

Innovative extension strategies for transfer of technologies in potato

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Effective agricultural extension strategies help to empower farmers with knowledge and skills that promote sustainable practices, increase yield, and enhance overall well-being. By employing a combination of extension strategies with innovative approaches, agricultural organizations, government agencies, NGOs, and other stakeholders can effectively transfer technologies of best practices to potato farmers, which enable them to adopt sustainable and profitable production methods and contribute to food security and agricultural development in the country.

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INDIA is among the fastest-growing major economies of the world and it is the world's fifth-largest economy by nominal GDP and the third-largest by purchasing power parity (PPP). Agriculture and allied sectors accounted for 18.4% of the GDP, and the sector employed 51.2 crore persons or 45.5% of the workforce in India are employed in agriculture. India is a major agriculture-producing country and has the most arable land in the world followed by the United States. However, agricultural output lags far behind its potential. Agricultural development is still essential for the nation's food and nutritional security, economic growth, and poverty reduction. Green Revolution brought sufficiency in food production due to several technologies, including fertilizers, enhanced agronomic techniques, assured irrigation, hybrid and high-yielding cultivars, price support policies, and enhanced agronomic practices. This revolution was made possible through an organised and committed effort of the Agricultural Extension System (AES).

In India, potatoes are a significant commercial food crop that supports the livelihoods of

millions of smallholder farmers and supplements the calorie and nutritional requirements. Potatoes are accessible throughout the year and are consumed in several forms, as vegetable and value-added processed products. Approximately 10% of the potatoes harvested in India are transformed into value-added products, the demand for which has been growing at a faster rate than for staple foods. India is the world's second-largest producer of potatoes. It makes up 11.3% of the world's land area and 12.5% of its total production. India's potato production has been increasing fast due to the country's expanding demand as well as advances in technology and innovations. The production of potatoes is affected by several factors. This article highlights some of the strategies relevant to the efficient technology transfer in potato production applicable to the Indian context.

Agencies involved in potato based ToT activities

It is estimated that the total number of extension workers in the country under the public extension umbrella are ~1.2 lakh. However, about 15% of the manpower that

is available for extension works is in administrative and supervisory capacities, meaning that they are not available for field-level extension. As a result, the current 1162:1 farmer-to-extension functionary ratio may be further impacted. One of the main causes of low productivity in potatoes is the lack of knowledge of scientific potato growing techniques, and storage procedures as well as a low level of adoption of new varieties and technologies. Therefore, proper dissemination of potato technologies and their acceptance among potato growers are important to boost potato yield. The agencies involved in technology transfer for any crop, including potatoes, are mentioned below.

Public-Sector extension agencies

ICAR-Central Potato Research Institute (CPRI), Shimla: CPRI is a premier institute of ICAR working on the growth and development of the potato sector in India. Its main aim is to carry out research, education and extension on potatoes in collaboration with national and international partners for enhancing productivity and profitability, achieving sustainable food and nutritional security and alleviating

rural poverty. The Social Sciences Division of the institute conducts various extension activities to transfer modern potato technologies to farmers as well as other stakeholders. The institute offers a variety of year-round training programmes for progressive potato growers and extension agents from various states. It also organizes *kisan melas*, exhibitions, conferences, and seminars. In addition to training, the division is involved in the adoption and diffusion of the latest knowledge and technology with farmers and other stakeholders, such as input dealers and private processing firms etc.

Central Agricultural Universities (CAUs)/Central University with Agricultural Institutions: CAUs in India are institutions of higher learning, research, and extension in the field of agriculture and allied sciences. The role of CAUs encompasses various functions aimed at advancing agricultural education, research, and development. It also engages in agricultural extension activities to facilitate the adoption of modern technologies and practices by farmers. They established extension networks, demonstration farms, to provide technical guidance, training, and advisory services to farmers to increase agricultural productivity, improve livelihoods, and promote sustainable agricultural development.

State Agricultural Universities (SAUs): State Agricultural Universities play a multifaceted role in advancing agricultural knowledge, enhancing food security, promoting rural development, and contributing to the overall well-being of society. SAUs provide extension services to disseminate research findings and agricultural technologies to farmers, agribusinesses, and other stakeholders. To meet the needs of farmers and improve agricultural sustainability and production, extension operations include organizing workshops, field demonstrations, training courses and consulting services.

