.65	15.40	184.24
25	Jharkhand	39.33	22.52	8.15	69.99	56.53	27.24	6.44	90.21	84.36	30.03	8.11	122.49
26	Orissa	32.42	16.48	8.70	57.60	32.36	16.91	9.79	59.06	35.51	14.88	6.13	56.52
27	West Bengal	74.93	47.92	45.79	168.64	74.75	52.00	38.18	164.93	87.30	49.97	32.43	169.70
Average (East Zone)		**69.20**	**31.55**	**24.51**	**125.26**	**72.42**	**35.50**	**22.45**	**130.37**	**81.42**	**34.54**	**17.86**	**133.81**
North East Zone													
28	Assam	33.15	12.70	17.26	63.11	34.83	14.52	18.25	67.59	36.85	11.97	18.42	67.25
29	Tripura	27.74	10.38	10.51	48.63	25.92	14.47	11.20	51.59	33.72	17.77	8.83	60.32
30	Manipur	45.40	4.30	1.53	51.23	21.89	4.72	1.29	27.90	28.28	4.16	1.89	34.33
31	Meghalaya	8.83	2.93	1.24	13.00	9.02	4.52	1.43	14.97	9.73	3.69	0.74	14.17
32	Nagaland	1.18	0.78	0.40	2.35	1.58	0.99	0.35	2.92	1.54	1.01	0.41	2.96
33	Arunachal Pradesh	1.88	0.81	0.33	3.01	1.88	0.80	0.33	3.01	1.99	0.36	0.11	2.46
34	Mizoram	20.83	25.10	11.04	56.98	16.67	19.76	9.11	45.53	7.48	1.71	0.49	9.67
35	Sikkim	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average (North East Zone)		**27.37**	**10.22**	**12.89**	**50.48**	**27.01**	**11.61**	**13.39**	**52.01**	**28.90**	**9.59**	**13.19**	**51.67**
All India (Average)		**79.57**	**37.15**	**18.55**	**135.27**	**86.15**	**41.88**	**18.28**	**146.32**	**90.01**	**41.18**	**13.14**	**144.33**

Annexure. 3.9: Crop-wise Distribution of Certified/ Quality Seeds

(Lakh Quintals)

	Crops	1983-84	1991-92	1996-97	2001-02	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
	1	2	3	4	5	6	7	8	9	10	11
	Cereals Wheat	10.94	14.04	23.22	32.59	54.55	63.25	74.83	90.66	97.83	94.69
	Paddy	8.86	14.47	16.57	25.58	43.51	48.93	58.18	60.95	69.34	70.11
	Maize	1.44	1.50	1.88	2.75	5.74	5.80	7.94	7.74	8.94	8.70
	Jowar	2.59	3.46	2.73	2.20	2.32	2.38	2.41	2.24	2.16	1.99
	Bajra	1.65	1.68	1.71	1.80	2.16	1.90	2.20	1.74	2.31	5.00
	Ragi	0.12	0.15	0.19	0.14	0.21	0.27	0.25	0.05	0.26	0.23
	Barley	0.07	0.05	0.13	0.50	1.08	1.27	1.62	1.77	1.79	3.80
Sub-Total (Cereals)		**25.67**	**35.35**	**46.43**	**65.56**	**109.87**	**123.80**	**147.43**	**165.15**	**182.62**	**184.52**
	Pulses Gram	0.85	1.03	1.44	1.53	5.08	6.73	8.6	12.32	12.50	11.21
	Lentil	0.06	0.08	0.08	0.29	0.54	0.56	0.59	0.55	0.74	0.66
	Peas	0.19	0.31	0.25	0.31	0.93	1.10	1.29	2.07	1.47	1.36
	Urad	0.38	0.65	1.07	0.97	0.8	1.40	1.37	1.61	1.96	1.72
	Moong	0.39	0.62	0.65	0.83	0.23	1.34	1.23	1.29	1.76	1.77
	Arhar	0.14	0.49	0.58	0.64	0.85	1.18	1.09	1.37	1.52	1.94
	Cowpea	0.08	0.08	0.12	0.05	0.09	0.10	0.16	0.20	0.33	0.28
	Others	-	0.03	-	0.07	0.11	0.16	0.15	0.28	0.56	0.25
Sub-Total (Pulses)		**2.09**	**3.29**	**4.19**	**4.69**	**9.63**	**12.57**	**14.48**	**19.69**	**20.83**	**19.19**
	Oilseeds Groundnut	5.16	6.72	7.27	5.25	9.89	14.43	15.90	18.86	21.79	17.83
	Rapeseed & Mustard	0.29	0.77	1.02	0.86	1.36	1.71	1.63	2.09	2.07	2.49
	Til	0.03	0.08	0.10	0.16	0.16	0.22	0.18	0.18	0.20	0.23
	Sunflower	0.25	0.55	0.58	0.48	0.89	0.92	0.80	0.76	0.55	0.22
	Soyabean	0.60	1.23	3.08	4.99	14.05	16.52	20.89	28.44	25.55	36.84
	Linseed	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.04	0.02
	Castorseed	0.10	0.21	0.30	0.26	0.36	0.42	0.42	0.29	0.31	0.69

	Crops	1983-84	1991-92	1996-97	2001-02	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
	1	2	3	4	5	6	7	8	9	10	11
	Safflower	0.05	0.08	0.16	0.07	0.07	0.08	0.09	0.07	0.08	0.07
	Others		0.01	-	0.01	0.20	0.01		0.01	0.01	0.01
Sub-Total (Oilseeds)		**6.49**	**9.66**	**12.53**	**12.10**	**27.00**	**34.33**	**39.92**	**50.71**	**50.61**	**58.40**
	Fibres Cotton	1.78	1.77	2.93	2.62	2.45	1.89	2.27	2.36	2.33	2.52
	Jute	0.12	0.26	0.25	0.21	0.26	0.24	0.28	0.27	0.27	0.63
	Mesta/Others	0.01			0.06	0.34	0.50	0.03	0.02	0.04	0.21
Sub-Total (Fibers)		**1.91**	**2.03**	**3.18**	**2.89**	**3.05**	**2.63**	**2.58**	**2.65**	**2.64**	**3.36**
	Other Miscellaneous Potato	8.74*	6.90	6.69	6.33	5.12	5.35	10.55	18.68	20.08	16.68
	Others	0.07	0.27	0.25	0.23	0.34	0.37	0.85	0.23	0.55	1.70
Sub-Total (Other Misc.)		**8.81**	**7.17**	**6.94**	**6.56**	**5.46**	**5.72**	**11.40**	**18.91**	**20.63**	**18.38**
Grand Total		**44.97**	**57.50**	**73.27**	**91.80**	**155.01**	**179.05**	**215.81**	**257.11**	**277.34**	**283.85**

* Estimated

Source: Department of Agriculture and Cooperation, Seeds Division

Annexure. 3.10: Flow of Institutional Credit to Agriculture Sector

(Rs. in Crore)

Particulars/ Agency	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12P
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
I. Production (ST) Credit														
Cooperative Banks	12514	14771	16528	18787	19668	22640	27157	34930	38622	40515	40230	56946	69038	81829
RRBs	1710	2423	3245	3777	4775	6088	10010	12712	16631	20715	22413	29802	38121	47401
Commercial Banks	9622	11697	13486	17904	21104	26192	36793	57640	83202	122289	147818	189908	NA	266928
Other Agencies	59	74	55	41	39	57	104	68	0	0	0	0	0	0
Sub Total (A)	23905	28965	33314	40509	45586	54977	74064	105350	138455	183519	210461	276656	107159	396158
II. MT/LT Total														
Cooperative Banks	3356	3489	4190	4737	3968	4235	4074	4474	3858	3169	5962	6551	9083	6134
RRBs	750	749	974	1077	1295	1493	2394	2511	3804	4099	4352	5415	6172	7049
Commercial Banks	8821	13036	14321	15683	18670	26249	44688	67837	83283	58798	81133	95892	NA	101688
Other Agencies	30	29	28	39	41	27	89	314	0	0	0	0	0	0
Sub Total (B)	**12957**	**17303**	**19513**	**21536**	**23974**	**32004**	**51245**	**75136**	**90945**	**66066**	**91447**	**107858**	**15255**	**114871**
ST+MT/LT Credit														
Cooperative Banks	15870	18260	20718	23524	23636	26875	31231	39403	42480	48258	46192	63497	78121	87963
RRBs	2460	3172	4219	4854	6070	7581	12404	15223	20435	25312	26765	35217	44293	54450
Commercial Banks	18443	24733	27807	33587	39774	52441	81481	125477	166485	181088	228951	285800	345877	368616
Other Agencies	87	103	83	80	80	84	193	382	0	0	0	0	0	0
Grand Total (A+B)	**36860**	**46268**	**52827**	**62045**	**69560**	**86981**	**125309**	**180485**	**229400**	**254658**	**301908**	**384514**	**468291**	**511029**

Source: Department of Agriculture and Cooperation, Credit Division.

Annexure. 3.11: National Agricultural Insurance Scheme (NAIS), Season wise Cumulative up to 2011-12

(Rs. in Lakh)

S. No.	Season	Farmers Insured (no.)	Area Insured (ha.)	Sum Insured	Farmer Premium	GOI Share in Premium	Premium Collected	Claims Payable	Claims Paid	Farmers Benefitted (no.)
1	2	3	4	5	6	7	8	9	10	11
1	Rabi 1999-2000	579940	780569	35641	377	83	542	769	769	55288
	Year 1999-2000	579940	780569	35641	377	83	542	769	769	55288
2	Kharif 2000	8409374	13219829	690338	15934	2370	20674	122248	122248	3635252
3	Rabi 2000-01	2091733	3111423	160268	1955	412	2779	5949	5949	526697
Year 2000-01		10501107	16331252	850607	17889	2782	23452	128197	128197	4161949
4	Kharif 2001	8696587	12887710	750246	21400	2381	26162	49354	49354	1741873
5	Rabi 2001-02	1955431	3145873	149751	2237	389	3015	6466	6466	453325
	Year 2001-02	10652018	16033583	899997	23637	2770	29177	55819	55819	2195198
6	Kharif 2002	9768711	15532349	943169	28060	2243	32547	182431	182431	4297155
7	Rabi 2002-03	2326811	4037824	183755	3178	336	3850	18855	18855	926408
Year 2002-03		12095522	19570173	1126924	31238	2580	36397	201286	201286	5223563
8	Kharif 2003	7970830	12355514	811413	25889	1222	28333	65268	65268	1712269
9	Rabi 2003-04	4421287	6468663	304949	5782	312	6406	49706	49706	2098125
	Year 2003-04	12392117	18824177	1116362	31670	1534	34739	114974	114974	3810394
10	Kharif 2004	12687104	24273394	1317062	43885	1005	45894	103817	103817	2674743
11	Rabi 2004-05	3531045	5343244	377421	7173	206	7585	16059	16059	772779
Year 2004-05		16218149	29616638	1694482	51058	1211	53480	119875	119875	3447522
12	Kharif 2005	12673833	20531038	1351910	42951	1022	44995	107192	107192	2674505
13	Rabi 2005-06	4048524	7218417	507166	9959	262	10482	33830	33830	980748
	Year 2005-06	16722357	27749455	1859076	52911	1283	55477	141022	141022	3655253
14	Kharif 2006	12934117	19672994	1475946	44075	1327	46729	177491	177491	3131511
15	Rabi 2006-07	4977980	7632882	654221	13150	569	14288	51596	51596	1390430
Year 2006-07		17912097	27305875	2130168	57224	1896	61017	229087	229087	4521941
16	Kharif 2007	13398822	20754747	1700796	49766	1333	52432	91536	91448	1591863
17	Rabi 2007-08	5044016	7387156	746664	14071	900	15871	81005	81005	1578608
Year 2007-08		18442838	28141903	2447461	63838	2233	68303	172540	172453	3170471

