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भाकृअनुप – राष्ट्रीय कृषि आर्थिकी एवं नीति अनुसंधान संस्थान

ICAR - National Institute of Agricultural Economics and Policy Research

(Indian Council of Agricultural Research)

New Delhi 110 012

Annual Report 2022-23

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Preface

Indian agriculture is at crossroads, confronting several challenges, and opportunities as well. The ICAR-National Institute of Agricultural Economics and Policy Research (NIAP) has been consistently providing evidence-based inputs to research administrators and policymakers for informed decision-making to overcome the challenges and to harness the opportunities. Besides, the Institute also contributes to capacity-building of social scientists engaged in agricultural economics and policy research through workshops, seminars, lectures, brainstorming sessions, partnerships, collaborations and networking.

During 2022-23, the Institute has undertaken several studies on leading issues in agriculture. The main research activities include identification of key sources of growth, trends in varietal development, economic impacts of improved technologies, practices, and information, production and disease forecasts, supply response of oilseed crops, regional disparities in fertilizer consumption, agricultural subsidies, and farm-level investments, implications of Ukraine-Russia war for Indian agriculture, prospects for export promotion and import substitution, impacts of climate change on agricultural production, productivity and risk benefits of financing agriculture, water-energy nexus and its implications for food production, economics of crop diversification, valuation of ecosystem services, managing food price volatility, monetary policy and agricultural prices, and price transmission along food supply chains. Importantly, the Institute has undertaken an exercise on outlook for wheat and rice to predict their area, production, consumption, and exports to 2030-31.

The Institute has been proactively engaged in policy interactions on issues related to agriculture and rural development. The ICAR-NIAP is a knowledge partner of the Ministry of Agriculture and Farmers Welfare and has contributed towards developing a framework for doubling farmers' income. It has functional linkages and partnerships with NITI Aayog, CGIAR centres, State Agricultural Universities, and ICAR Institutes. On the capacity-building front, the Institute conducted several training programs in advanced quantitative techniques for impact assessment and policy analysis.

The Institute has received exceptional support from the Indian Council of Agricultural Research. I am grateful to Dr. Himanshu Pathak, Secretary, Department of Agricultural Research and Education & Director General, ICAR, and Mr. Sanjay Garg, Secretary, ICAR, for their guidance and support for smooth functioning of the Institute. I am equally thankful to Dr. R.C. Agrawal, Deputy Director General (Education), ICAR, for his continuous support. I place on record my sincere gratitude to the members of the Research Advisory Committee and the Institute Management Committee for their cooperation and suggestions. Lastly, I am thankful to my colleagues, Dr. Khem Chand, Dr. Arathy Ashok, Dr. Purushottam Sharma, Dr. Vinayak Nikam, Mrs. Sonia Chauhan, Dr. Jaya Jumrani, Dr. Sant Kumar, Dr Vikas Kumar, and Mr. Deepak Tanwar for their efforts in compiling, collating and editing this report.

Date : July 10, 2023

Pratap Singh Birthal
Director

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List of Acronyms

AAU	Assam Agricultural University
ACZs	Agro-Climatic Zones
ADB	Asian Development Bank
AEC	Allocative Efficiency Change
AES	Agricultural Economics Society
AF	Agroforestry
AgGDP	Agriculture Gross Domestic Product
AGMARKNET	Agricultural Marketing Information System
AHP	Analytic Hierarchy Process
AI	Artificial Intelligence
AKMU	Agricultural Knowledge Management Unit
ARDL	Autoregressive Distributed Lag
ATARI	Agricultural Technology Application Research Institute
AWD	Alternate Wetting and Drying
BE	Biennium Ending
BHU	Banaras Hindu University
CACP	Commission for Agricultural Costs and Prices
CAGR	Compound Annual Growth Rate
CAS	Current Awareness Service
CAZRI	Central Arid Zone Research Institute
CD	Compact Disk
CEO	Chief Executive Officer
CGIAR	Consultative Group on International Agricultural Research
CI	Composite Index
CIFOR	Center for International Forestry Research
CIRC	Central Institute for Research on Cattle
CIRG	Central Institute for Research on Goats
CISH	Central Institute for Subtropical Horticulture
CIWA	Central Institute for Women in Agriculture
CMFRI	Central Marine Fisheries Research Institute
CNN	Convolutional Neural Network
CPI	Consumer Price Index
CPRI	Central Potato Research Institute
CRIDA	Central Research Institute for Dryland Agriculture
CSCs	Common Services Centres
CSR	Corporate Social Responsibility
CWMR	Composite Water Management Report
DAHD	Department of Animal Husbandry and Dairying
DARE	Department of Agricultural Research and Education
DDGs	Deputy Director Generals
DDS	Document Delivery Service
DES	Directorate of Economics and Statistics
DG	Director General
DIC	Dairy Industry Conference
DIM	Dairy Impact Methodology
DMEO	Development Monitoring and Evaluation Office
DRMR	Directorate of Rapeseed and Mustard Research
DSR	Direct-Seeded Rice

DUVSAU	Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Anusandhan Sansthan
ECA	Essential Commodities Act
EFC	Expenditure Finance Committee
EH	Eastern Himalayan
e-HRMS	e-Human Resource Management System
ENVI	The Environment for Visualizing Images
EPH	Eastern Plateau and Hills
EPTD	Environment and Production Technology
EPW	Economic and Political Weekly
ERP	Enterprise Resource Planning
ES	Ecosystem Services
ESRI	Environmental Systems Research Institute
EU	European Union
FAO	Food and Agriculture Organization
FAVAR	Factor Augmented Vector Auto-Regression
FCI	Food Corporation of India
FMS	Financial Management System
FPOs	Farmer Producer Organisations
GAP	Good Agricultural Practices
GCA	Gross Cropped Area
GCF	Gross Capital Formation
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GHP	Good Handling Practices
GIDS	Giri Institute of Development Studies
GLM	Generalized Linear Models
GMP	Good Manufacturing Practices
GNP	Gross National Product
GPF	General Provident Fund
GVA	Gross Value Added
HR	Human Resource
HS	Harmonized System
HYPM	Half Yearly Progress Monitoring
IARI	Indian Agricultural Research Institute
IAS	Indian Administrative Services
IASRI	Indian Agricultural Statistics Research Institute
ICAAAS	Innovative and Current Advances in Agriculture and Allied Sciences
ICAR	Indian Council of Agricultural Research
ICBLE	International Conference on Blended Learning Ecosystems for Higher Education in Agriculture
ICMR	Indian Council of Medical Research
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFPRI	International Food Policy Research Institute
IGFRI	Indian Grassland and Fodder Research Institute
IGP	Indo-Gangetic plains
IIC	India International Centre
IIFSR	Indian Institute of Farming Systems Research
IIOPR	Indian Institute of Oil Palm Research
IIS&WC	Indian Institute of Soil and Water Conservation
IJSC	Institute Joint Staff Council

ILSP	Integrated Livelihood Support Project
IMC	Institute Management Committee
IMTA	Integrated Multi-Trophic Aquaculture
IoTs	Internet of Things
IPR	Intellectual Property Right
IRC	Institute Research Committee
IRR	Internal Rate of Return
ISAS	Institute of South Asian Studies
ISF	Irrigation Service Fee
ISO	International Organization for Standardization
ISSS	Indian Society of Soil Science
IT	Information Technology
IVRI	Indian Veterinary Research Institute
KU	Kasetsart University
KVK	Krishi Vigyan Kendra
KWh	Kilowatt Hour
LAN	Local Area Network
LGP	Lower Gangetic Plains
M.Sc.	Master of Science
MACE	Mainstreaming Agricultural Curriculum in School Education
MBA	Master of Business Administration
MCS	Multilevel Coordinate Search
MIS	Management Information System
Mkwhr	Mega Kilo Watt Hour
ML	Machine Learning
MoSPI	Ministry of Statistics and Program Implementation
MSP	Minimum Support Price
NAARM	National Academy of Agricultural Research Management
NAAS	National Academy of Agricultural Sciences
NABARD	National Bank for Agriculture and Rural Development
NAHEP	National Agricultural Higher Education Project
NARS	National Agricultural Research System
NASC	National Agriculture Science complex
NBPGR	National Bureau of Plant Genetic Resources
NDVI	Normalized Difference Vegetation Index
NHM	National Horticulture Mission
NIAP	National Institute of Agricultural Economics and Policy Research
NITI	National Institute for Transforming India
NMAM&T	National Mission on Agricultural Mechanization and Technology
NPK	Nitrogen, Phosphorus and Potassium
NPV	Net Present Value
NRAA	National Rainfed Area Authority
NRRI	National Rice Research Institute
NSSO-HCES	Household Consumer Expenditure Surveys of the National Sample Survey Office
O&M	Operation and Management
OECD	Organisation for Economic Co-operation and Development
OUAT	Odisha University of Agriculture and Technology
PCI	Principles Criteria Indicators
PERMISNET	Personnel Management Information System
PG	Post Graduate
Ph. D.	Doctor of Philosophy

PIMS	Project Information Management System
PME	Priority Setting, Monitoring and Evaluation
PMFBY	Pradhan Mantri Fasal Bima Yojana
PPV&FRA	Protection of Plant Variety and Farmers Right Act
PSPS	Policy and Strategy Processes Specialist
R&D	Research and Development
R&E	Research and Extension
RAC	Research Advisory Committee
RCP	Real Cost of Production
RFF	Reservoir Fish Farming
RIS	Research and Information System for Developing Countries
ROMs	Read Only Memories
RPCAU	Rajendra Prasad Central Agricultural University
RPI	Retail Price Index
RPS	Retention Price Scheme
RR	Response Ratio
RSCA	Revealed Symmetric Comparative Advantage
RTI	Right to Information
SAEA	Sri Lanka Agricultural Economics Association
SAMARTH	Sustainable Application in Mission Approach through Research and Technology Based Holistic Interventions
SAUs	State Agricultural Universities
SC	Schedule Caste
SERB	Science and Engineering Research Board
SKRAU	Swami Keshwanand Rajasthan Agricultural University
SKUAST	Sher-e-Kashmir University of Agricultural Sciences and Technology
SOC	Senior Officers' Committee
SRI	System of Rice Intensification
STMVs	Salt Tolerant Varieties
TBI	Trade Balance Index
TCS	Tata Consultancy Services
TE	Triennium Ending
TEC	Technical Efficiency Change
TERI	The Energy and Resources Institute
TFP	Total Factor Productivity
TGP	Trans Gangetic Plains
TNAU	Tamil Nadu Agricultural University
TOF	Trees Outside Forest
TOFI	Trees outside forests in India
TOP	Tomato, Onion and Potato
TVC	Total Variable Cost
UGP	Upper Gangetic Plains
UNFSS	United Nations Food Systems Summit
USA	United States of America
VAMNICOM	Vaikunth Mehta National Institute of Cooperative Management
VCs	Vice-Chancellors
VIT	Vellore Institute of Technology
WII	Water Institution Index
WPH	Western Plateau and Hills
WPI	Wholesale Price Index
WTO	World Trade Organisation
WUA	Water Users' Association

कार्यकारी सारांश

भा.कृ.अ.प.–राष्ट्रीय कृषि आर्थिकी एवम् नीति अनुसंधान संस्थान (निआप) ने राष्ट्रीय कृषि अनुसंधान प्रणाली (नार्स) में कृषि और नीति अनुसंधान को सबल बनाने की दिशा में निरंतर प्रयासरत है। यह संस्थान विश्वसनीय अनुसंधान आधारित साक्ष्य प्रदान करके भारतीय कृषि अनुसंधान परिषद् (भा.कृ.अनु.प.) को नीतिगत विचार–विमर्श में भागीदारी एवं निर्णय लेने में भूमिका निभाता है और परिषद् के प्रबुद्ध मंडल के रूप में कार्य करता है। संस्थान की अनुसंधान गतिविधियों को प्रमुख तीन विषयों–जैसेकि कृषि वृद्धि एवं विकास, प्रौद्योगिकी एवं टिकाऊ कृषि और कृषि विपणन एवं व्यापार में बांटा गया है। वर्षावधि 2022–23 के दौरान संस्थान की अनुसंधान उपलब्धियों तथा अन्य गतिविधियों का संक्षिप्त ब्यौरा निम्नानुसार हैः

अनुसंधान उपलब्धियाँ

कृषि वृद्धि एवं विकास

किसानों की आय बढ़ाने, समग्र आर्थिक वृद्धि को गति देने, पोषण में सुधार और गरीबी को कम करने के लिए कृषि वृद्धि में तेजी लाना आवश्यक है। नब्बे (1990) के दशक तक कृषि वृद्धि में तकनीकी बदलाव एवं कृषि विविधीकरण प्रमुख स्रोत थे, हालांकि समय के साथ कृषि वृद्धि के स्रोत्रों में बदलाव हुआ है। हाल के वर्षों में कृषि में वृद्धि प्रमुख रूप से इसके उत्पादों की कीमतों में वृद्धि के कारण हुई है और मूल्य आधारित कृषि वृद्धि अधिक समय तक कायम नहीं रह सकती हैं।

भारतीय कृषि ने कोविड–19 महामारी के दौरान काफी लचीलापन दिखाया है जिससे समग्र आर्थिक वृद्धि को गति देने में सहायता मिली है। इसके अलावा, कोविड महामारी के दौरान कृषि खाद्य पदार्थों के निर्यात में उल्लेखनीय वृद्धि हुई है साथ ही इसमें नये बाजार क्षेत्र एवं उत्पाद भी जुड़े हैं। लेकिन, कोविड महामारी के बाद अन्तर्राष्ट्रीय बाजारों में खाद्य सुरक्षा एवं गुणवत्ता की माँग बढ़ी है जोकि आधारभूत ढ़ाचे एवं आपूर्ति श्रृंखलाओं में अधिक निवेश तथा मानकों के अनुपालन एवं प्रतिस्पर्धी होने पर बल देते हैं।

कृषि वृद्धि के पूर्वानुमान पर एक अध्ययन दर्शाता है कि वर्ष 2036–37 तक कृषि में वृद्धि दर लगभग 4 प्रतिशत तक सीमित रहने की संभावना है। संभावित 4 प्रतिशत वृद्धि दर की प्राप्ति हेतु कृषि अनुसंधान में निवेश बढ़ाने, अधिक मूल्य वाली कृषि वस्तुओं की तरफ विविधीकरण, सार्वजनिक निवेश की दक्षता में वृद्धि, बाजारों में निवेश के प्रवाह में निरंतरता, मूल्य–श्रंखला और कृषि प्रसंस्करण को बढ़ावा देने की आवश्यकता है।

प्रक्षेत्र सहायता के रूप में आदानों पर सरकारी सहायता (सब्सिडी) एवं उत्पादों के न्यूनतम समर्थन मूल्य ने कृषि उत्पादकता, किसानों की आय बढ़ाने, खाद्य आपूर्ति प्रवाह एवं खाद्य सुरक्षा में महत्वपूर्ण भूमिका अदा की हैं। पिछले एक दशक में कृषि सब्सिडी पर व्यय लगभग दोगुना, वर्ष 2011–12 में 1.18 लाख करोड़ रूपये से बढ़कर वर्ष 2019–20 में 2.21 लाख करोड़ रूपये हो गया। इसके बावजूद किसानों को मिलने वाली सरकारी सहायता में क्षेत्रवार काफी विषमता है तथा इसकी पहुँच कुछ फसलों/जिंसों तक सीमित है। इसके अतिरिक्त कृषि सब्सिडी एवं समर्थन मूल्य के परिणामस्वरूप प्राकृतिक संसाधनों, यानी भूमि एवं जल के क्षरण एवं गुणवत्ता में गिरावट शुरू हो गयी है। इसलिए, पर्यावरण के अनुकूल प्रौद्योगिकियों और विधियों के लिए कृषि सहयोग पर जारी सरकारी सहायता में नीतिगत परिवर्तन आवश्यक है, जिससे कि कृषि सहयोग को पुनर्उद्देश्यित एवं तर्कसंगत बनाया जा सके।

प्रौद्योगिकी एवं टिकाऊ कृषि

कृषि वृद्धि में तेजी लाने के लिए प्रौद्योगिकी का अहम स्थान है। पिछले कुछ वर्षो में अधिसूचित फसल किस्मों की संख्या में उल्लेखनीय बढ़ोत्तरी हुई है लेकिन इसमें खाद्य फसलों की हिस्सेदारी अधिक है और दलहनी एवं तिलहनी फसलों की किस्मों की संख्या कम रही है। इसका तात्पर्य यह है कि कृषि अनुसंधान में तिलहनी एवं दलहनी फसलों पर अधिक ध्यान दिया जाना चाहिए, जिनकी देश में काफी वर्षों से कमी महसूस की जा रही है। विशेष रूप से तिलहनी एवं दलहनी फसलों की खेती, अनउपजाऊ भूमि तथा वर्षा आधारित क्षेत्रों/कम सिंचित क्षेत्रों में की जाती है। क्षेत्रीय अनुसंधान प्राथमिकताओं पर किये गये एक अध्ययन से प्रदर्शित हुआ है कि शोध संसाधन

आंवटन में काफी क्षेत्रीय असमानता है और पिछड़े क्षेत्रों में अनुसंधान पर अधिक ध्यान देने की आवश्यकता है।

उर्वरक कृषि में एक आवश्यक उत्पादन कारक है एवं इसकी खपत, कृषि वृद्धि दर की तुलना में तेजी से बढ़ी है। फिर भी, इसके उपयोग में काफी क्षेत्रीय असमानता विद्यमान है। सिंचित क्षेत्र एवं फसलें, उर्वरक की बड़ी मात्रा का उपयोग करते हैं। इसके अतिरिक्त वृहद पोषक तत्वों (NPK) के उपयोग में असंतुलन बढ़ा है और इनका असंतुलित प्रयोग बढ़ता ही जा रहा है जिसके कारण इनके अधिक प्रयोग से कम लाभ मिल रहा है।

नेटवर्क मोड में कुछ उन्नत प्रौद्योगिकियों एवं विधियों के प्रभाव आकलन का अध्ययन दर्शाता है कि इन प्रौद्योगिकियों पर किये गये निवेश से प्राप्त आय की दर अधिक एवं सार्थक है। पंजाब में धान के 10 प्रतिशत क्षेत्रफल (3.16 लाख हेक्टेयर) में धान की सीधी बिजाई विधि के अंगीकरण तथा 3 प्रतिशत अधिक उपज प्राप्त होने से 517.82 करोड़ रूपये की अतिरिक्त आय होती है। यदि अतिरिक्त उपज नहीं होती है तो भी धान की सीधी बिजाई विधि के अपनाने से पानी एवं बिजली की खपत में बचत से किसानों को लाभ होता है। तोरिया/सरसों की लवण सहिष्णु किस्मों के अंगीकरण का अध्ययन दर्शाता है कि यदि इन सहिष्णु किस्मों को लवण प्रभावित क्षेत्रफल के 15 प्रतिशत हिस्से में अंगीकृत किया जाता है तो वर्ष 2030 तक इनसे 6,500 करोड़ रूपये की अतिरिक्त आय हो सकती है। इसी तरह मवेशियों, बकरी, भेड़ और बैकयार्ड कुक्कुट पालन की उन्नत प्रजातियों के अपनाने से अधिक आर्थिक लाभ प्राप्त होता है। मुर्गियों की बंजारा एवं ग्रामप्रिया नस्लों के अपनाने से प्रतिवर्ष क्रमशः 583.53 करोड़ रूपये तथा 1125.39 करोड़ रूपये आर्थिक लाभ प्राप्त हुआ है। फ्रीजवाल गायों के अपनाने से 1326 करोड़ रूपये, जबकि बरबरी बकरी तथा अविशान भेड़ की उन्नत किस्मों के अंगीकरण से क्रमशः 1.13 करोड़ रूपये तथा 0.084 करोड़ रूपये की आय प्राप्त हुई।

प्रक्षेत्र स्तर से इतर द्वितीयक कृषि क्रियाओं में भी प्रौद्योगिकी बदलाव महत्वपूर्ण है। चीनी उद्योग के एक अध्ययन से पता चला है कि इस उद्योग की उत्पादकता वृद्धि में प्रौद्योगिकी बदलाव का प्रमुख योगदान रहा, जबकि स्केल एवं एलोकेटिव दक्षता का प्रभाव कम रहा जोकि नई मशीनों, मानव संसाधन विकास में निवेश और मूल्य नीतियों में सुधार की आवश्यकता का सुझाव देती है।

भारतीय कृषि के लिए जलवायु परिवर्तन बहुत गंभीर खतरा है। सिंधु–गंगा के मैदानी भागों में जलवायु परिवर्तन का कृषि पर प्रभाव विश्लेषण दर्शाता है कि सिंचाई के बढ़तें प्रयोग के बावजूद, जलवायु परिवर्तन से धान, मक्का, गेहूँ और बाजरा फसलों की उपज में काफी कमी आयेगी, जबकि कपास, चना और तोरिया–सरसों की उपज पर प्रभाव नगण्य या सीमित होगा। यह अध्ययन जलवायु परिवर्तन के प्रभाव को कम करने तथा उन्नत विधियों को अपनाने के लिए तकनीकी एवं वित्तीय सहायता की आवश्यकता का सुझाव देता है।

हालांकि जलवायु संबंधी आघात स्थानिक होते हैं लेकिन उनका प्रभाव स्थानिक सीमाओं से बाहर भी पड़ता है। बरसात के मौसम में कम बारिश का प्रभाव अधिक बारिश की तुलना में नकारात्मक रूप से ज्यादा प्रभावी होता है। इसी प्रकार, मानसून के बाद के दिनों में तापमान में वृद्धि का प्रभाव स्थानिक सीमा के बाहर भी प्रभाव डालता है। इन परिणामों का मुख्य निहितार्थ यह है कि जलवायु आघातों की स्थानिक निर्भरता की अनदेखी करने से कृषि में जलवायु परिवर्तन के प्रभाव को कमतर आंका जाता है और जलवायु परिवर्तन के प्रभावों की अधूरी जानकारी, जोखिम प्रबंधन रणनीतियों एवं लक्ष्यीकरण में खामियाँ पैदा कर सकती है।

उपज वृद्धि एवं जोखिम कम करने में सिंचाई एक महत्वपूर्ण कारक है। हालांकि, दिनोदिन जल की उपलब्धता दुर्लभ होती जा रही है, इसलिए क्षेत्रवार एक प्रभावी संरचना की आवश्यकता है। भूजल को निकालने के लिए बिजली आवश्यक है लेकिन सस्ती बिजली दर (बिजली पर सरकारी छूट/सहायता) से भूजल संसाधनों का अविवेकपूर्ण और अत्यधिक दोहन हुआ है। इसका निहितार्थ यह है कि सिंचाई एवं बिजली क्षेत्रों में सुधार की काफी आवश्यकता है।

भूजल संसाधनों पर दबाव कम करने के लिए चावल जैसी अधिक पानी चाहने वाली फसल के लिए कृषि में विविधीकरण एक विकल्प है। लेकिन वैकल्पिक फसलों का आर्थिकी विश्लेषण चावल फसल के समतुल्य नहीं बैठता है। इसलिए आवश्यकता इस बात की है कि वैकल्पिक फसलों की उपज में सुधार, मूल्य प्रोत्साहन और मुआवजा पैकेज के माध्यम से वैकल्पिक फसलों को चावल के समतुल्य लाभदायी बनाया जाए।

जलवायु सहिष्णु प्रौद्योगिकियों एवं विधियों को अपनाने तथा आर्थिक प्रोत्साहन से जोड़ने पर इससे प्राकृतिक संसाधनों के संरक्षण तथा सब्सिडी के बोझ को कम करने में मदद् मिलती है। कुछ प्रौद्योगिकियों/विधियों के पारिस्थितिकीय सेवाओं के मूल्यॉकन से पता चलता है कि धान की सीधी बिजाई, शून्य जुताई, कार्बनिक खाद, दलहनी फसलें और बायोचार आदि से उत्पन्न पारिस्थितिकीय सेवाओं से प्राप्त लाभ के आधार पर सब्सिडी को पुनर्प्रयोजित किया जा सकता है। कार्बन सीक्वेस्ट्रेशन को मापने के तरीके विकसित करने और इनकी निगरानी तथा कार्बन बाजारों के प्रमाणन के लिए मानकों की आवश्यकता है।

कृत्रिम बुद्धिमता और मशीन लर्निंग विधियाँ प्राकृतिक संसाधनों के संरक्षण, फसलोत्पादकता और फसलों के रोगों की घटनाओं को मापने, निगरानी एवं भविष्यवाणी करने में महत्वपूर्ण सिद्ध हुई हैं। साथ ही में इन विधियों से आर्थिक रूप से व्यावहारिक और पर्यावरण की दृष्टि से अनुकूल फसल योजनाएं विकसित करने में मदद् मिलती है।

विपणन, व्यापार एवं संस्थाएं

शहरी एवं ग्रामीण दोनों क्षेत्रों में खाद्य उपभोग के पैटर्न में झुकाव अनाज फसलों से अधिक मूल्य वाली खाद्य वस्तुओं की तरफ हो रहा है। हालांकि गरीबों की थाली में अभी भी अनाज खाद्य पदार्थो की अधिकता है। इसके बावजूद, पिछले वर्षों में खाद्य उपभोग में बदलाव कृषि में अनाज फसलों से इतर विविधीकरण की तरफ संकेत करता है।

खाद्य उपभोग में उभरते परिवर्तनों से संबंधित एक दृष्टिकोण अध्ययन से पता चला है कि वर्ष 2030–31 तक प्रौद्योगिकी बदलाव के अपनाने से भारत में चावल का उत्पादन बढ़कर 144.7 मिलियन टन होगा। इसी प्रकार, गेहूँ का उत्पादन 136 मिलियन टन तक बढ़ने की संभावना है जोकि घरेलू मॉंग से 25 मिलियन टन अधिक होगा। अध्ययन से संकेत मिलता है कि अतिरिक्त उत्पादन के लिए योजना बनायी जानी चाहिए साथ ही में गेहूँ तथा चावल फसलों के क्षेत्रफल को विशेष रूप से फलों, सब्जियों, तिलहनों एवं दलहनों की तरफ स्थानान्तरित करने के कार्यक्रम विकसित किये जाने चाहिए।

किसानों को कृषि विविधीकरण से लाभान्वित करने के लिए बाजार में उनकी पहुँच बढ़ाने की आवश्यकता है। चुनिंदा सब्जियों के थोक एवं खुदरा मूल्यों तथा प्रक्षेत्र के बीच नीचे से ऊपर की तरफ मूल्य संचरण असममित है, इसका निहितार्थ है कि मूल्य वृद्धि का लाभ उत्पादकों एवं उपभोक्ताओं से ज्यादा बिचौलियों को मिलता है। अध्ययन से पता चलता है कि कृषि वस्तुओं की कीमतें अस्थिर हैं जिनमें प्रमुख रूप से चावल, गेहूँ, सरसों, सोयाबीन, प्याज, टमाटर, सूरजमुखी और अनाज शामिल हैं। हालांकि सब्जियों की कीमतें अधिक अस्थिर तथा अनाज की कीमतें कमोवेश स्थिर रही हैं। कृषि उत्पादन में वर्षा एक प्रमुख कारक है इसलिए कीमतें एवं अस्थिरता महत्वपूर्ण निर्धारक हैं। अच्छी बारिश के कारण उत्पादन में वृद्धि होती है तथा कीमतों में गिरावट आती है, जबकि कम बारिश से उत्पादन घटता है जोकि कीमत में वृद्धि एवं अस्थिरता को बढ़ावा देते हैं।

भारतीय कृषि निर्यात बढ़ रहा है तथा कुल कृषि निर्यात में चावल, मत्स्य उत्पादों, भैस का मांस, कपास और मसालों की हिस्सेदारी लगभग 70 प्रतिशत है। कृषि वस्तुओं की निर्यात क्षमता के एक अध्ययन से प्रदर्शित होता है कि मछली, मांस, अनाजों, सब्जियों, चाय, काफी, मसालों तथा कपास के निर्यात बढ़ने की अधिक संभावना है। लेकिन इन कृषि पदार्थों में जीवनाशी रसायनों एवं दवाईयों के अवशेष और सूक्ष्म जीवों के संदूषण की उपस्थिति के कारण इनका निर्यात संभावित क्षमता से कम हुआ है। अच्छी उत्पादन तकनीकों/विधियों तथा अच्छी प्रबंधन विधियों के अंगीकरण के साथ–साथ भंडारण एवं प्रचालन तंत्र में निवेश बढ़ाकर कृषि वस्तुओं के निर्यात में सुधार किया जा सकता है।

हालांकि, कुछ कृषि उत्पादों जैसेकि चावल का निर्यात, प्राकृतिक संसाधनों, विशेष रूप से पानी के लिए हानिकारक है। चावल अधिक पानी चाहने वाली फसल है, और इसका निर्यात पानी की अधिक मात्रा समाहित करता है। एक अध्ययन से पता चलता है कि चावल की खेती के क्षेत्रों का पुनर्गठन करके पानी की क्षेत्रीय स्थिति एवं दोहन तथा चावल के निर्यात में समाहित पानी के आभासी निर्यात को कम किया जा सकता है।

भारत कृषि और खाद्य वस्तुओं के द्विपक्षीय व्यापार के अवसर तलाश रहा है। इस संदर्भ में कृषि निर्यात एवं

आयात के पिछले रूझान और तुलनात्मक लाभ की मात्रा एक महत्वपूर्ण मार्गदर्शक की भूमिका निभाते हैं। भारत और यूरोपीय संघ के बीच व्यापार प्रवाह के एक अध्ययन से निष्कर्ष निकलता है कि भारत, यूरोपीय संघ के लिए कृषि वस्तुओं का लगातार शुद्ध निर्यातक रहा है। यह भारत और यूरोपीय संघ के बीच मुक्त व्यापार समझौते पर विचार के लिए एक महत्वपूर्ण जानकारी (फीडबैक) है।

तिलहनों के घरेलू उत्पादन में भारी कमी के कारण, भारत अपनी खाद्य तेल माँग का लगभग 55–60 प्रतिशत हिस्सा आयात करता है। तिलहनों की आपूर्ति प्रक्रिया पर किए गए एक अध्ययन से उसके घरेलू उत्पादन में सुधार के लिए तकनीकी और नीतिगत हस्तक्षेप की आवश्यकता का पता चलता है।

अन्य गतिविधियाँ

वर्ष 2022–23 के दौरान, भाकृअनुप–निआप ने अपनी दूसरी कृषि विकास रिपोर्ट (2022–23), दो नीति पत्र, छः नीति संक्षेप और कई शोध पत्र उच्च श्रेणी की राष्ट्रीय और अंतर्राष्ट्रीय पत्रिकाओं में प्रकाशित किए हैं। इसके अलावा, पत्रिकाओं और समाचार पत्रों में कई लोकप्रिय लेख प्रकाशित हुए। संस्थान के वैज्ञानिकों ने जन संचार माध्यमों और नीतिगत चर्चाओं में बढ़–चढ़कर भाग लिया।

संस्थान ने जनवरी 2023 से कृषि में समकालीन मुद्दों पद एक नीति व्याख्यान श्रंखला शुरू की है। संस्थान ने नार्स के कृषि अर्थशास्त्रियों और सीमांत ग्रामीण समुदायों के लिए भी क्षमता निर्माण कार्यक्रम आयोजित किए। संस्थान, कृषि एवं किसान कल्याण मंत्रालय और नीति आयोग के लिए ज्ञानपरक साझेदार है, और कृषि कार्यक्रमों और नीतियों में सुधार के लिए उन्हें नीतिगत और तकनीकी आदान उपलब्ध कराता है। इसके अलावा, यह संस्थान केन्द्र सरकार के अन्य मंत्रालयों और राज्य सरकारों को भी साक्ष्य–आधारित नीतिगत जानकारी प्रदान करता है।

Executive Summary

The ICAR-National Institute of Agricultural Economics and Policy Research (ICAR-NIAP) plays the leadership role in strengthening agricultural economics and policy research in the National Agricultural Research System (NARS), and acts as a think tank of the Indian Council of Agricultural Research (ICAR) by providing credible research-based inputs to facilitate its participation in policy debates, and decision-making regarding resource allocation across commodities and regions. The research activities of the Institute are broadly classified into three core themes, viz., Agricultural Growth and Development, Technology and Sustainable Agriculture, and Markets, Trade and Institutions. The research outputs of the studies carried out under these themes in 2022-23 are summarized below:

Research Achievements

Agricultural Growth and Development

Fostering rapid growth in agriculture remains important for enhancing farmers' income, accelerating overall economic growth, improving nutrition, and reducing poverty. Until 1990s, agricultural growth was fueled by technological change and agricultural diversification. However, the growth engines have changed over time. The recent growth has been driven by increases in output prices. The price-driven growth, however, is unlikely to sustain in the long-run.

Indian agriculture has shown considerable resilience during the Covid-19 pandemic, providing a succor to overall economic growth. Also, agri-food exports experienced a significant growth during this period, and with a visible shift towards new commodities and markets. Nevertheless, post-Covid pandemic, the international markets have become more demanding of food safety and quality, suggesting more investment in infrastructure and supply chains for compliance and competitiveness.

A study on the forecast of agricultural growth reports that by 2036-37, growth in the agricultural sector is unlikely to exceed 4%. Even to achieve this level of growth, there is a need for more investment in agricultural research, acceleration in the pace of agricultural diversification towards high-value commodities, increase in the efficiency of public investment, and a continuous flow of private investment in markets, value chains, and agro-processing.

Farm support, in terms of input subsidies and minimum support prices for output, has played an important role in enhancing agricultural productivity, farmers' income, food supplies, and food security. Expenditure on agricultural subsidies almost doubled, from Rs. 1.18 lakh crore in 2011-12 to Rs. 2.21 lakh crore in 2019-20. Nevertheless, the farm support remains unequal across regions and farmers, and concentrated on a few commodities. Moreover, the subsidy and price support have started causing degradation to the natural resources, that is, land and water. It is, therefore, essential to change the policy stance, focusing on rationalization and repurposing of farm support towards eco-friendly technologies and practices.

Technology and Sustainable Agriculture

Technology is crucial for accelerating agricultural growth. Over time, there has been a significant increase in the number of notified crop varieties but disproportionately across crops, more of staple food crops and less of oilseeds and pulses. This suggests the need for a greater emphasis of agricultural research on oilseeds and pulses, in which the country is chronically deficit. Notably, these crops are cultivated mainly on poor soils in rainfed environments.

A study on regional research priorities also shows a considerable regional disparity in research resource allocation, suggesting a higher emphasis of research in regions lagging behind in agricultural development.

Fertilizer is an essential input in agriculture, and its consumption has grown at a rate faster than the rate of agricultural growth. Nevertheless, there exists considerable regional disparity in its use; irrigated crops and regions account for bulk of the fertilizer consumption. Besides, there is a considerable imbalance in the application of NPK, and the imbalance has increased over time leading to diminishing returns to their additional application.

A few studies carried out in a network mode on the impacts of improved technologies and practices have shown signifcant economic impacts. The adoption of Direct Seeded Rice (DSR) on 3.16 lakh ha (10% of paddy area) in Punjab can generate an additional Rs. 517.82 crores in case it results in yield advantage of 3%. Even if there is no yield advantage, DSR benefits farmers in terms of reduction in irrigation water and electricity use. An assessment of the impact of salt-tolerant varieties of rapeseed-mustard shows that by 2030 if adopted on 15% of the salt-affected land these may generate a surplus of about Rs. 6500 crores. Likewise, the adoption of improved germplasm of cattle, goat, sheep and backyard poultry has generated considerable economic benefits. The economic surplus from Vanjara and Gramapriya poultry breeds is estimated at Rs. 538.53 crores and Rs. 1125.39 crores per annum, respectively. From Frieswal cattle, the surplus is Rs. 1326.34 crores, while from Barbari goat and Avishan sheep it is estimated Rs. 1.13 crores and 0.084 crores, respectively.

Technological change is also important beyond the farm-gate for improving secondary agricultural processes. A case study on sugar industry has shown that the productivity growth has resulted primairly from technical progress and not much from improvements in scale and allocative efficiency, suggesting the need for price policy reforms, and for investment in new machines and human resource development.