Krishi Vigyan Kendras (KVKs): KVKs or Farm Science Centres serve as knowledge and resource hubs for disseminating agricultural technologies and information to farmers at the grassroots level. It plays a vital role in bridging the gap between agricultural research and extension services, facilitating technology transfer, empowering farmers with knowledge and skills, promoting sustainable farming practices, and contributing to agricultural development and rural livelihood improvement in India. There are currently 731 KVKs, at least one for each district in India. It serves as a centre for technology assessment and demonstration, capacity building, advisory services, seed production and distribution, livelihood diversification, technology refinement, demonstration of best practices & farm advisory centres.

State Departments of Agriculture: The Department of Agriculture is responsible for implementing extension activities at the state level. The extension employees of the Department of Agriculture work at the district and block levels, which are administrative units for the operation. Contact farmers or para-extension workers are involved in how information is communicated from district and block extension staff to village levels.

Agricultural Technology Management Agency (ATMA): To help farmers diversify their farming into high-value crops and livestock enterprises as a method of raising their farm incomes and rural employment, this organization was established as a new institutional framework for agricultural extension. A broader 'farming systems' approach, decentralising extension decision-making to the district and block levels, establishing connections between farmer interest groups (FIGs) and small-scale farmers, including women, and connecting these groups to markets are the main components of the ATMA.

Private-Sector Extension: Numerous private organisations offer advisory and various forms of assistance to farmers working in agriculture and related fields. Input agencies, farmer organisations, producer cooperatives, NGOs, agribusiness enterprises, agro-processing companies, agri-marketing firms, financial institutions, media, and internet services are a few of these. However, the presence of these private extension providers is generally skewed towards well-endowed regions and high-value crops.

Public-Private Partnership (PPP): Agriclincs and Agribusiness Centres (ACABC) employ 'agripreneurs,' or technically qualified agricultural graduates, to assist farmers with agricultural advising services at the village level. The role of an agriclinc is to provide expert services and advice to farmers, while agribusiness centres provide inputs and farm equipment on hire. PPP models can be developed for use in implementation with policies that support them. Extension outreach to more farmers and regions can be expanded with the help of additional private sector personnel.

Civil Society Organisations: Self-help groups (SHGs) and farmer-based organisations (FBOs) are essential for making extension demand-driven approaches to address the issues of smallholder farmers. This method reduces a number of generic problems related to public-sector extension, such as worker incentives and farmer responsibility. FBOs have the potential to help farmers to achieve economies of scale and reduce the shortcomings of the supply chain.

Innovative extension strategies for ToT

Extension strategies play a crucial role in disseminating knowledge, information, and technologies to farmers and stakeholders in the agricultural sector. These strategies aim to bridge the gap between research institutions, extension services, and end-users, facilitating the adoption

of best practices, innovative technologies, and sustainable farming methods. The following are some essential extension strategies that are frequently used in agricultural development:

Training and Capacity Building:

Investing in capacity building and training for extension workers and farmers is crucial for the successful dissemination of knowledge and technology. Continuous professional development equips extension agents with the latest research findings and enables them to effectively transfer this knowledge to farmers. Similarly, farmer training programmes enhance their skills in applying modern techniques and technologies.

Demonstration and Field Trials:

Organizing on-farm demonstrations and field trials helps showcase the performance and benefits of new agricultural technologies and practices. Farmers can observe the results first-hand and gain confidence & trust by interacting with experts in adopting these technologies on their farms. It is also advisable to establish demonstration plots and model farms to showcase integrated farming systems, sustainable agricultural practices, and the successful adoption of new technologies.

Farm Visits and Exposure

Tours: Farm visits and exposure tours are valuable extension strategies that involve taking farmers and stakeholders out of their farming environments to visit other farms, agricultural research centres, or successful agricultural enterprises. These visits provide first-hand exposure to different farming systems, technologies, and management practices, fostering learning, inspiration, and knowledge exchange. Farmers can interact with their peers, observe best practices in action, and gain practical insights into the implementation and benefits of adopting innovative agricultural technologies.

Farmers' Field Days: Organizing farmers' field days, workshops, and interactive sessions to facilitate knowledge sharing, experience sharing, and peer-to-peer learning among farmers. These events provide a platform for farmers to exchange ideas, discuss challenges, and explore solutions related to technology adoption and farm management. Experts share research findings, technical insights, and practical advice on various aspects of agriculture. It promotes community engagement, participation, and empowerment by involving farmers in decision-making processes, planning activities, and resource allocation.