S. No.	Season	Farmers Insured (no.)	Area Insured (ha.)	Sum Insured	Farmer Premium	GOI Share in Premium	Premium Collected	Claims Payable	Claims Paid	Farmers Benefitted (no.)
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
18	Kharif 2008	12990975	17635162	1566541	47820	1686	51192	237771	237771	4218958
19	Rabi 2008-09	6210620	8857495	1114859	23077	3247	29572	150884	150234	1977328
Year 2008-09		19201595	26492657	2681400	70897	4933	80764	388655	388006	6196286
20	Kharif 2009	18253072	25769817	2761671	80572	2856	86285	456700	447012	7970524
21	Rabi 2009-10	5646964	7866818	1087561	21457	3639	28735	58611	39077	1042548
Year 2009-10		23900036	33636635	3849232	102030	6495	115020	515312	486089	9013072
22	Kharif 2010	12684117	17194678	2370509	67625	2270	72165	163820	154541	2251059
23	Rabi 2010-11	4896958	6855237	1069198	19909	4448	28804	57900	56654	1068177
	Year 2010-11	17581075	24049915	3439707	87534	6718	100969	221720	211195	3319236
24	Kharif 2011	11554285	15774075	2348533	71427	2616	71427	161635	153810	1777138
25	Rabi 2011-12	5188712	7190212	1051350	21492	3761	29013	1867	8	14063
Year 2011-12		16742997	22964286	3399882	92920	6376	100441	163502	153817	1791201
Total		**192941848**	**291497118**	**25530938**	**683222**	**40894**	**759779**	**2452758**	**2402589**	**50561374**

Source: Department of Agriculture and Cooperation, Credit Division.

Annexure. 4.1: All India Estimates of Area of Foodgrains

Crops	Season	Area ('000 Hectare)															
		1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13*
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Rice	Autumn	3140	3085	3033	3103	3043	2784	2696	2633	2557	2298	2224	2230	2084	1837		
	Winter	15704	15283	15542	14926	15321	14731	14835	14544	14987	13500	13627	13971	13573	11009		
	Kharif	20982	22088	22374	22673	22255	20522	21700	21187	21791	23803	23622	24609	21961	25203		
	Total Kharif	39825	40456	40949	40703	40619	38037	39231	38364	39335	39601	39472	40810	37618	38049	40123	38372
	Rabi/ Summer	3622	4347	4213	4009	4285	3139	3362	3543	4325	4212	4442	4727	4300	4814	3883	3788
	Total	**43447**	**44802**	**45162**	**44712**	**44904**	**41176**	**42593**	**41907**	**43660**	**43814**	**43914**	**45537**	**41918**	**42862**	**44006**	**42159**
Wheat	Rabi	26696	27523	27486	25731	26345	25196	26595	26383	26484	27995	28039	27752	28457	29069	29865	29434
Jowar	Kharif	5204	5043	4826	4863	4473	4243	4463	4099	3763	3738	3500	2893	3239	3072	2620	2407
	Rabi	5598	4752	5425	4993	5322	5056	4868	4994	4904	4734	4264	4638	4548	4310	3625	3822
	Total	10801	9794	10251	9856	9795	9300	9331	9092	8667	8473	7764	7531	7787	7382	6245	6229
Bajra	Kharif	9888	9297	8897	9829	9529	7740	10612	9233	9581	9508	9571	8753	8904	9612	8777	7253
Maize	Kharif	5762	5591	5727	5987	5934	5976	6590	6594	6758	6960	7119	6895	7063	7282	7381	7084
	Rabi/ Summer	560	613	695	624	648	659	753	836	830	934	999	1279	1198	1271	1401	1275
	Total	**6321**	**6204**	**6422**	**6611**	**6582**	**6635**	**7343**	**7430**	**7588**	**7894**	**8117**	**8174**	**8262**	**8553**	**8782**	**8359**
Ragi	Kharif	1657	1758	1634	1759	1647	1415	1666	1553	1534	1177	1387	1381	1268	1286	1176	1179
Small Millets	Kharif	1529	1495	1411	1424	1311	1201	1191	1101	1064	1010	1039	905	831	800	799	692
Barley	Rabi	858	793	725	778	660	702	657	617	630	646	603	706	624	705	643	755
Coarse Cereals	Kharif	24039	23184	22496	23862	22893	20575	24523	22579	22701	22394	22616	20826	21305	22053	20753	18615
	Rabi	7015	6157	6845	6395	6630	6417	6279	6447	6364	6314	5866	6623	6370	6286	5669	5852
	Total	31054	29341	29340	30257	29523	26992	30801	29025	29065	28708	28482	27450	27675	28339	26422	24467
Cereals	Kharif	63864	63639	63445	64565	63512	58612	63753	60943	62036	61995	62088	61636	58923	60102	60876	56987
	Rabi	37333	38027	38543	36135	37259	34752	36235	36372	37173	38521	38346	39103	39128	40168	39417	39074
	Total	**101197**	**101666**	**101988**	**100700**	**100771**	**93364**	**99988**	**97315**	**99208**	**100516**	**100435**	**100739**	**98051**	**100270**	**100293**	**96061**
Tur (Arhar)	Kharif	3359	3439	3427	3632	3328	3359	3516	3519	3581	3562	3726	3378	3466	4367	4007	3794
Pulses Other Than Tur	Kharif	7147	6910	6367	7026	7395	6592	8168	7799	7099	7114	7764	6431	7117	7953	7183	5847
Gram	Rabi	7563	8469	6146	5185	6416	5906	7048	6715	6926	7494	7544	7893	8169	9186	8299	8925

Pulses Other Than Gram	Rabi	4802	4683	5176	4505	4870	4639	4727	4731	4785	5022	4600	4393	4531	4897	4973	5295
Pulses	Kharif	10506	10349	9794	10658	10722	9950	11683	11317	10680	10676	11490	9809	10582	12320	11190	9641
	Rabi	12365	13152	11322	9690	11286	10546	11775	11446	11712	12516	12144	12285	12700	14082	13272	14220
	Total	**22871**	**23501**	**21116**	**20348**	**22008**	**20496**	**23458**	**22763**	**22391**	**23192**	**23633**	**22094**	**23282**	**26402**	**24462**	**23861**
Foodgrains	Kharif	74369	73988	73238	75223	74235	68563	75436	72260	72715	72671	73578	71446	69506	72421	72066	66628
	Rabi	49698	51179	49866	45825	48545	45298	48010	47818	48884	51037	50490	51388	51828	54250	52689	53294
	Total	**124068**	**125167**	**123104**	**121048**	**122780**	**113860**	**123447**	**120078**	**121600**	**123708**	**124068**	**122834**	**121334**	**126671**	**124755**	**119922**

* As per 2nd Advance Estimates released on 08.02.2013.

