Innovative Extension Models in promoting Climate Change Adaptation in Agriculture

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Abstract

Increasing climate variability would aggravate the problem of food and nutritional security of the growing population in India. Concerted efforts are required for mitigation and adaptation to reduce the vulnerability of Indian agriculture to the adverse impacts of climate change and make it more resilient. The Government of India has taken several steps to address climate change and reduce the vulnerability of farmers to adverse impacts of climate change. Various extension models are being adopted by different public and private organizations in dissemination of climate resilient technologies and to enhance the preparedness of the farmers. A few such innovative models are discussed in the paper. A strong extension network and appropriate extension methods, can help enhance the capability of farmers towards adaptation of climate resilient technologies say the authors.

Keywords: Climate change, Extension Models

Introduction

The impacts of climate change on agriculture will be severely felt in India. During the course of the 20th century, the average temperature in the country has increased by 0.6°C, and the trend continues to be upward. The cases of ravaging and recurrent floods, drought, and late arrival of the monsoon, erratic rainfall etc., have left the people in peril and these recurrent occurrences of extreme events amply indicate climatic anomalies.

One of the critical issues in Indian agriculture is the high proportion of rainfed agriculture which is climatically classified as semi-arid tropics. Rainfed agriculture in the semi-arid tropics is particularly vulnerable to climate change, carries a much higher degree of risk, and is characterized by high variability in production, low yields and low returns, often not even covering the cost of cultivation for several crops in many regions. The semi-arid tropics are important to total agricultural production, gross cropped area and farmers' livelihoods in India.

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The Government of India has taken several steps to address climate change and reduce the vulnerability of people to adverse impacts of climate change. Some of the important interventions include, Launching of a National Action Plan on Climate Change (NAPCC) and implementing the plan through eight National Missions such as Jawaharlal National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for Sustaining the Himalayan Ecosystem, National Mission for Green India, National Mission for Sustainable Agriculture, National Mission on Strategic Knowledge on Climate Change, which form the core of the National Action Plan and incorporate multi-pronged, long-term and integrated strategies for achieving India's key goals in the context of climate change. The Government of India has also launched a new crop insurance scheme called Pradhan Mantri Fasal Bima Yojana (PMFBY) with the aim of providing a more efficient insurance support with low premium insurance cover to the farmers so that they can sustain even if the yield is damaged.

India is a major player in carbon markets, on the mitigation side of climate finance. The Government of India also established the National Adaptation Fund to assist national and state level activities to meet the cost of adaptation measures in areas that are particularly vulnerable to the adverse effects of climate change. The Indian Network for Climate Change Assessment (INCCA) was launched to enhance knowledge about the impacts of climate change at the national and sub national level. The National Institute for Climate Change Studies and Actions (NICCSA) is being set up by the Government of India under the Climate Change Action Program (CCAP) to conduct analytical studies on scientific, environmental, economic developments and technological issues related to climate change. Policy support and infrastructure related to climate change are relevant if adequate extension is in place.

Technology Dissemination through Innovative Extension Models. Various Extension models are being adopted by different public and private organizations in dissemination of climate resilient technologies and to enhance the preparedness of the farmers. A few such innovative models which have been pilot tested and in practice are discussed here.

(i) Extension Model adopted under NICRA

National Innovation on Climate Resilient Agriculture (NICRA) is a Network project of Indian Council of Agricultural Research (ICAR) launched in 2011

with the objectives of 1) enhancing the resilience of Indian agriculture (including crops, livestock and fisheries) to climatic variability and climate change through strategic research on adaptation and mitigation, 2) demonstrating site specific technology packages on farmers' fields to cope with current climatic variability and 3) to enhance the capacity of scientists and other stakeholders in climate resilient agricultural research and awareness of impacts. In order to attain these objectives, the project has adopted four components such as (i) Strategic research on adaptation and mitigation; (ii) Technology demonstration; (iii) Capacity building; and (iv) Sponsored competitive research. Of the four components, this paper focuses on the Extension Model adopted under this project, *i.e.*, Technology Demonstration component. Under this component, Climate resilient Technologies are being demonstrated, through 121 Krishi Vigyan Kendras (KVKs) and technology transfer division of core institutes, in eight zones across the country to address various climate vulnerabilities. About one lakh farmers are covered in 130 village panchayats across the country.