Farmers' Field Schools (FFS):

FFS involve participatory, hands-on learning in the field where farmers gather regularly to observe, experiment, and learn from each other under the guidance of facilitators. This approach fosters experiential learning, encourages farmer-to-farmer knowledge exchange, and promotes the adoption of new techniques and technologies. Instead of traditional classroom-style teaching, FFS employ participatory methods such as group discussions, problem-solving exercises, and hands-on activities in the field. Farmers learn by doing, engaging directly with agricultural practices and technologies.

Farmer-to-Farmer Knowledge

Exchange: Encouraging the sharing of knowledge among farmers can be a successful strategy, particularly in regions where access to extension services is scarce. Peer learning systems help farmers build trust and a feeling of community by allowing seasoned farmers to impart their knowledge to nearby farmers. Increased adoption of technologies can result from this informal knowledge transmission, which can support and lead to the adoption of innovations within the farming community.

Farmer-Centric Approach:

Understanding the unique requirements and difficulties

experienced by farmers in various regions is necessary to adopt a farmer-centric approach, which is one of the key strategies in agricultural extension. By engaging in participatory processes, extension workers can collaboratively identify suitable technologies, best practices, and tailored solutions that address local conditions.

Commodity Specialized Approach:

The Commodity Specialized Approach in agricultural extension offers a targeted, value chain-focused, and market-oriented approach to promoting sustainable and competitive commodity production systems. By tailoring extension services to the unique characteristics and needs of specific commodities, this approach aims to enhance the productivity, profitability, and resilience of farmers engaged in commodity value chains.

Participatory Approaches:

The best way to characterize participative techniques is as a set of 'guiding principles' that help practitioners build new kinds of relationships with people who are supposed to gain something from their work. Farmer Field Schools, Study Circles, and Participatory Village Development in Isolated Areas (PaVIDIA) are a few instances of participatory programmes. Farmers can share experiences, overcome obstacles as a group, and learn by doing with this technique.

Community-Based Organizations (CBOs):

Partnering with local community-based organizations, farmer producer organizations (FPOs), farmer groups, cooperatives, and self-help groups to facilitate extension activities at the grassroots level. It helps smallholder farmers to strengthen their bargaining power, access resources, and improve market linkages.

Value Chain Development:

The most effective way to increase farmers' income is to integrate extension services with the value chain to promote market-oriented

production, value-addition, and market linkages for agricultural products. Extension efforts may focus on access to markets, credit, inputs, and post-harvest infrastructure, and value addition to better market opportunities and higher returns for farmers.

Climate-Smart Agriculture:

Extension agents play a pivotal role in promoting and facilitating the adoption of climate-smart agriculture (CSA) practices among farmers. Climate-smart agriculture involves the integration of sustainable farming techniques, resilient crop varieties, and adaptive strategies to mitigate climate change impacts, enhance productivity, and ensure food security.

Gender Mainstreaming: Gender parity in extension and advisory services (EAS) is essential to the success of programmes aimed at increasing food security and lowering poverty. Programmes for agricultural extension must acknowledge and address gender differences. Gender mainstreaming guarantees equitable access to resources, expertise, and decision-making opportunities and the role of women in agriculture improves household food security and results in overall development.

Advisory Services and Helplines: Providing timely and personalized advisory services to farmers through extension agents, helplines, mobile apps, and other communication channels. When farmers have questions or concerns about adopting new technology or managing their farms, extension agents provide knowledgeable counsel, suggestions, and assistance with troubleshooting.

Information and Communication Technology (ICT): ICTs have revolutionized agricultural extension services, enabled faster, more efficient, data-driven solutions and offered creative means of information dissemination. Real-time communication, access to market prices, weather forecasts,

and best agricultural practices are made possible by mobile devices, internet platforms, and agricultural apps. DAC&FW has implemented several ICT initiatives such as public portals like the m-Kisan Portal, Kisan Knowledge Management System, Farmer Portal, Portal on Crop Insurance Scheme, Kisan Call Centres, Portal on Soil Health Card, and the latest electronic National Agriculture Market; etc. for various value-added activities.

Mobile Apps: Mobile applications have emerged as powerful tools in agricultural extension services. They provide services like disease and pest identification, agronomic guidance, and help with crop planning. Mobile apps enable farmers to make better decisions and increase their farm productivity. Public and private extension institutions have offered several mobile apps to revolutionize agricultural extension by providing farmers with easy access to information, services, and support, thereby empowering them to adopt sustainable farming practices, improve productivity, and enhance their livelihoods.

