

Agricultural Extension for Sustainable Development



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|| Sri Shivarathreeswaraya Namaha ||

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10.12.2019

MESSAGE

JSS Krishi Vigyan Kendra, Suttur, is organizing a three-day International Conference at Suttur from 14-16 December 2019 and thereby fulfilling its purpose of research and dissemination of current information in the field of agriculture.

It is heartening to note that the Agricultural Technology Application Research Institute, Bengaluru (Institute of ICAR, New Delhi) and the Extension Education Society, Tamil Nadu Agriculture University Campus, Coimbatore, have joined hands in this meaningful academic event.

The Krishi Vigyan Kendra, Suttur, a frontline extension unit of ICAR, is working closely with the aspirations of farmers through multifarious activities and innovative initiatives. It has genuine efforts in earning the confidence of the farmers in Mysuru District. Completing 25 years for a noble cause of national reconstruction, through agrarian sector, is certainly an occasion to rejoice.

The modern agriculture is undergoing radical reorientation towards understanding sensibilities of earth and nature. It is hoped that the conference will be a platform for deliberating on such contentious and challenging global and regional issues. It provides, thereby, an opportunity for the participants to share their experiences and make recommendations for improving extension work, which incidentally, has a direct bearing on the research area.

The organizers of the Conference intend to bring out a compendium of articles of research presented at the Conference. This is highly appreciative as it would serve the need of all the stakeholders.

We wish the conference all the very best.

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12.12.2019

MESSAGE

JSS Mahavidyapeetha has taken upon itself the task of transforming the society and seeks to achieve this goal by bringing education to all, specially the poorest of poor, largely in the rural areas. In this pursuit, we have set up institution after institution, taking the tally past 300, that includes primary, middle and high schools, junior colleges, degree colleges, diploma and management schools, going all the way up to setting up deemed universities offering professional degrees. In the middle of all these institutions we have JSS Krishi Vigyan Kendra (KVK), catering to the agricultural education and development needs of farm families in Mysuru district. Established in the year 1994, with the financial assistance from the Indian Council of Agricultural Research (ICAR), we look back at the last 25 years with a feeling of satisfaction that we have fulfilled the expectations of the ICAR by bringing the benefits of science and technology to innumerable farmers.

What is more, the KVK has been in the middle of some unique activities and innovations – the seed village project that crossed the district boundary and was implemented across the state of Karnataka, the annual Krishimela that displays a crop diversity in excess of 150 crops, JSS Agri Clinic that is being patronized by thousands of farmers. The KVK has indeed set a very high standard for itself and for the rest of the KVKs in the country.

I congratulate the staff of KVK on the occasion of Silver Jubilee Year and urge them to continue their quest for excellence. I offer my best wishes to the success of the International Conference and hope that this book adds up to the KVK's many cherished achievements. I thank ICAR ATARI, Bengaluru and EES, Coimbatore for joining us in this event as collaborators.

(Dr.C.G. Betsurmath)

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1 December 2019

MESSAGE

In a country like India where agriculture is more a faith than a mere means of livelihood, **Krishi Vigyan Kendras (KVK) should be treated as a temple by farmers.**

Now, almost every district in the country has at least one KVK where farmers can avail expert advice, training on agricultural technologies and obtain quality planting material. I have had the privilege of being involved in various capacities at the Indian Council of Agricultural Research (ICAR) in shaping the KVKs the way they are today. It is also my honour to be closely associated with the JSS KVK in Suttur, Mysuru, for 16 years. It is through this KVK that we experimented with the '**Seed Village Concept**'. True to its innate nature, the KVK has been implementing many innovative initiatives on a regular basis. The JSS Agri Clinic, the unique annual Krishimela, '**Shubharambh**' - the virtual incubator for young agricultural entrepreneurs, are but a few examples.

It is a matter of pride and profound happiness that the **JSS KVK in Suttur has turned 25 years** serving farmers in Mysuru district. Organizing the International Conference '**eSARD 2019**' is indeed a befitting way to celebrate KVK's Silver Jubilee. It is a great gesture on the part of ICAR - ATARI, Bengaluru and the EES, TNAU, Coimbatore, to have joined hands with the KVK in this endeavour. It is still in my vivid memory how this KVK got into the annals of ICAR by hosting its historical event, 'National Farm Innovators Meet' in Suttur during 2010. This showed that Suttur KVK has the experience and the required infrastructure to organize international events. This was possible only due to the generous support by its host organization, JSS Mahavidyapeetha and the ICAR.

I have a special affinity towards Extension as it is critical to transfer the right innovations from lab to land in order to bring about positive changes in livelihoods of farmers, who are the backbone of our nation. Farming is now '**knowledge intensive**', enormously increasing the responsibility of researchers as well as the Extension professionals to keep information up to date. It is unfortunate that Extension system today is facing problems of inadequate manpower and investments. **Precision agriculture** is an inevitable need to significantly and quickly enhance country's food production and to combat the implications of climate change and many other challenges. Hence, precision agriculture demands serious attention by the government. Needless to say, Research and Extension must work in tandem with a lot more energy and enthusiasm.

Poor productivity across crops is a clear reflection of Indian farmers being denied the benefit of modern science and technology; there are apparently many hurdles in our research and Extension system. I look forward to this conference paving way for purposeful interactions among various stakeholders, particularly the younger generation of agriculture scientists and Extension professionals. These interactions will hopefully lead to valuable recommendations on matters of high priority across the agriculture value chain to strengthen both research and extension systems in the country. **Congratulations to Suttur KVK team** for taking on this daunting task of organizing this international conferences and for compiling this **book** ahead of such an event. I offer my best wishes to the organizers of the conference and editors of the book.



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FOREWORD

Over the last seven decades, the Indian agricultural extension system has spearheaded the production oriented, area development and target group-based developmental programs, while donning the primary role of technology delivery. 'Helping people to help themselves' by linking technologies to the needs and opportunities of the farmers has been the core focus of all these efforts. Farming, now being increasingly driven by markets, poses a difficult challenge to the Extension System to guide and enable farmers. It must be recognized and appreciated that the focus of policy has shifted from 'crops and yields' to the 'farmers' and 'income'. The national goal of doubling farmers income in the next three years puts more onus on both Research as well as Extension systems to reorient the next course of action. Strengthening Research and Extension continuum in this context is hence, today's priority. The International Conference on Extension for Strengthening Agricultural Research and Development with Focus on Farmers Income is a timely and significant event.

Indian agricultural extension system is known for its multi-agency, parallelly existing diaspora of extension service providers, each one applying its own mechanisms and modus operandi. The ICAR frontline extension system of Krishi Vigyan Kendras (KVK) at the district level has been liaising, catalyzing and leading the technology-led convergence and collaborations for the agricultural development at the level of a compact geographic area. I complement KVK Mysuru, under the administrative control of JSS Mahavidyapeetha, for its dedicated service to farmers since the last 25 years. It has lived up to its tagline of 'Celebrating Science with Farmers', by linking agricultural science and development institutions to the farmers doorstep. It is fascinating to note that the ICAR ATARI, Bengaluru and Extension Education Society, Coimbatore have joined hands in celebrating the silver jubilee year of the KVK by jointly organizing the conference at a very appropriate time. Moreover, the select papers received for the Conference are being brought out in the form of a book which has all the potential to become a useful reference material to the agricultural extension researchers, teachers and students in their professional activities.

Dated: 4th December, 2019

Place : New Delhi

(A.K Singh)

The Editorial Team



Dr. M.J. Chandre Gowda, M.Sc.Ag., Ph.D.
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Completed Masters and Doctoral education with Gold Medals at University of Agricultural Sciences Bangalore. After a brief stint at Canara Bank as Agricultural Extension Officer, joined Indian Council of Agricultural Research (ICAR) as Scientist in 1991. Got trained at National Academy of Agricultural Research Management, Hyderabad before joining Indian Institute of Horticulture Research, Bangalore, where he excelled in participatory technology development as a core team member in the multidisciplinary R&D projects and trained horticulture development officers from all over the country till 2000. The Indian Society of Extension Education recognised the efforts with Young Scientist Award. Based on the experience of monitoring and coordinating the Krishi Vigyan Kendras (KVK) in the states of Karnataka, Kerala, Tamil Nadu, Puducherry, Goa and Lakshadweep at the ICAR Zonal Coordinating Unit, was selected by UPSC as Additional Commissioner, Ministry of Agriculture, Government of India in 2007. The policy initiatives and leadership that contributed to agricultural development of the country was appreciated by bestowing with Utkrisht Krishi Sewa Trophy of Ministry of Agriculture in 2011. Presently, as Director of ICAR frontline extension system, guiding KVKs in preparing strategy documents for achieving doubling of farmers income and implementing it through convergence of all stakeholders. Has more than 150 research papers, published in the International and National Journals, Conferences & Seminar proceedings, Books, Magazines and Dailies.



Arun Balamatti has been working in civil society organisations since 20 years. Born in 1967, Arun has post graduate and doctoral degree in Agricultural Extension from the University of Agricultural Sciences, Dharwad, and a master's degree in renewable energy sources and management from the University of Flensburg, Germany.

Arun has led a project on improving livelihoods in dryland areas of Deccan Plateau in India, funded by the FAO of the United Nations, from 2005 to 2008. This apart, he has led other development projects assisted by Swiss Agency for Development Cooperation (SDC), Department for International Development (DFID), WWF-ICRISAT, DBT and DST of the government of India. Dryland agriculture and watershed development apart, Arun has expertise in Farmer Field School (FFS), Participatory Technology

Development (PTD), Participatory Rural Appraisal (PRA) and System of Rice Intensification ((SRI).

Arun has published and presented papers in many national and international conferences, seminars and workshops.



Dr. Philip H., M.Sc.Ag. Ph.D., Professor of Agricultural Extension, Tamil Nadu Agricultural University

Served as Director of Extension Education, Tamil Nadu Agricultural University (TNAU) during 2015 to 2019, during which time provided new vistas that uplifted the performance of Krishi Vigyan Kendras in the state of Tamil Nadu. Started his career in the Department of Agricultural extension and Rural Sociology as Assistant Professor in 1985, served in various capacities in the TNAU Communication Centre, Video Production Unit, and University Press, Coimbatore. He established the Educational Media Centre and Multimedia studio at TNAU. Produced more than 700 radio programmes for the All India Radio and 600 TV programmes for Doordarshan, 1000 3G video modules for students and professionals, and 112 video and audio lessons on agriculture and allied subjects. Provided leadership as Professor and Head of the Agricultural Extension Department at Forestry College and Research Institute, Mettupalayam and Training Division of Directorate of Extension Education, TNAU Coimbatore. Published more than 250 research papers and 15 books. Served as the Chief Editor of the Journal of Extension Education for 20 years, an active member in 14 Professional Societies, and is the President of Extension Education Society, Coimbatore. Has served in various committees constituted at the State and National level, and guided several students for post graduate and doctoral research work.



