Information and Communication Technologies for Integrated Pest Management- Some Experiences

Singh, Pushpa and Singh, K M and Shahi, Brajesh

RPCAU, Pusa

14 September 2018

Information and Communication Technologies for Integrated Pest Management- Some Experiences

Pushpa Singh[1], K.M. Singh[2] and Brajesh Shahi[3]

Abstract

In this transitory and challenging phase of agriculture development and extension, quick and easy transfer of technological information from the research system to end client farmer as well as feedback from farmers to the research system back is very critical and this gap can be easily achieved by the outright and expanding penetration of Information and Communication Technologies (ICTs). Information that is need-based, demand driven, location-specific as well as in local language can be easily provided by internet services and mobile phones. In extension system ICTs can help in emergence of knowledge workers resulting in the realization of a bottom-up, demand-driven paradigm for technology generation, assessment, refinement and transfer ICTs can make significant contribution in increasing the efficiency, productivity and sustainability of small farmers by providing early warning system regarding pest and disease control, new varieties, soil health, water management and weather. Computers, internet, geographical information systems, mobile phones, as well as traditional media such as radio or TV can bring about awareness of up-to-date market information on prices of commodities, inputs and consumer trends which will improve farmers' livelihoods substantially and have a dramatic impact on their negotiating position and marketing prospects. A number of internet sites have come up to support agricultural development in India. Websites like ikisan.com, krishivihar.com, agriwatch.com and commodityindia.com provides information to farmers on production and marketing of agricultural commodities. In the current changing scenario of emerging pest management problems, ICTs can play an important role in analyzing data regarding pest identification, dissemination and sharing of IPM information, internet based decision support tools, training and spread of scientific documents to other scientists, researchers, extension agencies, farmers as well as for public viewing. Internet and other ICT tools like mobile phones are very fast, persistent, detailed, open and interactive so are much suitable. Internet based services are presently being used for IPM based pest surveillance and advisory projects in management of insects pests of paddy, chickpea as well as pigeon pea. ICTs can provide the farmers with all the necessary information they require their decision regarding pest identification, life cycle, sampling, economic threshold decision, pest distribution, eco-friendly bio-control management tactics, pesticides availability as well as their environmental impact and safety risks. With growing popularity of smart mobile phones, hand held computers and global positioning systems IPM extension professionals and farmers are able to access relevant information anywhere anytime as well as inspiring insect pest informatics experts to create and standardize IPM information relevant to pest of specific area and time.

Key words: Agricultural Extension, Information and Communication Technologies, Integrated Pest Management

[1] Scientist (Plant Protection), Krishi Vigyan Kendra, RAU, Pusa Samastipur, Bihar
[2] Director, Extension Education, RAU, Pusa, Samastipur-848125, Bihar
[3] Senior Scientist (Soil Science), RAU, Pusa, Samastipur-848125, Bihar

Information and Communication Technologies for Integrated Pest Management- Some Experiences

Pushpa Singh, K.M. Singh and Brajesh Shahi

Introduction

Agricultural extension is in a transitory phase where, quick and easy dissemination of agricultural research to farmer's field and their feedback to the research system is very critical in transfer of technology. Information and communication technology has huge potential to bridge the existing gap between present research system and farming. Recent advances have seen an extensive use of ICTs in almost all spheres of rural farming community although there are many persisting problems of access, connectivity, literacy, content, and costs. The modern ICT applications like Internet services, mobile phones are becoming an important tool in dissemination and spread of knowledge. Agricultural extension depends on problem and information exchange where ICTs provides both opportunity and challenges to use this technique need based, in local language and site specific. ICT is an term with includes a range of technologies to enable the Agricultural extension system to gather, store, retrieve, adapt, localize and disseminate wide range of information to farming community (Davison *et al.,* 2005*)*. ICTs can help in developing skill of extension workers who will help in bottom-up, demand-driven paradigm for technology generation, assessment, refinement and transfer (Meera, 2003; Meera *et.al*. 2004).

