Annual Report

2016-17

ICAR – National Institute of Agricultural Economics and Policy Research

Indian Council of Agricultural Research

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ICAR-NIAP Annual Report 2016-17

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PREFACE

Credible and evidence based agricultural policy research has been the mission of ICAR-NIAP, and therefore, it is recognized as a economic think tank of ICAR. In order to retain this position, NIAP continued its efforts in 2016-17 also to address contemporary policy issues. As Indian agriculture is under transformation, understanding multiple dimensions of this process, and analysis of policy alternatives are necessary. Role of agricultural policy research is crucial to align policies, technology and institutions with the transformation process. NIAP therefore continued to play a significant role in this direction. NIAP provided policy inputs on regular basis to ICAR, NITI Aayog, DAC&FW and state governments. NIAP has made significant contributions in the area of regional crop planning, market intelligence and commodity price forecasts, and research impact. Trends in economics of crop production, climate resilience of agriculture, dairy development, agricultural wages, gender mainstreaming and consumption pattern are some notable areas of research contribution in 2016-17. Participation in policy discussion on doubling farmers income, agriculture in SAARC region, planning for agriculture, and review of ICAR are some major policy outreach activities. Besides research and policy inputs, NIAP has also made significant contribution towards capacity building. The Institute organized capacity building programs for NARS scientists and probationers of Indian Economic Service. Dr. P. S. Birthal was awarded with ICAR National Professorship.

The Institutes received overwhelming support from ICAR in terms of resources, guidance and various other facilities. We place our grateful thanks to Dr. T. Mohapatra, Secretary, Department of Agricultural Research and Education and Director General, ICAR for involvement of NIAP in strategic matters related to agricultural R&D. We express our gratitude to Sh. S. K. Singh, AS (D) and FA, Sh. Chhabilendra Roul, AS (D) and Secretary, ICAR and Dr. N. S. Rathore, DDG (Education) for providing invaluable guidance for successful implementation of different programs. Thanks are also due to Chairman and Members of Research Advisory Committee, and Members of Institute Management Committee for their valuable guidance. My colleagues at NIAP have been extremely cooperative and proactive in undertaking different activities of the Institute. Dr. Usha Ahuja ably managed responsibilities of NIAP for most of the year. Dr. T. K. Immanuelraj, Dr. Sant Kumar and Ms. Sonia Chauhan have compiled and coordinated the Annual Report. I appreciate commitments and cooperation of all of them.

(Suresh Pal)
Director

June, 2017

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LIST OF ACRONYMS

AERA	Agricultural Economics Research Association
AERR	Agricultural Economics Research Review
AGM	Agricultural Growth and Market
AKMU	Agricultural Knowledge Management Unit
APAARI	Asia Pacific Association of Agricultural Research Institutions
APMC	Agricultural Produce Market Committee
BCM	Billion Cubic Metre
BHU	Banaras Hindu University
BPL	Below Poverty Line
BSI	Borlaug Institute for South Asia
CACP	Commission for Agricultural Cost and Prices
CAFT	Centre of Advanced Faculty Training
CAGR	Compound Annual Growth Rate
CAS	Current Awareness Service
CDAC	Commodity Derivatives Advisory Committee
CD-ROM	Compact Disc-Read Only Memory
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	International Maize and Wheat Improvement Centre
CPIAL	Consumer Price Index for Agricultural Labourers
CRIDA	Central Research Institute for Dryland Agriculture
CSSRI	Central Soil Salinity Research Institute
DATA	Data Analysis Tools and Approaches
DDS	Document Delivery Service
DG	Director General
DMR	Directorate of Maize Research

DSR	Directorate of Soybean Research
DST	Department of Science and Technology
EFC	Expenditure Finance Committee
e-NAM	e-National Agricultural Market
EPW	Economics and Political Weekly
ERNET	Education and Research Network
ERP	Enterprise Resource Planning
FFP	Farmer FIRST Programme
FGD	Focused Group Discussion
FL	Family Labour
GAMS	General Algebraic Modelling System
GDP	Gross Domestic Product
GIS	Geographic Information System
GPF	General Provident Fund
GW	Ground Water
HER	Herd Efficiency
HRM	Human Resource Management
HRMS	Human Resource Management System
HYPM	Half Yearly Progress Monitoring
IARI	Indian Agricultural Research Institute
IASRI	Indian Agricultural Statistics Research Institute
ICAR	Indian Council of Agricultural Research
ICRAF	International Council for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	Information and Communication Technology
IES	Indian Economic Service
IFPRI	International Food Policy Research Institute
IFS	Institute of Food Security

IGIDR	Indira Gandhi Institute of Development Research
IIFSR	Indian Institute of Farming Systems Research
IMC	Institute Management Committee
IPM	Integrated Pest Management
IRR	Internal Rate of Return
ISO	International Organization for Standardization.
IWMI	International Water Management Institute
JAU	Junagadh Agricultural University
JSC	Joint Staff Council
KVK	Krishi Vigyan Kendra
LAN	Local Area Network
MAPE	Mean Absolute Percentage Error
MCX	Multi Commodity Exchange of India
MEP	Minimum Export Price
MGMG	Mera Gaon Mera Gaurav
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MIS-FMS	Management Information System -Financial Management System
MPCE	Monthly Per Capita Expenditure
MPKV	Mahatma Phule Krishi Vidyapeeth
MPUAT	Maharana Pratap University of Agriculture and Technology
MT	Market and Trade
NAARM	National Academy of Agricultural Research Management
NAAS	National Academy of Agricultural Sciences
NABARD	National Bank for Agriculture and Rural Development
NARS	National Agricultural Research System
NASC	National Agricultural Science Complex
NCIPM	National Research Centre for Integrated Pest Management
NFSA	National Food Security Act

NIAP	National Institute of Agricultural Economics and Policy Research
NIC	National Informatics Centre
NISCAIR	National Institute of Science, Communication and Information Resources
NISTADS	National Institute of Science, Technology and Development Studies
NITI	National Institution for Transforming India
NKN	National Knowledge Network
NPL	National Physical Laboratory
NPS	New Pension Scheme
NRC	National Research Centre
NDRI	National Dairy Research Institute
NRM	Natural Resource Management
NSA	Net Sown Area
NSSO	National Sample Survey Office
OLIC	Official Language Implementation Committee
PAD	Policy Advocacy Dissemination
PAU	Punjab Agricultural University
PDS	Public Distribution System
PERMISNET	Personnel Management Information System Network
PIMS	Personnel Information Management System
PME	Priority Setting, Monitoring and Evaluation
PO	Post Office
PPVFRA	Protection of Plant Varieties and Farmers' Rights Authority
PRA	Participatory Rural Appraisal
QRT	Quinquennial Review Team
R&D	Research and Development
RAC	Research Advisory Committee
RPCAU	Dr Rajendra Prasad Central Agricultural University
RPF	Request for Proposal

SAARC	South Asian Association for Regional Cooperation
SAS	Statistical Analysis System
SAUs	State Agricultural Universities
SC/ST	Scheduled Case / Scheduled Tribe
SMS	Short Message Service
SPSS	Statistical Package for Social Sciences
SQL	Structured Query Language
STATA	Statistics and Data
SUR	Seemingly Unrelated Regression
TARINA	Technical Assistance and Research for Indian Nutrition and Agriculture
TDS	Tax Deducted at Source
TE	Triennium Ending
TFP	Total Factor Productivity
TP	Technology Policy
UDC	Upper Division Clerk
UMP	Unified Market Platform
UP	Uttar Pradesh
USA	United State of America
VOP	Value of Product

विशिष्ट सारांश

भाकृअनुप – राष्ट्रीय कृषि आर्थिकी एवम् नीति अनुसंधान संस्थान (ICAR - NIAP) कृषि अर्थशास्त्र तथा नीति अनुसंधान में उत्कृष्टता बनाये रखने के लिए प्रयासरत है। इस संस्थान को नीतिगत शोध में विशेषज्ञता प्राप्त है तथा यह भारतीय कृषि अनुसंधान परिषद् को विश्वसनीय एवं साक्ष्य–आधारित सुझावों द्वारा नीति संबंधी विचार–विमर्श तथा निर्णय लेने में सहयोग करता है। यह संस्थान देश के किसानों की चिंताओं तथा खेती में आ रहे बदलाव से नीति–निर्माताओं तथा शोध प्रशासकों को अवगत कराता है। इसके अतिरिक्त यह संस्थान अन्य सार्वजनिक निकायों, विभागों, मंत्रालयों तथा राज्य सरकारों को कृषि नीति संबंधी सूचनाएं उपलब्ध कराता है।

इस संस्थान में 22 वैज्ञानिक, 17 अन्य कर्मचारी तथा शोध परियोजनाओं के अन्तर्गत अनेक कर्मचारी कार्यरत हैं। वर्षावधि 2016–17 में वाह्य वित्तपोषित परियोजनाओं सहित संस्थान का कुल व्यय 939.59 लाख रुपये था।

इस संस्थान में सामयिक महत्व के विषयों पर अनुसंधान कार्य तीन प्रमुख क्षेत्रों में किये जाते हैं। ये क्षेत्र हैः प्रौद्योगिकी एवं टिकाऊ विकास, कृषि प्रगति एवं विकास, और विपणन, व्यापार तथा संस्थागत विकास। प्रत्येक क्षेत्र में अनुंसधान कार्य एक वरिष्ठ कृषि अर्थषास्त्री की देख–रेख में किया जाता है। कृषि के विभिन्न अनुसंधान क्षेत्रों में शोध कार्यों का समन्वय इस प्रकार किया जाता है कि संस्थान के निर्धारित उद्देश्यों की प्राप्ति की जा सके। प्रतिवेदन वर्षावधि (2016–17) के दौरान संस्थान ने कुल 16 परियोजनायें संचालित की तथा एक परामर्शी परियोजना को भी पूरा किया। इस संस्थान ने देश तथा विदेश में अनेक संस्थानों के साथ सम्पर्क एवं सहयोग कायम रखा। वर्षावधि 2016–17 के दौरान संस्थान ने अनेक कार्यशालाओं, प्रशिक्षण कार्यक्रमों एवं नीति विचार–विमर्श कार्यक्रमों का आयोजन किया। प्रतिवेदन वर्षावधि के दौरान संस्थान की प्रमुख अनुंसधान उपलब्धियों और गतिविधियों को नीचे प्रस्तुत किया गया हैः–

अल्पावधि में किसानों की आय दोगुना करना एक चुनौतीपूर्ण कार्य हैं, इसके लिए कम आय या अलाभकारी क्षेत्रों एवं किसानों की पहचान करना जरूरी है जिससेकि प्रौद्योगिकी, बाजार, ऋण, सूचना एवं बुनियादी सुविधाओं तक उनकी पहुँच हो सके। देश के कुल सीमांत किसानों जिनकी आमदनी कम है के लगभग 80 प्रतिशत लोग पूर्वी क्षेत्र में रहते हैं इनमें से 58 प्रतिशत किसान केवल उत्तर प्रदेश के हैं। देश के पश्चिमी क्षेत्र में लगभग 21 प्रतिशत सीमांत किसान हैं, जोकि कृषि अनुसंधान एवं विकास, खराब बुनियादी ढ़ाचें तथा संस्थागत विकास आदि में निवेश के अभाव में कृषि एवं आर्थिक विकास में पिछड़े हुए हैं। इनके विकास हेतु उपलब्ध उपायों में अधिक मूल्य वाली फसलों तथा पशुओं का उत्पादन, फसलचक्र सघनता में वृद्धि, उत्पादन अक्षमता में कमी लाना, फसलों का विविधीकरण तथा संचार की आधुनिक विधियों के प्रयोग शामिल हैं। कृषि अनुसंधान में निवेश तथा विकास कार्यो के पुर्ननिर्धारण पर भी ध्यान देना जरूरी है।

समेकित रीति से जलवायु अनुकूलन रणनीतियों को मुख्य धारा में लाने तथा इनकी प्रभावशीलता एवं लक्ष्य में वृद्धि करने के लिए विभिन्न मंत्रालयों के विविध विकास परक कार्यक्रमों का अध्ययन किया गया। अध्ययन में छः व्यापक विषयी समूहों एवं जारी विकास क्रार्यक्रमों–ग्रामीण आजीविका सुरक्षा; प्राकृतिक संसाधन प्रंबधन; उत्पादन एवं उत्पादकता में वृद्धि; जोखिम हेतु वित्तीय सहायता; खाद्यान्न प्रबंधन तथा अनुसंधान एवं प्रसार आदि को सुझाया गया है। जोकि कृषि की अनुकूलनशीलता को बढ़ानें में महत्वपूर्ण हैं। इन व्यापक विषयी समूहों के अनुसार, वर्षावधि 2015–16 में 24 मंत्रालयों द्वारा चलाये जा रहे कार्यक्रमों में से 161 विकासपरक क्रार्यक्रमों की पहचान की गयी। पुनः इन व्यापक विषयी समूहों को 24 उप–समूहों एवं 54 श्रेणियों में विभक्त किया गया। इससे जमीनी स्तर पर विभिन्न कार्यक्रमों की प्रभावशीलता एवं दक्षता वृद्धि के आकलन करने में मदद् मिलेगी।

भारत में विभिन्न कृषि परिस्थितिकीय प्रणालियों के बीच कृषि प्रदर्शन पर सामाजिक–आर्थिक एवं सामाजिक–वैयक्तिक कारकों, उनके प्रभावों और पाथवे (Pathway) की पहचान करने के लिए सुझाव दिया गया

है जिससेकि विशेषकर कम उत्पादक पूर्वी क्षेत्र में भूजल संसाधनों के सतत विकास से कृषि उत्पादकता बढ़ाने में सहायता मिल सकती है। इसी प्रकार उर्वरकों का प्रयोग बढ़ाकर कृषि उत्पादकता में सुधार लाया जा सकता है। दूसरा, कृषि क्षेत्र से अतिरिक्त श्रमिकों को अकृषित क्षेत्र में स्थापित करने से उनकी आमदनी बढ़ेगी साथ ही इससे कृषि उत्पादकता में सुधार आयेगा और ग्रामीण परिवेश में बदलाव भी आयेगा। तीसरा, कम लागत वाली प्रौद्योगिकी के प्रयोग तथा संसाधन बचत के प्रति जागरूकता से बेहतर लाभ मिलेगा। अन्त में परामर्शी सेवाओं और प्रसार कार्मिकों की उपलब्धता ग्रामीण विकास में सर्वाधिक महत्वपूर्ण भूमिका अदा कर सकते हैं।

भारत में कृषि मजदूरी पर किये गये एक अध्ययन में पता चला है कि अकृषित क्षेत्र में मजदूरी की दरें, राष्ट्रीय ग्रामीण रोजगार योजना क्रियान्वयन, ग्रामीण साक्षरता दर, श्रमिक सघनता, ट्रैक्टर का प्रयोग एवं संभावित उपज, कृषि मजदूरी को प्रभावित करने वाले प्रमुख कारकों में शामिल हैं। राष्ट्रीय ग्रामीण रोजगार योजना के क्रियान्वयन से इसके पूर्व अवधि की तुलना में कृषि मजदूरी में 16 प्रतिशत तक की वृद्धि हुई है। फसल उपज में संभावित वृद्धि के कारण कृषि मजदूरी की दरों में भी वृद्धि होती है। ट्रैक्टर के प्रयोग एवं कृषि मजदूरों के बीच पारस्परिक संबंधों के कारण मजदूरी दरों में सकारात्मक प्रभाव पड़ता है। इससे स्पष्ट है कि सीमांत उत्पादकता में सुधार लाने में कृषि मशीनीकरण और कृषि मजदूर एक–दूसरे के पूरक हैं और इससे कृषि में मजदूरी की दरें बढ़ती हैं।

दुग्ध क्षेत्र में वित्तीय क्रियाविधियों में संलग्न औपचारिक तथा अनौपचारिक मूल्य श्रखलाओं का आकलन दर्शाता है कि औपचारिक क्षेत्र की संस्थाओं (सहकारी समितियों, बहुराष्ट्रीय एवं निजी घरेलू प्रसंस्करणर्ताओं) का प्रदर्शन उल्लेखनीय था। छोटी जोत के साथ–साथ कम संख्या में पशुधन रखने वाले किसान, स्थानीय विक्रेताओं एवं उपभोक्ताओं की भॉति अनौपचारिक मूल्य श्रृंखलाओं से अधिक जुड़े हुए हैं। श्रृंखला आधारित वित्तीय सहायता, ग्रामीण परिवारों तक बहुत कम अनुपात में उपलब्ध है विशेषकर ऐसे किसानों के लिए जो स्थानीय व्यापारियों और निजी घरेलू प्रसंस्करणकर्ताओं को दूध की आपूर्ति करते हैं। बहुराष्ट्रीय कम्पनिओं एवं सहकारी समितिओं द्वारा मुश्किल से किसानों को किसी प्रकार की ऋण सहायता दी जाती है। व्याणिज्यिक बैंको द्वारा दी जाने वाली वित्तीय मदद् भी सीमित है जोकि समृद्ध किसानों को ही मिलती है। किसानों को दुग्ध व्यवसाय में प्रशिक्षण एवं खाद्य सुरक्षा मानकों के प्रति जागरूक करने से दुग्ध उत्पादकों के प्रदर्शन में सुधार लाया जा सकता है।

बाजार संबंधी खुफिया सूचना पर आधारित नेटवर्क परियोजना का अध्ययन दर्शाता है कि इससे उत्पादकों को बेहतर निर्णय लेने तथा कीमत जोखिम प्रबंधन और देशभर में विभिन्न कृषि जिंसों के विश्वसनीय पूर्वानुमान सूचना प्रसार में सहायता मिलती है। इस परियोजना के प्रभाव आकलन से पता चलता है कि मूल्य संबंधी जानकारी को किसानों द्वारा प्रभावी ढंग से उपयोग किया गया। उत्तर प्रदेश में कुछ किसानों ने मार्च–अप्रैल (वर्ष 2016) के दौरान आलू को भण्डारित कर जब उसे मई 2016 में बेचा तो उन्हें 30–40 प्रतिशत अधिक लाभ मिला। आलू के मूल्य में औसत वृद्धि 100–150 रुपये/क्विंटल हुई। इसी प्रकार, गुजरात में कपास की खेती करने वाले किसानों को मूल्य पूर्वानुमान सूचना से लाभ मिला। प्रारम्भ में कपास का औसत वास्तविक मूल्य 4,594 रुपये प्रति क्विंटल था, जोकि जूनागढ़ कृषि विश्वविद्यालय द्वारा किसानों को उपलब्ध कराये गये मूल्य पूर्वानुमानों के अनुसार बाद में बढ़कर 5040 रुपये प्रति क्विंटल हो गया। अध्ययन से पता चलता है कि प्रसारित पूर्वानुमान बुनियादी बाजार सुविधाओं एवं अन्य आवश्यक सुविधाओं के सहयोग से अधिक प्रभावी सिद्ध हो सकता है।

उत्तर प्रदेश (संकुल रूप में) के पहाड़ी एवं मैदानी भागों में आलू की कीमतों में संबंध पर किया गया अध्ययन दर्शाता है कि उपरोक्त क्षेत्रों के विभिन्न बाजारों में आलू के मूल्यों में घटने–बढ़नें की प्रवृत्ति साथ–साथ मिली और यह भी पाया गया कि आलू की अधिक कीमतों में काफी अन्तर था। आलू की कीमतें विभिन्न बाजारों में परस्पर समाकलित थी। हल्द्वानी बाजार का अन्य बाजारों के साथ एक सकारात्मक एवं मजबूत सह–संबंध देखने को मिला। आगरा बाजार को छोड़कर उत्तर भारत के अन्य बाजारों और हल्द्वानी के बीच एक द्वि–दिशात्मक करणीय संबंध पाया गया तथा देहरादून और अन्य बाजारों यथा दिल्ली, लखनऊ के बीच अल्पावधि में मूल्य अभिसरण (Price convergence) की स्थिति मिली।

कर्नाटक राज्य में ई–टेंडरिंग प्रणाली के अध्ययन में मिला कि ई–टेंडरिंग का बाजार मूल्य और आवक पर कोई सीधा प्रभाव नहीं था लेकिन कुल मिलाकर इसका कृषि बाजार में पारदर्शिता और प्रतिस्पर्धा सुधार की दिशा में उल्लेखनीय योगदान है। इसके अतिरिक्त, इससे उत्पादों के विपणन में लगने वाले समय में उल्लेखनीय रूप में

कमी आयी है। ई–गेट प्रवेश को अनिर्वाय बनाने से बाजार आवक की निगरानी की जा सकी जिसके परिणामस्वरूप बाजार की आमदनी बढ़ी। हालांकि, किसानों के बीच बाजार सुधार के बारे में जागरूकता का अभाव है जबकि आढ़तियों का मानना है कि ई–नैम (e-NAM) के प्रभावी होने से कृषि बाजारों में उनकी भूमिका खत्म हो जायेगी। व्यापारी खरीद से पहले उत्पाद की भौतिक रूप में जांच करना पंसद करते हैं और इसलिए वे आन–लाईन व्यापार प्रणाली, जिसमें उत्पादों की गुणवत्ता का निर्धारण कृषि जिंसो के ग्रेड विनिर्देशों के माध्यम से किया जाता है के बारे में संशय रखते है। कई व्यापारी, किसानों को आन–लाईन भुगतान करने के पक्ष में नहीं हैं साथ ही में किसानों की कृषि एवं गैर कृषि ऋणों के लिए व्यापारियों एवं आढ़तियों पर अधिक निर्भरता भी उन्हें स्थानीय बाजार के बिचौलियों को अपने उत्पाद बचने के लिए बाध्य करती है।

भारत में विभिन्न श्रेणी के परिवारों के बीच खाद्य उपभोग (Food intake) में अभिसरण (convergence) का विश्लेषण दर्शाता है कि उर्जा अन्तर्ग्रहण पर प्रतिव्यक्ति मासिक व्यय (MPCE) का सकारात्मक प्रभाव मिला। इसमें कोई भी विचलन खाद्य की पहुँच को प्रभावित करने वाले अनेक कारकों के कारण हो सकता है। अध्ययन में अमीर और गरीब परिवारों के बीच उर्जा अन्तर्ग्रहण के अभिसरण की भी पुष्टि होती है। अभी भी गरीब परिवारों में खाद्य उर्जा की खपत कम है। अध्ययन में सुझाया गया है कि गरीब परिवारों के पोषण स्तर में सुधार लाने के लिए लक्षित नीतियों एवं कार्यक्रमों पर बल दिया जाना चाहिए, जबकि अमीर परिवारों के बीच अल्प पोषण का मुकाबला करने के लिए प्रभावी पोषण रणनीतियों पर कार्य करने की आवश्यकता है। गरीब परिवारों में खाद्य एवं पोषण सुरक्षा में सुधार लाने के लिए उनके आय में पर्याप्त वृद्वि हेतु आकर्षक अवसर प्रदान किए जाने चाहिए।

भारत में मसालों की खपत के स्वरूप से पता चला कि औसतन प्रत्येक भारतीय एक वर्ष में 3.25 किग्रा. मसालों का उपभोग करता है जोकि कुल खाद्य व्यय का 4.40 प्रतिशत है। भारतीय परिवारों की खान–पान आदतों में अन्तर के कारण देश के विभिन्न भौगोलिक क्षेत्रों के बीच मसालों के खपत स्वरूप में अधिक अन्तर मिलता है। वर्ष 2011–12 के दौरान जहाँ पूर्वोत्तर क्षेत्र में कुल खाद्य व्यय में मसालों पर व्यय 3.21 प्रतिशत था वहीं दक्षिणी क्षेत्र में यह 5.34 प्रतिशत था। मात्रा के सन्दर्भ में, पूर्वोत्तर क्षेत्र में मसालों की खपत 2.15 किग्रा. थी, जबकि दक्षिणी क्षेत्र में यह 4.92 किग्रा. मिली। समय के साथ, भारतीय परिवारों द्वारा मिश्रित मसालों पर किया जाने वाला व्यय बढ़ रहा है। रेडी टू कुक, रेडी टू ईट तथा प्रसंस्कृत खाद्य उत्पादों के प्रति बढ़ती रूचि के साथ मिश्रित मसालों की महत्ता बढ़ी है। इससे मसाला क्षेत्र में प्रसंस्करण की बुनियादी सुविधाओं तथा सेवाओं में सुधार लाकर मूल्य वर्धित उत्पादों के लिए बढ़ रहे बाजार अवसरों का लाभ उठाया जा सकता है।

प्रक्षेत्र स्तरीय आकलनों से पता चला कि समय के साथ–साथ किसान तापमान एवं वर्षा में विचरण के संबंध में जलवायु परिवर्तन आधारित घटनाओं के प्रति जागरूक हो रहे हैं। जैसाकि किसानों द्वारा अनुभव किये गए जलवायु परिवर्तन के प्रमुख प्रभावों में यथाः वर्षा की मात्रा तथा वितरण में बदलाव, फसल उपज में कमी, भूजल में गिरावट, तथा न्यूनतम एवं अधिकतम तापमान में वृद्धि, आदि शामिल हैं। जलवायु परिवर्तन के प्रभावों का मुकाबला करने के लिए किसानों ने कम अवधि वाली फसल किस्मों, जल संरक्षण तकनीकों और फसल बीमा जैसी अनुकूल रणनीतियों का उपयोग किया तथा अकृषित गतिविधियों व रोजगार गारंटी योजनाओं में भागीदारी की। जलवायु परिवर्तन को अपनाने में किसानों द्वारा किए जाने वाले प्रयासों में अनेक प्रौद्योगिकी, सामाजिक–आर्थिक, एवं संस्थागत बाधाएं हैं। इनमें अनुकूलन की लागत – लाभ की सीमित जानकारी, अनुकूल प्रौद्योगिकियों तक पहुंच एवं जानकारी का अभाव; वित्तीय संसाधनों का अभाव और मौसम संबंधी सीमित जानकारी जैसी प्रमुख संस्थागत एवं प्रौद्योगिकी बाधाएं हैं। इसके अलावा, किसानों द्वारा जलवायु परिवर्तन के अनुकूल रणनीतियों को अपनाने हेतु अन्य बाधाओं में बाजारों तक पहुँच की कमी; अपर्याप्त खेतिहर मजदूर और सीमित प्रक्षेत्र आकार शामिल हैं।

पंजाब प्रांत में भूजल की टिकाऊ क्षमता बनाए रखने के लिए इष्टतम फसल योजना से पता चलता है कि यदि राज्य द्वारा 10 प्रतिशत तक अधिक जल निकासी को कम करने का लक्ष्य रखा जाता है तब खेती से मिलने वाले राजस्व में पुनः गिरावट आएगी। इसलिए, खेती से मिलने वाले राजस्व में बढ़ोतरी करने के साथ–साथ जल की बचत करने के प्रयोजन से, लेजर लेवलिंग, धान की पछेती किस्मों और सूक्ष्म–सिंचाई विधियों जैसे जल की बचत करने वाले बेहतर प्रौद्योगिकी एवं फार्म प्रबंधन

विकल्पों का उपयोग करने की सिफारिश की जाती है। पूर्व अध्ययनों में मिला है कि चावल के खेतों में लेजर लेवलिंग का प्रयोग करने पर प्रति मौसम प्रति हेक्टेयर 47–69 घंटों तक सिंचाई के समय में कमी आती है और पारम्परिक लेवल्ड खेतों की तुलना में लगभग 7 प्रतिशत अधिक उपज हुई।

पंजाब में फसल लाभप्रदता, फसलचक्र प्रणाली और भूजल उपयोग पर ऊर्जा सहायता (Subsidy) समाप्त करने के प्रभाव का अध्ययन दर्शाता है कि पंजाब में एक घन मीटर भूजल निकालने की लागत रुपये 0.91 थी जिसमें से किसान द्वारा रुपये 0.46 का वहन किया गया और शेष रुपये 0.45 सब्सिडी व्यय था। परिवर्तनीय लागत खर्च में बढ़ोतरी हुई है जिसके कारण सिंचाई जल के प्रयोग और निकासी के कारण धान, मक्का, गेहूँ, गन्ना और कपास से मिलने वाले शुद्ध लाभ में कमी आई है। विभिन्न फसलों में ऊर्जा सब्सिडी समाप्त करने के प्रभावों में भिन्नता देखने को मिली, लेकिन फसलों की लाभप्रदता की रैंकिंग विशेषकर धान की लाभप्रदता द्वारा मक्का फसल के साथ प्रतिस्पर्धा करने में कोई बदलाव की संभावना नहीं है। अध्ययन से यह अनुमान लगाया गया है कि ऊर्जा पर सब्सिडी समाप्त करने से पंजाब में वर्तमान फसलचक्र प्रणाली में धान की प्रधानता में कोई विशेष बदलाव आने की संभावना नहीं है, लेकिन इससे चावल में 3533 घन मीटर/हे.; गन्ना में 2749 घन मीटर/हे.; कपास में 1478 घन मीटर/हे.; मक्का में 1217 घन मीटर/हे; एवं गेहूं में 1200 घन मीटर/हे. तक वर्तमान भूजल प्रयोग में कमी लाने में मदद मिलेगी।

भारत में महाराष्ट्र सबसे बड़ा चीनी उत्पादक (36.5 प्रतिशत) राज्य है और यहां गन्ने की खेती के लिए कुल उपलब्ध जल का 60 प्रतिशत से भी अधिक का इस्तेमाल किया जाता है जबकि राज्य की कुल कृषि भूमि में गन्ना की खेती केवल 3 प्रतिशत क्षेत्रफल में की जाती है। इसलिए, भूजल स्तर की गिरावट में इसका विशेष योगदान है और अन्य फसलों पर इसके नकारात्मक प्रभावों की अनदेखी नहीं की जा सकती। अन्य फसलों की तुलना में गन्ना फसल का सुनिश्चित मूल्य और बेहतर लाभ मिलने के कारण सिंचाई जल का अधिक प्रयोग किया जाता है। सिंचाई जल प्रयोग में अक्षमता को कम करके और मशीनीकरण को बढ़ावा, तथा ड्रिप सिंचाई आदि सुविधाएं अपनाकर सिंचाई क्षमता में वृद्धि संभव है। सिंचाई क्षमता को बढ़ाने और जल के फालतू प्रयोग को कम करने में ड्रिप सिंचाई उपयुक्त माध्यम है। अन्य सहायी नीतियों के साथ, ड्रिप सिंचाई को अपनाकर सिंचाई जल प्रयोग में टिकाऊपन लाया जा सकता है।