Dr. D. Puthira Prathap, Principal Scientist (Agricultural Extension), ICAR – Sugarcane Breeding Institute belongs to the 1995 batch of Agricultural Research Service (ARS) and has had a remarkable career spanning over 23 years involved in transferring agricultural technologies, and bringing rural development & knowledge empowerment to the farthest reaches. He was awarded the ‘Jawaharlal

Nehru Award for Outstanding Postgraduate Research of ICAR in 2005. He has implemented several externally funded projects and has employed several ICT tools in sugarcane technology transfer. He has developed a dynamic, free- to-access , user-centered website – Cane Info..all about sugarcane, for the sugarcane growers and cane development personnel of the country. Had employed ‘Focus Group’ methodology for assessing the content priorities

of this website and has effectively used the Participatory Action Research approach to sensitize cane growers in five districts of Tamil Nadu on water conservation, while leading a multi-disciplinary team of scientists in conducting over 100 demonstrations in 100 ha. Dr Prathap co-ordinates the State-level ‘Sugarcane R&D Workshops’ – a unique initiative of Sugarcane Breeding Institute in Tamil Nadu & Puducherry, Southern Karnataka and Northern Karnataka. Accolades received include, Dr. Narasinga Rao’s Founder’s Day Prize in 1993, CaneInfo ‘Best telecentre initiative’ recognition in 2011 and ‘Best Accomplishment report’ recognition from ICDF, Taiwan in 2018 . Dr Prathap is currently the Chief Editor of two NAAS-rated journals viz., Journal of Extension Education and Journal of Sugarcane Research.



Dr. Saju George is currently working as Principal Scientist and Head, ICAR-KVK, Gonikoppal, Kodagu, Karnataka under ICAR-IIHR, Bengaluru. He did his graduation from TNAU, Coimbatore and Post graduation from NDRI, Karnal and PhD in Agricultural Extension from YCMOU, Nashik. He entered ICAR service as scientist (Agricultural Extension) in the year 1999 at Central Horticultural Experiment station, Bhubaneswar under ICAR-IIHR and is having 20 years of experience in different aspects of Agricultural Extension Research and Development. Currently he is involved in conducting Front line demonstrations, On farm trials and Impact assessment studies of technologies in KVK System and is promoting one FPO called Puthari Farmers Producer Organization through NABARD support in KVK campus itself as an innovative model of technology dissemination through KVK.

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Abbreviations

AAO	: Assistant Agriculture Officer
ADA	: Assistant Director of Agriculture
AI	: Artificial Insemination
ANOVA	: Analysis of Variance
AO	: Agricultural officer
ARIS	: Agricultural Research Information Systems
ATIC	: Agricultural Technology Information Centre
AWS	: Automatic Weather Stations
BCR	: Benefit Cost Ratio
CADC	: Centre for Development of Advanced Computing
CARDS	: Centre for Agricultural and Rural Development Studies
CFLDs	: Cluster Front Line Demonstrations
CRIDA	: Central Research Institute for Dryland Agriculture
CRS	: Community Radio Centre
DAC	: Department of Agriculture and Cooperation
DBT	: Direct Benefit Transfer
DCCD	: Directorate of Cashew and Cocoa Development
DEMIC	: Domestic and Export Market Intelligence Cell
DOEE	: Directorate of Extension Education
EMC	: Educational Media Centre
eSARD	: Extension for Strengthening Agricultural Research and Development
FAO	: Food and Agriculture Organization
FIG	: Farmers Interest Group
FLD	: Front Line Demonstration
FLPS	: Forage Based Livestock Production Systems
FPC	: Farmer Producer Companies
FPOs	: Farmer Producer Organizations
GDP	: Gross Domestic Product
GENSTAT	: General Statistical package
GKVK	: Gandhi Krishi Vigyan Kendra
GOI	: Government of India
GOK	: Government of Karnataka
ICAR	: The Indian Council of Agricultural Research
ICT	: Information and Communications Technology
IDP	: Innovation Decision Process
IGIDR	: Indira Gandhi Institute of Development Research
IIT	: Indian Institute of Technology
IJMSSR	: International Journal of Management and Social Sciences Research
ISOPOM	: Integrated Scheme on Oilseeds, Pulses, Oil palm & Maize
IT	: Information Technology
ITDA	: Integrated Theory of Diffusion and Adoption
IWMI	: International Water Management Institute
JSS	: Jagadguru Sri Shivarathreshwara
KCC	: Kisan Credit Card
KSSC	: Karnataka State Seed Corporation

KVK	: Krishi Vigyan Kendra
LWUE	: Livestock Water Use Efficiency
ME	: Metabolizable energy
MGNREG	: Mahatma Gandhi National Rural Employment Guarantee Act
NABARD	: National Bank For Agriculture & Rural Development
NADP	: National Agricultural Development Project
NAIP	: National Agricultural Innovation Project
NARS	: National Agricultural Research System
NeGP-A	: National e-Governance Plan in Agriculture
NGOs	: Non-government organization
NHM	: National Horticulture Mission
NIC	: National Innovation Council
NOSB	: National Organic Standards Board
NSC	: National Seed Corporation
NSSO	: National Sample Survey Organization
OFT	: On-Farm Testing
OSM	: Open series maps
PAO	: Principal Agricultural Officer
PFPCCL	: Puthari Farmers Producer Company Ltd
PI	: Programmed Instruction
PODF	: Producer Organisation Development Fund
POP	: Package of Practice
POPI	: Producer Organisation Promoting Institution
RKVY	: Rashtriya Krishi Vikas Yojana
RRBs	: Regional Rural Banks
RSK	: RaithaSampark Kendra
RTBI	: Rural Technology and Business Incubator
SAS	: Statistical Analysis software/system
SAU	: State Agricultural University
SC/ST	: Scheduled Caste / Scheduled
SD	: Standard Deviation
SFAC	: Small Farmers Agri-Business Consortium
SNA	: Social Network Analysis
SPSS	: Statistical Package for the Social Sciences
SRTT	: Sir Ratan Tata Trust
TANUVAS	: Tamil Nadu University of Veterinary and Animal Sciences
TAWN	: Tamil Nadu Agriculture Weather Network
TNAU	: Tamil Nadu Agricultural University
TNAU	: Tamil Nadu Agriculture University
TOT	: Transfer of Technology
TPB	: Theory of Planned Behaviour
TRA	: Theory of Reasoned Action
UAS	: University of Agricultural Sciences
VAO	: Village Agriculture Officer
ZT	: Zero tillage

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INTRODUCTION

Chandre Gowda M.J. and Arun Balamatti

Post-independence, and particularly since early 1950s, India has witnessed a long history of planned agricultural development. National and state governments have initiated several programmes and schemes, besides supporting policies to make sure that the national food security is achieved. Between 1951 and 2017, the country has achieved increase in production of food-grains by 5.4 times, horticultural crops by 10.1 times, fish by 15.2 times, milk 9.7 times and eggs 48.1 times. The credit for this achievement must be given to the toiling farming community, as also to the technological support provided by the research and development system and extension educational services that spearheaded the monumental task of taking these technologies to the farming community spread in the nook and corners. With 101 research institutes and 71 agricultural universities spread across the country, the National Agricultural Research System (NARS) is one of the largest networks in the world. The network covers all crops and commodities, besides its physical presence in all agro-climatic situations of the country. Such a mammoth technology generation system is supported by a pluralistic extension system, both public and private, at national, regional and local levels.

Indian agricultural extension system is known for its multi-agency, parallelly operating diaspora of extension service providers, each one having its own priorities and approaches. The estimates in India indicate that to disseminate advanced agricultural technological information to its 120 million farm holdings it requires at least 1.3-1.5 million extension personnel.

The ICAR frontline extension system of Krishi Vigyan Kendras (KVK) at the district level is serving as the crucial link between the NARs and the public and private extension systems. KVKs are

liaising, catalyzing and leading the technology-led convergence and collaborations for agricultural development at the level of a compact geographic area, in the district.

Agriculture development in India and elsewhere in the world is at the crossroads, not because of any threat to food security. Food production isn't a triumph anymore what with nutrition security becoming a larger challenge to deal with, and climate change adding to research challenges. In the rapidly evolving situations, innovations, technologies and good management practices are vital for farmers and practitioners to sustain their profession. Farming, now being invariably driven by markets, poses an equally difficult challenge to the weakened Extension system, which is surrounded by the more innovative competitors in the information marketplace. The challenge of increasing farmers' income, therefore, comes in as a compelling reason for the extension professionals to look around and within to come up with necessary course corrections to strive and thrive in the new world order. Strengthening Research-Extension-Development continuum hence is today's priority. The International Conference on Extension for Strengthening Agricultural Research and Development (eSARD 2019) has the objective of bringing together agricultural extension scientists, researchers, academicians, professionals, students and many other stakeholders for a purposeful dialogue to get deeper insights into the current dynamics and for drawing future roadmap for agricultural extension.

In the changing global scenario, reaching all the farmers through government extension agencies may be difficult. Therefore, private agencies, including input dealers and NGOs can play an important role in technology dissemination. In this context, capacity development of such players is important as the farmers need one-stop-solution. A regular interface with these multiple extension agencies will go a long way in strengthening the system.

Farmer-to-farmer extension is quite efficient, cost effective and leads to good adoption. Identification of successful farmers and supporting them to organize farm schools has given encouraging results. Such farmers need to be accredited and recognized to formalize their involvement in extension services. The main aim of mobilization of such farmers' organizations is to use them as channel for group-based technology dissemination and seeking farmer's feedback and ensuring their active participation in the planning and

implementation of research and extension activities. This will help to a great extent in diversification and introduction of new commodities/areas such as seed production, organic farming, aromatic and medicinal plants, mushroom production, fisheries, floriculture, etc. Involvement of farmers in extension delivery system provides them an opportunity to highlight various problems faced by them. Thus, farmers play an important role in setting extension priorities of the district. With accountability to solve farmers' problems and in-built operational flexibility, extension system can make more appropriate interventions. With new institutional arrangements farmers' position will be strengthened, with change in officials' approach and farmers will have some say in extension planning and officials can listen to the farmers.

Farm women constitute the bulk of rural clientele. In 2009, the panchayat raj system (local elected body) further got a boost through an act of Parliament which approved 50% reservation for women in panchayat raj institutions. Women empowerment in India has been evolving much faster than anticipated thanks to the interest and involvement shown by women in rural areas. Women in rural India are contributing to nation's development through their active involvement. As on March 2013, there were 13,65,000 women representatives in the country. There are panchayats where 100% members are women. Milk Cooperative Societies managed completely by women and the emerging Farmer Producer Companies owned and run by women stand testimony to the women-centric development. Surveys on women in agriculture have unequivocally revealed the importance and contribution of women in the day-to-day management of agricultural affairs in a rural household. It is high time that the gender concerns are integrated into technology dissemination protocols and policies.

The extension system in India is evolving over decades from top-down to bottom-up approach with involvement of farming community in planning and implementation process. In Indian agriculture, the public extension system has rather dominated the private players. Despite various efforts of different agencies, the reach of extension system to the vast farming community in India is still very limited. The decentralization and farmers' participation, increased accountability to farmers, making the system demand-driven, inclusiveness of smallholder and marginal farmers and

group approaches need strengthening at the block and village levels. There are many institutional innovations such as Farmer Producer Organizations (FPOs) that need to be harnessed.