Annexure. 4.2: All India Estimates of Production of Foodgrains

Crops	Season	Production ('000 Tonnes)															
		1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13*
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Rice	Autumn	4591.1	4237.2	4653.2	4356.3	4661.9	3346.3	3733.8	3493.9	3449.9	6445.3	6430.6	6928.7	4557.6	3261.1		
	Winter	27993.1	26717.1	26983.9	25759.6	29692.1	23499.5	27708.5	25540.6	26900.0	27004.9	25776.7	27487.2	26316.9	25742.3		
	Kharif	39945.7	41765.8	45843.4	42662.5	46167.8	36237.3	47176.2	43195.5	47922.0	46720.6	50495.6	50535.5	45083.4	51690.7		
	Total Kharif	72529.9	72720.1	77480.5	72778.4	80521.8	63083.1	78618.5	72230.0	78271.9	80170.8	82702.9	84951.4	75957.8	80694.0	92747.6	90687.5
	Rabi/ Summer	10014.6	13356.6	12202.4	12198.2	12818.2	8737.1	9907.5	10901.7	13521.5	13184.5	13990.0	14231.1	13135.1	15285.8	12563.4	11113.5
	Total	82544.5	86076.7	89682.9	84976.6	93340.0	71820.2	88526.0	83131.7	91793.4	93355.3	96692.9	99182.5	89092.9	95979.8	105311.0	101801.0
Wheat	Rabi	66349.9	71287.5	76368.9	69680.8	72766.3	65760.8	72156.2	68636.9	69354.5	75806.7	78570.2	80679.4	80803.6	86874.0	94882.1	92298.8
Jowar	Kharif	4962.5	5279.9	4818.5	4561.3	4228.6	4222.7	4843.6	4044.4	4071.6	3706.8	4114.9	3051.9	2763.2	3439.1	3320.3	2576.7
	Rabi	2565.6	3135.5	3866.4	2968.1	3328.2	2789.7	1837.7	3199.9	3558.0	3444.0	3811.0	4193.7	3935.0	3564.0	2686.2	2679.6
	Total	7528.1	8415.4	8684.9	7529.4	7556.8	7012.4	6681.3	7244.3	7629.6	7150.8	7925.9	7245.6	6698.2	7003.1	6006.5	5256.4
Bajra	Kharif	7644.4	6955.6	5782.2	6759.2	8284.0	4718.9	12109.3	7931.3	7684.0	8423.7	9970.1	8887.1	6506.4	10369.9	10276.0	8148.9
Maize	Kharif	9429.8	9538.7	9706.2	10219.6	11248.3	9272.4	12734.4	11476.4	12155.9	11556.3	15106.7	14120.5	12293.3	16637.4	16486.3	15594.0
	Rabi/ Summer	1389.4	1609.0	1803.4	1823.6	1911.9	1879.3	2249.9	2695.6	2554.0	3540.7	3848.7	5610.9	4426.2	5088.4	5273.1	5464.4
	Total	10819.2	11147.7	11509.6	12043.2	13160.2	11151.7	14984.3	14172.0	14709.9	15097.0	18955.4	19731.4	16719.5	21725.8	21759.4	21058.4
Ragi	Kharif	2086.8	2608.1	2289.5	2731.7	2374.6	1315.7	1965.7	2432.4	2353.6	1443.6	2152.2	2039.9	1888.5	2193.5	1929.2	1784.9
Small Millets	Kharif	639.9	670.8	618.2	586.9	576.7	459.3	563.8	477.6	471.6	479.6	550.7	444.8	381.9	442.0	451.5	402.2
Barley	Rabi	1679.4	1537.8	1447.0	1430.6	1424.5	1407.4	1297.6	1207.1	1220.6	1327.9	1196.1	1689.1	1354.7	1662.9	1618.7	1816.5
Coarse Cereals	Kharif	24763.4	25053.1	23214.6	24858.7	26712.2	19989.0	32216.8	26362.1	26736.7	25610.0	31894.6	28544.2	23833.3	33081.8	32463.3	28506.8
	Rabi	5634.4	6282.3	7116.8	6222.3	6664.6	6076.4	5385.2	7102.6	7332.6	8312.6	8855.8	11493.7	9715.8	10315.2	9578.0	9960.5
	Total	30397.8	31335.4	30331.4	31081.0	33376.8	26065.4	37602.0	33464.7	34069.3	33922.6	40750.4	40037.9	33549.1	43397.1	42041.3	38467.3
Cereals	Kharif	97293.3	97773.2	100695.1	97637.1	107234.0	83072.1	110835.3	98592.1	105008.6	105780.8	114597.5	113495.6	99791.2	113775.9	125210.9	119194.3
	Rabi	81998.9	90926.4	95688.1	88101.3	92249.1	80574.3	87448.9	86641.2	90208.6	97303.8	101416.0	106404.2	103654.4	112475.0	117023.5	113372.8
	Total	179292.2	188699.6	196383.2	185738.4	199483.1	163646.4	198284.2	185233.3	195217.2	203084.6	216013.5	219899.8	203445.6	226250.9	242234.4	232567.1
Tur (Arhar)	Kharif	1849.5	2707.9	2693.8	2246.3	2259.8	2185.8	2356.4	2346.9	2738.0	2314.1	3075.9	2265.5	2464.6	2861.1	2654.1	2745.1
Pulses Other Than Tur	Kharif	2440.1	2433.2	2122.4	2201.9	2578.4	1965.2	3808.3	2370.4	2126.8	2481.3	3327.3	2420.7	1739.7	4259.0	3403.8	2737.0
Gram	Rabi	6132.2	6800.7	5118.1	3855.4	5473.0	4236.8	5717.5	5469.4	5599.9	6333.7	5748.6	7060.2	7475.9	8221.1	7702.3	8567.8

Crops	Season	Production ('000 Tonnes)															
		1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13*
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Pulses Other Than Gram	Rabi	2549.0	2965.3	3483.8	2771.8	3056.9	2737.2	3023.0	2942.8	2919.7	3068.4	2609.7	2820.0	2981.7	2899.8	3328.8	3525.6
Pulses	Kharif	4289.6	5141.1	4816.2	4448.2	4838.2	4151.0	6164.7	4717.3	4864.8	4795.4	6403.2	4686.2	4204.2	7120.1	6057.9	5482.1
	Rabi	8681.2	9766.0	8601.9	6627.2	8529.9	6974.0	8740.5	8412.2	8519.6	9402.1	8358.3	9880.2	10457.6	11120.8	11031.1	12093.4
	Total	12970.8	14907.1	13418.1	11075.4	13368.1	11125.0	14905.2	13129.5	13384.4	14197.5	14761.5	14566.4	14661.8	18240.9	17089.0	17575.5
Food grains	Kharif	101582.9	102914.3	105511.3	102085.3	112072.2	87223.1	117000.0	103309.4	109873.4	110576.2	121000.7	118181.8	103995.4	120896.0	131268.8	124676.3
	Rabi	90680.1	100692.4	104290.0	94728.5	100779.0	87548.3	96189.4	95053.4	98728.2	106705.9	109774.3	116284.4	114112.0	123595.8	128054.6	125466.3
	Total	**192263.0**	**203606.7**	**209801.3**	**196813.8**	**212851.2**	**174771.4**	**213189.4**	**198362.8**	**208601.6**	**217282.1**	**230775.0**	**234466.2**	**218107.4**	**244491.8**	**259323.4**	**250142.6**

* As per 2nd Advance Estimates released on 08.02.2013.

Annexure. 4.3: All India Estimates of Yield of Foodgrains

Crops	Season	Yield (Kg./Hectare)															
		1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13*
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Rice	Autumn	1462	1373	1534	1404	1532	1202	1385	1327	1349	2804	2892	3107	2186	1776		
	Winter	1783	1748	1736	1726	1938	1595	1868	1756	1795	2000	1892	1968	1939	2338		
	Kharif	1904	1891	2049	1882	2074	1766	2174	2039	2199	1963	2138	2054	2053	2051		
	Total Kharif	1821	1798	1892	1788	1982	1658	2004	1883	1990	2024	2095	2082	2019	2121	2312	2363
	Rabi/ Summer	2765	3073	2897	3042	2992	2783	2947	3077	3127	3130	3149	3010	3055	3176	3235	2934
	Total	1900	1921	1986	1901	2079	1744	2078	1984	2102	2131	2202	2178	2125	2239	2393	2415
Wheat	Rabi	2485	2590	2778	2708	2762	2610	2713	2602	2619	2708	2802	2907	2839	2989	3177	3136
Jowar	Kharif	954	1047	998	938	945	995	1085	987	1082	992	1176	1055	853	1119	1267	1070
	Rabi	458	660	713	594	625	552	377	641	726	727	894	904	865	827	741	701
	Total	697	859	847	764	771	754	716	797	880	844	1021	962	860	949	962	844
Bajra	Kharif	773	748	650	688	869	610	1141	859	802	886	1042	1015	731	1079	1171	1124
Maize	Kharif	1637	1706	1695	1707	1896	1552	1932	1740	1799	1660	2122	2048	1740	2285	2234	2201
	Rabi/ Summer	2482	2626	2594	2921	2952	2851	2987	3224	3076	3793	3854	4387	3694	4003	3765	4287
	Total	1712	1797	1792	1822	2000	1681	2041	1907	1938	1912	2335	2414	2024	2540	2478	2519
Ragi	Kharif	1260	1483	1401	1553	1442	930	1180	1567	1534	1226	1552	1477	1489	1705	1641	1514
Small Millets	Kharif	418	449	438	412	440	383	473	434	443	475	530	491	460	553	565	581
Barley	Rabi	1958	1940	1997	1840	2160	2006	1975	1958	1938	2055	1985	2394	2172	2357	2516	2405
Coarse Cereals	Kharif	1030	1081	1032	1042	1167	972	1314	1168	1178	1144	1410	1371	1119	1500	1564	1531
	Rabi	803	1020	1040	973	1005	947	858	1102	1152	1316	1510	1735	1525	1641	1689	1702
	Total	979	1068	1034	1027	1131	966	1221	1153	1172	1182	1431	1459	1212	1531	1591	1572
Cereals	Kharif	1523	1536	1587	1512	1688	1417	1739	1618	1693	1706	1846	1841	1694	1893	2057	2092
	Rabi	2196	2391	2483	2438	2476	2319	2413	2382	2427	2526	2645	2721	2649	2800	2969	2902
	Total	**1772**	**1856**	**1926**	**1844**	**1980**	**1753**	**1983**	**1903**	**1968**	**2020**	**2151**	**2183**	**2075**	**2256**	**2415**	**2421**
Tur (Arhar)	Kharif	551	787	786	618	679	651	670	667	765	650	826	671	711	655	662	724
Pulses Other Than Tur	Kharif	341	352	333	313	349	298	466	304	300	349	429	376	244	536	474	468
Gram	Rabi	811	803	833	744	853	717	811	815	808	845	762	895	915	895	928	960

Crops	Season	Yield (Kg./Hectare)															
		1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13*
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Pulses Other Than Gram	Rabi	531	633	673	615	628	590	640	622	610	611	567	642	658	592	669	666
Pulses	Kharif	408	497	492	417	451	417	528	417	456	449	557	478	397	578	541	569
	Rabi	702	743	760	684	756	661	742	735	727	751	688	804	823	790	831	850
	Total	567	634	635	544	607	543	635	577	598	612	625	659	630	691	699	737
Foodgrains	Kharif	1366	1391	1441	1357	1510	1272	1551	1430	1511	1522	1645	1654	1496	1669	1822	1871
	Rabi	1825	1967	2091	2067	2076	1933	2004	1988	2020	2091	2174	2263	2202	2278	2430	2354
	Total	**1550**	**1627**	**1704**	**1626**	**1734**	**1535**	**1727**	**1652**	**1715**	**1756**	**1860**	**1909**	**1798**	**1930**	**2079**	**2086**

* As per 2nd Advance Estimates released on 08.02.2013.