The responsibility to sustain and increase agricultural production is responsibility of all stakeholder of agriculture i.e., farmers, universities, research institutes, extension services, commercial enterprises, and non-governmental organizations (NGOs). The agricultural knowledge is very poorly documented and hard to access by everyone. It is mostly available in hardcopy form, which is mostly incomplete or not compatible with other sources. Indigenous knowledge on good practices and local innovations is not documented. Information has to be presented in proper format to be effectively used by farming communities. Information on videos in local languages are very effective, so if we combine old and new media is most successful, such as videos of good practices, rural theatre, TV and radio broadcasts, which all provide input for local innovation it will be very effective in transfer of technology and bridge the huge gap

between information residing in agricultural knowledge centers and rural communities. It is very important to make relevant information accessible to end users so that there is an effective mechanism to ensure learning and information sharing both at local and national level. Satellite connections now make broadband access possible in remote areas. Use of mobile smart phones has seen an enormous increase in recent years, especially in rural areas. New mobile phones and laptops now provide access for communication, transactions and transfer of data. Some of the significant advantages of ICT are timely information on weather forecasts and calamities, better and spontaneous sustainable agricultural practices, better marketing exposure and pricing, reduction of agricultural risks and enhanced incomes, better awareness and information, improved networking and communication, facility of online trading and e-commerce, better representation at various forums, authorities and platform, etc.

India as a country is a powerhouse in ICTs internationally. The Indian Government's IT task force and the National Working Group on "Taking IT to the Masses" and many other private entrepreneurs are working on how ICTs can fulfill the requirement of farming community. The “National Commission on farmers” (http://krishakayog.gov.in/) under the chairmanship of Dr. M.S. Swaminathan has recommended harnessing the benefits of ICT for improving the socio-economic status of rural people by suggesting the establishment of “Rural Knowledge Centers” all over the country using modern ICT tools.

As on 2009, 452.91 million fixed land line telephones, 415.25 million wireless and 6.4 million broadband subscribers were estimated by the Telecom Regulatory Authority of India (TARI, 2009). The Tele-density has reached 38.88 (number of telephone subscribers per 100 individuals). Although, there is gap between urban and rural telephone density 64.48 and 9.03 respectively and the growth in telephone density is skewed in favor of urban India. In India, total internet users are 49.40 million. In rural India, only 1.2 per cent people have internet access, whereas, it is 12 per cent in urban India. The overall urban and rural mobile penetration remains 43.88 and 4.92 per cent, respectively and it is estimated that by the end of the year 2020, India will have highest number of mobile subscriber in the world. Agricultural Advisory services offers text, voice and video content based Agricultural information services through mobile phones and are becoming an essential device for all types of users irrespective of the age group and have unleashed a shift in the communication medium to reach out to the masses

Potential Role of ICTs in Integrated Pest Management

IPM which has proved to be most effective system approach method for pest management has benefited significantly from a wide range of ICT applications. Andrew Bartelett, IPM Programme Development Officer, FAO, have categorized the various fields of IPM in which ICTs are being applied (Xia,Yunlong, 2003), which may be identification of insect pest, IPM related information dissemination and sharing, internet based pest management decision tools and also supports updated training to extension functionaries and farmers. It can also support in help researchers and extension scientists to analyses data and help in scientific papers writing (A. Bartlett, 2002). The internet service has made it possible to share these documents to other scientist, researchers, extension worker and farmers and other people as E-mail attachment, or by placing on a website for public viewing. In country like India where internet is making new inroad in rural area through internet kiosks or smart phone this can be very effectively utilized as tool for scientist. The ICT has a number of characteristics which make it highly suitable for this purpose: It is quick, persistent, detailed, open and interactive are some of the characteristics which prove ICTs to be very effective. Online discussion group and websites offering 'asks an expert' service gives it an added advantage. Farmers, government agencies, NGOs as well as other private agencies who advise and train farmers need more knowledge and skill than was required under earlier extension systems. ICTs in IPM programme can be used to support pest management decision making and also to support IPM Training (A. Bartlett, 2002). The use of ICT to support Pest management decision making can be supported by ICT in identifying the pest species, its damage and life history, establishing economic injury thresholds, monitoring, scouting and predicting population, Selecting and applying control technique as well as evaluating treatment effectiveness. Initiatives such as IPMNet, Africa IPM Link and IPM CRSP have developed ICT channels for disseminating information, such as websites, online databases and discussion forums, email list servers and multimedia CD-ROMs. This decision support systems provide users with all the information to select suitable pest control strategy which includes pest identification, pest life cycles, sampling and decision-making criteria, sampling threshold calculations, and pest distribution models linked to weather monitoring systems offering environmentally friendly bio-control methods, as well as of available pesticides and their safety risks and impact on environment.