Agricultural extension system in India has the potential to reach a greater number of villages and farmers if mass media and digital media are used effectively. Increasing the use of information and communication technologies in reaching the farmers through use of mobile phones, better internet connectivity and context and locality-specific portals could be useful tools to support extension. Consistent investment in technology applications and capacity building are needed to tap the potential of media. The use of community radio and television stations to develop locality-specific agriculture-related programmes could be effective in providing knowledge and information to smallholder farmers. However, specific strategies for effective use of modern communication methods to support knowledge intermediaries are needed.

The National Commission on Farmers has noted that knowledge deficits constrain agricultural productivity in India. It added that the use of Information and Communications Technology (ICT) for popularization of agricultural technologies is one way of addressing the information needs of farmers. The digital strategies in India were initiated or piloted based on five core necessities - bringing efficiency in extension delivery, harnessing effective tools for research & education, need to mechanize (level of farm mechanization is about 35% to 40% in India while most developed countries have over 90%), realizing financial inclusion, including markets (farmer value realisation is between 20 to 30% versus the global benchmark of 50 to 60%) and bridging the broken value chains in Indian agriculture (food processing is still less than 15% in India compared to global averages of 30 to 40%). India has witnessed changes in each of the above-mentioned factors and Indian agriculture is now poised to make a dent in digital strategies. These interventions could create opportunities for Indian farmers to raise their income levels and provide strong impetus to India's overall economic growth.

India has deployed a plethora of digital pilots in the field of agricultural development in last two decades. The Indian government and public-private partnerships are developing and disseminating a series of innovative, networked solutions, under the Digital India initiative, to increase availability, accessibility and applicability of agriculture services at farm level. Key Government initiatives to

promote digital agricultural strategies include National e-Governance Plan in Agriculture (NeGP-A), Mobile apps deployment, Knowledge Management Portals, Krishi Vigyan Kendra (KVK) Portal, Touch Screen Kiosks, Kissan Call Centres, Agri-Clinics, Common Service Centers, mKisan, Direct Benefit Transfer (DBT) schemes, Kisan TV and various other applications. Private initiatives include digital startups in agriculture (such as CropInfo), e-choupal (of ITC), mobile apps (such as FarmRise by Monsanto), weather systems (such as Skymet), Reuters Market Lights, Digital Traceability (such as SourceTrace), Direct Market Interventions (such as Naa Panta) etc. Digital strategies in agricultural research and education are instrumental in changing the landscape of current research and education programs. From the earliest initiatives like Agricultural Research Information Systems (ARIS) to advanced National Bio Informatics Grid, India has always bolstered the agricultural research with state of art digital computing technologies. ICTs alone can't bring about rural development. Education is one of the basic problems for application of ICT. All modern economies have demonstrated in the past that education is the first step to building the capacity, which people can then use. Therefore, introducing ICTs alone will not meet the development challenge. The proportion of people involved in the ICT Industry, especially in the rural areas is negligible. Thus, another priority action, in order for the benefits of ICT to trickle down as well as contribute to the rural prosperity, would involve setting up several rural and village level micro-enterprises.

Agricultural markets, by and large, decide the profits or losses farmers make. Both input and output markets have been playing hide-and-seek with farmers and their income from the enterprise. While the reforms in agricultural marketing are part of the long-drawn process, the farmers continue to remain in an uncertain future. This is particularly a difficult domain for the extension system to educate and handhold farmers on market-driven technology uptake. The agricultural marketing system in India had mainly focused on market infrastructure and regulations, while strategies for improving the distribution and supply chain network for agricultural produce was largely sidelined. There is not only a need for creating value chains for the different enterprises engaged by the farmers, but also to educate and empower farmers to understand the changing systems. Farmers have to be trained to understand and do direct marketing, contract farming and organized retailing.

India is rich in diversity, natural resources and climatic advantages than many other countries in the world. The efficiency of an extension service for farmers depends on the effectiveness of planning at four levels, viz. policy, programme, projects and strategy. While policy and programmes can be driven by the public extension system, projects and strategies can be supplemented and complemented by the private and non-government organizations.

As the demand for food is likely to be doubled by 2050, farmers and governments will be under enormous pressure to increase the agricultural production. In the process, the farmers and farming profession are facing serious constraints from several support systems, including the weather, markets and resources. Agricultural Extension, which has the formidable task of helping farmers to help themselves in pursuit of a sustainable and profitable future, also has the great challenge on hand ensuring an enabling system between farmers on one hand and the support system on the other. Extension Education is an applied science with its contents derived from research and field experiences accumulated, over time, as also the relevant principles drawn from behavioral sciences. The necessity for this evolving scientific discipline to sustain itself depends on its own strengths drawn from both applied and adaptive research. Extension can spread research-based information and technology to the farmers and agribusinesses and transmit information about farmers' and industry's needs back to the researchers. Agricultural research and development are offering many advances that need to be applied by the farmers by using their meager natural, social and financial resources. At the same time, markets and consumers have been demanding products of different quality at competitive prices. A compilation of chosen articles that were part of the deliberations of all these contemporary issues in the Conference on 'Extension for Strengthening Agricultural Research and Development' at Mysuru are presented in this book. Besides global perspective of extension sciences and approaches, the articles have given emphasis to the role of media, farmers' organizations, support systems, markets and value chains.

1

Puthari Farmer Producer Organisation (FPO) –An Initiative of KVK Kodagu towards increasing Farmers' Income

Saju George and Prabhakar B.

INTRODUCTION

Producer organisation is defined as “membership-based organisations or federation of organisations with elected leader, accountable to their constituents (World Bank, 2008) and have been viewed as a hybrid of private companies and cooperative societies (Trebbin and Hassler, 2012). In India, the Companies Act, 1956 was amended in 2002 to allow incorporation of producer organisation on the basis of the recommendation of a high-powered committee chaired by Y K Alagh (Government of India, 1999). Since then, the realm of producer companies has been dominated by institutions such as NABARD and the SFAC, under the Department of Agriculture and Cooperation (DAC), Ministry of Agriculture. NABARD has, since the past few years, supported formation and promotion of FPOs using the Producer Organisation Development Fund (PODF). In Karnataka itself NABARD has promoted about 177 FPOs with total farmer membership of 67,000 members under its Produce Fund.

The felt need of FPO in Kodagu District

Karnataka accounts for 85 percent of the coffee crop in India with the remainder coming from Kerala and Tamil Nadu. Kodagu, Hassan and Chikkamagalur are the major coffee growing districts of Karnataka. Kodagu district is known for its vast areas of coffee grown in an eco-friendly way since decades. The Kodagu coffee plantations have predominantly prospered under natural shade which support the

environment. So it is one the most eco-friendly way of cultivation of coffee, which anyone can see among the coffee growing areas worldwide. Along with coffee, black pepper is grown on the silver oak and Erythrina support, which adds to the income of farmers. There are many other useful trees like avocado, Coorg mandarin, which is interspaced within this unique growing system and the practice has been perfected over the years, blending nature with agricultural production.

Although farmers are aware that in other coffee growing areas of the world, the coffee is mostly sun-grown by clearing large tracts of forestland and thereby reaping higher yields which is unsustainable, intensive cultivation, but still farmers in the district have stuck to their sustainable plantation practices, although low yielding, for the sake of long term sustainability and environment. So there was a felt need for an FPO for addressing the issues of increased cost of cultivation and equipping farmers with the latest scientific technology package to increase the income of the farmers. Thus the idea of an FPO for solving some of these issues emerged.

Origin of the FPO

The ICAR Krishi Vigyan Kendra, Gonikoppal hosted by ICAR - Indian Institute of Horticultural Research, Bangalore has been promoting an FPO, as the Producer Organisation Promoting Institution (POPI) with support from NABARD since 2017, for coffee, pepper and paddy farmers. This FPO was registered as Puthari Farmers Producer Company Ltd (PFPCCL) under the Companies Act in December 2016 with 15 promoters. Farmers having land (with RTC) as the proof and growing any crop were taken as members, majority being coffee and pepper growers. At present, after 2 years and 6 months of operation the company is having 489 growers as members of the FPO and every month new farmers are registering as members, with the target of total membership of 1000 members by March 2020.

How the FPO came into existence

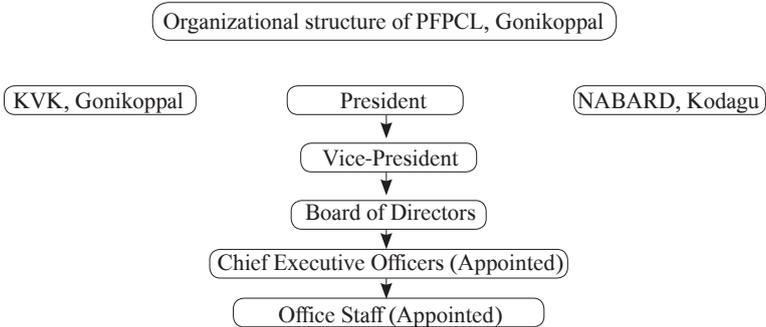
The ICAR KVK conducted a seminar on farmer producer organisations with the help of NABARD in the month of September, 2016. After the seminar, a few like-minded, enterprising farmers and youth came forward to immediately put the idea into action. There

the seeds were sown for the birth of Puthari FPO in December, 2017. Initial founder members contributed Rs 5000/- as share capital and the process of registration of FPO was started under the Company's Act. Meanwhile KVK and NABARD, Kodagu tried for getting the NABARD funding under the Produce Fund of NABARD and it materialised in March 2018. NABARD agreed to fund the FPO for 2 years under its Produce Fund.

In the first year the number of shareholders was 173. With the funding support from NABARD, the company recruited Chief Executive Officer (CEO) and minimum manpower to start an office for the FPO. KVK provided the office space inside the campus itself. The company initially started with retailing of basic inputs like most used fungicides and insecticides, irrigation equipments, coffee picking mats, etc. The FPO formally launched its first retail outlet in September 2017. It was a big success. The company which started with 15 no. of products, today has about 300 products, catering to the needs of coffee, pepper and paddy farmers. After seeing the progress the membership of FPO started increasing. Today as on September 2019 the membership stands at 489, which effectively translates into an acreage of more than 4800 acres, thus making it as one of the largest farmers organisation/companies in the area of plantation crops. The FPO as a whole produces about 6000 tonnes of Robusta Cherry in a year. Apart from retailing, the FPO has also focussed on providing regular training programmes to its members and handholding of young farmers, to guide them towards standardized scientific farming practices. Products which are supplied are at much cheaper rates than the market, as the FPO charges only minimal administrative costs and margin.

The Management Structure of Puthari FPCL: Organizational structure

Being a young FPO, the organizational structure of the company is very simple as follows:



Handholding by KVK

The KVK has been playing a major role from the birth of PFPCL to its nurturing as a mature self-sustaining organisation with 500 members through its 2 years journey. The KVK has been supporting the PFPCL through regular capacity building programmes for its members, Board of Directors training, through exposure visits to different FPOs and progressive farmers field, member mobilisation etc.