Annexure. 4.4: Area under Commercial Crops

Crops	Season	Area ('000 Hectares)															
		1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13*
Groundnut	Kharif	6064.9	5886.2	5808.8	5705.2	5461.0	5272.4	5196.2	5786.3	5739.7	4780.3	5312.1	5285.8	4616.0	4977.4	4316.1	3823.5
	Rabi	1023.3	1509.8	1058.5	853.4	777.1	663.1	790.8	854.1	996.3	834.8	979.9	879.1	861.5	878.7	947.7	1042.8
	Total	7088.2	7396.0	6867.3	6558.6	6238.1	5935.5	5987.0	6640.4	6736.0	5615.1	6292.0	6164.9	5477.5	5856.1	5263.8	4866.3
Castorseed	Kharif	641.3	682.4	781.6	1079.6	716.6	583.2	717.2	743.0	864.2	628.4	786.9	866.2	734.9	880.3	1470.9	1296.4
Nigerseed	Kharif	520.9	494.8	480.1	439.9	478.0	414.4	431.7	429.9	414.4	469.0	407.6	393.4	375.5	371.0	364.4	289.6
Sesamum	Kharif	1660.0	1609.0	1560.2	1720.0	1670.6	1444.4	1700.3	1844.0	1723.2	1703.2	1799.1	1809.1	1942.1	2083.2	1901.5	1702.5
Rapeseed & Mustard	Rabi	7041.0	6513.2	6026.8	4476.7	5073.0	4544.0	5428.1	7316.4	7276.5	6790.0	5825.5	6298.1	5588.0	6900.5	5893.5	6196.7
Linseed	Rabi	793.9	749.4	593.1	579.9	535.8	450.1	476.5	448.7	436.8	436.5	467.9	407.9	342.0	359.2	322.6	303.7
Safflower	Rabi	619.8	440.2	438.5	424.8	404.3	369.5	363.9	369.1	364.6	377.0	320.3	294.6	287.8	243.8	250.4	157.1
Sunflower	Kharif	590.5	732.9	473.4	419.1	309.3	531.9	610.7	873.1	919.4	860.4	761.9	661.5	567.7	315.3	260.2	315.3
	Rabi	1152.9	1091.8	814.7	654.7	867.5	1110.3	1392.8	1287.5	1420.2	1304.4	1149.7	1151.3	908.8	613.7	471.7	555.9
	Total	1743.4	1824.7	1288.1	1073.8	1176.8	1642.2	2003.5	2160.6	2339.6	2164.8	1911.6	1812.8	1476.5	929.0	731.9	871.2
Soyabean	Kharif	5986.1	6488.9	6222.4	6416.6	6343.1	6105.5	6554.7	7571.2	7707.5	8328.7	8881.7	9510.8	9734.7	9601.0	10109.1	10631.7
Edible Oilseeds	Kharif	14822.4	15211.8	14544.9	14700.8	14262.0	13768.6	14493.6	16504.5	16504.2	16141.6	17162.4	17660.6	17235.9	17348.0	16951.3	16762.6
	Rabi	9837.0	9555.0	8338.5	6409.6	7121.9	6686.9	7975.6	9827.1	10057.6	9306.2	8275.4	8623.1	7646.1	8636.7	7563.3	7952.5
	Total	24659.4	24766.8	22883.4	21110.4	21383.9	20455.5	22469.2	26331.6	26561.8	25447.8	25437.8	26283.7	24882.1	25984.7	24514.6	24715.1
Non Edible Oilseeds	Kharif	641.3	682.4	781.6	1079.6	716.6	583.2	717.2	743.0	864.2	628.4	786.9	866.2	734.9	880.3	1470.9	1296.4
	Rabi	793.9	749.4	593.1	579.9	535.8	450.1	476.5	448.7	436.8	436.5	467.9	407.9	342.0	359.2	322.6	303.7
	Total	1435.2	1431.8	1374.7	1659.5	1252.4	1033.3	1193.7	1191.7	1301.0	1064.9	1254.8	1274.1	1076.9	1239.6	1793.5	1600.1
Total Nine Oilseeds	Kharif	15463.7	15894.2	15326.5	15780.4	14978.6	14351.8	15210.8	17247.5	17368.4	16770.0	17949.3	18526.7	17970.9	18228.4	18422.2	18059.0
	Rabi	10630.9	10304.4	8931.6	6989.5	7657.7	7137.0	8452.1	10275.8	10494.4	9742.7	8743.3	9031.0	7988.1	8995.9	7885.9	8256.2
	Total	26094.6	26198.6	24258.1	22769.9	22636.3	21488.8	23662.9	27523.3	27862.8	26512.7	26692.6	27557.7	25959.0	27224.3	26308.1	26315.3
Cotton	Total	8868.0	9342.2	8709.5	8534.4	9131.8	7669.6	7597.9	8786.6	8677.1	9144.5	9413.7	9406.7	10131.7	11235.0	12178.0	11773.0
Jute	Total	906.2	848.3	846.6	827.9	873.1	864.5	849.0	773.9	759.8	792.9	814.1	785.6	811.2	773.6	809.0	773.9
Mesta	Total	200.5	177.1	188.7	189.7	174.1	170.8	152.5	141.8	137.9	142.2	146.2	115.3	94.2	98.6	95.6	86.8
Jute & Mesta		1106.7	1025.4	1035.3	1017.6	1047.2	1035.3	1001.5	915.7	897.7	935.1	960.3	900.9	905.4	872.1	904.6	860.7
Sugarcane	Total	3929.8	4054.9	4219.7	4315.7	4411.6	4520.3	3938.4	3661.5	4201.7	5150.8	5055.2	4415.4	4174.6	4884.8	5037.7	5062.5

* As per 2nd Advance Estimates released on 08.02.2013.

Annexure. 4.5: Production of Commercial Crops

Crops	Season	Production (000 Tonnes)															
		1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13*
Groundnut	Kharif	5900.4	6910.0	3800.0	4910.0	5622.3	3094.8	6859.5	5262.1	6297.9	3294.2	7362.4	5617.1	3852.2	6642.8	5126.9	3767.6
	Rabi	1470.0	2070.0	1450.0	1500.0	1405.2	1026.3	1267.0	1512.3	1695.4	1569.3	1820.1	1551.0	1576.3	1622.0	1836.8	2011.4
	Total	7370.4	8980.0	5250.0	6410.0	7027.5	4121.1	8126.5	6774.4	7993.3	4863.5	9182.5	7168.1	5428.5	8264.8	6963.7	5779.0
Castorseed	Kharif	830.0	840.3	770.0	880.0	652.6	427.5	796.7	793.4	990.7	762.3	1053.6	1171.1	1009.0	1350.3	2294.9	1722.9
Nigerseed	Kharif	139.9	139.6	150.3	110.0	129.9	86.2	108.9	112.2	108.0	120.9	109.5	117.0	99.9	107.7	98.1	84.0
Sesamum	Kharif	570.0	530.0	479.9	520.0	697.8	441.3	782.1	674.1	641.1	618.4	756.9	640.3	588.4	893.0	810.3	748.2
Rapeseed & Mustard	Rabi	4699.9	5659.9	5790.0	4190.0	5082.6	3879.8	6291.4	7593.1	8131.2	7437.8	5833.6	7200.7	6608.1	8178.7	6603.7	7364.6
Linseed	Rabi	240.0	270.0	240.0	200.0	209.1	176.7	196.5	169.7	172.5	167.9	163.4	169.2	153.7	146.5	152.5	141.7
Safflower	Rabi	120.0	240.0	260.0	200.0	220.6	178.5	134.9	173.6	228.6	240.3	224.5	189.2	178.8	150.4	145.3	86.8
Sunflower	Kharif	239.6	240.1	200.1	240.0	155.1	271.5	306.1	431.1	455.8	365.5	462.8	357.1	214.4	191.8	147.4	171.5
	Rabi	650.0	710.0	490.0	409.9	524.4	601.1	624.3	755.6	983.2	862.0	1000.3	800.9	636.3	459.2	369.3	409.5
	Total	889.6	950.1	690.1	649.9	679.5	872.6	930.4	1186.7	1439.0	1227.5	1463.1	1158.0	850.7	651.1	516.7	581.0
Soyabean	Kharif	6460.0	7140.0	7080.0	5280.0	5962.7	4654.7	7818.9	6876.3	8273.5	8850.8	10968.2	9905.4	9964.5	12736.4	12213.5	12957.0
Edible Oilseeds	Kharif	13309.9	14959.7	11710.3	11060.0	12567.8	8548.5	15875.5	13355.8	15776.3	13249.8	19659.8	16636.9	14719.5	20571.7	18396.2	17728.3
	Rabi	6939.9	8679.9	7990.0	6299.9	7232.8	5685.7	8317.6	10034.6	11038.4	10109.4	8878.5	9741.8	8999.5	10410.4	8955.1	9872.3
	Total	20249.8	23639.6	19700.3	17359.9	19800.6	14234.2	24193.1	23390.4	26814.7	23359.2	28538.3	26378.7	23719.0	30982.1	27351.3	27600.6
Non Edible Oilseeds	Kharif	830.0	840.3	770.0	880.0	652.6	427.5	796.7	793.4	990.7	762.3	1053.6	1171.1	1009.0	1350.3	2294.9	1722.9
	Rabi	240.0	270.0	240.0	200.0	209.1	176.7	196.5	169.7	172.5	167.9	163.4	169.2	153.7	146.5	152.5	141.7
	Total	1070.0	1110.3	1010.0	1080.0	861.7	604.2	993.2	963.1	1163.2	930.2	1217.0	1340.2	1162.7	1496.9	2447.4	1864.6
Total Nine Oilseeds	Kharif	14139.9	15800.0	12480.3	11940.0	13220.4	8976.0	16672.2	14149.2	16767.0	14012.1	20713.4	17808.0	15728.4	21922.0	20691.1	19451.2
	Rabi	7179.9	8949.9	8230.0	6499.9	7441.9	5862.4	8514.1	10204.3	11210.9	10277.3	9041.9	9911.0	9153.2	10556.9	9107.6	10014.0
	Total	21319.8	24749.9	20710.3	18439.9	20662.3	14838.4	25186.3	24353.5	27977.9	24289.4	29755.3	27719.0	24881.6	32479.0	29798.7	29465.2
Cotton@	Total	10850.0	12290.0	11530.0	9520.0	9997.0	8623.7	13729.0	16428.6	18499.0	22631.8	25884.1	22276.2	24021.8	33000.0	35200.0	33800.0
Jute$	Total	9960.0	8840.0	9420.0	9320.0	10583.9	10273.7	10251.6	9399.3	9969.5	10317.1	10220.1	9634.4	11230.4	10009.4	10735.6	10558.5
Mesta$	Total	1060.0	970.0	1130.0	1240.0	1094.4	1001.7	921.3	873.0	870.1	955.9	990.4	730.9	587.0	610.8	663.0	568.9
Jute & Mesta		11020.0	9810.0	10550.0	10560.0	11678.3	11275.4	11172.9	10272.3	10839.6	11273.0	11210.5	10365.3	11817.4	10620.2	11398.6	11127.4
Sugarcane	Total	279540.0	288720.0	299320.0	295960.0	297207.8	287383.2	233861.8	237088.4	281171.8	355519.7	348187.9	285029.3	292301.6	342381.6	361036.6	334540.5

* As per 2nd Advance Estimates released on 08.02.2013.
@ Thousand bales of 170 kgs each.
$ Thousand bales of 180 kgs each.