पशुधन सेवाओं की समेकित उपलब्धता को बढ़ाने के लिए नवोन्मेषी संस्थाओं द्वारा किसानों की विभिन्न जरूरतों को पूरा करने हेतु मजबूत पशुधन सेवा आपूर्ति प्रणाली तथा निजी प्रैक्टिशनर्स की सहभागिता के महत्व को रेखांकित किया गया। नमूना सर्वेक्षण में निजी सेवा प्रदाता (70 प्रतिशत) एवं सरकारी संस्थानों की सेवा आपूर्ति को पसंद किया गया, क्योंकि किसान अपने पशु का उपचार उधारी पर कराते हैं और इनकी सेवाएं कम महँगी हैं। किसानों द्वारा अधिकांशतः अपने दुधारू पशुओं का उपचार कराया गया। आमतौर पर, निजी प्रैक्टिशनर तथा स्थानीय चिकित्सक की तुलना में सरकारी पशु अस्पताल की सेवा फीस महँगी थी। सरकारी पशु अस्पताल से प्रजनन संबंधी सेवाओं की खरीद, निजी प्रैक्टिशनर्स की अपेक्षा सस्ती थी।

पशुधन बीमा सेवाओं के सन्दर्भ में, किसी पशु का बीमा उसके शत्–प्रतिशत बाजार मूल्य तक किया जाता है और इसके लिए बीमित राशि पर 50 प्रतिशत तक सरकारी सहायता (Subsidy) मिलती है। सामान्य श्रेणी के किसानों के लिए कुल बीमित राशि का 4 प्रतिशत बीमा शुल्क देना पड़ता है जबकि लक्षित लाभार्थियों के लिए यह 2.25 प्रतिशत निर्धारित है। सरकार के अथक प्रयासों के बावजूद, पशुधन बीमा की प्रगति धीमी है। नमूना आधारित पारिवारिक आकड़ो से पता चलता है कि हरियाणा राज्य में केवल 8.4 प्रतिशत और राजस्थान प्रान्त में केवल 7.7 प्रतिशत पशुधन बीमा कवरेज में शामिल थे, और इनमें से केवल 8 प्रतिशत परिवारों ने अपने पशुधन बीमा का नवीनीकरण कराया। इसके अतिरिक्त लगभग 90 प्रतिशत लक्षित लाभार्थी बीमा सेवाओं को जारी रखने के इच्छुक नहीं हैं इससे देश में पशुधन बीमा पद्धति की कार्यप्रणाली के बारे में पता चलता है।

पिछले दशक के दौरान प्रारंभ की गई चावल–गेहूँ फसलचक्र प्रणाली में प्रौद्योगिकी के आर्थिक प्रभाव से पता चलता है कि नवीन तकनीकों में उन्नत फसल किस्में और संसाधन संरक्षण प्रमुख थे। गेहूँ तथा प्रचलित चावल किस्मों द्वारा तीन–चौथाई से भी अधिक लाभ मिला और उपभोक्ताओं को भी अधिक लाभ पहुंचा। लाभ की आंतरिक दर 38.80 प्रतिशत है और लागत तथा शुद्ध लाभ का अनुपात 17.31 है। इसके अलावा, ईंधन की बचत के

मामले में उत्पन्न पर्यावरणीय लाभों तथा घटी हुई जुताई से कम कार्बन उत्सर्जन, पादप अपशिष्ट का समावेश, पानी की बचत और अल्पावधि चावल किस्मों में संसाधनों की बचत आदि का उल्लेखनीय योगदान है।

कुल कारक उत्पादकता (TFP) में तकनीकी प्रगति का योगदान हरित क्रान्ति के प्रारंभिक वर्षों में आंशिक रूप से ऋणात्मक (–6 प्रतिशत) था लेकिन कृषि अनुसंधान और विकास में प्रगति के साथ–साथ यह धनात्मक हो गया और वर्ष 1981–1995 के दौरान इसकी भागीदारी 36 प्रतिशत थी, जोकि वर्षावधि 1996–2011 के दौरान बढ़कर 46 प्रतिशत हो गई। हालांकि, समग्र अध्ययन अवधि के दौरान तकनीकी प्रभावशीलता लगभग एक जैसी बनी रही। कुल कारक उत्पादकता वृद्धि तथा इसके संघटकों के अनुमानों से पता चला कि अर्ध–शुष्क शीतोष्ण क्षेत्र में कुल कारक उत्पादकता में अधिकतम वृद्धि हुई, जबकि इसके बाद क्रमशः आर्द्र क्षेत्र, अर्ध–शुष्क उष्णकटिबंधीय क्षेत्र तथा शुष्क क्षेत्र में हासिल हुई। साथ ही सभी क्षेत्रों में कुल कारक उत्पादकता एक उच्च प्रौद्योगिकी शीर्ष पर आगे बढ़ रही है। जैसाकि कुल कारक उत्पादकता में वृद्धि मुख्यतः तकनीकी प्रगति से उत्पन्न होती है, जोकि शुष्क क्षेत्र को छोड़कर अन्य क्षेत्रों में अनुकूल पथ प्रदर्शक साबित हुआ है।

अर्ध–शुष्क शीतोष्ण तथा आर्द्र क्षेत्रों में चावल तथा गेहूँ अथवा दोनों प्रधान फसलें हैं। भरपूर सिंचाई सुविधा के कारण इन फसलों को अर्ध–शुष्क शीतोष्ण क्षेत्र में अपनाया जाना संभव हुआ है जबकि अधिक वर्षा के कारण आर्द्र क्षेत्र में भी इन फसलों को अपनाया गया है। जैसाकि ये फसलें कृषि अनुसंधान एवं विकास का केन्द्र रहीं हैं, अर्ध–शुष्क शीतोष्ण और आर्द्र क्षेत्र में कुल कारक उत्पादकता में अधिक वृद्धि देखने को मिली। वहीं दूसरी ओर, शुष्क और अर्ध–शुष्क क्षेत्रों में जल संसाधनों की गंभीर कमी और संस्थागत जोखिम प्रबंधन क्रियाविधियों की अनुपस्थिति के कारण यहां के प्रायः किसान नई प्रौद्योगिकियां नहीं अपनाते। इसके अलावा, इस क्षेत्र में मोटे अनाजों, दलहनों तथा तिलहनों की प्रधानता मिलती है साथ ही इन क्षेत्रों में चावल तथा गेहूँ की भांति अन्य फसलों पर कृषि अनुसंधान एवं विकास में अधिक ध्यान नहीं दिया गया है। इससे भी इन क्षेत्रों में कुल कारक उत्पादकता वृद्धि कम हुई है।

ग्लोबल पेटेन्ट विश्लेषण और भारतीय आलू प्रसंस्करण उद्योग के भविष्य का अध्ययन दर्शाता है कि भारत व चीन जैसे विकासशील देशों ने आलू और इसके प्रसंस्कृत उत्पादों को प्रमुख खाद्य तथा पोषण सुरक्षा विकल्प के रूप मानना प्रारंभ कर दिया है। चीन ने विश्व स्तर पर आलू प्रसंस्करण उद्योग में भावी क्षेत्रों पर ध्यान रखते हुए किसी भी अन्य देश के मुकाबले कहीं अधिक पेटेन्ट दर्ज कराए हैं, जोकि भविष्य में आलू और इसके प्रसंस्कृत उत्पादों के व्यवसाय तथा खाद्य सुरक्षा में महत्वपूर्ण भूमिका निभाएगा। अध्ययन से यह सुझाव मिलता है कि भारत द्वारा अंतर्राष्ट्रीय संस्थानों के साथ अनुसंधान सहयोग को बढ़ावा देकर वैश्विक प्रतिस्पर्धा और अवसरों के लिए प्रयास किया जाना चाहिए।

भारत में डेयरी विकास के स्वरूप और इसके प्रभावी कारकों से पता चला कि गोजातीय पशुओं की उत्पादकता में वृद्धि तथा नर पशुओं की संख्या में कमी के साथ हासिल हुई है । किसान पशुसमूह प्रबंधन में कहीं अधिक सक्षम बन रहे हैं। निर्धन परिवार भी अपनी आजीविका के लिए गोजातीय पशुओं पर अधिक आश्रित हैं। पशु उत्पादों की लगातार बढ़ रही माँग के साथ इनके उत्पादन में तेजी बनाये रखने की आवश्यकता है क्योंकि आहार में विविधता और दूध तथा दूध से बने उत्पादों का उपभोग बढ़ रहा है। इसे तभी हासिल किया जा सकता है जबकि डेयरी पशुओं की उत्पादकता को बढ़ाया जाए। प्रक्षेत्र मशीनीकरण, फसल विविधीकरण, सतत् सिंचाई विकास और बाजार सम्पर्क में सुधार करने से छोटे किसानों को कहीं अधिक प्रभावी दूध उत्पादक बनने में मदद मिलती है। टिकाऊ रूप से बढ़ रही डेयरी अर्थव्यवस्था से न केवल परिवार के पोषण स्तर में सुधार आएगा वरन् इससे अति छोटी कृषिजोत वाले किसानों की आमदनी बढ़ाने में भी मदद मिलेगी।

पंजाब में दूध उत्पादन की परिवर्तनशील गत्यात्मकता तथा उत्पादकता पर गोवंश– नस्ल सुधार के प्रभाव का अध्ययन किया गया। अध्ययन में पता चला कि डेयरी गतिविधियों में विविधीकरण से वास्तविक मायनों में दुग्ध व्यवसाय की लाभप्रदता बढ़ी है। जोकि किसानों की आमदनी को बढ़ाने में पूरक है। आहार संयोजन के मामलों में किसानों का रूझान चारा फसलों से कम्पोजिट आहार की ओर बदल रहा है। दूध उपज पर गोवंश पशुओं की नस्ल के प्रभाव के निष्कर्षों से पता चलता है कि राष्ट्रीय स्तर पर नस्ल सुधार कार्यक्रमों के सकारात्मक परिणाम सामने आए हैं और इस बात पर भी बल दिया गया है कि किसानों द्वारा अच्छी नस्ल को अपनाने से दूध उत्पादन में वृद्धि होगी।

वर्षावधि में संस्थान द्वारा अनेक प्रशिक्षण कार्यक्रमों का आयोजन किया गया ताकि भारतीय कृषि अनुसंधान परिषद् के संस्थानों तथा राज्य कृषि विश्वविद्यालयों के वैज्ञानिकों और परियोजना कर्मचारियों के क्षमता विकास के उद्देश्य को हासिल किया जा सके। इसके अलावा, संस्थान द्व ारा भारतीय आर्थिक सेवा के अधिकारियों के लिए ''कृषि क्षेत्र में प्रमुख मुद्दे'' विषय पर एक सप्ताह अवधि के दो प्रशिक्षण कार्यक्रम आयोजित किए गए। इसके अतिरिक्त कई अन्य अल्पावधि परियोजनावार प्रशिक्षण कार्यक्रमों, पारस्परिक बैठकों, कार्यशालाओं आदि के आयोजन भी किये गये, जिससे परियोजना भागीदारों के क्षमता निर्माण में मदद मिली। वर्षावधि में संस्थान के प्रकाशन विशेष रूप में नीति संक्षेप (Policy Brief) तथा नीति पत्र (Policy Paper) सर्वाधिक अवलोकित किये गये तथा संस्थान के वैज्ञानिकों ने कई व्यवसायी एवं नीति विचार–विमर्श कार्यक्रमों एवं परियोजनाओं में सहभागिता की।

EXECUTIVE SUMMARY

The ICAR-National Institute of Agricultural Economics and Policy Research (NIAP) continued its efforts towards achieving excellence in agricultural economics and policy research in the country. The Institute serves as a policy think tank and provides Indian Council of Agricultural Research through credible evidence-based inputs for agricultural policy decisions. The Institute sensitizes policy planners and research managers about the emerging challenges, concerns related to farmers and farming and research impacts realized. Besides, the Institute also provides policy inputs to several other public sector bodies, departments, ministries and state governments.

The staff of the Institute comprised of 22 scientists, 17 other staff members and the research project staffs. The total expenditure of the Institute, including that from external sources was ₹ 939.59 lakh during the year 2016-17.

Research studies of topical importance were conducted under three broad themes, viz. Technology and Sustainable Development, Agricultural Growth and Development, and Markets, Trade and Institutions. Each theme is supervised by a senior faculty. Research programmes with and across themes are so designed as to achieve the mandate of the Institute. During the year under report, the Institute undertook 16 research projects and completed one consultancy project. The Institute has maintained linkages and collaborations with many institutions in India and abroad. The Institute organized number of workshops, trainings and policy advocacy programmes. The main research achievements of the Institute during 2016-17 are given below:

Doubling farmers' income in a short period of time is a challenging task and it will require identification of low incomes or disadvantaged regions and farmers in terms of access to technology, markets, credit, information and infrastructure. Approximately 80% of the low-income marginal farmers are located in the eastern region including Uttar Pradesh (58%), and western region (21%) have been lagging behind in agricultural and economic development on account of lack of investment, poor infrastructure and institutional support. The strategies available are raising cropping intensity, reducing inefficiency in production, and diversifying production portfolio towards high-value crops and animal production, and exploiting modern means of communication. Investment in agricultural research and reorientation of the development agenda taking into consideration the emerging challenges and opportunities in agriculture are also necessary.

For mainstreaming the climatic adaptation strategies, various developmental programmes of different ministries were studied for enhancing their effectiveness and targeting. Six broad thematic groups were suggested for existing development programmes and interventions, namely rural livelihood security, natural resource management, production augmentation and productivity enhancement, risk financing, food grain management and research and extension that are perceived to be critical domains for enhancing the resilience of agriculture. Pertinent to these broad thematic groups, the study identified twenty four ministries and 161 development programmes being operationalised during the year 2015-16. Further, these broad thematic groups were segregated into 24 sub-groups and 54

categories. This will help in assessment of convergence and enhancement of effectiveness and efficiency of the different programs at grass root level.

The pathways of influence of socio-economic and socio-personal attributes on agricultural performance across different agro-ecosystems in India suggested that the sustainable development of groundwater resources, particularly in the low productive eastern region, would go a long way in improving agricultural productivity in the country. Second, shift of excess labour from agriculture to non-farm sector would not only increase their income but will also improve agricultural productivity and accelerate rural transformation. Third, cost reducing technologies and awareness on resource saving will give better returns. Finally, the advisory services and availability of extension personnel will play most important role in rural development.

The study on agricultural wages in India has shown that the major factors that influenced agricultural wages were non-farm wage rate, time proxy of MGNREGS implementation, rural literacy rate, labour intensity, farm tractor use and expected crop yield. The launch of MGNREGS has increased the wage rate by 16 per cent over the pre-implementation period. The improvement in crop yield has also caused substantial increase in wages of farm labourers. The interaction between tractor and labour was found to be positively affecting the wage rate. This implies that farm mechanization and labour complemented each other in improving the marginal productivity and thereby increasing the agricultural wage rates.

The assessment of the formal and informal value chains for efficiency, inclusiveness and financing mechanisms found that significant penetration of the formal sector buyers (cooperatives, multinational and private domestic processors) in the dairy sector. Farmers with smaller livestock as well as land holdings are more associated with informal value chains like vendors and local consumers. Chain-based financing is limited to a small proportion of households, especially among those supplying milk to local traders and private domestic processors. Multinationals and cooperatives hardly provide credit support to farmers. Financing by commercial banks is also limited, and biased towards resource-rich farmers. Training of farmers in dairying, and creating awareness about the food safety standards improves farm performance.

The network project on market intelligence was carried out to enable the producers to make better-informed decisions and manage price risk by developing and disseminating reliable price forecasts for various agricultural commodities throughout the country. The impact assessment of this project reveals that price information was efficiently utilized by farmers. In Uttar Pradesh, few farmers stored potato during March-April and sold it in May in 2016, which led to about 30-40 per cent higher price realization. The average increase in price was estimated to be ₹ 100-150 per quintal. Similarly, cotton farmers in Gujarat benefitted from the price forecast information. The average price realization was ₹ 4,594 per quintal, which increased later on to ₹ 5,040 per quintal as per the price forecast provided to farmers. The farmers followed the price advisory and the incremental gain realized per farmer was ₹ 36,000. Besides, the study revealed that disseminated price forecast would be more effective with the support of market infrastructure and other logistics.

The analysis of potato price linkages in the Northern Hills and Plains showed that potato prices tend to move together across the markets, and high prices of potato were associated with high variability. Potato prices in different markets are co-integrated. Haldwani market showed a positive and strong correlation with

other markets. A bidirectional causality is observed among Haldwani and all the markets of Northern India, except Agra, and there exists the phenomenon of price convergence in the short run between Haldwani and all the markets, namely Delhi, Lucknow from the Plain region and Dehradun from the hilly region of Northern India.

A case study of e-tendering system in Karnataka indicated that e-tendering did not have a direct impact on market prices and arrivals, but contributed greatly towards improving the transparency and competition in agricultural markets. Besides, it significantly reduced the transaction time in marketing of produce. Mandatory e-gate entry enabled monitoring the market arrivals, resulting in increased market revenue. However, there is lack of awareness on market reforms among the farmers. Commission agents perceived that initiation of eNAM could eliminate their role in the APMC markets. Traders still have a preference for physically examining the produce before purchase and hence, were skeptical about online trading wherein product quality is determined through grade specifications of the agricultural commodities. Many of the traders were not in favour of online payment of amount to farmers. Heavy reliance of farmers on traders and commission agents for farm and non-farm credit needs makes them obliged to sell the produce to the local market intermediaries.

The analysis of convergence in dietary energy intake among different expenditure-classes of households in India has established that marginal effect of monthly per capita expenditure on calorie intake is positive and any deviation could be due to the net outcome of several other factors influencing access to food. Also, confirmed that there is convergence (catch-up effect) in calorie intake among rich and poor households classes. Yet, poor households have witnessed inadequate consumption energy. The study suggested that there should be targeted policy and programs to improve nutritional status of poor households, while effective nutrition communication strategies are necessary to address the undernourishment among rich households. Also providing attractive avenues for earning income would be desirable to improve food and nutritional security of poor households.

The consumption pattern of spices in India shows that on an average, Indian consumes 3.25 kg of spices in a year which constitutes 4.40 per cent share in total food expenditure. Due to varying food habits of Indian households, consumption pattern of spices varies significantly across geographical regions of the country. During 2011-12, the share of spices in total food expenditure varied from 3.21 per cent in the north-east region to 5.34 per cent in the southern region. In quantity terms, spices consumption varied from 2.15 kg in the north-east region to 4.92 kg in the southern region. Over the years, Indian households spending towards mixed spices have increased. The rising importance of mixed spices is consistent with peoples' inclination towards ready-to-cook, ready-to-eat and processed food products. This offers a scope to cash in on the rising market opportunities for the value added products by improving the processing infrastructure and services in spices sector.

Farmers are aware of climate change phenomenon in terms of temperature and rainfall deviations over the years. The farmers perceive change in the quantum and distribution of rainfall, decline in crop yield, ground water depletion and rise in minimum as well as maximum temperature was the major impacts of climate change. In order to cope with climate change, farmers used adaptation strategies such as use of crop varieties of shorter duration, water conservation techniques, crop insurance, non-farm activities and employment guarantee schemes. Farmers' attempts to adapt to the

changing climate are constrained by several technological, socio-economic and institutional barriers. The limited knowledge on the costs-benefits of adaptation, lack of knowledge of adaptation technologies, lack of financial resources and limited information on weather were the major institutional and technological barriers for adaptation.

The optimum crop plan for ground water sustainability in Punjab indicates that if the state decides to reduce excess water extraction by 10 per cent, farm revenue would further fall. Therefore, in order to improve farm revenue along with saving of water, it is recommended to use better technological and farm management options to save water like laser levelling, late varieties of paddy and micro irrigation methods. Literature shows that laser levelling in rice fields reduced irrigation time by 47-69 hours per hectare per season and improved yield by approximately 7 per cent compared with traditionally levelled fields.

The study on effect of energy de-subsidization on crop profitability, cropping pattern and groundwater use in Punjab revealed that on an average, extraction cost of a cubic meter groundwater in Punjab was ₹ 0.91, out of which, farmer incurred cost was ₹ 0.46 and remaining ₹ 0.45 was subsidy. The variable costs has increased which has reduced the net returns in paddy, maize, wheat, sugarcane and cotton, to the degree of irrigation water use and extraction. The effects of energy de-subsidization are found to vary across crops, but ranking of the profitability of crops, specifically, profitability of paddy to competing crops like maize is unlikely to change. The findings projects that withdrawal of energy subsidy is unlikely to bring substantial change in dominance of paddy in existing cropping pattern in Punjab, but leads to reduction in existing groundwater use by 3533 cum/ha in rice, 2749 cum/ha in sugarcane, 1478 cum/ha in cotton, 1217 cum/ha in maize, and 1200 cum/ha in wheat.

Maharashtra state is the largest sugar producer (36.5 %) and utilizes more than 60% of total available water for sugarcane cultivation that occupies only 3% of the total cropped area of the state. Hence, its contribution to declining water tables is serious. The overuse of irrigation water in sugarcane cultivation mainly attributed to assured price and better return compared to other crops. Increasing irrigation price, with or without intervention, has the tendency to minimize the inefficiency in the irrigation water use and promotes mechanization that includes drip irrigation and other facilities which increase the efficiency of irrigation. Drip irrigation has the drastic potential to increase irrigation efficiency and reduce water wastage. With other supporting polices, adoption of drip irrigation can bring sustainability in irrigation water use.

Institutional innovations for enhancing outreach and inclusiveness of livestock services underline importance of strong livestock service delivery system and increasing participation of private practitioner in meeting the various needs of livestock farmers. The sample respondents preferred service delivery from private service provider (70%) followed by government institutions mainly because the farmer treat the animal on credit basis and their service are less expensive. The farmers availed treatment mostly for milch animals. In general, the service fee of government dispensary was expensive than private practitioner and local healers. In the case of breeding services, government service charge was less expensive than private practitioners.

In case of livestock insurance services, an animal is insured up to 100 % of its market value and its premium is subsidized down to 50 %. The premium is 4 % of the sum insured for general public and 2.25 % for the targeted beneficiaries. In spite of the concerted efforts, progress in livestock insurance was slow. The sample households data show only 8.4 per cent in Haryana and 7.7 per cent in Rajasthan

had the livestock insurance coverage. Out of which, only 8 per cent of the households have reportedly renewed livestock insurance. About 90 per cent of the beneficiaries are not interested to continue the service which speaks volumes about the functioning of the livestock insurance delivery system in the country.

Economic impact of technology in the rice-wheat system introduced during the last decade indicates that the major interventions were improved crop varieties and conservation of resources. Wheat and common rice varieties have generated more than three-fourths of the benefits and much of the benefits benefited the consumers. The internal rate of return is 38.80 percent and the ratio of net benefits to the cost is 17.31. In addition, environmental benefits were generated in terms of saving of fuel and low carbon emission in zero-tillage, incorporation of plant residue in reduced tillage and water saving using zero-tillage and shorter duration of basmati rice varieties.

The contribution of technical progress to TFP was marginally negative (-6%) in the initial years of Green Revolution, but with advancement in agricultural research and development, it turned out to be positive, and its share improved to 36% during 1981-1995 and further to 46% during 1996-2011. Technical efficiency, however, remained almost stagnant throughout the study period. The estimates of TFP growth and its components revealed that semi-arid temperate zone realized the highest TFP growth followed by humid zone, semi-arid tropics zone and arid zone. Further, all the zones have kept on moving on a higher technological plateau. As TFP growth mainly derived from technical progress, TFP growth and technical progress exhibited smooth path except in arid zone.

The dominant crops in semi-arid temperate and humid regions are either rice and wheat, or both. The existence of high level of irrigation enabled adoption of these crops in semi-arid temperate zone. While high rainfall enabled adoption of these crops in the humid zone. As these crops have been at the centre of agricultural research and development, semi-arid temperate and humid experienced higher TFP growth. On the other hand, arid and semi-arid zones are acutely scarce in water resources, and in absence of institutional risk management mechanisms farmers are often averse to adopt new technologies. Moreover, the cropping pattern of these zones are dominated by coarse cereals, pulses and oilseeds, which have not received as much attention in agricultural research as did rice and wheat. That explains the reason for low TFP growth of these zones.

The study of global patents analysis and future of Indian potato processing industry has shown that developing countries like India and China have started considering potato and processed potato products as an important food and nutrition security option. China, has filed very large number of patents in this field than any other country. It indicates its focus on future dominance in the potato processing industry at the global level. In future, potato and its processed products would constitute very important part of business and food security in China. This study suggests that India should strengthen collaborative research with the institutions of international standing for global competitiveness.

The patterns and drivers of dairy development in India indicated that the dairy growth has been achieved with an increase in the productivity of the bovine herd and reduction in the number of male bovines. Farmers are becoming more efficient in herd management. The poorer households have higher dependence on bovines for their livelihoods. The production needs to keep pace with the rising demand as diets diversify and intake of milk and milk products increases. This can be achieved sustainably only if the productivity of dairy animals increases. Farm mechanization,

crop diversification, improved access to year-round irrigation and improvement in market linkages help smallholders to become more efficient milk producers. A more efficient and sustainably growing dairy economy would not only improve nutritional status of households, but also help in augmenting income of small farmers.

The study on changing dynamics of milk production and impact of cattle-breed improvement on milk yield in Punjab shows that increasing profitability of dairy enterprise in real terms, over the years, offers a great scope to supplement and improve the farmers' income. Regarding the composition of feed, farmers are shifting from fodder to composite feeds. The findings of the effect of cattle breed on milk yield reveal that breed improvement programmes at the nation level have positive outcome, and emphasize that adoption of improved breed by the farmers would further improve the milk production.

The Institute organised a number of training programmes to build capacity of scientists in ICAR institutions and state agricultural universities (SAUs). Besides, NIAP conducted two one week training programmes on "Core Issues in the Agricultural Sector" for the officers of Indian Economic Service. The several other short-term project-wise trainings, interaction meetings, workshops, etc. were also organized which helped in capacity building of the project partners. NIAP publications viz. Policy Briefs and Policy Papers were the most referred publications during the year. The scientists of the Institute were involved in a number of professional and policy interactions and projects. Important among these include: high level committees on doubling farmers income.

I PROFILE OF NIAP

The National Institute (earlier Centre) of Agricultural Economics and Policy Research (NIAP), established in 1991 by the Indian Council of Agricultural Research (ICAR), is committed to strengthen agricultural economics and policy research in the national agricultural research system (NARS) of the country. The Institute acts as a think tank of ICAR and helps the Council to actively participate in policy debates and decision making by providing evidence based policy inputs. It serves as the nodal agency of ICAR in interpreting research implications of changes at farm level and macroeconomic environment at the national and international levels.

Location

The Institute is located in the Pusa Campus in New Delhi. It has in its close vicinity several institutes of ICAR and CSIR like Indian Agricultural Research Institute (IARI), Indian Agricultural Statistics Research Institute (IASRI), National Physical Laboratory (NPL), National Institute of Science, Technology and Development Studies (NISTADS), and National Institute of Science, Communication and Information Resources (NISCAIR). The institute is very close to the National Agricultural Science Complex (NASC) which houses National Academy of Agricultural Sciences (NAAS), regional offices of nine Consultative Group on International Agricultural Research (CGIAR) Centers and offices of many professional societies. Thus, the Institute has the locational advantage in terms of multidisciplinary studies, inter-institutional interactions and research linkages, library facilities, etc.

Vision

'Leveraging innovations for attaining efficient, inclusive and eco-friendly agricultural growth through agricultural economics and policy research'

Mission

'To strengthen agricultural economics and policy research for providing economically-viable, socially-acceptable and environmentally-feasible policy options for science-led agricultural growth'.

Mandate

The mandate of the Institute is:

(1) Agricultural economics and policy research on markets, trade and institutions

(2) Growth and development models for sustainable agriculture

(3) Technology policy, evaluation and impact assessment

Research Activities

Research activities of NIAP are broadly covered under the following three major theme areas:

(1) Technology and Sustainable Development

(2) Agricultural Growth and Development

(3) Markets, Trade and Institutions

As a part of policy advocacy, the Institute organizes workshops and participates actively in policy debates and interactions where issues

of major policy interests are discussed by the policymakers, academicians and stakeholders etc. The Institute also organizes events where distinguished scholars and policymakers debate policy issues for developing a deeper understanding of various developments. Trainings and capacity building in frontier areas of agricultural economics and policy research are accorded high priorities by the Institute.

The Institute maintains close linkages with several national and international organizations involved in agricultural economics research, development and policy issues. Collaborative research projects, seminars, workshops, publications and participation in policymaking bodies are the usual modes of policy interface which help improve the outreach of the Institute. The Institute regularly brings out publications like Policy Paper, Policy Brief, Conference Proceedings, and Working Papers, besides publication of research articles in journals of national and international repute. These serve as the main agents for dissemination of its research findings. The Institute has succeeded in integrating social science research into agro-biological research, and through its credible policy research and communication has come to the expectation of its sponsors and stakeholders. Currently the Institute just completed implementing three mega network project (ICAR-SSN) in the areas of Market Intelligence, Regional Crop Planning and Impact Assessment of Agricultural R&D collaborating with various ICAR institutes and SAUs across the country.

Management

A high-powered Research Advisory Committee (RAC) comprising eminent professionals, mostly from outside the ICAR system, guides the Institute on its research activities. Prof. S. Mahendra Dev, Director and Vice Chancellor, Indira Gandhi Institute of Development Research (IGIDR), Mumbai, is the Chairman of present RAC. The RAC provides guidance to the Institute in planning research thrusts and strategies. Initiatives in human resource development, approaches towards improving policy dialogues and evaluation are some other areas in which Institute receives guidance from the RAC.

The functioning of the Institute is supervised by the Institute Management Committee (IMC) which is constituted and mandated by the ICAR. Besides, a number of internal committees and cells, including those mandated by the ICAR, are operating for an efficient and decentralized management of the Institute. The Joint Staff Council (JSC) promotes healthy interaction and congenial work environment at the Institute. Director conducts regular meetings with staff, mostly every month, to discuss problems and difficulties, if any, faced by the staff and to elicit their suggestions for the cordial functioning of the Institute. The organogram of the Institute is illustrated in Figure 1.