Future Roadmap for the Puthari FPO

The fragility of the coffee plantation economy is because the bulk of coffee prices have actually stagnated compared to other commodities in the food basket. The cost of other inputs such as fertiliser, labor wages, pesticides and fuel have undergone geometric progression over the years. With 2007 as a base, in the last 10 years the international prices of Robusta Coffee have increased by about 1.75 percent, whereas the cost cultivation has increased by two and half times. This reduces profitability of the farmers by nearly 33 percent for coffee plantations. As a result, much needed development work such as replanting of old plantations, investment into infrastructure like irrigation and drying yards, among others have suffered, which in turn impact the plantation productivity. This downward spiral has

prompted coffee planters to explore other avenues of income. To reduce dependency on one crop, pepper is inter planted in plantations which fetched attractive prices till end of 2017. However with crash in prices of pepper since February 2017, plantation economy was hit very badly.

Tasks like pruning, shade management of trees demand high skill sets and thereby higher wages. Given the growing labour shortage, mechanisation of coffee cultivation is the option. Picking the ripe fruit alone requires about 50 per cent of the annual labour requirement in terms of expenditure. Mechanisation has proven to be a major challenge considering the undulating terrain and maintenance of forest trees in the plantations, where the coffee is grown. However with the depletion of skilled labour force, these operations are not being carried out to the required standards. The acute shortage of plantation labour is evident from the thousands of workers from Assam and Jharkhand who have migrated to Kodagu district and staying in labor colonies. But again they cannot be depended upon, as they also move out in droves, like what was seen during the recent episodes of National Register in Assam etc. The FPO is committed to provide support mechanisms, for keeping this eco-friendly practice of cultivation and giving the farmers higher price for their eco-friendly coffee along with looking at options to reduce the cost of cultivation. For labor scarcity the organisation is working on options of adopting mechanisations wherever possible and pooling of labor resources for labor intensive works like weeding, harvesting, pruning etc.

The Puthari FPO is also preparing a roadmap for entering into coffee and pepper marketing of its members, so as to provide the member farmers with a higher share of the consumers price and thus contributing towards higher income for farmers. The FPO is also actively deliberating on starting a rural mart where fellow farmers can sell their produce directly to the consumers, as well as establishing linkage with other FPOs in the country for mutual marketing of their produce. Capacity building will be a continuous activity being organised by Puthari FPO in close collaboration with KVK, Coffee Board, Spices Board etc for its members.

Impact

The FPO created its first major impact in reduced cost of production

through its retail unit. The cost of cultivation has been brought down by 20 to 25 percent for farmers through supply of quality cheaper inputs. The regular capacity building programmes conducted have contributed towards standardised scientific approach to cultivation. The number of applications of plant protection chemicals also has been streamlined, which has resulted in better control of diseases in coffee and pepper plantations, which was a major cause of losses for the farmers. Further coffee board will be handholding the PFPCCL towards marketing of coffee of the members of the FPO and the members are eagerly looking forward to the day when their coffee will be marketed under its own brand.

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2

Demand-driven Extension – The Case of JSS Agri Clinic by KVK, Mysuru

Arun Balamatti

INTRODUCTION

Agriculture in India and elsewhere in the world has transformed from subsistence to market-oriented farming as a result of Green Revolution and as the countries opened to free trade. Under centuries of subsistence farming the farmers were essentially living in a ‘known’ world where they secured seeds from previous crop, labourers from friends and neighbours, manure from cattle and crop residues while they traded their produce in the village shandy; farming until then was largely ‘self-contained’. However, the advent of Green Revolution technologies such as improved and high yielding varieties, chemical fertilizers and pesticides catapulted the farmers into an ‘unknown’ world; they were pushed abruptly from their self-contained world into an unknown and predatory market world. Unfortunately, while the farmers’ information and input requirements intensified the public extension service has gone from weak to weaker state.

The 2003 National Sample Survey Organization (NSSO) survey showed that 60 percent of farmers had not accessed any source of information on modern technology to assist in their farming practices in the past year. Of those who had sourced information, 16 percent received it from other progressive farmers, followed by input dealers. Of those farmers who had accessed information, the major problem of extension services was found to be the practical relevance of the advice (NSSO 2005).

Swanson (2008), reviewing the global agricultural extension and advisory service practices opined that “The perceived lack of

success of public agricultural extension systems in many countries has resulted in new approaches being tried in reorganizing extension services. In some countries, such as India and China, public extension systems have been decentralized to the district/county level and these public extension systems are now pursuing a more market-driven approach” and adds that “There is growing recognition that markets, not technology, have become the primary driver for agricultural development in many countries”.

Gupta and Shinde (2013), referring to the 2005 (NSSO) reported while various other studies also said, “The information flow within the public sector moves linearly, with content focusing on the transfer of technology for increasing crop production. A wider definition of agricultural extension, beyond improving crop productivity, has not been embraced. Information flow is supply-driven and not needs based or area-specific, so farmers see the quality of the information provided by the public extension staff as a major shortcoming. This is due to the static and inflexible nature of the organization, where a top-down hierarchical approach continues. Access to extension is also an issue, because of the low level of outreach by public extension services. This is partly due to the public staff being overburdened with implementing state and centralized schemes, which are also not easily modified to suit local needs and conditions.” While the call for demand driven agricultural extension has existed for several decades now, new modes of reaching out to farmers could have significant impact in India, as they might better reflect the local information needs of farmers (Gupta and Shinde, 2013).

Today, farming is no longer a means of subsistence; it is to be handled like any other enterprise. Farming requires not just the successful cultivation of a crop, but also demands a reasonable price for the farmer to succeed in the complex ‘marketplace’. This change has not spared a single farmer; whether it is a big farmer or smallholder, literate or illiterate, every farmer is compelled to put together the available knowledge, technology and financial resources in addition to other essential inputs like seeds, fertilizers, pesticides etc. The key to success here lies in the farmer acquiring quality inputs at competitive price, putting them into his field appropriately, growing a good crop and selling it for a profit. Thus, the system demands a farmer to be not only an intelligent farmer, but also a shrewd manager. Unfortunately, a majority of our farmers are good at cultivation, but have no clue on

the required managerial skills; hence, even the best of the farmers are losing in the market.

The market, in agriculture, has two dimensions. The middlemen dominated ‘produce market’ is a familiar one where the farmer is a constant loser; the other, less familiar dimension, is the unfathomable ‘input market’ where the farmer has to buy various inputs. Farmers constantly struggle to choose and procure the right quantity and quality of seeds, fertilizers, pesticides, and farm machinery. Only those farmers succeed who have the ability to deal with these input as well as output markets. An overwhelming majority of the farmers do not have the knowledge, skills and capacities to cope with these challenges. While there is a wide recognition of the exploitative practices of middlemen and the poor prices for crops, the mismatch in the access to technology and proper inputs is not often debated in the public domain.

In the conventional ‘Supply Oriented Extension System’ in which the public research institutes are developing technologies, the public extension agencies are striving to transfer such technologies and the farmers are expected to utilize new technologies, the system is rendered ineffective due to various limitations and, hence, the private input traders are becoming decision makers for the farmers. As a consequence, it is not the problems of the crops or the farmers’ requirements, but the corporate interest of the private players that becomes the farmers’ decisions, albeit imposed. The farmers, in this ‘Supply Oriented Agricultural Extension System’ have become hapless consumers instead of being ‘the end users of technologies.’

Because the supply-oriented system is failing to meet the demands of ‘Market oriented farmers and farming’ there is a need to reorient the Extension System in a way the system addresses the farmers’ needs from the market point of view. However, since the farmers’ welfare cannot be relegated to the ‘profit oriented input traders and output buyers’, it may be appropriate for a public agency to experiment with a ‘Social Enterprise Model’. Thus, in order to enable the farmers to meet the growing challenges there is now a need for reorienting the present supply-oriented system into ‘Demand Driven Extension Service.’

METHODOLOGY

Jagadguru Sri Shivarathreeshwara (JSS) KVK has conceptualized and initiated a pilot effort in Mysore district since July 2013 in the name of “JSS Agri Clinic”.

“Agri Clinic” is an innovative social enterprise and is being built as ‘Demand-driven Extension System’ where the KVK positions itself in the ‘input market’. Agri Clinic is meant to provide twin services, ‘Agri Doctor’ and ‘Agri Pharmacy’. The technical staff of KVK (Agri Doctors) provide diagnostic services, free of cost, by studying the affected plant specimen brought by the farmers and provide written ‘prescription’; the other service i.e., “Agri Pharmacy” which involves selling agri inputs to farmers, based on prescription. The KVK staff screen the market for quality of agricultural inputs, reliable brands, reasonableness of price etc., procure and sell such inputs from the Agri Clinic outlet to the needy farmers. The KVK has obtained the necessary registration and licences for engaging in input trade. In this process, the KVK staff are ensuring that the farmers are provided with appropriate diagnostic and advisory services and also educating farmers on buying and using only such inputs which are absolutely necessary, particularly the chemical inputs. The farmers are otherwise going to the private input traders, many of them are neither academically qualified nor have the necessary knowledge and practical skills of diagnosing and are hence selling many products where one or two would serve the purpose. Their technical inadequacies and profit motives are causing unnecessary expenditure on part of farmers and avoidable use of agro chemicals harmful to the environment. The larger purpose of the Agri Clinic, therefore, is to bring down farmers’ production costs and reduce the indiscriminate use of agro chemicals. The Agri Clinic also acts as a means of application and management of new technologies; it is found, from past 6 years of experience, that the farmers are more receptive when they approach the Clinic for seeking solutions from the staff of KVK whereas similar intent and effectiveness are not noticed when the KVK offers training to farmers.

A reorientation, not a replacement: The Demand Driven Extension Service proposes a reorientation wherein the system addresses farmers’ needs from the market point of view by providing both the knowledge and required inputs at one place, instead of offering technologies through extension agencies and leaving the supply of inputs to the traders.

Social enterprise: The Supply Oriented Extension System is in the realm of “service to farmers by public agencies” and its failure implies the solution could lie in providing extension services by private players. However, the performance of private extension is said to vary widely; it tends to focus its services on areas with sufficient resources and is limited to a few crops and areas where profits can be assured (Sulaiman and van den Ban 2003). The private sector serves a corporate interest, working with individual farmers, so social capital is not built. Moreover, private extension can only work well if farmers are willing and able to pay (Swanson 2008). Therefore, the Demand Driven Extension Service is being proposed as a “social enterprise by public agencies”. This reorientation is necessary for two reasons; one, the system approaches farmers from their market requirements and the other reason is that the model, by virtue of being an enterprise, is expected to generate revenues to remain a self-financed initiative and does not depend on external funding. More importantly, the Demand Driven Extension Service is deliberately proposed to be undertaken by a public agency to protect farmers from possible exploitative trade practices of the private agencies.

Low-cost: Being a social enterprise, preferably managed by a public institution like KVK, the Agri Clinic remains less capital intensive and hence does not have to pass on its administrative costs to the farmers. While the expert staff of the KVKs are paid by the KVK (ICAR) itself, the inputs such as agro chemicals are borrowed from manufacturers at distributor price. The Agri Clinic needs to generate revenue only to maintain a couple of support staff and an outlet, preferably at the district headquarter.

Supply to service, instead of being service to supply oriented: While the conventional extension approach lays emphasis on transfer of technologies and skill building, and thereby expects the farmers to seek and search for inputs and services on their own, Demand Driven Extension Service thrives on attracting the farmers through its delivery of services and inputs. Once the farmers start patronizing the Agri Clinic the KVK can make use of the rapport and trust built with farmers to extend skill building services as well.