Climate change is a significant threat to agriculture in India. An assessment of its impacts on agriculture in the Indo-Gangetic plains shows that despite the increasing use of irrigation, climate change will significantly reduce yields of paddy, maize, wheat and pearl millet. Its impact on cotton, chickpea and rapeseed-mustard is either insignificant or positive. Nevertheless, this study suggests the need for technical and financial support for adaption and mitigation in agriculture.

However, there is a spatial dependence in climatic shocks, and their impacts are felt beyond spatial boundaries. Deficit rains in the rainy season produce more significant cross-border effects than excess rains. Similarly, the excess temperature in the post-rainy season produces significant cross-border effects. The key implication of these results is that ignoring spatial dependence in climate in empirical analysis underestimates the impacts of climate change on agriculture; and, an incomplete understanding of the climate change impacts may engender imperfections in the risk management strategies and targeting thereof.

Irrigation is important for productivity enhancement and risk mitigation as well. Water, however, is becoming scarce, and therefore needs an effective governance across regions. Electricity is essential for pumping groundwater, but heavily subsidized electricity has led to injudicious and overexploitation of groundwater resources. This implies the need for reforms in irrigation and power sectors.

Diversification away from water-guzzling crops such as rice is another option for reducing pressure on groundwater resources. But the economics of alternative crops does not favor growing these crops in place of rice. The need is to make the alternative crops as profitable as rice through yield improvements, price incentives, and compensation packages.

Linking economic incentives to the adoption of climate-resilient technologies and practices helps preserve natural resources and reduce subsidy burden. The valuation of some practices for their ecosystem services shows that subsidies can be repurposed based on ecosystem services generated through technologies and practices, such as direct seeded rice, no-tillage, organic manure, legumes, and biochar. The need is to develop methods to measure carbon sequestration and its monitoring, and standards for certification in carbon markets.

Artificial Intelligence and Machine Learning can significantly contribute towards measuring the contribution of different practices towards preserving natural resources and forecasting crop yields and disease incidences, and hence in designing economically feasible and environmentally sound crop plans.

Markets, Trade and Institutions

The food consumption pattern has been undergoing a shift away from cereals to high-value food commodities, in both urban and rural areas. The food basket of the poor, however, remains dominated by staple foods. Nevertheless, the past changes in food basket indicate a need for accelerating the pace of diversification in agriculture away from staple cereals.

Given the emerging changes in food basket, an outlook exercise brings out that by 2030-31, driven by technological change, India's rice production will increase to 144.7 million tons, about 20 million tons more than its domestic demand. Likewise, production of wheat is projected to increase to 136 million tons, exceeding 25 million tons of its domestic demand. This suggests the need for planning for utilization of additional produce for exports, value added products, and feed, and also shifting area from rice and wheat to other crops, especially fruits, vegetables, oilseeds and pulses.

For farmers to benefit from diversification they need to be empowered in the market place. A study on the linkages between farm, wholesale and retail prices of selected vegetables indicates asymmetric price transmission from downstream to upstream of the value chains, implying that intermediaries benefit more from price rises than the producers and consumers. Prices of agricultural commodities are volatile, and these have become more volatile in case of rice, wheat, mustard, soybean, onion, tomato, sunflower, groundnut, and potato. Vegetable prices, however, are the most volatile, and cereal prices the least. Rainfall is an important input in agricultural production, and hence an important determinant of prices and volatility therein. Positive rainfall shocks lead to an increase production, and pull down prices, while negative shocks reduce production and fuel a rise in prices and volatility therein.

India' agricultural exports have been rising. Rice, fisheries products, buffalo meat, cotton, and spices comprise 70% of the export basket. An analysis of the export potential of different commodities indicates a significant scope for increasing exports of cereals, fish, meat, vegetables, tea, coffee, spices and cotton. Yet, their potential remains underexploited because of the presence of pesticide and drug residues, and microbial contamination. The adoption of good agricultural practices (GAP), good manufacturing practices (GMP), and good handling practices (GHP) together with investment in storage and logistics can help improve their exports.

Nevertheless, export of some commodities, such as rice, is detrimental to natural resources, especially water. Evidence from a study suggests realignment of rice cultivation to the regional endowment of water and the extent of its exploitation to reduce virtual export of water embedded in rice exports.

India has been exploring opportunities for bilateral trade in agriculture and food commodities. In this context, the past trends in commodity exports and imports and the degree of comparative advantages serve an important guide. A study on trade flows between India and the European Union shows that India has been as a consistent net exporter of many agricultural commodities to the European Union. This is an important feedback for consideration of Free Trade Agreement between India and the European Union.

India imports 55-60% of its edible oil demand because of significant shortfall in domestic production of oilseeds. A study on supply response of oilseeds suggests the need for technological and policy interventions to improve their domestic production.

Other Activities

During 2022-23, the ICAR-NIAP published its second Agricultural Development Report-2022-23, two Policy Papers, six Policy Briefs and several research articles in peer-reviewed national and international journals. Besides, many popular articles were published in magazines and newspapers. The faculty increasingly participated in mass media and policy debates.

The Institute started a policy lecture series on contemporary issues in agriculture in January 2023. It also organized capacity-building programs for agricultural economists and social scientists in the NARS, and also for the marginalized rural communities.

The Institute is knowledge partner of the Ministry of Agriculture and Farmers' Welfare, and NITI Aayog, and has provided policy and technical inputs to them for reforming agricultural programs and policies. Besides, it has also provided evidence-based policy inputs to other ministries and state governments.

1 ICAR-NIAP: An Overview

Vision

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

Mission

Strengthen agricultural economics research for providing economically viable, socially acceptable and environmentally feasible policy options for science-led agricultural growth

Mandate

- Agricultural economics and policy research on markets, trade and institutions
- Growth and development models for sustainable agriculture
- Technology policy, evaluation and impact assessment

The National Institute (formerly Centre) of Agricultural Economics and Policy Research (NIAP) was established in 1991 by the Indian Council of Agricultural Research (ICAR) to strengthen agricultural economics and policy research in the National Agricultural Research System (NARS), and to act as a think tank for the ICAR by providing credible research-based inputs to enhance its participation in policy debates and decisions. The Institute also to provide evidence-based inputs to NITI Aayog, Ministry of Agriculture and Farmers Welfare and other ministries of the Central Government, and the state governments.

In the past, ICAR-NIAP has significantly contributed to the growth of agricultural economics discipline. The expertise and research studies of the Institute have made remarkable contributions to understanding contemporary issues and challenges in Indian agriculture. It has guided the Council in prioritizing its research agenda to improve the efficiency, sustainability and equity of research investment. The Institute has made notable contributions in the areas such as assessment of the impacts of agricultural R&D, returns on investment versus subsidies, total factor productivity, climate change impacts and adaptations, sustainability of agri-food systems, management of groundwater resources, agricultural diversification, structural change in agriculture, international trade in agriculture, institutional innovations, crop insurance, impact of Covid-19 pandemic on Indian agriculture, market intelligence, commodity outlook, value chains of food commodities, price volatility and transmissions, market integration and demand forecasts. It strives to foster partnerships with national and international organizations for research on common economic and social problems, and directs the trajectory of agricultural growth through policy-oriented research and communication. Its vision and mandate focus on:

1. Policy studies on agricultural development issues through in-house, collaborative and consultancy research
    - R&D policy and technology management
    - Natural resource and environmental economics
    - Agricultural development, markets and trade
2. Strengthening agricultural economics and policy research
    - Capacity development through facilitation and networking

- Enhance ICAR's participation in policy decisions through policy dialogues and institutional linkages

Institute Activities

Research activities

Research activities at ICAR-NIAP are organized under two divisions *viz.*, *Technology and Sustainable Agriculture,* and *Agricultural Markets and Trade,* and one research unit *Agricultural Growth and Development.*

The research on sources and prospects of agricultural growth, farmers' income, subsidies, and research priorities is undertaken in the unit on *Agricultural Growth and Development*. Studies related to impacts of technologies, climate change, adaptation and mitigation, input-use, water management, valuation of ecosystem services, application of Artificial Intelligence (AI), database on rural households, farmer producer organizations and sustainable ecosystems are carried out in the division of *Technology and Sustainable Agriculture*. The division of *Agricultural Markets and Trade* focuses on studies related to price volatility, effect of monetary policy, and rainfall shocks on prices, price transmission asymmetries, price forecasts, agricultural exports, food safety, food consumption patterns, supply response, and commodity outlook.

These issues are addressed through in-house research and network research involving social scientists from the NARS.

Capacity building

The ICAR-NIAP plays a key role in building capacity of scientific human resources engaged in agricultural economics and policy research. Towards this, formal linkages have been established both within and outside the NARS through networking and training on advanced analytical skills. The Institute has also started a Policy Lecture Series on contemporary issues in agriculture for benefit of the social scientists in the NARS.

Policy interface activities and communication

The ICAR-NIAP contributes to policy formulation through participation of its faculty in policy dialogues, debates and committees of the central and state governments. The Institute regularly publishes Policy Papers and Policy Briefs on contemporary policy issues.

Organization and Management

The Director of the Institute is advised and assisted by several committees to manage research and administration. The Research Advisory Committee (RAC) guides in planning research capacity building, policy communication and research evaluation. Dr. H.K. Bhanwala, former Chairman, NABARD, is the Chairman of the present RAC. The Institute Management Committee (IMC) supervises functioning of the Institute. There are several internal committees to assist the Director in efficient management of the Institute. The Institute Joint Staff Council (IJSC) enables consultative decisions on safeguarding and promoting interests of the staff. The Institute also conducts regular meetings with its scientific, technical and administrative staff to discuss scientific and management issues. The organogram of the Institute is shown in Figure 1.1.

Information, Data and Facilitative Services

Agricultural Knowledge Management Unit (AKMU)

Agricultural Knowledge Management Unit (AKMU) maintains research-related databases. It contributes to the implementation of the advancements in information technologies. It

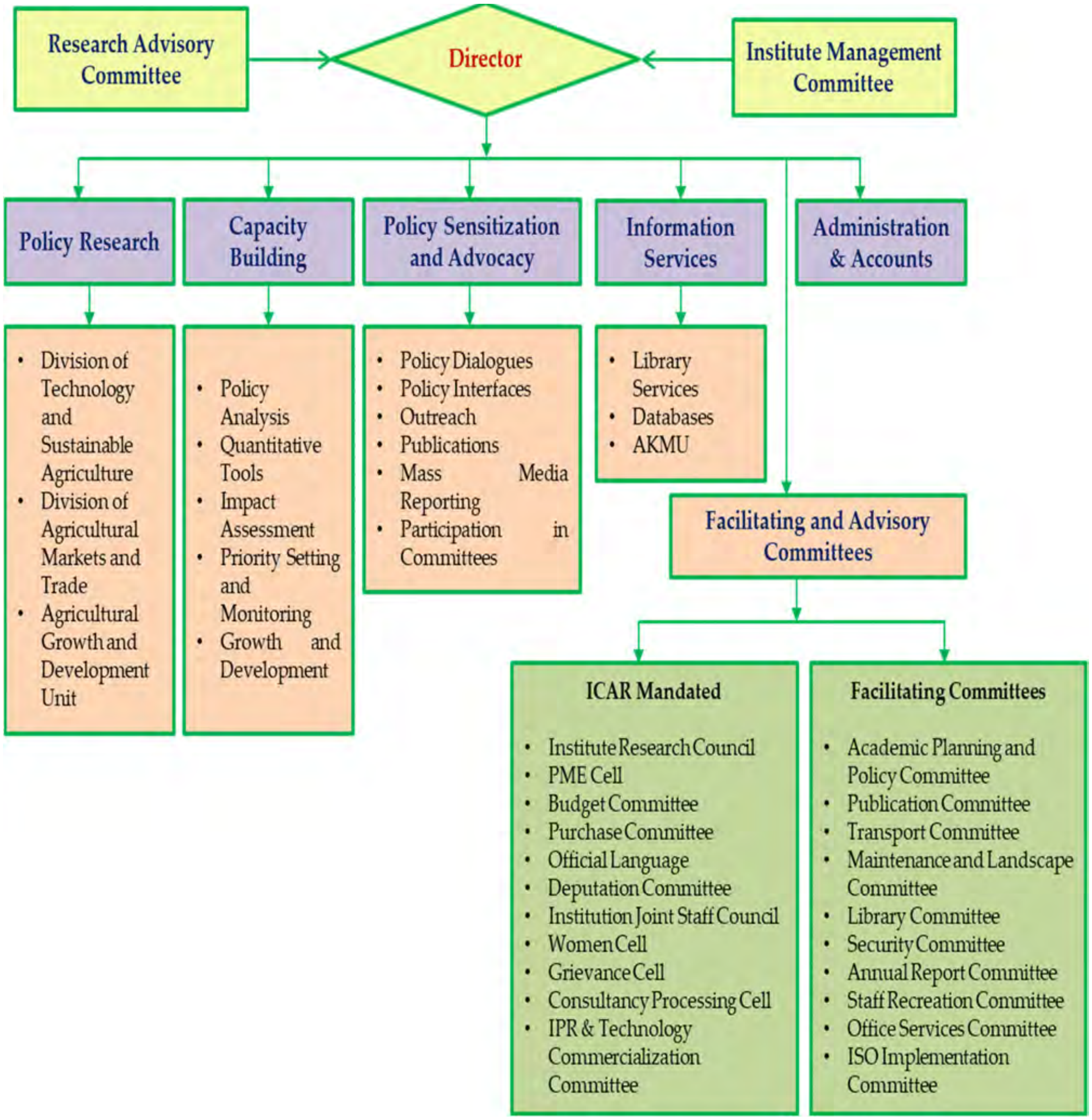


Figure 1.1: Organogram of the ICAR-NIAP

is equipped with state-of-the-art computers, servers, and a robust internet security, antivirus server, and econometric software.

All staff members have been provided with computers, software, LAN, internet access, and other essential computational resources. Further, AKMU consistently manages various information system (MIS) modules, including Financial Management System (FMS), Personnel Management Information System (PERMISNET), Project Information and Management System (PIMS), and Half Yearly Progress Monitoring (HYPM).

ICAR-NIAP website

The Institute takes pride in its website, https://niap.icar.gov.in/, available in English and

Hindi. It serves as a comprehensive platform to showcase the latest information and activities of the Institute. It provides details of all research projects, publications, employment opportunities, tenders, Right to Information (RTI) information, infrastructure, and staff profiles.

Weblog analytics show that users from 154 countries visited the website in April 2022 (Figure 1.2). On average, the website attracts 68 visitors and receives approximately 161 Flag Counter views every day.

Library

The library of the ICAR-NIAP has a collection of print, electronic and digital resources. It operates innovative information platforms; J-Gate and Consortium for e-Resources in Agriculture. The library houses books, journals, bulletins, CD-ROMs, databases, and research reports. It has a separate section for Hindi books. It timely disseminates scientific and technical information on research via Document Delivery Service (DDS), Current Awareness Service (CAS), Newspaper Clipping Service, and Resource Sharing Activities. Inter-library loan facility is also available on a reciprocal basis.

Exhibition-cum-record room

Research and other accomplishments of the Institute are displayed and documented in the Exhibition-cum-Record room. It displays research documents, publications, annual reports, recognitions and awards. Memories of all the important events organized by the Institute are displayed in the photo gallery.

ISO certification

To ensure the highest standards of quality and excellence, the Institute has successfully obtained ISO 9001:2015 (Figure 1.3). This highlights Institute's adherence to internationally recognized quality management practices.

Management Information System (MIS)

A Centralized Enterprise Resource Planning (ERP) system is fully functional at the ICAR-NIAP. This system includes projects, materials, human resources and financial management solutions. Various functionalities provided in these modules are as follows:

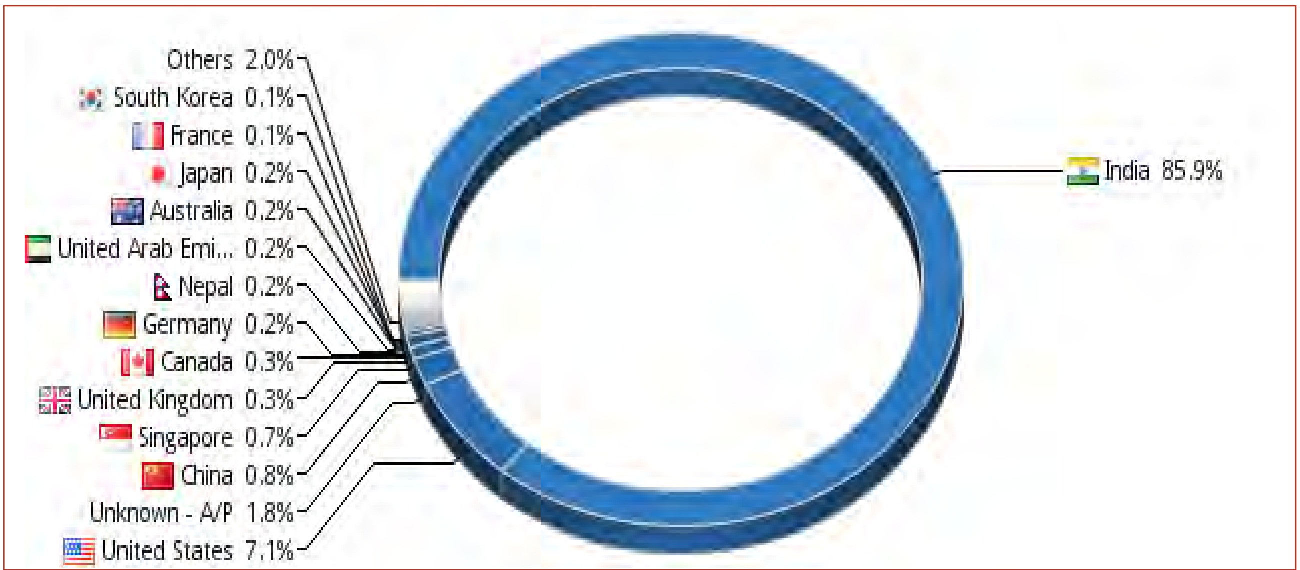


Figure 1.2: Worldwide distribution of visitors of ICAR-NIAP's website


DBS CERT

CERTIFICATE

This is to Certify that

Quality Management System

of

ICAR – NATIONAL INSTITUTE OF AGRICULTURAL ECONOMICS & POLICY RESEARCH (NIAP)
DEV PRAKASH SHASTRI MARG, PUSA, NEW DELHI – 110012, INDIA.

has been independently assessed by DBS
and is compliant with the requirement of:

ISO 9001:2015

For the following scope of activities:

PROVIDING RESEARCH ON ECONOMIC AND POLICY ASPECTS OF AGRICULTURE AND PROVIDING POLICY INPUTS TO STAKE HOLDERS AND CAPACITY DEVELOPMENT IN AGRICULATURAL ECONOMICS AND POLICY RESEARCH.

Certificate Number: Q-205022122804

Date of Certification:	28th December 2022
1st Surveillance Audit Due:	27th December 2023
2nd Surveillance Audit Due:	27th December 2024
Certificate Expiry:	27th December 2025

Head of Certification

UAF IAF

DBS CERTIFICATIONS PVT. LTD.

ACCREDITED BY :

Figure 1.3: ISO Certificate

- Financial management: Solutions for General Ledger, Account Payable, Account Receivable, Cash Management, Fixed Assets Management, Budget Management and Grants.
- Project management: Scope for Project Information, Costing, Project Documents, Contract Management and Collaboration of Project documents.
- **Material management**: Solutions for Purchase and Inventory Management.
- Human resource: Employees Information, HR Policies, Leave Management, Performance and Appraisal System.
- Payroll system: Salary, GPF, Pension Payment, Retirement Benefit Calculation and Income Tax Calculation Solutions.

ICAR-eHRMS at ICAR-NIAP

The ICAR-NIAP is committed towards successful implementation of the ICAR-eHRMS (Indian Council of Agricultural Research - e-Human Resource Management System). The ICAR-eHRMS is a comprehensive digital platform designed to streamline and automate human resource management processes. Through this system, the ICAR-NIAP plans for effective management of employee records, attendance, and leave applications amongst many others.

Human Resources

The staff position at the ICAR-NIAP during 2022-23 is given below in Table 1.1.

Table 1.1: Staff position at ICAR-NIAP during 2022-23 (as on 31.03.2023)

Name of the Posts	Sanctioned strength	In Position
RMP	1	1
Head of Division	2	0
Scientific	28	27
Technical	5	4
Administrative and Supporting Staff	15	10
Total	**51**	**42**

*Assistant Finance & Accounts Officer has been working against the post of Finance & Accounts Officer

2 Research Achievements

AGRICULTURAL GROWTH AND DEVELOPMENT

Growth prospects in Indian agriculture

Raka Saxena and Balaji S. J.

This study generated forecasts of agricultural Gross Domestic Product (GDP) for 2036-37 under three scenarios; *the best-growth scenario*, *the least-growth scenario*, and *the business-as-usual scenario*, considering Gross Capital Formation (GCF) in public and private sectors, institutional credit and fertilizer subsidy. If the trend since mid-1990s were to continue, the agricultural sector is projected to grow at an annual rate of 2.7 to 2.9%. This growth is expected to be lower considering the trend from mid-2000s.

Public sector capital formation has remained stagnant during the 1990s and it began rising thereafter. After a break in the late 2000s, it sustained a growth of 5.9%. Private investment has rather behaved the opposite, signaling a crowding-out effect during the post-reforms period. Institutional credit has consistently grown at an annual rate of 7.8%, while fertilizer subsidy has dropped considerably. In *the best-growth scenario*, the growth in capital formation is assumed to accelerate to 8% and no further hike in fertilizer subsidy. With these assumptions, agriculture can achieve a maximum 4% growth during 2021-37 (Table 2.1). In the *least-growth scenario*, the public capital is presumed to grow at slightly lower rate. During the 2010s, it grew at an annual rate of 5.9%. The forecast horizon is long, and the public investment growth is projected to grow more than 5%, and the private investment to grow 3.5% a year.

Table 2.1: Predicted growth in agriculture

Indicator	Period	Annual growth (%)	Potential impact on agricultural GDP growth (% p.a.)
Business as usual scenario			
GCF-Public sector	1983-2020	1.9	3.0
GCF-Private sector		4.8	
Institutional credit		6.4	1.0
Fertilizer subsidy		6.5	
Best-growth scenario			
GCF-Public sector	-	8.0	4.0
GCF-Private sector		5.0	
Institutional credit		8.0	1.0
Fertilizer subsidy		-	
Least-growth scenario			
GCF-Public sector	-	5.0	2.7
GCF-Private sector		3.5	
Institutional credit		3.0	0.4
Fertilizer subsidy		1.0	

Farmers' livelihoods: Insights from household surveys

Raka Saxena, S. K. Srivastava and Balaji S. J.

The study compares performance of various parameters related to farming and farm households utilizing data from three rounds of the Situation Assessment of Agricultural Households conducted in 2002-03, 2012-13, and 2018-19. The household income between 2012-13 and 2018-19 grew at an annual rate of 1.5%. The share of income from crops has declined. Much of the increase in household income has come from wages and animal farming. In 2018–19, wages contributed 40% to the household income, and followed by income from crops (37%). Jharkhand and Odisha were at the bottom of the income ladder in 2018-19. Other states which have considerably lower income are Bihar, Chhattisgarh, Telangana, Uttar Pradesh, and West Bengal. The income from crops has witnessed a negative growth of 2.72% between 2012-13 and 2018-19. Most states experienced modest or even negative growth in crop income.

Income from crops is negatively associated with landholding size, compelling the smallholders to diversify their income portfolio towards non-agricultural activities. There exists ample scope to promote non-farm economic activities, and animal farming. Livestock income has a high share in Punjab and Haryana, while Chhattisgarh, West Bengal, and Odisha have low income from livestock.

Large farmers (>10 hectares) invest 25 times more than what the marginal farmers (<0.4 ha) do. Smallholders invest more in livestock and poultry, while large farmers invest in farm machinery and implements. Thus, the financial institutions must extend short-term and medium-term credit for investment in animal husbandry, and long-term credit for mechanization of agriculture.

Farmers still rely heavily on local markets and *mandis* for sale of produce. Wheat and paddy are the main crops sold to procurement agencies at the government-decided minimum support prices (MSP). Effective implementation of market reforms and price support is needed to enhance farmers' income.

Sources of growth in Indian agriculture

Prem Chand, P. S. Birthal, Kiran Kumara T.M. and Pardeep Singh

Identifying sources of growth in agriculture is essential for targeting opportunities and alleviating constraints on future growth. Agricultural growth emanates from area expansion, yield improvements, price increases, and diversification. Prices have been the major driver of growth in Indian agriculture, particularly during 2000-01 to 2019-20. Technology contributed 39.25% until 1999-2000, but its contribution declined later on (Figure

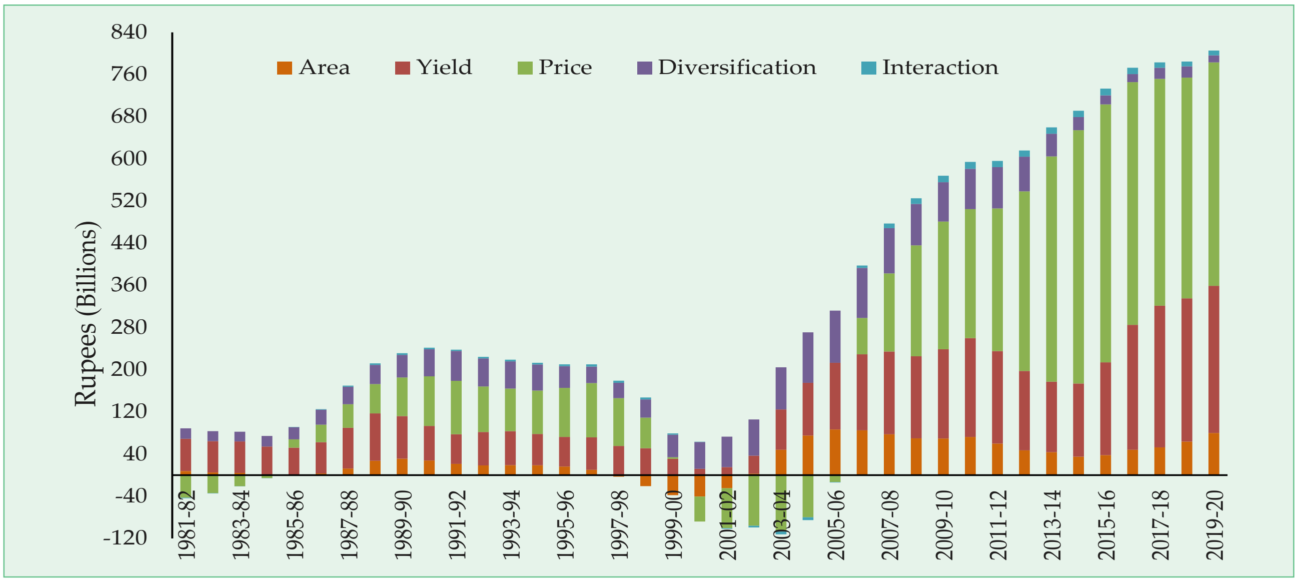


Figure 2.1: Contribution of various sources to growth in crop output in India

2.1). Close to half (47.66%) of the growth comes from horticultural crops.

Performance of Indian agriculture during Covid-19 lockdown

S.K. Srivastava, Raka Saxena, D. C. Meena and Purushottam Sharma

To contain the Covid infection, India imposed lockdown on March 24, 2020 and it remained in force till May 31, 2020. The lockdown was gradually relaxed. Due to the lockdown, gross value added (GVA) from non-agricultural sectors (at 2011-12 prices) declined by 16.2% during 1st and 2nd quarter (construed as "lockdown period") of 2020-21 as compared to 7.2% growth during 2011-12 to 2019-20 ("pre-lockdown period"). The output from agriculture decelerated from 4.1% quarterly growth during "pre-lockdown period" to 3.1% growth during "lockdown period". However, as compared to non-agricultural sectors, the growth in agriculture was positive during the lockdown period. On account of relatively better resilience, the share of agriculture in the total GVA increased from 13.5% (quarterly average) during pre-lockdown period (2011-12 to 2019-20) to 15.1% during lockdown period (2020-21, Q1:Q2) (Figure 2.2).

The economy revived post-lockdown (2021-22, Q1:Q2). The non-agricultural sectors grew at an annual rate of 15.3% as compared to the lockdown period (2020-21, Q1:Q2). This along with 2.7% growth in agriculture resulted in 13.2% growth in overall economy. It is to be noted that the adverse effect of lockdown on output was limited to 1st and 2nd quarter of 2020-21. During 3rd and 4th quarters of 2020-21, the level of output (at 2011-12 prices) from non-agricultural sectors was 3.99% higher over corresponding quarters of the previous year. Further, although agricultural output did not decline during the lockdown period, its growth slowed down and did not attain its previous level afterwards.

Food and agricultural subsidies in India

S.K. Srivastava, P. S. Birthal and Prabhat Kishore

Farm support, input subsidies and MSP for produce, plays an important role in enhancing agricultural productivity, farmers' income, food

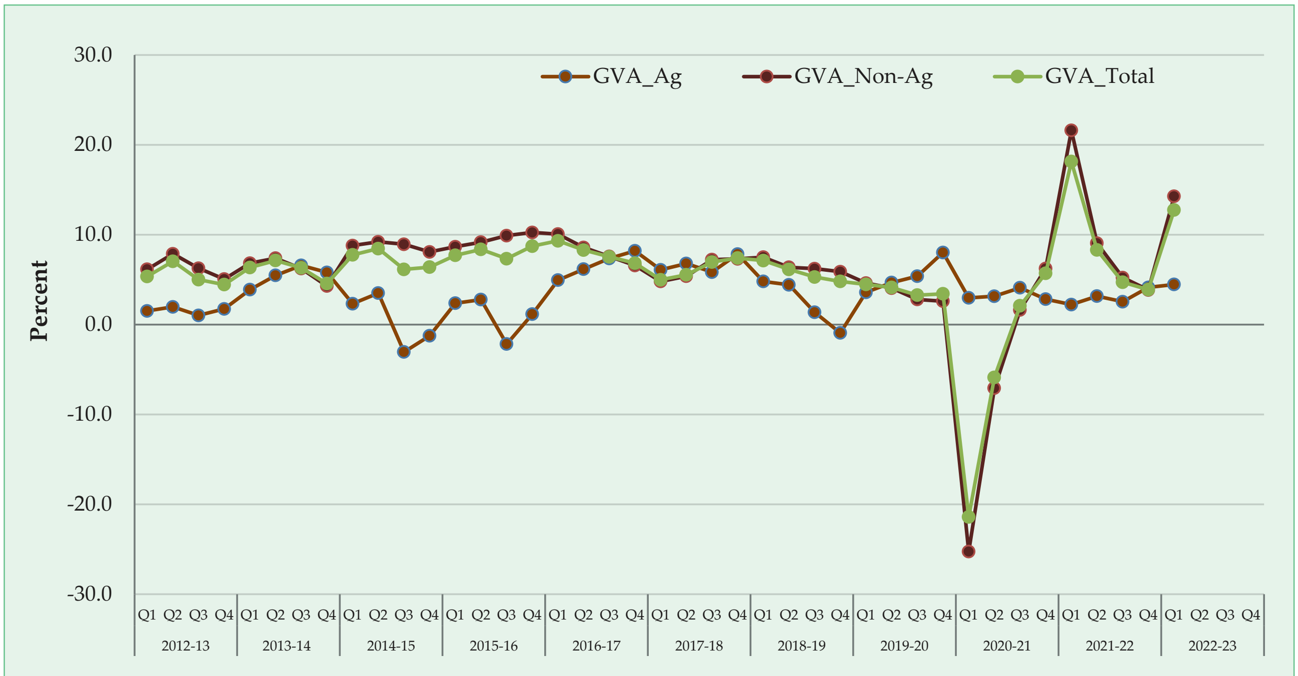


Figure 2.2: Quarterly growth in gross value added (at 2011-12 prices)

supplies and food security. In 2019-20, about six lakh crore rupees were spent on subsidies, about 1.7 times more than in 2011-12 (Table 2.2). Of the total public expenditure on subsidies, the fertilizers, power, short-term credit, and other agricultural inputs accounted for 37.1%, and the food subsidies 18.3%.

In the total agricultural subsidy, fertilizer and power subsidies have almost a similar share, i.e., about 37%, and the interest subvention on short-term credit 7.3%. The expenditure on subsidies on fertilizer and credit is borne by the central government, while the subsidy on power is provided by the state governments. On per

Table 2.2: Trend in food and agricultural subsidies in India

Rs. crore (current prices)

Year	Food subsidy	Agricultural subsidy*	Total Subsidy#	Share in total subsidy (%)	
				Food	Agriculture (incl. power)
2011-12	76920	118063	351614	21.9	33.6
2012-13	90915	131996	415353	21.9	31.8
2013-14	99825	127600	417893	23.9	30.5
2014-15	125218	138689	464334	27.0	29.9
2015-16	129990	164130	460608	28.2	35.6
2016-17	110173	158994	465402	23.7	34.2
2017-18	101282	194689	485880	20.8	40.1
2018-19	101327	205678	514942	19.7	39.9
2019-20	108688	220666	594288	18.3	37.1

*Includes fertilizer, power for irrigation, interest subvention on short-term credit, and others.

#Includes subsidies by Central and state governments on general public services, defence, public order & safety, economic affairs, environmental protection, housing & community amenities, health, recreation, culture & religion, education, and social protection.

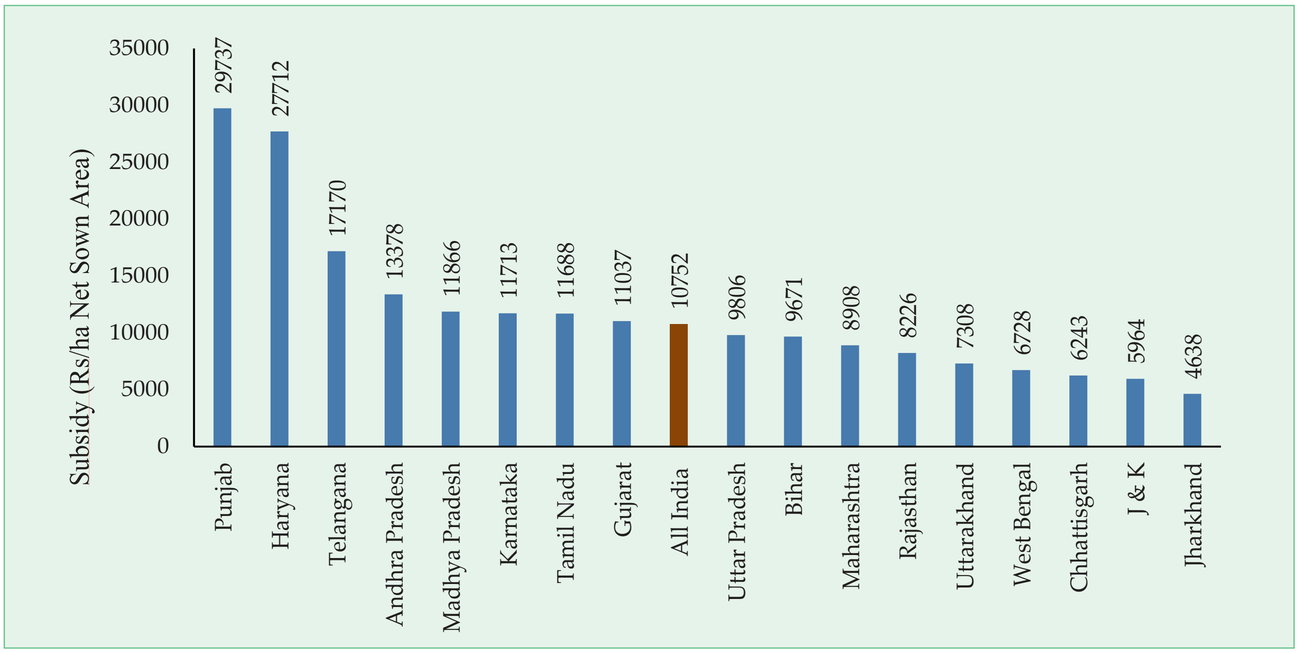


Figure 2.3: State-wise agricultural subsidy (fertilizer and power) during 2018-20

hectare basis, the expenditure on agricultural subsidies is estimated as Rs. 15835, equaling to 18.2% of the total input cost (including farm wages). Similarly, the food subsidy bill in India has increased by 41%, from Rs. 0.77 lakh crore to R.s 1.09 lakh crore between 2011-12 and 2019-20.