Annexure. 4.6: Yield of Commercial Crops

Crops	Season	Yield (Kgs./Hect.)															
		1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13*
Groundnut	Kharif	973	1174	654	861	1030	587	1320	909	1097	689	1386	1063	835	1335	1188	985
	Rabi	1437	1371	1370	1758	1808	1548	1602	1771	1702	1880	1857	1764	1830	1846	1938	1929
	Total	1040	1214	764	977	1127	694	1357	1020	1187	866	1459	1163	991	1411	1323	1188
Castorseed	Kharif	1294	1231	985	815	911	733	1111	1068	1146	1213	1339	1352	1373	1534	1560	1329
Nigerseed	Kharif	269	282	313	250	272	208	252	261	261	258	269	297	266	290	269	290
Sesamum	Kharif	343	329	308	302	418	306	460	366	372	363	421	354	303	429	426	439
Rapeseed & Mustard	Rabi	668	869	961	936	1002	854	1159	1038	1117	1095	1001	1143	1183	1185	1121	1188
Linseed	Rabi	302	360	405	345	390	393	412	378	395	385	349	415	449	408	473	467
Safflower	Rabi	194	545	593	471	546	483	371	470	627	637	701	642	621	617	580	553
Sunflower	Kharif	406	328	423	573	501	510	501	494	496	425	607	540	378	608	566	544
	Rabi	564	650	601	626	604	541	448	587	692	661	870	696	700	748	783	737
	Total	510	521	536	605	577	531	464	549	615	567	765	639	576	701	706	667
Soyabean	Kharif	1079	1100	1138	823	940	762	1193	908	1073	1063	1235	1041	1024	1327	1208	1219
Edible Oilseeds	Kharif	898	983	805	752	881	621	1095	809	956	821	1146	942	854	1186	1085	1058
	Rabi	705	908	958	983	1016	850	1043	1021	1098	1086	1073	1130	1177	1205	1184	1241
	Total	821	954	861	822	926	696	1077	888	1010	918	1122	1004	953	1192	1116	1117
Non Edible Oilseeds	Kharif	1294	1231	985	815	911	733	1111	1068	1146	1213	1339	1352	1373	1534	1560	1329
	Rabi	302	360	405	345	390	393	412	378	395	385	349	415	449	408	473	467
	Total	746	775	735	651	688	585	832	808	894	874	970	1052	1080	1208	1365	1165
Total Nine Oilseeds	Kharif	914	994	814	757	883	625	1096	820	965	836	1154	961	875	1203	1123	1077
	Rabi	675	869	921	930	972	821	1007	993	1068	1055	1034	1097	1146	1174	1155	1213
	Total	817	945	854	810	913	691	1064	885	1004	916	1115	1006	958	1193	1133	1120
Cotton	Total	208	224	225	190	186	191	307	318	362	421	467	403	403	499	491	488
Jute	Total	1978	1876	2003	2026	2182	2139	2173	2186	2362	2342	2260	2207	2492	2329	2389	2456
Mesta	Total	952	986	1078	1177	1131	1056	1087	1108	1136	1210	1219	1141	1121	1115	1248	1180
Jute & Mesta		1792	1722	1834	1868	2007	1960	2008	2019	2173	2170	2101	2071	2349	2192	2268	2327
Sugarcane	Total	71133	71203	70934	68578	67370	63576	59380	64752	66919	69022	68877	64553	70020	70091	71667	66082

* As per 2nd Advance Estimates released on 08.02.2013.

Annexure 4.7: All India Estimates of Area under Horticulture Crops

(Area in 000 Ha)

Commodities	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13@
Fruits												
Almond/Walnut *	117	117	106	106	130	132	132	136	142	23	22	22
Aonla										67	95	98
Apple	242	193	201	231	227	252	264	274	283	289	322	325
Banana	466	475	499	535	570	604	658	709	770	830	797	814
Ber										22	34	34
Citrus												
(i) Lime/Lemon										219	234	243
(ii) Mandarin										324	329	340
(iii) Sweet Orange												
(Mosambi)										157	162	165
(iv) Others										147	190	195
Citrus Total (i to iv)	**619**	**563**	**683**	**708**	**742**	**798**	**867**	**924**	**987**	**846**	**915**	**943**
Custardapple										15	19	20
Grapes	48	52	58	61	66	65	68	80	106	111	116	118
Guava	155	155	166	161	167	176	179	204	220	205	220	229
Jackfruit										36	60	62
Kiwi										0	3	3
Litchi	58	54	54	60	63	65	69	72	74	78	80	82
Mango	1576	1623	1907	1970	2081	2154	2201	2309	2312	2297	2378	2466
Papaya	74	68	58	73	68	72	83	98	96	106	117	123
Passion Fruit											16	16
Peach										18	20	20
Pear										41	48	49
Pineapple	77	80	81	83	82	87	80	84	92	89	102	104
Plum										14	26	26
Pomegranate			97	112	112	117	124	109	125	107	112	111
Sapota	52	84	121	134	140	149	152	156	159	160	163	169
Walnut *										114	150	158
Others	645	441	737	922	1008	1016	1112	1083	1105	913	889	884

Commodities	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13@
Total Fruits	**4127**	**3905**	**4767**	**5155**	**5454**	**5687**	**5989**	**6238**	**6471**	**6382**	**6705**	**6877**
Vegetables												
Beans										100	118	122
Bitterguard										68	77	79
Bottleguard										75	105	108
Brinjal	502	507	516	527	560	568	561	600	612	680	692	705
Cabbage	258	234	255	288	254	249	266	310	331	369	390	397
Capsicum										6	10	10
Carrot										56	62	64
Cauliflower	270	255	268	239	289	302	312	349	348	369	391	399
Cucumber										35	40	44
Muskmelon										40	38	39
Okra	347	329	353	357	392	396	407	432	452	498	518	535
Onion	496	425	554	614	704	768	821	834	756	1064	1087	1014
Parma l(pointed gourd)	-	-	-	-	-	-	-	-	-	-	-	-
Peas	303	305	285	276	286	297	313	348	365	370	408	419
Potato	1260	1337	1485	1524	1569	1743	1795	1828	1835	1863	1907	1931
Radish										133	160	162
Sitaphal/Pumpkin										5	11	11
Sweet Potato	132	132	133	133	123	123	123	124	119	113	110	111
Tapioca	239	207	220	245	245	255	270	280	232	221	227	244
Tomato	458	479	503	505	546	596	566	599	634	865	907	933
Watermelon										67	71	72
Others	1891	1882	1510	2037	2247	2282	2414	2275	2299	1496	1661	1681
Total	**6156**	**6092**	**6082**	**6744**	**7213**	**7581**	**7848**	**7980**	**7985**	**8495**	**8989**	**9081**
Aromatic				**131**	**262**	**324**	**397**	**430**	**509**	**510**	**506**	**531**
Flowers Cut												
Flowers Loose	**106**	**70**	**101**	**118**	**130**	**144**	**166**	**167**	**183**	**191**	**254**	**272**
Plantation Crops												
Arecanut	334.8	334.8	365.0	364.3	381.1	382.7	386.6	387	400	400	464	476
Cashewnut	740.0	740.0	780.0	820.0	843.4	854.0	868.0	893	923	953	979	991

Commodities	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13@
Cocoa	16.2	16.2	23.6	27.7	29.5	30.3	31.8	34	46	57	63	66
Coconut	1893.0	1893.0	1933.7	1935.0	2028.9	1939.9	1903.2	1903	1895	1896	2071	2132
Total	**2984.0**	**2984.0**	**3102.3**	**3147.0**	**3282.9**	**3206.9**	**3189.6**	**3217**	**3265**	**3306**	**3577**	**3666**
Spices												
Ajwan						16.00	19.29	20	17	26	35	35
Cardamom	102.70	102.70				104.00	81.93	92	90	87	89	89
Chillies (Dried)	881.30	881.30	834.30			761.00	808.17	779	767	792	805	805
Cinnamon/Tejpata						5.00	3.32	3	4	3	3	3
Celery,Dill & Poppy						18.00			19	38	33	33
Clove						2.00	2.25	3	3	2	2	2
Coriander	433.40	433.40	282.50			321.00	384.21	397	360	530	558	558
Cumin	526.60	526.60	521.30			364.00	429.38	429	377	508	594	594
F.Greek	115.60	115.60	50.60			46.00	55.20	68	51	81	94	94
Fennel	39.90	39.90	22.90			48.00	54.29	47	43	62	100	100
Garlic	88.10	88.10	107.10			151.00	206.12	166	165	201	242	242
Ginger	84.60	84.60	85.10			107.00	104.36	109	108	149	155	155
Nutmeg						14.00	15.26	15	16	16	17	17
Pepper	216.50	216.50	223.10			237.00	197.33	239	196	184	200	200
Vanilla						10.00			9	7	7	7
Tamarind	60.80	60.80	62.50			58.00	55.04	55	58	60	58	58
Turmeric	163.00	163.00	149.40			185.00	174.51	181	181	195	219	219
Others $	508	508	2817				27	27				
Spice Total	**3220**	**3220**	**5155**	**3150**	**2366**	**2447**	**2617**	**2629**	**2464**	**2940**	**3212**	**3212**
Mushroom												
Honey	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Total	**16593**	**16270**	**19208**	**18445**	**18708**	**19390**	**20207**	**20662**	**20876**	**21824**	**23242**	**23639**

* Includes walnut up to 2009-10, thereafter A & P of walnut is given separately.
$ includes mustard seeds area of 467.8 thousand Ha and 410.5 thousand MT
@ First Advance Estimates

Annexure 4.8: All India Estimates of Production of Horticulture Crops

(Production in 000 Tonnes)

Commodities	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13@
Fruits												
Almond/Walnut*	114	114	121	121	149	150	177	173	193	14	4	4
Aonla										677	961	993
Apple	1158	1348	1522	1739	1814	1624	2001	1985	1777	2891	2203	1845
Banana	14210	13304	13857	16328	18888	20998	23823	26217	26470	29780	28455	30283
Ber										188	252	256
Citrus												
(i) Lime/Lemon										2108	2272	2339
(ii) Mandarin										3255	3128	3227
(iii) Sweet Orange												
(Mosambi)										1316	1232	1186
(iv) Others										784	1290	1331
Citrus Total (i to iv)	4789	5677	5787	5933	6139	7145	8015	8623	9638	7464	7922	8083
Custardapple										105	127	133
Grapes	1184	1248	1475	1565	1650	1685	1735	1878	881	1235	2221	2690
Guava	1716	1793	1831	1683	1737	1831	1981	2270	2572	2462	2510	2613
Jackfruit										540	1042	1032
Kiwi										1	6	6
Litchi	356	476	479	369	392	403	418	423	483	497	538	555
Mango	10020	12733	11490	11830	12663	13734	13997	12750	15027	15188	16196	17513
Papaya	2590	2147	1692	2535	2173	2482	2909	3629	3913	4196	4457	4745
Passion Fruit											97	98
Peach										92	91	90
Pear										300	294	317
Pineapple	1182	1172	1234	1279	1263	1362	1245	1341	1387	1415	1500	1542
Plum										32	72	69
Pomegranate			665	801	809	840	884	807	820	743	772	772