The present study is based on the data collected from the two JSS Agri Clinic outlets run by the KVK, one in Suttur, a village where the KVK is located and the second one in Mysuru city for easy access to more farmers due to its accessibility. The number of farmers personally

visiting the two outlets every day is computed on a daily basis and is compiled on monthly and yearly basis. The data on total transactions is likewise compiled from the invoices raised on daily basis for inputs procured by each farmer and is totalled month-wise and annually.

RESULTS AND DISCUSSION

The Table 1 indicates the number of farmers who visited JSS Agri Clinic between July 2013 and July 2019.

Table 1. Number of farmers visiting JSS Agri Clinic

	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
April		137	210	483	815	865	589
May		150	130	701	1024	947	818
June		309	316	770	1521	802	1066
July	193	189	560	987	351	729	959
August	289	169	690	924	989	782	
September	366	442	593	971	866	994	
October	463	706	826	1092	1292	1357	
November	84	291	689	1183	1244	765	
December	104	261	770	649	738	600	
January	104	190	750	697	794	510	
February	83	241	525	774	755	405	
March	152	276	612	933	648	678	
	1838	3361	6671	10164	11037	9434	3432

It is evident from the Table 1 that there is a progressive increase in the number of farmers visiting the JSS Agri Clinic over the past six years. About two thousand farmers visited the JSS Agri clinic in the first year of operation (2013-14). In the subsequent years, the number of farmers visiting the clinic was nearly doubling every year and has stabilised around to about 10000 farmers visit in the last 3 completed years of operation. Hence, taking holidays into account, it can be inferred that about 1000 farmers are visiting the agri clinic every month since last three completed years.

Table 2. Transactions of JSS Agri Clinic

	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
April		106164	164581	327779	365062	685870	494700
May		90924	299987	558666	1242069	918225	662360
June		224091	192100	675945	1669445	607274	947845
July	187080	168533	348928	809975	277626	599465	767100
August	233182	151597	431112	637909	708504	648540	
September	239042	276729	382351	619346	719048	806250	
October	298536	303985	507162	647247	814846	872010	
November	71213	207896	239550	709692	909428	537085	
December	98085	156789	255899	496438	594313	575815	
January	124165	88543	268472	485313	587476	487625	
February	102381	157488	217144	547673	671379	375605	
March	151758	335431	302029	790829	725750	593040	
	1505442	2268170	3609315	7306812	9284946	7706804	2872005

The data on various inputs procured by the farmers visiting JSS Agri Clinic is presented in Table 2. While the total transaction during 9 months of the first year, 2013-14 was a little over Rs. 15 lakh, it has progressed to Rs. 22 lakh (2014-15), Rs. 36 lakh (2015-16), Rs. 73 lakh (2016-17), nearly Rs 93 lakh (2017-18) and Rs. 77 lakh during 2018-19. The farmers have procured a wide range of products from JSS Agri Clinic including seeds and seedlings, bioagents and micronutrients, vermicompost and fodder cuttings and so on.

The experience from the Agri Clinic, in the last 6 years between July 2013 and July 2019, reveals that, a total of 45,937 farmers have visited the Agri Clinic (Table 1 and 2, combined data for two outlets, one at KVK and one in Mysuru city). This means an average 26 farmers are visiting the Agri Clinic every day, seeking diagnostic services and inputs. The total transaction during this period is Rs. 3,45,53,494 at an average daily transaction of Rs. 19,292. This works out to about Rs. 745 pay out by a farmer per visit whereas the same farmers claim that their spending would be in excess of Rs. 2,000 when they used to visit private traders. The KVK is making use of one rented premise in Mysuru city, has hired a helper at each outlet and its monthly operational cost is about Rs. 30,000. At about 10 per cent net profits on the gross transactions, the KVK has made a profit of about Rs. 20 lakh in the four and half years i.e., about Rs. 40,000 every

month. It is to be noted here that the KVK started operationalizing the Agri Clinic concept by initially investing about Rs. 4 lakh from its Revolving Funds and has used no other grants or loans. Nearly 40 per cent of the products sold from Agri Clinic are KVK's own products such as Banana Special, Vegetable Special, vermicompost, seeds and seedlings, fodder cuttings etc., produced by using the revolving funds whereas the rest 60 per cent constitutes agro chemicals, including environment-friendly products like neem oil, neem cake, humic acid etc., obtained 'on credit' from the dealers and distributors. The products are borrowed from the dealers and payments are made on fortnightly or monthly basis. The farmers as well as the input dealers are able to recognise the 'quality' of products by merely glancing through the various brands being dealt with through the Agri Clinic outlets.

Further analysis of the data has showed that in each year the 'peak month' of transaction is around October, largely coinciding with pest and disease incidence in the major crop of the district, namely paddy. There has been a steady increase in the number of visits by farmers and the annual transaction every year. During the first year (July 2013 to March 2014) a total of 1,838 farmers have sought the services of the Agri Clinic amounting to a gross transaction of Rs. 15.05 lakh (monthly average Rs. 1.67 lakh). The farmers' visits have risen by nearly double every year to cross 10,000 mark in the year 2016-17 turning out a business of Rs. 73.07 lakh with the monthly average crossing Rs. 6 lakh. The growth of Agri Clinic has successfully passed through the trial phase in 6 years.

Six technical staff of the KVK attend to Agri Clinic duty on rotation basis at one day at KVK outlet and one day in the Mysuru outlet, every week. This way, while their mandated activities are unaffected the 'hands-on experience of diagnosis and offering advisory services is compelling each one of them to be updated in not only their specialized subject but also in acquiring basic knowledge of all other important agricultural disciplines like agronomy, horticulture, plant protection covering all types of crops – field crops and horticulture crops, soil science, seed technology, animal husbandry, fisheries etc. This is helping each technical staff to develop skills of playing the role of a competent 'general physician' or a 'skilled generalist'.

On the part of the farmers, earlier while they used to visit the KVK without bringing the specimen, they have now realized the importance of accuracy of diagnosis by actually bringing the affected plant parts;

many farmers are now able to understand the minute differences between pest, disease and nutrient deficiency symptoms. Going a step forward, they are also being guided to address the ‘immediate problem’, whether it is pest, disease, nutrient deficiency or even water stress, and they are also being educated on taking up measures of improving the ‘overall health’ of the crop through advisories on soil testing, nutrient management based on soil test analysis, addressing ‘hidden hunger’ by identifying and meeting secondary and micronutrient deficiencies and the like.

The staff and farmers, both empowered by the modern information technology (IT) gadgets, are able to connect with each other, especially after the farmers visit the technical staff personally, at least once. As the farmer and the technical staff get to know each other and reach a stage where they both can feel the ‘face’ at the other end of the phone information exchange becomes free flowing. More significantly, going beyond the limits of ‘office time’ and ‘formal consultation’ the conversations often take place beyond office time. The farmers though prefer personal visit by the technical staff to their fields once in a while have realized the difficult of staff catering to such requests by so many farmers. Having recognized this limitation very quickly, the ‘smart farmers’ wielding ‘smart phones’, have started exchanging digital images and videos through ‘WhatsApp’. This has helped farmers in seeking advice from distant places; the farmers are able to buy inputs locally by writing down the oral recommendations or the prescriptions sent by the Agri Doctors in the form of SMS.

CONCLUSION

The sheer number of farmers’ visits to Agri Clinic is telling a unique story. The KVK reach, through its mandated activities such as trials, demonstrations and on and off-campus trainings, is about 500 farmers a year. The staff might offer additional diagnostic services to either the farmers visiting the KVK or the staff themselves visiting the farmers’ field - the number of such advisories do not exceed another 500 in a given year. Thus, about 8 technical staff members of the KVK would be able to extend technical assistance to about thousand farmers in a year. The KVK considered this as a limitation of the conventional ‘supply-oriented extension system’. By positioning the KVK in the market, the ‘demand-driven extension

system' has now enabled the same number of KVK staff to reach out to about 10,000 farmers in a year, in a one-to-one personalized individual contact method, which is still the most trusted and effective extension method. And this is not all; the number does not include innumerable advisories offered over phone and WhatsApp, the reach by this way could be at least ten times more than the personal consultations. While individual staff sits in the Agri Clinic one each at two outlets, attend to farmers as well as phone calls, all the 8 technical staff attend to many phone calls, every day, often including holidays. However, all these 'free advisories' offered over phones do not necessarily get converted into 'business' for Agri Clinic in the form of purchase of inputs. Therefore, the staff have learnt to offer generic advisories on phone and provide complex and detailed advisories in person

With about Rupees Eight lakh monthly transaction in the recent months, the KVK is soon going to reach a stage where every rupee invested by the Government on the KVK, through ICAR, is going to be converted into services to farmers of matching or even greater monetary value. In the process, the KVK would be directly saving farmers' production costs by at least about two times the amount they would have otherwise paid to the input traders while simultaneously reducing indiscriminate use of agro chemicals avoiding that much pressure on the environment.

The KVK is convinced that the 'Agri Clinic' has succeeded as a workable model of 'demand-driven extension system'. The KVK plans to further expand the clinic into a super speciality hospital for plants by extending the portfolio of services and inventory. There are limitations though, such as not every 'doctor' being perceived as equally effective, the consultation with some farmers taking longer time keeps the other farmers waiting, especially during peak seasons when the number of farmers visiting the Agri Clinic exceeds 30 per day, rotation of Agri Doctors making it difficult for one staff to administer the enterprise and take control of the inventory and financial transactions. However, IT enabled information exchange between the farmers and the technical staff, inventory management, billing, and incentivising services by technical staff and 'loyal customers' has the potential to take the Agri Clinic to greater scales and thus redefine the way the KVKs work as 'technology and resource centres' at the district level.

The KVKs, these days, are being recognized as the key technical institutions at the grassroots level, by all – the farmers, extension agencies and input agencies. It is impossible for a KVK to reach out to all the farmers in the district with its limited staff strength. Instead, a KVK can position itself strategically in an easily accessible location, through its ‘Agri Clinic’, and make use of its presence in the district and grow up as an ‘agricultural technology and resource centre’. For this to happen, the Government and particularly ICAR will have to take a relook at the functioning of the KVKs and support them with the required policy support.

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3

Design and Development of an Online AgriQuiz Module for Technology Transfer

Sunil V.G., Berin Pathrose and Prasanth K.

INTRODUCTION

The agricultural sector is getting more complex due to globalization, impact of climate change, entry of corporate sector in agriculture value chain and expanding demand for processed food. India will need rich human capital of highly qualified, motivated, skilled human resources, well trained agricultural scientists and extension personnel to meet these challenges of 21st century (Tamboli and Nene, 2013). It is the responsibility of the state agricultural universities (SAUs) to provide such human resources. In the first green revolution, SAUs played a key role in generating technology and taking it to end users through effective integration of education, research, and extension. Several workers, such as Ahluwalia (2011), Desai et al. (2011), Chand and Parapprathu (2012), and Lele et al. (2012), have indicated that the agricultural sector has gone through different phases of growth, embracing a wide variety of institutional interventions and technological and policy regimes.