Consumption of inputs differs across states, and therefore the benefits of subsidies are disproportionately distributed at the sub-national level. Figure 2.3 shows state-wise expenditure on fertilizer and power subsidies per hectare of net sown area for the biennium ending 2020.

Although the subsidies are essential for farmers' welfare, its benefits are not equitably distributed across regions and farmers, and these are also not environmentally sustainable. Given the changing scenario towards nutritional security and sustainable food production system, it is essential to change the policy stance to rationalize and repurpose farm support.

R & D outputs in Indian agriculture

Ankita Kandpal

Patent Grants

During 2005 to 2021, the agriculture class 'A01' had 1675 patent grants, while 438 patents were granted in food class 'A23' and 109 patents in fertilizers class 'C05' by the Indian Patent Office. Total active patents from the ICAR were 335 and from the State Agricultural Universities (SAUs) these were 107 in 2021. ICAR was granted patents mainly for chemicals, including agrochemicals (23%), biotechnology (20%), engineering (19%) and food (11%). The average renewal term for ICAR patents is 10.9 years during a patent term of 20 years, while the average lag between patent filing and grant is 7.8 years. Patents from SAUs holds an average renewal term of 9.4 years and a grant lag of 8.6 years.

Table 2.3: Crop-wise number of notified varieties

Crops	1981-1990	1991-2000	2001-2010	2011-2020
Cereals				
Paddy	206	197	282	348
Wheat	75	68	103	117
Maize	46	61	111	122
Sorghum	61	50	46	42
Pearl millet	41	42	48	64
Barley	14	16	27	20
Pulses				
Chick pea	42	37	62	49
Green gram	37	32	44	36
Red gram/ *Arhar*	38	27	30	33
Black gram	18	27	26	41
Field pea	15	17	25	24
Lentil	10	13	19	27
Oilseeds				
Ground nut	42	39	60	42
Mustard	9	6	53	63
Soybean	26	24	32	39
Sesame	24	15	26	15
Sunflower	10	20	28	12
Linseed	19	7	20	32
Castor	11	14	12	10
Cotton	76	81	85	66

Notified varieties

The trend in the notified varieties for different crop categories is presented in Table 2.3. For cereals, there has been an increasing trend in the notified varieties of cereals. In case of paddy, these increased from 206 varieties in 1981-1990 to 348 varieties in 2011-2020. The number of wheat varieties also increased from 75 varieties to 117, and that of maize from 46 to 122. Notified varieties of chickpea and red gram saw a modest increase, while there was a significant increase in case of black gram. The notified varieties of groundnut and castor remained almost stagnant, while of mustard, soybean, and linseed experienced a significant rise.

Crop wise varieties certificates issued under PPV&FRA (2009-2021)

The highest number of certificates was issued for paddy, with 162 new varieties, 340 extant varieties and 1735 farmer's varieties. Private sector holds a dominant position in new varieties (except of wheat and chickpea). Certified varieties from public sector are largely extant varieties (except pearl millet, cotton and sunflower). About 67% of the certified varieties from public sector are from the ICAR. Nuziveedu seeds holds largest share (25%) in certified varieties from private sector, followed by Kaveri seeds (12%), Maharashtra hybrid seeds (6%) and Pioneer Overseas Corporation (6%) (Table 2.4).

Research Priorities in Indian Agriculture

S. V. Bangararaju Tatipudi, Raka Saxena and P.S. Birthal

It is widely recognized that agricultural research has helped increase productivity, improve food security and reduce food prices (in real terms) enabling millions of poor to have affordable access to food. However, now agriculture is facing complex challenges of declining factor productivity, degrading soil and water resources, rising food and energy prices, and increasing frequency of extreme climatic events. On the other hand, resources for research are scarce; India spends only about 0.6% of its agricultural

Table 2.4: Registration certificates issued for crops under PPV&FRA, 2009-2021 (No.)

Crop	New varieties			Extant varieties			Farmer's variety	EDV	Total certificates issued
	Private sector	Public sector	Total	Private sector	Public sector	Total			
Paddy	137	25	162	85	255	340	1735		2237
Wheat	12	22	34	9	184	193	37		264
Maize	128	37	165	76	110	186	7		358
Sorghum	38	30	68	14	85	99	25		192
Pearl millet	67	0	67	65	46	111	1		179
Barley	0	0	0	1	17	18	7		25
Chickpea	0	2	2	0	45	45	18		65
Green gram	0	0	0	1	35	36	6		42
Pigeon pea	14	1	15	2	26	28	10		53
Black gram	0	0	0	1	30	31	2		33
Lentil	0	0	0	0	12	12	9		21
Groundnut	1	0	1	0	38	38	1		40
Mustard	3	1	4	16	64	80	20		104
Soybean	2	0	2	1	36	37	6		45
Sesame	0	0	0	0	10	10	1		11
Sunflower	39	0	39	20	7	27	0		66
Castor	2	1	3	4	4	8	0		11
Linseed	0	0	0	0	7	7	4		11
Potato	17	2	19	7	15	22	1		42
Cotton	143	7	150	227	90	317	1	14	482
Sugarcane	0	7	7	1	45	46	0		53

Note: EDV means Essentially Derived Varieties

Gross Domestic Product (GDP) on agricultural research, much less than in developed countries. These challenges call for a judicious allocation of scarce resources, so as to enhance research efficiency and improve food and nutrition security in a sustainable manner.

This study has assessed commodity and regional priorities for agricultural research taking into consideration the efficiency, equity and sustainability aspects. The ratio of proposed and existing share of expenditure on research and education indicates significant heterogeneity across states, with half of the states having existing share in research resources lower than the proposed share (Table 2.5).

Table 2.5: State-wise percent share of R&E expenditure (2021-22)

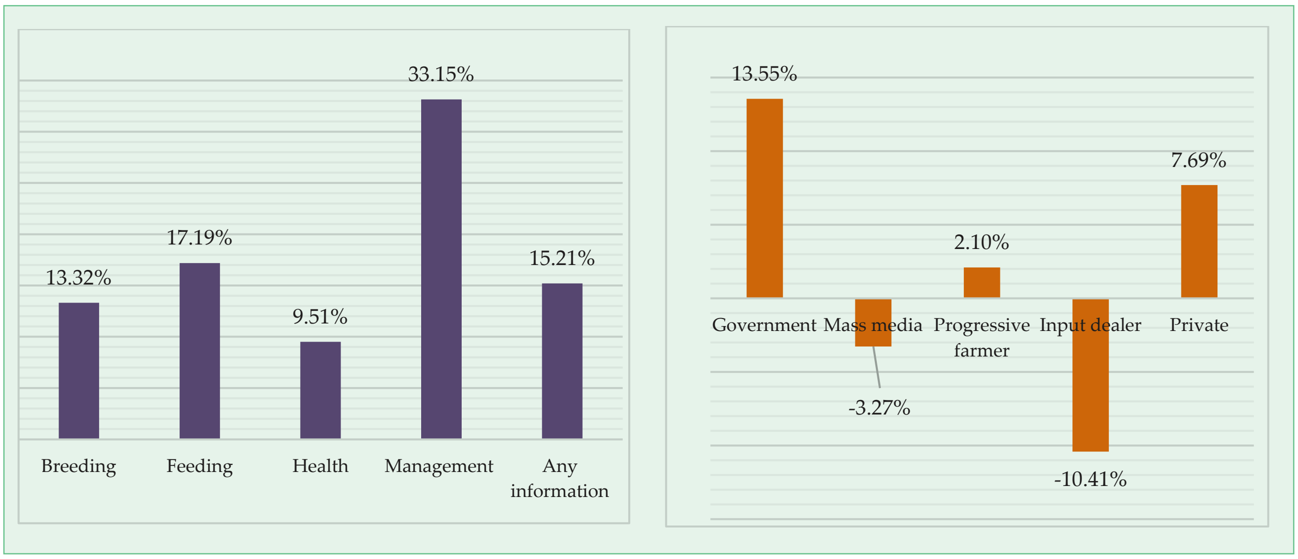
S. No.	States	Existing share of expenditure on R&E	Proposed	Deviation	Ratio (Proposed/ existing)
1	Andhra Pradesh	6.22	8.44	2.21	1.36
2	Arunachal Pradesh	0.07	0.22	0.15	3.24
3	Assam	4.04	1.51	-2.53	0.37
4	Bihar	4.95	9.05	4.11	1.83
5	Chhattisgarh	2.47	2.05	-0.42	0.83
6	Goa	0.05	0.07	0.01	1.24
7	Gujarat	6.48	4.47	-2.01	0.69
8	Haryana	6.04	1.64	-4.40	0.27
9	Himachal Pradesh	2.16	0.50	-1.66	0.23
10	Jammu & Kashmir	4.13	0.53	-3.59	0.13
11	Jharkhand	1.33	2.34	1.02	1.77
12	Karnataka	6.73	4.40	-2.33	0.65
13	Kerala	6.19	1.03	-5.17	0.17
14	Madhya Pradesh	1.53	6.34	4.81	4.15
15	Maharashtra	13.83	10.68	-3.15	0.77
16	Manipur	0.05	0.10	0.05	1.96
17	Meghalaya	0.30	0.12	-0.18	0.40
18	Mizoram	0.13	0.07	-0.06	0.52
19	Nagaland	0.13	0.51	0.38	3.84
20	Odisha	3.25	2.86	-0.39	0.88
21	Punjab	3.84	1.48	-2.36	0.39
22	Rajasthan	2.68	9.58	6.90	3.58
23	Tamil Nadu	10.31	6.32	-3.99	0.61
24	Telangana	4.50	6.49	1.98	1.44
25	Tripura	0.05	0.18	0.13	3.35
26	Uttar Pradesh	3.26	14.14	10.89	4.34
27	Uttarakhand	2.15	0.57	-1.59	0.26
28	West Bengal	2.88	4.62	1.74	1.60
29	Delhi	0.04	0.22	0.19	5.79
30	Puducherry	0.22	0.04	-0.18	0.18

Impact of information on livestock productivity

P. S. Birthal, Jaweriah Hazrana and Raka Saxena

Information by influencing farmers' decisions regarding the adoption of improved technologies, innovations, inputs, and management practices can help improving livestock productivity. Using data from a large-scale nationally representative farm survey in India, this study has assessed the impact of information on the productivity of dairying. The results show that farmers face an acute information constraint — only about one-fourth of the dairy farmers have access to information. Information on animal health is the most sought-after (by >50% of farmers), followed by the information on animal breeds and breeding practices (21%), feeds, feeding practices and nutrition (20%), and management (8%). Farmers depend on several formal and informal sources for their information needs, the prominent being the informal ones, including the private service providers (39%), followed by the progressive farmers or social networks (17%), mass media (14%), and input dealers (13%). The outreach of the public extension system is limited to 14% of the dairy farmers.

Information improves dairy productivity by 15% (Figure 2.4). However, different types of information have differential impacts. The information related to management aspects is more effective in raising milk yield (33%), followed by information on feeds and nutrition (17%), animal breeding (13%), and disease and health management (10%). However, bundled information has in a more pronounced effect. There is also a source effect—the public extension system has the highest impact— a 14% higher milk yield. The effect of information from private sources is just half of it. The other information sources, including mass media, progressive farmers, and input dealers, do not affect productivity in a significant manner. These findings have some important policy implications for extending support services to livestock farmers, particularly in developing countries where the information dissemination systems for livestock, including public extension system, have not received much attention in livestock development. Note, in India, extension activities are hardly allocated 2% of the total public spending for livestock development.



Type of information Sources of information

Figure 2.4: Impact of information on milk yield

Given the higher impact of the public extension system on productivity enhancement, the need for improving its outreach cannot be undermined. The government should utilize the existing human resources and infrastructure or evolve new institutional arrangements to strengthen the flow of information to the livestock sector. India has a strong network of dairy cooperatives and a strong presence of private dairy processors in some states. Effective policy facilitation can leverage their potential for delivering livestock information and services. A few livestock services, particularly those not complex and difficult to understand by the farming communities, can be considered for privatization. However, the relatively small impact of private information on productivity points towards the need for enhancing the capacities of private service providers in understanding animals' biological systems for accurate diagnosis of ailments and their remedies. Given the more significant impact of the joint use of information, there is a need for a single-window approach to the delivery of livestock services.

TECHNOLOGY AND SUSTAINABLE AGRICULTURE

Trends and disparities in fertilizer use in India

Sant Kumar and Kingsly I. T.

Fertilizer is a key input in agriculture. Fertilizer consumption at all-India level has increased significantly from 0.70 lakh tons in 1950-51 to 281.2 lakh tons in 2010-11, but declined to 232 lakh tons in 2020-21. Fertilizer consumption grew at an annual rate of above 4% (Table 2.6) during 1980-2020 but at the lowest rate of 0.72% in the recent decade, perhaps due to improvement in methods of fertilizer application and fertilizer quality.

During 1970-71 to 2020-21, the total consumption of fertilizers and their consumption per unit of cultivated land increased by 14-fold and 12-fold, respectively (Figure 2.5). By season, the share of kharif season crops in the total fertilizer consumption has increased from 35% in 1975-76 to 48% in 2020-21. Northern irrigated region shares 36% of the total fertilizer consumption,

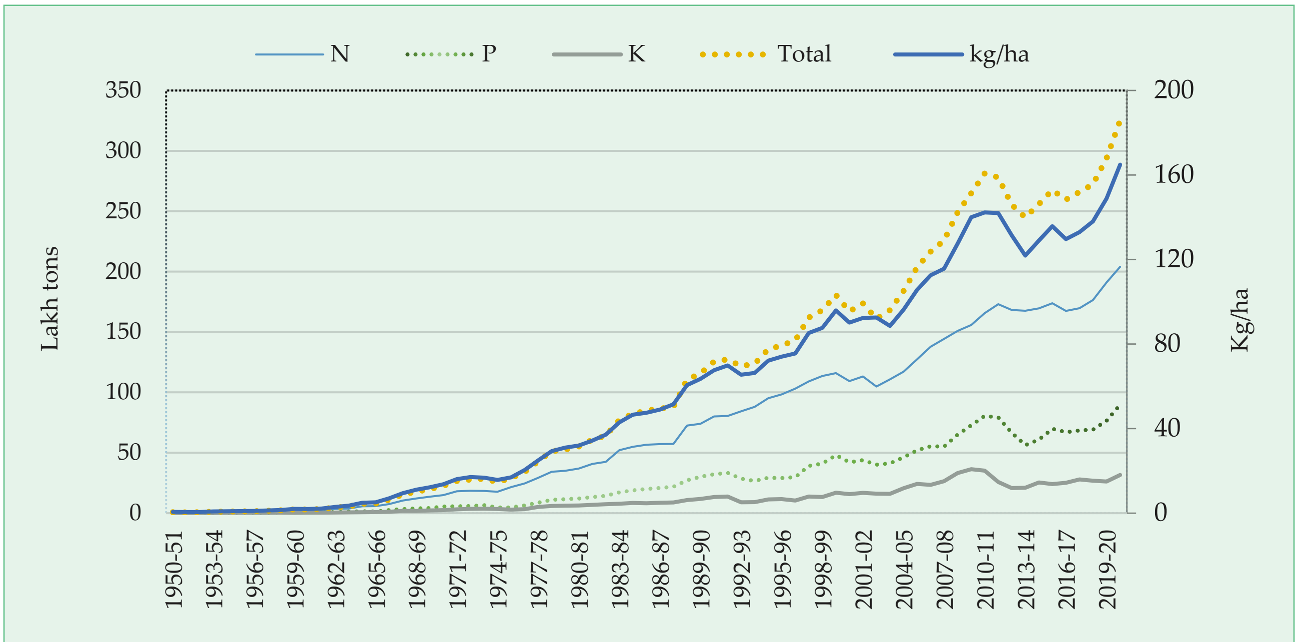


Figure 2.5: Trends in fertilizer use in India, 1950-51 to 2020-21

followed by southern (31%), western (22%) and eastern (10%) regions.

The use of potassic fertilizers has increased faster compared to nitrogenous and phosphatic fertilizers. The use of NPK in a ratio of 4:2:1 is considered desirable for soil health. However, the use of nitrogenous fertilizers has remained higher than desired level, except during 2008-09 to 2010-11.

Table 2.6: Annual compound growth (%) in fertilizer use in India, 1980-81 to 2020-21

Period (TE)	Total	Kharif	Rabi
1980-81 to 1989-90	7.81	10.20	6.08
1990-91 to 1999-00	3.92	4.64	3.29
2000-01 to 2009-10	4.41	4.66	4.17
2010-11 to 2020-21	0.56	0.39	0.72
1980-81 to 2020-21	4.16	4.52	3.87

Source: Authors' estimate

Decomposition of productivity growth in Indian sugar industry

Shiv Kumar

The WTO regime has created pressure on sugar industry to be efficient to meet the challenges of globalization. This study used state-level panel data from 2002 to 2018 to estimate total factor productivity (TFP) and its components, *viz.* technical progress, technical efficiency and scale efficiency in sugar industry (Figure 2.6). Overall, there has been technical progress, but the TFP growth has declined due to negative growth in allocative and scale efficiency.

The scale change has shown an improvement, but not in all the states. The growth technical change has also improved. Thus, the productivity growth in sugar industry is attributed to technical progress (innovations) rather than to technical efficiency change. The technical efficiency change (TEC) in the sugar industry improved due to the optimal allocation of inputs. The allocative efficiency change (AEC) shows temporal fluctuation due to erratic supply of sugarcane. Rhythm of the TFP growth matches with price changes indicating prices driving TFP growth. The global recession has impacted input prices, leading to a decline in TFP growth. After 2012, scale efficiency started improving, and hence its contribution to TFP growth (Figure 2.7).

These findings suggest the need for price policy reforms to improve allocative efficiency besides putting in place mechanisms for improving technical efficiency. To boost technical progress, the old and obsolete technologies need to be replaced with modern processing and preservation technologies. Capital augmentation is one of the key pathways to remain competitive in the global sugar market.

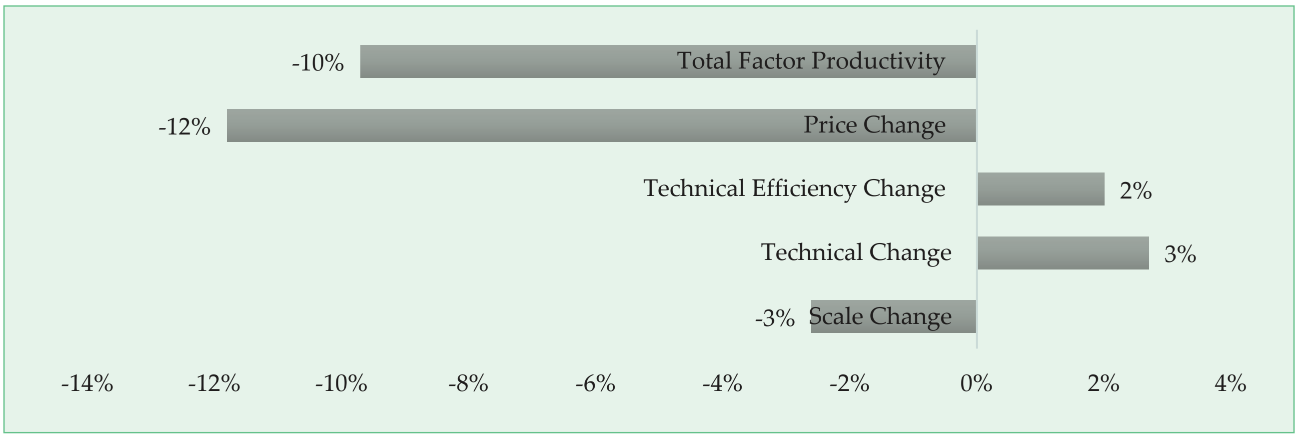


Figure 2.6: Total Factor Productivity growth in Indian sugar industry (2002-2018)

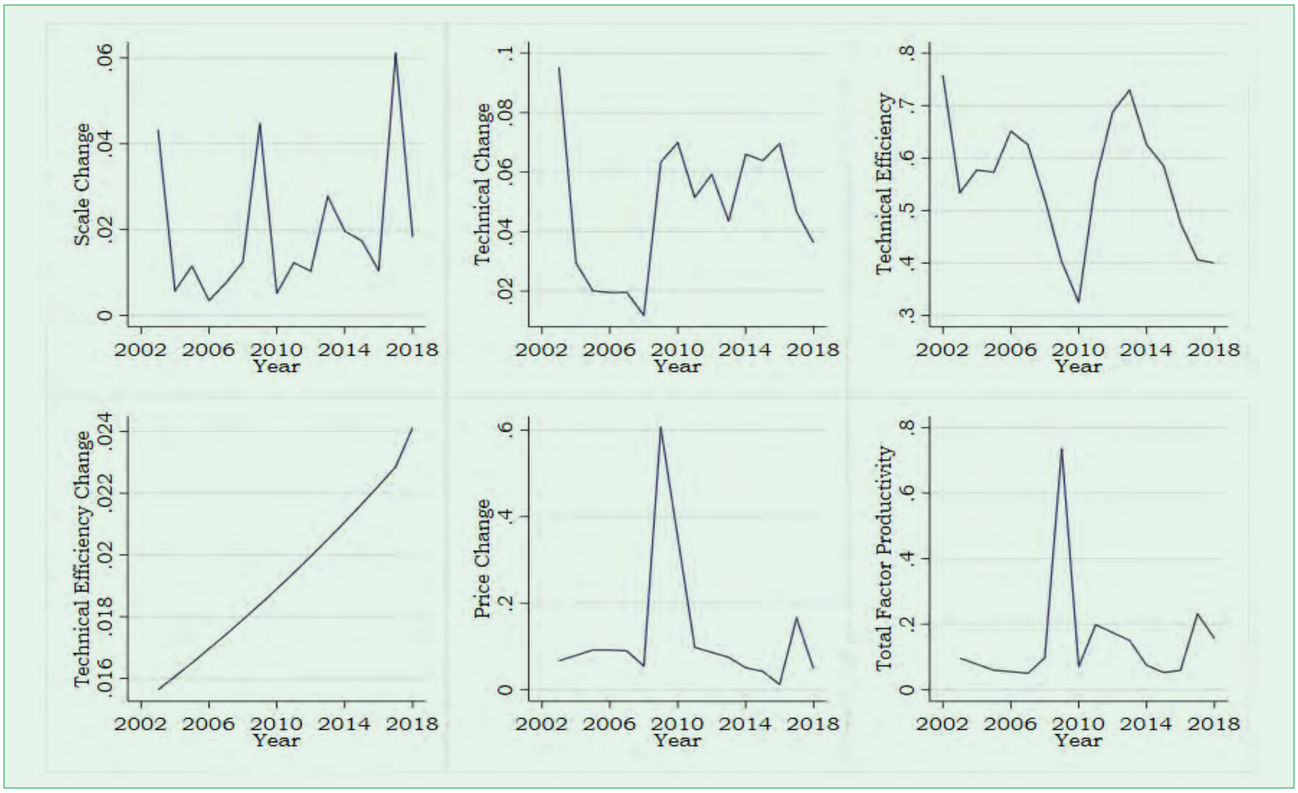


Figure 2.7: Temporal changes in components of TFP in sugar industry (2002-2018)

Impact of DSR in Punjab

Kamal Vatta, Baljinder Kaur Sidana, Laishram Priscilla, Rajni Jain and Gurleen Kaur

Economic benefits of the Direct Seeded Rice (DSR) were assessed for Punjab over 2010–2035 using the Economic Surplus Model of a closed economy framework. Three scenarios of change in paddy yield with DSR are considered: no change, 3% increase in yield, and 3% decrease in yield. On an average, DSR could save 28% irrigation water, and an equal amount of electric power consumption. The variable cost was about 14% less with DSR. Assuming electricity tariff of Rs. 5.65 per KWh, the cost reduction was 17%. Area under DSR is projected to increase to 30% by 2035.

The results show that adoption of DSR technology on 10% of paddy area may generate net present value (NPV) of Rs. 517.82 crore assuming a 3% increase in yield (Table 2.7). Adoption rates of 20% and 30% enhances NPV to Rs. 2068.25 crores and Rs. 4655.10 crores with internal rate of returns (IRR) of 82 and 92%,

Table 2.7: Net Present Value of benefits and Internal Rate of Return from the adoption of DSR during 2010-2035

Adoption rate (%)	No change in yield		Increase in yield (3%)		Decrease in yield (3%)	
	NPV (Rs crore)	IRR (%)	NPV (Rs crore)	IRR (%)	NPV (Rs crore)	IRR (%)
10	290.44	58.00	517.82	65.00	63.39	42.00
20	1161.06	74.00	2068.25	82.00	256.55	56.00
30	2612.09	84.00	4655.10	92.00	578.12	65.00

respectively. The results imply that even with yield penalty, DSR enhances farm profits by reducing the cost.

Economic impact of salt-tolerant mustard varieties

Subhasis Mandal, Suresh Kumar, Anil Kumar, Jogendra Singh, Harshit Bansal, Prem Chand, Rajni Jain, Ankita Kandpal, P. C. Sharma and R. K. Yadav

The economic benefits of salt-tolerant varieties (CS52, CS54, CS56, CS58 and CS60) of Indian mustard *(Brassica juncea)* developed by the ICAR-Central Soil Salinity Research Institute, Karnal during 1997-2018 was examined against the popular mustard varieties. The management practices are almost similar but the cost of cultivation differs; the hybrid 'Pioneer 45S46' has an 8% higher cost of cultivation than the salt tolerant varieties (STMVs) mainly due to higher cost of seed. The profitability of hybrid mustard is relatively higher (16%) due to its higher yield (15%). However, the STMVs perform well under multiple stresses, including sodicity (pH above 8.5), very low temperature, and aphid infestation. Based on the seed demand, the estimated present adoption rate of STMVs is 5.17%, which is expected to increase to 15% by 2030 due to the increasing area under salt-affected soils. The estimated yield advantage is about 16% over the prevailing varieties under salt-stress conditions, however, the cost of cultivation is slightly more (5.45%). The consumer and producer surplus due to adoption of salt-tolerant varieties are estimated Rs. 175 crores and Rs. 390 crores, respectively, which is expected to be Rs. 2010 crores and Rs. 4472 crores by 2030.

Sustainable intensification of mariculture enterprises in India

P. Shinoj, C. Ramachandran, Rajni Jain and Ankita Kandpal

A comprehensive assessment of the selected mariculture enterprises in coastal regions was done focusing on their long-term sustainability. Farm-level, region-specific, techno-economic, and socio-cultural factors, and conditional on sustainable intensification of mariculture-based production systems were examined. The selected mariculture enterprises include (i) open sea cage farming, (ii) coastal water cage farming, (iii) integrated multi-trophic aquaculture (IMTA), and (iv) seaweed farming.

The Principles-Criteria-Indicators (PCI) approach was used to establish linkages between farm-level indicators and various dimensions of sustainability. The enterprises are found to technically and economically viable, but glaring gaps exist in some sustainability indicators such as legitimacy of access to water bodies, institutional credit, and markets; use of quality seed and feed, fair marketing practices, optimal stocking density, mechanization, use of renewable energy, adoption of environmental-friendly culture practices, farm surveillance, crew safety, and social protection.

Key recommendations to ensure long-term sustainability of mariculture include: (i) development of marine spatial plans (MSP) for optimal allocation of available ocean space (ii) introduction of legislations to support leasing and licensing arrangements (iii) measures to ensure adequate supply of seed and feed (iv) strengthening of food safety and health management in mariculture farms (v) mandatory guidelines on good farming practices to obtain farm registration (vi) enhancing multi-disciplinary research on mariculture systems (vii) market reforms for competitive value chains (viii) introduction of specialized schemes to support pre-requisites such as credit and insurance, and (ix) collective farming .

Impact of hatchery technology for Asian seabass

Geetha R., T. Ravisankar, P. K .Patil, Rajni Jain and Ankita Kandpal

Asian seabass is a brackish water finfish. The

ICAR-Central Institute of Brackish water Aquaculture has developed a year-round captive breeding and hatchery technology for this. An estimated 20 million seabass seeds are stocked for nursery in India. Returns from Asian seabass farming are estimated for Krishna district, Andhra Pradesh where it is practiced in about 88,000 acres by more than 23,000 farmers. Generally, nursery-rearing cycle is for 30 to 60 days at a stocking density of 10,000 per acre. Pre-grow-out farming of 1 to 3-inch size is mainly practiced in nearly 3000 to 4000 acres. Farmers harvest three crops a year. Selling price of juvenile fish is Rs. 90 to 100 per piece. Seabass grow-out culture is practiced in an about 2500 to 3000 acres with an average culture duration of 18 months. The average stocking density is 2000 per acre. More than 90% farmers harvest fish at a weight of 3-4 kg after 18 months, and sell at Rs. 560-580/kg. The economics of nursery, pre-grow out and grow-out cultures given in Table 2.8 shows significant returns on investment in Asian seabass.

Impact assessment of cage culture in reservoir in Chhattisgarh

Arun Pandit, Anjana Akka, Rajni Jain and Ankita Kandpal

Chhattisgarh has an estimated water area of 1.64 lakh hectares, which can be utilized for fish culture. Over past decade, it has witnessed remarkable growth in fish production. Till 2023, there were 4936 cage culture units in 42 reservoirs. Pangasius and Tilapia species are the main cultivated species, yielding 2.5-3.0 tons per cage per annum. On the whole, cage culture adds 5092 tons of fish, and generates 2.5 lakh man-days of employment. The net returns from cage culture units are estimated at Rs. 75,420 per cage.

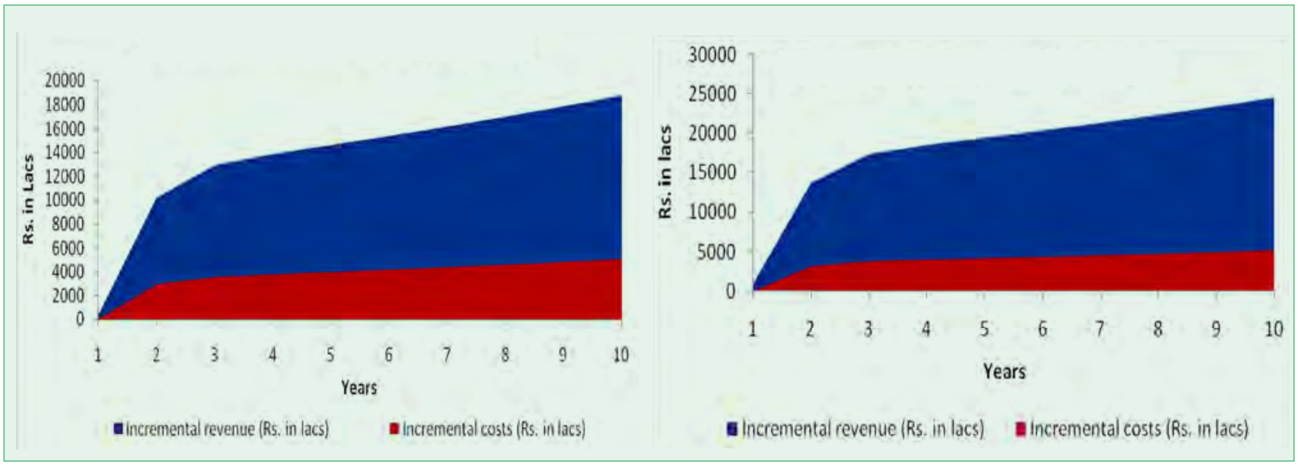
Impact assessment of livestock and poultry germplasm

Dwaipayan Bardhan, Sushil Kumar, Achintya Das, Aupam Krishna Dixit, Vijay Kumar, Leela Ram Gurjar and Rajni Jain

The study presents evidence on the contribution of germplasm to production and productivity growth in the livestock sector. The germplasms for assessment include Vanaraja and Gramapriya breeds under backyard poultry system, Frieswal cattle, Barbari goats, and Avishan sheep. System dynamic modelling has been applied to assess the linkages between production and reproduction parameters. Figure 2.8 (a) and Figure 2.8 (b) present projected trends in incremental revenue and costs of improved germplasms in relation to the local varieties.

Table 2.8: Economics of seabass farming in Andhra Pradesh, 2022

Parameters	Nursery	Pre-grow out	Grow out
Duration of crop (Months)	2	3	18
Stoking density (No/acre)	10000	4919	2056
Survival rate (%)	80	80	88
Production (Number/acre)	8000	3935	1810
Total fixed cost (Rs./crop/ha)	75613	88912	545723
Total variable cost (Rs./crop/ha)	224725	527350	5382909
Total cost (Rs./crop/ha)	300340	616263	5928632
Total production (kg)	80	393	6195
Sales price (Rs./ per kg)	2065	1097.5	554
Gross return (Rs./crop/ha)	413000	1079786	8595055
Net return (Rs./crop/ha)	112660	463523	2666423
Return on Investment (ROI) %	38	75	45



(a) Vanaraja **(b) Gramapriya**

Figure 2.8: Incremental revenues & costs of Vanaraja & Gramapriya vis-a-vis local poultry variety

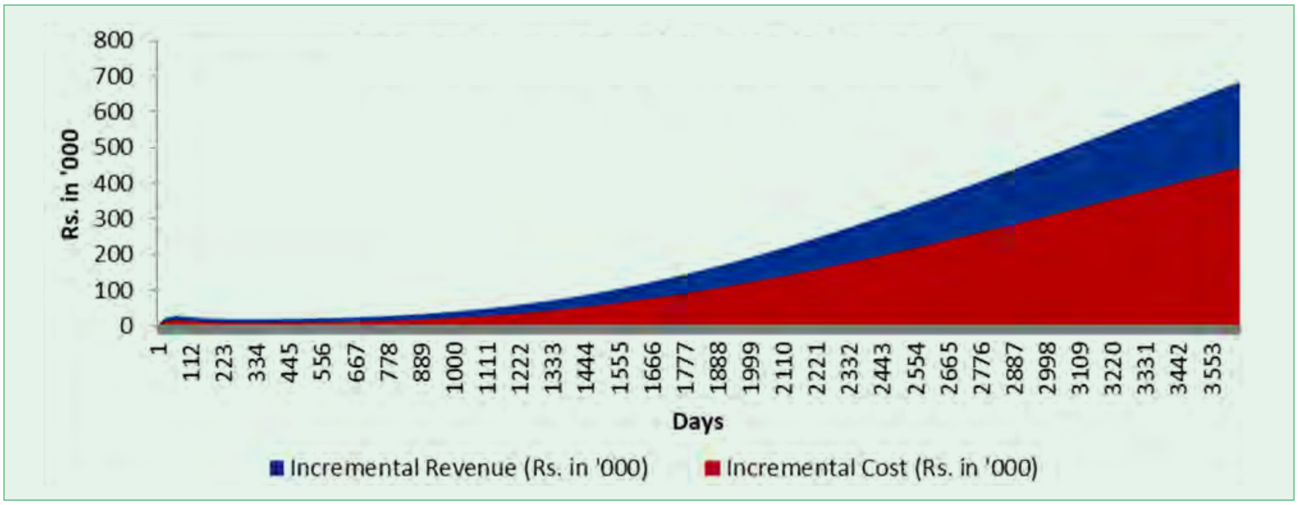
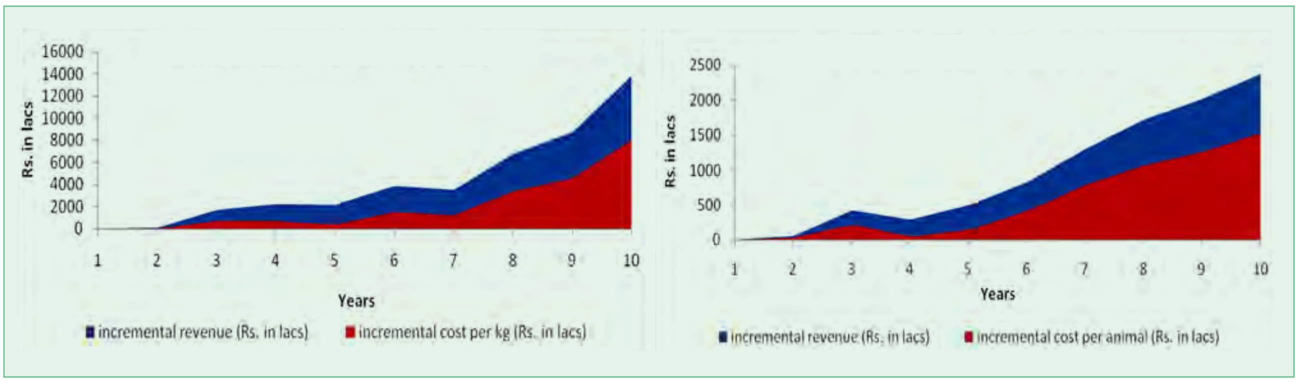


Figure 2.9: Trends in incremental net revenue and cost (Frieswal vis-a-vis non-Frieswal)



(a) Barbari breed of goat **(b) Avishan breed of sheep**

Figure 2.10: Trends in incremental net revenue and cost

Figure 2.9 presents the projected trends in incremental revenue and cost of Frieswal cattle. Figure 2.10 presents the projected trends in incremental revenue and cost of Barbari goat breed and Avishan sheep breed. The economic surplus from Vanjara and Gramapriya is estimated Rs. 538.53 crore and Rs. 1125.39 crore per annum, respectively. For Frieswal cattle, it is Rs. 1326.34 crore, while for Barbari goat and Avishan sheep it is estimated at Rs. 1.13 crore and Rs. 0.084 crore per annum, respectively.