The Technology Demonstration Module consists of four modules.

Module I: Natural Resource Management - which covers interventions on in-situ moisture conservation, rain water harvesting and recycling for supplemental irrigation, improved drainage in flood prone areas, conservation tillage, ground water recharge and water saving irrigation methods.

Module II: Crop Production - focus is on introducing drought/temperature tolerant varieties, advancement of planting dates of *rabi* crops in areas with terminal heat stress, water saving paddy cultivation methods (SRI, aerobic, direct seeding), frost management in horticulture through fumigation, community nurseries for delayed monsoon, custom hiring centres for timely planting, location specific intercropping systems with high sustainable yield index.

Module III: Livestock and Fisheries - Augmentation of fodder production during droughts/floods, improving productivity of CPRs, promotion of improved fodder/feed storage methods, preventive vaccination, improved shelters for reducing heat/cold stress, management of fish ponds/tanks during water scarcity and flooding.

Module IV: Institutional Interventions - Institutional interventions either by strengthening the existing ones or initiating new ones relating to seed bank, fodder bank, custom hiring center, collective marketing, and introduction of weather index based insurance and climate literacy through a village level weather station

are being initiated. In each NICRA village, a Village Climate Risk Management Committee (VCRMC) is constituted representing all sections of the community with at least 2-3 women members and they are maintaining the local level institutions.

Monsoon Action Plan for NICRA villages is being prepared for every season. It essentially deals with village level contingency measures. Availability of inputs such as seed of short duration varieties and other inputs are ensured based on the anticipated climate variability. The KVKs concerned prioritize the technology interventions to focus on building climate resilience in farming and strengthening coping ability of farmers. Appropriate and focused advisories are being prepared and disseminated so as to reach the farmers in time to cope with various contingent situations. NICRA has an exclusive website, and brings out a monthly e-Newsletter on Climate Resilient agriculture as an outreach program.

NRM interventions are being promoted as flagship interventions and are crucial to build resilience against climate variability. Emphasis on NRM has stirred new enthusiasm and energy in KVKs and among the communities. Promotion of NRM interventions require a higher level of commitment and better facilitation from host institutions.

NICRA addresses a number of research gaps. NICRA could serve as a model or inspiration for similar government programs in other countries. NICRA research results and adaptation technology packages developed as part of the initiative's demonstration component are likely to be highly transferable within India. Some learning and technology may also prove to be transferable to other parts of the world. (NICRA and FARMS project).

(ii) Village Knowledge Centre – ClimaAdapt

The Village Knowledge Centers (VKC), leverage best-fit Information and Communication Technologies (ICTs) and function as a conduit for information, knowledge, and skill transfer to rural communities. Under ClimaAdapt project, 8 VKCs have been established by M.S. Swaminathan Research Foundation (MSSRF), supported by NIBIO and Norwegian Embassy. The purpose of the VKC is to enable a sustainable single window knowledge platform to the community, which renders location specific climate smart agro advisories and technologies to the farmers for informed decisions and to provide demand responsive holistic information and knowledge to the community in general based on their knowledge

requirements. VKCs focus on climate literacy and so far the project has reached 29 villages and almost 77,500 farmers. Gender segregated needs are identified across the study areas and accordingly content is developed and rendered through Knowledge Management Systems (KMS) in Village Knowledge Centres (VKCs).