In India, broadcasting started through '*Akashvani*' (All India Radio) in 1957 which provided information to farmers on new crops, insect pest disease management, soil and water management (Thamizhpparithi *et al.,* 2007; Farm & Home programme, 2006). Establishment of Community radio station in Krishi Vigyan Kendra of India is the step to provide special attention on crop production technology and insect pest management as well as location specific weather forecasting, helping framer's to adopt Integrated Pest Management (Chiranjeev, A 2000). Another initiative is Kisan Call Centre having a toll free number 1800-100-1551 where farmer's can call and get information regarding disease and insect pest management. In same manner ICAR institutes and SAUs have also started consultation to farmers giving them location specific insect pest and disease management. *Doordarshan* as well as other private television channels are nowadays showing agriculture based programs like *Krishi Darshan*, *Kheti Bari , Batein Kheti Kee* and many other programs on different topics of agriculture including Integrated Pest Management. A whole new channel has 'Kissan' is devoted only on agriculture information.

Agricultural Research Information Centre (ARIC) provides a central source of information on the nature, location and status of current research project conducted in the country (Handbook of agriculture, 2008). M. S. Swaminathan Research Foundation, under "Village Knowledge Centre" provides variety of information in fostering agricultural and rural development through the use of ICTs. ikisan limited is an initiative that launched ikisan portal and information kiosks to disseminate information on agriculture practices and IPM practices and farmers can access this portal free of cost. Similarly, E-chaupal, and *Gyan Doot* by the Indian Tobacco Company (ICT) in MP and SEWA in Gujarat providing agriculture information related to insect-pest management similarly many such agencies are working in this regard.

Other institutes like National Institute of Agricultural Extension Management (MANAGE) have developed system which diagnoses pests and diseases for rice crop and also suggests control measures, IIHR, Bengaluru has developed grape Expert system, Mushroom Expert system, cabbage Pest Expert Systems. Central Silk Board, Bengaluru has developed an expert System for the management of insect pest management in Sericulture. AGREX, centre for information Kerala gives timely and correct advice to the farmers. Similarly, much Agricultural university has well developed farm advisory system for agriculture information with information related to pest diagnostics with photographs and pest management practices.

National Centre for IPM (NCIPM, New Delhi) is the main centre to look into insect pest management needs of different agro ecological zones of the country. It conducts eco-friendly IPM research and development programmes for sustainable agriculture. Services like pest surveillance and advisory project, chickpea and pigeon pea production through intensive application of IPM and major insect pest problems of rice and other agricultural pest is provided through internet.

Some useful ICT initiative in India

1. Help-line services
2. e-Extension (e-Soil Health card Programme): The Department of Agriculture, Gujarat State is one of the ambitious programmes which aims to analyses the soil of all the villages of the state and proposes to provide online guidance to farmers on their soil health condition, fertilizer usage and alternative cropping pattern. The website is www.agri.gujarat.gov.in, www.shc.gujarat.gov.in.
3. ITC-e- Choupal (http://www.echoupal.com).
4. Village Knowledge centre-hybrid wireless network comprising computers, telephones
5. AGRISNET- uses state-of-the-art broadband satellite technology to establish the network within the country. The website is http://www.apgrinet.gov.in for Andhra Pradesh and http://agriculture.up.nic.in for UP.
6. Asha services portal offers services on five different sectors of farming- agriculture, horticulture, animal husbandry, fisheries and sericulture.
7. Digital Ecosystem for Agriculture and rural livelihood- It is a multimedia platform for creation, sharing and dissemination of agricultural information among farmers and experts.
8. e-krishi (http://www.e-krishi.org)
9. e-Sagu (e-cultivation)system: The eSagu is a ICT-based personalized agro-advisory system.("Sagu" means cultivation in Telugu language). It aims to improve farm productivity by delivering high quality personalized (farm-specific) agro-expert advice in a timely manner to each farm at the farmer's door-steps. In eSagu, the developments in ICT such as (database,

internet and digital photography) are extended to improve the performance of agricultural extension services.