Commodities	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13@
Sapota	594	913	921	1077	1114	1216	1258	1308	1347	1424	1426	1587
Walnut										187	284	277
Others	5202	4391	4991	5730	6715	6244	7321	7234	7201	5447	4991	5012
Total Fruits	**43115**	**45317**	**46063**	**50988**	**55505**	**59714**	**65764**	**68638**	**71709**	**74878**	**76424**	**80557**
Vegetables												
Beans										888	1151	1232
Bitterguard										749	866	870
Bottleguard										1354	1984	2052
Brinjal	8348	8001	8477	8601	9365	9453	9678	10378	10563	11896	12634	12995
Cabbage	5678	5392	5595	6114	5637	5584	5910	6870	7281	7949	8412	8603
Capsicum										65	127	131
Carrot										953	1153	1150
Cauliflower	4891	4444	4940	4515	5323	5538	5777	6532	6569	6745	7349	7464
Cucumber										525	607	674
Muskmelon										740	791	811
Okra	3325	3245	3631	3512	3975	4070	4179	4528	4803	5784	6259	6479
Onion	5252	4210	6268	7761	9433	10847	13900	13565	12159	15118	17511	16817
Parmal(pointed gourd)	-	-	-	-	-	-	-	-	-	-	-	-
Peas	2038	2062	1901	1945	2270	2402	2491	2916	3029	3517	3745	3913
Potato	24456	23161	27926	28788	29175	28600	34658	34391	36577	42339	41483	42479
Radish										1878	2286	2309
Sitaphal/Pumpkin										143	278	282
Sweet Potato	1130	1130	1179	1179	1067	1067	1094	1120	1095	1047	1073	1089
Tapioca	6516	5426	5950	7463	7855	8232	9056	9623	8060	8076	8747	9944
Tomato	7462	7617	8126	8825	9820	10055	10303	11149	12433	16826	18653	19377
Watermelon										1436	1727	1793
Others	19526	20127	14342	22544	27481	29146	31402	28006	31168	18526	19487	19826
Total	**88622**	**84815**	**88334**	**101246**	**111399**	**114993**	**128449**	**129077**	**133738**	**146554**	**156325**	**160291**

Commodities	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13@
Aromatic				**159**	**202**	**178**	**396**	**430**	**573**	**605**	**566**	**586**
Flowers Cut #	25571	20605	17930	20710	29210	37175	43644	47942	66671	69027	75066	75413
Flowers Loose	**535**	**735**	**580**	**659**	**656**	**880**	**868**	**987**	**1021**	**1031**	**1652**	**1677**
Plantation Crops												
Arecanut	409.3	409.3	439.2	452.0	483.1	483.3	476.0	481	478	478	681	703
Cashewnut	460.0	460.0	535.0	544.0	579.4	620.0	665.0	695	613	675	725	752
Cocoa	6.4	6.4	8.5	10.0	10.2	10.2	10.6	12	13	14	13	13
Coconut	8821.3	8821.3	12178.2	8829.0	10190.1	10893.8	10148.3	10148	10824	10840	14940	15347
Total	**9697.0**	**9697.0**	**13160.9**	**9835.0**	**11262.8**	**12007.3**	**11299.9**	**11336**	**11928**	**12007**	**16359**	**16815**
Spices												
Ajwan						10.00	11.12	16	10	22	27	27
Cardamom	17.30	17.30				17.00	13.65	15	16	16	16	16
Chillies (Dried)	1113.10	1113.10	847.80			1233.00	1294.15	1270	1203	1223	1276	1276
Cinnamon/Tejpata						10.00	6.96	7	9	5	5	5
Celery,Dill & Poppy						11.00			13	40	33	33
Clove						1.00	1.01	1	1	1	1	1
Coriander	318.70	318.70	172.30			233.00	229.95	242	237	482	533	533
Cumin	206.40	206.40	134.80			130.00	172.47	172	156	314	394	394
F.Greek	136.60	136.60	64.20			54.00	55.48	77	57	118	116	116
Fennel	38.50	38.50	27.60			66.00	67.78	64	57	105	143	143
Garlic	367.60	367.60	436.10			710.00	1068.50	831	834	1058	1228	1228
Ginger	317.80	317.80	305.90			377.00	390.08	380	385	702	756	756
Nutmeg						12.00	11.37	11	8	11	13	13
Pepper	79.10	79.10	70.60			69.00	47.01	47	51	52	41	41
Vanilla						0.00			0	1	1	1
Tamarind	184.40	184.40	182.30			185.00	182.08	178	185	206	203	203
Turmeric	552.30	552.30	529.00			836.00	794.19	821	793	993	1167	1167
Others $	433	433	2343				11	11				

Commodities	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13@
Spice Total	**3765**	**3765**	**5113**	**4001**	**3705**	**3953**	**4357**	**4145**	**4016**	**5350**	**5951**	**5951**
Mushroom	**40**	**40**	**40**	**40**	**35**	**37**	**37**	**37**	**41**			
Honey	**10**	**10**	**10**	**10**	**52**	**51**	**65**	**65**	**65**			
Total	**145784**	**144380**	**153301**	**166938**	**182817**	**191813**	**211235**	**214716**	**223089**	**240427**	**257277**	**265877**

* Includes walnut up to 2009-10, thereafter A & P of walnut is given separately.
# Flowers Cut in Lakh number
$ includes mustard seeds area of 467.8 thousand Ha and 410.5 thousand MT
@ First Advance Estimates

Annexure 4.9 : Per Capita Net Availability of Foodgrains (Grams Per Day) in India

(As on 17.02.2012)

Year	Rice	Wheat	Other Cereals	Cereals	Gram	Pulses	Food Grains
1	2	3	4	5	6	7	8
1951	158.9	65.7	109.6	334.2	22.5	60.7	394.9
1956	187.7	61.5	111.2	360.4	29.0	70.3	430.7
1961	201.1	79.1	119.5	399.7	30.2	69.0	468.7
1966	161.9	95.4	102.6	359.9	18.3	48.2	408.1
1971	192.6	103.6	121.4	417.6	20.0	51.2	468.8
1976	187.2	79.5	107.4	373.8	20.2	50.5	424.3
1981	197.8	129.6	89.9	417.3	13.4	37.5	454.8
1985	188.8	138.6	87.9	415.3	12.9	38.1	453.4
1990	212.1	132.6	86.8	431.5	10.7	41.1	472.6
1991	221.7	166.8	80.0	468.5	13.4	41.6	510.1
1992	217.0	158.6	58.9	434.5	10.1	34.3	468.8
1993	201.1	140.2	86.6	427.9	10.7	36.2	464.1
1994	207.4	159.5	67.1	434.0	11.8	37.2	471.2
1995	220.0	172.7	64.9	457.6	14.9	37.8	495.5
1996	204.4	176.0	62.0	442.5	11.3	32.7	475.2
1997	214.0	179.1	72.9	466.0	12.4	37.1	503.1
1998	200.3	151.5	62.4	414.2	13.4	32.8	447.0
1999	203.4	162.3	63.4	429.2	14.6	36.5	465.7
2000	203.7	160.0	59.0	422.7	10.8	31.8	454.4
2001	190.5	135.8	56.2	386.2	8.0	30.0	416.2
2002	228.7	166.6	63.4	458.7	10.7	35.4	494.1
2003	181.4	180.4	46.7	408.5	8.5	29.1	437.6
2004	195.4	162.2	69.3	426.9	11.2	35.8	462.7
2005	177.3	154.3	59.4	390.9	10.6	31.5	422.4
2006	198.0	154.3	60.5	412.8	10.7	32.5	445.3
2007	194.0	157.8	55.5	407.4	11.9	35.5	442.8
2008	175.4	145.1	54.1	394.2	10.6	41.8	436.0
2009	188.4	154.7	63.9	407.0	12.9	37.0	444.0
2010	182.0	168.2	51.4	401.7	13.5	35.4	437.1
2011(P)	188.8	164.6	70.0	423.5	14.6	39.4	462.9

P- Provisional

Notes:- The net availability of foodgrains is estimated to be Gross Production (-) seed, feed & wastage, (-) exports (+) imports, (+/-) change in stocks.

The net availability of foodgrains divided by the population estimates for a particular year indicate per capita availability of foodgrains in terms of kg/year. Net availability, thus worked out further divided by the number of days in a year I.e., 365 days gives us net availability of foodgrains in terms of grams/day.

Figures in respect of per capita net availability given above are not strictly representative of actual level of consumption in the country especially as they do not take in to account any change in stocks in possession of traders, producers and consumers.

For calculation of per capita net availability the figures of net imports from 1981 to 1994 are based on imports and exports on Government of India account only. Net imports from 1995 ownwards are the total exports and imports(on Government as well as private accounts).

Cereals includes rice,wheat and other cereals. Pulses includes all kharif and rabi pulses

Foodgrains includes rice, wheat,other cereals and all pulses

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation.