Impact assessment of tractor-operated 2-row sugarcane settling transplanter

K. P. Saha, Dushyant Singh, T. Senthil Kumar, Rajni Jain and Ankita Kandpal

A tractor-operated 2-row semi-automatic sugarcane settling transplanter was developed by the ICAR-Central Institute of Agricultural Engineering to reduce labour and operational costs in sugarcane transplanting. The equipment was licensed to three private manufacturers in Coimbatore (Tamil Nadu), Pune (Maharashtra) and Haridwar (Uttarakhand) for manufacturing and supplying to end users. Altogether 58 units of this implement were supplied till 2023. The economic impact of the technology was assessed over 2013-2021. Its adoption resulted in an increase in yield by 0.65% and saving in cost by 63.55%. The aggregate total surplus is estimated to be Rs. 527.38 crore, most of which is realized by producers (73.39%).

Database on agricultural rural households with special focus on weaker sections

Subhash Chand, Rajni Jain, D.C. Meena, Vikas Kumar, Dilip Kumar, K. R. Chaudhary and M.S. Chauhan

A longitudinal database on agricultural households with a special focus on weaker sections is being developed for six villages in three districts: Panipat in Haryana, Bulandshahr in Uttar Pradesh, and Jaipur in Rajasthan. More than 80% of the households belong to scheduled castes, and more than 30% of them are landless. More than 50% of them depend on non-farm activities for their livelihoods. Agricultural information is crucial for supporting farmers to maintain their livelihoods. Most farmers seek information related to crops, and mainly from informal sources. But for information horticulture, livestock, and policies they depend on public extension system.

Artificial Intelligence based model for area estimation under wheat and mustard

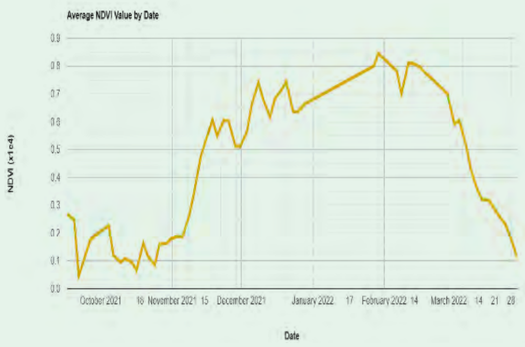
Rajni Jain, R. Saravankumar, Dilip Kumar, Anshu Bharadwaj and Sapna Nigam

The study aims at developing an inexpensive framework to predict crop yields from the publicly available satellite imageries applying the Artificial Intelligence (AI) and Machine Learning (ML) approaches. The framework was experimented for predicting area under wheat and mustard in Hisar district of Haryana. The procedure involved (i) extraction of satellite data and calculating Normalized Difference Vegetation Index (NDVI). The NDVI profile difference for the growing season was used to apply AI based K-means clustering algorithm (Figure 2.11). More than 30 types of clusters were identified. Visualization of these clusters led to identification of wheat and mustard clusters. Area under wheat (230.329 thousand ha) and mustard 76.908 thousand ha) was predicted using the satellite images up to second half of March 2021-22. The study shows that remote sensing data has the potential to provide advance estimates of crop production.

AI-based disease identification

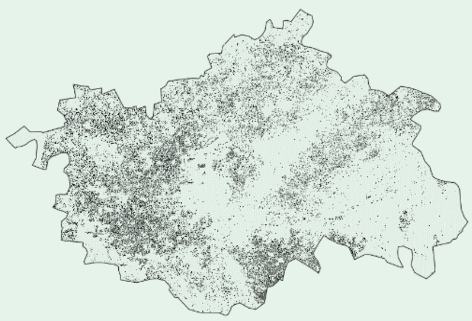
Sapna Nigam, Rajni Jain, Sudeep Marwaha, Alka Arora, and Vaibhav Kumar Singh

Wheat rusts can cause significant loss — leaf rust up to 45–50%, and stem and stripe rusts up to 100%. In this study, an EfficientNet architecture-based model for wheat disease identification has been proposed for automatically detecting



(a) NDVI pattern of Mustard

(b) NDVI pattern of Wheat



(c) Area under mustard in Hisar: 76908 Ha

(d) Area under wheat in Hisar: 230329 Ha

Figure 2.11: NDVI pattern (a-b) and corresponding area estimates (c-d) of mustard and wheat using the remote sensing data

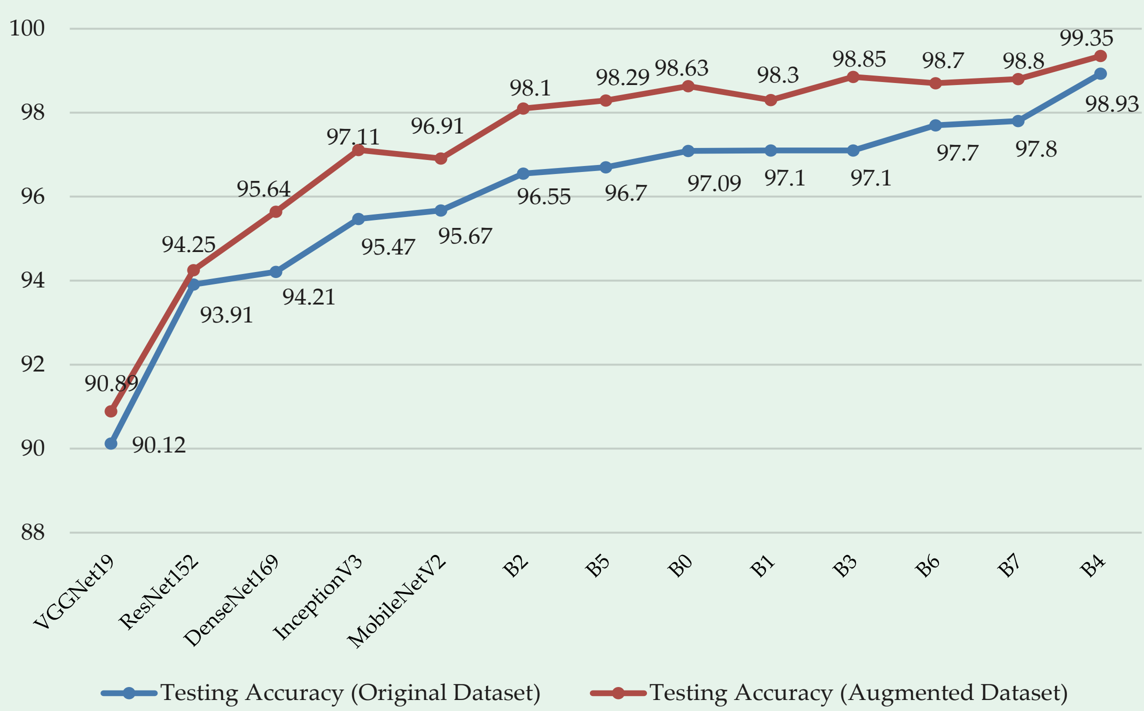


Figure 2.12: Comparative performance of AI models for image based wheat disease identification

major wheat rusts. A dataset containing 6556 images of healthy and diseased leaves was prepared, and is referred to as WheatRust21. The study attempted classical CNN-based models such as VGG19, ResNet152, DenseNet169, InceptionNetV3, and MobileNetV2 and obtained accuracy ranging from 91.2% to 97.8%. To further improve accuracy, the study experimented with eight variants of EfficientNet architecture (called B0, B1...B7) and discovered that fine-tuned EfficientNet B4 model achieved 99.35% testing accuracy (Figure 2.12). The model can be integrated into mobile applications for use by stakeholders for image-based identification of diseases.

Nutri-cereals scenario in India

Khem Chand, Arathy Ashok and Sonia Chauhan

Due to high nutritive values the millets can address the problem of malnutrition. During the green revolution period, millets were pushed to marginal lands. Their area declined from 37.97 m ha in Triennium Ending (TE) 1970-71 to 13.34 m ha in TE 2020-21. Sorghum suffered the most; its area declined from 18.2 m ha in 1970-71 to 4.3 m ha in TE 2020-21. The reduction was minimum for pearl millet, but its production increased due to technological progress. The average yield of millets increased from 494 kg/ha in TE 1970-71 to 1224.6 kg/ha in TE 2020-21 (Figure 2.13).

Impact of climate change on crops yields in IGP

Nalini Ranjan Kumar, Abdullah and Shilpi Kapoor

A fixed effect panel data model was estimated to know the impact of climate change on crop yields in the Indo-Gangetic plains, controlling for several time time-invariant location-specific factors. In kharif season, rainfall has a positive impact on paddy, negative on maize, and non-significant on pearl millet and cotton. In rabi season, it has a positive impact on chickpea, negative on rapeseed-mustard, and no impact on wheat. However, excess rainfall is detrimental to paddy, pearl millet, sugarcane and chickpea, but has a positive effect on maize, wheat and rapeseed-mustard.

A 1°C rise in minimum temperature in *kharif* season reduces yield of paddy by 2.43%, of maize by 3.1%, and of cotton by 10%, while it increases

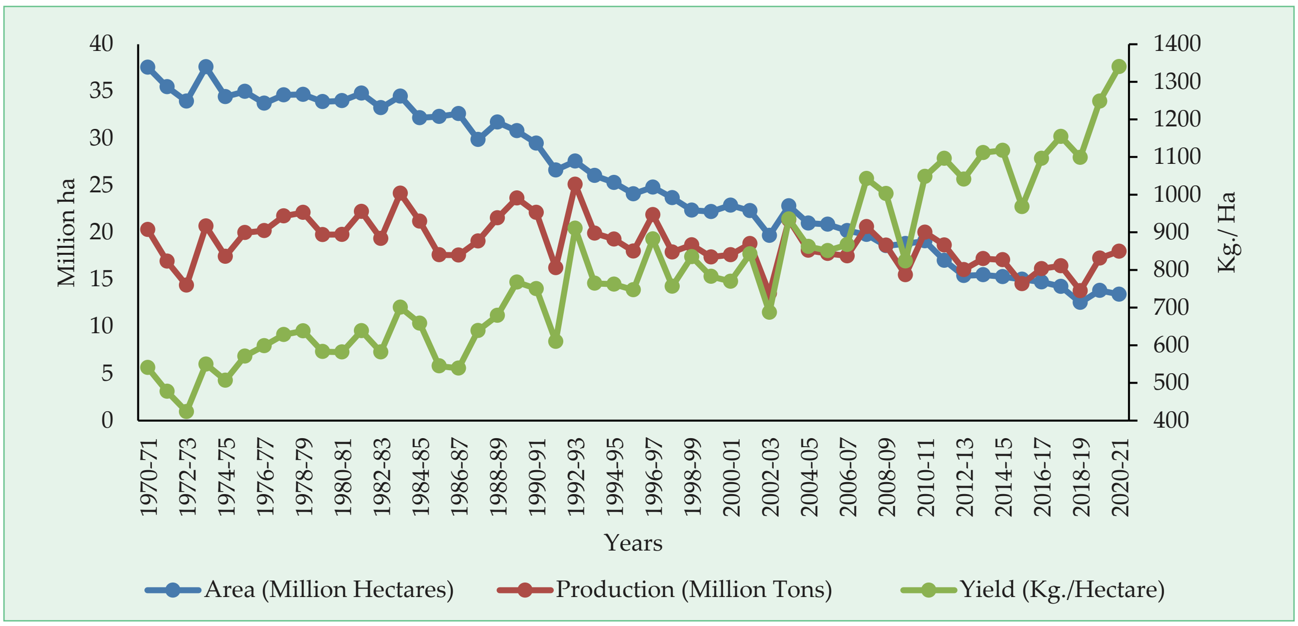


Figure 2.13: Trend in area, production and yield of nutri-cereals in India, 1970-71 to 2020-21

yield of pearl millet by 10.4 %. However, a 1ºC rise in maximum temperature reduces yield of paddy by 10.56%, of maize by 1.74%, of pearl millet by 12.53%, and increases yield of cotton by 1.80% (Table 2.9). The net effect of change in temperature is observed to be positive for cotton, but negative for other *kharif* crops —paddy (-13.0%), maize (-4.9%) and pearl millet (-2. 1%). Among *rabi* crops, 1ºC rise in minimum temperature significantly and negatively affects yield of wheat (-3.0%) and rapeseed-mustard (-4.46%) while chickpea gains by 6.1%. However, 1ºC rise in maximum temperature has significant and positive impact on yield of rapeseed & mustard (5.90%) and negative and significant on yield of chickpea (-4.30%).

The impact of climate change on crop yield has been projected under RCP 4.5 and RCP 8.5 for three time slices, *i.e.,* 2040s, 2050s and 2080s (Table 2.10). Further, a variation of 7%, 10% and 12% in rainfall has been assumed for 2040s, 2050s and 2080s. In kharif season, the yield of paddy, maize and pearl millet will decline, while of cotton will increase. Paddy will suffer the most, followed by maize and pearl millet. Among rabi crops, wheat yield will decline, while of chickpea and rapeseed-mustard will increase.

Cross-border effects of climatic shocks on agriculture

P.S. Birthal and Jaweriah Hazrana

There exists enormous empirical evidence on the adverse effects of climate change on agriculture, but our understanding of its cross-border effects is limited. This study, using a long panel of district-level data from India and applying spatial econometric techniques, has first looked into spatial dependence in climate and then assessed its cross-border effects on agriculture. The findings reveal a spatial dependence in climatic shocks, influencing the performance of agriculture beyond spatial boundaries. However, the cross-border effects of different climatic shocks are different. Deficit rains in the rainy season produce more significant cross-border effects than excess rains. Similarly, the excess temperature in the post-rainy season produces significant cross-border effects. The key implication of these results is that ignoring spatial dependence in climate in empirical analysis leads to underestimating the

Table 2.9: Marginal effects of temperature and rainfall on crop yields

Variable	Kharif Crops			
	Paddy	**Maize**	**Pearl millet**	**Cotton**
Min. Temp	-0.02429***	-0.03113**	0.10400***	-0.09994***
Max. Temp	-0.105627***	-0.01742	-0.12527***	0.13798***
Rainfall	0.00008***	-0.00028***	-0.00008*	0.00010
Irrigation	0.00003	0.00545***	0.00914***	-0.00048
Year	0.02469***	0.02391***	0.02104***	0.01808***
	Rabi Crops			
	Wheat	**Chickpea**	**Rapeseed-mustard**	**Sugarcane**
Min. Temp	-0.02961***	0.06051***	-0.04456***	-0.00168
Max. Temp	0.00263	-0.04296***	0.05865***	-0.01127
Rainfall	-0.00020***	0.00037***	-0.00033***	0.00005***
Irrigation	0.00104***	0.00043	0.00101***	0.00044**
Year	0.01829***	0.00877***	0.02075***	0.01240***

Table 2.10: Projected crops yield under different scenarios by 2040s, 2050s and 2080s (% change)

Crop	RCP 4.5			RCP 8.5		
	2040s	2050s	2080s	2040s	2050s	2080s
	Δ MinT =1.75 Δ MaxT =1.50 Δ R=(+/-)7%	Δ MinT =2.14 Δ MaxT =1.81 Δ R=(+/-)10%	RCP 8.5 =2.63 Δ MaxT =2.29 Δ R=(+/-)12%	Δ MinT =2.05 Δ MaxT =1.83 Δ R=(+/-)7%	Δ MinT =2.60 Δ MaxT =2.30 Δ R=(+/-)10%	Δ MinT =4.43 Δ MaxT =3.94 Δ R=(+/-)12%
Kharif						
Paddy	**-20.04**	**-24.23**	**-30.48**	**-24.25**	**-30.53**	**-52.28**
Maize	-8.26	-10.09	-12.51	-9.76	-12.38	-20.99
Pearl millet	-0.65	-0.50	-1.43	-1.66	-1.85	-3.38
Cotton	3.28	3.69	5.44	4.83	5.85	10.21
Rabi						
Wheat	**-4.93**	**-6.06**	**-7.43**	**-5.73**	**-7.30**	**-12.33**
Chickpea	4.41	5.55	6.52	4.80	6.23	10.33
Rapeseed & Mustard	0.77	0.75	1.31	1.36	1.57	2.97
Sugarcane	-1.95	-2.35	-2.96	-2.37	-2.98	-5.12

impacts of climate change on agriculture; and, an incomplete understanding of the climate change impacts may engender imperfections in the risk management strategies and targeting thereof.

What can substitute rice in Indian states? An economic perspective

Prem Chand, P. S. Birthal and Rajni Jain

Using data on cost of cultivation for triennium ending (TE) 2019-20, this study assesses returns from paddy vis-à-vis its alternative crops. In Trans-Gangetic plains, substituting rice with other crops is extremely difficult. For example, in Haryana, net returns from paddy are 109% more than from cotton and 382% more compared to bajra (Table 2.11). However, the rice can be economically substituted by jute in Assam, Bihar and West Bengal, by maize in Bihar, Jharkhand and Tamil Nadu, by cotton in Gujarat, Madhya Pradesh and Odisha, by green gram in Bihar and Best Bengal, by bajra in Gujarat, and by tur and groundnut in Uttar Pradesh. However, relatively high risk in production and prices of substitute crops is a major hindrance.

The plausible pathways to substitute rice with other crops are: (i) increase in yield and price of alternative crops, (ii) monetary incentives for saving of natural resources, and (iii) assured markets for alternative crops.

Inter-state variation in water management institutions

S.K. Srivastava, Sudipta Paul, Darshnaben Mahida and Prabhat Kishore

Given limits to the augmentation of water supply, the problem of water scarcity can be addressed through improvements in the use and management of water resources. This requires changes in water institutions, i.e., water-related legal, policy and organizational arrangements

Table 2.11: Net returns from paddy vis-à-vis alternative crops (Rs/ha over A_2 cost), TE 2019-20

States	Net returns from paddy (Rs./ha)	Alternative crops (Rs./ha)
Andhra Pradesh	50253	Maize (46483), black gram (26122), cotton (20714)
Assam	23852	Jute (57498)
Bihar	21542	Jute (43352), green gram (39015), maize (37320)
Chhattisgarh	42085	Maize (8541), soybean (8479), tur (3241)
Gujarat	40689	Cotton (41634), bajra (41509), groundnut (40534)
Haryana	93214	Cotton (44499), bajra (19346)
Himachal Pradesh	44754	Maize (28866)
Jharkhand	23639	Maize (30657)
Karnataka	42941	Cotton (39041), sorghum (19778), tur (19725)
Madhya Pradesh	25459	Cotton (31861), sorghum (18030), sesame(17685)
Odisha	28376	Cotton (28368), groundnut (22288), maize(21903)
Punjab	83583	Cotton (67553), maize(18961)
Tamil Nadu	33483	Maize (38719), sesame(31545), cotton (31541)
Telangana	45496	Maize (42464), groundnut (31071), soybean (28362)
Uttar Pradesh	23851	Tur (33718), groundnut (32645), bajra (22558)
Uttarakhand	33427	Ragi (24567)
West Bengal	25786	Jute (50708), green gram (20491), sesame (15693)

Note: Figures in parentheses are net return per ha (Rs./ha)
Source: Computations based on data of Cost of Cultivation, CACP, Government of India

that govern water resources. A structural framework of the existing water management institutions at the national and sub-national levels has been constructed and roles of various institutions have been analyzed. Further, a Water Institution Index (WII) consisting 12 indicators of institutional structure has been constructed, and the states have been ranked. The selected indicators include: (i) notification of any act or a regulatory framework for regulation of groundwater use/management, (ii) notification of any law/legal framework to facilitate participatory irrigation, (ii) percent of irrigated command areas having water users' association (WUAs) involved in operation & management (O&M) of irrigation, (iv) percent of irrigation service fee (ISF) retained by WUAs as compared to the fee collected by them, (v) whether state has segregated agriculture power feeder, (vi) area covered with segregated agriculture power feeder as a percent of total area under cultivation with power supply, (vii) is electricity to tube-wells/water pumps charged in the State, (viii) whether the state has enacted any legislation for protection of waterbodies and water-supply channels and prevention of encroachment into/on them, (ix) whether the state has any framework for rainwater harvesting in public and private buildings, (x) state have a separate integrated data centre for water resources, (xi) percent of hired machine hours out of total (hired and owned irrigated hours), and (xii) percent of net sown area irrigated by wells. State-wise data on these were compiled from the *Composite Water Management Report, 2019* of NITI Aayog. Analytic Hierarchy Process (AHP) method was used to estimate weights of these indicators and WII was estimated for each state. The ranking of the states based on WII is presented in

Figure 2.14. There is a large inter-state variation in water management institutions, affecting the outcomes of water management efforts.

Groundwater utilization-food-energy association

S.K. Srivastava and Prabhat Kishore

Groundwater has emerged as the dominant source of irrigation, consolidating its share in net irrigated area from 30.36% in 1964-65 to 64.47% in 2017-18. It has positively contributed to crop productivity (Figure 2.15). Sustainable management of groundwater resources is, therefore, critical for sustaining food security. As extraction of groundwater depends on energy, there exists a strong nexus (inter-dependence) among food, groundwater and energy, which can be capitalized for developing sustainable food system.

Power subsidy for irrigation and its implications for groundwater sustainability

S.K. Srivastava and Prabhat Kishore

Presently, the state governments, except West Bengal, provide subsidized or free electricity for pumping groundwater for irrigation. The estimated power subsidies for irrigation is presented in Table 2.12. In 2019-20, the

Table 2.12: Power subsidy for irrigation in India, 2009-10 to 2019-20

Year	Power sale for irrigation (Mkwhr)	Average cost of supply (Rs./kwhr)	Average revenue (Rs./kwhr)	Revenue gap (Revenue-Cost)		Share of irri. in total loss (%)	Total tariff subsidy received for all sectors (Rs .crore)	Power subsidy for irrigation	
				Rs. Crore	Rs./ Kwhr			Rs. crore	Rs./ha NSA
2009-10	119897	4.9	0.89	-48545	-4.05	74	19074	14065	1011
2015-16	179582	6.8	0.79	-108154	-6.02	74	75608	55981	4013
2016-17	193742	6.8	0.79	-117180	-6.05	73	83837	61384	4403
2017-18	204064	7.0	0.69	-128070	-6.28	74	92552	68126	4895
2018-19	216136	7.5	0.75	-145754	-6.74	69	110959	76548	5493
2019-20	208911	7.5	0.75	-141523	-6.77	67	119943	80777	5797

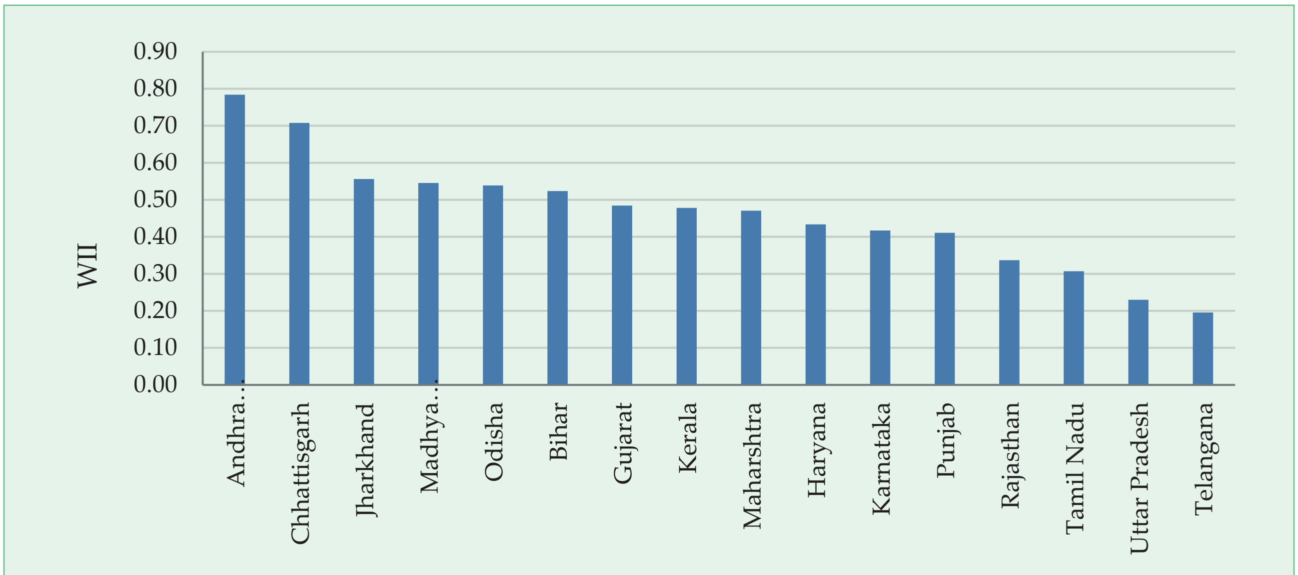


Figure 2.14: Ranking of states based on water institution Index (with AHP based weights)

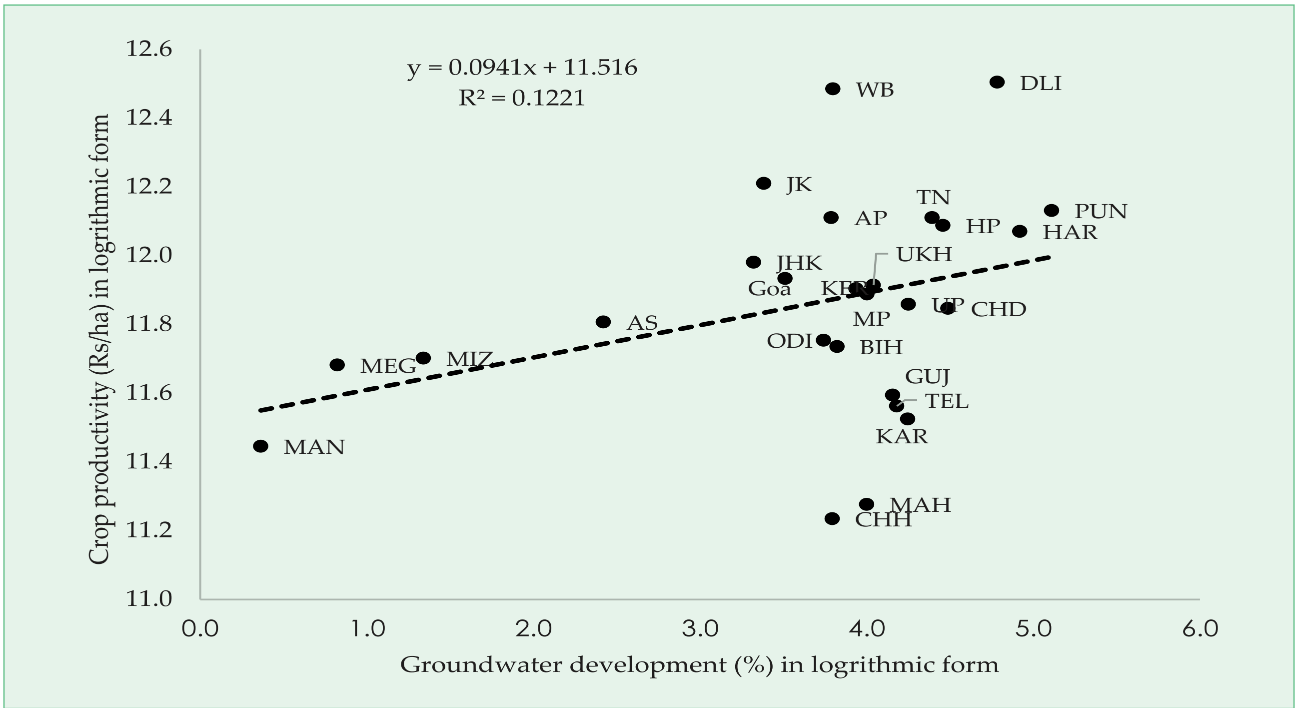


Figure 2.15: Association between groundwater development and crop productivity

estimated electricity subsidy for groundwater irrigation a was estimated Rs. 80,777 crore. On per hectare basis, it comes out to be Rs. 5,797/ ha of net sown area. Over the past 10 years, the power subsidy has increased more than four times.

There exists significant variation in electricity consumption and tariff across states, and therefore, there is a significant inter-state variation in power subsidy, ranging between Rs. 233 in West Bengal to Rs. 16,893 in Punjab. Although subsidy is essential for affordable access to energy, it fails to generate scarcity value of groundwater and dis-incentivizes farmers to use water efficiently. The preliminary analysis reveals a direct association between power subsidy and groundwater depletion (Figure 2.16).

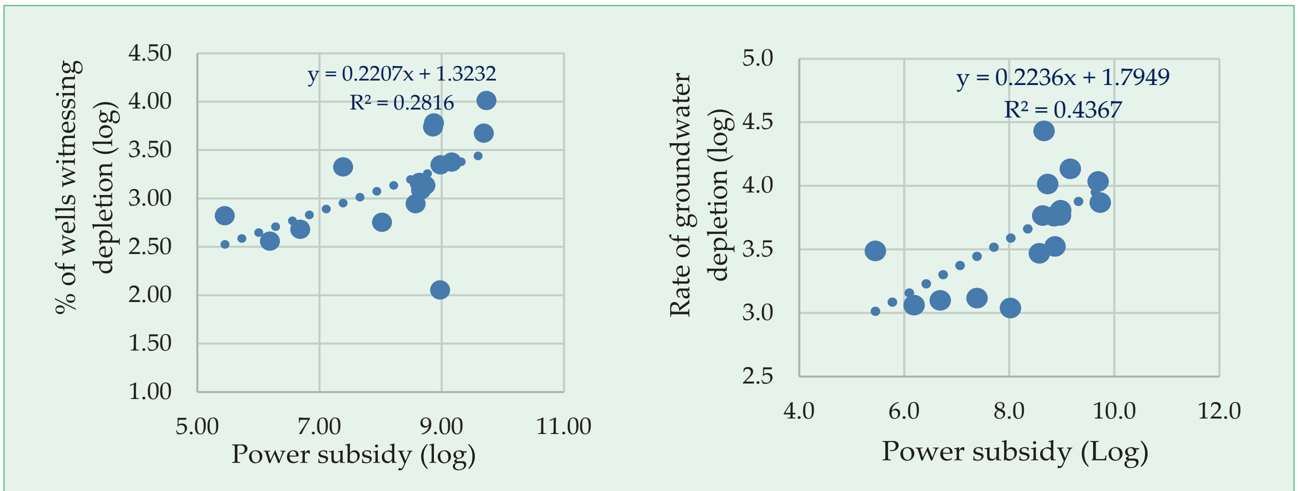


Figure 2.16: Power subsidy and groundwater depletion at state level

Ex-ante environmental impact of biochar application in agriculture

Prem Chand, Kiran Kumara T.M. and Purushottam Sharma

Biochar, a carbon-rich biomass, has the potential to bring about several positive impacts on agriculture, waste management, and climate change mitigation. Biochar improves soil organic carbon content, manages organic waste, mitigates climate change, enhances farmers' income, and promotes organic farming. However, studies on quantification of such benefits are lacking. The findings of this study show significant potential to convert stalks of cotton and pigeon pea, and weeds like *Lantana camera* into biochar. If the surplus stalks of cotton and pigeon pea are used for biochar production, they can avoid at least 7.67 million tons of CO_2 equivalent emissions valued at Rs. 556.72 crores (Table 2.13). Likewise, if the entire produce of *Lantana camara* from one million hectare occupied by it, is used for biochar production, it could save Rs. 571.47 crore, which otherwise could have costed a significant amount to control it. This figure could be higher if other benefits such as carbon sequestration, soil fertility improvement, and climate mitigation from the biochar are considered.

For valuing carbon sequestration potential of biochar, a meta-analysis was done, and the results indicate that biochar application is the most effective means of carbon sequestration: 3.27 tons/ha valued at Rs. 24,437/ha.

Carbon sequestration potential of agroforestry systems

Kiran Kumara T.M., Suresh Pal, Prem Chand and Ankita Kandpal

Agroforestry (AF) systems offer numerous ecosystem services and environmental benefits. Compared to conventional agricultural practices, these systems can mitigate climate change through carbon sequestration. This study examines the impacts of four dominant AF systems, *viz.*, agrisilviculture, silvipasture, agrihortisilviculture, and agrihorticulture, on soil carbon sequestration. To evaluate relative differences in the soil carbon sequestration, AF systems are the treatment group, and agriculture/ pasture/ grassland/ forest as control groups. The response ratio (RR), the ratio of the treatment group outcome variable to that of the control group, was used to calculate the effect size. A generalized linear mixed (GLM) model was fitted to determine the factors associated with carbon sequestration potential. Results reveal that conversion to agroforestry systems results in a considerably higher carbon sequestration (+25.34%) than non-agroforestry systems. The highest mean soil carbon stock is found in agrihorticulture (38.11Mg C ha^{-1}), 31.64% more than in

Table 2.13: Impact of biochar on GHG emission

States/ Crops	Cotton (Lakh tons)			Pigeon pea(Lakh tons)			Emission avoided (in MT Co2 eq)	Emission avoided (Rs. crore/ year)
	Residue produced	Residue burned	C emission	Residue produced	Residue burned	C emission		
Odisha	2.81	0.51	0.25	0.19	0.03	0.02	0.10	7.12
Maharash-tra	51.54	9.28	4.64	0.00	0.00	0.00	1.70	123.24
Madhya-Pradesh	6.83	1.23	0.61	24.61	3.93	1.97	0.94	68.55
All India	179.77	32.36	16.18	59.75	9.55	4.77	7.67	556.72

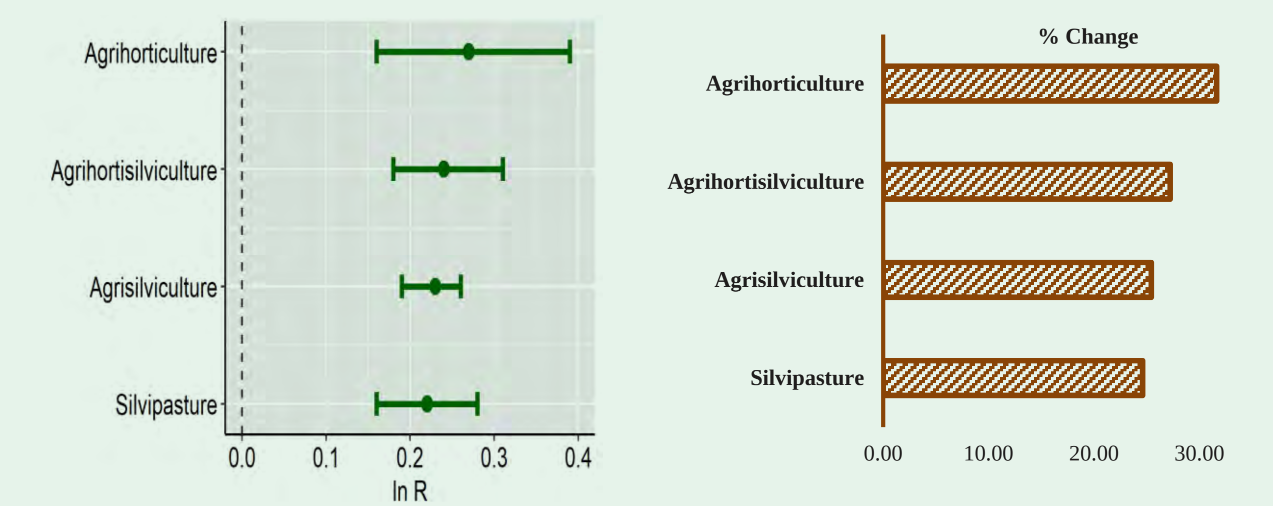
conventional systems. The transformation from grasslands to agroforestry systems results in the highest carbon sequestration, with an increase of 36.94%. In contrast, the transition from forest to agroforestry systems results in a decline in soil carbon sequestration (-23.42%) (Figure 2.17). A higher carbon sequestration is observed in younger trees (+39.51%) and in the upper soil layers (up to 30 cm) of AF systems. The previous land use, system type, and rainfall are major drivers of carbon sequestration. Findings also indicate that all AF systems are economically profitable. Reorienting and extending incentives for agroforestry, improving certification standards for agroforestry products, and strengthening AF extension system is crucial for enhancing ecosystem services.