The role of information technology to develop agricultural research, education and extension to improve quality of life is well established (Chauhan, 2010). With the advent of internet technology, the learners can attend ‘virtual class’ on the monitor of their computer at their homes or workplace. There are enormous scopes of internet to develop agricultural education management through smart exposure of agricultural teachers and educational planners, classrooms, virtual class as well as dropout agricultural learners.

Active learning is increasingly promoted within institutions of higher education worldwide to assist students develop higher order thinking and link knowledge to meaning. Online quizzes were found to be an effective mechanism for incentivizing student completion of preparatory work, enhancing active learning (Cook and Babon 2016). Quizzes can be seen as an effective and efficient strategy for enhancing active learning. Online quiz platforms in agriculture education systems are meager. In this context, an attempt was made to develop an online agricultural quiz module.

METHODOLOGY

The online agricultural quiz module was developed to bring objectivity to agricultural education. The need identification process was carried to identify the user need and requirements for online agricultural quiz. Data from the respondents were collected through a questionnaire. The respondents included agricultural students, extension workers and progressive farmers. And the total sample size 100.

Based on the need data, the basic design of the software was developed. Agile software development approach was used for design and development of the online agricultural quiz module for technology transfer. The agile development approach enables requirements and solutions to evolve through the combined effort of the development team and the customer (Collier 2011). It promotes adaptive planning, evolutionary development, early delivery and continuous improvements.

Questions were prepared and corrected with expert to serve as a database. Questions were vetted through a three stage validation process. First, the questions were prepared and corrected by the research team. Then the materials were given to two experts and their suggestions were incorporated. At a third level technological workshops were arranged with research scientists, agricultural students, extension personnel and progressive farmers and the materials were validated.

Thereafter, the software was developed and tested for its working. The final software was uploaded in the online website www.farmextensionmanager.com and was observed continuously for user feedback and comments.

RESULT AND DISCUSSION

A. Analysis of user needs

The user needs and requirements for content information were assessed through a questionnaire developed for the purpose. The result of the survey is presented in Table 1. Based on the results, it can be assumed that the respondents are looking for an online agricultural quiz module that contains photos of diseases and pests for diagnosis (93 per cent). This was followed by the user requirement of error free technical content in the questions and answers section (88 percent).

Table 1. Analysis of user needs for content materials

No	Parameter	Respondents (%)
1	The online quiz module should have photos of diseases and pests for diagnosis	93
2	The questions and answers should be objective and error free	88
3	The questions should be based on latest technologies relevant for field use	72
4	The questions should cover common crops and problems of Kerala	61
5	The questions should be in common man's language	59

The results of the analysis of user needs for system design were represented in Table 2. The results show that 71 percent of the respondents need random questions in the system that automatically brings dynamicity. It was followed by use of separate colours to distinguish answered, unanswered, correct and wrong questions (63 percent).

Table 2. Analysis of user needs for system design

No	Parameter	Respondents (%)
1	The questions should be made available randomly from a database	71
2	There should be colour coding to distinguish between answered, correct and wrong questions	63
3	The design of the system should be responsive to screen size of different computers and mobiles	51
4	There should be facility for the admin to add, edit and delete questions from the data bank	47
5	There should be a fixed length of time allowed for answering each question	37

B. Designing the functional model

Three basic functions were identified for the online agricultural quiz module (Fig.1). The functions include question management, paper generation, valuation and result publication. The question management section should have options for addition of questions to the database. There should also be options for modification of questions and deletion of questions. The question part and the option part for each question should be taken into the system separately. The correct answer should also be stored in the system.

The paper generation part should take individual question according to certain logic and present in units as fed into the system. To bring dynamicity to the online agricultural quiz module, it was decided to take questions from the parent database at random. It was also decided to keep five questions at a time in one round for descriptive round and one question for picture round. The decision was based on the screen space that gives maximum attention and least distraction. To distinguish between the answered and unanswered questions, a blue colour was used for highlight.

The valuation and result publication part will check the answers and indicate the correct and wrong answers with separate colours. The



Fig. 1. Function diagram of online agricultural quiz module

green colour is used to highlight correct answers and red for wrong answers. The advantage is that the users are disturbed to minimum degree in this process. At the end the users are also given the option to continue the quiz with a new round of questions or skip the round.

C. Creating the content database

The content data base was decided to have two different layers. One is a descriptive round where descriptive questions with four multiple choices were included. The second is a picture round where photos of field problem will form the question and the four options will be given for identification of the problem. The questions were prepared taking Package of Practice prepared by Kerala Agricultural University as the basic reference book. The photos on various field problems were collected from different authentic sources.

The questions were wetted through a three stage validation process. First, the questions were prepared and corrected by the research team. Then the materials were given to two experts and their suggestions were incorporated. At a third level technological workshops were arranged with research scientists, agricultural students, extension personnel and progressive farmers and the materials were validated.

D. Designing the software architecture

Converting the theoretical design to computer design is meant by the term software development. The development of software was done in such a way so as to work in offline and online mode. And based on the analysis of data structure, it was found necessary to develop the software in three basic layers. The three basic layers include the user side interface layer, the business logic layer and the database layer at the bottom.

The user side interface layer represents the layer of the programme that appears in front of us. The user interface was designed using Hyper Text Markup Language. The business logic layer acts as the connecting link between the database layer and client side interface layer. The request from the users are processed and replied through this layer. The business logic application layer for the programme was developed through JavaScript. Database layer represents the area where the basic data to be used by the system was stored. The data base layer for the system was developed in JavaScript language.

The software thus developed was tested in three stages. During the first stage the working of the programmewastested. In the second stage, the language parts of the software were checked for spelling and grammatical errors. In the third stage, the programmes were used in different computers with different operating systems to see their working. The problems noticed were rectified every now and then. And the final software was made available in the domain www.farmextensionmanager.com

E. Testing and validation of the system

The testing and validation of the online agricultural quiz module was done with three different groups of respondents. Twenty-five number each of agricultural students, agricultural officers and progressive farmers' form the sample group. The opinion of agricultural students about the online agricultural quiz module is presented in Table 3. The students find the online quiz module useful to test their knowledge in agriculture (81 percent). This was followed by usefulness of the module for preparing competitive test as opined by 65 percent of the respondents.

Table 3. Opinion of agricultural students about the online quiz module

No	Parameter	Respondents (%)
1	The online agricultural quiz module serves as a platform to test knowledge in agriculture	81
2	It will help in preparing for competitive tests on agricultural subject	65
3	The content information can be used for arranging quiz competitions	61
4	The quiz can be played in mobile as a leisure time activity	58
5	The pictures will help to correctly identify pest and disease problems	41

The opinion of agricultural officers about the online agricultural quiz module is presented in Table 4. The agricultural officers find the online agricultural quiz module useful to sharpen their diagnostic capacity (87 percent). Further, they find the quiz module good to learn new technology (75 percent).

Table 4. Opinion of agricultural officers about the online quiz module

No	Parameter	Respondents (%)
1	The picture round of the online quiz module sharpens the diagnostic capacity	87
2	The online agricultural quiz module helps to learn new technology	75
3	The randomness in display of questions makes learning interesting	69
4	It is very much helpful in arranging farmer level quiz competitions	63
5	If the control measures are also given in the answer part, it will be more useful	58

The results of the opinion of progressive farmers about the online agricultural quiz module is presented in Table 5. They find the online quiz module good for learning new technology (93 percent). This was followed by the use of photos which helps in better connect to field problems (81 percent).

Table 5. Opinion of progressive farmers about the online quiz module

No	Parameter	Respon- dents (%)
1	The online agricultural quiz module helps to learn new technology	93
2	The photos used in the quiz module is very much connected to field level problems	81
3	The questions are relevant and easy to read and understand	78
4	If the control measures are also given in the answer part, it will be more useful	69
5	The randomness in display of questions makes learning interesting	64

CONCLUSION

Agricultural education is very much important in equipping the extension system for technology transfer. The objective questions are very much accepted as the correct method of teaching. So bringing objectivity in technology transfer through the use of online quiz module is attempted through this research activity.

The multiple choice questions are developed for the purpose. There are two different rounds of questions. One is the descriptive round and the other is the picture round. The questions are selected randomly from a question bank stored in the database. The questions are displayed for a fixed period of time. After every unit of questions, the users can go to the answers of the questions. The application was found to generate an interest for learning and a method to test the knowledge for the agricultural students. It was also found to sharpen the diagnostic capacity of agricultural officers. The farmers found it useful as an interactive tool for updating their knowledge.

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4

Design and Development of an Expert System for Credit Calculation for Crop Loan

Sunil V.G., Berin Pathrose and Prasanth K.

INTRODUCTION

Agriculture needs continuous diffusion of new technology to meet global food security, poverty reduction and environment sustainability (Pandey 2017). Agriculture is an important sector of Indian economy. Farming is becoming a more time-critical and information-intense business. It faces major challenges including poor agricultural practices, inefficiencies in information delivery, reconciliation of records between farmers and traders and lack of information on best practices to farmers (Arjun 2013). A push towards higher productivity will require an information-based decision-making agricultural system. Empowering farmers with the right information at the right time and place is essential for improving the efficiency and viability of small and marginal holdings (National Policy for Farmers 2007).

Agricultural credit has played a vital role in supporting agricultural production in India. Credit requirements would go up due to purchased-input intensive and heterogeneous production cycles of the new areas of agriculture. Rural credit system assumes importance because for most of the Indian rural families, savings are inadequate to finance farming and other economic activities (Mohan 2004). The institutional credit system is critical for agricultural development and its role has further increased in the liberalized economic environment (Yadav 2017). Newer forms of credit assessment and risk management systems may also have to be put in place and the rural credit system has been bypassed by the revolution in information technology.

The Kisan Credit Card (KCC) has emerged as an innovative credit delivery mechanism to meet the production credit requirements of the farmers in a timely and hassle-free manner. The scheme is under implementation in the entire country by the vast institutional credit framework involving Commercial Banks, RRBs and Cooperatives and has received wide acceptability amongst bankers and farmers. However, during the last 13 years of implementation, many impediments were encountered by policymakers, implementing banks and the farmers in the implementation of the scheme. Hence the present study was to find such factors and also to design a credit calculator for ready to use.

METHODOLOGY

The need identification process was carried to identify the present problems and issues in the disbursement of crop loan. The user need and requirements for an online credit calculator was identified. Data from 100 respondents were collected through a questionnaire. The respondents include bank officers, research scientists, extension workers and farmers who have preliminary knowledge on KCC (Kissan Credit Card). Based on the need analysis data, the basic design of the software was developed. Agile software development approach was used for design and development of the expert system for credit calculation for crop loan. The agile development approach enables requirements and solutions to evolve through the combined effort of the development team and the customer (Collier, 2011). It promotes adaptive planning, evolutionary development, early delivery and continuous improvements.

The data on scale of finance was collected from NABARD, Trivandrum. The revised Kissan Credit Card (KCC) Scheme guidelines issued by RBI/2011-12/553 dated May 11, 2012 was used to set basic fields for the system.

Thereafter, the software was developed and tested for its working. The final software was uploaded in the online website www.farmextensionmanager.com and was observed continuously for user feedback and comments.