The type of services provided to them ranges in different thematic areas such as agriculture, animal husbandry, health, education and government entitlements. The information such as weather forecast, climate literacy, climate smart agricultural/ water management techniques, IPM & INM, livestock care and disease management, career guidance etc, are disseminated for catering to the knowledge requirements of the community in the project villages. The dissemination of knowledge is through multiple communication tools such as notice boards, flash cards, CDs, GSM / Wired / Wireless based Public Address System, Mobiles -text based menu, audio and SMS, WhatsApp, Fixed Wireless Group Audio Conferencing, Mobile vans, Video Conferencing, Webinars etc., to the farming community. 'Webinar' based meetings with people, has been the first-of-its-kind under VKC's synchronous tools enabled through ClimaAdapt for promoting climate literacy. Strategic partnership is established with more than 50 district and block level departments/organizations to bridge the gap between knowledge seekers and knowledge providers. 'Plant clinics' to offer precise, diagnostic, and advisory services for plant diseases, pest management and periodic soil & water testing through 'mobile soil testing van' of MSSRF are being facilitated through VKCs. The Knowledge Workers are from the community and manage the VKC and are able to cater to the knowledge needs of the rural community by garnering community participation, especially women.

To ensure the sustainability of the VKC, MSSRF has made efforts to involve VKC Management Committee from the community and strategic partners from both public and private sector. There was an initiative to integrate Common Service Centre, a gateway to access government entitlements and e-services in collaboration with DEITY (Department of Electronics and Information Technology, Ministry of Information Technology, Government of India).The interventions helped the farmers to undertake timely and informed decisions and thereby reduce risks and enhance economic benefit. (MSSRF – ClimaAdapt -2016).

(iii) HARITA-PRIYA: A Wireless Sensor Networks (WSN) based Disease Forewarning and Crop Advisory Model

HARITA (Harmonized Information of Agriculture, Revenue and Irrigation for

a Transformation Agenda)' - PRIYA (Precision Technology for Agriculture) is a 'Precision Agriculture' pilot study by the Centre for Development of Advanced Computing (C-DAC), Hyderabad and Government of Andhra Pradesh, to develop a replicable model to acquire micro-climate information from farmers' fields on a real-time basis using Wireless Sensor Networks (WSN) technology, thereby enabling the Agriculture Department to disseminate personalised advisory to farmers.

In 2015, a C-DAC Team deployed 74 WSN nodes in 5 villages of Anantapur District, Andhra Pradesh state, covering approximately 450 acres of groundnut crop. These WSN nodes sense the micro-climate at crop canopy level on real-time basis and transfer the data periodically to a remote server, through a field 'Gateway' having Internet access. At the server, crop centric 'Decision Support Models' analyse the data received from the field and alerts are generated for pest/ disease forewarning or irrigation scheduling. Based on the alerts generated by the system, the Agriculture Department sends personalized crop advisories to the farmers via SMS in Telugu language. During *Kharif* season (July-October 2015), a total 41 forewarning alerts for groundnut leaf spot disease outbreak were generated by the system, helping the Agriculture Department to send timely advisories to the groundnut farmers in those villages.

HARITA-PRIYA model enabled agriculture officers to reach out to more number of farmers with personalised advisories. An individual farmer received an average of 18 advisories during this crop season as compared to a maximum of 2 or 3 general advisories issued by the Agriculture Department in the past. Weather data is available at the village level (10 to 15 locations) along with village specific crop management practices and personalised advisories to the farmers, whereas, earlier, availability of weather data was only at the district level. Sending personalised advisories to individual farmers via SMS in the regional language (Telugu) resulted in better reachability, acceptance and adoption compared to the traditional way of sending seasonal advisories through newspaper and radio. WSN alert based advisories resulted in reducing indiscriminate use of fungicides or pesticides to only 2 to 3 sprays (in normal cases 6-8 sprays), thereby helping the farmers to reduce input cost. (Kathiresan, C. 2016).