Economic valuation of ecosystem services from improved agricultural practices

Kiran Kumara T.M., D.C. Meena and P.S. Birthal

Ecosystem services of agriculture often go unacknowledged and uncompensated due to market failures. Besides the tradable provisioning services, agriculture provides several supporting and regulatory service. The contribution to ecosystem services (ES) is undervalued or not estimated, depriving farmers for their contribution to societal and environmental health. This study has generated economic value of the ecosystem services due to adoption of improved agricultural practices, viz., direct seeded rice (DSR), no-till wheat, inclusion of legumes, organic manure, and agroforestry. The study valued provisioning (yield), supporting (soil fertility and biological nitrogen fixation, nutrient retention), and regulating (carbon flow and water holding) ecosystem services through a meta-analysis. The weighted average and effect size of each practice were estimated as response ratio (RR). The total value of ecosystem services of each improved practice was estimated as sum of the value of the marketed and non-marketed ecosystem services. The value of tradable ES was estimated at market prices, while non-marketed services were valued using indirect methods.

The results indicate that with DSR, despite lower yield, the total economic value of



(a) Size effect

Figure 2.17: Effect of agro forestry systems on soil carbon stocks

ecosystem services is positive and estimated at Rs. 1,503/ha. The economic value of non-marketed services from DSR such as climate regulation, water regulation, soil fertility, and nitrogen fixation are estimated at Rs. 13,335/ha, accounting for 49% of the total value of ES. Similarly, compared to conventional tillage, no-tillage generates higher economic and environmental benefits of Rs. 7,220/ha, of which the non-marketed ecosystem services share 75%. For agroforestry, the economic value of non-marketed services is estimated at Rs. 7,759/ha. Legume crops also provide significant non-marketed ecosystem services (Rs. 17,161/ha). ES from farmyard manure are valued at Rs. 3,742/ha. The overall value of non-marketed services of improved practices is given in Figure 2.18. Therefore, in order to promote the adoption of improved farm practices, it is essential to provide incentives to farmers as the payment for ecosystem services.

Does people's participation boost watershed ecosystems services?

D.C. Meena and Prem Chand

The watershed approach effectively manages land and provides various ecosystem services. For the success of watershed programs, the policymakers and academicians are keen on integrating local knowledge with scientific innovations involving local stakeholders in development and management activities. A systematic review of people's participation in watershed institutions shows that their higher participation delivers higher ecosystem services. Thus, the management of watersheds does not relate to technology provision but requires institutional and social innovations.

Crop insurance in India: Progress and farmers' perceptions

Khem Chand and Vikas Kumar

Since its inception in 2016-17, the share of non-loanee farmers in the Pradhan Mantri Fasal Bima Yojana (PMFBY) scheme has increased from 24% to 36% in 2020-21. The registration of marginal and small farmers too has increased, but it has caused a reduction in area insured per farmer from 0.98 ha to 0.72 ha. The sum insured per farmer has increased from Rs. 35097 to Rs. 43511, and per farmer premium reduced from Rs. 646 to Rs. 611. The farmer-based claim ratio (claim received by farmer/premium paid by farmer) has increased from 4.15 to 5.84. The

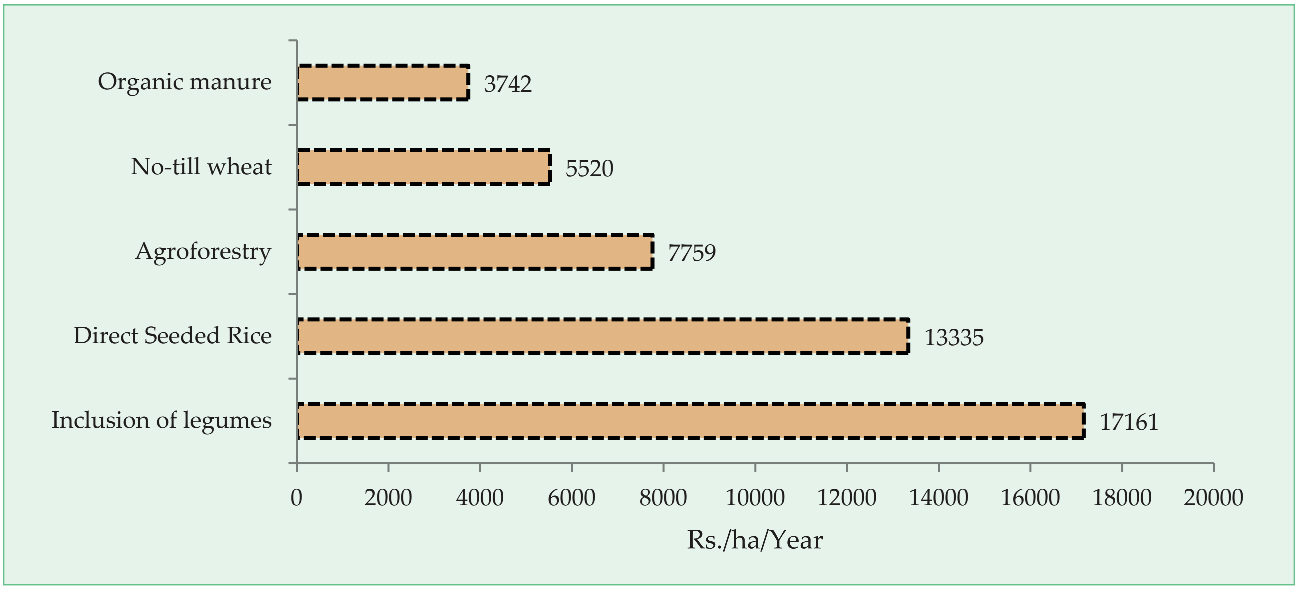


Figure 2.18: Value of non-marketed ecosystem services

claim received per farmer has also increased from Rs. 2683 to Rs. 3810.

A primary survey was conducted in Uttar Pradesh and Rajasthan in 2020-21 to know farmers' perceptions on the PMFBY. Close to 24% non-beneficiaries have even not heard of this scheme, and 89% did not know the procedures for enrolling in the scheme. About 62% of the non-beneficiaries suggested frequent meetings for its promotion.

MARKETS, TRADE AND INSTITUTIONS

Outlook for rice and wheat

Kingsly I.T., Shiv Kumar, Shinoj P. and Suresh Pal

A dynamic spatial partial equilibrium modelling framework has been utilized to predict demand and supply of rice and wheat. Rice area is projected to decline by 0.8 million hectares, from 43 million hectares in 2020-21 to 42.2 million hectares in 2030-31, while its production is projected to increase from 122 million tons in 2020-21 to 144.7 million tons in 2030-31. This means that the future growth in rice production has to come from technological change. By 2030, India's demand for rice, including its use as food and for other purposes, is projected to be 20 million tons more than in 2020-21, with food accounting for 92% of the total demand. In 2030, India will be surplus in rice by 21.6 million tons, of which 18.1 million tons will be exported (Table 2.14).

By 2030, India's wheat production is expected to reach 136 million tons, about 25 million tons more than in 2020-21. Its area is predicted to increase by one million hectare and yield by 0.7 tons/ha. Demand for wheat is projected to increase to 108 million tons, about 18 million tons more than in 2020-21, and food will account for 95% of this. India will continue to be surplus in wheat, but its exports will not increase much due to its lack of competitiveness. These estimates are closer to those of NITI Aayog.

There are four important implications. First, there is limited scope to increase production through area expansion and the future growth has to come from yield improvements. Therefore, increased research investment and appropriate public policies are essential to raise yield frontiers. Second, the country will have surplus rice and wheat. This indicates the need to diversify area away from these crops towards oilseeds and pulses, where the country is deficit and relies on imports to meet domestic demand. Their area can also be diversified towards high-value crops such as fruits, vegetables, spices, aromatic and medicinal plants, as the demand for these products is expected to grow faster than that for staple cereals. This will reduce pressure on natural resources, especially groundwater. Third, the Food Corporation of India (FCI) procures huge quantities of both the cereals for the public distribution system incurring huge operational costs, called "buffer costs" for storage and stockholding. With proper planning based on demand and production forecasts, these costs and losses can be reduced. Fourth,

Table 2.14: Comparison of projections for 2030-31

Crop	Particular	FAO-OECD	NITI Aayog	ICAR-NIAP	Deviation from FAO-OECD (%)	Deviation from NITI Aayog (%)
Rice	Production (Million tons)	139.2	145.9	144.7	4.0	-0.8
	Demand (Million tons)	121.3	118.6	123.1	1.5	3.7
Wheat	Production (Million tons)	121.8	132.9	135.8	11.5	2.1
	Demand (Million tons)	120.1	110.2	107.5	10.5	-2.5

there is a need to strengthen value addition and exports.

Changes in food consumption pattern

S.K. Srivastava, Sivaramane N. and P. S. Birthal

With improving income and changing lifestyle, food consumption pattern is shifting away from staples to high-value commodities. The share of food in the total consumption expenditure has declined from 69% in 1972-73 to 44% in 2011-12. Further, the food basket is diversifying away from cereals to high-value food commodities. The study has categorized food items as: primary products, first-processed products (low), first- processed products (high), and second-processed products based on the extent of value addition. The primary products are consumed as produced (e.g. fresh fruits, vegetables, eggs, milk, *etc*.). The first-processed products (low) undergo a minimum (0-5%) level of processing (e.g., rice, floor, pulses, spices, *etc*.). The first-processed products (high) undergo a sophisticated level of processing resulting in relatively higher (5-15%) value addition (e.g., dairy products like butter, curd, meat, fish, sugar, *etc*.). Second- processed products are produced from the first-processed products adding other ingredients, flavours, and preservatives (e.g., biscuits, bread, ghee, ice creams, jam, etc.). In 2011-12, the primary, first-processed (low), first-processed (high) and second- processed products constituted 15%, 35%, 36% and 14% of the total food expenditure , respectively. Between 2004-05 and 2011-12, the share of first-processed (low) products in the total food expenditure declined, while that of first-processed (high) and second- processed items increased (Figure 2.19). This implies a shift in the consumer preferences towards value-added food commodities.

The consumption pattern varies across income categories. Food basket of the poor is less diversified. They allocate about 50% of their food expenditure to the first-processed (low) items. On the other hand, rich households have relatively less diversified food basket with a higher allocation to the first-processed (high) products (Figure 2.20). Similarly, rich households allocate a significantly higher share of the food expenditure to the second-

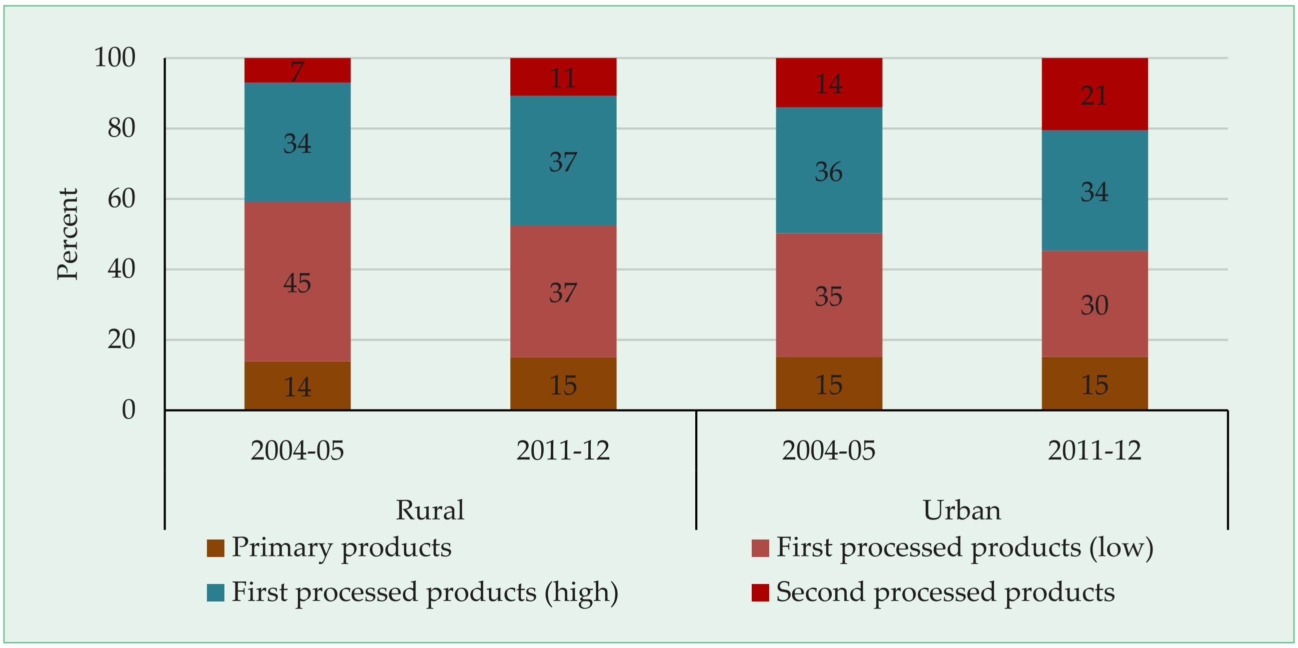


Figure 2.19: Changing consumption preference towards value added products

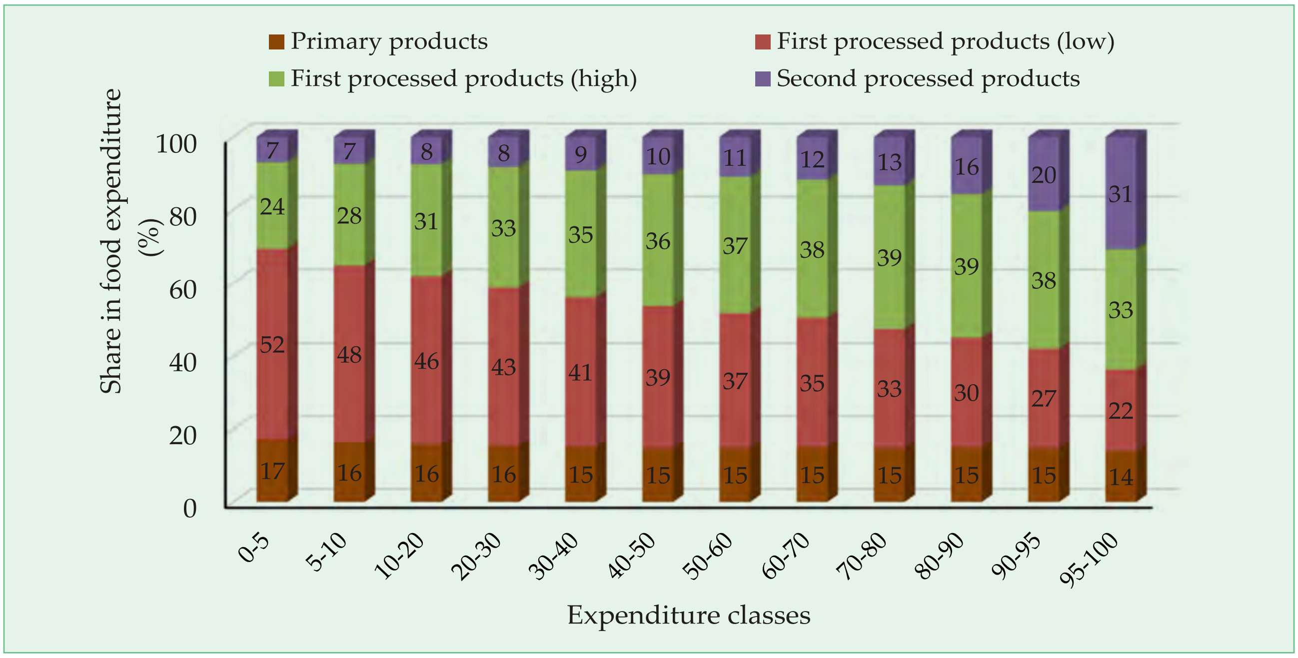


Figure 2.20: Expenditure class-wise preferences for value added food products, 2011-12

processed products (31%) as compared to poor households (7%).

Effect of monetary policy on agricultural prices

Purushottam Sharma and D. C. Meena

This study has examined the effect of monetary policy on food prices employing the factor augmented vector auto-regression (FAVAR) model. The response of the Wholesale Price Index (WPI) (107 food commodities) and Retail Price Index (RPI) (144 food commodities) to 25 basis point positive repo rate shock was examined. The results indicate that WPI, WFPI (Wholesale Food Price Index) and IIP (Index of industrial production) food start declining with a lag of two months; the declining response of CPI starts immediately in the following month, and the decline persists (Figure 2.21). The WPI and RPI exhibit a heterogeneous response. Majority of the commodity prices respond with a lag of 1-9 months confirming the negative response of commodity prices to the contractionary monetary policy.

Price transmission asymmetries along value chain of perishables

Purushottam Sharma, D. C. Meena, and Md. Ejaz Anwar

This study has looked into asymmetries in the price transmission, both in magnitude and speed, along the farm-wholesale and wholesale-retail supply chains of potato, tomato, and onion applying the linear and non-linear ARDL models. The results indicate the presence of long and short-run relationships between farm and wholesale, and wholesale and retail prices. There is a long and short-run price transmission asymmetry in case of potato; long-run asymmetry (asymmetry in magnitude) in wholesale-retail chain of tomato and farm-wholesale chain of onion.

The magnitude of the adjustment is larger for positive shocks in the long run, indicating that the effects of price increases at downstream of the supply chain are larger than that of the price decreases. Thus, retailers benefit more than the wholesalers and producers. The asymmetric price transmission might be due to information

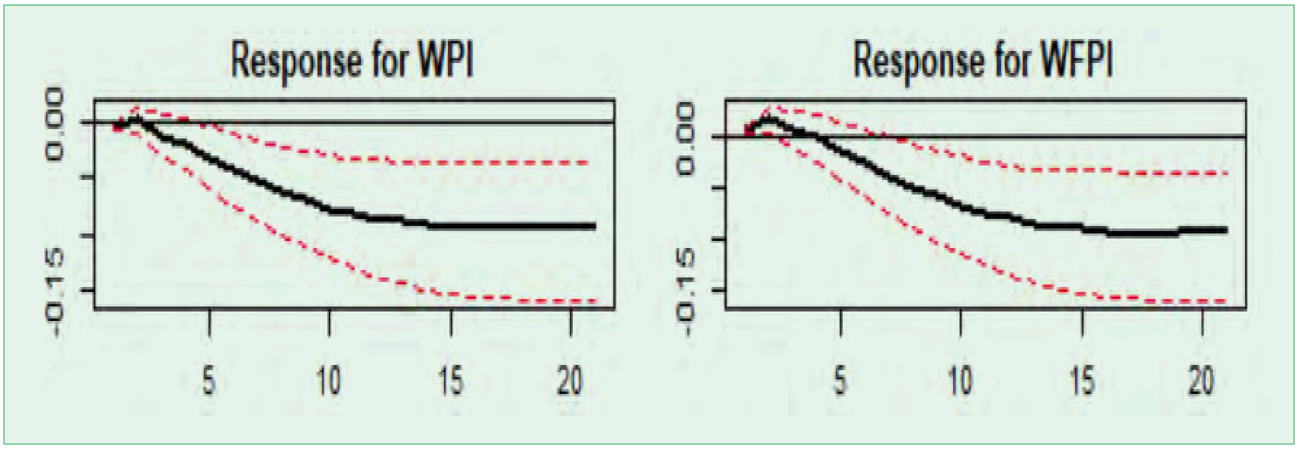


Figure 2.21: Impulse response to 25 basis point increase in repo rate for a horizon of 24 months

asymmetry, high transaction costs, and lack of storage. These suggest integration of the supply chains, and improvements in infrastructure, storage and market intelligence for achieving higher market efficiency.

Trend and pattern of price volatility in agricultural commodities

Ranjit Kumar Paul, Purushottam Sharma, Md. Yeasin, D. C. Meena and Md. Ejaz Anwar

This study looks into volatility in the prices of agricultural commodities during January 2010 to October 2022 traded in major markets. There is an increase in volatility in the prices of rice, wheat, mustard, soybean, onion, tomato, sunflower, groundnut, and potato (Figure 2.22). The price volatility is the highest in vegetables, and the lowest in cereals. Amongst vegetables, tomato price is the most volatile, followed by onion. The seasonal pattern in price volatility shows that in case of potato it starts increasing in September, reaches its peak in December - January, and decreases in March. Volatility in tomato price starts increasing in June, and reaches its peak in September.

Effects of rainfall shocks on production and price of potato

Girish Kumar Jha, Purushottam Sharma, Asha Devi S.S., Renjini V.R. and D. C. Meena

The effect of rainfall-induced shocks on production and prices of potato was estimated using panel data on monthly wholesale prices, monthly cumulative rainfall, and annual potato production (rabi) from 2010-11 to 2020-21. Rainfall shocks have a symmetric production response, i.e., positive shocks increase production, and negative shocks tend to reduce it. However, the rainfall-induced production response does not seem to translate into price seasonality symmetrically. Positive shocks exert a downward pressure on prices. The impact of negative shocks on prices is visible during the harvest season, i.e., a significant rise in price. During the lean months, the effects of negative rainfall shocks on prices are insignificant. The occurrence of positive shocks generates a significant negative and prolonged effect on prices than the negative shocks.

Facilitating agricultural exports

Raka Saxena, Purushottam Sharma and Devesh Kumar Pant

For long, India has remained a net exporter of agricultural products. The export mix, however, has changed, due to shifts in global dietary patterns. Rice, marine products, buffalo meat, cotton, and spices comprise the bulk of agricultural exports. In 2021, together these products comprised more than 70% of the agricultural exports. Sugar, coffee, tea, and vegetables are other important export commodities. The export basket exhibits varying patterns. One pattern characterizes consistent

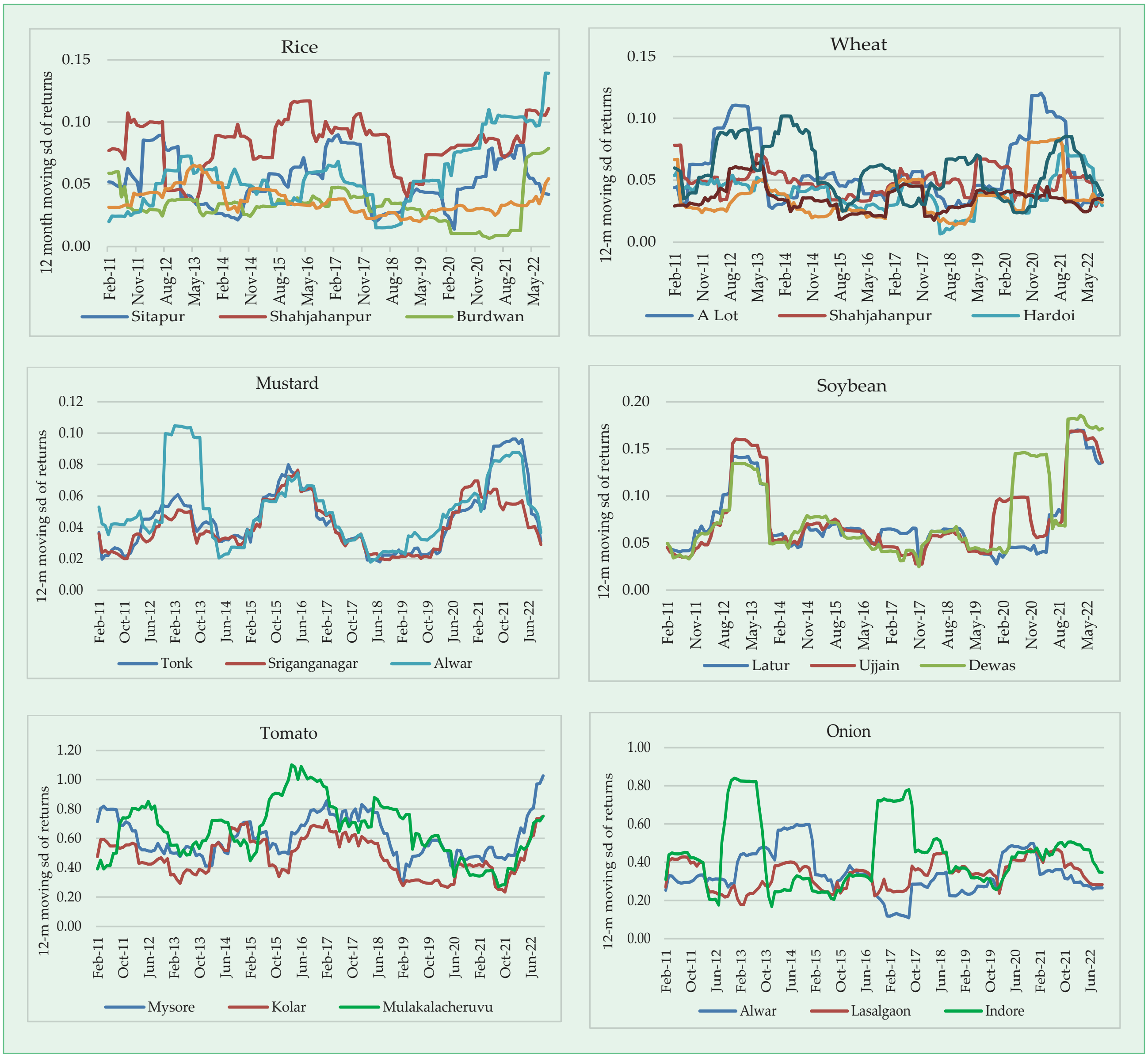


Figure 2.22: Changes in price volatility in food commodities

growth, and another shows a bulk but declining share in total agricultural exports. The third pattern includes commodities whose share in the export basket is low but growing. Agricultural exports have accounted for 10-13% of the total merchandise exports in the past two decades. The export potential of several commodities remains untapped indicating a scope to raise the share of agricultural exports. For example, exports of cotton can be raised by 60% (Table 2.15). Cereals, fish, meat, vegetables, tea, coffee, and spices also have significant untapped export potential.

Table 2.15: Untapped potential of agricultural exports

Products	TE 2021 (US$ million)	Untapped export potential (%)
Cereals	9363.0	56
Meat	3313.6	49
Cotton	7280.1	62
Fruits	1442.4	32
Vegetables	1237.9	44
Fish	6061.7	50
Coffee, tea & spices	3675.6	42
Dairy Produce	421.3	37

Agricultural exports face several challenges, from upstream to downstream. Food safety is a critical issue in international trade. Import refusals can discourage exports and diminish value of exported products, leading to food and monetary losses. The main exports rejected by the USA include spices, cereals & products, ready-to-eat food items, bakery products, shrimp & prawns, and vegetables. Spices, oilseeds & products, vegetables, and shrimp & prawns are the main rejections in the EU market. Spices have higher rejections than any other commodity. Pesticide residues comprise main reason for rejection of consignments of rice, seed spices, vegetables, fruits and their products, oilseeds and their products, and herbs in the USA as well the EU markets (Table 2.16). Similarly, the presence of veterinary drug residues is the main cause of rejection of consignments of shrimp and prawns.

Salmonella, mycotoxins and microbial contamination are the main causes of rejection of fishery products, shrimp and prawns, rice, seed spices, oilseeds, herbs and products, and ready-to-eat foods. Insanitary control or conditions during packing, transportation, and processing are other causes of rejections of fishery products,

Table 2.16: Commodity-wise reasons for rejection during 2011-2021

Commodity/ Product	Rejections by the USA		Rejections by the EU	
	Number	Reasons	Number	Reasons
Basmati rice	1368	Pesticide residue (75%), filthy (22%)	119	Pesticide residue (83%), mycotoxins (8%)
Rice	379	Pesticide residue (82%), filthy (9%)	38	Pesticide residue (79%), mycotoxins (13%)
Shrimp & prawn	798	Microbial (42%), filthy (21%), vet. drug residue (17%)	141	Vet. drug residue (62%), microbial (13%)
Fish & aquaculture	299	Filthy (58%), salmonella (23%), insanitary control (11%)	147	Heavy metals (46), insanitary control (24%), microbial (14%)
Seed spices	697	Salmonella (57%), unsafe substance (17%), labelling (13%)	41	Pesticide residue (63%), Salmonella (27%)
Other spices	3016	Salmonella (54%), filthy (13%), pesticide residue (11%), labelling (9%)	906	Pesticide residue (51%), mycotoxin (27), adulteration (12%)
Vegetables	565	Pesticide residue (50%), labelling (15%), insanitary control (14%)	436	Pesticide residue (94%)
Fruits & products	287	Insanitary control (28%), labelling (25%), pesticide residue (15%)	17	Pesticide residue (82%)
Oilseeds, oil & products	440	Unsafe additive (30%), pesticide residue (27%), salmonella (23%)	1060	Pesticide residue (39%), mycotoxin (32%), salmonella (22%)
Herbs & products	695	Poisonous substance (38%), unsafe substance (38%), pesticide residue (7%)	61	Pesticide residue (51%), salmonella (33%)
Ready to eat foods	1351	Labeling (40%), pesticide residue (13%), filthy (12%), salmonella (11%),	74	Aflatoxin (42%), adulteration (38%)

Note: Rejection reasons may be more than one for a consignment.

vegetables, and fruits and their products. Rejections of herbs and their products, and oilseeds and their products are due to the use of unsafe substances or additives. Inappropriate labelling or misbranding, packaging, and lack of documents are also important reasons in spices and mixtures, vegetables, fruits, and products. Sensitization of food supply chain actors for proper export documentation and labelling is also called for. Food safety issues are ascribed to poor sanitary facilities, inadequate food safety practices and knowledge, and insufficient food safety management system. Implementation of best practices at various levels of export supply chains (i.e., good agricultural practices, at the production level, good manufacturing practices at the processing level, and good handling practices at all levels, must be improved.

Export advantages in Indian horticulture

Raka Saxena and Raman M.S.

This research mapped horticultural commodities based on export competitiveness (revealed symmetric comparative advantage (RSCA) index and trade surplus (trade balance index) and also examined seasonality along and untapped export potential. The country holds a positive trade balance in most vegetables. However, a comparative disadvantage is noted in case of potato, tomato and capsicum (Figure 2.23). Benefits of comparative advantage and trade surplus in selected fruits exist., suggesting improving cost advantage and quality standards. India holds a leading position in export of most spices, and continuous efforts are required to sustain their export advantage. Most exported fruits and spices have seasonality, but not all vegetables. Strong seasonality patterns are noted in spices - dried capsicum, nutmeg, coriander, cumin, ginger, and turmeric.

Export potential of many horticultural products remains untapped. More than 70% of the export potential for pineapple, fresh melon, orange, desiccated coconut, and dried grapes is untapped (Table 2.17). The country needs to focus on commodity-specific strategies to enhance exports. Developing market intelligence will strengthen market linkages and aid in regional crop planning. With increased export focus and growth linkages, a significant impetus is required to boost spice exports. Non-compliance with food safety standards of importing countries, spices have negatively impacted exports of spices. Application of block chains and the Internet of Things (IoTs) can be of great help in marketing, traceability, and transparency in exports.