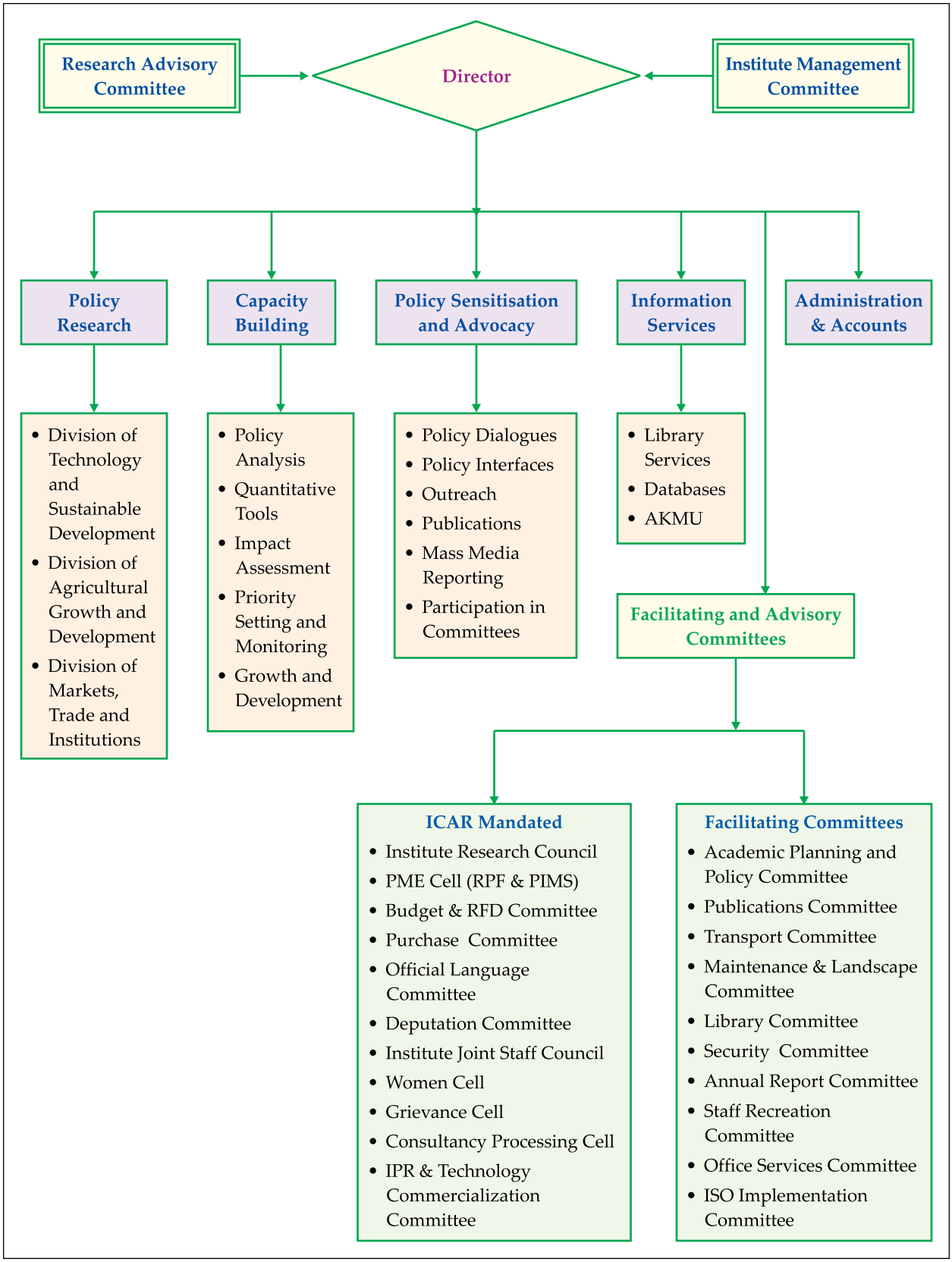


Figure 1 : Organogram of NIAP

NIAP Website

The Institute website (http://www.ncap.res. in) provides the updated information and activities, particularly about its staff, infrastructure, research projects, publications, employment, tenders, RTI information and linkages (Figure 2). The Institute's website is hosted through Education and Research Network (ERNET), New Delhi, and is updated on a regular basis. All the NIAP publications like Policy Papers, Policy Briefs, Working Papers, PME Notes, Workshop Proceedings, etc. are available on the website in the form of PDF files. The website is published both in English and Hindi.

Agricultural Knowledge Management Unit

AKMU at NIAP is delivering policy related research inputs, and providing other information through electronic and web mode. The goal of AKMU is to strengthen information management using modern technologies within NARS. The major objectives are:

1. To put information close to managers and scientists,
2. To build capacity to organize, store, retrieve and use the relevant information,
3. To share information over NARS using NIAP website,
4. To improve the capacity to plan, execute, monitor and evaluate research programmes, and-
5. To provide the technical assistance and instrumental support to the researchers on miniature basis.

To attain these objectives, the AKMU at NIAP is well equipped with latest computers, servers, firewall (Fort iGATE 80c), centralised antivirus server and analytical software like SPSS, STATA, LIMDEP, GIS, GAMS, Stella, Eviews and SAS For data management and in-house

Figure 2 : Homepage of NIAP website

software development, SQL server and Visual Studio facilities have been installed. NKN leased line of 100 mbps has been functional to enhance quality and timeliness of the research work. Each individual staff of the Institute has been provided with latest computer and software, LAN, email account, internet facilities and required computational facilities. A blade server has been purchased to enhance the centralized server capacity of the Institute. Microsoft Exchange emailing solution has been established for smooth communication system at the Institute.

This unit facilitates use of many MIS developed and used within ICAR like PERMISNET, PIMS, HYPM, MIS-FMS and many others as required by the council.

Figure 3 : AKMU at NIAP

MIS-FMS Implementation

MIS-FMS of ICAR has been initiated at the institute to enhance its efficiency and introduces best practices in the areas of Grants and Budgeting, Financial Management, Project Management, Procurement and Stores Management, Human Resource Management and Payroll. This system integrates internal and external management of information across the entire organization. ERP system facilitate the flow of information across all business functions (like Finance, Admin, Scientific, Technical) inside the boundaries of the organization and manage the connections to outside stakeholders (like suppliers, banks etc.). It provides a platform in a most effective way to perform each business process without losing the process integrity. Payroll and human resource management system are closely linked together and their utility can be optimized with an integrated approach. Payroll system has been successfully implemented on monthly basis at NIAP by Establishment and Personnel Section. The payroll system also takes care of handling of employee loans and advances, TDS Deductions, NPS, GPF and gratuity.

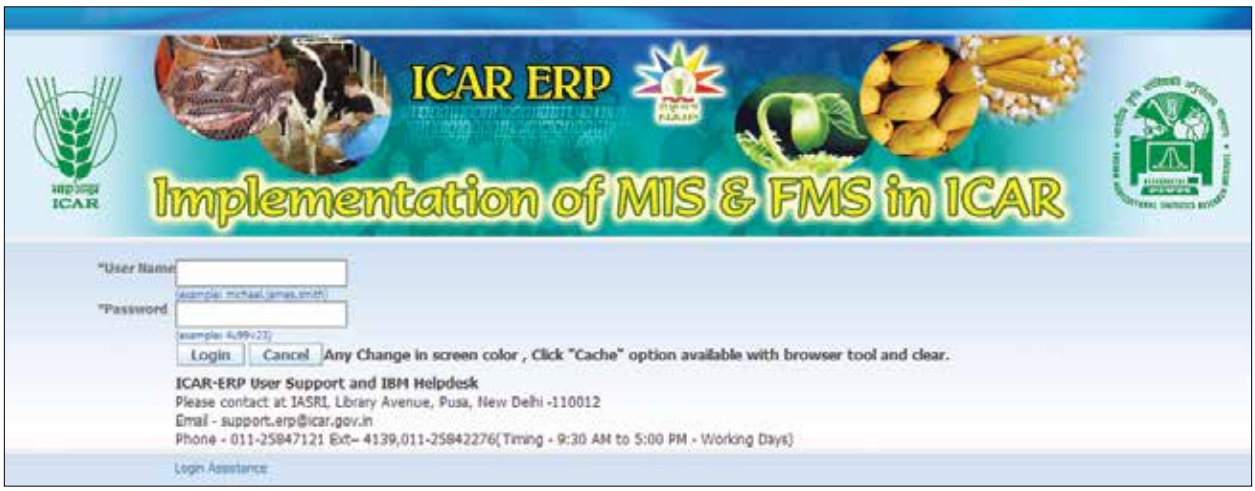


Figure 4 : ERP system implementation at NIAP

Core HRMS through ERP system helps in maintenance of service books of employees, employee promotion and pay fixation, employee transfer and deputation, employee leave management. Some information can be updated directly by employees through self-service HRMS. Grants and Budgeting Process has also been under progress.

Library

NIAP library provides reading materials to scientist, agricultural policy makers, students and other stakeholders in the NARS. It has a specialized collection of print, electronic, and digital resources. Presently, library subscribes Economic and Political Weekly (EPW) digital archives and database like EPW Research Foundation (India time series). Electronic database is made available through Institute network to the library users. Library is conducting innovative information literacy programme of J-Gate, Consortium for e-Resources in Agriculture for NIAP staff. This library housing a total of 6978 publications including books, journals, reports, bulletin, database publications, CD-ROM, SAARC publications and other reference materials, etc. The institute's library has subscription to 12 international and 17 national journals. Library has reserved a separate section for the books of official language (Hindi). The library has members viz, scientist, technical and administration staff. It also serves visitors every year.

During the period under report, the library procured publications, which includes 31 reference books, 25 official language books, 4 CD-ROM, 19 database publications. The library also acquired 84 gift publications. Library is playing active role in timely dissemination of scientific and technical information for research via Document Delivery Service (DDS), Current Awareness Service (CAS), newspaper clipping service, resource sharing activities in other sister Institute's libraries like IARI, IASRI, inter library loan (reference services) to scientific community from APAARI, ICRISAT, CIMMYT, IFPRI, ICARDA, IWMI, IRRI, ICRAF, FAO, World Bank, NABARD, PPVFRA, etc.

Exhibition and Record Room

The NIAP has created an exhibition cum record room to showcase the accomplishments of the Institute following the recommendations of the QRT. Accordingly, the record room showcases research and other achievements and activities, and displays all NIAP publications, annual report, and publications of individual scientist, recognitions and awards received by the Institute and by individual scientists. A photo gallery displays memories of all important events organized by the Institute.

II RESEARCH ACHIEVEMENTS

AGRICULTURAL GROWTH AND DEVELOPMENT

Enhancing Farmers' Incomes: Who to Target and How?

P.S. Birthal, D.S. Negi and D. Roy

The Government of India in its annual budget of 2016-17 set a policy target of doubling farmers' incomes by 2022, and this was reiterated in the budget of 2017-18 as well. This is indeed an important objective as agriculture, besides being of significant importance to the nation's food security, remains one of the principal sources of livelihood for more than half of the country's population and is critical to poverty reduction especially in rural areas where most poor live. The past experiences in agricultural and rural development, however, indicate that doubling farmers' income in such a short period can be a formidable task.

The target of doubling farmers' income would be difficult to accomplish unless it is known who within agricultural sector have low incomes and are disadvantaged in terms of access to technology, markets, credit, information and infrastructure. This study using household-level data from the nationally representative survey of farmers conducted in 2012-13 by the NSSO, attempt to identify who within agriculture constitute the poor or low-income farmers, and where are they located.

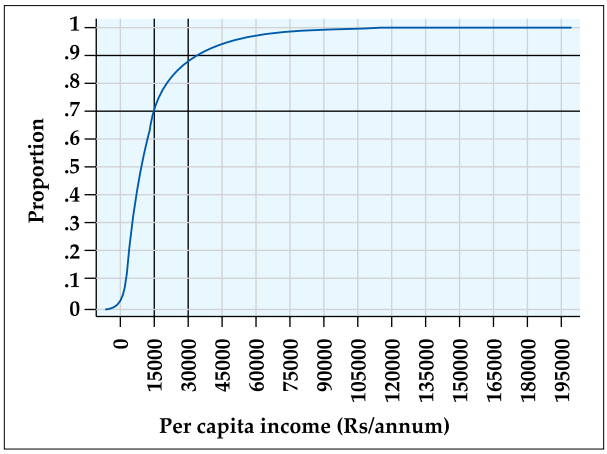


Figure 5 : Cumulative distribution of per capita income of farmers, 2012-13

Figure 5 shows significant disparities in income distribution among farmers. An overwhelming majority of farmers stays at the bottom of income distribution—about 70% of them earn per capita income less than Rupees 15,000 (which is about the same as the average per capita income of Rupees 14,470). For another 20% of the farmers it is in the range of Rupees 15,000 to 30,000, and only 10% of the farmers have per capita income more than Rupees 30,000.

Further, more than three-fourths of the farmers in the bottom income class (≤ 15,000 Rupees) are marginal farmers (≤ 1.0 ha), but 7% of them also fall in the top income class (>30,000 Rupees). The marginal farmers in high-income class have a more diversified income portfolio than their counterparts in low-income class. They cultivate their land more intensively and allocate larger area to high-value crops, and thus obtain significantly more income from cultivation. They are also more engaged in animal husbandry, non-farm business activities and wage and salaried employment. This is because of their better capabilities and greater access to technology, markets, credit, information and infrastructure.

Approximately 80% of the low-income marginal farmers are located in the eastern

region including Uttar Pradesh (58%) and western region (21%) that have been lagging behind in agricultural and economic development on account of a lack of investment in agricultural research and development, poor infrastructure and institutional support and lack of complementarities among these (Figure 6). Low-income farmers comprise around 80% of the total farm households in the eastern states, while in the western region, the share ranges from 51% in Gujarat to 78% in Chhattisgarh.

The findings of this study have important policy implications amidst the push to double farmers' incomes in a short period. The key message is that the marginal farmers, especially in the eastern and western states, should be at the forefront of income-enhancing strategy. The other important implications discussed below are generic in nature and can be modified suiting to the location-specific requirements.

Our net cropped area has stagnated, implying limited scope for income growth through area expansion. The optional strategies available are raising cropping intensity, reducing inefficiency in production, and diversifying production portfolio towards high-value crops and animal production. The expansion in agriculture needs to exploit the intensive margin a lot more, that can be done by improving farmers' access to reliable irrigation facilities and seeds of short-duration high-yielding crops/varieties, and mechanization of agricultural operations. Another important message that emerges is in terms of improving water- use efficiency through application of water-saving technologies such as sprinkler and drip irrigation systems, and other resource conservation technologies such as zero-tillage and laser-leveling.

Another valuable finding is related to augment farmers' access to various agricultural information despite most of the rural India being connected through mobiles. In fact, this means of communication has remained grossly under-exploited for dissemination of information on agricultural technologies, practices, weather advisories, programs and

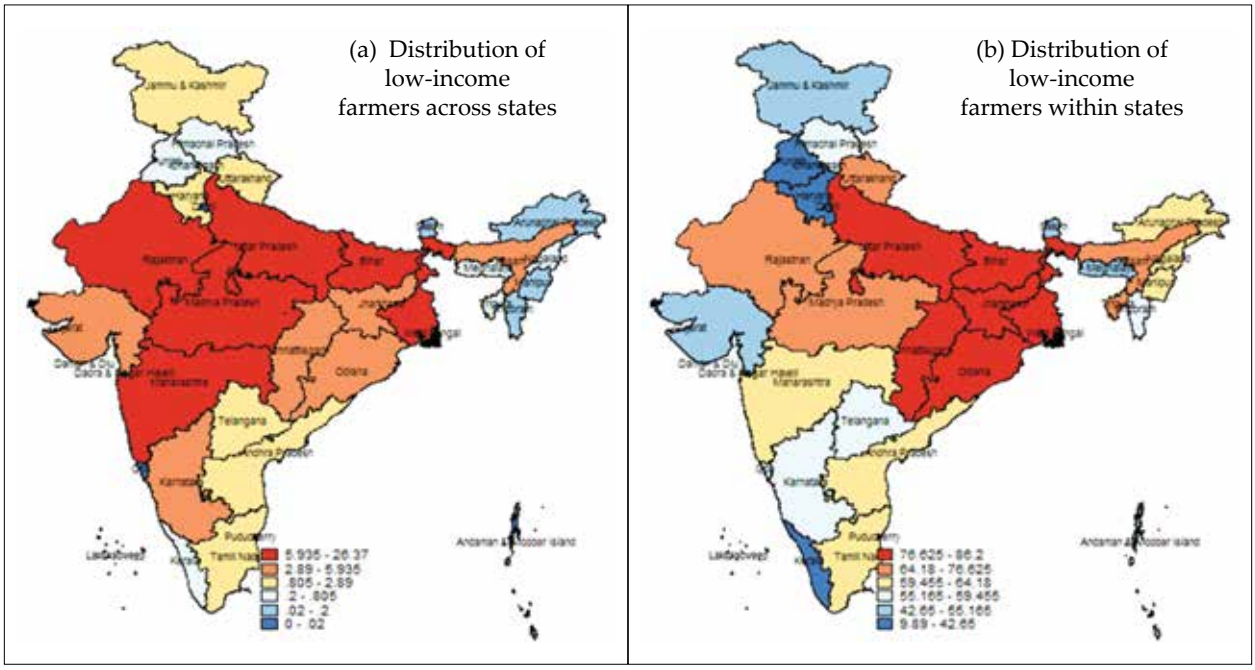


Figure 6 : Spatial distribution of low-income farm households (%), 2012-13

policies. In view of the limited outreach of the government extension system, the mobile and internet can serve an important vehicle for information dissemination. The need is to create a repository of agricultural information and link it with the modern communication networks. An important message that emerges is that if farmers' incomes have to be doubled or enhanced to a significant degree then the emphasis should be on diversification towards high value crops and animal production. In the long run, boost to farmers' incomes must come from technological breakthroughs that push yields towards the frontier, enhance resource-use efficiency, reduce cost of production and improve resilience of agriculture to climate change. This implies more investment in agricultural research, improvements in efficiency of research and reorientation of the research agenda taking into consideration the emerging challenges and opportunities in agriculture.

More importantly, doubling farmers' incomes would require lowering the load on agriculture and enhancing the role of the nonfarm sector. The profiling of high income farmers brings out the role of non-farm sector vividly. There is considerable scope for rural industrialization, as agriculture generates considerable surpluses to attract investment in local manufacturing of value-added products to respond to the local, regional and export demand. The expanding rural non-farm sector will also create opportunities for investment in ancillary industries related to inputs, equipment, machines and support services, and generate incomes for investment in farm production. Investment in human capital or skill development and value chains will be a key to rural industrialization. Finally, the findings also clearly show that farmers' incomes can be enhanced by improving complementarities among different types of infrastructures and institutions, and a lack of any of the critical infrastructure and/or institution may restrict farmers benefit from the investment in others.

The study concludes, doubling farmers' income in a shorter period is a challenge but the challenge is not insurmountable if the central and state governments follow a comprehensive, multi-pronged and targeted approach encompassing income opportunities and their enabling conditions such as research, infrastructure, institutions and human resources that are considered crucial for broad-based growth of agriculture and rural economy.

Patterns and Drivers of Dairy Development in India

Avinash Kishore, P. S. Birthal, P.K. Joshi, Tushaar Shahand Abhishek Saini

India's dairy economy has grown rapidly over the past four decades. The growth has been achieved with an increase in the productivity of bovine herd and reduction in the number of male bovines. Animals are being reared more for dairying than for the draught power. Farmers are becoming more efficient in herd management. This improvement in efficiency, in a land and fodder scarce country like India, is much needed for sustainable development of dairying.

An increasing share of this growing economy has been captured by the marginal and sub-marginal farmers. Though there has been a reversal in this trend in recent years, the marginal and near-landless or landless farmers have been benefited largely from the transformation of bovine economy from draught to dairying. This study finds that households who do not own any agricultural land, have higher herd efficiency (HER), i.e. they have the highest share of in-milk animals in their herds. If these trends persist, rapid dairy development could lead to more equitable distribution of farm income.

On the flip side, there are large inter-district variations in the levels of dairy development

(as measured by HER (ranging from 0.085 to 0.43) and the pace of change in the dairy economy. The eastern India continues to have a very small share of in-milk animals in their bovine herd and they lag behind the rest of India (Figure 7). Poverty is high in the eastern states and dairy development can make a notable contribution towards poverty reduction.

On the supply side, groundwater irrigation helps farmers to intensify land use and ensures year-round access to green fodder which is required to maintain an efficient herd with high proportion of in-milk animals at any point of time. Farm mechanization is another big contributor to increase in herd efficiency and development of dairy economy. It reduces the need for or dependence on draught animals and allows farmers to diversify towards dairying. Crop diversification away from cereals is also associated with increase in herd efficiency.

Bovines are an important major source of household income and nutrition. The poorer households tend to have even a higher dependence on bovines for their livelihoods. As diets diversify and intake of milk and milk products increases, the production needs to keep pace with the rising demand. This can be achieved sustainably only if the productivity of dairy animals increases. Farm mechanization, crop diversification, improved access to year-round irrigation and improvement in market linkages could help smallholders to become more efficient milk producers. A more efficient and sustainably growing dairy economy would not only improve nutritional status of households, but also help to bring a greater share of farm income to the farmers who own very small landholdings. The study emphasizes that policy should focus on increasing crop diversification and smallholders' access to irrigation, farm machines and markets.

Differential Gender Perception in Rural Farm Households Decisions

Usha Ahuja, Rajni Jain and Sonia Chauhan

The FAO reported that agriculture underperforms because half of all farmers—women—lack equal access to the resources and opportunities. Women continue to have limited access to productive resources and

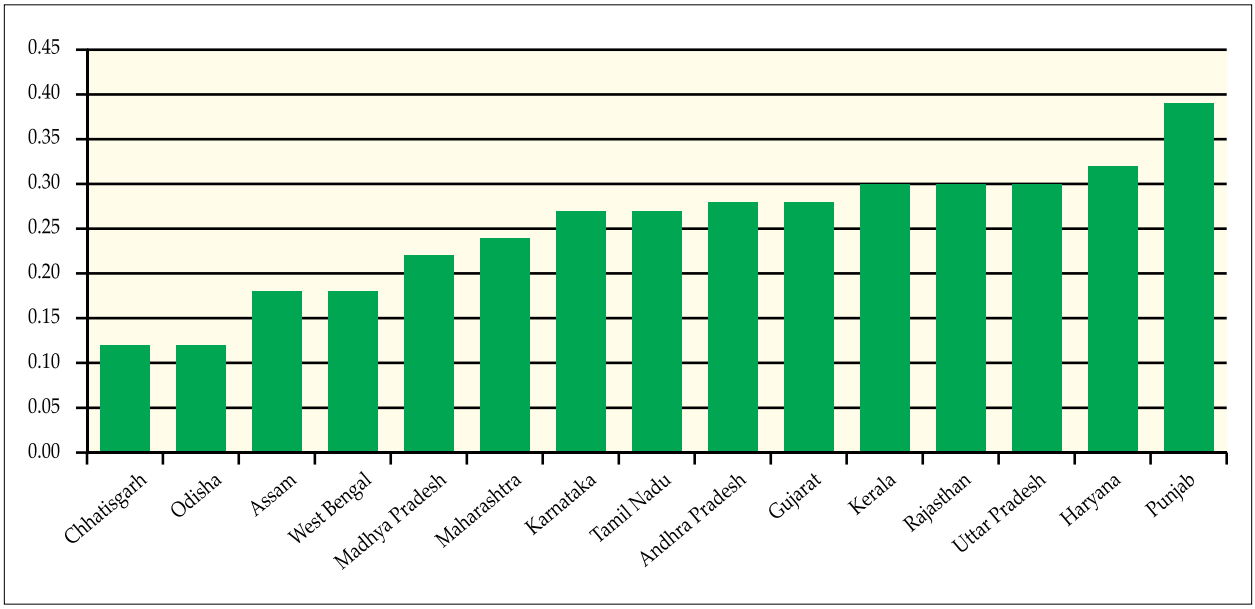


Figure 7 : Herd efficiency ratio in Indian states, 2007

services, markets and marketing facilities, the literature survey confirm. The recent studies indicate that disparity between male and female perceptions has bearing on gender differential role, specifically women's unequal role in decision making. This study was carried out to assess the extent of disparity in gender's perception of participation in various decisions, like status of access and control of assets, and family well being. Primary data were collected in six villages of three states (Bihar, Odisha and Jharkhand) of eastern India from the males and females of 480 farm families.

The results are presented in Table 1, taking female perception as referral point. Under the disparity column, positive numbers indicate over estimation and negative numbers indicate under estimation in decision making. In Bihar, perceived participation of male in all the aspects, is positive which imply that males participation according to their perception is more. However, females do not agree with it, means that males dominate in decision making by over estimating their participation and under estimating female participation in most of the crucial decisions. In Jharkhand, although the disparity of males perceived their participation is positive and male perceived females participation is negative, the magnitude is low which shows lower level of disagreement regarding the gender differential perception. In case of Odisha, the highest level of disparity with the same signs has been observed implying, thereby more male dominance and more subordination of females in all the fields of decision making.

Table 1 : Gender differential perception in decision making of assets and production resources (%)

	Male perception			Female perception			Disparity		
	M*	F#	B$	M	F	B	MM	FF	BB
Bihar									
Assets	37.2	19.8	43.0	31.9	21.4	46.7	5.3	-1.6	-3.8
Inputs	40.1	17.8	42.1	35.1	20.7	44.2	5.0	-2.8	-2.1
Labour	38.5	17.6	44.0	34.0	20.6	45.4	4.5	-3.0	-1.5
Output	35.4	18.4	46.2	30.4	21.0	48.6	4.9	-2.5	-2.4
Jharkhand									
Assets	54.9	2.8	42.4	54.7	2.8	42.5	0.2	-0.1	-0.1
Inputs	74.8	1.6	23.5	74.4	1.7	24.0	0.5	0.0	-0.4
Labour	43.6	1.4	55.0	39.6	4.3	56.2	4.1	-2.9	-1.2
Output	47.1	1.8	51.0	43.5	5.4	51.1	3.6	-3.6	0.0
Odisha									
Assets	50.5	6.2	43.3	39	8.6	52.4	11.5	-2.4	-9.2
Inputs	66.4	3.4	30.2	60.4	5	34.6	6	-1.6	-4.4
Labour	52.2	8.9	38.9	26.5	29.7	43.7	25.7	-20.8	-4.8
Output	43.7	7.4	48.9	27.7	8.5	63.8	16	-1	-14.9

* Male, # Female, $ Both

Trust and Trustworthiness in Rural Eastern India: Gender Perspective

Usha Ahuja, Rajni Jain and Sonia Chauhan

Trust and reciprocity are one of the core elements of economic decision making. It allows a society to invest more capital and conduct transactions with greater efficiency. Previous studies indicate that a gender difference has bearing on trust and trustworthiness of any individuals, and so on their decision making. In general, prevailing tendency in trust games is men trust more than women and women are more trustworthy than men. Keeping this in mind, mutual trusting and trustworthiness has been studied in the six villages of selected three states (Bihar, Odisha and Jharkhand) of eastern India. The experiment is based on a sequential prisoner's dilemma game or binary trust game following. The behaviour of male and female in four important aspects like agriculture, livestock, finance and domestic has been analysed to see the gender differential trust and trustworthiness for various decisions of the household.

The Trust Decisions: Descriptive results of the trust decision for, male vs. female are presented in Table 2. In case of Bihar, females are less trusting for all the activities barring agriculture, and the results are confirmatory with the results of earlier studies conducted on these lines. In case of Jharkhand, in agricultural and livestock activities, females are found more trusting than their counterparts. In financial and household activities females are less trusting, here it is worth to mention that in case of finance they are risk averters and regarding domestic activities , they are confident of themselves as girls are trained in household activities since childhood. In Odisha, the situation is entirely reverse where the females are trusting more as compared to male, which may be attributed to lack of confidence among them due to illiteracy and backwardness.

Table 2 : Extent of trust among male and female (%)

Aspects	Bihar		Jharkhand		Odisha	
	Male	Female	Male	Female	Male	Female
Finance	39.81	36.27	72.16	69.44	32.08	41.82
Agriculture	45.63	51.96	69.07	69.44	45.28	70.91
Livestock	55.34	47.06	70.10	74.07	42.45	59.09
Domestic	46.60	34.31	72.16	50.93	37.74	52.73

The Trustworthiness: In Bihar and Jharkhand, males are found to be more trustworthy than females and these findings contrast with the results from other trust games, which typically found women to be more trustworthy than men. Odisha females are found to be more trustworthy than males in all selected aspects, viz. finance, agriculture, livestock and domestic. These findings are pretty much in line with the literature on trust games in combination with gender issues

Table 3 : Extent of trustworthiness among male and female (%)

Aspects	Bihar		Jharkhand		Odisha	
	Male	Female	Male	Female	Male	Female
Finance	89.32	88.24	96.91	86.11	70.75	86.36
Agriculture	88.35	81.37	94.85	94.44	72.64	88.18
Livestock	85.44	83.33	96.91	91.67	69.81	88.18
Domestic	85.44	81.37	93.81	80.56	68.87	82.73

Determinants of Agricultural Wages in India

Sant Kumar, Md. Ejaz Anwer, H.P. Singh, Sarba N. Mishra, S.K. Sarkar, and T. K. Immaneuraj

In India, agricultural wages are one of the main sources of income for landless rural households. This is evident from the fact that about 42 per cent of casual labourers depended on wages in 2013-14 as compared to 39 per cent in 2009-10.

Labour scarcity and rise in agricultural wages have been widely discussed issues in the past few years, especially after 2007-08 with launch of the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS). As wage is a major component of cost of cultivation, substantial rise in wages may lead to increased cost of food production. During the decades of 2000s, payments to agricultural wages accounted for about 32 per cent of total cost of paddy cultivation, which increased to nearly 34 per cent after the years of 2010s.

The regression coefficients of factors like non-farm wage, MGNREGS, rural literacy, farm tractor and productivity (expected yield) were positive (Table 4). The regression coefficient of 'non-farm wage' was found to be significant and had a positive role in affecting wage rate. The elasticity coefficient implies that one per cent increase in non-farm wages had increased the agricultural wages by 0.74 per cent. The launch of MGNREGS in states has emerged as another major variable, which increased the wage rate by 16 per cent over the pre-implementation period. The coefficient of rural literacy suggests that improvement in education level (knowledge and skill) is related with increase in agricultural wages. The positive and significant coefficient of tractor-use is found to be another important variable related with increase in agricultural wages. The use of tractor enhances both crop and labour productivity, and so raises the expectations of increase in wages.

The supply of agricultural labour plays an vital role in determining the agricultural wages. The coefficient of labour supply (labour availability per ha net sown area) was found to be negative as expected. This explains the phenomenon of rising wage rate over increasing supply of labour is that high labour demand in 'non-farm' and MGNREGS activities have improved the bargaining power of farm labourers in receiving higher wages.

The positive coefficient of crop productivity (expected yield) denoted that improvement in crop yield was correlated with a substantial increase in wages of farm labourers. The significant positive coefficient of interaction effect (between farm tractor and agricultural labour) implied that farm mechanization and agricultural labour complemented each other in improving the marginal productivity and thereby increased the agricultural wage rates.