Annexure. 4.10: Per capita Consumption of Conventional Food Items

Commodities	Year	Quantity in Kg	
		Qty. consumed per Annum	
		Rural	Urban
Rice	1993-94	82.61	62.42
	2004-05	77.62	57.31
	2009-10	74.70	56.64
Wheat	1993-94	52.56	54.02
	2004-05	50.98	53.05
	2009-10	53.03	52.82
Coarse cereals	1993-94	27.86	12.53
	2004-05	18.86	10.59
	2009-10	10.34	4.60
All cereals	1993-94	163.03	128.97
	2004-05	147.46	120.94
	2009-10	138.08	114.05
All pulses & Pulse Products	1993-94	9.25	10.46
	2004-05	8.64	9.98
	2009-10	7.92	9.60
All edible oil	1993-94	4.50	6.81
	2004-05	5.84	8.03
	2009-10	7.74	9.95

Source: NSSO, various rounds

Annexure 4.11: Per capita Consumption of Emerging Food Items

Commodities	Year	Quantity in Kg/Litre/No.	
		Qty. consumed per Annum	
		Rural	Urban
Fruits and Vegetables	1993-94	32.97	35.41
	2004-05	35.53	38.57
	2009-10	49.14	50.11
Milk (Litre)	1993-94	47.94	59.50
	2004-05	46.11	62.05
	2009-10	50.09	65.19
Eggs (No.)	1993-94	7.79	18.01
	2004-05	12.29	20.93
	2009-10	21.08	32.53
Fish (kg)	1993-94	2.19	2.43
	2004-05	2.45	2.51
	2009-10	3.27	2.90
Goat meat/Mutton (Kg)	1993-94	0.73	1.34
	2004-05	0.57	0.85
	2009-10	0.57	1.11
Chicken (kg)	1993-94	0.24	0.37
	2004-05	0.61	1.03
	2009-10	1.50	2.19

Source: NSSO, various rounds

Annexure. 4.12: Percentage Composition of Consumer Expenditure

	Rural					Urban				
Item group	Share in total consumer expenditure					Share in total consumer expenditure				
	1987-88	1993-94	1999-00*	2004-05	2009-10	1987-88	1993-94	1999-00*	2004-05	2009-10
1	2	3	4	5	6	7	8	9	10	11
Cereal	26.3	24.2	22.2	18.0	15.6	15.0	14.0	12.4	10.1	9.1
Gram	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1
Cereal substitutes	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Pulses & products	4.0	3.8	3.8	3.1	3.7	3.4	3.0	2.8	2.1	2.7
Milk & products	8.6	9.5	8.8	8.5	8.6	9.5	9.8	8.7	7.9	7.8
Edible oil	5.0	4.4	3.7	4.6	3.7	5.3	4.4	3.1	3.5	2.6
Egg fish & meat	3.3	3.3	3.3	3.3	3.5	3.6	3.4	3.1	2.7	2.7
Vegetables	5.2	6.0	6.2	6.1	6.2	5.3	5.5	5.1	4.5	4.3
Fruits & nuts	1.6	1.7	1.7	1.9	1.6	2.5	2.7	2.4	2.2	2.1
Suger	2.9	3.1	2.4	2.4	2.4	2.4	2.4	1.6	1.5	1.5
Salt & spices	2.9	2.7	3.0	2.5	2.4	2.3	2.0	2.2	1.7	1.5
Beverages, ect.	3.9	4.2	4.2	4.5	5.6	6.8	7.2	6.4	6.2	6.3
Food tatal	64.0	63.2	59.4	55.0	53.6	56.4	54.7	48.1	42.5	40.7
Pan, tobacco, intox.	3.2	3.2	2.9	2.7	2.2	2.6	2.3	1.9	1.6	1.2
Fuel & light	7.5	7.4	7.5	10.2	9.5	6.8	6.6	7.8	9.9	8.0
Clothing & bedding	6.7	5.4	6.9	4.5	4.9	5.9	4.7	6.1	4.0	4.7
Footwear	1.0	0.9	1.1	0.8	1.0	1.1	0.9	1.2	0.7	0.9
Misc. & services	14.5	17.3	19.6	23.4	24.0	23.2	27.5	31.3	37.2	37.8
Durable goods	3.1	2.7	2.6	3.4	4.8	4.1	3.3	3.6	4.1	6.7
Non-food total	36.0	36.8	40.6	45.0	46.4	43.6	45.3	51.9	57.5	59.3
Total expenditure	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* URP estimates shown except for 1999-2000, for which only MRP estimates are available.
Source: NSSO Household Consumer Expenditure survery 2009-10.

Annexure 5.1: Minimum Support Prices

(According to Crop Year) (As on 26.12.2012)
(Rs. per quintal)

Sl. No.	Commodity	Variety	2008-09	2009-10	2010-11	2011-12	(#) increase in MSP 2011-12 over 2010-11	2012-13	(#) increase in MSP 2012-13 over 2011-12
	KHARIF CROPS								
1	Paddy	Common	850$	950$	1000	1080	80(8.0)	1250	170(15.7)
		Grade 'A'	880$	980$	1030	1110	80(7.8)	1280	170(15.3)
2	Jowar	Hybrid	840	840	880	980	100(11.4)	1500	520(53.1)
		Maldandi	860	860	900	1000	100(11.1)	1520	520(52.0)
3	Bajra		840	840	880	980	100(11.4)	1175	195(19.9)
4	Maize		840	840	880	980	100(11.4)	1175	195(19.9)
5	Ragi		915	915	965	1050	85(8.8)	1500	450(42.8)
6	Arhar (Tur)		2000	2300	3000¶	3200¶	200(6.7)	3850	650(20.3)
7	Moong		2520	2760	3170¶	3500¶	330(10.4)	4400	900(25.7)
8	Urad		2520	2520	2900¶	3300¶	400(13.8)	4300	1000(30.3)
9	Cotton	Medium Staple	2500[a]	2500[a]	2500[a]	2800[a]	300(12.0)	3600	800(28.6)
		Long Staple	3000[aa]	3000[aa]	3000[aa]	3300[aa]	300(10.0)	3900	600(18.2)
10	Groundnut in Shell		2100	2100	2300	2700	400(17.4)	3700	1000(37.0)
11	Sunflower Seed		2215	2215	2350	2800	450(19.1)	3700	900(32.1)
12	Soyabeen	Black	1350	1350	1400	1650	250(17.8)	2200	550(33.3)
		Yellow	1390	1390	1440	1690	250(17.4)	2240	550(32.5)
13	Sesamum		2750	2850	2900	3400	500(17.2)	4200	800(23.5)
14	Nigerseed		2405	2405	2450	2900	450(18.4)	3500	600(20.7)
	RABI CROPS								
15	Wheat		1080	1100	1120$	1285	165(14.7)	1350	65(5.05)
16	Barley		680	750	780	980	200(25.6)	980	0(0.00)
17	Gram		1730	1760	2100	2800	700(33.3)	3000	200(7.14)
18	Masur (Lentil)		1870	1870	2250	2800	550(24.4)	2900	100(3.57)
19	Rapeseed/ Mustard		1830	1830	1850	2500	650(35.1)	3000	500(20.00)
20	Safflower		1650	1680	1800	2500	700(38.9)	2800	300(12.00)
21	Toria		1735	1735	1780	2425	645(36.2)	2970	545(22.47)
	OTHER CROPS								
22	Copra	Milling	3660	4450	4450	4525	75(1.7)	5100	575(12.7)
	(Calender Year)	Ball	3910	4700	4700	4775	75(1.6)	5350	575(12.0)
23	De-Husked Coconut (Calender Year)		988	1200	1200	1200	0(0.0)	1400	200(16.7)
24	Jute		1250	1375	1575	1675	100(6.3)	2200	525(31.3)
25	Sugarcane		81.18	129.84¤	139.12¤	145.00¤	5.88(4.2)	170.00¤	25(17.2)

\# Figures in brackets indicate percentage increase.
$ An additional incentive bonus of Rs. 50 per quintal was payable over the Minimum Support Price(MSP).
[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
¶ Additional incentive at the rate of Rs. 500 per quintal of tur, urad and moong sold to procurement agencies is payable during the harvest/arrival period of two months.
¤ Fair and remunerative price.
* Not announced.

Annexure 5.2: Top 10 Agricultural Exports Items

Qty. '000' tonnes, Value: Rs. in crores

Sl. No.	Item	2009-10		2010-11		2011-12		Percent change in Value during 2010-11 over 2009-10	Percent change in Value during 2011-12 over 2010-11
		Qty.	Value	Qty.	Value	Qty.	Value		
1	Cotton Raw incl. waste	1358	9537	1258	12981	2013	21623	36.1	66.6
2	Marine products	710	9999	801	11548	1032	16588	15.5	43.6
3	Guargum Meal	218	1133	403	2806	707	16357	147.7	482.9
4	Rice Basmati	2017	10890	2186	10582	3212	15450	-2.8	46.0
5	Meat & Preparations		6286		8776		14111	39.6	60.8
6	Spices	663	6157	749	7870	931	13176	27.8	67.4
7	Oil Meals	4671	7832	6798	10846	7436	11762	38.5	8.4
8	Sugar	45	110	3241	10339	2747	8779	9299.1	-15.1
9	Rice (other than Basmati)	140	365	96	220	4099	8668	-39.7	3840.0
10	Other cereals	2892	2973	3188	3596	4072	5479	21.0	52.4

Source: DGCI & S

Annexure 5.3: Top 10 Agricultural Import Items

Qty. '000' tonnes, Value: Rs. in crores

Sl. No.	Item	2009-10		2010-11		2011-12		Percent change in Value during 2010-11 over 2009-10	Percent change in Value during 2011-12 over 2010-11
		Qty.	Value	Qty.	Value	Qty.	Value		
1	Vegetable Oils fixed edible	8034	26483	6905	29860	8429	46242	12.8	54.9
2	Pulses	3510	9813	2591	6980	3308	8767	-28.9	25.6
3	Cashew Nuts	756	3048	504	2480	809	5338	-18.6	115.2
4	Fruits & Nuts (excl. Cashew nuts)		2873		3684		4519	28.2	22.7
5	Sugar	2551	5966	1198	2787	997	3138	-53.3	12.6
6	Spices	153	1432	108	1359	124	2102	-5.1	54.7
7	Cotton raw & waste	171	1241	56	604	78	1059	-51.3	75.3
8	Milk & Cream	8	78	37	492	63	1038	530.8	111.0
9	Jute, raw	63	149	75	273	181	449	83.2	64.5
10	Cereal Preparation	41	188	37	226	46	300	20.2	32.7

Source: DGCI & S

Annexure: 6.1. List of ICAR/DARE Institutions

Deemed Universities

1 Indian Agricultural Research Institute, New Delhi
2 National Dairy Research Institute, Karnal
3 Indian Veterinary Research Institute, Izatnagar
4 Central Institute on Fisheries Education, Mumbai

Institutions

1 Central Rice Research Institute, Cuttack
2 Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora
3 Indian Institute of Pulses Research, Kanpur
4 Central Tobacco Research Institute, Rajahmundry
5 Indian Institute of Sugarcane Research, Lucknow
6 Sugarcane Breeding Institute, Coimbatore
7 Central institute of Cotton Research, Nagpur
8 Central Research Institute for Jute and Allied Fibres, Barrackpore
9 Indian Grassland and Fodder Research Institute, Jhansi
10 Indian Institute of Horticultural Research, Bangalore
11 Central Institute of Sub Tropical Horticulture, Lucknow
12 Central Institute of Temperate Horticulture, Srinagar
13 Central Institute of Arid Horticulture, Bikaner
14 Indian Institute of Vegetable Research, Varanasi
15 Central Potato Research Institute, Shimla
16 Central Tuber Crops Research Institute, Trivandrum
17 Central Plantation Crops Research Institute, Kasargod
18 Central Agricultural Research Institute, Port Blair
19 Indian Institute of Spices Research, Calicut
20 Central Soil and Water Conservation Research & Training Institute, Dehradun
21 Indian Institute of Soil Sciences, Bhopal
22 Central Soil Salinity Research Institute, Karnal
23 ICAR Research Complex for Eastern Region including Centre of Makhana, Patna
24 Central Research Institute of Dryland Agriculture, Hyderabad
25 Central Arid Zone Research Institute, Jodhpur
26 ICAR Research Complex Goa