India's agricultural exports during Covid-19 pandemic

Raka Saxena, Ranjit K. Paul, Balaji S. J. and Rohit Kumar

How India's agricultural exports behaved during the Covid-19 pandemic? Rice is the most important export from India. Its exports during the Covid-19 pandemic witnessed a remarkable increase of 24.4% during the biennium ending (BE) 2021 from US$ 7.07 billion over the pre-Covid period, i.e., BE 2019. Crustaceans are the most exported fish from India, accounting for 75% of the total exports of fish products. Exports of crustaceans declined in 2020. However, the country recovered from the crisis, leading to a 11% increase in its exports in 2021 (Table 2.18). Overall, crustacean exports experienced a decline. Bovine meat exports dwindled due to and quality issues. Similar trends continued even during the Covid-19 pandemic, and bovine meat exports declined by about 11% during the pandemic. Spice exports, on the other hand, witnessed a significant jump. Most spices are known for their therapeutic qualities, and there was an increase in their demand during the pandemic. Exports of cotton products increased during the last three decades, but with some extreme aberrations. Cotton yarn exports

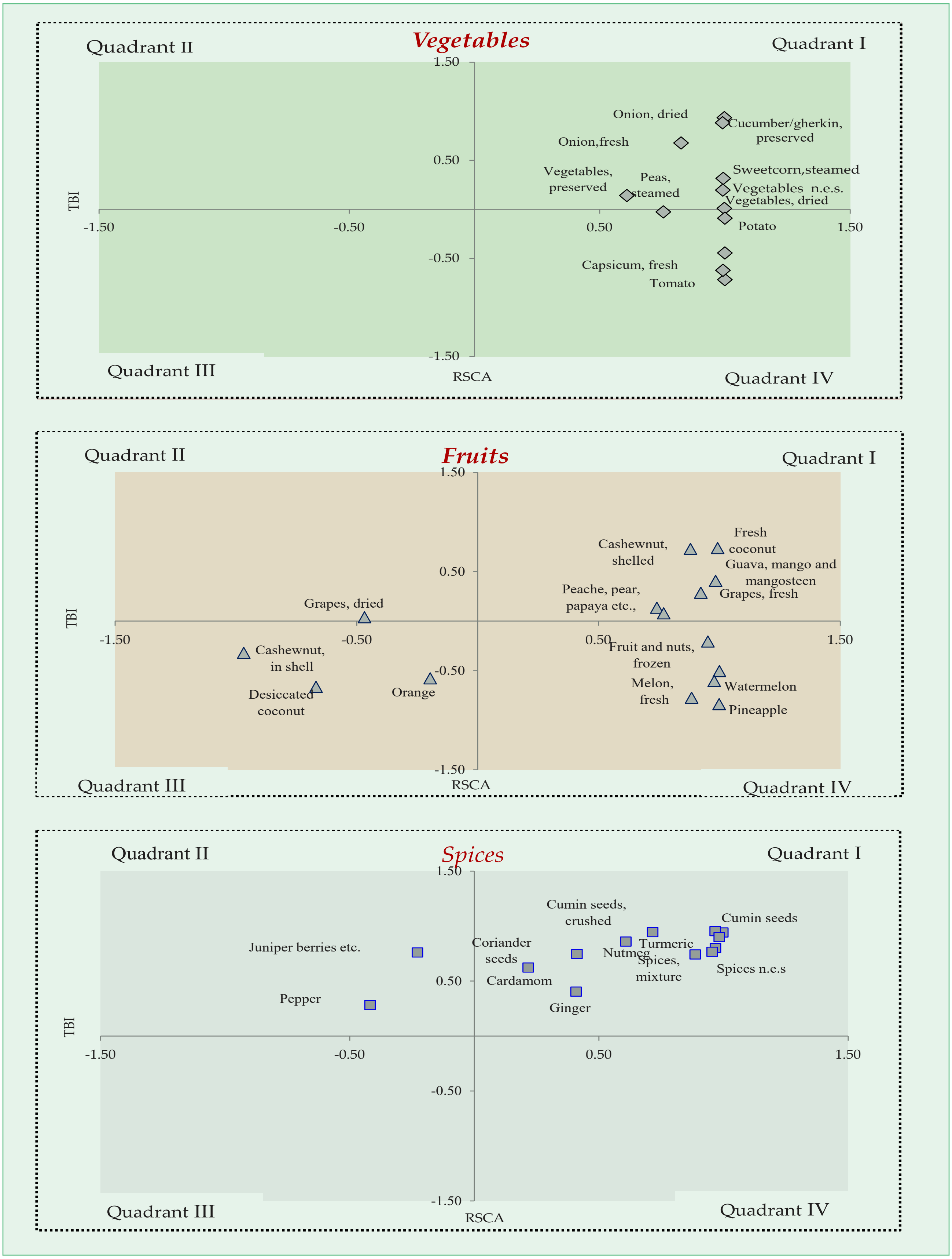


Figure 2.23: Product mapping of horticultural commodities, TE 2020

Table 2.17: Trade advantages and untapped potential in selected horticultural products

Products	RCA [√ (Yes), × (No)]			TBI [+ (Positive), - (Negative)]			Seasonality		Export potential	
	2003	2011	2020	2003	2011	2020	Pattern [√ (Yes), × (No)]	Advantage	Total exports (USD, million)	Potential untapped* (%)
Vegetables										
Potato	×	×	√	+	+	+	×		154	59.09
Tomato	×	×	×	+	+	+	×		39	51.28
Onion, fresh	√	√	√	+	+	+	×		997	58.98
Capsicum, fresh	×	×	×	+	+	+	√		59	57.63
Pea, steamed	x	×	√	+	+	+	×		8.7	49.43
Sweetcorn, steamed	x	×	√	-	+	+	×		16	68.75
Cucumber and gherkin, preserved	√	√	√	+	+	+	√	Strong	108	31.48
Onion, dried	√	√	√	+	+	+	√	Strong	193	43.52
Vegetables, dried	×	×	√	+	+	+	√		57	45.61
Fruits										
Desiccated coconut	×	×	×	+	+	-	×		22	72.73
Fresh coconut	×	√	√	+	+	+	×		122	59.02
Cashewnut, in shell	√	×	×	-	-	-	×		27	59.26
Cashewnut, shelled	√	√	√	+	+	+	√	Strong	1400	59.79
Pineapple	×	×	×	+	+	+	×		9.4	82.98
Guava, mango and mangosteen	√	√	√	+	+	+	√	Nil	359	66.85
Orange	×	×	×	+	-	-	×		66	84.85
Grapes, fresh	×	×	√	+	+	+	√	Partial	798	64.54
Grapes, dried	×	×	√	-	+	-	√		75	69.33
Watermelon	×	×	×	+	+	+	√		20	60.00
Melon, fresh	×	×	×	-	+	+	√		9.7	83.51
Fruit and nuts, frozen	×	×	×	+	+	+	√		76	63.16
Peache, pear, papaya etc.,	×	√	√	+	+	+	√		55	69.09
Spices										
Pepper	√	√	√	+	+	-	×		118	66.10
Nutmeg	n.a.	n.a.	√	n.a.	n.a.	+	√	Nil	60	68.33
Cardamom	n.a.	n.a.	√	n.a.	n.a.	+	n.a.		214	63.08
Coriander seeds	n.a.	n.a.	√	n.a.	n.a.	+	√	Strong	140	60.00
Cumin seeds	n.a.	n.a.	√	n.a.	n.a.	+	√	Strong	852	51.29
Juniper berries etc.	n.a.	n.a.	√	n.a.	n.a.	-	×		69	55.07
Ginger	n.a.	n.a.	√	n.a.	n.a.	+	√		154	67.53
Turmeric	√	√	√	+	+	+	√	Strong	385	46.49
Spices, mixture	√	√	√	+	+	+	√	Strong	177	60.45
Spices n.e.s	√	√	√	+	+	+	√	Strong	207	56.52

Note: n.a. denotes ‘data not available’

Source: Authors’ computations based on ITC and UNCOMTRADE Database, accessed in April, 2022;

* sourced from ITC Export Potential Map

Table 2.18: Impact of Covid-19 on major agricultural exports

Commodity	Particular	BE 2001	BE 2011	Pre-Covid BE 2019	Covid BE 2021	% change in		
						Overall-Covid (2020-21)	2020	2021
Bovine meat (HS 0202)	Quantity (Th Tons)	210	715	1093	973	-11.04	-14.53	-7.55
	Value (million $)	213	2122	3198	2849	-10.88	-13.61	-8.16
Crustaceans (HS 0306)	Volume (Th Tons)	144	209	621	612	-1.33	-13.50	10.84
	Value (million $)	906	1359	4580	4569	-0.23	-15.18	14.72
Tea (HS 0902)	Volume (Th Tons)	189	271	260	204	-21.66	-19.12	-24.21
	Value (million $)	390	780	790	690	-12.65	-12.39	-12.92
Pepper (HS 0904)	Volume (Th Tons)	77	220	441	554	25.76	20.27	31.26
	Value (million $)	109	552	851	1237	45.38	37.20	53.56
Rice (HS 1006)	Volume (Th Tons)	1608	3762	10742	17945	67.05	36.01	98.09
	Value (million $)	620	3185	7073	8802	24.43	12.82	36.05
Cane sugar (HS 1705)	Volume (Th Tons)	757	2242	3862	8100	109.74	82.86	136.63
	Value (million $)	195	1386	1321	3154	138.83	88.91	188.75
Cotton yarn (HS 5205)	Volume (Th Tons)	315	787	1099	1126	2.43	-10.50	15.36
	Value (million $)	834	2757	3346	3652	9.16	-22.04	40.37

Note: BE refers to the biennium average. UVR is the unit value realized. The numbers in parentheses indicate the harmonized system (HS) codes of selected commodities at 4-digit.

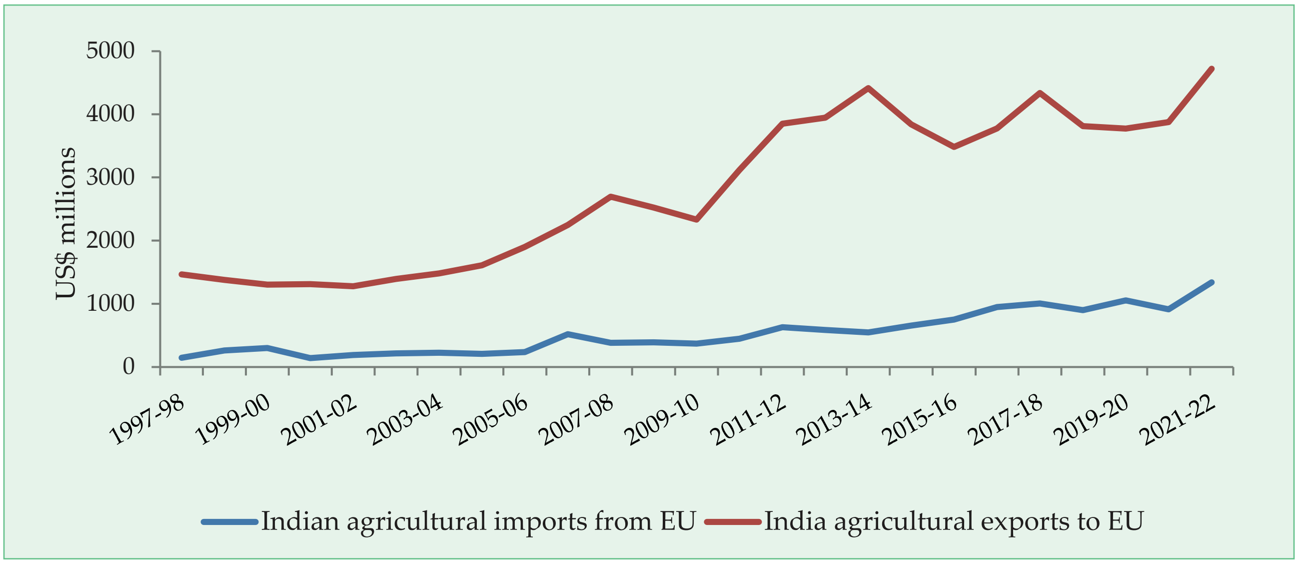
dipped to the lowest levels due to the Covid-19 pandemic.

The country introduced export-enhancing measures such as (temporary) elimination of export duties, eliminating export prohibitions, and terminating prior export authorization. It created a Covid-19 emergency response cell to help exporters and ensured real-time export clearance. For effective compliance with global standards, India must invest in infrastructure for food quality and safety and create awareness among supply chain actors to improve export competitiveness.

Agricultural trade between India and the European Union

Shiv Kumar and Sharath Yeligar

Trade relationship between India and the EU have strengthened over time, as is seen in the increasing exports and imports of agricultural commodities (Figure 2.24). India has been a net exporter of agricultural commodities to the EU. Agricultural imports have grown nine-fold from US$ 145.54 million in 1997-98 to US$ 1339.91 million in 2021-22. During this period, India's agricultural imports from the EU have grown at an annual rate of 8.93%, and consistently and its agricultural exports to the EU have grown three-fold from US$ 1463.57 million in 1997-98 to US$ 4271 million in 2021-22 at annual rate of 6.17%. This confirms the fact that India and the EU are stable and reliable partners in agricultural trade. This is an important feedback for creating a free trade environment *via* Free Trade Agreement between India and the EU.



Note: Data for 1997-98 is normalised by taking average of 1996-97 to 1998-99

Figure 2.24: Trend in India's agricultural trade with EU in 1997-2021

Sustainable rice ecosystem for managing virtual water trade

Raka Saxena, Raman M. S., S. K. Srivastava and Rohit Kumar

This study has assessed the temporal changes in export of virtual water embedded in rice. Rice is the most important export from India; hence the country exports the bulk of water virtually (Figure 2.25). It suggests realigning the rice ecosystem based on demand–supply gap, groundwater exploitation, productivity growth and untapped potential and to focus on shifting rice from water-stressed regions to favorable agroclimatic zones (ACZs) for managing virtual water exports. Shifting a major chunk of non-*basmati* rice to Eastern Himalayan (EH), Upper Gangetic Plains (UGP), and Eastern Plateau and Hills (EPH) from Lower Gangetic Plains (LGP), Trans Gangetic Plains (TGP), Western Plateau and Hills (WPH), could help prevent water crisis. Practices such as direct seeding (DSR), system of rice intensification (SRI), and alternate wetting and drying (AWD) are the mechanisms that can be considered in managing shift in rice cultivation. Crop diversification along with required logistic support towards environment-friendly crops like pulses, millets, vegetables, and fruits would also help the transition. Investments should be encouraged to improve farming practices targeting yield-enhancing and water-saving technologies.

Supply response of oilseeds

Pavithra B., Kingsly I.T. and Shiv Kumar

Per capita consumption of edible oil has increased from 10.6 kg/person in 2005-06 to 19.7 kg/person in 2020-21. The current per capita consumption of edible oil is 79% above the ICMR recommendation of 10.95 kg/person. According to the Ministry of Consumer Affairs, Food and Public Distribution, the total domestic demand for edible oil is about 25 million tons, and has been increasing at 5% annually. Assuming an average oil recovery rate of 28%, about 10.1 million tons of edible oils is produced from 36.1 million tons of oilseeds. Domestic production can meet 41% of the total demand. On the other hand, edible oil production has stagnated.

This study identified determinants of supply response for major oilseeds. The result show that oilseeds' prices, price risk and cost of production

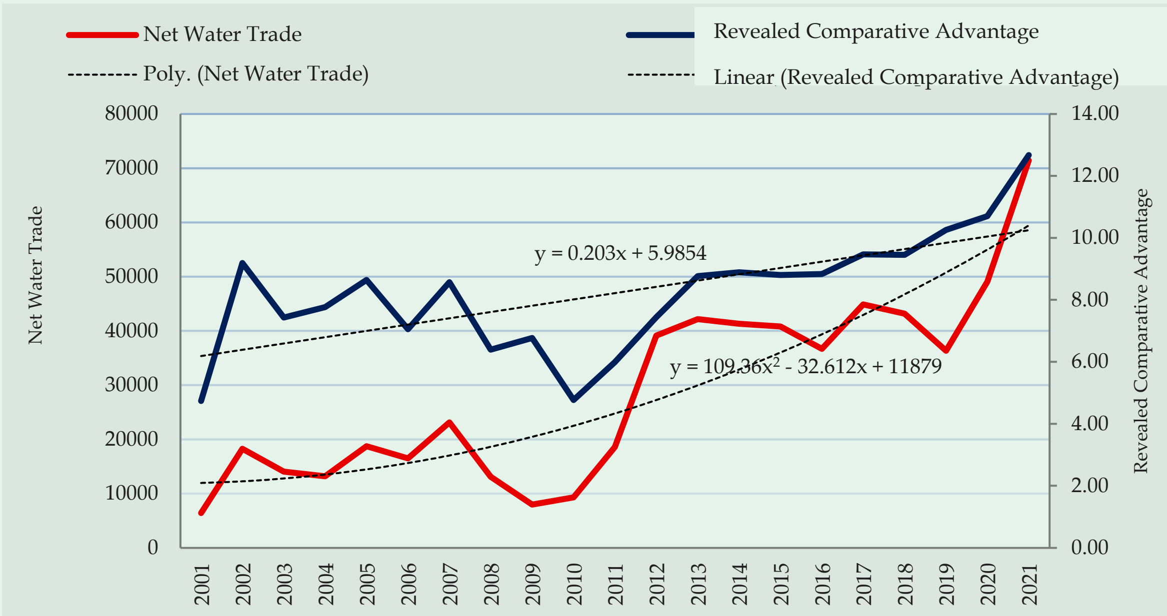


Figure 2.25: Trends in revealed comparative advantage and net water trade in rice

are the most important factors in farmers' production decisions. In case of groundnut in Gujarat, farm harvest price has increased, but at the same time, the unit cost of production has increased at a faster rate. This clearly shows that relative profitability of groundnut is declining. Rainfall and irrigation have a positive impact on production. Hence, efforts should be made to bring more of oilseeds area under irrigation (Table 2.19).

Table 2.19: Determinants of production response in groundnut, rapeseed-mustard and soybean

Variables	Groundnut	Rapeseed- Mustard	Soybean
Log Production(t-1)	0.427*** (0.037)	0.527*** (0.042)	0.928*** (0.020)
Constant	-1.332*** (0.571)	-1.982*** (0.457)	-2.308*** (0.724)
Log Farm harvest price	0.428*** (0.076)	0.270*** (0.078)	0.507*** (0.127)
Yield growth	0.444*** (0.0037)	0.072*** (0.018)	0.349*** (0.036)
Price risk	-3.367* (0.076)	-3.391** (1.445)	-8.395*** (3.361)
Log Irrigated area	0.336*** (0.023)	0.271*** (0.024)	0.036*** (0.013)
Log cost/qtl	-0.398*** (0.064)	-0.196*** (0.067)	-02224*** (0.061)
Log Rainfall	0.232*** (0.079)	0.202*** (0.062)	0.039 (0.076)

List of Research Projects

Table 2.20: Completed and ongoing research projects

Title of project	Project area	Project duration	Project team	Project status
Network Project (Ecosystems, agribusiness and institutions)				
Component I: Inclusive agricultural development (Hill and arid agriculture)	Technology and Sustainable Development	April 2021- March 2026	Prem Chand Khem Chand Kiran Kumara T.M.	Ongoing
Component II: Impact of agricultural technology	Technology and Sustainable Development	April 2021- March 2026	Rajni Jain Ankita Kandpal Vinayak Nikam	Ongoing
Component III: Agricultural market intelligence and commodity outlook	Agricultural Markets and Trade	April 2021- March 2026	Purushottam Sharma D. C. Meena Kingsly I.T.	Ongoing
Component IV: Farmers' income, governance impacts and agricultural trade	Agricultural Growth and Development	April 2021- March 2026	Raka Saxena Balaji S.J.	Ongoing
Externally funded projects				
Doubling farmers' income in India by 2021-22: Estimating farm income and preparation of strategic framework	Agricultural Growth and Development	April 2017- March 2023	Raka Saxena Balaji S.J. R. K. Paul	Completed
Strategic research component of National Innovations on Climate Resilient Agriculture (NICRA)	Technology and Sustainable Development	April 2017- Contd.	Nalini Ranjan Kumar S. K. Srivastava N. P. Singh	Ongoing
Trees outside forests in India	Technology and Sustainable Development	November 2021- October 2026	Prem Chand Kiran Kumara T.M. Vinayak Nikam	Ongoing

Title of project	Project area	Project duration	Project team	Project status
Improving groundwater sustainability through analyzing groundwater-energy nexus	Technology and Sustainable Development	April 2021-March 2026	S. K. Srivastava Subhash Chand Prabhat Kishore Ranu Rani Sethi (ICAR-IIWM) Ankhila R.H. (ICAR-IIWM)	Ongoing
Management and impact assessment of farmer FIRST	Technology and Sustainable Development	February 2017- March 2024	Shiv Kumar Rajni Jain Vinayak Nikam Ankita Kandpal Kingsly I.T.	Ongoing
Institute funded projects				
Database development for agricultural rural households with special focus on weaker sections	Technology and Sustainable Development	April 2020-March 2025	Subhash Chand Rajni Jain Vikas Kumar Dilip Kumar D. C. Meena K. R. Chaudhary M. S. Chauhan	Ongoing
Farm mechanization-The role of custom hire services and rural labour market	Technology and Sustainable Development	April 2020-March 2023	Nalini Ranjan Kumar S. K. Srivastava	Completed
Sustainable intensification of agriculture	Technology and Sustainable Development	April 2020-March 2024	Prem Chand Kiran Kumara T.M. D. C. Meena	Ongoing
Institutions and technology for agricultural water management	Technology and Sustainable Development	April 2021-March 2024	S. K. Srivastava Subhash Chand Prabhat Kishore	Ongoing
COVID-led changes in agricultural sector and food consumption	Technology and Sustainable Development	April 2020-March 2023	S.K. Srivastava Raka Saxena Purushottam Sharma Balaji S.J. D.C. Meena	Completed

Title of project	Project area	Project duration	Project team	Project status
Performance and impact of Farmer Producer Organizations (FPOs)	Technology and Sustainable Development	April 2021-March 2024	Vinayak Nikam Prem Chand	Ongoing
R & D investment and innovation outcomes in Indian agriculture	Technology and Sustainable Agriculture	August 2020-March 2025	Ankita Kandpal	Ongoing
Welfare gains to the farm households with access to minimum support price and its effect on groundwater depletion	Agricultural Markets and Trade	April 2022-March 2024	Prabhat Kishore P.S. Birthal S. K. Srivastava	Ongoing
Economic valuation of ecosystem service from sustainable agricultural practices in India	Technology and Sustainable Development	July 2022-June 2023	Kiran Kumara T.M. D.C. Meena P.S. Birthal	Ongoing
Agricultural price analysis and forecasting	Agricultural Markets and Trade	April 2020-March 2025	Purushottam Sharma D.C. Meena Kingsly I.T. Shiv Kumar	Ongoing
AI and Machine Learning for supply forecasts	Technology and Sustainable Development	April 2021-March 2026	Rajni Jain Dilip Kumar Abimanyu Jhajhria Anshu Bharadwaj Sapna Nigam	Ongoing
Regional disparity in use of fertilizers in India: Causes and impacts	Technology and Sustainable Development	September 2022-August 2024	Sant Kumar Kingsly I.T.	Ongoing
Appraisal of dairy services: Access, preferences and impacts	Technology and Sustainable Development	January 2023-December 2024	Arathy Ashok Vikas Kumar Vinayak Nikam	Ongoing
Value chain study on non-bovine milk in India	Technology and Sustainable Development	January 2023-December 2024	Khem Chand	Ongoing

Title of project	Project area	Project duration	Project team	Project status
Impact analysis of Farmers' Innovations on agro-economic development in rural areas	Technology and Sustainable Development	July 2022-December 2024	Vikas Kumar Arathy Ashok Dilip Kumar	Ongoing
Digital innovations in agriculture	Technology and Sustainable Development	January 2023-March 2025	Rajni Jain Vikas Kumar Arathy Ashok	Ongoing

Table 2.21: Consultancy and contract research projects

Area of consultancy/ contract research	Institution to which consultancy provided	Name of the scientists
Impact of blending of edible on the production of select oilseeds	Ministry of Agriculture and Farmers Welfare, Government of India	Shiv Kumar Raka Saxena R. K. Paul P.S. Birthal
Management and institutional recommendations for bringing reforms in PMFBY	Ministry of Agriculture and Farmers Welfare, Government of India	Khem Chand Vikas Kumar Raka Saxena
Value chain analysis and effect of agricultural application of biochar on livelihood in India	World Agroforestry (CIFOR-ICRAF), South Asia, New Delhi	Prem Chand Purushottam Sharma Kiran Kumara T.M. P.S. Birthal
Economic valuation of ecosystem services from agriculture in India	IFPRI, South Asia, New Delhi	Kiran Kumara T.M. D.C. Meena P.S. Birthal
The Ukraine-Russia War and its food security implications in South Asia	IFPRI, South Asia, New Delhi	Balaji S. J.
Investigating the potential uses for behavioral economic interventions in food choice on Indian college campuses	Cornell University, USA	S. K. Srivastava
Unpacking social and gender dynamics of seed systems for sustainable intensification of agriculture	International Rice Research Institute (IRRI)	Raka Saxena Shiv Kumar Prabhat Kishore S .V. Bangara Raju P.S. Birthal

3 Capacity Building

Seminars, Workshops, Trainings and Lectures Organized

ICAR-NIAP Policy Lecture Series

ICAR-NIAP initiated a policy lecture series on contemporary issues in Indian agriculture from January 2023. The following lectures were delivered:

- Relevance of Lewis Model and Rethinking the Role of Agriculture in Economic Transformation by Prof. Ramesh Chand, Member (Agriculture), NITI Aayog, January 19, 2023.
- Climate Change and Food System Sustainability: Challenges and Solutions by Dr. Rob Vos, Director, Trade, Markets and Institutions, International Food Policy Research Institute (IFPRI), Washington D.C., February 17, 2023.
- Risky Choice, Lottery Selection and Probability Weighting: Testing Robustness to Extremes by Dr. David R. Just, Susan Eckert Lynch Professor in Science and Business, The Charles H. Dyson School of Applied Economics and Management, Cornell University, USA, March 27, 2023.

Glimpses of Policy Lecture Series on Contemporary Issues In Indian Agriculture

Azadi ka Amrit Mahotsav Lectures

As a part of Azadi ka Amrit Mahotsav celebrations, ICAR-NIAP organized several lectures during 2022-2023.

- Vedic Ecosystem-based Research for Sustainable Agriculture by Mr. Akhilesh Srivastava, Senior Consultant- Standards and IPR, Tata Consultancy Services (TCS) Limited, Mumbai, May 26, 2022.
- Digital Transformation of Agriculture - A Global Perspective *by* Mr. Deepak Pareek, CEO, Agriwatch, July 27, 2022.
- The Russia-Ukraine War: Implications for Global and Regional Food Security *by* Dr. Channing Arnt, Director-EPTD, IFPRI, Washington, D.C., July 20, 2022.
- Repurposing Agricultural Policies and Support for Transformation of Agriculture and Food System to Better Serve the Health


Azadi ka Amrit Mahotsav Lectures delivered at ICAR-NIAP

of People by Dr. Madhur Gautam, Lead Agricultural Economist, World Bank, Washington, D.C., August 25, 2022.

- Agri-Startups in India by Dr. Harsh Kumar Bhanwala, former Chairman, NABARD, Mumabi, August 30, 2022.
- Nutri-Garden by Dr. Lipi Das, Principal Scientist, ICAR-Central Institute for Women in Agriculture (CIWA), Bhubneshwar, August 17, 2022.

Food Systems Dialogue India 2022

As a part of the two-day Dialogue on Food Systems for India organized by Bharat Krishak Samaj on November 15-16, 2022, at New Delhi, the ICAR- NIAP organized deliberations on the theme ***Food Production System.*** Participants from different ICAR institutions discussed key dimensions related to input management (seed and fertilizers), resource conservation, irrigation water management, integrated pest management, good agricultural practices, regional crop planning, crop diversification, sustainable farming systems, food and nutritional security, effective price policies, ecosystem services, dairy innovations, food safety, quality, etc.

Dialogue on Food Systems for India organized by Bharat Krishak Samaj on November 15-16, 2022

Brainstorming Session on Beyond Price Support and Subsidies

On behalf of the National Academy of Agricultural Sciences (NAAS), ICAR-NIAP convened a brainstorming session on Beyond Price Support and Subsidies on September 30, 2022, at NAAS, NASC, New Delhi. Mr. Siraj Hussain, former Secretary, Agriculture, Government of India and Dr. T. Mohapatra, President, NAAS co-chaired the session.

Workshops under the project Trees Outside Forests in India (TOFI)

- A two-day stakeholder consultation workshop was conducted during June 21-22, 2022 at Forest College and Research Institute, TNAU, Mettupalayam to seek feedback regarding the policy changes required for deregulation of some of the native species grown outside the forest.
- A one-day Technical Workshop on Identification of Opportunities for TOF

A two-day stakeholder consultation workshop at Forest College and Research Institute, TNAU, Mettupalayam, June 21-22, 2022

Expansion in Tamil Nadu under the Trees Outside Forests in India (TOFI) was organised at the Forest College and Research Institute, TNAU Mettupalayam, Tamil Nadu, September 22, 2022.

- A state launch workshop of the TOFI Project was organised at Guwahati, Assam, October 18-19, 2022.

Review Meeting on Network Project

As a part of a network project on *Ecosystem, Agribusiness and Institutions,* the following review meetings were organized:

- A virtual meeting to discuss the progress of the network project, on December 14, 2022.
- Annual review workshop of network project to track progress and charter future plans on March 6-7, 2023.

Training Programs under SC Sub-Plan

- The following training programs on tailoring for the benefit of women belonging to SC communities were organized:

The following trainings related to nutrition and vegetable cultivation were organized:

- Enhancing Nutrition through Vegetable Cultivation at Dhamarvali village, Bulandshahr, Uttar Pradesh, June 27, 2022.
- Organic Vegetable Production for Nutritional Security, at Jagatpur Sultanpur village, Bulandshahr, Uttar Pradesh, September 1, 2022.
- Organic Vegetable Production for Nutritional Security, at Dhamrawali, Sunana and Jagatpur Sultanpur, Bulandshahr, Uttar Pradesh, November 17-18, 2022.
- A training-cum-goat distribution program as a part of SCSP at KVK, Chomu, Jaipur, February 10, 2023.

Table 3.1: Training *programmes* for women under SC Sub-Plan

S. No.	Title of training	Period of training	No. of participants
1.	Tailoring training to the weaker section women, Basada, Samalkha block, Panipat, Haryana	August 15 to September 14, 2022	23
2.	Tailoring training to the weaker section women, Basada, Samalkha block, Panipat, Haryana	November 14 to December 15, 2022	22
3.	Tailoring training to the weaker section women, Raksada, Samalkha block, Panipat, Haryana	December 28, 2022 to January 27, 2023	25
4.	Tailoring training to the weaker section women, Basada, Samalkha block, Panipat, Haryana	February 23 to March 23, 2023	26
5.	Tailoring training to the weaker section women, Raksada, Samalkha block, Panipat, Haryana	February 23 to March 23, 2023	29
6.	Tailoring training to the weaker section women, Dhamravali, Bulandshar, Uttar Pradesh	February 27 to March 28, 2023	24

- A workshop-cum-training for skill development of field investigators under the project Database Development for Agricultural Rural Households, at ICAR-NIAP, February 3-4, 2023.

Human Resource Development activities in Rural India

Consultations under PMFBY

- A state level stakeholder consultation workshop on Management Issues in PMFBY was organized at Pant Bhawan, Jaipur, May 31, 2022.
- A stakeholder consultation meeting related to Management Issues in PMFBY was organized at Karnal and Kurukshetra in Haryana, June 6, 2022.
- A state level stakeholder consultation workshop on Management Issues in PMFBY was organized at office of Department of Agriculture, Govt. of Haryana in Punchukula, June 7, 2022.

Stakeholders interactions under PMFBY at Jaipur, Rajasthan

Others

- An official language workshop on the use of Unicode in typing in Hindi, June 28, 2022.

Teaching and student guidance

Table 3.2: Teaching activities undertaken by ICAR-NIAP Scientists

Name of the scientist	Course Name	Credit hours	Role (Course Leader/ Associate)	Division
Nalini Ranjan Kumar	Agricultural Production Economics (AgEcon 502)	2+1	Course Associate	Agricultural Economics, ICAR-IARI, New Delhi
	Advanced Macro Economic Analysis (AgEcon 602)	3+0	Course Associate	Agricultural Economics, ICAR-IARI, New Delhi
Rajni Jain	GIS and Remote Sensing Techniques (CA572-2020)	2+1	Course Associate	Computer Application, ICAR-IASRI, New Delhi
	Artificial Intelligence (CA575-2020)	2+1	Course Leader	Computer Application, ICAR-IASRI, New Delhi
	Fuzzy Sets and Rough Sets (CA612-2020)	2+1	Course Leader	Computer Application, ICAR-IASRI, New Delhi
	Artificial Intelligence and Machine Learning	2+1	Course Leader	Computer Application, ICAR-IASRI, New Delhi
	Spatial Informatics, GIS and Remote Sensing	1+1	Course Associate	Computer Application, ICAR-IASRI, New Delhi
Shiv Kumar	Agricultural Marketing	1+1	Course Leader	Agricultural Economics, ICAR-IARI, New Delhi
	International Trade	2+0	Course Leader	Agricultural Economics, ICAR-IARI, New Delhi
S.K. Srivastava	Agricultural Price Analysis	2+0	Course Associate	Agricultural Economics, ICAR-IARI, New Delhi
	Quantitative Analysis for Marketing and Business Decisions	2+0	Course Associate	Agricultural Economics, ICAR-IARI, New Delhi
	International Trade	2+0	Course Leader	Agricultural Economics, ICAR-IARI, New Delhi
Vinayak Nikam	Advanced Management Techniques	2+1	Course Leader	Agricultural Extension, ICAR-IARI, New Delhi
	Policy Engagement and Extension	2+1	Course Leader	Agricultural Extension, ICAR-IARI, New Delhi
	Organisational Behaviour	2+1	Course Associate	Agricultural Extension, ICAR-IARI, New Delhi
	Advances in Evaluation Designs and Methods	2+1	Course Associate	Agricultural Extension, ICAR-IARI, New Delhi
Kingsly I. T.	Operation Research (AGECON620-2020)	1+1	Course Leader	Agricultural Economics, ICAR-IARI, New Delhi
	Agricultural Price Analysis (AGECON630-2020)	1+1	Course Leader	Agricultural Economics, ICAR-IARI, New Delhi

Table 3.3: Student guidance as chairperson of the advisory committee

Name of scientist	Name of student	Degree (M.Sc./ Ph.D.)	Division	Thesis topic
P.S. Birthal	Shweta Bijla	Ph.D.	Dairy Economics, Statistics and Management, ICAR-NDRI, Karnal	Assessment of the Impact of Livestock on Rural Poverty and Child Nutrition
P.S. Birthal	Amit Thakur	Ph.D.	Dairy Economics, Statistics and Management, ICAR-NDRI, Karnal	Economic Impact of Sex Semen Technology in Dairy Cattle
Nalini Ranjan Kumar	Subrata Gorain	Ph.D.	Agricultural Economics, ICAR-IARI, New Delhi	Impact of Conservation Technologies in Agriculture
	Thrilok Belli B.M.	Ph.D.	Agricultural Economics, ICAR-IARI, New Delhi	Impact Assessment of Paddy Mechanization
	Rohith S.	Ph.D.	Agricultural Economics, ICAR-IARI, New Delhi	Evaluation of Some Innovative Custom Hiring Models of Farm machineries
	Rajrattan Pandey	Ph.D.	Agricultural Economics, ICAR-IARI, New Delhi	Climate Change Impacts
	Ms. Soumya Cheela	Ph.D.	Agricultural Economics, ICAR-IARI, New Delhi	Impact Assessment of National Rural Livelihood Mission (NRLM) on Climate Change Vulnerability
Rajni Jain	Sapna Nigam	Ph.D.	Computer Application, P G School, ICAR-IARI, New Delhi	Development of Deep Learning Model for Identification of Major Wheat Diseases
S. K. Srivastava	Sunil Naik	M.Sc.	Agricultural Economics, ICAR-IARI, New Delhi	Crop Output Disposal Pattern and its Implications for Farmers Income in Odisha
	Sneha S. B.	M.Sc.	Agricultural Economics, ICAR-IARI, New Delhi	Changing Rural Employment Pattern and its Implications on Farm Economy

Name of scientist	Name of student	Degree (M.Sc./ Ph.D.)	Division	Thesis topic
Kingsly I.T.	Pavithra B.	M.Sc.	Agricultural Economics, ICAR-IARI, New Delhi	An Economic Analysis of Supply Response and Price Transmission in Major Edible Oilseeds Of India
	Hitashree	M.Sc.	Agricultural Economics, ICAR-IARI, New Delhi	Competitiveness, Concentration and Capacity Utilization of Oilseeds Processing Industry
	Seema Arya	Ph. D.	Agricultural Economics, ICAR-IARI, New Delhi	Pass Through Effects of Energy Prices on Prices of Agricultural Commodities
Vinayak Nikam	Veesam Haripriya	M.Sc.	Agricultural Extension, ICAR-IARI, New Delhi	An Institutional Analysis of Performance of Farmer Producer Organizations in India
	Sahithi Pasupuleti	M.Sc.	Agricultural Extension, ICAR-IARI, New Delhi	Evaluation of the Mango Value Chain of Farmer Producer Organizations
	Mathi Girishma	M.Sc.	Agricultural Extension, ICAR-IARI, New Delhi	Access to Extension and Advisory Services: Diversity and Impact in India

4 Policy Interactions

- The Institute being a member of the group of ICAR institutions (i.e., CRIDA, NBSSLUP, IIFSR and NIAP) constituted by the ICAR has helped developing economically feasible crop plans for different agro-ecological zones and suggested technological, institutional and policy options for accelerating pace of agricultural diversification for arresting degradation of land and water resources and increasing farmers' income. The evidence so generated will serve as input to the Committee for Minimum Support Price (MSP), Natural Farming and Crop Diversification to suggest pathways for crop diversification away from water-guzzling crops.
- The ICAR-NIAP provided inputs to the Committee for Minimum Support Price (MSP), Natural Farming and Crop Diversification constituted by the Government of India to look for alternative mechanisms to minimum support prices of agricultural commodities and their feasibility of implementation.
- The Institute in collaboration with the National Academy of Agricultural Sciences (NAAS) organized a brainstorming session to explore possibilities for re-orienting and re-purposing agricultural subsidies and minimum support prices as to ensure long-term sustainability of agriculture without affecting farmers' welfare.
- The Institute provided inputs to the Ministry of Agriculture and Farmers Welfare, Government of India for fixing minimum support price of copra.
- The Institute provided inputs to the Ministry of Agriculture and Farmers Welfare, Government of India on fixing of minimum support price of jute.
- The Institute participated in the discussion on the modalities for restructuring cooperatives for inclusive and sustainable economic development organized by the newly constituted Ministry of Cooperation, Government of India.
- The Institute is a knowledge partner of the Ministry of Agriculture and Farmers Welfare, Government of India to provide evidence-based inputs to the Committee on Doubling Farmers Income for evolving a framework for improving efficiency and outreach of agricultural schemes leading to doubling of farmers' income.
- The Institute provided inputs to the Statistical Commission, Ministry of Statistics and Program Implementation, Government of India, on the savings and investment behaviour of rural and urban households.
- The Institute is engaged in generating demand and supply forecasts of various agricultural commodities for the NITI Aayog, Government of India, which will help formulating programs for effective crop and livestock planning.
- The Institute provided inputs to the Ministry of Agriculture and Farmers Welfare, Government of India on the impact of banning blending of the mustard oil on the price of mustard seed, oil and acreage. This is expected to serve as an input for taking appropriate decisions for enhancing domestic production of oilseeds, oils and reducing import dependence.
- The Institute provided evidence-based inputs to the Ministry of Agriculture and Farmers Welfare, Government of India for reforming the Pradhan Mantri Fasal Bima Yojana (PMFBY).
- The Institute provided inputs to the National Bank for Agriculture and Rural Development (NABARD) for financing mitigation and adaptation in agriculture, and for financing livestock development.