10. Query Redress Services: Empowering the farmer community through effective, need-based interventions. The project helps the farming community by giving a 10000 plus network of experts to them. Any queries from farmers are forwarded to the ISAP central office from where it is routed to the relevant experts. The service caters to information and knowledge needs of the farmers, professional members of ISAP, individuals and other stakeholders involved in the wider agricultural and allied sectors.
11. Kisan Call Centers: Kisan call centers have been established across the country with a view to leverage the extensive telecom infrastructure in the country to deliver extension services to the farming community. The sole objective is to make agriculture knowledge available at free of cost to the farmers as and when desired. Queries related to agriculture and allied sectors are addressed through the kisan call centres, instantly, in the local language by the experts of SAUs, ICAR institutions etc. There are call centers for every state which are expected to handle traffic from any part of the country. SMSs using telephone and computer interact with farmers to understand the problem and answer the queries at a call centre. The infrastructure is placed at three locations namely-a professionally managed call center (level-I), a response center in each organization, where services of SMSs are made available (level-II) and the Nodal Cell (level-III).
12. i Kisan (http://www.ikisan.com)
13. ishakti (http://www.stockholmchallenge.se/data/ishakti_bridging_digital_

Modeling and Forecasting of Insect Pests

Crop Pest Surveillance and Monitoring is one of the most important aspect of pest management in which ICTs have major role to play and can be exploited to give forewarning to farmers for management initiatives to be taken. It will help to find about pest population, natural enemies population, cropping Systems, weather factors. Forecasting is the compilation of data and study of the information obtained from survey this analysis is done by some models like Simulation Models, Analytical Models, Management Models, Expert System Models. The benefits of these models is in understanding pest population and damage caused as well as improving research and

development strategies which ultimately provides basis of pest management advise for real time operations by predicting the timing of events in insect population dynamics and level of attack. The computer based models helps in pest Identification, assessment of levels of pest attack, crop loss levels, determining control options & their effectiveness, cost/ Benefit assessment.

Pest forecasting provides opportunity to farmers for preparedness and take timely action to apply bio-agents and pesticides which ultimately cut down the cost of production and serve as a tool in precision farming, which can be Short-term forecasting or medium, long term forecasting. The major component of forecasting are direct measurement of pest numbers, measurement of climactic variables, changes in the pest host plant relationships, evaluation of forecasting procedures.

Conclusions

The ICT tools which are generally used in transfer of technologies among farmers, extension workers, pest management agencies, and plant protection officials are computer, the internet and digital media which can be used to support decision making by Integrated Pest Management. IPM related information on websites can be used as identification guides and pest fact sheets providing information on Identification of pest species, its damage and life history, some websites with market news and agriculture statistics provide information on Economic injury thresholds as well as information on Monitoring, scouting and predicting populations, some websites provides real time pest maps or modeling software or weather information and some websites with data bases of chemicals and guides to natural enemies provide information on selecting and applying control techniques.

The Changing pest scenario with modern agriculture and emerging pest problem due to climate change, information and communication technology is being the need of the day which helps researchers to analyze data and write scientific paper and communication among them as well as extension worker deputed for transfer of Technology from lab to land through Krishi Vigyan Kendra all over the country. With the growing range of mobile ICT applications, such as web-capable mobile phones, handheld computers and global positioning systems (GPS), IPM practitioners will be able to access relevant information anywhere, at any time. This may inspire insect informatics experts to create IPM information and products that are relevant for specific

locations at particular times. As a result in the future more web-based intelligent information systems will be developed that will allow users to access real-time online information that is relevant to their needs, rather than the technology-driven products that are available.