RESULTS AND DISCUSSION

A. Analysis of the decision making situation

The issues and problems in the disbursement of KCC were discussed with the respondents. The results obtained are content analyzed and presented in Table 1. Based on the results it could be understood that the consumptive repair and maintenance part of KCC is rarely given (82%). This was followed by the improper transfer of the subvention amount to farmers (79%).

Table 1. Issues in the disbursement of KCC

No	Issues in the disbursement of KCC	Respon- dents (%)
1	The loan amount is limited to the scale of fi- nance for the crop part alone. The consumptive repair and maintenance part is not considered.	82
2	The interest subvention is not transferred in full amount to farmers in many cases. This happens because of the back end nature of the subven- tion.	79
3	KCC are normally sanctioned for one year even though it can be sanctioned for more years	75
4	The loan is disbursed at one go and repaid in one go without considering crop growth stages. So correct use of loan amount is not ensured.	70
5	The bank officials are not insisting for crop insurance. At times of natural calamities, the farmers are ending in distress.	62
6	Processing fees are sometimes taken at the time of renewal also even though the rule says otherwise.	52
7	Bank officials are insisting for collateral security even for small loan limits.	45
8	KCC is sanctioned for people who do not have genuine interest in agriculture especially in case of gold loan.	44

The problems in the existing scale of finance part of KCC are presented in Table 2. It can be seen from the results that the minor

crops are rarely covered under the scale of finance scheme (87%). This was followed by the wide variation in the scale of finance amount among the nearby districts (71%).

Table 2. Problems in the existing scale of finance

No	Problems in the scale of finance	Respon- dents (%)
1	The scale of finance is developed for major crops alone leaving minor crops unattended.	87
2	There is a big difference between scale of finance for same crops in nearby districts.	71
3	The scale of finance data is not available in public domain.	65
4	Dairy and other allied sectors are not properly considered under scale of finance	51
5	The cost of cultivation and market data was not properly used in arriving scale of finance	42
6	The unit of applicability of scale of finance like spacing, no of plants etc. not specified properly in some cases.	32
7	Revision of scale of finance data is not done in a fixed interval.	26
8	There are also ranges for the scale of finance for the same crop in some districts	24

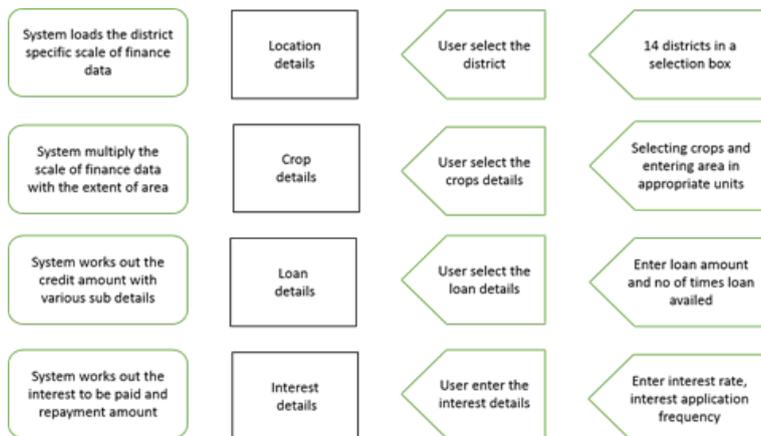
B. Preparation of database for the tool

The basic information needed for the crop loan calculator is the scale of finance data. The latest available scale of finance data was collected from NABARD, Kerala Regional Office Trivandrum. The Package of Practice (POP) of Kerala Agricultural University was used to arrive at the spacing and details of planting density. The data was then shaped to the required format for including in the database.

C. Design of the prototype

The basic design of the prototype of the expert system for crop loan calculation was prepared (Fig.1). The variables that critically decide the user journey through the system were identified and they are discussed below.

Fig.1.Functional Diagram for the Expert System on Credit Calculator



Locational details

Scale of finance data forms the most basic requirement to work out crop loan. The District Level Bankers Committee will determine the scale of finance data for each district every year. It is the cost of cultivation amount minus the margin money. It is given as a single value or in a range for a crop. The crops included also vary among districts.

There is a considerable variation in the scale of finance data among districts. Thus district forms another important unit to be included in the system. All the fourteen districts of Kerala were thus included.

Crop details

Homestead farming is the specialty of Kerala. Most of the farmers of Kerala cultivate a number of crops. Hence, the system should have provision to include more crops and details. Considering many factors, space for input of five crops were included in the prototype design.

Further, the crop loan is estimated based on the extent of area under each crop. Area thus become a variable and farmers need to input the area data into the system. Here, to simplify the input process, the crop specific spacing data was also considered. Based on spacing data, a separate field for selection of unit convenient for the farmer is included. The farmers can thus make their selection in cent, in acre, in hectare or in terms of the number of plants grown.

Loan details

The loan is sanctioned according to the amount asked and the eligible limit. Hence, both are worked out separately based on the input data on loan amount. The consumptive credit is worked out at 10 per cent of loan amount with a maximum of Rs 20000/-. And the repair and maintenance option is there for 20 per cent of loan amount.

Similarly, the loan limit is determined by the number of times the user have availed the KCC limit. From second year onwards, there is a possibility for 10 per cent enhancement of loan amount.

Interest details

The interest rate varies from time to time. The method of application of interest changes from monthly frequency to annual frequency. Hence both are taken as variables. The system based on feed in formula will calculate the interest rate for the loan amount asked by the user. The interest amount and final repayment amount at the end of the year will be worked out separately. Once the user inputs the above details, the system will do a series of calculations and generate the required result.

D.Development of the software architecture

Converting the theoretical design to computer design is meant by the term software development. The development of software was done in such a way so as to work both in offline and online mode. And based on the analysis of data structure, it was found necessary to develop the software in three basic layers. The three basic layers include the user side interface layer, the business logic layer and the database layer at the bottom.

The user side interface layer represents the layer of the programme that appears in front of us. The user interface was designed using Hyper Text Markup Language. The business logic layer acts as the connecting link between the database layer and client side interface layer. The request from the users are processed and replied through this layer. The business logic application layer for the programme was developed through Java script. Database layer represent the area where the basic data to be used by the system was stored. The data base layer for the system was developed in java script language.

The software thus developed was tested in three stages. During the first stage the working of the programme was tested. In the second stage, the language parts of the software were checked for spelling and grammatical errors. In the third stage, the programmes were used in different computers with different operating systems to see their working. The problems noticed were rectified every now and then. And the final software was made available in the domain www.farmextensionmanager.com

E. Testing and validation of the tool

The testing and validation of the expert system on credit calculator was done with 100 number of respondents which included bank officials and farmers who have availed KCC. The respondents were asked to use the expert system for half an hour. Then they were asked to list out their opinion on the credit calculator. The responses were content analyzed and classified to arrive at the result (Table3).

Table 3. User response on credit calculator

No	User response on credit calculator	Respon- dents (%)
1	The users can arrive at their loan eligibility with minimum input details.	91
2	The interest amount and repayment amount are correctly worked out.	87
3	The scale of finance and other variables considered are mentioned clearly.	79
4	The calculator has flexibility for changes in interest rate or calculation method.	64

5	The farmers cultivating multiple crops are also able to arrive cumulative credit requirements.	62
6	The unit used for calculation are scientific and at the same time user friendly.	55
7	The consumptive credit and repair and maintenance credit are separately worked out.	52
8	There is also a range for eligible credit for crops having range in scale of finance.	51

Based on the result it can be assumed that the users were able to correctly navigate through the system with minimum input details (91 per cent). This was followed by 87 per cent of the respondents opining that the interest amount and repayment amount worked out through the system are correct.

CONCLUSION

Agricultural credit is one of the most important determining factors in successful farming. Farmers avail short term credit to meet their cultivation needs and a small part for consumptive needs. The short term credit thus provided by commercial banks is commonly called as Kissan Credit Card (KCC). There is a well-defined guideline by Reserve Bank of India for assessing and sanctioning KCC. It is based on the concept of scale of finance. The district level bankers' committee with the guidance of NABARD will develop scale of finance for crops and enterprises for every year. However, many a time the farmers are ignorant about their credit limit and get lesser than the eligible loan.

The credit calculator is developed to overcome this problem. The scale of finance of all districts in Kerala was collected from NABARD. The Agile Software Development approach was used for the development of the software. The interactivity and easiness of use were specially taken into care in the development phase. The developed software was tested with a group of bank and farmer respondents for final validation. It was made available in the website www.farmextensionmanager.com. The application acts as a ready to use guide for the farming community in the area of crop loan planning.

ACKNOWLEDGEMENT

Department of Agriculture and Farmer Welfare, Kerala Government for the financial assistance provided for the project.

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5

Innovative ICT enabled Extension Platform for Providing Farm Specific Agro Advisory

Sriram N.

INTRODUCTION

India is home to 103 million farm families who cultivate 165 million agricultural land holdings spread over more than 6,00,000 villages in 598 rural districts of the country. In the era of knowledge and information the agricultural extension agent-farmer ratio is as low as 1:2000! Farmers are ill equipped to deal with changing market trends and opportunities and hence do not find agriculture as efficient or remunerative. The current extension service delivered through trained officers at the local level is also limited and erratic. Furthermore, most of the agricultural advice is generic to block levels and rarely deals with plot level advice concerning the requirements of individual farmers. Therefore, there is a strong need to align the needs of farmers, their existing experience and knowledge base with modern agricultural trends and practices.

In the present Indian agriculture scenario, the public agriculture extension service departments possibly cannot provide additional qualified man power to adequately address the complex demands of the farmers by reaching to millions of farmers. The development and dissemination of ICT in rural sectors in recent years, provide viable alternatives to overcome the physical barriers of face-to-face inter personal communication. Use of ICT in extension enables the extension workers to be more effective in meeting the information needs of the farmers and to speed up the extension process. This project is aimed at harnessing the present-day technology platforms that are already available and use them innovatively to build tools that can aid in bridging the information gaps that exist between the farmers and the extension workers / agricultural scientists.

The major objectives of the project

1. Development of Multi-Media Interface between Mobile Phones and a Central Database
2. To create Farm Plot Historian Database System
3. To develop Market Information Database
4. To develop and test the Voice based Interactive System
5. To develop and test the Multi-media Agri-Advisory System
6. To Create and test Multi-party Conferencing system between farmers, experts and extension workers

METHODOLOGY

Three Districts from Tamil Nadu namely Kanchipuram, Dharmapuri and Erode were selected based on the characteristics of cropping system, agro eco system and nature of farmers.