Table 4 : Determinants of agricultural wages with respect to specified variables

Explanatory variable	**Number of observation = 228 R-square = 0.872**	
	Coefficient	**Std. error**
Non-farm wages	0.7447***	0.0484
MGNREGS (After 2007 = 1, otherwise = 0)	0.1567***	0.0238
Rural literacy (%)	0.0077**	0.0036
Labour intensity	-0.0255	0.0824
Farm tractor availability	0.0557***	0.0167
Yield	0.2151*	0.1224
Interaction effect	0.053***	0.0185
Andhra Pradesh	-0.0511	0.4386
Assam	-0.0557	0.3745
Bihar	-0.1519*	0.3663
Haryana	-0.1093	0.4489
Karnataka	-0.2887*	0.4407
Madhya Pradesh	-0.2135**	0.3629
Odisha	-0.2788**	0.3796
Punjab	-0.2243	0.4767
Tamil Nadu	-0.3191*	0.4239
Uttar Pradesh	-0.2986**	0.4028
West Bengal	-0.0846	0.4006

Note: ***, **, and * denote significance at 1, 5 and 10 per cent levels of significance, respectively.

Tobacco Dilemma in India: A Synthesis

Naveen P. Singh, Usha R. Ahuja

The complex interplay between tobacco production and consumption translates into a major economic and public health challenge for India and the world, with specific population groups such as rural workers and communities being more vulnerable. Tobacco control has always been a complex subject in India as it is world's third largest producer, second largest consumer of tobacco products and it involves six ministries, namely Agriculture, Commerce, Finance, Industry, Labour and Rural Development. The study made an attempt to identify major economic and social factors affecting tobacco production and consumption, and to explore the economic implications of government policy measures for tobacco control. The review studied the trends of the tobacco production and its impact on Indian economy over the decades.

Additionally, the study attempted to review the scientific literature published between 1960 and 2016 on the economic and health impacts associated with tobacco cultivation and its control, with particular emphasis on the Indian context. On the whole, an integrated approach of tobacco control, incorporating region specific elements seems to have a bigger mileage in achieving the objective of controlling the tobacco epidemic. The supply side measures focusing on agricultural diversification may be considered as long term measures to supplement the demand side measures. It should also be emphasized that only the demand side measures within a country without global control of supply side, may not achieve the goal of tobacco control within a reasonable period of time. It is imperative that we need to understand the nuanced development pathways and evidence based policies for tobacco cultivation as well as to control the tobacco epidemic in India.

Pathways of Influence of Socio-economic Variables on Agricultural Performance

Naveen P. Singh, S.K. Srivastava, Balaji, S.J, Shirish Sharma and Swatantra Singh

In the context of wide regional disparities, it is essential to ensure agricultural growth in an inclusive manner to ensure food security of the country. In addition to weather parameters, this heterogeneity also roots from other factors such as access to technology, infrastructure, institutions and various underlying socio-economic factors determining the access to the above. The extent of technology adoption varies across regions and depends on several socio-economic, institutional, and household level factors. The dynamics of rural settings in India was studied by examining correlation between various demographic, socio-economic, and infrastructure development indicators at meso (district) level. The mean value of agricultural performance composite index in four quartile classes were 0.498, 0.623, 0.692 and 0.770 based on which sub-zones falling in each quartile class were named as 'most developed regions', 'highly developed regions', 'moderately developed regions' and 'least developed regions'. The poverty rate in 'most developed zone' was only 10 per cent as compared to 30 per cent in 'least developed zone'. The level of under-nourishment of 73 per cent in 'most developed zone' necessitates urgent attention to improve nutritional status of the households in the rural areas. The level of farmers' income and agricultural productivity was 31 per cent and 19 per cent higher in 'most developed zone' as compared to 'least developed zone', respectively.

The result shows that farmers' income (Figure 8) was found to be negatively correlated with the rural poverty with the estimated correlation coefficient of -0.288. This is expected because agriculture is the predominant and the least profitable economic activity in the rural areas.

Table 5 : Indicators of agricultural performance across agro-climatic sub-zones in India

Zones*	Farmer income (₹)	Agri. Productivity (₹/ha)	Crop intensity (%)	Irrigation coverage (%)	G Water develop-ment (%)	Fertilizer use (Kg/ha)	Marketed surplus (%)	Labour productivity (₹/person)
1	14702.0	73098.0	119.0	78.0	0.0	54.0	34.0	18372.0
2	11104.5	43225.7	127.0	34.0	69.5	90.2	60.0	68942.5
3	9601.0	30781.0	118.0	31.0	53.0	172.0	79.0	24949.0
4	7490.0	47764.5	149.2	66.2	72.0	133.0	53.7	30103.0
5	7320.0	66199.6	134.6	47.0	85.0	146.0	56.3	60477.6
6	7995.5	45751.0	133.7	23.2	65.5	153.2	74.2	33287.7
7	6641.6	53801.0	128.6	51.3	47.3	279.0	86.3	25642.3
8	7294.0	47527.6	114.0	48.3	62.6	198.6	79.0	19573.6
9	8834.5	75160.0	164.0	89.0	80.0	203.0	50.0	42390.5
10	5674.2	28504.0	139.2	36.5	60.5	77.5	55.0	21048.2
11	4602.0	27559.0	122.0	30.0	30.0	118.0	37.0	10440.0
12	4690.0	36796.3	152.6	43.6	57.0	94.3	35.6	13482.6
13	4086.0	55265.0	151.5	68.5	85.5	162.0	41.5	17962.0
14	8869.0	47892.4	163.8	44.4	39.6	113.6	40.4	17983.8
15	6698.2	52305.0	166.5	23.0	7.5	101.2	56.2	20244.2
16	6822.0	45948.3	156.0	16.0	27.6	94.0	52.0	29131.3
17	9199.5	33728.0	142.5	4.5	10.0	46.0	45.0	19537.5
18	5916.7	44689.5	134.7	56.7	33.2	168.7	74.7	19584.2
19	9405.0	47918.3	117.6	26.3	45.3	141.3	59.6	26883.3

*(1) Western Himalayas (2) Western Plain (3) Karnataka Plateau (4) Northern Plain and Central Highlands (5) Central Highlands-Gujarat Plain (6) Deccan Plateau-Hot Semi Arid region (7) Deccan Plateau and Eastern Ghats (8) Eastern Ghats and Tamil Nadu Uplands (9) Northern Plain Hot Subhumid region (10) Central Highlands-Malwa and Bundelkhand regions (11) Moderate and Gentle slopped region (12) Eastern Plateau (13) Eastern Plain (14) Western Himalayas (15) Assam and Bengal Plain (16) Eastern Himalayas (17) North Eastern Hills (18) Eastern Coastal Plain (19) Western Ghats and Coastal Plain

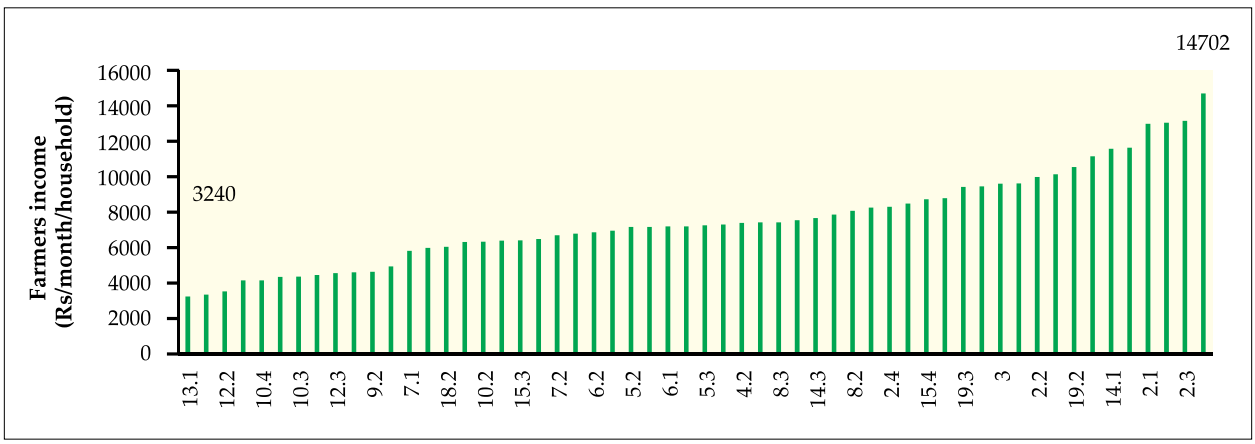


Figure 8 : Agro-climatic sub-zone wise monthly farmers' income in India

The correlation coefficient of agricultural productivity with farmers' income, rural poverty and under-nourishment were 0.402, -0.311 and -0.094, respectively. The results revealed that deviation in rainfall from normal level negatively affects agricultural productivity. A strong relationship between agricultural productivity and groundwater development is reflected through the positive and significant correlation coefficient of 0.435. Similarly, agricultural productivity can be improved by increasing fertilizer use. The average cropping intensity in the country is only 146 per cent which indicates that more than 50 per cent of the net sown area remains fallow in a year. The positive correlation coefficient between agricultural productivity and cropping intensity (0.435%) indicates a great scope to increase per hectare agricultural output by bringing fallow area under cultivation through improvement in agricultural infrastructure and availability of crop inputs.

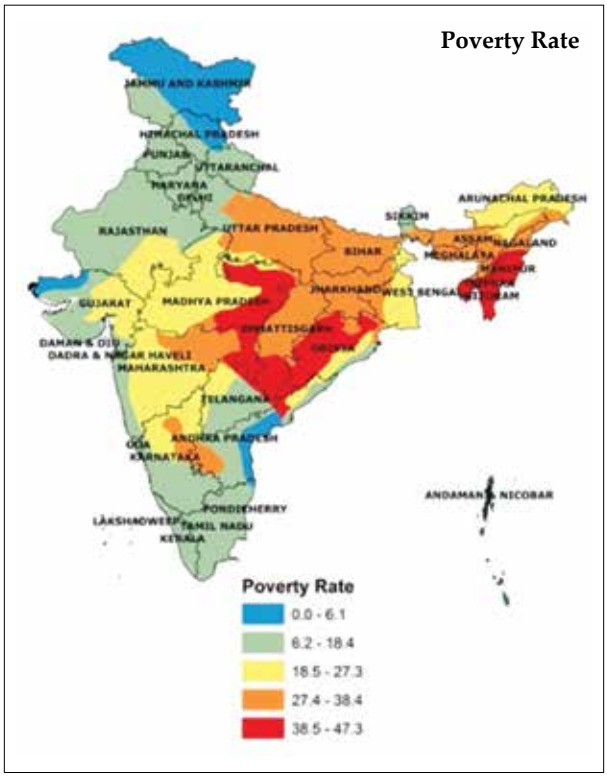


Figure 9 : Poverty rate (%)

Improvement in labour productivity would bring a significant increase in the land productivity as shown by a strong correlation coefficient of 0.741 between them. The agriculture sector in India is characterised with inefficient and unskilled labour and presence of disguised employment. The withdrawal of excess labour from agriculture towards non-farm sectors would not only increase their income but will also lead to improvement in agricultural productivity and acceleration in rural transformation in the country. The results show that population density; family size and higher proportion of disadvantaged class (SC/ST) in the society were positively correlated with poverty in rural areas. Rural poverty has strong positive correlation coefficient of 0.421 with under-nourishment. Similarly, inverse correlation between access to MGNRGES and under-nourishment suggests that supplementary income from MGNRGES leads to improvement in nutrition level, although correlation coefficient was found to be insignificant. The access to BPL/antyodaya card was found to be positively correlated with under-nourishment. This is expected because most of the under-nourished persons are those who have been given BPL/antyodaya card to provide them food at subsidized cost. Monthly farmers' income varied widely from Rs 3240 in sub-zone 13.1 to Rs.14702 in sub-zone 1.2 during the year 2012. The average estimated agricultural productivity (Rs/ha NSA) varied from Rs 12898 in sub-zone 14.3 to Rs 98851 in sub-zone 9.1. The results of primary survey indicate that despite of high yield and returns, higher cost wipe-out net incomes in Uttar Pradesh.

Cost reducing technologies and creating awareness on better resource saving options could help in this front. Irrigated ecosystem indicates need of higher credit, met out

Table 6 : Comparative farm-level economic benefits from selected crop production

Variable	Rajasthan	Uttar Pradesh
Total input cost (Rs)	11255	22557
Grain yield (qtl)	13.06	43.64
By product yield (qtl)	28.73	53.39
Grain Revenue (Rs)	17612	62626
By product revenue	8126	5339
Total returns (Rs)	25738	67966
Return over cost (Rs)	14483	45409
Return/cost (Rs)	2.28	2.01

mostly by commercial banks, among other sources. Amount of credit received seems to be correlated with input intensity in cultivation.

Despite the fact, poor net returns would in turn reduce the scope of repayment. Adoptions of modern and recent techniques were common in irrigated ecosystem, in converse to the arid ecosystem. The study showed that major constraints in the adoption (Figure 10) were less awareness of fertility-restoring, conservation and yield-raising technologies. Advisory services and availability of extension personnel were the second major constraints reported, followed by poor infrastructure and gender gap in the awareness.

Among several coping strategies to climate vulnerability, other than a shift towards rain-fed crops, reducing the number of irrigation, deepening existing wells and advancing or delaying in sowing were common in both arid and irrigated ecosystems. Some important policy messages have been drawn from this study. First, the sustainable development of groundwater resources, particularly in low productive eastern region would go a long way in improving agricultural productivity in the country. Similarly, agricultural productivity can be improved by increasing fertilizer use. Second, to withdrawal of excess labour from agriculture towards non-farm sectors would not only increase their income but also leads to improvement in agricultural productivity and acceleration in rural transformation in the country. Third, provide cost reducing technologies and creating awareness on better resource saving options to get better returns. Finally, the advisory services and availability of extension personnel play most important roles in rural development.

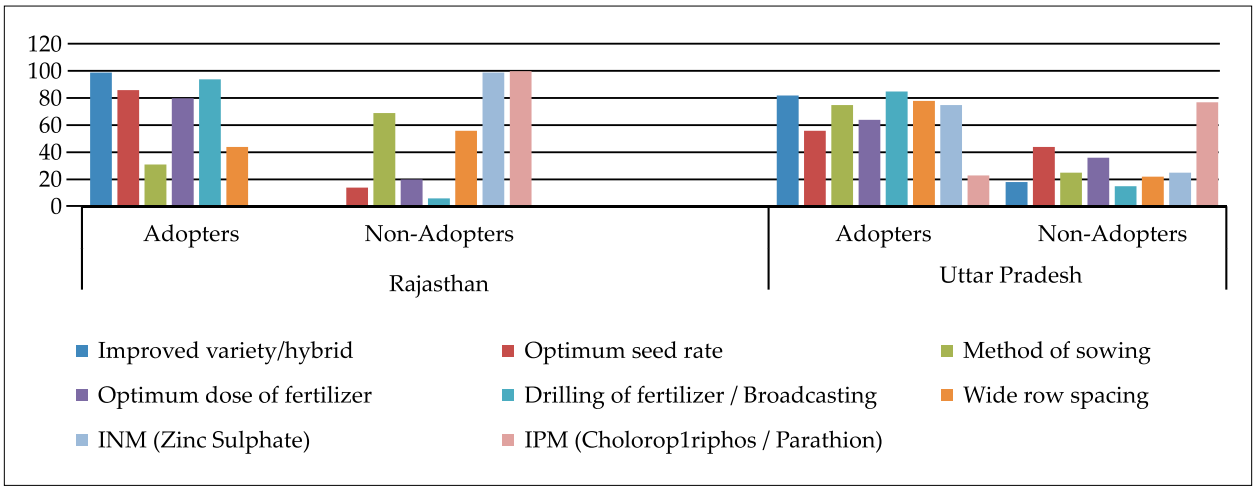


Figure 10 : Factors influencing technology adoption

Approach for Farmers' Income Estimation

Raka Saxena, S K Mukherjee and Suresh Pal

A number of attempts have been made in India to estimate the farm income; however, these attempts were largely based on the point information. Also, in some cases, the approach could not cover the sector as a whole due to paucity of data and aggregation issues. The doubling of farmers' income requires initial or benchmark set of estimates regarding the income which are to be doubled in a given time-frame.

Three approaches for estimation of farmers/ household income are given below:

(1) ***Estimating Net farm Income from Agriculture by deducting the paid-out labour cost, imputed value of family labour and rental value of land.***

This is equivalent to returns to family labour and fixed factors of production i.e. land. The net value added is computed by deducting the value of inputs such as seeds, organic manure, chemical fertilizers, current repairs & maintenance of fixed assets and other operational cost, feed of livestock, irrigation charges, market charges, electricity, pesticides & insecticides, diesel oil, financial intermediation services indirectly measured and consumption of fixed capital. It does not deduct the cost of paid-out human labour which is one of the important cost items. There can be three approaches to estimate the paid out labour cost.

a) Through Estimated Wage Bill: The wage bill can be computed by multiplying the wage earnings and days of wage employment by the number of hired human labour in agriculture. The income computed at current price can be converted into real terms by dividing with the suitable deflator like the consumer price index for agricultural labour (CPIAL) in the country.

b) Through Compensation of Employees: Another measure of paid out labour costs is the Compensation of Employee (CE) in agricultural sector and published in the National Accounts.

c) Using the Labour Share in disaggregated studies: Another approach which could be considered for estimating the paid out labour costs is to use the labour cost shares available in household level studies for various sub-sectors, namely crops, livestock and fisheries. Recently, NSSO has completed the Situation Assessment Survey of Agricultural households and also provides the data related to cost of cultivation of crops and livestock.

The paid out labour costs using various approaches seems justified when we simply want to analyse the gains to farmers over the paid out expenses. However, one needs to adjust these gains by deducting the opportunity cost of agricultural land i.e. the rental value of land in agriculture. For this, the aggregate land cost may be imputed and the farm income may be adjusted for this estimate. One option is to synthesize the rental value of land for various crops from CACP Reports. The average rental value may be worked out by taking the

weighted average of crop-wise rental values and the weights were crop area shares. The average rental value may be multiplied with the net sown area of the country to arrive at the aggregate land cost. This value may be deducted from the farm income computed earlier by adjusting for paid-out labour costs (using the wage bill).

(2) Computing the Total Household Income

As farmers derive a certain proportion of income from non-farm sources, it would be worthwhile to consider the non-farm income of agricultural households and thus, total household income (farm and non-farm) needs to be computed. In order to assess the gross farmer welfare, one needs to examine the income from farm as well as non-farm sources. Inclusion of non-farm income is important as this will be directly responsible for upscaling farmers' welfare. It is supposed to bring improvement in overall status of living and also should induce investment in farming at the same time. A recently conducted Situational Assessment Survey of NSSO provides the details of farmers' income from farm as well as non-farm sources. Using this, the ratio between total household income and income from farm sector may be computed. This ratio signifies the gains from non-farm sector. A ratio of 1.67 was derived between total household income and income from farm sector. This signifies that a household is able to earn 67 per cent more from non-farm sources over a base of 100 per cent income from farm sector. As the SAS provides single point information, the growth in GDP agriculture and GDP non-agriculture may be used to project it further. The income derived earlier by deducting the paid-out cost may be multiplied by this ratio to arrive at the total household's income. The nominal income needs to be converted to real income by using a suitable deflator. The gross real income may be divided by the number of cultivators, holdings and nets sown area to examine the changes happening at individual level.

MARKETS AND TRADE

Crowding-out Effects of Consumption of Tobacco and Alcohol

Jaya Jumrani and P.S. Birthal

Consumption of tobacco and alcohol is one of the foremost escapable causes of morbidity and mortality in the world. More than eight million people in the world die every year from harmful use of these goods – 5 million due to tobacco and 3.3 million due to alcohol. The threat is more alarming in the developing countries as India, where exist the prevalence of high rates of consumption of such goods, poverty and undernourishment, and lack financial resources to provide for the health and nutrition of their populations. Besides the apparent health risks associated with the consumption of tobacco and alcohol, there is another dimension of their consumption, that is, their crowding-out effects on the consumption of food and non-food commodities. In other words, consumption of addictive goods such as tobacco and alcohol can potentially reduce a household's spending on food and non-food commodities.

In India, consumption of tobacco and alcohol is reported by at least one of the household members in more than 50% and 19% of the households, respectively. On an average, on these goods, 2.1% and 4.5% household

budgets are spent (Table 7). The study results indicate that expenditure on tobacco and alcohol crowds out food items. But, the effect is not as pronounced as for the non-food items (Figure 11). In the case of tobacco spending the consumer durables are most traded-off, followed by food grains, healthcare and education. Food grains are traded-off more among the poor households.

Across social groups, findings reveal that tobacco consumption leads to a reallocation of budgets with consumer durables being most displaced, followed by foodgrains and healthcare. Similarly, in case of alcohol consumption the crowding out is observed for foodgrains, fuel and light, consumer durables and education, but more for consumer durables in the households at the bottom of social hierarchy. On the whole, the crowding effects of tobacco are stronger than of alcohol and in the households at the lower rungs of both the income and social pecking order.

Table 7 : Tobacco and alcohol consumption behaviour in rural India (%)

Item	Income class				Caste			
	Low income	Middle income	High income	Sched-uled tribes	Sched-uled castes	Other back-ward classes	Others	All
Households	30.0	40.0	30.0	11.4	21.2	44.2	23.2	100.0
Households reporting tobacco consumption	57.0	60.0	55.3	71.1	60.5	54.4	51.1	57.4
Households reporting alcohol consumption	18.0	19.9	20.7	37.5	21.9	16.8	12.0	19.9
Expenditure share of tobacco	2.7	2.3	1.8	2.4	2.3	2.0	1.8	2.1
Expenditure share of alcohol	5.1	4.6	4.2	4.0	5.2	4.5	4.0	4.5

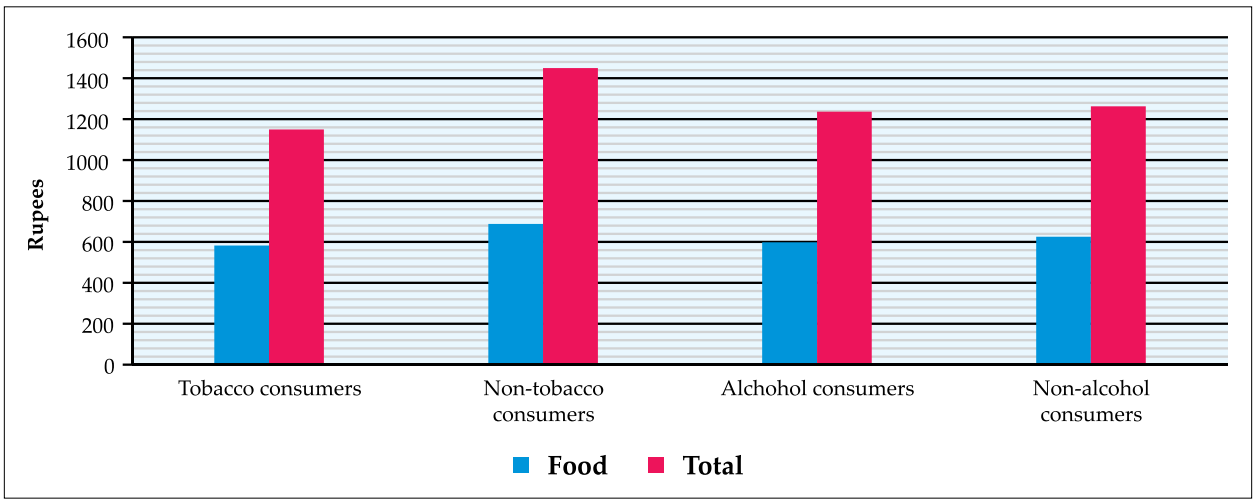


Figure 11 : Per capita monthly food and total expenditure

Efficiency, Inclusiveness and Financing of Dairy Value Chain

P. S. Birthal, R. Chand, P. K. Joshi, R. Saxena, P. Rajkhowa, Md. Tajuddin Khan, Mohd. Arshad Khan and K. R. Chaudhary

India's dairy sector has witnessed an impressive demand-led growth over the past four decades. The sector is dominated by small-scale producers who often lack access to markets and finances. Using a unique data of 612 dairy households from the state of Punjab, this study compares the formal and informal value chain for their efficiency, inclusiveness and financing mechanisms at their upstream. The study finds significant penetration of the formal sector buyers in the dairy sector with 62 per cent of the farmers representing 69 per cent of the sales supplying milk to cooperatives, multinationals and private domestic processors. Farmers with smaller livestock as well as land holdings are more associated with informal value chains (vendors and local consumers) although they are not excluded from formal value chains.

Farmers supplying milk to dairy cooperatives are more efficient. Compared to others, they realize significantly higher profit per unit of output despite no significant difference in the milk yield. There is a positive but insignificant effect of herd size on productivity, but it is significantly higher for those operating large landholdings due to presence of positive spill-overs of land size on dairy production *via* availability of feeds and fodders. The impact of herd size on profits is positive and significant, but these do not vary significantly across land classes. An important finding is that farmers' training in dairying, and awareness about the food safety standards improves farm performance.

Chain-based financing is limited to a small proportion of households especially among those supplying milk to local traders and private domestic processors. Multinationals and cooperatives hardly provide credit support to farmers. Financing by commercial banks is also limited, and biased towards resource-rich farmers. Smallholders, who have limited collateral for obtaining institutional loans depend more on informal sources for their credit requirements.

The findings of this study have direct implications for agribusiness firms as well as financial institutions. The agribusiness firms should not expand their back-end activities in terms of provision of quality inputs and services to farmers so as to improve their farm performance. Improving farmers' skills in dairy management and food safety issues are also important for improving farm performance and to address consumer concerns of safe and quality products that are being triggered by India's strong trends in income growth and urbanization. Further, they should consider supporting farmers in meeting their dairy related financial requirement considering the contract as collateral. Likewise, they may induce financial institutions to lend them against contracts. This will reduce their transaction costs and lending risks. There is also a considerable scope for financial institutions to improve their outreach directly without intermediation through value chains. Presently, commercial banks advance credit to dairying as investment credit primarily for the purchase of animals, construction of cattle-sheds, etc. An animal is a reproducible asset that can be easily multiplied by farmers to scale up their dairying business, but they are constrained by operational capital. Financial institutions must provide credit to meeting operational expenses so as to enable them to adopt yield-enhancing technologies and inputs.

Price Forecasting and Market Intelligence

Raka Saxena, Naveen P Singh, Pavithra S, Ranjit K Paul, Deepika Joshi, Md Ejaz Anwer, Rohit Kumar, Mohit Singh, Anupriya Mishra and Rani Vibhushita

High price volatility in agricultural commodities and increased risk faced by the farming community necessitate the study of agricultural commodity prices and their behaviour to understand the causes and providing the real time information to the stakeholders. The Network project on Market Intelligence was carried out to provide reliable and timely price forecasts to farmers for more than 40 major agricultural commodities through a network of 14 institutions throughout the country. Price forecasts for agricultural commodities were developed using scientific analysis to allow producers to make better-informed decisions and manage price risk. More than 180 pre-sowing and 263 pre-harvest price forecast have been disseminated through various means like personal contacts, SMS, television, radio, university websites, pamphlets, Facebook, WhatsApp and YouTube etc. to the farmers before sowing and during harvests to facilitate informed and intelligent decisions by the farmers.

To provide the precision information to the farmers, it is essential that that forecast prices turn out to be closest to the actual market prices. Forecast accuracy, estimated as the mean absolute percentage error (MAPE), is given in Table 8. It indicates the degree of closeness of the forecasts to the actual market prices and reflects the quality of forecasts. Through

Table 8: Forecast Accuracy (MAPE)

Subsectors/Commodities	2013/14	2014/15	2015/16	2016/17	Overall
Pre-harvest	9.35	11.02	11.90	11.83	11.54
Cereals	2.00	9.70	6.30	15.63	9.71
Dry Fruits	-	16.78	8.91	9.30	11.50
Fibre	-	2.45	10.69	11.15	7.58
Fruits	-	7.81	15.66	12.45	13.94
Oilseeds	3.90	4.50	5.13	2.84	4.38
Plantation crops	-	11.86	9.94	4.22	9.72
Pulses	8.43	6.00	8.31	5.75	7.01
Spices	17.76	8.24	8.70	4.29	7.79
Vegetables	11.90	16.79	12.38	18.79	14.82
Pre-sowing	**19.52**	**17.89**	**15.15**	**18.80**	**17.30**
Cereals	11.76	7.47	7.42	26.51	14.12
Fibre	-	18.69	9.12	10.90	14.08
Oilseeds	5.36	19.01	10.99	11.19	14.02
Pulses	11.85	19.29	24.75	22.25	19.94
Spices	17.00	6.52	9.98	6.76	9.06
Vegetables	43.22	25.40	17.79	15.74	21.39

innovations in methodological approaches followed, we could attain greater precision in forecasts overtime; however, certain categories like horticulture and pulses remained volatile. Potato and onion are extremely sensitive crops in terms of the impact of all external influences to the prices. The pre-harvest forecasts, due to obvious reasons, were more precise than pre-sowing harvests.

It was also tried to examine the impact of price forecasts on the stakeholders. As hypothesized, the farmers change the marketing pattern as per the price forecasts provided to them, farmers store the commodities and sell when the prices are high as per the price forecast information. For illustration, the forecasts by BHU (Varanasi) Centre revealed that the prices for potato crop were expected to be low during March and high during May 2016 in Uttar Pradesh. This information was efficiently utilized by few farmers; they stored the crop during March-April and sold it in May which led to realization of 30-40 per cent higher price by them. The average increase in income per qtl of farmer was estimated to be Rs. 100-150 per quintal. Similar results were reported from Bengal gram farmers but the changes in marketing pattern on the basis of price forecast were observed only in less perishable commodities. The income of farmers was increased by storing the produce for few months in case of potato, mustard and Bengal gram. The storage cost was covered by increase in prices. Similarly in case of Gujarat, the cotton farmers benefitted from the price forecast information. The average price realized by the Gujarat cotton farmers was Rs. 4,594 per quintal, which increased later on to Rs. 5,040 per quintal as per the price forecast provided to farmers by JAU (Junagadh) Centre. The farmers followed the price advisory and the incremental gain realized per farmer was Rs. 36,000.

Besides these, the project entails the regional studies also which helped in understanding the price movements, linkages between marketing infrastructure and price behaviour, impact on farmers' decision making etc. Market intelligence efforts are extremely important and need to be institutionalized over time. There is a need to develop a sound market intelligence system in the country with wide coverage in terms of regionally important commodities. Timely, adequately and reliable forecast disseminated to farmers will be more effective if supported by market infrastructure and other logistics.

Potato Price Linkages in Northern Hill and Plain Markets of India

Raka Saxena, Naveen P. Singh, Ranjit K Paul, Pavithra S, Deepika Joshi, Rohit Kumar and Md Ejaz Anwer

Potato has been historically the most important vegetable crop and comprised of approximately 21 per cent share in value of output (VOP) of vegetables in 2014-15 at 2004-05 prices. Variations in prices of agricultural commodities, especially of horticultural commodities are becoming much more frequent and severe. Potato crop also exhibits temporal and spatial variations in prices which have become increasingly evident phenomena in the current regime. Considering this few important potato markets in northern hill and plain region were selected; Haldwani and Dehradun were selected from hill region, Agra and Lucknow from plains and Delhi as the major consuming market in northern India. We studied the price movements, arrival pattern and cointegration among the selected hills and plains markets. It has been observed that high prices in potato have been associated with high variability. Strong and positive association has been noticed among the potato prices in selected markets, which indicates that prices tend to move together across the markets.