Pest management strategies could be further improved with addition of intelligent functions such as e-learning tools and dynamics and dynamic simulations of crop ecosystems. Integrated Pest Management training materials for many crop systems are available on CD-RoM or online. Pest managers as well as farmers are able to access relevant information anywhere, at any time, with the help of ICT applications like web capable mobile phones, handheld computers and Global Positioning System (GPS). With advancement of ICT applications, more web based intelligent information systems will be developed that will allow users relevant real time online information related to pest in particular and agriculture as whole.

References

Bartlett A. (2002). ICT and IPM, *Farmers, FAO and Field Schools: Bringing IPM to the grass roots in Asia*. P. 8-9.

Chiranjeev A (2000). Digital Communication, Authors press, Delhi

Farm and Home Programmes (2006), All India Radio-Chennai-4.

Kumar, A., and Singh, K.M., (2012). Role of ICTs in Rural Development with Reference to Changing Climatic Conditions. In: ICTs for Agricultural Development Under Changing Climate, Eds: K.M. Singh, and M.S. Meena, Narendra Publishing House, New Delhi http://dx.doi.org/10.2139/ssrn.2027782

Meena, M. S., Singh, K.M. and Singh, R.K.P., (2012). ICT-Enabled Extension in Agriculture Sector: Opportunities and Challenges in Climate Change Situation. In: ICTs for Agricultural Development Under Changing Climate, Eds: K.M. Singh, and M.S. Meena, Narendra Publishing House, New Delhi. http://ssrn.com/abstract=2027803

Meena, M.S., Singh, K.M., Swanson, B.E., 2013. Pluralistic agricultural extension system in India: Innovations and constraints.MPRAWorking Paper 48324.

Meena, M.S., and Singh, K.M.,. 2013. Information and Communication Technologies for Natural Resource Management. *Journal of Environmental Management and Tourism*. Vol.IV, Issue 2 (8): 77-90. http://dx.doi.org/10.14505/jemt

Meena, M.S., Singh, K.M. and Swanson, B.E.,(2015). Indian Agricultural Extension Systems and Lessons Learnt: A Review (December 7, 2015). *Journal of AgriSearch.* 2(4):281-285..

Meena, M. S., Singh, K.M. and Swanson, B.E., (2015). Pluralistic Agricultural Extension System in India: Innovations and Constraints. http://dx.doi.org/10.2139/ssrn.2293788

Sahoo, R.N. 2010. Geoinformatics for Precision Agriculture Lecture delivered in FAI Workshop on 'Fertiliser Reform through ICT'14-17 June 2010 at Kufri Holiday Resort, Kufri, Shimla

Singh, K.M. and Meena, M.S.. 2010. Harnessing Benefits of Communication Technology through Phone-in Programme: A case study.*Agricultural Extension Review*, 22 (2): 3-6.

Singh, K.M., Meena, M.S. and Swanson, B.E., (2013). Extension in India by Public Sector Institutions: An Overview. http://dx.doi.org/10.2139/ssrn.2315457

Singh, K.M., Swanson, B.E. and Meena, M.S.,(2013).Reforming India's Pluralistic Extension System: Some Policy Issues. http://dx.doi.org/10.2139/ssrn.2306980

Singh, K. M., Singh, R.K.P., and Kumar, Abhay. 2014. Adoption of Modern Agricultural Technologies in Bihar: A Farm Level Study. *Environment & Ecology*, 32(4), 1342-1346.

Singh, K.M., Kumar,Abhay and Singh, R.K.P., (2015). Role of Information and Communication Technologies in Indian Agriculture: An Overview. http://dx.doi.org/10.2139/ssrn.2570710

Singh, R,K,P, Singh, K.M. and Kumar, Abhay. 2015. A Study on Adoption of Modern Agricultural Technologies at Farm-level in Bihar. *Economic Affairs*. 03/2015; 60(1):49-57. http://dx.doi.org/10.5958/0976-4666.2015.00005.4

TARI, 2009. Information note to the press (Press Release No. 56/2009), Telecom Regulatory Authority of India (TARI). www.trai.gov.in

Thamizhpparithi M and Subramani R. (**2007**). Role of farm and home radio programme in the development of agriculture. (Media Science).

Xia, Y. **(2003):,** The status of ICTs in Integrated pest management, Issue: 11.p. 1-2.