5 Research Outputs

Agricultural Development Report

1. ICAR-NIAP. (2023). Agricultural Development Report 2022-23. ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi (Eds. P.S. Birthal, Raka Saxena, Purushottam Sharma, and Kiran Kumara T.M.).

Policy Papers

1. Birthal, P. S., Hazrana, J., and Saxena, R. (2023). Livestock Farmers' Information Needs, Search Behaviours and Their Impact: Lessons for Extension Policy. Policy Paper 38, ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi.
2. Saxena, R., Srivastava, S. K., Balaji, S. J., Jhajhria, A., and Khan, Md. A. (2023). Changes in Indian Agriculture: Household-level Evidence. Policy Paper 39, ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi.

Policy Briefs

1. Birthal, P.S., Hazrana, J., Negi, D.S., and Mishra, A. (2022). To Insure or Not to Insure: What Explains Low Uptake of Crop Insurance? Policy Brief 47, ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi.
2. Birthal, P.S. (2022). Managing Climate Risks in Indian Agriculture: What do We Need to Know? Policy Brief 48, ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi.
3. Balaji, S. J., Sharma, P. Venkatesh, P., and Shreya, K. (2022). Technology and Policy Options for Reducing India's Import Dependence on Edible Oils. Policy Brief 49, ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi.
4. Saxena, R., Paul, R. K., Balaji, S. J., and Kumar, R. (2022). India's Agricultural Exports during the Covid-19 Pandemic. Policy Brief 50, ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi.
5. Kumar, S., Kishore, P., Srivastava, S. K., and Chand, S. (2023). Potential of Micro-Irrigation for Sustainable Intensification of Agriculture. Policy Brief 51, ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi.
6. Kingsly, I.T., Kumar, S., Parappurathu, S., and Pal, S. (2023). Outlook for Rice and Wheat to 2030-31. Policy Brief 52, ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi.

ICAR-NIAP Diary

1. ICAR-NIAP Diary (2022). Six monthly bulletin of ICAR-NIAP. (Eds. Rajni Jain, M. S. Chauhan, and Sonia Chauhan). E-published by Director, ICAR-National Institute of Agricultural Economics and Policy Research (NIAP), New Delhi.

Research Papers in Peer-reviewed Journals

1. Amale, H.S., Birthal, P.S., and Negi, D.S. (2022). Delayed monsoon, irrigation and crop yields. *Agricultural Economics*, https://doi.org/10.1111/agec.12746.
2. Anirudh, K.C., Aditya, K.S., Subash, S.P., and Kuruvila, A. (2022). Paddy farmers in Kerala

are willing to pay more for a modified crop insurance product. *Agricultural Economics Research Review*, 35(1): 115-122.

3. Balaji, S. J. and Babu, S.C. (2022). Russia-Ukraine War: India's fertilizer supply woes. *The Global Analyst, 11*(5): 38-41.

4. Bardhan, D., Kumar, S., Kumar, N., Khan, R., Talukder, S., and Mendiratta, S. K. (2022). Identifying disease risk hotspots in buffalo meat (Carabeef) value chain. *The Indian Journal of Animal Sciences*, 92(1): 3-11.

5. Basantaray, A.K., Paltasingh, K.R., and Birthal, P.S. (2022). Crop diversification, agricultural transition and farm income growth: Evidence from Eastern India. *Italian Review of Agricultural Economics,* 77(3): 55-65. https://doi.org/ 0.36253/rea-13796.

6. Biradar, N., Tirlapur, L., Kerur, A. Chand, K., and Raghuprasad, K.P. (2022). Documentation and validation of scientific rationality of ITKs relating to fodder management and livestock health. *Range Management and Agroforestry,* 43 (2): 317-325.

7. Birthal, P.S., Hazrana, J., and Saxena, R. (2022). Investigating the impact of information on the efficiency of smallholder dairy production systems in India and the lessons for livestock extension policy. *Agricultural Economics Research Review*, 35 (2): 27-42.

8. Birthal, P.S., Hazrana, J., Negi, D.S., and Mishra, A.K. (2022). Assessing benefits of crop insurance vis-a-vis irrigation in Indian agriculture. *Food Policy*, https://doi.org/10.1016/j.foodpol.2022.102348

9. Birthal, P.S., Joshi, P.K., Roy, D., and Pandey, G. (2022). Transformation and sources of growth in Southeast Asian agriculture. *Journal of Southeast Asian Economies,* 39(2): 171-191.

10. Bisen, J., Kumar, S., Singh, D.R., Nain, M.S., Arya, P., and Tiwari, U. (2023). Performance and macro-economic scenarios of rice market outlook in India. *Oryza*, 60 (Special Issue): 78-90. https://doi.org/10.35709/ory.2023.60.0.7.

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12. Bunkar, K., Prakash, S., Ramasubramanian, V., Krishnan, M., and **Kumar, N.R. (2022).** Economic efficiency analysis of fish farming in Bharatpur district, Rajasthan: A corporate social responsibility (CSR) initiative. *Indian Journal of Fisheries,* 69(4): 109-114.

13. Chand, P., Singh, J.M., Sachdeva, J., Singh, J., Agarwal, P., Jain, R., Rao, S., and Kaur, B. (2022). Irrigation water policies for sustainable groundwater management in irrigated northwestern plains of India. *Current Science,* 123 (10): 1225-1231. https://doi.org/10.18520/cs/v123/i10.

14. Chand, S. (2023). Institutional innovation in water resource management under ILSP programme in Uttrakhand: A case study. *Agro Economist - An International Journal,* 9(04): 259-267.

15. Chand, S. Kingsly, I.T., Kumar, A., and Bharaty, A. (2023). Causes and consequences of conflicts in surface irrigation: Micro level study from Northern India. *Indian Journal of Soil Conservation*, 51(1):1-8.

16. Choudhary, B.B., Dev, I., Singh, S., Singh, R., Sharma, P., Chand, K., Garg, K.K., Anantha, K.H., Akuraju, V., Dixit, S., Kumar, S., Asharam, and Kumar, N. (2022). Impact of soil and water conservation measures on farm productivity and income in the semi-arid tropics of Bundelkhand, central India. *Environmental Conservation*, https//doi.org/10.1017/S0376892922000352.

17. Das, A., and Kumar, N. R. (2022). Common pool resource dependency of fisheries based rural households: An evidence from North-east India. *Indian Journal of Fisheries,* 69(3): 144-149.

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19. Gawa, S., Siddique, P. A., Kumar, P., Chaudhary, A. K., and Kumar, N. R.. (2022). Economic performance of reservoir fish farming (RFF): A reinvented pen culture system introduced by Directorate of Fisheries, Jharkhand to adapt hydrological characteristics of reservoirs of Jharkhand. *Journal of Experimental Zoology, India*, 25(1): 775-779.

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22. Kingsly, I. T. and Kumar, S. (2022). Water sustainability concerns in sugarcane and the role of drip irrigation in Maharashtra, India. *Indian Journal of Agricultural Economics*, 77 (Conference issue): 503.

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26. Jumrani, J. and Meenakshi, J. V. (2022). How effective is a fat subsidy? Evidence from edible oil consumption in India. *Journal of Agricultural Economics*, https://doi.org/10.1111/1477-9552.12510.

27. Kandpal, A., Kar, A., Kingsly, I. T., Singh, A., Jha, G. K., and Singh, P. (2022). Insights on ownership pattern and demand for machinery in Indian agriculture. *Indian Journal of Agricultural Sciences,* 92 (1): 18–21.

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3. Chand, P. (2023). The half-sickle women of Maharashtra. The Hindu. March 24, 2023. https://www.thehindu.com/news/national/the-half-sickle-women-of-maharashtra/article66654750.ece. March 24, 2023.

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2. Chand, K., Kumar, V., and Saxena R. (2022). Final Report of the Consultancy Project on Management and Institutional Recommendations for Bringing Reforms in PMFBY. Submitted to NRAA, Ministry of Agriculture and Farmers' Welfare, Government of India, New Delhi.

3. Dalwai, A., Kohli, P., Nagnur, S., Saxena, R., and Singh, R. (2022). India's Food System Policies. Discussion Paper, United Nations Food Systems Summit (UNFSS), New Delhi.

4. Kumar, S., Saxena, R., Birthal, P. S., and Paul, R. K. (2023). Final Report of the Consultancy Project on Impact of Blending of Edible Oils on the Production of Select Oilseeds. Submitted to the Ministry of Agriculture and Farmers' Welfare, Government of India, New Delhi.

5. Pal, S., Chand, P., Kiran Kumara, T.M., and Chaudhari, S.K. (2022). Agricultural Sustainability in India- A Parametric Study. Research Report. ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi.

6. Saxena, R., Balaji, S.J., and Ashok, V. (2022). Growth Trajectory of Indian Agriculture: Forecasting Key Variables, 2036-37. Submitted to NITI Aayog, New Delhi.

7. Saxena, R., Balaji, S.J., and Ashok, V. (2022). Sustaining Agricultural Growth, 2046-47: The Enabling Environment. Submitted to NITI Aayog, New Delhi.

6 Awards and Recognitions

Awards

S. K. Srivastava

- Lal Bahadur Shastri Outstanding Young Scientist Award, 2021.
- Best Poster Award in Second Indian Rice Congress-2023 (SIRC-2023) organized by Association of Rice Research Workers at ICAR-National Rice Research Institute, Cuttack during February 11-14, 2023.

Prem Chand

- Dr. N. A. Majumdar Prize Award of the Indian Society of Agricultural Economics.

Raka Saxena

- First Best Research Article entitled *Enhancing farmers' incomes from livestock in eastern India with special emphasis on dairying: Major drivers and strategies* in the category of Dairy Economics, Extension and Management for the year 2019, during 49th Dairy Industry Conference (DIC) at Gandhinagar (Gujarat) at the Plenary Session, organized by the Indian Dairy Association on March 18, 2023.
- राका सक्सेना एवं सोनिया चौहान (2021),'पशुधन क्षेत्र में आर्थिक एवं व्यापारिक अवसरों का दोहन' पशुधन प्रकाश पत्रिका, भाकृअनुप – राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो, करनाल. Second prize during the Hindi Pakhwara, 2022.

D.C. Meena

- Best oral presentation award at IVth International Conference on ICAAAS-2022, organized by Society for Scientific Development in Agriculture & Technology during June 12-14, 2022.

Recognitions

P. S. Birthal

- Chairman, Working Group on *Demand and Supply Projections of Crops, Livestock, Fisheries and Agriculture Inputs*, NITI Aayog, New Delhi.
- Expert member on *Estimation of Savings and Investment through Household Survey* in respect to Ministry of Statistics & Programme Implementation, Government of India.
- Chief Editor, Agricultural Economics Research Review

ICAR-NIAP scientists receiving Prestigious Awards

- Member, Judging Committee for Lal Bhadur Shastri Outstanding Young Scientist Award 2021.
- Member, Judging Committee for the Presentations of the Significant Post Graduate Students Research during 61st Convocation of ICAR-IARI, New Delhi.

Nalini Ranjan Kumar

- Member, Editorial Board, Potato Journal.

Subhash Chand

- Session chair, in Regional Conference on *Specialty Agriculture in the Context of Farm Economy of Himalayan Region*, organized by SKUAST, Jammu.

Rajni Jain

- Panelist, *Women in STEM: Gender Disparity* organized by the Northcap University, Gurugram.
- Reviewer, Online Courses developed under National Agricultural Higher Education Project (NAHEP).

Sant Kumar

- Member, Research Advisory Committee, ICAR-National Research Centre for Integrated Pest Management, Pusa, New Delhi.

Shiv Kumar

- Member, Institute Technology Management Committee, ICAR- IASRI, New Delhi.
- Member, Institute Management Committee, Agricultural Technology Application Research Institute, Jabalpur.
- Associate Editor, Agricultural Research and Bioinfo publications
- Member, Editorial Board , Economic Affairs Journal

Khem Chand

- Chairman, Technical session on Social Sciences in International conference on *Advances in Agriculture, Veterinary and Allied sciences for Improving Livelihood and Environmental security*, September 28-30, 2022, University of Kashmir, Srinagar.
- Panelist and Convener in a panel discussion on *Insurance Needs for Rainfed Agro ecosystem* during International Conference *on Reimagining Rainfed Agro-ecosystems: Challenges & Opportunities,* ICAR-CRIDA, Hyderabad, Dec 22-24, 2022.

Raka Saxena

- Co-opted Member, Working Group on *Demand and Supply Projections of Crops, Livestock, Fisheries and Agriculture Inputs*, NITI Aayog, New Delhi.
- Associate Editor of Journal *Agricultural Economics Research Review.*
- Vice-President, Indian Society of Agricultural Economics.
- Rapporteur for Subject II *Gender equality and Resilient Agriculture* for 82nd Annual Conference of Indian Society of Agricultural Economics at Central Agricultural University, Imphal, November 10-12, 2022.
- Member, Evaluation Committee for the Best Thesis Award for Ph.D. on March 3, 2023 at ICAR-National Dairy Research Institute, Karnal.

Purushottam Sharma

- Member, Committee on Online Review of BIRAC BIG Funding Proposals.
- Member, Syllabus Review Committee Meeting (MBA Agribusiness Management) by the Department of Agribusiness Management and Food Technology, North-Eastern Hill University, Tura Campus.

Prem Chand

- Joint Secretary, Agricultural Economics Research Association, New Delhi.

- Member, Institute Management Committee, ATARI, Pune.

S. K. Srivastava

- Member, Working Group on *Demand and Supply Projections of Crops, Livestock, Fisheries and Agriculture Inputs*, NITI Aayog, New Delhi.
- Thematic Expert, *gLOCAL Skill Building Workshop on Designing Evaluations for Food Safety Net Interventions* organized by Development Monitoring and Evaluation Office (DMEO), NITI Aayog and World Food Programme at NITI Aayog, New Delhi.
- External Expert for Colloquium of Post-Graduate students of Galgotias University, Greater Noida.
- Convener, Brainstorming session on *Sustaining the Pulses Revolution in India: Technological and Policy Measures*, National Academy of Agricultural Sciences, NASC complex, New Delhi, April 5, 2022.
- Co-Convener, brainstorming session on *Beyond Price Support and Subsidies*, organized by the National Academy of Agricultural Sciences, NASC complex, New Delhi, September 30, 2022.
- Associate Editor, Agricultural Economics Research Review.

Prabhat Kishore

- Co-convener of the Brainstorming Session on *Beyond Price Support and Subsidies* organized by the National Academy of Agricultural Sciences, New Delhi, September 30, 2022.

7 Participation in Scientific Activities

Table 7.1: Lectures delivered by ICAR-NIAP scientists

Name of the scientist	Topic	Venue and date
P.S. Birthal	Livestock for sustainable and inclusive agricultural development	Central Institute for Research on Cattle (CIRC), Meerut, Uttar Pradesh, May 7, 2022
	Agricultural trade policy analysis	Research and Information System for Developing Countries (RIS)-International Food Policy Research Institute (IFPRI), September 29, 2022
Rajni Jain	Technology foresight in agriculture	ICAR-Directorate of Rapeseed and Mustard Research (DRMR), Bharatpur, Rajasthan, August 23, 2022
	Artificial intelligence for agricultural sustainability	Research Conclave, Northcap University, December 16, 2022
	Data mining and big data analytics in social sciences	ICAR-Central Marine Fisheries Research Institute (CMFRI), Kochi, January 27, 2023
Raka Saxena	Virtual water trade in food commodities: Mapping and sustainable options for rice cultivation in India	Asian Development Bank, August 8-11, 2022
	Agricultural trade policy analysis	Research and Information System for Developing Countries (RIS)-International Food Policy Research Institute (IFPRI), Chandigarh, September 29-30, 2022
	Sources of growth for enhancing farmers' incomes in Odisha	Odisha High-Level Policy Roundtable on Doubling Farmers' Income, Bhubaneshwar, Odisha, October 20-21, 2022
	India's agriculture trade engagement with the BIMSTEC region	RIS-IFPRI, Puducherry, February 17-18, 2023
Prem Chand	Agricultural sustainability in India: Issues and empirical evidence	ICAR-National Research Center on Mithun, Nagaland, April 13, 2022
	Recent ICT initiatives for agricultural technology transfer and frontline extension management in India	ICAR-National Research Center on Mithun, Nagaland, April 13, 2022
Kingsly I.T.	Economic surplus approach	ICAR-NIAP, New Delhi, March 6, 2023

Name of the scientist	Topic	Venue and date
D.C. Meena	Importance of backyard vegetable cultivation	Narsinghpura and Bobas village in Jaipur district, Rajasthan, April 4-5, 2022 and November 27-28, 2022
	Role of ecosystem services in sustainable food production	India International Centre (IIC), New Delhi, November 15-16, 2022
Vinayak Nikam	Generating research papers from the impact studies	Extension Education Institute (EEI), Hyderabad, November 25, 2022
Prabhat Kishore	Synthetic control method for assessing the impact of policy change	ICAR- Indian Agricultural Research Institute, New Delhi, December 12-22, 2022
	Synthetic control method	International Food Policy Research Institute (IFPRI), South Asia Regional Office, New Delhi, April 25-30, 2022

Table 7.2: Trainings attended

Name of the scientist	Name of the event	Venue and duration
Rajni Jain	Advances in web and mobile application development	ICAR-NAARM, August 2-6, 2022
	Data-driven decision Making	Administrative Staff College of India, September 12–16, 2022
	ENVI analytics	ESRI, India, June 30- July 01, 2022
Purushottam Sharma	Computable General Equilibrium (CGE) modeling for policy analysis	International Food Policy Research Institute (IFPRI), South Asia Office, NASC Complex, New Delhi, April 4 – May 18, 2022
	Training for vigilance officers of ICAR institutes	ICAR-NAARM, Hyderabad, August 24-26, 2022
Vinayak Nikam	Qualitative research and data analysis using Nvivo	VAMNICOM, Pune, July 29-30, 2022
	Multivariate data analysis	NAARM, Hyderabad, March 20-27, 2023
Ankita Kandpal	Analytical techniques for impact evaluation methods	BHU, Varanasi, April 25-30, 2022
Sonia Chauhan	Computer applications	ICAR-IASRI, New Delhi, December 15-21, 2022

Table 7.3: Seminar/Conference/ Workshop / Webinar-Paper presented

Name of the scientist	Name of the topic/event	Venue and duration
P. S. Birthal	Keynote lecture on Making agriculture climate resilient – The farmers way in Indian ecology, *in* International Conference 2022 on Sustainable Agricultural Innovations for Resilient Agri-Food Systems	Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST), Jammu, October 14, 2022
	Keynote address in the National Conference on Agro-Ecology based Agri-Food Transformation Systems	ICAR-IIFSR, Modipuram, January 27-28, 2023
	Keynote address in the National Conference on Integrating Sciences & Institutions for Resilient Production System	Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST), Jammu, March 17-18, 2023
Khem Chand	Development of common pasturelands and efficient livestock production in India, *in* National Symposium on Innovations in Forage and Livestock Sector for Enhancing Entrepreneurship and Farm Productivity	ICAR-Indian Grassland and Fodder Research Institute (IGFRI), Jhansi, India, November 1-3, 2022
	Crop risk, insurance premium and stakeholders' problems in PMFBY scheme implementation (Lead speaker), *in* First International Conference-ICRA 2022 on Reimagining Rainfed Agro- ecosystems: Challenges & Opportunities	Indian Society of Dryland Agriculture and ICAR-Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad, December 24, 2022
Subhash Chand	Impact of converting natural grasslands into Eucalyptus plantations: A case study of Nilgiris, Tamil Nadu (Lead paper), *in* Regional Conference on Specialty Agriculture in the Context of Farm Economy of Himalayan Region	Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST), Jammu, September 21-22, 2022 and March 17-18, 2023,
Rajni Jain	Factors influencing the ICT usage in agricultural higher education in the 73rd ISAS Conference	Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST), Jammu, November 14-16, 2022 and March 17-18, 2023,
	AI for plant protection, in 25th Annual International Conference on Significance of Statistical Sciences in Emerging Scenario (SSSES 2023)	Department of Statistics, University of Jammu, Jammu (J&K), February 15-17, 2023

Name of the scientist	Name of the topic/event	Venue and duration
Raka Saxena	Ensuring a trade-driven and sustainable rice value chain in India (Lead speaker), *in* 2nd Indian Rice Congress	ICAR - National Rice Research Institute (NRRI), Cuttack, February 11-14, 2023
	Special address at the International Conference on Globalization and Future of Rural-Agrarian in 21st Century India: Challenges, Lessons and Opportunities	Centre for Political Studies, Jawaharlal Nehru University, Delhi, February 23-24, 2023
	Realigning subsidies and price support ensuring trade through a sustainable rice ecosystem, *in* Brainstorming Session on Beyond Price Support Subsidies	NASC Complex, New Delhi, September 30, 2022
	Trajectory of Indian agricultural exports: competitiveness, diversification and growth linkages, *in* NABARD Seminar on India's Agriculture and Food Export: Opportunities and Challenges	Institute for Pioneering Insightful Research and Edutech Pvt. Ltd. Noida, August 12, 2022.
Prem Chand	Flood management strategies and economics of stress-tolerance rice varieties in Assam, *in* 82th Annual Conference of the Indian Society of Agricultural Economics	Central Agricultural University, Imphal, Manipur November 10-12, 2022
S.K. Srivastava	Agricultural subsidies in India: Status and emerging issues, *in* Brainstorming Session on Beyond Price Support Subsidies	NASC Complex, New Delhi, September 30, 2022
	Recalibrating agricultural subsidies in India, *in* Dialogue onFood systems for India organized by *Bharat Krishak Samaj*	India International Centre, New Delhi, November 15-16, 2022
	Food systems and nutrition, *in* Dialogue on Food systems for India organized by *Bharat Krishak Samaj*	India International Centre, New Delhi, November 15-16, 2022
	Sustaining groundwater resources in India: Technological and policy options, *in* International Conference on Environment and Sustainable Development: Interdisciplinary Trends and Practices	CHRIST (Deemed to be University), Delhi- NCR , December 16, 2022
	Overview of food security and nutrition indicators and tools for measurement, *in* skill building Workshop on Designing Evaluations for Food Safety Net	NITI Aayog, New Delhi, June 1, 2022

Name of the scientist	Name of the topic/event	Venue and duration
D.C. Meena	Farmers' awareness, attitude, adaptation behaviour and social vulnerability to climate change in the semi-arid region, *in* IVth International Conference on ICAAAS-2022	Himachal Pradesh University, Shimla, June 12-14, 2022
Vinayak Nikam	How are farmer producer organizations doing in India?: Evidence from a mixed method research synthesis, *in* 24th Annual Convention of the Strategic Management Forum	IRMA, Anand, Gujarat, December 21-23, 2022
Balaji S.J.	Crop choices, agriculture surplus and development: Implications for food security, *in* National Seminar on Law and Agriculture 2022	Vellore Institute of Technology (VIT), Vellore April 9, 2022.
Prabhat Kishore	Synthetic control method and synthetic difference-in-difference method for impact assessment and programme evaluation in Workshop organized by Sri Lanka Agricultural Economics Association (SAEA), Sri Lanka	Sri Lanka, January 17-18, 2023 (online)
	Governing the groundwater use in India: Assessing the effectiveness of the Punjab preservation of subsoil water act, 2009 *in* 17th Annual Conference of Economic Growth and Development	Indian Statistical Institute, New Delhi, December 19-21, 2022
	Beyond price support and subsidies in Brainstorming Session on Beyond Price Support Subsidies	NASC Complex, New Delhi, September 30, 2022
Kiran Kumara T.M.	Carbon sequestration potential of sustainable agricultural practices in Indian agriculture: A meta-analysis of evidences and economic assessment, *in* 96th Annual Conference of Agricultural Economics Society (AES)	KU Leuven, Belgium, April 4 – 6, 2022
	Role of ecosystem services in sustainable food production systems *in* Dialogue on Food Systems for India organized by *Bharat Krishak Samaj*	India International Centre, New Delhi, November 15-16, 2022

Table 7.4: Workshop/Seminar/Conference/Webinar/Lectures attended

Name of the scientist	Name of the event	Venue and duration
P. S. Birthal	Brainstorming Session on Mainstreaming Agricultural Curriculum in School Education (MACE) organized by National Agricultural Higher Education Project (NAHEP) and by the Indian Council of Agricultural Research (ICAR)	NASC Complex, New Delhi, June 13, 2022
	National Symposium on Food, Nutrition and Environmental Security: Towards Achieving SDGs organized by TAAS, ICAR, NAAS, ISPGR in collaboration with Alliance of the Biodiversity International & CIAT, ICRISAT, CIMMYT and IRRI	NASC Complex, New Delhi, August 29-30, 2022
	National Dialogue on Sustainable Growth and Development of Indian Dairy Sector	DUVSAU, Mathura, December 16, 2022
	International Conference on Pulses: Smart Crops for Agricultural Sustainability and Nutritional Security ICPULSES 2023	NASC Complex, New Delhi, February10, 2023
	Interactive Roundtable on Transforming Food System in India	IFPRI, South Asia, CR- I, NASC Complex, March 9, 2023
	International Conference on Blended Learning Ecosystems for Higher Education in Agriculture (ICBLE)	ICAR-IASRI, NASC Complex, March 21-23, 2023
P. S. Birthal, Subhash Chand, Prem Chand	30th Annual Conference of Agricultural Economics Research Association on Institutional Changes for Inclusive and Sustainable Agricultural Development	Sher-E-Kashmir University of Agricultural Sciences and Technology, Jammu, December 21-23, 2022
P. S. Birthal, S. K. Srivastava	Water Quality Issues and Policy Guidelines in Agriculture and Aquaculture	ICAR-IIWM, Bhubaneswar, January 13, 2023
P. S. Birthal, Khem Chand	National Pastoralist Meet	DAHD, Ministry of Fisheries, Animal Husbandry and Dairying, New Delhi, January 27, 2023

Name of the scientist	Name of the event	Venue and duration
P. S. Birthal, Nalini Ranjan Kumar	Workshop on Enhancing MDBs (AIIB, NDB AND IFAD) Engagement with India's Public and Private Sector	The Oberoi, Dr Zakir Hussain Marg, New Delhi, November 21, 2022
P. S. Birthal, Nalini Ranjan Kumar, S. K. Srivastava	Brainstorming Workshop on Sustaining Pulses Revolution in India organized by NAAS	NASC Complex, New Delhi, April 5, 2022
P.S. Birthal, Khem Chand, Sant Kumar, Rajni Jain, Prem Chand, Vinayak Nikam	Global Food Policy Report 2022 and Policy Forum on Climate Change and Food Security Systems in Asia	IFPRI-India Office, New Delhi, July 21 ,2022
Nalini Ranjan Kumar	National Webinar on Impacts of High Temperature and Drought Stress on Grain Sorghum (online)	April 19, 2022
	Webinar on Livestock for Sustainable and Inclusive Agricultural Development (online)	May 7, 2022
	Stakeholders' Consultation Workshop on Foresight Report on Climate Smart Agriculture	NASC Complex, New Delhi, May 11, 2022
	Import Substitution of Edible Oils through Enhancing Production and Productivity of Oilseeds	ICAR-IIOPR, Andhra Pradesh, April 18, 2022
	National Symposium on Indian Agriculture after Independence (online)	May 24, 2022
	Webinar on Challenges and Opportunities in Food Systems across the Eastern Gangetic Plains	IFPRI India, June 22-23, 2022
	Symposium on Soils: Where Food Begins by Indian Society of Soil Science (ISSS) (online)	November 30, 2022
	International Conference on Enhancing Productivity and Value Addition in Millets	NASC Complex, New Delhi, March 18-19, 2023

Name of the scientist	Name of the event	Venue and duration
Nalini Ranjan Kumar, Khem Chand, Sant Kumar, Purushottam Sharma, Prem Chand, S. K. Srivastava, Arathy Ashok, Vinayak Nikam, Prabhat Kishore	Brainstorming Session on Beyond Price Support Subsidies	NASC Complex, New Delhi, September 30, 2022
Nalini Ranjan Kumar, Sant Kumar	Webinar on Sustainable Application in Mission Approach through Research & Technology Based Holistic Interventions (SAMARTH)	Ministry of Agriculture and Farmers Welfare, February 24, 2023
Khem Chand	International Conference on Advances in Agriculture, Veterinary and Allied sciences for Improving Livelihood and Environmental Security (Online)	University of Kashmir, September 28-30, 2022
	Innovations in Forage and Livestock Sector for Enhancing Entrepreneurship and Farm Productivity	Range Management Society of India and ICAR-IGFRI, Jhansi, India, November 1-3, 2022
	राष्ट्रीय घुमन्तु मालधारी युवा सम्मेलन–कच्छ	Centre for Pastoralism, Sahjeevan, Bhuj, Gujarat, January 19-21, 2023
	National Consultation on Pastoralism	Centre for Pastoralism, Sahjeevan, Bhuj, Gujarat, January 20-21, 2023
	First International Conference-ICRA 2022 on Reimagining Rainfed Agro- ecosystems: Challenges & Opportunities	Indian Society of Dryland Agriculture and ICAR-CRIDA, Hyderabad, December 22-24, 2022
Nalini Ranjan Kumar, Sant Kumar	Harnessing Potential of Pulses for Import Substitution	ICAR-CRIDA, Hyderabad, April 1, 2022
Sant Kumar	Natural Farming: A Comparative Assessment	ICAR-IIS&WC, RC Vasad, Gujarat, June 30, 2022

Name of the scientist	Name of the event	Venue and duration
	Soil Health Management in Horticultural Ecosystem	ICAR-CISH, Lucknow, December 20, 2022
Nalini Ranjan Kumar, Sant Kumar, D.C. Meena, Purushottam Sharma	Role of Youth for a Secure and Sustainable Agriculture by Dr. R.S. Paroda, Chairman, TAAS and Former Secretary, DARE & DG, ICAR	ICAR HQ, New Delhi, April 21, 2022
Rajni Jain, Khem Chand	Webinar on Sustainable Management of KANGAYAM Grassland	ICAR-IGFRI, Jhansi, February 27, 2023
Rajni Jain	Agriculture Education in Schools- Main-streaming Agricultural Curriculum in School Education	NASC complex, New Delhi, June 14, 2023
	International Conference on Blended Learning Ecosystems for Higher Education in Agriculture, Organized by NAHEP, ICAR	NASC complex, New Delhi, March 21-23, 2023
	eHRMS Workshop , Organized by ICAR	ICAR-NIAP, New Delhi, March 31, 2023
Raka Saxena	Annual Conference of Indian Society of Agricultural Economics 2022	Central Agricultural University, Imphal, November 10-12, 2022
Purushottam Sharma	International Conference on Harnessing Indian Agriculture for Domestic and Global Prosperity, organised by Bhartiya Agro-Economic Research Centre, *Bhartiya Kisan Sangh* and Indian Council of Agricultural Research	New Delhi, July 22-23, 2022
	Webinar on Cluster Identification Approach to Testing Market Integration: Evidence from Indian Agriculture	Food and Agricultural Research Discussion Forum, May 7, 2022
Rajni Jain, Prem Chand	National Meeting on Crop Diversification	ICAR-IIWM, Bhubaneswar, October 31, 2022
Prem Chand	Workshop on Promoting Trees Outside Forests Certification Standards	ICRAF India, New Delhi, January 30, 2023
	Indian Dairy Impact Methodology (DIM) Workshop	Greater Noida, Uttar Pradesh, September 11, 2022

Name of the scientist	Name of the event	Venue and duration
S. K. Srivastava	Sustaining the Pulses Revolution in India: Technological and Policy Measures	NASC complex, New Delhi, April 5, 2022
Shiv Kumar, Prem Chand, S. K. Srivastava, D. C. Meena, Kiran Kumara T.M.	Dialogue on Food Systems for India organized by *Bharat Krishak Samaj*	India International Centre, New Delhi, November 15-16, 2022
Vikas Kumar	National Conference on Crop Estimation Methodology	DES, Ministry of Agriculture and Farmers' welfare, July 13, 2022
	Annual Hindi Conference	Deen Dayal Indoor Stadium, Surat September 14-15, 2022
Arathy Ashok	IFPRI-ICAR Workshop on Reaching Women Farmers with Climate-smart Agriculture Information: How Can We Do Better?	The Dome, the Ambassador-Vivanta by Taj, New Delhi September 27, 2022
Vinayak Nikam	Strengthening Capacities of Key Regional Research and Extension Organizations to Support Agriculture Innovation in Asia-Pacific	FAO, June 21, 2022
	Comprehensive Extension Strategies for Sustainable Development of FPOs: Opportunities and Challenges	MANAGE, Hyderabad, April 22-24, 2022
	How (and why) to Address Gender in Value Chains Studies?	USAID funded Innovation lab for PRCI in coordination with Kasetsart University (KU) and the IFPRI, May 11, 2022
Balaji S. J.	13^{th} South Asia Economic Summit	Research and Information System for Developing Countries (RIS), New Delhi, April 19-20, 2022
	Import Substitution of Edible Oils through Enhancing Production and Productivity of Oilseeds	ICAR-IIOPR, Andhra Pradesh, April 18, 2022
	Atmanirbhar Bharat – Harnessing Potential of Oilseeds for Import Substitution	ICAR-CRIDA, Hyderabad, April 16, 2022

Name of the scientist	Name of the event	Venue and duration
	Russia-Ukraine Conflict: A South Asian Economic Crisis?	Institute of South Asian Studies (ISAS), National University of Singapore, April 21, 2022
	National Symposium: Indian Agriculture after Independence	ICAR, New Delhi, May 24, 2022
	Ukraine: War, Economy, Path to Rebuilding	Cornell University, USA, May 13, 2022
	Introduction to GTAP CGE Modeling	NITI Aayog, New Delhi, May 20, 2022
Kiran Kumara T. M.	The Economics of Ecosystem and Biodiversity (TEEB) for Agriculture Symposium	Virtual, June 21-23, 2022
	EAT LANCET 2.0 Consultation Programme	India International Centre, New Delhi, November 17, 2022
	Workshop on Emissions Trading System (ETS) Simulation	India Habitat Centre, New Delhi, February15, 2023

Azadi Ka Amrit Mahotsav Lectures attended by scientists

- ICAR-NIAP scientists had attended different lecture series organized as a part of *Azadi Ka Amrit Mahotsav* celebrations organized by ICAR and different ICAR Institutes

Meetings attended by scientists

P. S. Birthal

- Electronic Human Resource Management System (eHRMS) Software Meeting under the Chairmanship of Addl. Secretary, DARE and Secretary, ICAR, February 28, 2023, online
- Inaugural Function of Pusa Krishi Vigyan Mela-2023, March 2, 2023, IARI Mela Ground
- Conference of Vice-Chancellors (VCs) of Agricultural Universities and Directors of ICAR, March 4-5, 2023, C. Subramaniam Auditorium, NASC Complex
- SoC Meetings of ICAR
- 94th Annual General Meeting of ICAR Society, March 10, 2023, NASC Complex

Nalini Ranjan Kumar

- NICRA Review Meeting on July 28, 2022 at NASC Complex, New Delhi
- 2nd meeting of Agriculture Sectoral Working Group for the preparation of the India's Adaptation Communication under the Chairpersonship of Joint Secretary (NRM), DA&FW organized on April 21, 2022
- Virtual Meeting chaired by Secretary DARE and DG, ICAR to finalize work plan for International Year of Millets 2023 for Enhancing the production and productivity of millets on December 15, 2022
- Celebration of KISAN DIWAS, 2022

under the Chairmanship of Shri Narendra Tomar, Hon'ble Minister of Agriculture & Farmers Welfare on December 23, 2022

Rajni Jain

- Meeting on Cropping Pattern Optimization, Council on Energy, Environment and Water on December 19, 2022
- Meeting on Development of Policy Document on Crop Diversification with ICAR-CRIDA on January 16 and February 19, 2023

Raka Saxena

- Second Meeting of Working Group To Assess and Project Demand Supply of Crops, Livestock, Fisheries and Agriculture Inputs for 2025-26 and 2035-36 in NITI Aayog on 27th February 2023
- Annual Conference of Directors of ICAR Institutes, Vice-Chancellors of Agricultural Universities and Industries on March 4-6, March 2023

Purushottam Sharma

- Meetings on the Agricultural Market Intelligence Project in Krishi Bhawan, New Delhi

Participation in mass media

P. S. Birthal

- Participated as panelist in Live TV programme of Sansad TV namely "अर्थनीति, बजट विशेष: कृषि का बजटीय अर्थशास्त्र" aired on January 18, 2023

Nalini Ranjan Kumar

- Participated as a panelist in a Live TV programme of DD Kisan namely "Hello Kisan- Krishi Budget-2023" aired on February 1, 2023
- Participated as a panelist in the TV programme of DD Kisan namely "Conclave-Budget-2023" aired on February 8, 2023

Shiv Kumar

- Participated as expert speaker in a Live discussion programme conducted by All India Radio on "Expectation of farmers from Union Budget 2023-24" on January 31, 2023

Raka Saxena

- Participated in a Live panel discussion on "Budget Expectations for Agriculture" at DD-Kisan channel on February 1, 2023

Prem Chand

- Interview, "The half-sickle women of Maharashtra", Spotlight, The Hindu, March 24, 2023. https://www.thehindu.com/news/national/the-half-sickle-women-of-maharashtra/article66654750.ece

Khem Chand

- Participated as a panelist in a Live TV programme of DD Kisan namely "Hello Kisan- Krishi Budget-2023" aired on February 1, 2023
- Interview on "Agri-insurance and farming in India" recorded by eco India - a co-production between Scroll and German broadcasters, Deutsche Welle on August 22, 2022. https://youtu.be/0PfyCd96pr8

ICAR-NIAP in media as a part of SC Sub-Plan interventions

Interventions undertaken by ICAR-NIAP as a part of the SC Sub-Plan scheme were widely covered in different media. Dr. Subash Chand, Dr. Rajni Jain, Dr. Vikas Kumar, Sh. Dilip Kumar, Dr. D. C. Meena, Sh. K. R. Chaudhary and Sh. M. S. Chauhan were involved in conducting the interventions in different selected villages in Haryana, Rajasthan and Uttar Pradesh.