Haldwani market showed a positive and strong correlation with other markets. It was observed that potato prices are co-integrated in the hill and plain regions of northern India. A bidirectional causality is observed among Haldwani and all the markets of northern India except Agra and there exists the phenomenon of price convergence between Haldwani and all the markets in the short run with markets mainly Delhi, Lucknow from plain region and Dehradun from hill region of northern India (Table 9). The analysis of variance decomposition in prices revealed that fluctuations in Lucknow market were highly affected only due to price movements in Agra market in both short and long term but on other side it is observed that prices in Agra, Dehradun and Haldwani markets were fluctuating majorly by their own shock.

Sustainable Onion Export Policy

Raka Saxena and Deepika Joshi

A disquiet feature of the exports from India is much higher volatility as compared to the global exports. The volatility in Indian exports may be attributed to the domestic supply instability along with the policy uncertainty regarding the Indian onion exports.

Survey of onion Market

Figure 12 presents the changes in onion exports following the changes in onion production. Onion production has witnessed tremendous growth during the recent years; the production grew at rate of 12.44 from 2000-01 to 2014-15. Onion exports also exhibited impressive growth during the said period (CAGR, 9.72). Further, the growth in onion export has been lower than the growth in production despite spectacular growth in production. Since 2000-01, share of export in domestic production was lowest in year 2014-15 despite reasonable level of production. Even when onion recorded bumper production in year 2013-14, the exports

Table 9 : Granger-Causality between Hill and Plain markets

Null Hypothesis:	lag	F-Statistic	Probability
Haldwani does not granger cause Dehradun	2	5.950	0.004
Dehradun does not granger cause Haldwani	2	6.152	0.003
Haldwani does not granger cause Delhi	2	4.499	0.013
Delhi does not granger cause Haldwani	2	9.682	0.000
Haldwani does not granger cause Agra	2	1.748	0.179
Agra does not granger cause Haldwani	2	6.451	0.002
Lucknow does not granger cause Haldwani	2	8.631	0.000
Haldwani does not granger cause Lucknow	2	5.950	0.004

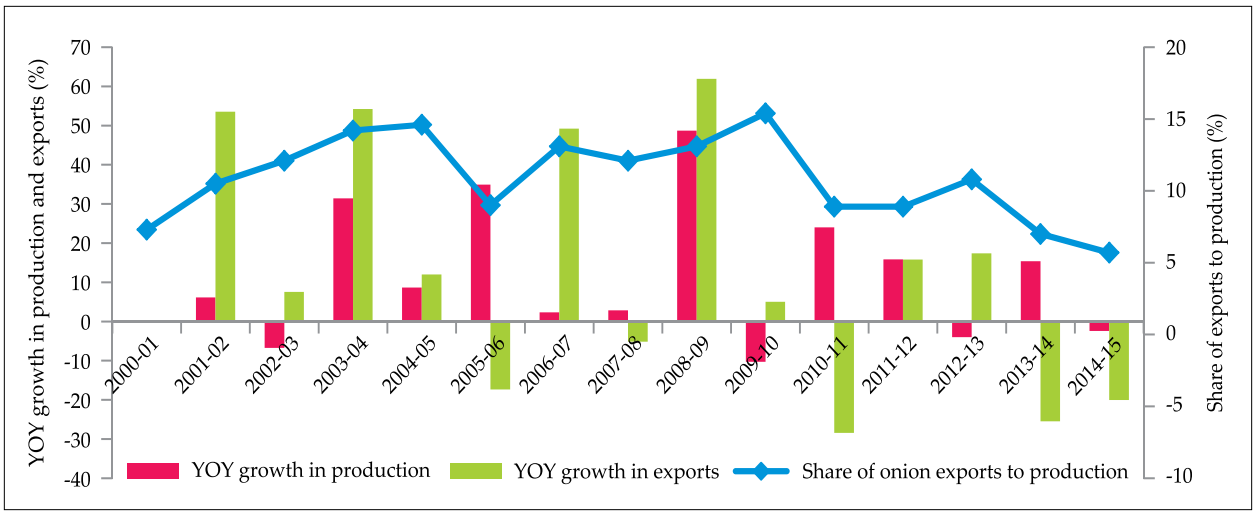


Figure 12 : Trends in onion production and exports

remained low. In general, a positive increase in production leads to a positive change in exports, however, certain deviations are also observed in this due to changes in associated parameters.

The major policy instrument to regulate onion export and stabilise domestic market is minimum export price (MEP). A higher value of MEP is supposed to reduce the exports and vice versa. The other policy instrument is physical restriction on exports through banning the exports or canalising (routing) the exports through state trading enterprises. The motive behind such policies remains the stabilisation of domestic supply of onion and to keep check on domestic prices turning too high. Though the major objective of onion export policy is domestic stabilization, it seems to be inconsistent considering the trade objectives. In India, 38 notifications regarding onion export policy have been issued by Directorate General of Foreign Trade during the last five years. Surprisingly, fifty per cent of these were issued in just one year i.e. 2011. During the same year, onion exports were banned twice. Some varieties of onion like Bangalore rose onion and Krishnapuram onion having special attributes are treated differently in implementation of MEP policies.

Time series data on onion prices indicate that 2013 price crises was the most severe with intense price shock in the recent year. This situation needed immediate attention of policy makers, consequent upon which the MEPs were kept at the historically highest levels. As the crisis became intense, the government responded by repeatedly raising the MEP which went up to $1150/MT. The situation eased only at the end of December. A similar price crises situation re-emerged in 2015 which appeared to be little less severe as compared to 2013 crises. An MEP level of $700/MT was notified in August 2015, which was 8 per cent higher as compared to August 2013 MEP. No further notifications were issued except in December 2015 when the price situation eased. An examination of onion prices and policy in the recent years indicates as if domestic supply management follows contingent planning rather than advance and well thought out plan in response to the signals given by relevant organizations and averting the price spike situations. An ideal approach demands proper market intelligence based on production and price forecast. Failing which the contingent management in terms of higher MEPs and export bans might affect export earnings of India as a less credible nation as compared to the competing countries like China and Pakistan.

IT approach to agricultural marketing: A case of e-tendering system in Karnataka

Pavithra S and Raka Saxena

The mode of operation, effectiveness and challenges in implementing e-tendering marketing system for pigeon pea in Gulbarga market of Karnataka was amalysed. Primary survey of farmers, traders and market officials was carried out three APMCs from Gulbarga district, viz., APMC located in Gulbarga, Chittapur and Sedam taluks. Several rounds of focussed group discussions were held with market officials, farmers including progressive farmers of selected villages and traders in order to obtain qualitative information on pigeon pea marketing and on Unified Market Platform (UMP) which aims at integrating APMC markets across the states. The information on market revenue, prices and arrivals was obtained from the APMC records. The results of the study indicated that e-tendering did not have a direct impact on market prices and arrivals, but contributed greatly towards improving the transparency and competition in agricultural markets. Besides, it significantly reduced the transaction time in marketing of produce. Mandatory e-gate entry enabled monitoring the market arrivals, resulting in increased market income.

Qualitative information obtained highlighted certain concerns of the stake holders regarding the implementation of UMP which could be potential lessons for the implemenattion of e-NAM. There is a lack of awareness on market reforms among the farmers. Commission agents perceive that initiation of e-NAM could eliminate their role in the APMC markets. Traders still have a preference for physically examining the produce before purchase hence, were skeptical online trading wherein product quality is determined through grade specifications of the agricultural commodities. Many of the traders are not in favour of online payment of amount to farmers. Requirement

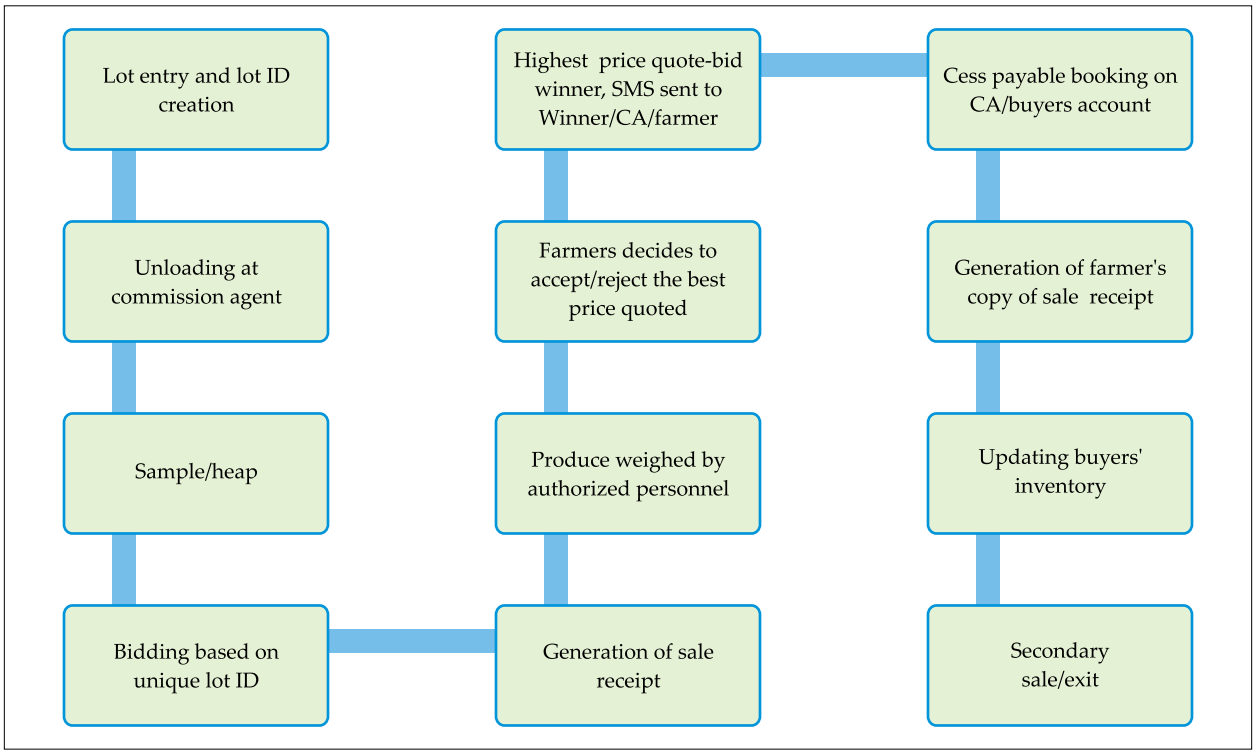


Figure 13 : Mechanism of e-Tendering for pigeon pea

of pre-bid deposition of margin amount before the purchase of produce is also percieved as a constraint by the farmers. Heavy reliance of farmers on traders and commission agents for farm and non-farm credit, makes them obliged to sell the produce to the local market intermediaries. Some farmers do not prefer online payment either due to lack of knowledge on banking or fear that banks might divert the payment for loan recovery. Lack of staff in the APMC markets, inadequate infrastructure, lack of assaying facilities at the markets are the other major constraints for the integration of APMC markets. Market integartion could be successful and could contribute in competitive price discovery for agricultural commodities if some of these issues are addressed.

Is there a Convergence in Dietary Energy Intake among Expenditure-Classes in India?

S.K. Srivastava, Balaji S.J. and Deepthi Kolady

The successive NSSO surveys have revealed contrary trends in real monthly per capita expenditure (MPCE) and dietary energy intake among Indian households. The cross-sectional data show a positive association between calorie intake and real MPCE, whereas the temporal trends between 1993-94 and 2004-05 have shown an opposite MPCE-calorie relationship. This contrasting temporal and cross-sectional trend is termed as 'calorie-consumption puzzle' in the literature. The post 2004-05 period had witnessed 'trend reversal' in calorie intake and empirical evidence suggests that calorie-consumption puzzle seems to have disappeared in the recent years. The study has established that marginal effect of MPCE on calorie intake is positive and any deviation could be the net outcome of several other factors influencing access to food. Therefore, food and nutritional security can be improved by providing attractive avenues for earning income. As indicated by calorie expenditure-elasticities, the response of increase in income would be higher among rural households than urban households. Similarly, MPCE-calorie relationship is found to be much stronger for households belonging to lower expenditure classes because of their higher marginal propensity to consume food than the relatively rich households.

The temporal changes in calorie intake across expenditure-classes are tending towards the recommended level of energy intake (Figure 14). The households belonging to lower 32-33 expenditure-classes witnessed increase in calorie intake between 1993-94 and 2011-12. On the other hand, relatively rich households, particularly those with higher calorie intake than recommended norms, reduced dietary

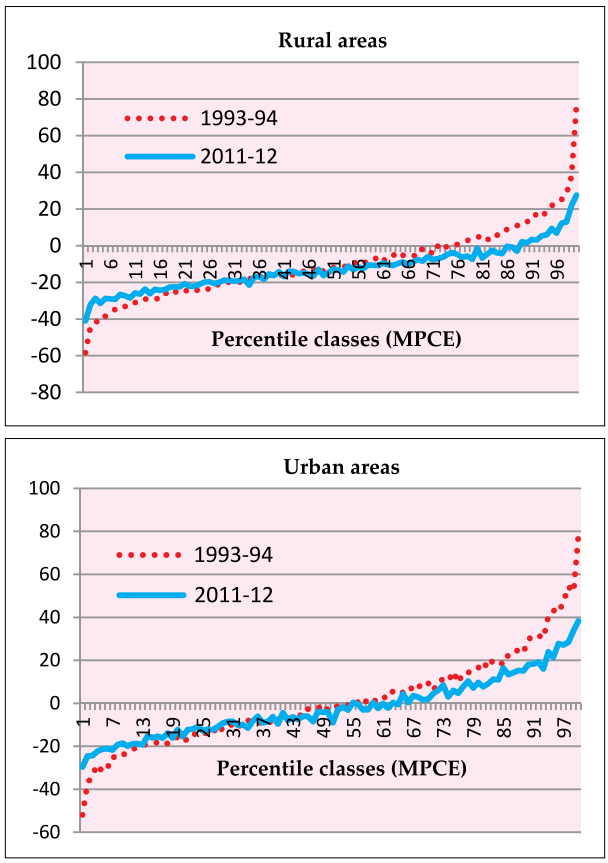


Figure 14 : MPCE percentile class-wise deviation in calorie intake from recommended dietary allowance in rural (2400 kcal) and urban areas (2100 kcal)

energy intake. The possible factors behind the increasing calorie intake by poor households might be related to higher income and improved access to food, while the factors such as increasing health consciousness, sedentary life-style and changing food habits might be leading to declining calorie intake by richer households.

The results of conditional β-convergence have revealed a higher rate of growth in calorie intake among poor households than richer households (Table 10). Among factors conditioning β-convergence, real MPCE, food expenditure share and calorie intake from PDS have shown positive effects on growth in calorie intake. On the other hand, calorie prices and dietary diversification index have depicted marginal effects on growth in calorie intake. The convergence in calorie intake among expenditure-classes was further confirmed by the σ-convergence test.

Table 10 : β- convergence in calorie intake between 1993-94 and 2011-12

Variables	Estimated coefficients
Dependent variable:	Growth in calorie intake (%)
Explanatory variable:	
Initial level of calorie intake (kcal/capita/day)	-7.351*** (0.432)
Real MPCE (Rs/capita/month)	4.005*** (0.391)
Food expenditure share (%)	3.784*** (0.398)
Dietary diversification index (SID)	-1.078* (0.573)
Calorie price (Rs/1000 kcal)	-1.926*** (0.365)
Calorie intake through PDS (kcal/capita/day)	0.263*** (0.051)
Sector dummy (Rural=1; 0 otherwise)	0.712*** (0.069)
Constant	15.247*** (2.075)
R^2	0.9654
Observations (No.)	200

Note: Explanatory variables are expressed in logarithmic form; Figures within the parentheses are standard errors of estimated parameters; Estimates are robust to heteroscedasticity; *** and * refers significance at 1%, and 10 % level, respectively.

Although convergence in calorie intake between poor and rich households is desirable from equity point of view, actual energy intake shall be accompanied by intake of at least minimum level of required energy, which has been found to be inadequate especially among poor households. The study has provided strong evidences to prioritize and target poor households in ongoing efforts to ensure adequate food and nutrition. The nutritional status of poor households can be improved by providing avenues of income, strengthening of PDS, and managing price rise. The finding that there is a substantial undernourishment among rich rural households highlights the need to create general awareness about nutrition and healthy diet among the rural households, irrespective of their income status. Overall, findings from our study imply that there should be targeted policy and program interventions to improve the nutritional status of poor households while effective nutrition communication strategies are necessary to address the undernourishment among rich households. Although, not the focus of this paper, these communication strategies might contribute to prevent or reduce the increasing trend of obesity and overweight among rich households as well.

Changing Consumption Pattern of Spices across Geographical Regions in India

S.K. Srivastava

Spices are integral part of Indian diet. Presently, an average Indian consumes 3.25 kg spices in a year which constitutes 4.40 per

cent share in total food expenditure (Figure 15 and 16). Due to varying food habits of Indian households, consumption pattern of spices varies significantly across geographical regions of the country. During 2011-12, the share of spices in total food expenditure varied from 3.21 per cent in north-east region to 5.34 per cent in southern region. In quantity terms, spices consumption varied from 2.15 kg in north-east region to 4.92 kg in southern region in 2011-12.

Composition of spices consumption basket:

In India, spices are consumed as whole spice or mixed spices. According to NSS data, mixed spices constitute 39 per cent of total spices budget of Indian households (Figure 17b). Among whole spices, dry chilli occupies a predominant share of 18 per cent share in total spices expenditure. Dry chilli is followed by turmeric, garlic, ginger, tamarind and black pepper with their respective share of 15 per cent, 12 per cent, 7 per cent, 5 per cent and 4 per cent.

Due to changing food habits, and taste and preferences of Indian households, the relative importance of spices is changing over the years.

Between 1993-94 and 2011-12, the share of dry chilli in spices budget has reduced by 6 percentage points (Figure 17a and 17b).

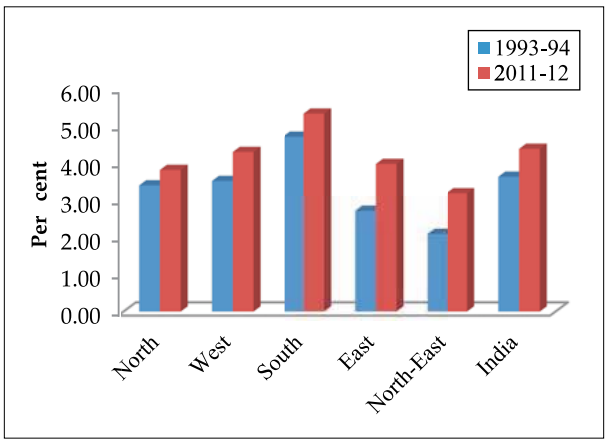


Figure 15: Share of spices in total food expenditure

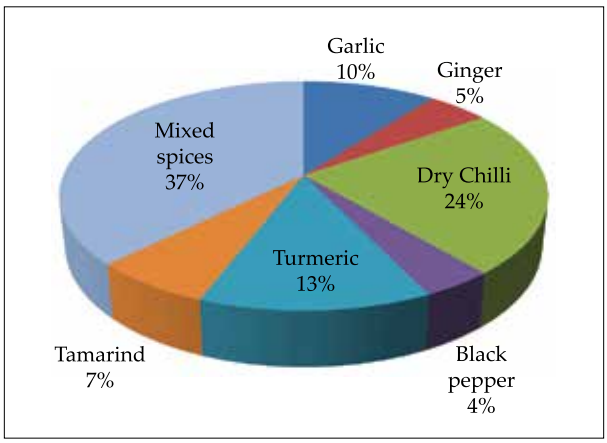


Figure 17a: Composition of spices consumption basket (1993-94)

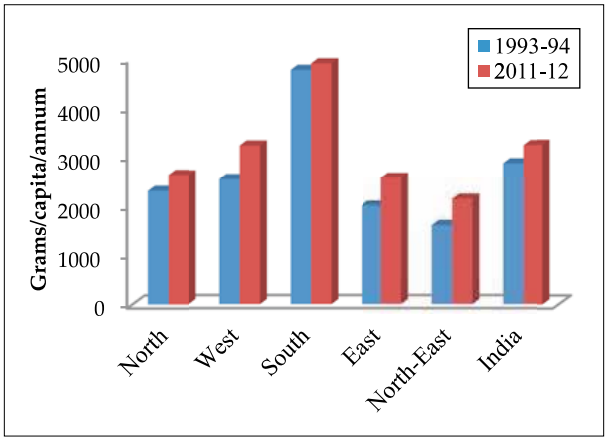


Figure 16: Consumption of total spices in India

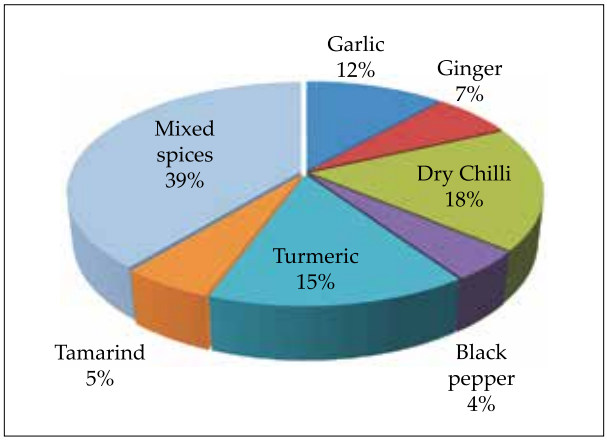


Figure 17b: Composition of spices consumption basket (2011-12)

Similarly, tamarind has lost its share by 2 percentage points during the same period. On the other hand, the share of garlic, ginger and turmeric has increased. Further, Indian households are increasing their spending towards mixed spices as shows by its increasing share over time. The rising importance of mixed spices is consistent with peoples' inclination towards ready-to-cook, ready-to-eat and processed food products. This offers a great scope to trap the rising market of value added spices products by improving the processing infrastructure and services in spices sector.

SUSTAINABLE DEVELOPMENT

Development and Validation of IPM Strategies for Mandarin Orchards

DB Ahuja and Usha Ahuja

The project, IPM for pest management in mandarin is implemented in three agro-climatic regions of India in collaboration with PAU, Ludhiana, SKRAU, Bikaner, Assam Agricultural University, Assam, NRC Citrus, Nagpur and NIAP, New Delhi. The major objectives of the project are to formulate and validate an effective, applicable IPM module through on-farm demonstrations in farmer's participatory mode and its dissemination, management and diagnosis of greening disease at farmer's field and replacement of infected plants with index planting materials. NIAP collected baseline information about the village and plant protection practices and did Impact analysis of IPM technology. The results of Impact of IPM in kinnow cultivation in the selected village of Punjab are presented in Table 11.

The impact analysis reveals that the adoption of IPM has increased the efficiency in term of reduction in cost and increase in productivity, accounting for about 12 per cent decrease in cost and more than 7 per cent increase in yield leading to about 19 per cent increase in net income. Further use of pesticides in terms of volume and number of applications has also reduced significantly accounting for 33.38% and 35.29% respectively. So, on the basis of these results it is inferred that the IPM technology has shown positive impact on farmers' fields, and up scaling of IPM in kinnow orchards can lead to uplift the economy of the rural households.

Table 11: Impact of IPM in kinnow cultivation in the selected village of Punjab

S. No.	Indicator	Particular	Before	After	Net change (%)
1.	Efficiency	Reduction in cost (Rs.)	37150	32773	11.78
		Increase in yield (Qtl /ac)	108	115.8	7.22
		Increase in income (Rs.)			
		(i) Gross income	97200	104220	7.22
		(ii) Net income	60050	71447	18.98
2.	Sustainability	Reduction in pesticide use (Rs. / ac)	13740	10638	22.58
		Reduction in pesticide (No. of sprays)	17	11	35.29
		Reduction in pesticide (Kg / ac)	5.862	3.905	33.38

Institutional Innovations for Enhancing Outreach and Inclusiveness of livestock Services

Subhash Chand, PS Birthal and Prem Narayan

Globally, India is not only the largest milk producer but also enjoys the splendid growth in livestock sector. In sustaining such growth in milk production, there is a need of strong livestock service delivery system. This study is based on the primary data collected in 2015 from the states of Haryana and Rajasthan and it focuses on the major services, viz., health, breeding and livestock insurances. The result reveals that the major service providers in the study area are government dispensaries and hospitals, private practitioner and local healers. The farmers preferred mostly livestock services done at farm than service centre. On an average, each household made 2 to 3 visits in a year. The respondents have availed services mainly from private service provider (70%) followed by the government institutions.

Survey work on effectiveness of livestock service delivery in Udaipur

Data on fees and expenses discloses the major health problems prevail in the study area. They are chronic diseases, surgical and gynaecological cases, etc. The average treatment cost paid for an animal was about Rs. 536.25 that includes medication and fees towards registration. The farmers availed treatment mostly for milch animals. In general, the service fee of government dispensary was more expensive than private practitioner and local healers. In the case of breeding services, government service charge was cheaper than private practitioner.

Data on livestock insurance services reveals that an animal is insured up to 100 % of its market value and its premium is subsidized down to 50 %. The premium is 4 % of the sum insured for general public and 2.25 % for the targeted beneficiaries. In spite of the concerted efforts, progress in livestock insurance was slow. By 2012-13, about 80 million animals alone were insured; that covers nearly 16 % of livestock population in India (Figure 18).

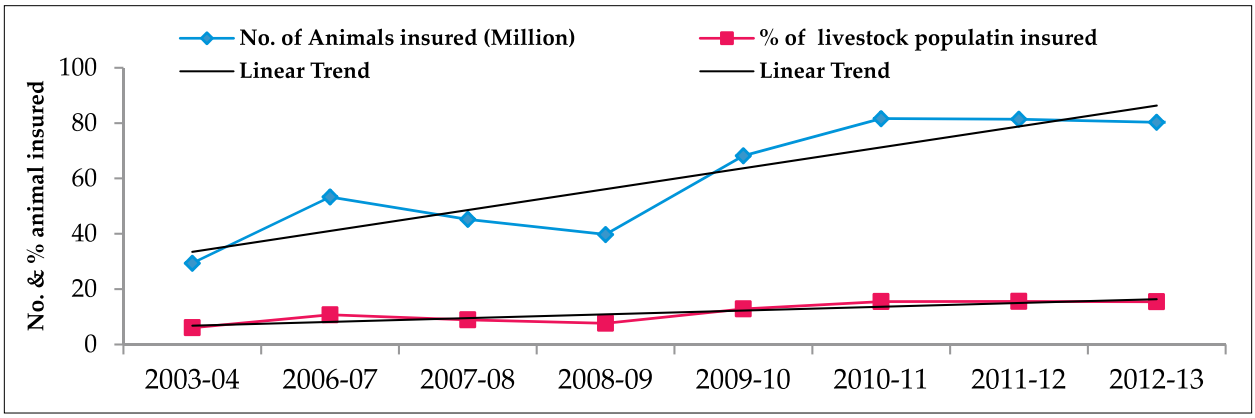


Figure 18 : Progress of livestock insurance in India

Source: Basic Animal Husbandry Statistics (various issues) and Livestock Census, Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture and Farmers Welfare, Government of India.

The sample households data show only 8.4 per cent in Haryana and 7.7 per cent in Rajasthan livestock population had the insurance coverage. Out of which, only 8 per cent of households have reportedly renewed livestock insurance is a cause for concern (Figure 19). About 90 per cent of the beneficiaries are not interested to continue the service speaks volumes about the functioning of the livestock insurance delivery system in the country. Hence, efforts need to be directed towards policies and programmes to create more awareness through interactional meets with farmers and insurance agencies for entire herd insurance provisions as desired by majority of livestock owners. The geographical diversity too affected significantly the adoption of livestock insurance

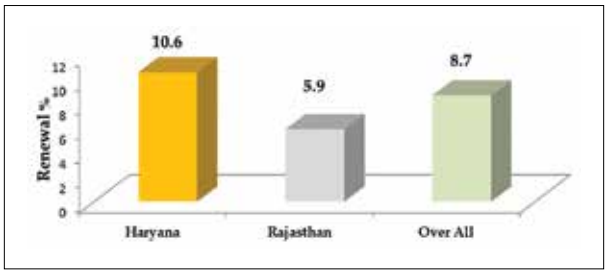


Figure 19 : Renewal of livestock insurance

The result of logit regression model reveals that age has a positive impact. Similarly, higher education, the proxy for awareness to deal with the impending danger in the absence of livestock insurance, has the positive impact. The herd size, household income and experience in livestock farming had a significant negative influence on adoption. The results of determinants of level of payment for livestock insurance premium reveals that family size, total land holding, average yield and owning buffalo significantly influence a payment of livestock insurance premium. The family size and higher milk yield have positive influence on the level of payment for livestock insurance. But the land size negatively influences the farmers' level of premium payment. Age,

Table 12 : Determinants of level of payment of livestock insurance premium

Parameters	Intensity of Payment from Tobit model	Standard Error
Age of household-head (years)	0.63 ^{ns}	(0.95)
Experience in livestock	-0.39 ^{ns}	(-0.60)
Family size	3.78*	(1.69)
Total land holding (in Ha)	-2.46**	(-1.96)
Average yield (Litre/hh/day)	13.90***	(6.00)
Dummy variable-Household occupation; Farming source as a main income (control) = 0, Livestock and others source of income = 1	-9.68	(-1.32)^{ns}
State specific effect, Haryana = 0, Rajasthan =1	12.84	(1.24)^{ns}
Dummy variables-Education of the household head		
Higher secondary school (D1), others zero	-9.95	(-1.19)^{ns}
Graduate and post graduate educated	-3.99	(-0.26)^{ns}
Adjusted R-square of the model	0.74	
F- statistics of the Model estimated	40.9***	
Total number of observations	906	
Log likelihood of the model	-1659.06	
Number of jackknife iteration of the model	900	

Standard errors in parentheses, ***, **, * significant at 1, 5, 10%, respectively.

experience in livestock enterprises, owning cow and degrees in higher education does not have any influence on paying livestock insurance premium. In the Tobit model, state (fixed) effect could not be observed, implying state has nothing to contribute to determine the level of payment.

Besides, study investigate the reasons of preference for particular livestock service provider, mainly private practitioner and local healer, discloses that they treat the animal on credit basis and their service are less expensive. Moreover, they are easily accessible in both states. Disease problems and scarcity of fodder are top constraints and non-availability of medicines and lack of support from the government ranked second and third important constraints in livestock farming.