Artificial Intelligence (AI): New opportunities in agricultural extension services have been made possible by artificial intelligence (AI). Large-scale agricultural data processing, pattern analysis, and significant insight generation are all possible with AI-driven solutions. Algorithms using machine learning can evaluate soil quality, forecast crop illnesses, and suggest appropriate remedies. Artificial intelligence-driven chatbots and virtual assistants are also gaining attraction, offering farmers real-time assistance and tailored guidance.

Drone Technologies: Drones in agriculture provide farmers with several advantages, including better yields, higher efficiency, and lower expenses. It is regarded as a green technology that offers farmers a safer alternative for applying agricultural chemicals to their fields while addressing labour shortages

and excessive labour costs. Drones are an efficient way for farmers to monitor crops and identify problem spots in huge fields. Given the advantages of drone technology, the CPRI Shimla has also worked to increase public awareness of its application in agriculture by holding drone spraying demos in the farmers' fields, especially in the potato crop which is a great leap towards smart farming of the future.

Data Analytics: Data analytics is essential for maximising the efforts of the extension activities. Extension workers can make data-driven decisions by gathering and evaluating data from a variety of sources, including weather stations, sensor networks, and satellite imagery. Farmers may maximise resource utilisation, reduce waste, and boost overall productivity with the aid of precision agriculture techniques. Data analytics also enable early detection of potential issues and facilitate timely interventions.

Social Media Engagement: Leveraging social media platforms such as Facebook, Twitter, and WhatsApp can facilitate communication and knowledge sharing among potato farmers and extension agents. Creating dedicated groups or pages for potato farmers provides a forum for sharing experiences, asking questions, and exchanging information on best practices, market trends, and success stories. Live streaming of training sessions, expert Q&A sessions, and virtual workshops also engage farmers and foster community participation.

Policy Advocacy and Institutional Strengthening: Advocating for supportive policies, regulations, and investments in agricultural extension services and rural development. Strengthening institutional capacity, coordination, and collaboration among government agencies, research institutions, NGOs, and private sector partners is essential for effective extension delivery and

sustainable impact.

Print and Digital Media : Print and digital media play complementary roles in advancing agriculture by providing information, education, technology transfer, market access, advisory support, policy advocacy, and research promotion. Utilizing radio, television, newspapers, magazines, websites, social media, and mobile apps helps as strategic tools to reach a wider audience and promote the adoption of agricultural technologies, their widespread reach, accessibility, versatility,

and make them indispensable for empowering farmers.

CONCLUSION

Agricultural development aims to reform agriculture in such a way that it is more equitable and inclusive so that all farmers can benefit. It is the reality that over 85% of farm holdings are marginal, small, and facing financial difficulties. To increase their income, there is a need for deploying scales of operation, and therefore, the need for promoting new generation farmer collectives, in the form of Cooperatives, Companies and Societies. Transfer

of technology (TOT), is an integral part of the extension process involving the transfer and spread of technical innovation and know-how to reach to the farming population. By combining extension strategies for ToT with innovative approaches, adaptive learning, and stakeholder engagement, agricultural extension programs can effectively empower farmers for their betterment and improve agricultural productivity, livelihoods, and rural development.

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International Day of Potato - Key Messages



Better Production: Promoting the adoption of good agricultural practices and key technologies can help millions of farmers to boost their productivity and incomes.

- Sustainable agronomic practices including integrated pest management need to be developed, validated and made available to farmers.
- Farmers need to have access to quality seeds of well-adapted and productive varieties that are most suited to production systems and ecologies.
- Improvements in breeding help meet demand for locally appropriate and climate-smart varieties.
- Farmers need support to access agronomic training and innovative technologies to boost yields and minimize loss and waste.



Better Nutrition: Potatoes are nutrient-rich, providing vitamins, minerals and dietary fibre.

- Potatoes are rich in vitamin C, which helps prevent scurvy.
- The nutritional value of the potato is highly dependent on the variety, climate, soil, cultivation techniques, storage conditions, processing, preparation and cooking method.
- Potatoes are rich in potassium, an electrolyte, which contributes to the proper functioning of our heart, muscles and nervous system.
- While potatoes can be part of a healthy diet, this depends on the amount consumed, how they are processed, prepared and cooked, and the balance with the rest of the diet.
- Potato skin contains dietary fibre, which is important for the digestion of food in the human alimentary system.

Source: A guide to International Day of Potato 2024. FAO, Rome.