(iv) e-Arik (e-Agriculture): Using ICTs to Facilitate "ClimateSmart Agriculture" among Tribal Farmers of North East India

A 'Village Knowledge Centre' was established under e-Arik project with a

computer, internet link, printer, scanner, phone and TV at Yagrung village in Pasighat, Arunachal Pradesh. The eArik project staff regularly undertake field visits to observe crop conditions and to diagnosis pests, diseases, nutrient deficiencies and physiological problems. They digitally document these issues using ICTs in the field and, via email and webcam, communicate them to staff at the eArik Research Laboratory at the Central Agricultural University. Problems are analysed by the experts (who also sometimes undertake field/advisory visits) and recommendations are passed on to the eArik Village Knowledge Centre by email and then to the concerned farmers by phone or personal face to face communication by farmer facilitators. Dissemination of information and good practices was also addressed by innovative approaches such as farmer to farmer communication and local self-help groups. Besides, a portal (www.earik.in) was established under the project to provide information on crop cultivation and other agricultural practices; basic information about agriculture and rural development departments of the government; specific information on government schemes related to farmer welfare and day to day market information and weather forecasts *etc.* A total of 500 farmers were covered in 12 villages.

The main impact of the project is that a total of 44 per cent and 92 per cent of the farmers have implemented the information they had received via eArikon climate smart farm practices on rice and mandarin crops respectively (Drishti, 2011). Two years after initiation of the project, 55 per cent of the farmers developed new khasi mandarin orchards in their *jhum* field, which means they are permanently moving from slash and burn to settled cultivation. Increased production of rice and khasi mandarin crops was reported by 42 per cent and 29 per cent of eArik beneficiaries, respectively. An estimated cost saving on fuel towards journeys to the agricultural extension office is on average Rs. 2,400 (US$53) per year for each farmer. Overall, it is estimated that the eArik approach is 3.6 times cheaper than a conventional agricultural extension system; farmers can get access to information and services 16 times more quickly. Success factors of the project included: utilizing trusted local intermediaries, appropriate use of different ICT tools including non-digital ICT formats, multichannel message reinforcement including face to face contact and multi stakeholder partnership. The challenges faced in project implementation are technological and human challenges of working in remote areas, creation of climate resilient practices, challenge of digital and project skepticism, demand from the farmers for total development assistance from the project and financial sustainability, (Adopted from Saravanan, 2011).

Summary and Recommendations

Increasing climate variability would aggravate the problem of food and nutritional security of the growing population in India. However, with a strong extension network and appropriate extension methods, it is possible to enhance the capability of farmers towards adaptation of climate resilient technologies.

Reviewing the existing extension Models, the following measures are suggested to prepare the farmers for climate change adaptation.

1. Climate literacy is important and hence, extension functionaries may organize village level climate workshops /campaigns to create awareness among the farmers and create Weather Conscience through Climate Schools.
2. Climate Clubs may be established at the village level as information sharing platforms.
3. Dedicated post of Monsoon Managers at State and District level may be created to facilitate them to focus on Climate change.
4. Within the Community one person may be selected as a Climate Manager at the village level and may be trained on Climate Resilient practices to disseminate among other members in the community.
5. Village Knowledge Centers may be established in every village and involvement of the community ensured for sustainability of the VKC.
6. Strategic partnership needs to be established with government agencies, scientific institutions and farmers at the district and village levels to cope up with extreme weather events.
7. Alternate livelihood options need to be promoted to enhance farmers' income in high risk prone areas.
8. Considering the varied agro – climatic zones in India, it is advisable to have more number of demand driven decentralized extension models.
9. The extension functionaries may identify appropriate potential adaptation strategies such as cultivars tolerant to heat, salinity stress and resistant to flood and drought, transfer of suitable crop management practices, improved water management practices, promoting resource conserving technologies, crop diversification, integrated pest management, providing timely and accurate weather forecasting *etc.*
10. Comprehensive weather based crop insurance and harnessing indigenous technical knowledge of farmers *etc.,* may be promoted.

11. Incentives may be provided to the farmers for switching over to Resource Conservation Technologies, which may encourage more farmers.

12. A strong social security net should be put in place as part of adaptation strategies such as timely and appropriate compensation for loss of crop / livestock due to extreme events, insurance and pension to the farmers *etc.*

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