Mainstreaming Adaptation Policies in Development Planning to Enhance Resilience of Indian Agriculture

Naveen P Singh, Balaji S. J., Pavithra S, Arathy Ashok, Mohd. Arshad Khan and Bhawna Anand

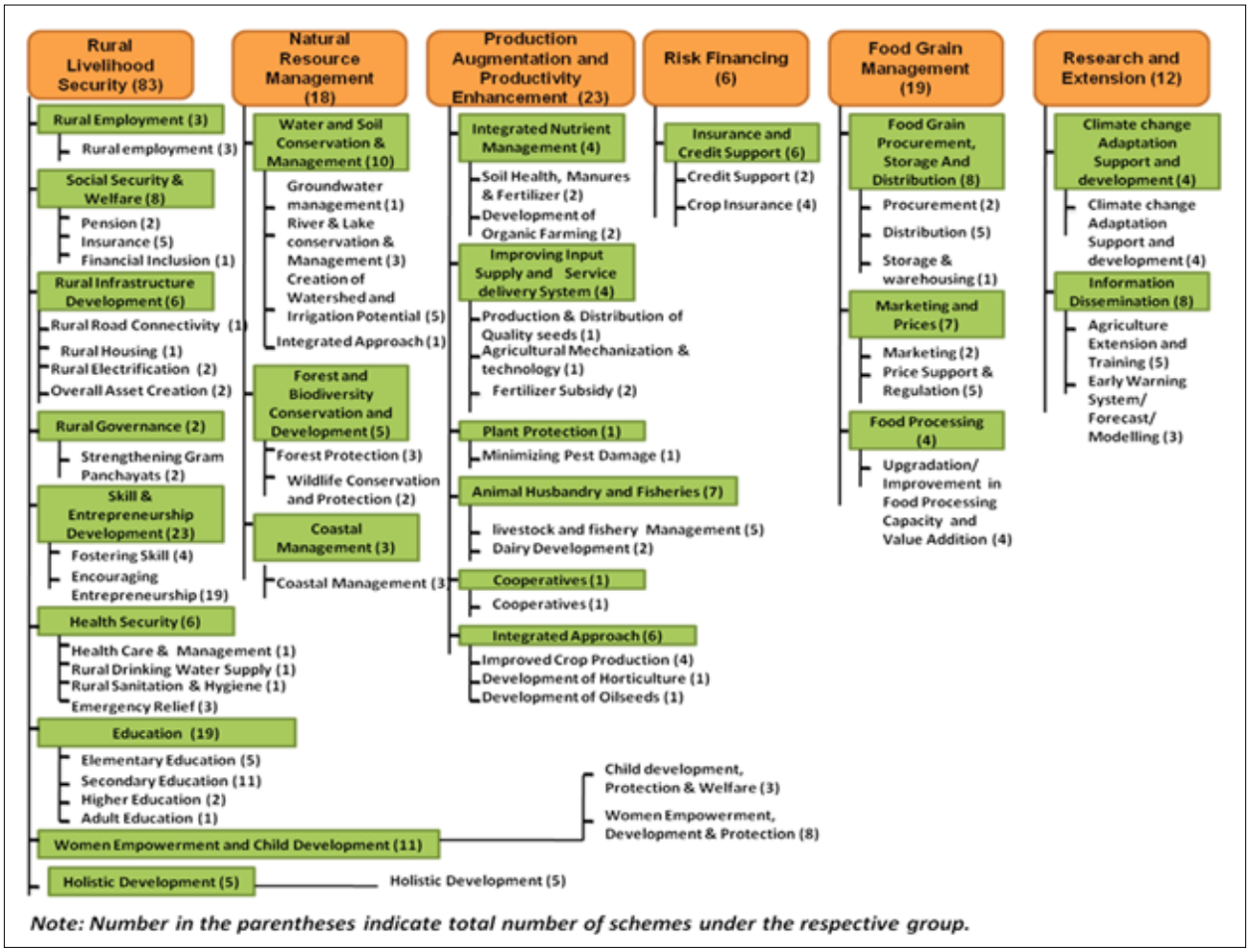
Climate change incidence on agriculture can be in the form of increased variability in temperature and rainfall and intensity of extreme weather events like drought and flood ultimately creating disturbance to agro-ecosystems, thereby impacting farmers and farming community. In the recent times, adaptation has emerged as a significant response strategy to fight against the effects of climate change. There is growing need towards mainstreaming adaptation in the current planning framework. This necessitates the need to address adaptation and rural development in an integrated manner, so as to achieve climate resilient development.

Farmers perceptions and responses: For the study purpose grass-root perceptions were obtained through participatory rural appraisals (PRA), Focused Group Discussions (FGD) from farm households in Mahbubnagar district of Telangana and Moga district of Punjab. Stakeholders' awareness towards climate change and its impacts, extent of preparedness, adaptation strategies followed, perceptions on mitigation, relief measures and reach and awareness of different government schemes and programmes was also elicited. The temperature and rainfall deviations over the years in both Mahbubnagar District of Telangana and Moga District of Punjab exhibited a climate change phenomenon and farmers are experiencing the same. Change in the quantum and distribution of rainfall, decline in crop yield, ground water depletion and rise in minimum as well as maximum temperature level were the major impacts of climate change as perceived by the farmers. The key socio-economic impacts of climate change included farm unemployment, decline in farm income, rural migration and increased indebtedness among the farmers. In order to cope with climate change, farmers used adaptation strategies such as use of crop varieties of shorter duration, water conservation techniques, crop insurance and participation in non-farm activities and employment guarantee schemes. Farmers' attempts to adapt to the changing climate are constrained by several technological, socio-economic and institutional barriers. These include limited knowledge on sharing the costs-benefits of adaptation, lack of access to and knowledge on adaptation technologies, lack of financial resources and limited information on weather were the major institutional and technological barriers for adaptation. Besides these, lack of access to markets, inadequate farm labour and limited farm size were the other constraints for adopting climate change adaptation strategies by the farmers. It was noticed that not only cultivators but also local institutions like KVKs were unacquainted about various welfare programmes formulated by the Government. Therefore, concerted efforts to enhance awareness of climate change adaptation

programmes among various stakeholders need to be made to ensure that intended benefits of the schemes reach targeted beneficiaries.

Mainstreaming adaptation in planning: In order to mainstream the adaptation strategies in an integrated manner, various developmental programmes of different ministries were studied and converged for enhancing its effectiveness and targeting. The study suggested 6 broad thematic groups for various existing development programmes and interventions namely; Rural Livelihood Security, Natural Resource Management, Production Augmentation and Productivity Enhancement, Risk Financing, Food Grain Management and Research and Extension that are perceived to be critical domains for enhancing the resiliency of the agriculture and rural communities. Pertinent to these broad thematic groups, the study identified twenty four ministries and 161 developmental programmes being operationalised during the year 2015-16. Further, these broad thematic groups were segregated into 24 sub-groups and 54 categories. The broad thematic groups were divided into sub-groups and categories, such an extended categorization is in consonance with the stated objectives and mandates of the programmes/ schemes and ability to mitigate the vulnerability to climatic changes.

Further the budget of the Central Government and the outcome budgets of the selected Ministries were consulted to quantify and assess the pattern of the budgetary expenditure



Note: Number in the parentheses indicate total number of schemes under the respective group.

Figure 20 : Extended thematic Categorization of Broad groups

over the broad thematic groups and sub-groups identified. The union budget of the Central Government and also the outcome budgets of the selected Ministries were compiled to quantify and assess the pattern of the budgetary expenditure over the broad thematic groups and sub-groups identified at three points of time (years 2010, 2015, 2016). It was observed that over the period, total share on broad thematic in the total budgetary expenditure have fallen from 26.39 (2010) to 25.55 (2015) to 23.97 (2016) as proportion of total outlay. Also the share of rural livelihood security, NRM and production augmentation which constitutes the critical foundation of rural development have significantly reduced, while risk financing being the only thematic groups that witnessed a marked increase in its allocation. This approach envisages to sensitize the policy makers towards the program replication issue and in ensuring effective utilization of the available financial resources thereby bringing prudency, effective targeting and outcome oriented towards enhancing the resilience of Indian agriculture/vulnerable section or region.

Effect of Energy De-subsidization on Crop Profitability, Cropping Pattern and Groundwater Use in Punjab

S.K. Srivastava, Ramesh Chand, Jaspal Singh, Amrit Pal Kaur, Rajni jain, T.K.Immauelraj, and S.S. Raju

Punjab state has emerged as an extreme case of groundwater over-exploitation, with 72 per cent excess groundwater withdrawal than its sustainability limit of 20 billion cubic metre (BCM) per annum. Depleting groundwater resources not only disrupts ecological balance but also puts heavy financial burden on farmers and gives rise to socio-economic inequality in its distribution. Survey of previous literature suggest that out of several direct and indirect, demand-side management and supply-augmentation approaches, regulation of energy supply and pricing may be an effective approach to improve groundwater sustainability in the state. With this background, this study intends to investigate the effect of de-subsidization on crop profitability, cropping pattern and groundwater use in Punjab.

The result unfolds that on an average extraction cost of a cubic meter groundwater in Punjab was Rs. 0.91, out of which, farmer incurred was Rs. 0.46 and remaining Rs. 0.45 was subsidized expenditure, that varied from Rs. 0.28 for diesel operated pumps to Rs. 0.63 for electric operated submersible pumps (Table 13). So, financial expenses were borne equally by the society and the farmers in extracting groundwater

The study estimates groundwater subsidy, across different crops based on the amount of groundwater utilized. The per hectare groundwater subsidy varied from Rs. 843 in maize cultivation to Rs. 5,087 in paddy

Table 13 : Effect of de-subsidization of energy on groundwater extraction cost during TE 2010-11

(Rs. /cum)

Groundwater extraction Device	Groundwater cost		Estimated subsidy	Share of subsidy in total GW extraction cost (%)
	With subsidy	Without subsidy		
Oil-engine	1.04	1.32	0.28	21
Electric pumps	0.23	0.52	0.29	56
Submersible pumps	0.55	1.18	0.63	53
Overall	0.46	0.91	0.45	49

cultivation during TE 2010-11 (Table 14). Also, assess the effect of de-subsidization of energy on profitability and reveals that effects were not found uniform across crops. As shown in Table 14, the variable cost (cost A_1 + imputed value of family labour) increased due to de-subsidization, that reduced net returns in paddy, maize, wheat, sugarcane and cotton by 12.94 per cent, 9.89 per cent, 4.37 per cent, 2.84 per cent and 2.64 per cent, respectively. However, the value of BC ratio, greater than one, across all the crops indicate that farmers could still cover variable cost of production.

The empirical evidences indicate that energy pricing would reduce net returns, but less likely to affect the ranking of the profitability of crops in general, specifically profitability of paddy vis-a-vis competing crops like maize. The study projects that withdrawal of energy subsidy is unlikely to bring substantial change in dominance of paddy in existing cropping pattern in Punjab. Yet, as depicted in Table 15, de-subsidization of energy would result in reduction in existing groundwater use by 3,533 cum/ha in rice, 2,749 cum/ha in sugarcane, 1,478 cum/ha in cotton, 1,217 cum/ha in maize, and 1,200 cum/ha in wheat in Punjab .

In relative terms, extent of groundwater saving is 29 per cent in rice, 38 per cent in cotton, 41 per cent in sugarcane, 48 per cent in wheat, and 82 per cent in maize. Based on these evidences, it can be concluded that withdrawal of energy subsidy will bring substantial reduction in groundwater extraction and improve groundwater use efficiency for crop production in Punjab.

Table 14 : Effect of de-subsidization of energy on crop profitability in Punjab during TE 2010-11

Particulars		Paddy	Sugarcane	Wheat	Cotton	Maize
Groundwater irrigation subsidy (Rs. /ha)		5,087	2,552	1,125	995	843
CostA_1+FL(Rs. /ha)*	With subsidy	29,482	58,680	21,474	30,599	21,955
	Without subsidy	34,569	61,232	22,599	31,594	22,798
Gross return (Rs. /ha)		68,788	148,539	47,237	68,326	30,477
Net return (Rs. /ha)	With subsidy	39,306	89,860	25,763	37,727	8,522
	Without subsidy	34,219	87,307	24,637	36,732	7,680
	Change (%)	-12.94	-2.84	-4.37	-2.64	-9.89
Gross Benefit-Cost ratio	With subsidy	2.33	2.53	2.20	2.23	1.39
	Without subsidy	1.99	2.43	2.09	2.16	1.34

*cost A_1+family labour.

Table 15 : Effect of withdrawal of energy subsidy on groundwater use for irrigation in Punjab

Particulars	Paddy	Wheat	Sugarcane	Maize	Cotton
Price elasticity of irrigation	-0.23	-0.37	-0.30	-0.43	-0.60
Irrigation hours (hours/ha)	285	60	170	53	46
Discharge (cum/hr)	55	55	55	55	55
Increase in groundwater cost due to subsidy withdrawal (%)	98	98	98	98	98
Effect on groundwater use (cum/ha)	-3,533	-1,200	-2,749	-1,217	-1,478
Present level of groundwater use (cum/ha)	12,151	2,520	6,735	1,485	3,920
Per cent change in groundwater use (%)	-29	-48	-41	-82	-38

Sugarcane Cultivation and Drip Irrigation in Maharashtra

T. K. Immanuelraj and Rajni Jain

Sugarcane is one of the water-intensive crops cultivated predominantly in Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh. Having more than 95 per cent of sugarcane area under irrigation, mostly surface irrigation method, its contribution to declining water table is serious. This study was conducted using time series cost of cultivation data for the period of 1973-2014, employing seemingly unrelated regression (SUR) model under translog profit function framework. Maharashtra state was purposively chosen for the study as it is the largest sugar producer (36.5%) and utilizes more than 60% of total available water for sugarcane cultivation that occupies only 3% of the total cropped area of the state.

Despite being a water-intensive crop and stagnant yield, area under sugarcane continued to grow at a rate of over 5 per cent per annum during the study period. This is mainly due to the relative profitability over other crops and assured purchase by the sugar industries. However, the declining total factor productivity (TFP) growth suggest that area expansion is not sustainable and more and more inputs are required to maintain the same level of yield per hectare. As well as, in terms of irrigation water productivity Maharashtra is found to be least productive among all the sugar producing states.

The results imply that a increase in one per cent sugarcane price increases the output supply by 2 per cent but increases the demand for irrigation water by 3.4 per cent (Table 16). The magnitude of the coefficient is highest among all the input demand elasticity coefficients explains the overuse of irrigation water in sugarcane cultivation. Similarly, increase in irrigation price by one per cent decreases the irrigation demand by 2.4 per cent and that will also increase the demand for machine power by 4.83 per cent. This finding suggests that increasing irrigation price, with or without intervention, has the tendency to minimize the inefficiency in the irrigation water use and promotes mechanization that includes drip irrigation and other facilities which increase the efficiency of irrigation. The study concludes that drip irrigation has the drastic potential to increase irrigation efficiency, certainly reduce the rate of water wastage if adopted desirably. However, in the long run, drip irrigation alone will not solve the water exploitation as per the working of Jevons paradox. With other supporting polices, adoption of drip irrigation can bring sustainability in the irrigation water use.

Table 16 : Elasticities of Output Supply and Input Demand

	Variables	Sugar cane price	Irrigation price
Supply	Output	1.97 *	-0.48
Input Demand/ Use	Human labour	1.83 *	-0.25
	Machine	3.29 *	4.83 *
	Fert & seed	2.06 *	-0.51
	Irrigation	3.64 *	-2.45 *
	Land	2.94 *	-0.27

*significant at 1 per cent.

PAD workshop at RPCAU, Pusa, Samastipur on January 25, 2017

Optimum Crop Plan for Punjab for Ground Water Sustainability

Rajni Jain, T.K. Immanuelraj, Ramesh Chand, Amrit pal Kaur, S.S. Raju, S.K. Srivastava and Jaspal Singh

This study was carried out to examine the sustainable use of groundwater and to sustain

productivity and profitability, using plot-level cost of cultivation survey data for the period of 2008-09 to 2010-11. The crops selected for the model are paddy, basmati rice, maize, moong, redgram, groundnut, sesame, cotton, fodder, wheat, barley, potato, pea, gram, sunflower, rapeseed, vegetables, sugarcane and lentil. Linear Programming framework was developed and various options of conserving water were examined (Table 17). This table shows the optimum crop plan under three scenarios. Scenario I projects the optimum crop plan under unrestricted water use, in which area under paddy in kharif and vegetables in rabi will increase further. Consequently, ground water continues to deplete further, and ground water extraction would be 17.3 per cent more than the rechargeable ground water available for agriculture. Scenario II allows for no further decline in water table along with marginal increase in farm revenue by 0.64 per cent. This concludes that farmers in Punjab are utilizing all resources exhaustively and are already close to optimum condition. Thus, neither much increase in farm revenue or saving of ground water is possible in this scenario. Scenario III projects a crop plan, where 10 per cent of existing ground water use is targeted to reduce every year to check the falling water table. However, at existing level of technology use and policy options this warns against fall in farm revenue. Therefore in order to improve farm revenue along with saving of water, it is recommended to use better technological and farm management options to save water like laser leveling,

Table 17 : Optimum crop model for Punjab under different scenarios

Crops	Existing area (000 ha)	Optimum area (000 ha)			Required Direction of Change for sustain-ability
		Un-restricted GW use (I)	Restricted GW to existing limit (II)	Restricted GW to 90 % of Existing use (III)	
Kharif Season					
Paddy (including Basmati)	2760	3584	2784	2331	-
Maize	136	102	102	102	-
Cotton	483	386	715	715	+
Vegetables	57	29	29	29	-
Others*	28	17	17	17	-
Rabi Season					
Wheat	3520	2954	3425	3878	+
Vegetables	65	104	104	104	+
Potato	69	35	35	35	-
Oilseeds (Rapeseed+Sunflower)	51	26	26	26	-
Others**	39	28	28	28	-
Sugarcane	70	35	35	35	-
Gross Cropped Area ('000 ha)	7298	7298	7298	7298	
Water savings (%) with reference water use in TE 2010-11	0	-17.3	0	+10	
Change in Farm revenue with reference to TE 2010-11 (%)	0	+2.5	+0.64	-0.87	

Note: * Includes moong, urad, redgram, groundnut, sesame and fodder.
** Includes barley, pea, gram, lentil, kenaf, oelery and fodder.

late varieties of paddy and micro irrigation methods. Literature shows that laser leveling in rice fields reduced irrigation time by 47-69 hours per hectare per season and improved yield by approximately 7 per cent as compared with traditionally levelled fields.

TECHNOLOGY POLICY

Economic Impact of Technology in the Rice-Wheat System

P Anbukkani, Shaloo Punia and Suresh Pal

Rice and wheat system is the most productive cropping system in India, spread around 10–12 million hectares (Mha). With the introduction of new technologies, rice-wheat system became productive and crucial to India's food security. So far, the major research efforts undertaken to improve the production of rice and wheat crops are mainly from the development of improved crop varieties and conservation of resources. This study attempts to assess impact of technology adopted in the rice wheat cropping system using information related to varieties and technology released after or picked for adoption in 2000, belong to the states of Punjab, Haryana, Bihar and UP.

Using economic surplus approach, total economic benefits generated by technologies are estimated and benefits are compared against the research cost of developing those technologies. All the combined technological interventions generated the economic benefits (net present value) of Rs. 190.8 billion over 20 years at 2014 prices. The study unfolds that more than three-fourths of aggregate benefits were generated by wheat and common rice varieties alone, and majority of the them have directly or indirectly benefited the consumers. The estimated internal rate of return is 38.80 per cent and the ratio of net benefits to the cost is 17.31. In addition, environmental benefits are generated in terms of saving of fuel and low carbon emission in zero-tillage, incorporation of plant residue in reduced tillage and water saving in zero-tillage and saving of resource in shorter duration of basmati rice varieties are not included in the computation, but their contributions are considerable.

The study estimates the internal rate of return (IRR) of the total economic benefits around 38.8 percent. Although, this estimate is slightly lower than the median IRR (53%) reported for India in the past for the green revolution technologies, but quite comparable to the rate of returns (IRR about 40 percent) from technological interventions under the National Agricultural Innovation Project. The estimate is fairly comparable to those obtained for CGIAR research; estimated B-C ratio for system-wide research was 4.76 for the period 1960-2001, which improved to 17.26 when the benefits were extrapolated through 2011. Most of these benefits were generated by rice and wheat varietal improvement programs and biological control of cassava mealybug.

Spatial and Temporal Growth in Total Factor Productivity in Indian Agriculture

Shiv Kumar, P.S. Birthal, Jaya Jhumrani, R.K. Paul, Showkat Bhatt, Jaweriah Hazrana, Bister Joshi and Amit Kumar

Understanding the significant relationship between the agriculture growth and Total Factor Productivity (TFP), this study attempt to quantify the TFP and its components, viz. technical progress, and technical efficiency and scale efficiency at the district level and also at the agro-climatic zone level using a long data series from 1966-67 to 2011-12 using fixed effect stochastic frontier function. The findings would help research managers to design, refine and promote technologies suiting to different agro-ecological conditions, and to

policymakers to target efforts and investments to harness the potential of technologies.

The study tentatively divide the entire period into three sub-periods, (i) 1966-1980, (ii) 1991-1995, and (iii) 1996-2011, based on the adoption rate of high-yielding varieties of rice and wheat. During the period 1966-2011, TFP growth remained positive and rising at 1.1% per annum and deriving its one-fifth of share from technical change and the rest from technical efficiency. Subsequently, growth of TFP accelerated from 0.73% a year during 1966-1980 to 1.26% during 1981-1995, but decelerated to 1.53% during 1996-2011. The contribution of technical progress to TFP was marginally negative (-6%) in the initial years of Green Revolution but with advancement in agricultural research and development of service delivery systems it turned out to be positive improving its share to 36% during 1981-1995 and further to 46% during 1996-2011. Technical efficiency, however, remained almost stagnant throughout the study period (Figure 21).

Further, the study reveals that standard deviation in TFP growth declined drastically from 0.38 during 1966-1980 to 0.11 per cent during 1981 to 1995 and further to 0.08 per cent during 1996-2011. The decline in the variability in technical progress was the main contributor to the sustainability of TFP growth. This implies that technological change progressed quite smoothly. Further, the variability in technical efficiency although was less than the variability in technical progress, yet declining variability in it suggests that technology is being used more efficiently irrespective the improvements in technology itself.

To understand the TFP growth at agro ecological zone level, the districts were grouped with similar agro-climatic conditions, and classified into agro-ecological zones, namely humid, semi-arid temperate, semi-arid tropics and arid zones. The estimates of TFP growth and its components reveal that semi-arid temperate zone realized the highest TFP growth throughout, and was followed by humid, semi-arid tropics and arid zones.

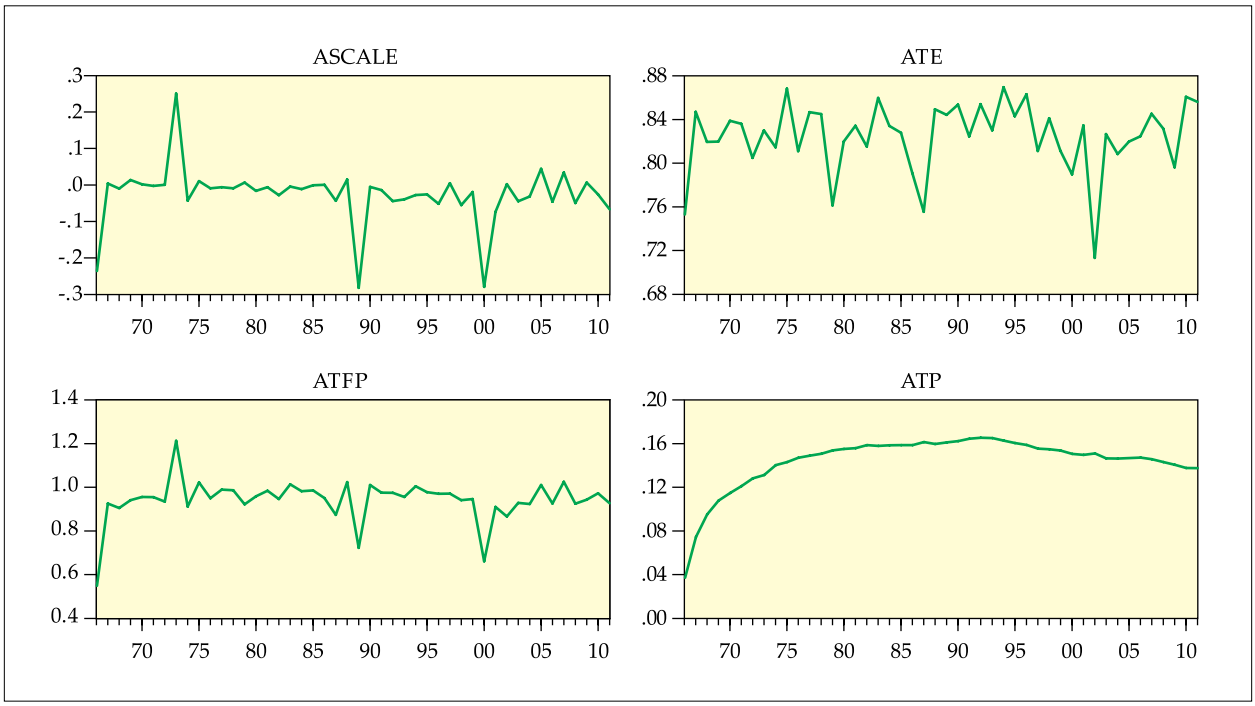


Figure 21 : Trend in TFP, TP, TE and scale efficiency at all-India level

Further, all the zones have kept on moving on a higher technological plateau. As TFP growth mainly derived from technical progress, TFP growth and technical progress exhibited smooth path except in arid zone, where it was quite irregular. These patterns of change in productivity growth are as expected. In case of rice and wheat either, or both, the dominant crops in semi-arid temperate and humid regions. Since, the high level of irrigation enabled the adoption in semi-arid temperate zone while, the high rainfall that enabled the adoption in the humid zone. As these crops have been at the centre of agricultural research and development, semi-arid temperate and humid experienced higher TFP growth. On the other hand, arid and semi-arid zones are acutely scarce in water resources, and in absence of institutional risk management mechanisms farmers are often averse to adopt new technologies. Moreover, the cropping pattern of these zones dominated by coarse cereals, pulses and oilseeds that have not received as much attention in agricultural research as did rice and wheat. That explains the reason for low TFP growth of these zones. Nonetheless, with development of irrigation markets, infrastructure and institutions, the technology has spilled over to the these less-endowed regions.

Global Patents Analysis and Future of Indian Potato Processing Industry

Rajesh K. Rana, Renu Martolia and Vikram Singh

Potato and its processed products have been an important food component in the developed world. Of late, developing countries like India and China have also began considering potato and its processed products, as important food and nutrition security items. This study compares the extent of patents filed as an indicator of research efforts in the field of potato processing by different countries/ regions of the world with special reference to India and China. As for as potato patenting is concern, North America together USA and Canada, dominated in processing right from early 1960s to the year 2000. Then, half of the patents were on potato chips while 26% were on french fries. Thereafter, European countries overtook North America. The share of patents on french fries increased to 65% while on potato chips decreased to 16%. After 2005, China and India emerged to be significant contributors. Globally, the share of patents filed by China increased to 72% during 2006 to 2015, and it increased to 85% (CGR) with the strategy of diversification on dehydrated products like potato starch, powder and flakes etc.

This study compares the global competitiveness of India in comparison with China and found that filed patent growth rate was increasing at 26%. This reflects how the competitiveness of potato research undertaken by India is low in relation to China. In order to enhance to global competitiveness in potato processing, appropriate management of Agri-IPRs would be crucial component of strategy for future agricultural growth. Although, recently established Intellectual Property and Technology Management infrastructure, is likely to promote more research efforts, in terms number of patents filed and national production of potatoes, India still has to make series of concerted efforts towards this end. This study explores ways and means to augment India's gains from global competence and opportunities in potato processing.

Changing Dynamics of Milk Production and Impact of Cattle-Breed Improvement on Milk Yield in Punjab

S.K. Srivastava, Jaspal Singh, N.P. Singh, and Shiv Kumar

Livestock is an important economic activity in Punjab state. Milk contributes about 26 per

cent share in total agricultural output in the state. The average fat corrected milk yield in the state is about 11 lit/day/animal which is more than double than the average milk yield in India. The higher milk productivity in the state is primarily because of dominance of improved breeds and cross-bred milch animals. The estimates based on unit-level cost of cultivation show that buffalo constitutes about 73% of total milch animals but share of cattle has increased over the years. Further, 76 per cent of the total milch cattle are of improved breed, and overall share of improved breeds in the Punjab has increased from 16% in 1996 to 20% in 2012.

The trend in profitability of dairy enterprise in Punjab was studied for the period during 1996-2012 (Table 18). The estimates show that during 2012, Punjab farmers spent on an average Rs. 22,451/ standard animal per annum and produced milk worth Rs. 48,077

Table 18 : Trend in economics of milk production in Punjab

Year	Cost (Rs./animal/year)				Total output (Rs./animal/year)		Output- cost ratio (based on real prices)	
	Paid-out cost#		Total cost@					
	Current prices	Real prices	Current prices	Real prices	Current-prices	Real prices	Paid-out cost	Total cost
1996	4,383	6,071	6,448	8,825	11,818	18,706	3.1	2.1
1997	4,568	5,925	6,986	8,966	11,697	17,558	3.0	2.0
1998	4,644	5,743	7,170	8,697	11,814	15,988	2.8	1.8
1999	6,610	7,398	9,712	10,711	15,268	19,412	2.6	1.8
2000	5,914	6,776	8,954	10,113	14,303	16,369	2.4	1.6
2001	5,759	6,477	9,022	10,043	14,525	16,251	2.5	1.6
2002	6,672	7,028	9,855	10,410	14,111	15,211	2.2	1.5
2003	5,955	5,907	8,755	8,723	15,467	16,339	2.8	1.9
2004	6,275	6,275	9,159	9,159	15,858	15,858	2.5	1.7
2005	6,594	6,064	9,857	9,121	17,240	17,156	2.8	1.9
2006	6,991	5,932	10,237	8,728	18,358	17,202	2.9	2.0
2007	6,957	5,536	10,441	8,314	21,509	19,011	3.4	2.3
2008	9,365	6,423	14,363	9,945	28,833	23,902	3.7	2.4
2009	10,382	6,015	15,801	9,325	30,112	21,835	3.6	2.3
2010	11,590	6,110	17,595	9,459	39,042	22,728	3.7	2.4
2011	12,983	6,727	20,816	10,965	49,443	26,274	3.9	2.4
2012	14,627	6,625	22,451	10,340	48,077	23,362	3.5	2.3
CGR, 1996-2012 (%)	**6.92**	**-0.02**	**7.09**	**0.38**	**9.36**	**2.38**	**2.39**	**1.99**

includes cost of fodder, grains, mixed feed, concentrate, veterinary expenditure and miscellaneous items.