27 ICAR Research Complex for NEH Region, Barapani
28 National Institute of Abiotic Stress management, Malegaon, Maharashtra
29 Central Institute of Agricultural Engineering, Bhopal
30 Central Institute on Post harvest Engineering and Technology, Ludhiana
31 Indian Institute of Natural Resins and Gums, Ranchi
32 Central Institute of Research on Cotton Technology, Mumbai
33 National Institute of Research on Jute & Allied Fibre Technology, Kolkata
34 Indian Agricultural Statistical Research Institute, New Delhi
35 Central Sheep and Wool Research Institute, Avikanagar, Rajasthan
36 Central Institute for Research on Goats, Makhdoom
37 Central Institute for Research on Buffaloes, Hissar
38 National Institute of Animal Nutrition and Physiology, Bangalore
39 Central Avian Research Institute, Izatnagar
40 Central Marine Fisheries Research Institute, Kochi
41 Central Institute Brackishwater Aquaculture, Chennai
42 Central Inland Fisheries Research Institute, Barrackpore
43 Central Institute of Fisheries Technology, Cochin
44 Central Institute of Freshwater Aquaculture, Bhubneshwar
45 National Academy of Agricultural Research & Management, Hyderabad

National Research Centres

1 National Research Centre on Plant Biotechnology, New Delhi
2 National Centre for Integrated Pest Management, New Delhi
3 National Research centre for Litchi, Muzaffarpur
4 National Research Centre for Citrus, Nagpur
5 National Research Centre for Grapes, Pune
6 National Research Centre for Banana, Trichi
7 National Research Centre Seed Spices, Ajmer
8 National Research Centre for Pomegranate, Solapur
9 National Research Centre on Orchids, Pakyong, Sikkim
10 National Research Centre Agroforestry, Jhansi
11 National Research Centre on Camel, Bikaner
12 National Research Centre on Equines, Hisar
13 National Research Centre on Meat, Hyderabad

14 National Research Centre on Pig, Guwahati

15 National Research Centre on Yak, West Kemang

16 National Research Centre on Mithun, Medziphema, Nagaland

17 National Centre for Agril. Economics & Policy Research, New Delhi

National Bureaux

1 National Bureau of Plant Genetics Resources, New Delhi

2 National Bureau of Agriculturally Important Micro-organisms, Mau, Uttar Pradesh

3 National Bureau of Agriculturally Important Insects , Bangalore

4 National Bureau of Soil Survey and Land Use Planning, Nagpur

5 National Bureau of Animal Genetic Resources, Karnal

6 National Bureau of Fish Genetic Resources, Lucknow

In XI Plan (total 185) 45 Institutes; 6 National Bureaux; 4 Deemed to be Universites; 17 NRCs, 25 PDs; 61 AICRPs, 17 Networks and 10 other programmes

Annexure: 6.2. List of Agricultural Universities

Andhra Pradesh	3	Acharya NG Ranga Agricultural Univerwsity, Hyderabad Sri Venkateswara Veterinary University, Tirupati Horticulture University, Venkataramanagudem near Tadepalligudem, West Godawari
Assam	1	Assam Agricultural University, Jorhat
Bihar	2	Rajendra Agricultural University, Pusa, Samastipur Bihar Agricultural University, Sabour, Samastipur
Chhattisgarh	1	Indira Gandhi krishi Vishwavidyalaya, Raipur
New Delhi (deemed to be)	1	Indian Agricultural Research Institute, Pusa-110012, New Delhi
Gujarat	4	Junagarh Agricultural University, Junagarh Sardarkrushinagar-Dantiwada Agricultural University, Sardar Krushinagar, Banaskantha Anand Agricultural University, Anand Navsari Agricultural University, Navsari
Haryana deemed to be	3	Ch. Charan Singh Haryana Agricultural University, Hisar Lala Lajpat rai Univ. of Veterinary and Animal Sciences, Hisar National Dairy Research Institute, Karnal-132001, Haryana
Himachal Pradesh	2	Dr. Yashwant Singh Parmar University of Horticulture & Forestry, Solan, Nauni Ch. Sarwan Kumar Krishi Viswa Vidalaya, Palampur
J & K	2	Sher-E-Kashmir University of Agricultural Sceinces & Technology, Jammu Sher-E-Kashmir University of Agricultural Sceinces & Technology of Kashmir, Srinagar
Jharkhand	1	Birsa Agricultural University, Kanke, Ranchi
Karnataka	4	University of Agricultural Sciences, Dharwad University of Agricultural Sciences, Bangalore University of Agricultural Sciences, Raichur, Karnataka University of Horticultural Sciences, Navanagar, Bagalkot, Karnataka
Kerala	3	Kerala Agricultural University, Vellanikara, Trichur Kerala University of animal Sciences, Directorate of Dair development, Pattom, Thiruvantapuram

		Kerala University of Fisheries & Ocean Studies, Papangad, Kotchi, kerala
Madhya Pradesh	3	Jawahar Lal Nehru Krishi Vishwavidyalaya, Jabalpur Madhya Pradesh Pashu Chikitsa Vigyan Vishvavidalaya, Civil Lines, Jabalpur Rajmata VRS Agri. University, Gwalior
Maharashtra	6	Dr. Balaesahib Sawant Konkan Krishi Vidypapeeth, Dapoli, Ratnagiri Dr. Punjabrao Deshmukh Krishi Vidyapeeth, Krishinagar, Akola Mahatma Phule Krishi Vidyapeeth, Rahuri Marathwada Agricultural University, Parbhani Maharastra Animal and Fisheries Sciences University, Nagpur
deemed to be		Central Institute of Fisheries Education, Mumbai-400061, Maharashtra
Manipur	1	Central Agri. University, Imphal
Nagaland	1	Nagaland University, Medizipherma, Nagaland
Odisha	1	Orissa University of Agriculture & Technology, Bhubaneshwar
Punjab	2	Punjab Agricultural University, Ludhiana Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana
Rajasthan	3	Maharana Pratap Univ. of Agriculture & Technology, Udaipur Swami Keshwanand Rajastahn Agricultural University, Bikaner Rajasthan Univ. of veterinary & Animal Sciences, Bijay Bhavan Palace Complex, Bikaner
Tamil Nadu	2	Tamil Nadu Agricultural University, Coimbatore Tamil Nadu Veterinary & Animal Sciences University, Chennai
Uttar Pradesh	9	Chandra Shekhar Azad Univeristy of Agriculture & technology, Kanpur Narendra Dev University of Agriculture & Technology, Faizabad UP Pandit Deen Dyal Upadhaya Veterinary and Animal Sciences University, Mathura Sardar Vallabh Bhai Patel University of Agriculture and Technology, Meerut Manyavar Shri Kanshiram Ji University of Agri. & Tech. Banda, UP
deemed to be		Allahabad Agricultural Institute, Allahabad-211007, Uttar Pradesh Indian Veterinary Research Institute, Izatnagar, Bareilly-243122, Uttar Pradesh

Cus		Banaras Hidu University, Varanasi, U.P. Aligarh Muslim University, Aligarh, U.P.
Uttarakhand	2	Govind Ballabh Pant University of Agriculture & Technology, Pantnagar University of Horticulture and Forestry, Ranichauri, Tehri Garhwal
West Bengal	4	Bidhan Chandra Krishi Vishwavidyalaya, Mohanpur, Nadia Uttar Banga Krishi Vishwavidyalaya, Coach Bihar West Bengal University of Animal & Fishery Sciences, Kolkata
deemed to be		Vishwa Bharti, Shantiniketan, West Bengal
Total	**61**	

In XI Plan 51 SAUs, 5 deemed to be Univ, 1 CAU, 4 CUs with Agri. Faculty

Annexure 7.1: Production of Milk, Eggs, Wool and Meat- All India

Year	Milk (Million Tonnes)	Eggs (Million Nos.)	Wool (Million Kgs.)	Meat (Million Tonnes)
1950-51	17.0	1832	27.5	-
1955-56	19.0	1908	27.5	-
1960-61	20.0	2881	28.7	-
1968-69	21.2	5300	29.8	-
1973-74	23.2	7755	30.1	-
1979-80	30.4	9523	30.9	-
1980-81	31.6	10060	32.0	-
1981-82	34.3	10876	33.1	-
1982-83	35.8	11454	34.5	-
1983-84	38.8	12792	36.1	-
1984-85	41.5	14252	38.0	-
1985-86	44.0	16128	39.1	-
1986-87	46.1	17310	40.0	-
1987-88	46.7	17795	40.1	-
188-89	48.4	18980	40.8	-
1989-90	51.4	20204	41.7	-
1990-91	53.9	21101	41.2	-
1991-92	55.7	21983	41.6	-
1992-93	58.0	22929	38.8	-
1993-94	60.6	24167	39.9	-
1994-95	63.8	25975	40.6	-
1995-96	66.2	27198	42.4	-
1996-97	69.1	27496	44.4	-
1997-98	72.1	28689	45.6	-
1998-99	75.4	29476	46.9	1.9
1999-2000	78.3	30447	47.9	1.9
2000-2001	80.6	36632	48.4	1.9
2001-2002	84.4	38729	49.5	1.9
2002-2003	86.2	39823	50.5	2.1

Year	Milk (Million Tonnes)	Eggs (Million Nos.)	Wool (Million Kgs.)	Meat (Million Tonnes)
2003-2004	88.1	40403	48.5	2.1
2004-2005	92.5	45201	44.6	2.2
2005-2006	97.1	46235	44.9	2.3
2006-2007	102.6	50663	45.1	2.3
2007-2008	107.9	53583	43.9	4.0
2008-2009	112.2	55562	42.8	4.3
2009-2010	116.4	60267	43.1	4.6
2010-2011	121.8	63024	43.0	4.8
2011-2012	127.9	66450	44.7	5.5

Note: Meat Production from Commercial Poultry Farm is included from 2007-08. - Data not available.
Source: Department of Animal Husbandry, Dairying and Fisheries.

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