आजादी का अमृत महोत्सव कार्यक्रम

किसानों को दिया पोषण वाटिका का प्रशिक्षण

जयपुर। आईसीएआर के राष्ट्रीय कृषि आर्थिकी नीति अनुसंधान संस्थान, पूसा, नई दिल्ली और राजस्थान कृषि अनुसंधान संस्थान, दुर्गापुरा के संयुक्त तत्वावधान में आजादी का अमृत महोत्सव कार्यक्रम के तहत गांव बोराज, बोबास और रामकुटिया में दो दिवसीय गृह वाटिका में सब्जी उत्पादन और पोषण सुरक्षा विषयक किसान प्रशिक्षण कार्यक्रम आयोजित किया गया। यह प्रशिक्षण कार्यक्रम अनुसूचित जाति उप योजना के तहत सम्पन्न हुआ। कार्यक्रम में रारी के निदेशक डॉ. अर्जुन सिंह बलौदा ने कहा कि घर की खाली जगह में गृह वाटिका लगाकर जैविक सब्जी फसलों का उत्पादन लिया जा सकता है। इससे परिवार के पोषण स्तर में भी बढ़ौत्तरी होगी। आईसीएआर के प्रधान वैज्ञानिक डॉ. सुभाष चन्द ने किसानों को पोषण वाटिका में सब्जी उत्पादन तकनीक के बारे में जानकारी दी। डॉ. कमल कुमार सैनी ने किसानों को सब्जी फसलों में जैविक विधि से रोग-कीट नियंत्रण के बारे मे बताया। कार्यक्रम को डॉ विकास कुमार, डॉ. होशियार सिंह, ख्यालीराम चौधरी ने भी सम्बोधित किया। इस मौके पर बोराज सरपंच सुरेन्द्र सिंह मीणा, बोबास सरपंच नारायण जाट और रामकुटिया सरपंच रामकरण कुडी भी उपस्थित रहे। कार्यक्रम के दौरान किसानों का रबी सब्जी फसलों का बीज वितरित किया गया। कार्यक्रम में 300 किसानों ने भाग लिया।

दैनिक भास्कर बालोतरा 20-03-2022

पादरू में किसान मेला का आयोजन किया

केंद्रीय कृषि एवं किसान कल्याण राज्य मंत्री कैलाश चौधरी सहित कई नेताओं एवं अधिकारियों ने मेले में किसानों को किया सम्बोधित

पादरूं में किसान मेले का हुआ आयोजन

किसानों की आय दुगुनी करने के लिए सभी का सयुक्त प्रयास करने है, ताकि आमदनी दुगुनी हो सकेः चौधरी

भास्कर संवाददाता | पादरू

पादरू. कृषि विज्ञान मेले में किसानों को संबोधित करते चौधरी।

सरकार की ओर से वर्ष 2022 तक देश के किसानों की आय को दोगुना करने के संकल्प के साथ विभिन्न प्रकार की कृषक लाभकारी योजनाएं और कार्यक्रम शुरू किए गए हैं। इनकी मदद से किसान समुदाय अपने सीमित संसाधनों के बावजूद आमदनी को बढ़ा सके। इस क्रम में परंपरागत खेती के साथ-साथ वैज्ञानिक कृषि के तौर तरीकों को अपनाना, समन्वित कृषि प्रणाली, व्यावसायिक फसलों के उत्पादन पर जोर देने की आवश्यकता है। साथ ही द्वितीयक कृषि से मूल्य संवर्धन, मार्केटिंग, ब्रांडिंग आदि की जरूरत है, ताकि किसानों की आय बढ़ सके। भारतीय कृषि अनुसंधान परिषद के देशव्यापी नेटवर्क के माध्यम से जागरूकता अभियान चलाए जा रहे हैं। इसी क्रम में यह मेला भी किसानों के लिए मील का पत्थर साबित होगा। केंद्रीय कृषि एवं किसान कल्याण राज्यमंत्री कैलाश चौधरी ने कृषि विज्ञान केंद्र गुड़ामालानी के तत्वावधान में पादरू में आयोजित किसान मेला में यह बात कही। कहा कि प्रधानमंत्री ने 2022 तक किसानों की आय दुगुनी करने के लिए हम सभी को मिलकर संयुक्त रूप से प्रयास करने है, इससे किसानों की आय दुगुनी हो सके। इससे पूर्व मंत्री ने मेले में लगी हुई विभिन्न प्रदर्शनियों का अवलोकन करते हुए बारीकी से जानकारी प्राप्त की। उन्होंने कहा कि ज्यादा से ज्यादा किसानों तक नवीन तकनीक का प्रचार-प्रसार हो ताकि ज्यादा से ज्यादा किसानों को फायदा मिल सके। कार्यक्रम की अध्यक्षता डॉ. बी.आर. चौधरी कुलपति कृषि विश्वविद्यालय जोधपुर ने कृषि विश्वविद्यालय जोधपुर के किए जा रहे कार्यों के साथ-साथ बीज उत्पादन के बारे में बताते हुए विश्वविद्यालय में विकसित एमपीएमएच- बाजरे, मूंग, मोठ, ग्वार, ईसबगोल आदि की उन्नत किस्मों के बारे में जानकारी देते हुए कहा कि इससे किसानों को लाभ प्राप्त करने का कहा। सिवाना विधायक हमीरसिंह भायल किसानों को अधिक से अधिक योजनाओं से लाभांवित होने के लिए प्रेरित किया, ताकि किसानों को अपनी आय दुगुनी करने में मदद मिले। पूर्व राजस्व मंत्री अमराराम चौधरी ने किसानों को अधिक से अधिक वैज्ञानिक तकनीकों से उत्पादन बढ़ाने के लिए प्रेरित किया। डॉ. ओ.पी. यादव निदेशक काजरी जोधपुर ने काजरी में किए जा रहे अनुसंधानों नवीन तकनीकों के बारे में विस्तारपूर्वक जानकारी देकर, ज्यादा से ज्यादा लाभ प्राप्त करने का कहा।

निदेशक एनआईएपी नई दिल्ली डॉ. सुरेश पाल ने संस्थान की विभिन्न योजनाओं के बारे में जानकारी दी। इस अवसर पर निर्यात योग्य अनार उत्पादन तकनीक की पुस्तिका का विमोचन किया गया। 110 किसानों को दुगुनी आय प्राप्त करने के लिए सम्मानित, 100 किसानों को सब्जी किट वितरण, प्राकृतिक व जैविक खेती को बढ़ावा देने के लिए वर्मी कम्पोस्ट का वितरण, खेजड़ी को बढ़ावा देने के लिए थार शोभा किस्म के पौधों का वितरण किया गया। कृषि विज्ञान केंद्र गुड़ामालानी प्रभारी प्रो. डॉ. प्रदीप पगारिया ने केन्द्र की ओर से कृषक हितार्थ के लिए किए जा रहे कार्यों पर प्रकाश डाला एवं भविष्य में केंद्र पर किए जाने वाले कार्यों की जानकारी प्रदान की। एनआइएपी, नई दिल्ली के वैज्ञानिकगण, कृषि विश्वविद्यालय जोधपुर के महेंद्र चौधरी, एसोसिएट डायरेक्टर डॉ. जे.आर. वर्मा, डॉ. महेंद्रसिंह चांदावत, वरिष्ठ वैज्ञानिक एवं अध्यक्ष केवीके सिरोही, डॉ. गोपीचंद्र, वरिष्ठ वैज्ञानिक एवं अध्यक्ष केवीके अठियासन, रिटायर्ड प्रो. तख्तसिंह, पदमसिंह भाटी, कृषि अधिकारी वीरेंद्र सोलंकी, उपनिदेशक कृषि विभाग बाड़मेर आदि ने अपने-अपने विषय एवं विभाग से संबंधित कृषि तकनीकि एवं योजनाओं की जानकारी किसानों तक पहुंचाई। मेले में भारतीय कृषि अनुसंधान परिषद नई दिल्ली के विभिन्न संस्थान, काजरी जोधपुर, बाजरा समन्वित इकाई संस्थान जोधपुर, कृषि विश्वविद्यालय जोधपुर, एनआईएपी, नई दिल्ली, आफरी जोधपुर, जूलॉजिकल सर्वे ऑफ इंडिया के साथ ही विभिन्न कृषि विज्ञान केंद्रों, कृषि विभाग, पशुपालन विभाग, डेयरी विभाग, स्वयंसेवी संस्थान, बीज उर्वरक, खाद विक्रेता के साथ ही प्रगतिशील किसान एवं गैर सरकारी संगठनों ने विभिन्न प्रदर्शनियां लगाई गई।

सब्जी फसलों का बीज वितरित

सब्जी फसलों का बीज वितरित

जयपुर। आईसीएआर के कृषि और आर्थिक नीति अनुसंधान संस्थान, नई दिल्ली के वैज्ञानिक दल ने कृषि विज्ञान केन्द्र कोटपूतली का दौरा किया। साथ ही, किसानों को अनुसूचित जाति उपयोजना के तहत सब्जी और खरीफ फसलों के बीज का वितरण भी किया। केन्द्र के प्रभारी वैज्ञानिक डॉ. सुपर्ण सिंह ने बताया कि आईसीएआर टीम के सदस्यों ने कृषि विज्ञान केन्द्र द्वारा किसानों की आय बढ़ाने के लिए आयोजित की जा रही गतिविधियों का जायजा लिया। साथ ही, केन्द्र पर लगी प्रदर्शन इकाईयों का अवलोकन भी किया। उन्होंने बताया कि यह वैज्ञानिक दल जयपुर जिले में कृषि का डेटा बेस तैयार करने के लिए आया था। भ्रमण के दौरान दल के सदस्यों ने खाद्य और पोषण सुरक्षा के लिए किसानों को खरीफ और जायद के दौरान बुवाई की जाने वाली सब्जी फसलों के बीज वितरित किए।

किसानों से किया संवाद : उन्होंने बताया कि वैज्ञानिक दल के सदस्यों ने नवल कुशालपुरा, नर सिंहपुरा, बोबास, चौमूं आदि गांवों का दौरा करके किसानों से संवाद भी किया। वैज्ञानिकों ने किसानों से फसल उत्पादन और आय-व्यय की जानकारी जुटाई। इस मौके पर कुशालपुरा के पूर्व सरपंच जसवंत सिंह, प्रो. बाबूलाल, छोटूलाल, आशा वर्कर शोभा देवी उपस्थित रहीं। वहीं, बोबास गांव में यंग प्रोफेशनल अरविंद कुमार, सरपंच रामस्वरूप सहित रारी के राजस्थान कृषि अनुसंधान संस्थान, जयपुर के कृषि वैज्ञानिक उपस्थित रहे।

दैनिक भास्कर जयपुर जिला चौमूं 13-11-2021

दो सौ किसानों को किट वितरण किए

हिरनोदा। अनुसूचित जाति के किसानों की पोषण सुरक्षा हेतु भारतीय कृषि अनुसंधान परिषद के राष्ट्रीय कृषि आर्थिकी एवं नीति अनुसंधान संस्थान निआप, पूसा, नई दिल्ली व कृषि विश्वविद्यालय जोबनेर की ओर से शुक्रवार को आजादी के अमृत महोत्सव व प्रशिक्षण कार्यक्रम बोराज में मुख्य अतिथि निदेशक अनुसंधान डॉ. अर्जुनसिंह व सरपंच सुरेंद्र सिंह मीणा की अध्यक्षता में आयोजित हुआ। गांव के 200 किसानों ने भाग लिया। इस मौके पर मुख्य अतिथि डॉ. अर्जुन सिंह ने पोषण सुरक्षा के महत्व के बारे में किसानों को जागरूक किया। प्रधान वैज्ञानिक डॉ. सुभाष चन्द ने किसानों को सब्जियों में पोषण के महत्व व भारत सरकार की महत्वपूर्ण योजनाओं के बारे में जानकारी दी।

हिन्दी दैनिक नवग्रह टाइम्स

सब्जियों की खेती के माध्यम से पोषण सुरक्षा विषय पर किसान गोष्ठी का आयोजन

8 Management Committee Meetings

Research Advisory Committee (RAC)

The second meeting of the 10th RAC was held on December 29, 2022 under the chairmanship of Dr. Harsh K. Bhanwala to review the research progress and proposed research programs. The list of RAC members is given in Table 8.1.

Institute Management Committee (IMC)

The 31st meeting of the Institute Management Committee was held on March 20, 2023 to discuss management issues of the institute. The Director, ICAR- NIAP apprised the members of the progress made by the institute in different aspects of research and administration. The IMC members appreciated the progress made and they also appreciated the field work done by the scientists for the benefit of the farmers. The list of IMC members is given in Table 8.2.

Second meeting of the 10th RAC on December 29, 2022

Table 8.1: Research Advisory Committee

Dr. Harsh K. Bhanwala Former Chairman, National Bank for Agriculture and Rural Development, Mumbai	Chairman
Dr. Ajit Mishra Director, Institute of Economic Growth, University of Delhi (North Campus)	Member
Dr. Shashanka Bhide Senior Advisor, National Council of Applied Economic Research, New Delhi	Member
Dr. A.K. Singh Former Director, Giri Institute of Development Studies (GIDS), Lucknow	Member
Dr. P. Kumar Former Head, Division of Agricultural Economics, ICAR-IARI, New Delhi	Member
Dr. P. S. Birthal Director, ICAR-NIAP, New Delhi	Member
Shri Harbir Singh, Village-Dadlu, P.O. Rava, Dist. Kurukshetra, Haryana	Member
Sh. Rajpal Rana Mukhamelpur, Delhi	Member (Ex-Officio)
Dr. Khem Chand, Principal Scientist (Ag. Economics), ICAR-NIAP, New Delhi	Member Secretary

Table 8.2: Institute Management Committee

Dr. P.S. Birthal Director, ICAR-NIAP, New Delhi	Chairman
Dr. S. K. Soam Head, ICM, ICAR-NAARM, Hyderabad	Member
Dr. D. P. Malik CCS Haryana Agricultural University, Hisar, Haryana	Member
Shri Harbir Singh Village- Dadlu, P.O. Rava, Dist. Kurukshetra, Haryana	Member
Shri Rajpal Rana Mukhamelapur, Delhi	Member
Dr. G.K. Jha Principal Scientist, ICAR-IARI, New Delhi	Member
Dr. T.M. Gajanana Principal Scientist, ICAR-IIHR, Bengaluru, Karnataka	Member
Dr. Mahesh Chander Head, Extension Education Division ICAR-IVRI, Bareilly, Uttar Pradesh	Member
Dr. K.P. Tripathi Principal Scientist, Education Division, ICAR, KAB-II, New Delhi	Member
Director, Directorate of Economics and Statistics, Delhi	Member
Director (Economics and Statistics), Department of Planning, Government of Haryana, Chandigarh	Member
Mr. Pawan Kumar Gupta Sr. Finance and Accounts Officer, ICAR- NBPGR, New Delhi	Member

Institute Research Council (IRC)

The annual Institute Research Committee (IRC) meeting of the Institute was held on December 13, 2022 under the chairmanship of the Director, ICAR-NIAP. The Chairman briefed the experts about the agenda of the IRC meeting and introduced the research themes. All the scientists presented the progress of their research projects during 2021-22 and presented research plans for the next year. The experts appreciated the excellent research work done and provided valuable suggestions for further improvement.

9 Other Institute Activities

Annual Day

The ICAR-NIAP celebrated its 31st Annual Day on May 2, 2022. On this occasion, Prof. C. Ramasamy, former Vice-Chancellor, TNAU delivered Professor Dayanatha Jha memorial lecture on *Journey towards Strengthening Sustainability in Indian Agriculture: The Roadblocks and Transformative Solutions*.

Glimpse of 31st Annual Day Celebration on May 2, 2022

Anti-Terrorism Day

ICAR-NIAP celebrated *Anti-Terrorism Day* on May 21, 2022. All staff took pledge for it.

International Yoga Day

ICAR-NIAP celebrated *International Yoga Day* on June 21, 2022. All staff members of the institute practiced yoga exercises to keep body fit and active for healthy life.

ICAR-NIAP Celebrated International Yoga Day on June 21, 2022

Independence Day

Independence Day was celebrated at ICAR-NIAP campus on August 15, 2022 and on this occasion, National Flag was distributed to all the employees for hoisting at their home. Employees participated in *Har Ghar Tiranga* initiative of Government of India by pinning the flag on the Amrut Mahotsav.nic. in website.

Independence Day Celebration at ICAR-NIAP campus on August 15, 2022

Handloom Day

Institute celebrated Handloom Day on August 7, 2022 and promoted on social media (ICAR-NIAP facebook page).

Swachhata Pakhwada

ICAR-NIAP celebrated Swachhata Pakhwada during October 16-31, 2022 and December 16-31, 2022 which included several sanitary activities to keep the institute premises clean. A special sanitation drive was also organized with IASRI to keep premises clean and free from encroachment near IASRI building on October 13, 2022.

Swachhata Pakhwada Celebration at ICAR-NIAP

National Unity Day

In the memory of Iron Man Sardar Vallabh Bhai Patel, ICAR-NIAP celebrated National Unity Day on October 31, 2022 and took pledge of national integrity.

Constitution Day

The institute celebrated Constitution Day on November 26, 2022 by taking pledge and reading preamble of the country. The focus of the day was India-the mother of Democracy. All the staff members joined the program online.

Cyber Awareness Day (Cyber Jagrookta Divas)

ICAR-NIAP organised Cyber Awareness Day on November 30, 2022. Shri Ummed Meel, cyber security expert delivered a lecture on *How to keep yourself secure in cyber space?* He covered numerous topics like banking fraud, social media and online account hacking, computer and mobile hacking, research and healthcare data hacking, Aadhar enabled payment security, keeping organization secure against cyber-attacks and safety measure.

Vigilance Awareness Week

On the eve of Vigilance Awareness Week on November 4, 2022, ICAR-NIAP conducted a poster competition for the staff and family members of ICAR-NIAP.

World Soil Day

ICAR-NIAP celebrated world Soil Day on December 5, 2022.

MOU with Assam Agricultural University

A MoU was signed between ICAR-NIAP and Assam Agricultural University (AAU) on March 21, 2023 to assist the latter in research and teaching.

MoU between NIAP and AAU at ICAR-NIAP

Mera Gaon Mera Gaurav

Under this scheme three teams have been formed at the institute for covering 15 villages from the three districts Bulandshahar (UP), Panipat (Haryana) and Jaipur (Rajasthan). In 2022-23, scientists organized 14 meetings/ Goshtis, 8 trainings and 10 awareness programs in the selected villages. Linkages were developed with KVKs, State Agricultural Departments and SAUs to facilitate the knowledge dissemination to the farmers in selected villages. More than 3100 farmers directly benefitted from the activities under the scheme.

Official language implementation

हिंदी पखवाडा

भा. कृ. अनु. प. –राष्ट्रीय कृषि आर्थिकी एवं नीति अनुसंथान संस्थान (निआप), नई दिल्ली में हिन्दी पखवाड़ा का आयोजन 14–30 सितम्बर, 2022 तक किया गया। हिन्दी पखवाड़ा के अंतर्गत निम्नलिखित प्रतियोगिताओ का आयोजन किया गया।

- भाषण प्रतियोगिताः विषय–रूस और यूक्रेन में अस्थिरता के कारण अंतर्राष्ट्रीय स्तर पर खाद्य सुरक्षा पर प्रभाव, दिनांकः 19–09–2022
- निबंध लेखनः विषयः देश में स्वच्छता अभियान का सकारात्मक प्रभाव (2500–3000 शब्द), दिनांकः 21–09–2022
- नोटिंग ड्राफ्टिंग/पत्र लेखन, दिनांकः 23–09–2022
- हिन्दी टायपिंग युनिकोड, दिनांकः 26–09–2022
- कविता पाठ, समापन समारोह एवं पुरस्कार वितरण, दिनांक : 30–09–2022

वर्ष 2022–23 में आयोजित राजभाषा कार्यशालाए

- पहली तिमाहीः 28 जून 2022 में हिन्दी कार्यशाला विषयः राजभाषा में सूचना प्रौद्योगिकी का उपयोग एवं महत्व पर श्री जगदीसन ए के उप निदेशक (राजभाषा) भारतीय कृषि अनुसंधान परिषद् ने संस्थान के स्टाफ के राजभाषा के प्रगामी उपयोग पर विस्तार से वक्तव्य दिया
- दूसरी तिमाहीः संस्थान में राजभाषा कार्यशाला, वैज्ञानिकों द्वारा 1 सितम्बर 2022 को ग्राम जगतपुर–सुलतानपुर, ब्लॉक सिकंदरावाद, जिला बुलंदशहर के लगभग 105 किसानों को पोषण सुरक्षा हेतु विषय "जैविक सब्जियों के उत्पादन एवं आर्थिक महत्त्व" पर आयोजित की गयी।
- तीसरी तिमाही : राजभाषा कार्यशाला का का आयोजन, 17–18 नवम्बर 2022 को ग्राम जगतपुर सुल्तानपुर, ग्राम धमरावाली एवं ग्राम सुनाना, जिला बुलंदशहर के लगभग 250 किसानों को विषय "जैविक सब्जियों के उत्पादन एवं आर्थिक विश्लेषण" पर किया गया। इस प्रशिक्षण कार्यशाला में, किसानों द्वारा सब्जियों के उत्पादन में उन्नति शील किस्मों के चयन एवं बाजार सुविधाओं की विशेष जानकारी दी गयी।
- चौथी तिमाहीः भा.कृ.अनु. प.–राष्ट्रीय कृषि आर्थिकी एवं नीति अनुसंधान संस्थान (निआप), नई दिल्ली द्वारा 13 मार्च 2023 को राजभाषा कार्यशाला का आयोजन किया गया। कार्यशाला का उदघाटन संस्थान के निदेशक डॉ प्रताप सिंह बिरथल जी ने कियाद्य डॉ बिरथल ने "संस्थान में राजभाषा के प्रसार के लिए किये जा रहे प्रयास" पर अपना व्याख्यान दिया और निआप के सभी स्टाफ को हिंदी में कार्य करने के लिए प्रेरित किया। इस अवसर पर राजभाषा विशेषज्ञ श्री आशुतोष कुमार, उपनिदेशक–राजभाषा, भा.

हिंदी पखवाडा प्रतियोगिता

संस्थान निदेशक डॉ प्रताप सिंह बिरथल का राजभाषा कार्यशाला में संबोधन

कृ.अनु.प. राष्ट्रीय पादप आनुवंशिक संसाधन ब्यूरो, नई दिल्ली, ने "सरकारी कार्यालयों में राजभाषा का कार्यान्वयन" विषय पर व्याख्यान दिया।

राजभाषा कार्यान्वयन समिति की नियमित तिमाही बैठक: संस्थान में राजभाषा के निरंतर विकास के लिए, हर तीन माह में राजभाषा कार्यान्वयन समिति की तिमाही बैठक का आयोजन किया जाता है।

अन्य प्रमुख उपलब्धियां

- भा.कृ.अनु.प.–केन्द्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान में 24–25 अगस्त 2022 को दो दिवसीय भाषा उत्सव एवं हिंदी संगोष्ठी "स्वतंत्रता के 75 वर्ष एवं राजभाषा का विकास" में श्री प्रेम नारायण, हिंदी प्रभारी और डॉ विकास कुमार, वरिष्ठ वैज्ञानिक द्वारा सहभागिता

केन्द्रीय गृह एवं सहकारिता मंत्री माननीय श्री अमित शाह जी द्वारा दो दिवसीय अखिल भारतीय राजभाषा सम्मलेन का उद्घाटन (इंडोर स्टेडियम, सूरत, 14–15 सितम्बर 2022) एवं संस्थान द्वारा प्रतिनिधित्व

- राजभाषा विभाग, गृह मंत्रालय, भारत सरकार द्वारा, पंडित दीनदयाल उपाध्याय इंडोर स्टेडियम, सूरत में 14–15 सितम्बर 2022 को आयोजित दो दिवसीय अखिल भारतीय राजभाषा सम्मलेन में श्री प्रेम नारायण, हिंदी प्रभारी और डॉ विकास कुमार, वरिष्ठ वैज्ञानिक द्वारा सहभागिता
- संस्थान के सभी कम्प्युटर में हिन्दी फॉन्ट एवं युनिकोड के माध्यम से द्विभाषीय सुविधाएं उपलब्ध हैं
- भा.कृ.अनु.प. के राजभाषा विभाग द्वारा प्रेषित समीक्षा रिपोर्ट में, (तिमाही दिसम्बर–अक्टूबर 2022) संस्थान द्वारा हिंदी में अधिक टिप्पणी लेखन पर संस्थान की सराहना की है।
- हिन्दी को बढ़ावा देने के लिए संस्थान की राजभाषा समिति ने भारतीय कृषि अनुसंधान परिषद और केन्द्रीय राजभाषा विभाग, भारत सरकार द्वारा जारी सभी परिपत्रों एवं वार्षिक कार्यक्रम के दिशा निर्देशों को लागू किया

राजभाषा में लिखे गए लेख

- प्रेम नारायण (2022) "कृषि में ग्रामीण कृषि वितरण से ग्रामीण विकास का बदलता परिदृश्य" पूसा सुरभि, छमाही अंक, अक्टूबर–मार्च 2022 में प्रकाशित. पेज 76–86.
- प्रेम नारायण (2022) "कृषि में स्मार्ट फार्मिंग तकनिकी से किसानो की आय में सकारात्मक वृद्धि", राजभाषा अलोक 2, भारतीय कृषि अनुसंधान परिषद्, पेज 42–49.

10 Personnel and Budget

Personnel

Scientific

S. No.	Name	Designation
1.	Dr. Pratap Singh Birthal	Director
2.	Dr. Nalini Ranjan Kumar	Principal Scientist (Ag. Economics) & Acting Head, Division of Technology and Sustainable Agriculture
3.	Dr. Khem Chand	Principal Scientist (Ag. Economics)
4.	Dr. I. Sekar	Principal Scientist (Ag. Economics)
5.	Dr. Rajni Jain	Principal Scientist (Computer Application in Agriculture)
6.	Dr. Subhash Chand	Principal Scientist (Ag. Economics)
7.	Dr. Naveen Prakash Singh[1]	Principal Scientist (Ag. Economics)
8.	Dr. Sant Kumar	Principal Scientist (Ag. Economics)
9.	Dr. Shiv Kumar	Principal Scientist (Ag. Economics) & Acting Head, Division of Agricultural Markets and Trade
10.	Dr. Raka Saxena	Principal Scientist (Ag. Economics) & I/c Ag. Growth and Development unit
11.	Dr. Purushottam Sharma	Principal Scientist (Ag. Economics)
12.	Dr. Prem Chand	Senior Scientist (Ag. Economics)
13.	Dr. Vikas Kumar	Senior Scientist (Ag. Economics)
14.	Dr. Shivendra Kumar Srivastava	Senior Scientist (Ag. Economics)
15.	Dr. Kingsly Immanuelraj T	Senior Scientist (Ag. Economics)
16.	Dr. Dinesh Chand Meena	Senior Scientist (Ag. Economics)
17.	Dr. Arathy Ashok	Scientist (Ag. Extension)
18.	Dr. Vinayak Ramesh Nikam	Senior Scientist (Ag. Extension)
19.	Mrs. Pavithra Srinivasamurthy	Scientist (Ag. Economics)
20.	Ms. Jaya Jumrani	Scientist (Ag. Economics)
21.	Mr. Subash S. P.	Scientist (Ag. Economics)
22.	Dr. S. J. Balaji	Scientist (Ag. Economics)
23.	Mr. S. V. Bangararaju	Scientist (Ag. Economics)
24.	Dr. Prabhat Kishore	Scientist (Ag. Economics)
25.	Dr. Ankita Kandpal	Scientist (Ag. Economics)
26.	Dr. Kiran Kumara T. M.	Scientist (Ag. Economics)
27.	Mr. Dilip Kumar	Scientist (Computer Application & IT)

[1]Dr. Naveen Prakash Singh, Principal Scientist is on deputation as Member, CACP, New Delhi.

Technical

S. No.	Name	Designation
1.	Mr. Khyali Ram Chaudhary	Chief Technical Officer
2.	Mr. Mangal Singh Chauhan	Chief Technical Officer
3.	Mrs. Sonia Chauhan	Chief Technical Officer
4.	Mr. Satender Singh	Technical Officer (Driver)

Administrative

S. No.	Name	Designation
1.	Mr. Navdeep Kumar Sharma	Administrative Officer
2.	Mr. Mohammad Irfan	Assistant Finance & Accounts Officer
3.	Mr. Inderjeet Sachdeva	Assistant Administrative Officer
4.	Mr. Yatin Kohli	Assistant
5.	Mr. Harish Vats	Assistant
6.	Mr. Ajay Tanwar	Assistant
7.	Mr. Deepak Tanwar	Personal Assistant
8.	Mrs. Kanika Arora	Lower Division Clerk
9.	Mr. Mahesh Kumar	Lower Division Clerk

Skilled Supporting Staff

S. No.	Name	Designation
1.	Mr. Mahesh Pal	Skilled Supporting Staff

Promotions & Transfer

S. No.	Name & Designation
1.	Dr. Shivendra Kumar Srivastava, promoted to the next higher grade from Level-12 to Level 13A w.e.f. 20.04.2022
2.	Dr. Dinesh Chand Meena, Scientist, promoted to the next higher grade from Level 11 to Senior Scientist in Level 12 w.e.f 01.07.2022
3.	Dr. Vinayak Ramesh Nikam, Scientist, promoted to the next higher grade from Level 11 to Senior Scientist in Level 12 w.e.f. 01.01.2022
4.	Dr. Kiran Kumara T.M, Scientist promoted to the next higher grade from Level-10 to Level 11 w.e.f. 04.01.2022
5.	Dr. Ankita Kandpal, Scientist promoted to the next higher grade from Level-10 to Level 11 w.e.f. 04.01.2022
6.	Mrs. Arathy Ashok, Scientist promoted to the next higher grade from Level 11 to 12 w.e.f. 25.10.2020
7.	Shri Khyali Ram Chaudhary, ACTO, promoted to the next higher grade from Level 11 to Chief Technical Office in Level 12 w.e.f. 11.04.2021

S. No.	Name & Designation
8.	Shri. Mangal Singh Chauhan, ACTO, promoted in the next higher grade from Level 11 to Chief Technical Office in Level 12 w.e.f 15.04.2021
9.	Smt. Sonia Chauhan, ACTO, promoted to the next higher grade from Level 11 to Chief Technical Office in Level 12 w.e.f. 26.05.2021
10.	Mr. Ajay Tanwar, UDC promoted to the post of Assistant (Level 6) w.e.f. 02.06.2022

New Joining

S. No.	Name& Designation	Joined on
1.	Dr. I. Sekar, Principal Scientist (Ag. Economics)	20.10.2022
2.	Mr. Navdeep Kumar Sharma, Administrative Officer	17.09.2022

Study Leave

S. No.	Name& Designation	Study Leave Period
1.	Mrs. Arathy Ashok, Scientist	01.08.2019 to 31.07.2022
2.	Mrs. Pavithra Srinivasamurthy, Scientist	19.08.2019 to 18.11.2022
3.	Mr. Subash S.P, Scientist	20.07.2021 to 19.07.2024
4.	Ms. Jaya Jumrani, Scientist	08.09.2021 to 27.01.2023

Superannuation

S. No.	Name & Designation	Date of superannuation
1.	Sh. Chander Vallabh , Administrative Officer	30.04.2022
2.	Sh. Prem Narayan, CTO	28.02.2023

Transfer

S. No.	Name & Designation	Date of Transfer
1.	Mrs. Umeeta Ahuja, Private Secretary	03.08.2022

Budget

Table 10.1: ICAR-NIAP Expenditure, 2022-23

(Rs. in Lakhs)

Head	Expenditure
Works	8.96
Equipment	25.70
Information Technology	16.51
Library Books and Journals	18.82
Furniture & Fixtures	0.00
Others	0.00
Total Capital Expenditure (A)	**69.99**
Grant in Aid-Salaries (Revenue)	892.17
Pension and other Retirements benefits	221.14
Total Establishment Expenses (B)	**1113.31**
Grant in Aid-General	
Travelling Allowance	6.35
Research and Operational Expenses	156.32
Administrative Expenses	189.65
Others	2.68
Total Expenditure Grant in Aid-General (C)	**355.00**
Grand Total (A+B+C)	**1538.30**
SCSP Grant in Aid Capital	**18.00**
SCSP Grant in Aid General	**25.00**
Total Expenditure SCSP (D)	**43.00**
Total Expenditure including SCSP (A+B+C+D)	**1581.30**
Revenue receipt	**8.20**
Budget of Externally Funded Projects (Expenditure)	**57.67**

भाकृअनुप – राष्ट्रीय कृषि आर्थिकी एवं नीति अनुसंधान संस्थान

ICAR - National Institute of Agricultural Economics and Policy Research

(Indian Council of Agricultural Research)

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