@ includes paid-out cost plus imputed value of labour, depreciation for animal and dairy infrastructure and interest for animal and dairy infrastructure.

per animal. Thus, per animal net return was Rs. 25,626/ per animal in year. Further, during the past 16 years, real output from milk increased at annual growth rate of 2.38 per cent as compared to only a marginal increase in real cost. This shows increasing profitability in real terms from dairy enterprise over the years, which is also reflected through increasing B-C ratio. Thus diversification towards dairy activities offers a great scope to supplement and improve the farmers' income.

Trend in composition of production cost shows that fodder alone constitutes about 40 per cent share in total cost of milk production. However, over the years, the share of fodder cost is declining, while the share of mixed feed is increasing. This shows that farmers are shifting from fodder to composite feeds. Further, the 65% of total milk production cost is variable or paid out cost. It is therefore desirable to arrange for suitable loans to meet operational expenses in rearing milch animal.

The effect of cattle breed on milk yield was examined by fitting a fixed effect production function. In the regression function, milk yield was regressed with labour use, green fodder, mixed feed, concentrates, veterinary expenditure, standard herd size, proportion of crossbreds in herd, education and age of household, and dummy for land size and year. The results are presented in Table 19. All the variables, except labour use, age, and land size dummy were found significantly affecting milk yield. The sign of the respective variable provides direction of effect on milk yield. The estimated coefficient of proportion of cross-breds was found to be positive and significant which indicated positive association between milk yield and cross–breds animals. These results reveal the positive outcome of breed improvement programmes in the nation and emphasized the adoption of improved breed by the farmers.

Table 19 : Estimated coefficients of fixed effect milk production function: 1996-2012

Variable	Coefficient
Intercept	1345*** (64.33)
Labour use (hrs/std animal/ annum)	0.07 (0.05)
Green fodder (qtl/std animal/ annum)	0.93*** (0.30)
Dry fodder (qtl/std animal/ annum)	-2.40*** (0.69)
Grains (kg/std animal/annum)	0.02* (0.01)
Mixed feed (kg/std animal/ annum)	0.03* (0.02)
Concentrates (kg/std animal/ annum)	0.05*** (0.02)
Veterinary exp (Rs. / std animal/ annum)	0.21** (0.1)
Standard herd size	14.43*** (2.91)
Crossbred per cent (%)	1.67*** (0.34)
Education (no. of years)	4.49** (2.02)
Age	-0.53 (0.73)
Small farm (1-2 ha)	-14.15 (28.27)
Medium farm (2-4 ha)	-26.49 (29.02)
Semi-medium farm (4-10 ha)	-21.14 (30.3)
Large farm (>10 ha)	33.09 (32.33)
Year dummies	Yes
Observations	4903
R^2	0.085
Dependent variables	Milk yield (lit/milch animal/annum)

Note: Within parentheses are standard errors of respective variable.

III POLICY INTERACTIONS AND ADVOCACY

- Member, Committee on Doubling Farmers Income, DAC&FW.
- Member, Commodity Derivatives Advisory Committee, SEBI, Mumbai.
- Attended Brain Storming Session (BSS) on future climate Change Research in agriculture at NASC, New Delhi on February 23, 2017.
- Attended Brain Storming meeting on 'Identification of indicators of resilience to climate change' held on 26.02.2016 at CRIDA, Hyderabad
- Member, Sub group meeting on Demand and Supply in agriculture, NIAP on 20th October, 2017 at NITI Ayog
- Discussant for the Session on Aggregation Models for Pulses in India during International conference on "Pulses for Sustainable Agriculture and Human Health" on 31 May-1 June, 2016 New Delhi, India.
- Attended workshop on Knowledge Network on Climate Change and Agriculture during April 28-29, 2016 for Organized by DST and ICAR, April 28-29, 2016
- Participated in Pre-Budget Consultation, Ministry of Finance, New Delhi.

IV AWARDS AND RECOGNITIONS

Suresh Pal

- Secretary, Agricultural Economics Research Association, New Delhi.
- Member Secretary, Expert Committee for ICAR Review.
- Member, Research Programme Committee of Indian Society of Agricultural Economics, Mumbai.

P.S. Birthal

- ICAR National Professor, Indian Council of Agricultural Research, New Delhi
- Chief Editor, Agricultural Economics Research Review (AERR), New Delhi.
- Member, Editorial Board, Indian Journal of Agricultural Marketing
- Vice President, Indian Society of Agricultural Economics, Mumbai.
- Member QRT, Central Sheep and Wool Research Institute, Avikanagar
- Member, Research Advisory Committee (2016-18), National Research Centre on Weeds, Jabalpur
- Member, Research Advisory Committee, National Dairy Research Institute, Karnal 2016-18
- Member, Standing Working Group on 'Revamping agricultural extension system' of the State Planning Board, Government of Chhattisgarh 2016 onward
- Member, Expert Committee on Research, National Bank for Agriculture and Rural Development, Mumbai.

Subhash Chand

- MSc student final exam was conducted on 14/03/2016 at Agriculture Business and Agriculture Economics Division, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu.
- Conducted Oral comprehensive examination of Ph.D student on 14/10/2016 at Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu.

Rajni Jain

- Member, Technical Programme Committee, 4th International Conference on Computing for Sustainable Global Development (1st - 3rd March, 2017), New Delhi

N.P. Singh

- Member, Committee for selection of the Best Teacher Award, NDRI, Karnal on 28/02/2017
- Member, Sub group meeting on Demand and Supply in agriculture represented Director, NIAP on 20th October, 2017 at NITI Ayog
- Member, Institute Management Committee (IMC), ICAR - Central Coastal Agricultural Research Institute, GOA
- Member, Promotion Committee Meeting of Scientist under career advancement scheme on 17/02/2016 at DSR, Indore

- Member, Promotion Committee Meeting of Scientist under career advancement scheme on 26/10/2016 at ICAR-CSSRI, Karnal
- Member, Global Technology Watch Group – Sustainable Agriculture (GTWG-SA) under aegis of TIFAC-DST, New Delhi
- Member, Commodity Derivatives Advisory Committee (CDAC), sub-group on spot price polling under aegis of SEBI, Mumbai

Raka Saxena

- Member-convener, Committee on Developing the standardized methodology for estimating the Farm income, Ministry of Agriculture & Farmers' Welfare, New Delhi.
- Creation of Policy and Strategy Cell (PSC) at ICAR-NIAP for Doubling Farmers' Income in India by 2021-22.
- Joint Secretary, Agricultural Economics Research Association, New Delhi.

S.K. Srivastava

- Joined NITI Aayog on secondment basis
- Selection committee member for filling up the post of consultant, Senior Research Fellow and Communication Specialist.
- Special invitee member of Institute Management Committee (IMC) meeting of ICAR-NIAP held on 10.03.2017.

R.K. Rana

- 30th National Conference on Agricultural Marketing during 20 and 22 October 2016 at BHU, Varanasi, jointly organised by BHU, Varanasi and Indian Society of Agricultural Marketing, Hyderabad.
- Rapporteur for the Theme 1 'Status of Reforms in Agricultural Marketing in Different States' and prepared Rapporteur's Report.

T.K. Immanuelraj

- Member, Board of study in IARI Division of Agriculture Economics.

V PUBLICATIONS

A. Research Papers

Balaji, S.J. and Kumar, S. (2016) Constraints in cotton cultivation: cost issues and options for income increments. *Indian Journal of Agricultural Economics*, 71(3):361-373.

Balaji, S.J., Arivelarasan, T., Surendran, A. and Anbukkani, P. (2017) Pattern, expenditure and inequality in food and non-food consumption among rural households- A micro level study in Tamil Nadu. *Indian Journal of Economics and Development*, 3(1):105-110.

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Nikam, V.R., Chinchmalatpure, A. R. and Kad, S. (2016) Farmers perception about salt tolerant wheat varieties in saline areas of Gujarat. *Indian Journal of Extension Education*, 52 (1&2), 61-64.

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Prasad, I., Rao, G.,G.,. Chinchmalatpure A. R., Kumar, S., Nikam, V. R., Singh, C. and Sharma, D.K. (2016) Morpho-physiological traits imparting salinity tolerance in Maize (Zea Mays L.) Hybrids under saline water irrigation in vertisols. *Communications in Soil Science and Plant Analysis*, DOI:10.1080/00103624.2016. 1208758.

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B. Book Chapters

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*sustainable global developmen*t, Eds: Bharati Vidyapeeth's Institute of Computer Applications and Management, New Delhi, pp434-437.

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C. Popular Articles

Balaji, S.J. (2016) Do we have more land for agriculture? *The Dialogue*, Online policy discourse dated 25-10-2016. http://www.thedialogue.co/do-we-have-more-land-for-agriculture/

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Rana, R. K., Martolia, R., Singh, S. and Srivastava, S. (2016) Agri-IPRs pricing in India: Viewing from two divergent cases, *ICAR-News*, 23(3): 9-11.

D. TV Talks/Radio Talks

Suresh Pal, Budget 2016-17, DD Kisan

E. Presentation in Conferences/ Workshops/Symbosia

Ahuja, U., Ahuja, D.B., Jain, R., Digvijay, S. N. and Narayan, P. (2016) Determinants of adoption of IPM in cauliflower cultivation. In: Haryana State Proceedings of the 10th INDIACom; INDIACom-2016, 2016.

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Birthal, P.S. (2016) Agricultural diversification for farmers' prosperity. Invited paper presented at the 4th International Agronomy Congress held at Indian Agricultural Research Institute, New Delhi, November 22-26, 2016.

Birthal, P.S. (2016) Agricultural research for rural prosperity. Science Forum 2016, United Nations Economic Commission for Africa, Addis Ababa, April 12-14.

Birthal, P.S. (2016) Doubling Farmers' Income. Seminar organized by NABARD at Vigyan Bhawan, New Delhi, July 12.

Birthal, P.S. (2016) Improving income of smallholder farmers through high value horticulture. Invited paper presented in the 7th Indian Horticulture Congress held at Indian Agricultural Research Institute, New Delhi, November 15-18.

Birthal, P.S. (2016) Innovations in marketing of livestock products in India. Conference of Indian Society of Agricultural Marketing, organized by Banaras Hindu University, Varanasi, October 20-22.

Birthal, P.S. (2017) Constraints to crop diversification & opportunities for achieving optimality. Lead paper presented at the National seminar on "NFSA & beyond: Challenges & Opportunities" organized by TCI-TARINA, Gurgaon, February 3.

Birthal, P.S. (2017) Enhancing farmers' incomes: Who to target and how? Lead lecture delivered at the India International Centre, New Delhi, organized by the Centre for Agricultural Policy Dialogue, New Delhi, March 8.

Immanuelraj, T.K. (2016) Trade off between food vis-a vis income security: A case of basmati cultivation in Punjab. Presented at the Policy Advocacy and Dissemination (PAD) workshops, Punjab Agricultural University, Ludhiana, November 10.

Immanuelraj, T.K. (2016) Linear Programming: An Introduction to optimization and GAMS. Presented at the winter school training, Division of agricultural economics, IARI, New Delhi, December 12.

Immanuelraj, T.K. (2016) Sugarcane cultivation in Maharashtra: Sustainability of irrigation water. Presented at the Policy Advocacy and Dissemination (PAD) workshops, Mahatma Phule Krishi Vishvavidyalaya, Rahori, Maharashtra, December 12.

Jain, R. (2016) International Conference on "Computing for Sustainable Global Development", 16th – 18th March, 2016 BharatiVidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi (INDIA).

Jhajhria, A., Kumar, S. , Balaji, S.J. and Singh, H.P. (2016) Price transmission in major onion markets of Uttar Pradesh. Presented at the 30th conference of Indian Society of Agricultural Marketing organized by Department of Agricultural Economics of Banaras Hindu University, Varanasi, October 20-22.

Kumar, S., Immanuelraj T. K., Nikam, V. R., Balaji, S.J., Joshi, V., Shah, S. A. and Kumar, A. (2016) An econometric analysis of structural factors of pulse production in India: A case of gram in Maharashtra. Presented at the AERA annual conference organized by ICAR-Indian Veterinary Research Institute, Izatnagar, December 15-17.

Nikam, V. R. and Kumar, S. (2016) Agriculture and extension policies in India: Connect and disconnect with nutrition. Presented at the AERA annual conference organized by 2016, ICAR-Indian Veterinary Research Institute, Izatnagar, December 15-17.

Nikam, V. R., Chinchmalatpure, A. R., Kad, S., Rao, G.G., Prasad, I, Kumar, S. and Camus, D. (2017) Performance and impact of salt tolerant wheat varieties on saline vertisols of Gujarat. Presented at the 5th National seminar on climate resilient saline agriculture: Sustaining livelihood security, SK Rajasthan Agricultural University, Bikaner, January, 21-23.

Saxena, R., Singh, N. P., Paul, R. K., Pavithra, S., Joshi, D., Zeeshan, Kumar, R., and Anwer, M.E. (2016) How evident are the potato price linkages among the Northern Hill and Plain markets?. Presented at the 31st National Conference on Agricultural Marketing, B.H.U., Varanasi, October 28-30.

Srivastava, S.K. (2016) Is there a convergence in the dietary energy intake among expenditure classes in India? Presented

at the 24th annual AERA conference on 'Agriculture for Nutritional Security' held at ICAR-Indian Veterinary Research Institute, Izatnagar, UP, December 15-17.

F. Abstracts

Balaji, S.J., Jhajhria, A., Kumar, S., Immaneulraj, T.K. and Kar, A. (2016) Agriculture - nutrition linkages : Preliminary investigation for rural India, *Agricultural Economics Research Review*, 29 (Conference Issue): pp.195.

Chand, S., Balaji, S. J., Kumar, D. and Lungkudailiu, M. (2016) Farmer's perception and adaptation strategies to mitigate the climate change: A case study of vulnerable areas of Rajasthan. *Journal of Andaman Science Association*, Conference issue : 199-200.

Chand, S. and Singh, S. (2016) Food and nutrition security in Andaman & Nicobar Islands. *Agricultural Economics Research Review*, Conference issue: 226.

Kumar, S., Immanuelraj, T.K., Nikam, V.R., Balaji S.J., Joshi, V., Ahmed, S. and Kumar, A. (2016) An Econometric analysis of structural factors of pulse production in India: The case of chickpea in Maharashtra, *Agricultural Economics Research Review*, Conference issue: 200.

VI ON-GOING RESEARCH PROJECTS

Sl. No.	Title of Research Project	Project Team
Institute Projects		
1.	Women Role in Agriculture and Gender Differential Perception of Trustworthiness	Usha Rani Ahuja Rajni Jain Sonia Chauhan
2.	Assessment of Technical Efficiency and Research Productivity of Wheat in India	T. K. Immanuelraj Sant Kumar
3	National Agricultural Innovation Fund	Rajesh Kumar Rana
4.	Assessing Impact of Bringing Green Revolution in Eastern India (BGREI) - A Case Study of Stress Tolerant Rice Varieties	Sant Kumar P. S. Birthal
5.	Institutional innovations for enhancing outreach and inclusiveness of livestock services: (June 2014 to April 2016). ICAR-NIAP institute funded project.	Subhash Chand P. S. Birthal Prem Narayan
Network Projects		
6.	Regional Crop Planning for Improving Resource Use Efficiency and Sustainability	Rajni Jain S. K. Srivastava T. K. Immanuelraj
7.	Network Project on Market Intelligence	Raka Saxena Pavithra S. Ranjit Paul
8.	Impact Assessment of Agricultural Research and Development	Shiv Kumar P. S. Birthal Jaya Jumrani S. K. Srivastava T. K. Immanuelraj Vinayak Nikam Balaji S.J.
External Funded Projects		
9.	Institutional Innovations in Irrigation Water Management Systems for Enhancing Efficiency and Inclusiveness of Stakeholder in Northern India	Subhash Chand Shiv Kumar N. Ravishankar R.C. Srivastava

10.	Mainstreaming Adaption Policies in Development Planning to Enhancing Resilience of Indian Agriculture	N. P. Singh Jaya Jumrani Pavithra S. Balaji S.J.
11.	Impact of ICT on Agricultural Education in India	Rajni Jain Pavithra S. Anshu Bhaedwaj Ranjit Paul
12.	Identifying Pathways of Socio-Economics and Socio-Personal Attributes and Study their Influence on Agricultural Performance Across Different Agro-Ecosystems in India	N. P. Singh S.K. Srivastava Balaji S.J.

VII CONSULTANCY AND CONTRACT RESEARCH

Name of scientist(s)	Institution to which consultancy provided	Area of consultancy / contract research
Usha Rani Ahuja N. P. Singh	WHO	A Study on Agro-Economics of Tobacco in India
Raka Saxena N. P. Singh	MCX, Mumbai	Evaluation of the Benefits of the Commodity Futures Market in the Cotton Ecosystem
Usha Ahuja V. R. Nikam	NABARD	Climate change, impact and adaptation: Gender perspective in Indian context

VIII RESEARCH ADVISORY COMMITTEE (RAC)

The Research Advisory Committee (RAC) of NIAP was constituted by the ICAR for a period of three years w.e.f. February 3, 2014. The composition of RAC is as follows:

Prof. S. Mahendra Dev (Chairman)
Director (Vice Chancellor)
Indira Gandhi Institute of Development Research
Mumbai – 400065

Dr Rajinder S. Sidhu
Dean
College of Basic Sciences
Punjab Agricultural University
Ludhiana, Punjab

Dr B. Gangiah
Economic and Statistical Adviser
Directorate of Economics and Statistics
Ministry of Agriculture
Department of Agriculture and Cooperation
New Delhi

Dr Bharat Ramaswami
Professor
Planning Unit,
Indian Statistical Institute
New Delhi – 110016

Dr K. Palanisami
Principal Researcher
International Water Management Institute
NASC Complex
New Delhi – 110012

Sh. Viswhasrao Anandrao Patil
P.O. Lohara, Taluq Pachora
Distt. Jalgaon
Maharashtra

Dr H. K. Srikanta
59/1, 8th Cross, 5th Main
R.K. Layout, Padmanabhanagar
Bangalore, Karnataka

Dr Suresh Pal (Ex-Officio)
Director
ICAR -National Institute of Agricultural Economics
and Policy Research
New Delhi – 110012

Assistant Director General (EQR)
Education Division
Indian Council of Agricultural Research
Krishi Anusandhan Bhawan-II
New Delhi-110 012

Dr Pratap S. Birthal (Member Secretary)
Principal Scientist
ICAR -National Institute of Agricultural Economics
and Policy Research
New Delhi – 110 012

Institute Research Committee

Institute Research Committee (IRC) of NIAP is comprised of Director NIAP and scientific staff of the institute. Director of NIAP is the chairman of IRC. Four meetings of the IRC were held during April – May, 2016 to review the annual progress of NIAP Scientists during 2015-16 and to discuss the new research proposals for 2016-17. A total of 17 number of presentations were made excluding 2 presentations on deputations to foreign visits.

IX INSTITUTE MANAGEMENT COMMITTEE

Institute Management Committee: The 26th Institute Management Committee Meeting was held on 10th March 2017.

Dr Suresh Pal
Director & Chairman
ICAR-National Institute of Agricultural Economics and Policy Research (NIAP)
New Delhi - 110 012

Director
Directorate of Economics & Statistics
Delhi State, Old Secretariat
Delhi – 110 054

Director (Economics & Statistics)
Deptt. of Planning
Yojana Bhawan, Govt. of Uttar Pradesh
Lucknow, Uttar Pradesh

Dr R.K. Grover
Director (HRM)
Haryana Agriculture University
Hisar, Haryana

Mr. Sanjay Kumar
R/o 187, Badarpur
New Delhi – 110 044

Mr. Jeet Ram Solanki
Ex. MLA, R/o H.No. 209
Pooth Kalanm
Delhi – 110 086

Dr Anil Rai
Professor and Head
Centre for Agricultural Bioinformatics
Indian Agricultural Statistical Research Institute (IASRI)
New Delhi – 110 012

Dr M.I. Krishnan
Head
National Academy of Agricultural Research Management (NAARM)
Rajendranagar, Hyderabad – 500 030
Telangana

Dr Harbir Singh
Principal Scientist
ICAR-Indian Institute of Farming System Research (IIFSR)
Modipuram, Meerut
Uttar Pradesh

Dr Amit Kar
Head
Division of Agricultural Economics
Indian Agricultural Research Institute (IAR)
New Delhi – 110 012

Assistant Director General (EQR)
Education Division
Krishi Anusandhan Bhawan – II,
New Delhi – 110 012

Director (Finance)
Indian Council of Agricultural Research (ICAR)
Krishi Bhawan
New Delhi – 110 001

Administrative Officer (Member Secretary)
ICAR-National Institute of Agricultural Economics and Policy Research (NIAP)
New Delhi – 110 01

X PARTICIPATION IN SCIENTIFIC ACTIVITIES

P.S. Birthal

- Agricultural research for rural prosperity. Invited lecture delivered in the Science Forum 2016 at organized by the CGIAR Independent Science and Partnership Council) at the United Nations Economic Commission for Africa, Addis Ababa, April 12-14, 2016.
- Panelist, National Seminar on Doubling Farmers' Income, organized by NABARD at Vigyan Bhawan, New Delhi on July 12, 2016.
- Keynote address :Innovations in marketing of livestock products in India. In the annual conference of Indian Society of Agricultural Marketing held at Banaras Hindu University on 20-22 October 2016.
- Improving income of smallholder farmers through high value horticulture. Invited Paper presented in the 7th Indian Horticulture Congress 2016 held at Indian Agricultural Research Institute, New Delhi on November 15-18, 2016.
- Agricultural diversification for farmers' prosperity. Invited Paper presented at the 4th International Agronomy Congress held at Indian Agricultural Research Institute, New Delhi November 22-26, 2016.
- Agricultural diversification and its impact on rural poverty. Invited Paper presented at the 99th annual conference of Indian Economic Association, held at Sri Venkateswara University, Tirupati, December 26-28, 2016.
- Constraints to crop diversification & opportunities for achieving optimality. Lead paper presented in the National Seminar on "NFSA & beyond: Challenges & Opportunities" organized by TCI-TARINA and IFS on February 03, 2017 at IFS Gurgaon.
- Enhancing farmers' incomes: Who to target and how? Lead lecture delivered at India International Centre, New Delhi, organized by the Centre for Agricultural Policy Dialogue, New Delhi. March 8, 2017.

Rajesh Rana

- 30th National Conference on Agricultural Marketing during 20 and 22 October 2016 at BHU, Varanasi, jointly organised by BHU, Varanasi and Indian Society of Agricultural Marketing, Hyderabad. Acted as Rapporteur for the Theme 1 'Status of Reforms in Agricultural Marketing in Different States' and prepared Rapporteur's Report.

Rajni Jain

- Inception-level Professional Training of the 2015 Batch of the IES Officer Trainees on Core Issues related to Agricultural Sector on 23 May 2016.
- Consultative workshop on "Methodological considerations for Impact Assessment of ICT on Agricultural Education in India" on 8-9 August, 2016 at NAARM Hyderabad.
- ERP implementation meetings at IASRI.

- 18th National Conference of Agricultural Research Statisticians at ICAR-Indian Institute of Farming Systems Research (IIFSR), Modipuram, UP organised during December 16-17, 2016.
- Annual review meeting of ICAR-extramural project on Impact of ICT on Agricultural Education in India, during 13-14 February, 2017 at Education division, ICAR, Krishi Anusandhana Bhavan 2, New Delhi.
- 4th International Conference on Computing for Sustainable Global Development organised during 01–03 March, 2017, New Delhi.
- Meeting of Assessment Committee for promotion of scientist as DG nominee, ICAR on 7 March, 2017 at ICAR-DMR, Solan.
- Institute Management Committee meeting, NIAP on 10 March, 2017.
- National Review Workshop of Farmer FIRST Programme (FFP) during 18-19 March, 2017 at NAARM, Hyderabad.
- Consultative workshop on synthesis of results under Impact Assessment of ICT on Agricultural Education in India, Education Division, ICAR, Krishi Anusandhana Bhavan 2 during 21-23 March 2017.

Subhash Chand

- Lectures delivered in a training programme "Marketing Research for Value Chain in Fruits" during 21 to 22nd February 2016 at SKAUT Jammu.
- Programmes and Policies for Fruit Production in India, lecture delivered in winter school organized by SKAUT, Jammu, December 2015.
- Watershed Programmes & Policies and Impact on Indian Agriculture: Concept & policy framework, lecture delivered in IES, training programme organized by ICAR-NIAP, New Delhi during (19-23 September 2016).
- Watershed Programmes & Policies and Impact on Indian Agriculture: Concept & policy framework lecture delivered during 21 days winter school 1-21 Nov. 2016 at Udhagmandalam, Tanmil Nadu.

Raka Saxena

- Saxena Raka, Naveen P. Singh, Ranjit K Paul, Pavithra. S, Deepika Joshi, Zeeshan, Rohit Kumar and Md. Ejaz Anwer. How Evident Are The Potato Price Linkages Among The Northern Hill and Plain Markets? Evidences and Implications. Paper presented in the 30th Annual Conference of Indian Society of Agricultural Marketing at BHU, Varanasi.
- Acted as the panellist in IFPRI Panel Discussion on Evidence based Policy for Growth of Indian Farm Income Doubling Farm Income: Policies and Strategies on 28th December 2016 at Tirupati.
- Evaluated Masters' thesis of four students of M.Sc. (Agricultural Economics), Punjab Agricultural University and conducted viva-voce examination on 28th April 2016.
- Evaluated Masters' thesis of two students of M.Sc. (Agricultural Economics), National Dairy Research Institute and conducted viva-voce examination on 21st July 2016.
- Guiding a student to complete Internship Project on Examining Trade Pattern, Composition and Opportunities in Agricultural Exports of SAARC Nations, from Sri Sri University, Cuttack.

Vinayak Nikam

- Basics of meeting online. In training "InformationCommunicationTechnologies Mediated Agricultural Extension" from 2-22 Aug, 2016, Division of Agricultural Extension, IARI, New Delhi.

Abhimanyu Jhajhria

- 30th National conference on Agricultural Marketing" of Indian Society of Agricultural Marketing held at BHU, Varanasi, 20-22 October, 2016.
- Official Language Conference of Northern Region of Department of Official Language, Ministry of Home Affairs held at Agra, 6th October, 2016.
- Workshop on "Official Language" held at NPL, New Delhi on 30th August, 2016, jointly organized by Town Official Language Implementation Committee and CSIR-National Institute of Science Communication and Information Resources.
- Launch event of the paper "*Fuel Blending in India: Learnings and Way Forward*" held at constitution club of India, New Delhi on 9th December, 2016 jointly organized by the University of Petroleum and Energy Studies, Dehradun, Centre for Study of Science, Technology & Policy, Bangalore and PLR Chambers, New Delhi.

S.K. Srivastava

- Presented research paper entitled "Is there a convergence in the dietary energy intake among expenditure classes in India?" 4th annual AERA conference on ' Agriculture for Nutritional Security' held at ICAR-Indian Veterinary Research Institute, Izatnagar, UP during 15-17 December, 2016.

S.J. Balaji

- Attended in-house workshop training organized at the institute (NIAP, New Delhi) on the research project "Impact Assessment of Agricultural Research and Development" (15th March, 2016).

XI VISITS ABROAD

Name of Scientist	Name of Training	Place	Duration
Suresh Pal	Paper presentation on India's research capacity: A response to the drivers of the structural change in India's food policy	Bangkok, Thailand	January 15-18, 2017
P.S. Birthal	Agricultural research for rural prosperity. Invited lecture delivered in the Science Forum 2016 at organized by the CGIAR Independent Science and Partnership Council	United Nations Economic Commission for Africa, Addis Ababa	April 12-14, 2016
Pavithra S.	Brainstorming workshop on Innovative Methods for Measuring Adoption of Agricultural Technology	Copley Place, Boston, USA	August 3-4, 2016

XII TRAINING AND CAPACITY BUILDING

Trainings organised by NIAP

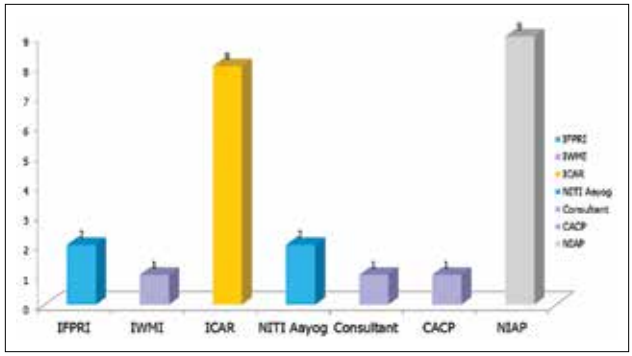
Title of the training	Duration	Category	Organizers
Inception-Level Training for Officer Trainees of the Indian Economic Service-2015 batch	23-27 May, 2016	Probationers	Usha R. Ahuja Rajesh K. Rana
Induction- Level Training for Officer of the Indian Economic Service	19-23 September, 2016	Inductees	Usha R. Ahuja Subash Chand Shiv Kumar
Diary & Dispatch, File Movement, Post (Dak) Delivery and Record Keeping	21 March, 2017	Skilled Supporting staff	Rajesh K. Rana V. R. Nikam

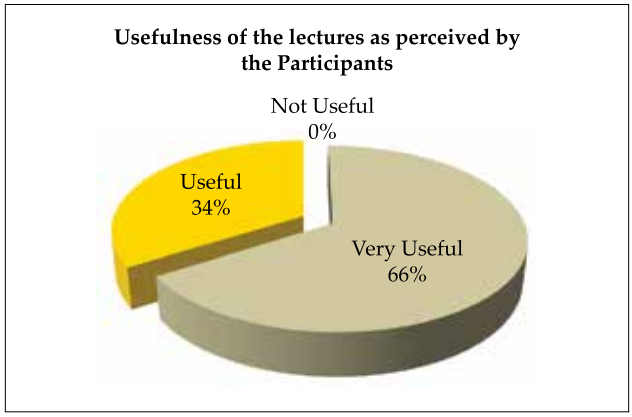
Training programmes for the officers of the Indian Economic Services (IES) were organised by ICAR-NIAP. The Inception Level Training Program for probationers during 23-27 May, 2016 and Induction Level Training for Inductees organized during 19-23 September, 2016. The programmes covered core issues related to agricultural sector. During the training programmes, twenty five topics on important issues related to core issues on agriculture were covered. Topic-wise pre-training and post- training assessment was carried out.

Induction- Level Training for Officers of the Indian Economic Service.

Post training knowledge level assessment: It was observed that they had mostly medium to low level of knowledge in most of the topics related to agriculture. The overall assessment indicated that about 67 % of total participants had medium level of knowledge while 33 % had low level of knowledge of core issues in agriculture.

Assessment of coverage of topics: ICAR-NIAP has invited resource persons were from national and international organizations. Trainee participants were of the opinion that the coverage of different topics with detailed deliberations were very informative and interesting. Most of them in opinion that 76% participants believed topics were well covered, while 24% of them rated as fairly covered well. Some of the participants were of the opinion that since duration of the training is short (5 days) only, number of topics should have been lesser. While others emphasized that exposure to more number of topics with the discussion on key policy has helped us in understanding the core issues.





Usefulness of training: Participants opinion on usefulness of the topics has indicated that 66% found topics most useful, followed by 34% considered as just useful no one has rated topics were not useful.

Network Projects "Regional Crop Planning for Improving Resource Use Efficiency and Sustainability"

Annual Review Meeting

The Annual review meeting of ICAR Social Science Network Project "Regional Crop Planning for Improving Resource Use Efficiency and Sustainability" was held on 24-25 June, 2016 at ICAR-NIAP, New Delhi. The meeting was attended by 22 participants from the collaborative centres. The meeting was started with welcoming address by Dr Rajni Jain, Principal Scientist and PI of the project at leading centre NIAP. The agenda of the meeting was to discuss and evaluate the progress of the project. All collaborators presented the results and progress achieved at their respective centres. All presentations were well received and followed by lively discussions. The problems in GAMS code, implementation of restrictions and calculation of input subsidy etc. were rectified during the training. The report format for final submission was discussed in detail with all the partners and finalised. It was suggested each centre should validate the model with respective state agricultural experts before dissemination of results. The partners may add other analytical details and tables as per the state requirements.

Brainstorming meetings

Brainstorming meetings were organised at the institute to discuss the problems, constraints, data limitations, region specific problems faced by the partners during the development of regional crop plan by the partners. General problems and model development issues were also discussed in the annual review meeting during 24-25 June 2016. Region specific model formulation related issues using linear programming framework were resolved for the partners in these meetings. The meetings were very helpful in building capacities for formulations of optimum crop model for the region. Five brainstorming meetings were organised during the year as per following schedule:

Date	Invited team for the Brainstorming meeting
18-20 August, 2016	DRCAU, Pusa, Samastipur
22-24 August, 2016	AAU, Jorhat
19-20 September, 2016	MPUAT Udaipur
28-30 September, 2016	MPKV, Rahori
14 October, 2016	PAU, Ludhiana

Policy Advocacy and Dissemination (PAD) workshops

PAD workshops aimed to share the findings of the optimum crop model developed for different regions with the state agricultural experts and the stake holders. Seven PAD workshops were jointly organised with respective project partner during the year as per the following schedules:

Date	Partner and Venue
10 November, 2016	Punjab Agricultural University, Ludhiana, Punjab
19 December, 2016	Maharana Pratap University of Agricultral Technology, Udaipur, Rajasthan
22 December, 2016	Mahatma Phule Krishi Vishvavidyalaya, Rahori, Maharashtra
04 January, 2017	Tamil Nadu Agricultural University, Coimbtore, Tamilnadu
25 January, 2017	Dr Rajender Prasad Central Agricultural University, Pusa, Samastipur, Bihar
28 January, 2017	Assam Agricultural University, Jorhat, Assam
30 January, 2017	University of Agricultural Sciences, Bengaluru, Karnataka

The workshops were attended by faculty from the respective departments, agricultural experts from the state, farmers and stakeholders. NIAP team presented the overview of the project and the partners presented the findings from the project. Comments and suggestions received during the workshops were used for further refining the models of the respective regions.

PAD workshop at PAU, Ludhiana on November 10, 2017.

Final Review Meeting

The Final Review Meeting of ICAR Social Science Network Project "Regional Crop Planning for Improving Resource Use Efficiency and Sustainability was held under the chairmanship of Dr Suresh Pal, Director, NIAP on 24-25 March, 2017 at ICAR-NIAP, New Delhi. The agenda of this meeting was to review the optimum crop model developed by all the project partners. Dr P S Birthal, National Professor, NIAP, Dr Anjani Kumar, Principal Scientist, NIAP, Dr N P Singh, Principal Scientist, NIAP, eminent economists were experts of the review meeting. The meeting was attended by 27 participants from seven collaborators and the lead centre. Dr S S Raju, Co-PI and former PI presented the background of the project. Dr Rajni Jain (PI), Dr S K Srivastava (Co-PI) and Dr Immamuelrej T.K. presented the common methodology developed for formulation of optimum crop plan in the project. Dr Suresh Pal, Director, NIAP extended a warm welcome to all network project collaborators and highlighted the expectations from the project. The results were by presented by PI/ Co-PI from Punjab Agricultural University, Ludhiana, Maharana Pratap University of Agriculture & Technology, Udaipur, Tamil Nadu Agricultural University, Coimbatore, Rajendra Prasad Central Agricultural University, Pusa, Mahatma Phule Krishi Vidyapeeth, Rahuri, Assam Agricultural University, Jorhat and University of Agricultural Science, Bengaluru. The presentations were well received and followed by lively discussion. Partners also shared their experiences while working in the project. The experts appreciated the results and also suggested ways for extending the research in future. The chairman expressed his satisfaction and recommended synthesis of the results. The meeting ended with thanks to the chair.

Network Project "Market Intelligence"

Final Review Workshop

The Final review workshopof the Network Project on Market Intelligence was held on 8-9 February 2017 at ICAR-National Institute of Agricultural Economics and Policy Research, Delhi. The workshop was organised to review the price forecasts including the dissemination mechanisms for the selected crops by the collaborating centres and also to discuss about other modalities regarding synthesis of the project and further institutionalization of market intelligence efforts. Dr. Suresh Pal, Director ICAR-NIAP, in his opening remarks, highlighted the need and importance of market intelligence in India and focused on the importance of the project in the context of how the farmer is making the use of this information for getting the benefits due to price forecasts. He highlighted that further methodological innovations in generating the price forecasts may further add precision. He emphasized that synthesis and conclusions based on market integration efforts will bring implications suitable for price policy. It was concluded that the project has made significant contribution in terms of research publications, policy inputs to the government and has rigorously contributed towards orientation and capacity building of the faculty and contractual staff employed in the project. The highlights of the project in terms of above achievements are as under:

1. ICAR-NIAP published a Manual on “Price Forecasting Techniques”, as a ready to serve material for use by the scientific fraternity working in the area of market intelligence.

Final review meeting of ICAR-SSN project held during 24-25 March, 2017.

2. Carried out methodological innovations for bringing in further precision in the price forecasts of highly volatile commodities like onion and potato

3. Published more than 40 research papers from the project in reputed journals and books

4. Published a number of popular articles for the benefits of stakeholders and also prepared documentaries

5. As onion price crisis in the country became much more pronounced and recursive, ICAR-NIAP provides inputs to NITI Aayog and prepared base paper on "Onion Price Crisis in India" with NITI Aayog, Govt. of India.

6. Along with other dissemination modes for the price forecasts, the forecasts were disseminated to the villages adopted under *Saansad Adarsh Gram Yojana*.

7. Stressed on continuous capacity building and methodological refinements: Organized a number of training programmes and capacity building programmes for the project partners and research team.

8. Prepared database of more than 2500 farmers for personal interaction, dissemination and follow-up

9. Carried out impact assessment analysis and assessed the impact of price forecasts on gains to the farmers along with their income

10. Organized stakeholder interface with onion farmers, traders and APMC Officials at Lasalgaon market

Final review workshop of ICAR-SSN project Market Intelligence held during 8-9 February, 2017.

As many policy and climatic variables influence the price forecasts, the methodological improvements for incorporating the effects of these objectively are the need of the hour. Revalidation also needs to be attempted specially for the volatile commodities, adjustments with respect to rainfall, policy changes for future development need to be incorporated while revalidation. Focus needs to be given to horticultural commodities like potato, onion tomato and others which are contributing significantly but are highly volatile at the same time. The holistic solutions will work better in these commodities along with price forecasts.

XIII TEACHING

Teaching: IARI PG Programs

Name	Course name (credit hrs)	Course Leader/ Associate	Division
Rajni Jain	Artificial Intelligence (2+1)	Course Leader	Computer Application
Rajni Jain	Rough Sets and Fuzzy Sets (2+1)	Course Associate	Computer Application
Rajni Jain	Seminar (1+0)	Course Assoicate	Computer Application
Shiv Kumar	International Trade (3+0)	Course Leader	Agricultural Economics
	Fundamentals of Business Management (3+1)	Course Leader	Agricultural Economics
N.P. Singh	Agricultural Marketing (2+1)	Course Associate	Agricultural Economics
S.K. Srivastava	Agricultural Marketing (2+1)	Course coordinator	Agricultural Economics
T.K. Immanuelraj	Agricultural production and Resource Economics-II (2+1)	Course Associate	Agricultural Economics
	Agricultural production and Resource Economics-IV (1+1)	Course Associate	Agricultural Economics
	Agricultural Price Analysis (2+1)	Course Leader	Agricultural Economics
Vinayak Nikam	Fundamentals of management in extension (2+1)	Course Associate	Agricultural Extension
	Advance Management Techniques (2+1)	Course Associate	Agricultural Extension
	Organizational Behaviour (2+1)	Course Associate	Agricultural Extension

Student Guidance

Name	Degree (No. of Students)	Division	Advisory Committee
Rajni Jain	M.Sc.	Computer Applications	Chairman
	M.Sc.	Computer Applications	Co-Chairman
	M.Sc.	Computer Applications	Member
Shiv Kumar	Ph.D (3), M.Sc. (1)	Agricultural Economics	Chairman
S.K. Srivastava	M.Sc.	Agricultural Economics	Member

XIV LECTURES DELIVERED BY NIAP SCIENTISTS

Name of Scientist	Topic and Date	Venue
P.S. Birthal	Agricultural research for rural prosperity, April 12-14, 2016	Science Forum 2016 United Nations Economic Commission for Africa, Addis Ababa
Rajesh Rana	Greater role of potato in development led changes in eating habits, In: Training Program for IES Officers, 23-27 May, 2016. Food and Nutritional Security in India: Why we should depend on potato? In: Training Program for IES Officers, 19-23 September, 2016. Potato and Mushroom for Ensuring Nutritional Security in India: Imperative Role of Ideal Marketing Mechanism, In: Panel Discussion on Role of Agricultural Marketing in Improving Nutrient Intake, 30th National Conference on Agricultural Marketing, 20 -22 October, 2016.	ICAR-NIAP, New Delhi ICAR-NIAP, New Delhi BHU
Usha Ahuja	Importance of Conservation Agriculture, In: Training Program for IES Officers, 23-27 May, 2016. Conservation Agriculture, In: Training Program for IES Officers, 19-26 September, 2016.	ICAR-NIAP, New Delhi ICAR-NIAP, New Delhi
Rajni Jain	TFP Trends in Indian Agriculture, In: Training Program for IES Officers, 19-23 September, 2016. Priorities for Human Resource Development in Computer Applications, In: 18th National Conference of Agricultural Research Statisticians, 16-17 December, 2016. Data Preprocessing Techniques, In: CAFT Training on Machine Learning Tools and Techniques for Agricultural Datasets for Knowledge Discovery, 3-23 August, 2016.	ICAR-NIAP, New Delhi ICAR-Indian Institute of Farming Systems Research (IIFSR), Modipuram, UP ICAR-IASRI, New Delhi

	Classification using Decision Tree, In: CAFT Training on Machine Learning Tools and Techniques for Agricultural Datasets for Knowledge Discovery, 3-23 August, 2016.	ICAR-IASRI, New Delhi
	Rough set Theory, In: CAFT Training on Machine Learning Tools and Techniques for Agricultural Datasets for Knowledge Discovery, 3-23 August, 2016.	ICAR-IASRI, New Delhi
	Applications of Rough Sets in Data Analysis, In: National Workshop on Fuzzy and Rough Sets for Knowledge Discovery, 5 – 9 September, 2016.	Jawaharlal Nehru University, New Delhi
	Computer Fundamentals, In: Training programme on E-governance in Indian Government, 15-16 December, 2017.	ICAR-NCIPM, New Delhi
Raka Saxena	Market Intelligence and Indian Agriculture, In: Training Program for IES Officers, 23-27 May, 2016.	ICAR-NIAP, New Delhi
	Market Intelligence and Indian Agriculture, In: Training program for IES Officers, 19-23 September, 2016.	
	Marketing Intelligence, Lecture to the faculty members of Punjab Agricultural University, Ludhiana, 28 April, 2016.	PAU, Ludhiana, Punjab
Sant Kumar	Prioritization of Agricultural Research in India, In: Training Programme for IES Officers, 19-23 September, 2016	ICAR-NIAP, New Delhi
S. K. Srivastava	Retrieval and Analysis of NSSO unit level data, In: CAFT Training on Quantitative Techniques for Agricultural Policy Research, 21 December, 2016.	Division of Agricultural Economics, ICAR-IARI, New Delhi
	Groundwater utilization and Energy Use Dynamics in Irrigation, In: Training Program for IES Officers, 19-23 September, 2016.	ICAR-NIAP, New Delhi
S. J. Balaji	Structural Breaks, Productivity Convergence and Role of Technology, In: CAFT Training on Quantitative Techniques for Agricultural Policy Research, 2016.	Division of Agricultural Economics, ICAR-IARI.
	Logistic Regression: Multinomial Approach, In: Training and Workshop on Data Analysis Tools and Approaches (DATA) in Agricultural Sciences.	ICAR-Indian Institute of Wheat and Barley Research, Karnal.

	Propensity Score Matching for Observational Data, Training and Workshop on Data Analysis Tools and Approaches (DATA) in Agricultural Sciences	ICAR-Indian Institute of Wheat and Barley Research, Karnal

XV TRAININGS, SEMINAR & CONFERENCE ATTENDED

Name of Scientist	Name of Training	Place	Duration
Rajesh Rana	Intellectual Property and Technology Management for Researchers (under IP&TM project)	ICAR-NAARM, Hyderabad	June 13-18, 2016
Subhash Chand	Conducted oral comprehensive examination of Ph.D student	Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu	October 14, 2016
	Conducted M.Sc. student final exam	Agricultural Business and Economics Division of SKUAT, Jammu	March 14, 2016
	Review meeting on Extramural Research project	SMD, NRM, ICAR, KAB-II	October 24, 2016
	Training organised for IES officers	ICAR-NIAP, Pusa, New Delhi	September 19-23, 2016
	Participated in IJAE conference	Assam agriculture University, Jorhat, Assam	November 21-23, 2016
Sant Kumar	National Seminar on Agricultural Marketing	BHU, Varanasi	October 21-23, 2016
	Impact Assessment of Agricultural Research and Development	ICAR-NIAP, New Delhi	March 15, 2017
Arathy Ashok	CAFT training on Enhancing Training and Teaching - Learning Competencies through Innovative Educational Methodologies and Instructional Technologies	Division of Agricultural Extension, ICAR-IARI, New Delhi	November 30, 2016 - December 20, 2016
Abhimanyu Jhajhria	Professional Attachment Training on Agriculture-Nutrition Linkages: A Preliminary Investigation for Rural India	Division of Agricultural Economics, Indian Agricultural Research Institute, New Delhi	May 11, 2016- August 10, 2016

Jaya Jumrani	CAFT on Quantitative Techniques for Agricultural Policy Research	ICAR-IARI, New Delhi	February 18, 2016-March 09, 2016
	Workshop on Difference in Difference and Propensity Score Matching methods under the SSNP-Impact Assessment	ICAR-NIAP, New Delhi	March 7-9, 2016
	Workshop on Measurement of Undernourishment and Severity of Food Insecurity	FAO, New Delhi	March 15, 2016
	Workshop on Multilevel modelling in health research using Stata	IIPH-Delhi	September 19-23, 2016
Vinayak Nikam	AERA Annual Conference 2016	ICAR-IVRI, Izatnagar, U.P.	December 15-17, 2016
Pavithra S.	Multilevel modelling in Health Research using STATA	IIPH, Delhi	September 19-23, 2016
	workshop on Methodological considerations for Impact Assessment of ICT on Agricultural Education in India	ICAR-NAARM, Hyderabad	August 8-9, 2016
M.S. Chauhan	Competency Development for Technical Officers	ICAR-NAARM Rajendranagar, Hyderabad	August 17-26, 2016
	Workshop of Nodal Officers of ICAR Research Data Repository for Knowledge Management	ICAR-IASRI, New Delhi	January 24-25, 2017
Sonia Chauhan	Competency Development for Technical Officers	ICAR-NAARM Rajendranagar, Hyderabad	August 17-26, 2016

XVI BUDGET

The expenditure of NIAP for the year 2016-17 is presented

Expenditure during 2016-17 (Rs Lakh)

Head of Account	Plan	Non-Plan	Total
Grants-in-Capital			
Equipment	6.53	0.00	6.53
Information Technology	10.53	0.00	10.53
Library Books and Journals	8.95	0.00	8.95
Furniture & Fixtures	0.52	0.00	0.52
Others	5.96	0.00	5.96
Total Capital	**32.49**	**0.00**	**32.49**
Establishment Expenses (Salaries)			
Establishment Charges	0.00	396.46	396.46
Total Establishment Expenses	**0.00**	**396.46**	**396.46**
Grants in Aid-General			
Pension & other Retirement benefits	0.00	21.32	21.32
Traveling Allowance	6.43	1.41	7.84
Research and operational Expenses	329.59	3.77	333.36
Administrative Expenses	123.94	2.43	126.37
HRD	2.26	0	2.26
Miscellaneous Expenses	2.66	0.83	3.49
Total Grants in Aid-General Expenses	**464.88**	**29.76**	**494.64**
Grand Total	**497.37**	**426.22**	**923.59**
Plan Scheme Projects	89.5	0.00	89.5
Others Project	15.79	0.00	15.79

XVII PERSONNEL

Scientific

Name	Designation
Dr Suresh Pal	Director
Dr P.S. Birthal	Principal Scientist
Dr Usha Rani Ahuja	Principal Scientist
Dr Rajesh K. Rana	Principal Scientist
Dr Anjani Kumar	Principal Scientist
Dr Rajni Jain	Principal Scientist
Dr Subhash Chand	Principal Scientist
Dr S.K. Pandey	Principal Scientist
Dr Naveen P. Singh	Principal Scientist
Dr Shiv Kumar	Principal Scientist
Dr Raka Saxena	Senior Scientist
Dr S.K. Srivastava (Deputation)	Scientist (SS)
Ms. Arathy Ashok	Scientist (SS)
Dr T.K. Immanuelraj	Scientist
Dr Vinayak Ramesh Nikam	Scientist
Mr. Sajesh V.K.	Scientist
Ms. Jaya Jumrani (Study Leave)	Scientist
Ms. Pavithra S.	Scientist
Mr. Balaji S.J.	Scientist
Mr. S V Bangaraju	Scientist
Dr Abimanyu Jhajhria	Scientist
Mr. Prabhat Kishore	Scientist

Technical

Name	Designation
Mr. Prem Narayan	Chief Technical Officer
Mr. Khyali Ram Chaudhary	Assistant Chief Technical Officer
Mr. Mangal Singh Chauhan	Assistant Chief Technical Officer
Mrs. Sonia Chauhan	Assistant Chief Technical Officer
Mr. Satender Singh	Senior Technical Assistant (Driver)

Administrative

Name	Designation
Ms. Neha Chandiok	Administrative Officer
Mr. Vinod Kumar Rai	Assistant Finance and Account Officer
Mr. Sushil Kumar Yadav	Assistant Administrative Officer
Mr. Inderjeet Sachdeva	Assistant
Mr. Sandeep Mathur	Assistant
Mr. Yatin Kohli	Assistant
Mr. Harish Vats	Assistant
Mr. Deepak Tanwar	Jr. Steno
Mr. Ajay Tanwar	UDC

Skilled Supporting Staff

Name	Designation
Mr. Mahesh Kumar	Skilled Supporting Staff
Mr. Mahesh Pal	Skilled Supporting Staff

XVIII OTHER INFORMATION

NIAP Annual Day

The Centre celerated its 24th Annual Day on 2 May, 2016. Prof. Ramesh Chand delivered 9th Prof. Dayanatha Jha Memorial Lecture on "Doubling farmers Income".

Glimpse of Silver Jubilee Celebration of NIAP

Promotion of Official Language (Rajbhasha)

According to Article 343 of the Constitution, Hindi shall be the Official Language (OL) of the Union Government. To implement the objectives in letters and spirit, NIAP is making consistent progress in the use of OL in agricultural research as well as in administration. An Official Language Implementation Committee (OLIC) was constituted by the Institute under the chairmanship of Director and the Committee ensures compliance of policy and rules of Official Language Act 1963 and Official Language rules of 1976. During the period under report, the meeting of this Committee was organized regularly in each quarter and necessary suggestions and instructions were given for promoting the use of Hindi in various official/research activities and the effective implementation of Official Language.

In order to motivate the staff members in different categories to do maximum work in Hindi, a Hindi Workshop on "*voice typing and google input tools*" was organized by the Institute. Dr Suresh Pal, Director inaugurated the workshop on 31st December 2016. In this workshop a lecture on "*voice typing and google input tools*" was delivered by Shri Kewal Krishan, senior technical director, NIC wing, Department of Official Language, Government of India.

Final day Workshop in Hindi Pakhwada

The Institute celebrated Hindi Pakhwada from September 14 to 30, 2016. Dr Usha Rani Ahuja, Director Acting inaugurated Hindi Pakhwada on September 14, 2016. On this occasion, a debate competition was also organized. Dr Aruna T. Kumar, Editor, Directorate of Knowledge Management in Agriculture, ICAR was invited to judge the competitions. During Hindi Pakhwada, various other Hindi competitions like essay writing, noting & drafting, quiz, etc. were also organized for all categories of the staff members to promote the use of Hindi. Hindi Pakhwada ended with poem recitation competition. Dr Usha Rani Ahuja, Director Acting, NIAP, chaired the session, Smt. Sujata Jethi, Director (Official Language), ICAR, Krishi Bhawan, New Delhi was chief guest. All the participants recited their poem with enthusiasm. The chief guest appreciated all the participants and he accolade the level of poetry delivered by the staff and encouraged to do more work in Hindi. Smt. Ranjana Agarwal, Poetess, Ex. Employee of IASRI, New Delhi was invited to serve the crucial role of Judging and to decide the winners of poetry competition. In last Dr Usha Rani Ahuja, Director Acting, and Chief Guest distributed the prize to winners. All the programs of Official Language were organised by Official Language Implementation Committee.

The details of events and prize winners were as follows:

S. No.	Events	Prize winners			
		First	Second	Third	Consolation
1.	Debate	Khyali Ram	M.S. Chauhan	Meenakshi	Vinayak Nikam
		Harish vats	Md. Ejaz Anwar		
2.	Speech (Non-Hindi speaking)	Arathy Ashok	Lungkudailiu Malangmeih	Balaji S.J.	S.V. Bangararaju Tatipudi
3.	Essay writing	Sushil Kumar Yadav	Ajay Tanwar	Ganesh Haldhar	Yatin Kohli
		Harish Vats	Punit Sharma	Sashikant Sharma	Hema Joshi
4.	Popular article	Renu Martolia	Raka Saxena	Raka Saxena	S.K. Srivastava
					M.S. Chauhan
5.	Creative writing	Ajay Tanwar	Md. Ejaz Anwar	Renu Martolia	Sushil Kumar Yadav
		Harish Vats	Anupriya Mishra		Amit Kumar
6.	Dictation	Sonam Sahani	Sushil Kumar Yadav	Md. Ejaz Anwar	S.K. Srivastava
			Ajay Tanwar	Meenakshi	Anupriya Mishra
					Harish Vats
7.	Hindi translation	Ajay Tanwar	Deepak Tanwar	Sandeep Mathur	Yatin Kohli
				Inderjeet Sachdeva	Harish Vats
8.	Extempore	Harish Vats	Rajesh Kumar Rana	Rajni Jain	S.K. Srivastava
9.	Poster preparation	Sandeep Mathur	Bhavna Anand	M.S. Chauhan	Yatin Kohli
		Rani Vibhushita		Anupriya Mishra	
10.	Quiz	Team 5	Team 4		Vijay Kumar
11.	Noting and drafting	Ajay Tanwar	Harish Vats	Sandeep Mathur	M.S. Chauhan
				Yatin Kohli	
12.	Poem recitation	Harish Vats	Raka Saxena	Md. Ejaz Anwar	M.S. Chauhan
			Hema Joshi		Rani Vibhushita
13.	Special prize	Abimanyu Jhajhria and Ajay Tanwar			

राजभाषा में प्रकाशित अनुसंधान

मंगल सिंह चौहान, रजनी जैन एवं सोनिया चौहान, कृषि ऐप एक संजीवनी, गेहूं एवं जौ स्वर्णिमा आठवां अंक–2016, भा.कृ.अनु.प. – भारतीय गेहूं एवं जौ अनुसंधान संस्थान, करनाल, हरियाणा।

वी निकम, पी सिंह, सत्यप्रिया एवं संगीता उपाधाय, खेती मे दूसरी हरितक्रांति लाने हेतु मोबाइल का उपयोग, प्रसारदूत, 4:36–37।

Mera Gaon Mera Gaurav

Mera Gaon Mera Gaurav (MGMG) scheme of the government aims at fulfilling dream of lab to land by regular contact of scientist with the farmers in the village. Under this scheme three teams have been formed in the institute and these teams have selected 15 villages from Rohtak, Palwal and Mewat district of Haryana state.

List of teams formed in NIAP and selected villages

	Team 1	Team 2	Team 3
Name of scientists	1. Dr. Rajesh K Rana 2. Dr. Rajni Jain 3. Dr. Sant Kumar 4. Mr. Balaji 5. Dr. Abhimanyu Jhajhariya 6. Mr. Raju Tatipudi B	1. Dr. Shiv Kumar 2. Dr. P S Birthal 3. Dr. Subhash Chand 4. Dr. T.K. Immanuelraj 5. Mrs. Pavithra 6. Dr. Vinayak Nikam	1. Dr. Usha Ahuja 2. Dr. Anjani Kumar 3. Dr. N.P.Singh 4. Dr. Raka Saxena 5. Dr. S. K.Srivastava 6. Mrs. Aarthy Ashok
Villages	Nangli Pachanki Rakhota Jor Khera Khokiyaka Mandori	Bhagwati Pur Samar Gopal Pur Sunder Pur Gharothi Khareinti	Khori Sonari Jorasi Kallarpuri Chundika
Block	Palwal, and Hathin	Lakhan Majra and Rohtak	Tauru, Tawadu and Mewat
District	Palwal	Rohtak	Mewat

Activities organized under MGMG in villages

Teams have visited the villages and carried out various activities like baseline survey of the villages, interface meetings/ goshtis, demonstrations , trainings, mobile based advisories etc. Considering importance of ICT in transfer of technology, Mobile based advisories were also provided to 310 farmers on fifteen different topics. Literature support about Pradhan Mantri Fasal Bima Yojana and Cleanliness in agriculture also provided to 166 number of farmers.

Different activities carried out by the teams in selected villages

S. No.	Name of activity	No. of activities conducted	No. of farmers participated/benefitted
1.	Visit to village by teams	13	1058
2.	Interface meeting/*Goshthies*	33	818
3.	Demonstrations	02	55
4.	Trainings	02	100
5.	Mobile based advisories	15	319
6.	Literature support provided	04	166
8.	Awareness created	17	960

Linkages created: Team of scientists created linkages with Krishi Vigyan Kendra, veterinary livestock assistant, Agriculture department, Sehgal foundation, Banks, Farmers association, ATIC IARI etc. for proper functioning of the scheme and benefits of the farmers.

Awareness created: Scientists created awareness among the farmers about various things viz. Quality seed (wheat, mustard), Management of salt affected soils, Management and distribution of water in the village, Market price, forecasting, crop diversification, About various Govt. programs/schemes for farmers like Doubling Farmers Income, Crop Insurance, Soil Health Card, Pradhan Mantri Fasal Bima Yojna etc.; Healthy seed procurement process for Rabi crops; importance of cleanliness in agriculture.




Activities by MGMG team in selected villages.

Swachhta Pakhwada

ICAR-NIAP celebrated Swachhta Pakhwada from 16-31 October, 2016. All NIAP staff took an active part in the Swachhta Pakhwada activities. Swachhta pledge taken by all NIAP staff. This Institute conducted various activities in this Pakhwada for cleanliness which included, cleaning of NIAP campus, cleaning in common facilities like Library, AKMU, Committee Rooms, Auditorium, Lawn area etc. Farmers were also made aware of clean farming technology and make the best use of farm waste in Mera Gaon Mera Gaurav (MGMG) villages adopted by NIAP. All NIAP staff including scientific, technical, administrative and others were enthusiastically involved in these Swachhta activities. These activities were followed on a regular basis.

NIAP Staff on Swatch Bharat Mission

Yoga Day Celebration

Participation in ICAR Sports Meet

Saluting the Dignitaries during march pass

ICAR Zonal Sports Tournament for the year 2016 (relevant for ICAR-NIAP) was organised by the Indian Institute of Agricultural Research, Pusa, New Delhi during 8-11 November 2016. Twenty four sports persons from ICAR-NIAP participated in this competition. Ms Sonia Chauhan, Assistant Chief Technical Officer from the institute won two gold medals (Chess and Carom Board for women) and two bronze medals (100 metre and 200 metre races for women). Besides this the institute performed very well in other sports like Table Tennis (men), Volleyball-Smashing (men) and Volleyball-Shooting (Men).

Promotions

- Merit promotion of Smt. Arathy Ashok, Scientist (Agricultural Extension) to the next higher grade of Scientist (Sr. Scale) w.e.f 25.10.2015
- Shri Mangal Singh Chauhan, Senior Technical Officer to the next higher grade of Assistant Chief Technical Officer (T 7-8) w.e.f. 05.04.2014

New Joining

- Dr Suresh Pal, joined as Director on 18.10.2016
- Dr Anjani Kumar, joined as Principal Scientist on 15.11.2016 (F/N)
- Mrs. Aarthy Ashok, joined as Scientist on 08.08.2016 (F/N)
- Shri Abimanyu Jhajharia, joined as Scientist (Agril .Economics) on 11.04.2016 (F/N)

- Shri S. V. Bangaraju, joined as Scientist (Agril. Economics) on 11.04.2016 (F/N)
- Shri Prabhat Kishore, joined as Scientist (Agril. Economics) on 14.10.2016 (F/N)
- Ms. Neha Chandiok, joined as Administrative Officer on 15.11.2016

Study Leave

- Ms. Jaya Jumrani, Scientist on study leave w.e.f. 09.08.2016 to Delhi School of Economics, University of Delhi and relieved on 08.08.2016 (A/N)

Superannuation

- Shri Jagan Swaroop, Administrative Officer, retired on 30 July 2016 (A/N) being Sunday on 31st July 2016