Project Districts Profile

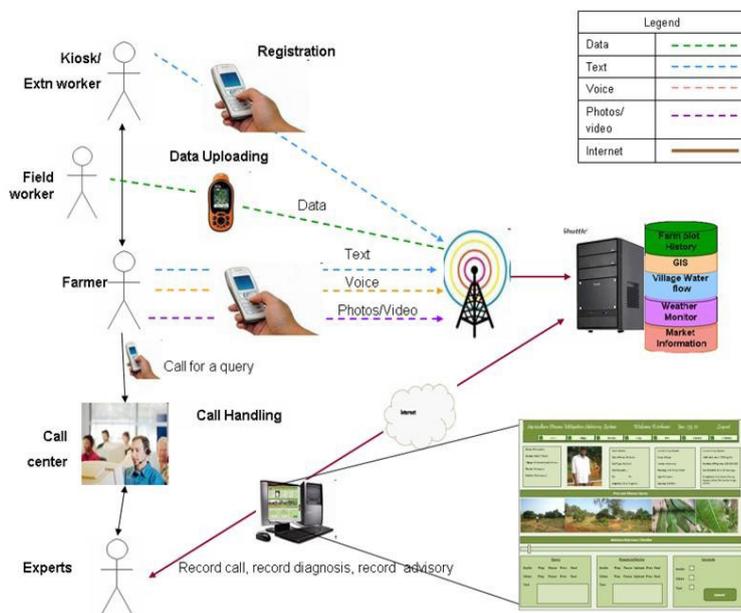
District / Criteria	Dharmapuri	Erode	Kanchipuram
Cropping System	Multiple / Horticulture	Multiple	Mono
Major Crop	Mango	Turmeric	Paddy
Other crops	Tapioca Tomato	Sugarcane Coconut	Groundnut Brinjal
Rainfall/ Climate	Rainfed	Scanty rain, dry climate	Seasonal rains, semi dry
Farming Techniques	Innovative farmers. High rate of adoption to new farming techniques	Moderate level of adoption to new technologies	Poor adoption of new farming technologies. Farm labour scarcity – migration

Commodity Groups	Large number of farmers' association and commodity groups exist	Commodity group and associations are the emerging trend. Women dominate agriculture system	Less commodity groups
Project Field Partners	Dharmapuri Precision Farmers Agro Service Ltd., Dharmapuri	Erode Precision Farm Producers' Company Ltd., Erode	National Agro Foundation, Kanchipuram

It is within this context that the three districts were selected for piloting this project. Before initiating the project, a baseline survey was carried out to identify the farmers. Based on the outcome of survey results, 1200 farmers (400 from each district) were selected and an orientation programme about the project was conducted in their respective districts. The criteria of selection of farmers adopted were cultivating the crops we had chosen in this project, willing to take part, having mobile phone for getting advisory from our experts, etc.

Implementation of Mobile Phone based Data Collection and Periodical Updates of Farming Details

A team of Tamil Nadu Agricultural University and Rural Technology and Business Incubator developed a Mobile application to collect data from the farm plot and directly entered into a remote database. During the data collection, the farm plot details on dashboard were refined periodically based on the suggestions and feedback given by the farmers. The farmers and data collectors have been given adequate training and the mobile interface employed user friendly icons. Details on relevant information pertaining to each of the farmer's field were collected using mobile phone application. The farm plot database included specific details such as farmer profile, previous/current crop cultivation practices and farm size. The periodical updates were also undertaken at regular intervals so as to facilitate the agri experts to view the latest information through

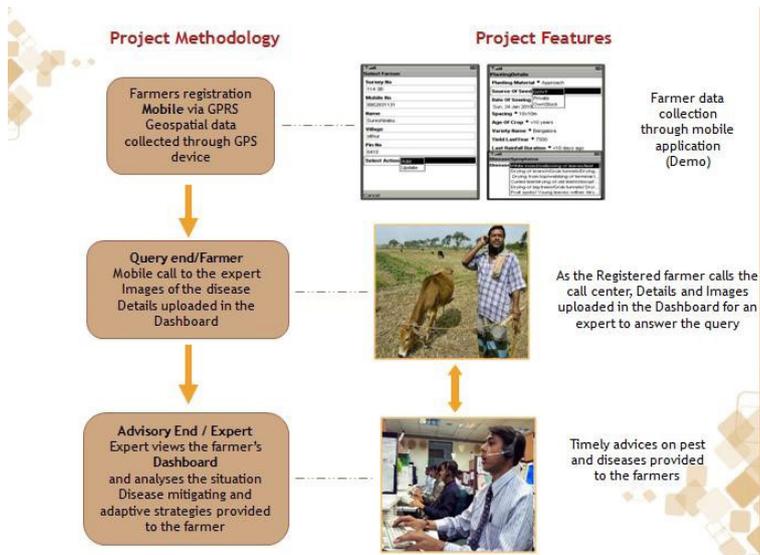


dashboard. A call centre equipped with multimedia agri advisory system was set up and started since January 2012.

When farmer's call landed, the farmer-specific dashboard opened up and the agricultural expert was able to analyze the data available on dashboard and gave advisory/recommendation to the farmer whenever they called the expert through their mobile phone. This has also facilitated good quality advisory both of content and quality of call.

Farmers were initially given awareness programme on how to get advisory on their own mobile phone. Enthusiastic farmers from the project districts have been calling our system through mobile phone to get agricultural advisory from the experts. Data on number of farmers registered through our system, farmers' land holding size and queries by type and crop were obtained through the back-end database. The collected data was subjected to descriptive analysis.

Flow chart on farmer's registration and expert's advisory to the farmer



RESULTS AND DISCUSSION

The research findings mainly focus on farmers' registration, landholding, Pest and Disease Image application training for farmers, advisories, challenges and a survey research amongst the farmers who had been taking part throughout this project.

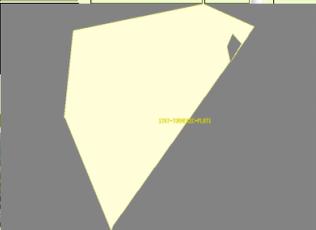
Farmers' Registration in the System

On an average 55 farmers were registered every month through mobile phones during April 2010 to January 2012. Over period of 22 months, 1200 farmers (400 from each district) from all the three districts were registered during this pilot implementation. The collected data during the registration process were viewed by the researcher to identify the quality of the submitted data. Technical team periodically checked the error in data and immediately rectified them with the help of inputs of Tamil Nadu Agricultural University. This has helped the customization of both mobile application and dashboard system. During the registration process, it was required to conduct several orientation programmes among the farmers in order

to enroll the farmers in the project. Initially, we thought of completing farmers registration within a short period of time but it was not possible without rapport building and constant interaction with the farmers. All the project partners in this process took care of completing the registration process and supported both data collectors and farmers.

Development of ICT based Tools/Technology towards an Interactive Multimedia
Agriculture Advisory System

Back ID: 1287 Logout

Farmer Profile	Farm Details	Current Crop	Crop Inputs
 M.Vijayakumar +91 9976393035 22-02-2011 Father's Name: Marappagounder Survey No.: 138,154 Total farm area (ac): 2.75 Hamlet Village: Vaduganur Taluk/Block: Erode District: Erode Pincode: 638109	Avail. Plot: <input type="text" value="-- Plot --"/> Current Plot: Plot1 Soil Type: Red Soil Testing: <input type="text"/> ECD: pH: 0 Irrigation: Channel Farm Plot: 	Turmeric Plot size in acres: 2.75 Variety: PT110 Source of seed: Ownstock Date of planting/sowing: 3-6-2010 Spacing: 2feet	Fertilizer applied: Complex,Urea,Sulphate,Potash Dose(kg/ac): 850,150,250,200 Method: Soil application Pesticide applied: Monocrotophos Dose(kg/ac): 50ml Spaying: <input type="text"/> No Nil

Crop and Disease Images



Advisory Reference Timeline

Previous Crop				Disease Symptoms	Nutrient Deficiency
Name	Variety	Duration	Fertilizer	Pesticide	Yield in kg/acre
Turmeric	PT110	9	Urea,Complex,Sulphate,Potash	Nil	2500
Turmeric	PT110	9	Complex,Urea,Potash,Sulphate	Nil	2500

Pest Symptoms	Rodent Problem
No pest	

Farm History Dashboard for providing advisory services Pest and Disease Image Upload application training for farmers

As part of this project, IIT-RTBI and TNAU have also developed an application called “Pest and Disease Image Upload (PDIU)”, this was not a defined objective by the Project but it was developed based on the relevance and high impact that it would have for the farming community. This application can be used for uploading pest and disease affected plants through the farmers’ mobile phone to seek call center experts’ advice. In order to equip the farmers on the usage pattern of this application, a series of training workshops were organized for the farmers in their respective districts. In all the training workshops, the farmers had undergone the training and took active participation.

Advisory to farmers

Once the farmers had registered and been oriented about the system, they started calling the call centre number that was given to them. Figure 5 shows that a total of 179 queries with an average of 36 queries per month were received from all the three districts during January 2012 and May 2012. The agri expert who received the queries responds immediately if the query is answerable by himself or the answer for the query is available from the frequently asked questions. In case the expert is not in a position to answer the query, the expert at the call center escalates the query to other subject specialist or expert and then reverts back to the farmer.

The analysis of district wise queries revealed that farmers from Erode district (60%) raised more queries than the farmers belonging to the other two districts (Figure 6). Generally it shows the positive attitude of Erode district farmers who have close interactions with extension workers of State agricultural department and scientists of Tamil Nadu Agriculture University. It has already been reported in one of the documentation reports by TNAU that the farmers of Erode district are more innovative and try to adopt any new technologies.

Query type

The analysis of the query type discovered that farmers had raised the maximum number of queries related to crop protection aspects with special reference to pest and disease management (42%) and this was followed by crop cultivation practices (37%). The lowest percentage of queries was on weather information (14%) and market information (6%) (Figure 7). From this analysis it could be inferred that farmers were more concerned about pest and disease management and crop cultivation aspects.

Queries regarding Crops

The respective district farmers were motivated to contact the call center to get advisory from the experts on the selected crops such as paddy, groundnut, brinjal, turmeric, sugarcane, coconut, tomato, tapioca and mango after registration was over. The analysis of queries regarding crops revealed that the farmers who were cultivating turmeric crop (27%) had raised more queries than the other project crops. It was also found that considerable queries were about the crops (33%) which were not selected in this project.

Challenges during Farmers' Registration

- When farmers were about to register themselves by collecting farm details through mobile phones, there were no project crops being cultivated in most of the farmer's fields. This has hindered the initial data collection process and farmers' registration.
- The locations of the selected farmers' fields are fairly scattered, with a distance of minimum 20 km radius between each farmer's field. The field level staff faced difficulties in reaching the farmer's field by foot which posed as one of the challenges.
- Shortage of field level staff posed as a challenge (only one SRF per district was appointed by the project). Currently available field level staff could not travel beyond more than one village in one day.
- As the field level staff were not able to meet with farmers repeatedly, there was a lack of awareness about the project among the farmers, which has affected their active participation during various stages of the project implementation.

Challenges during Farming Advisory to Farmers

Current market information for turmeric crop was not available from any of the sources (i.e. TNAU website, etc.). This has affected many of the farmers who were keenly asking price details at the time of harvesting of this crop. There were also queries regarding future prices of turmeric for which there is no readily available source.

As most of the farmers did not go for soil testing for the specific plot, general fertilizer recommendation was given to the farmers.

Since our project was focused only on certain crops, many of the farmers who had a query regarding other crops could not get specific farm-plot information.

The advisory system was unable to assist in weather forecasting particularly rainfall status. Currently the rainfall status is available only for previous day. We are also trying to accommodate unregistered farmers who contact our call center. As there is a lack of continuous motivation and facilitation to the farmers, pest and disease image upload application is not being effectively utilized by the farmers.

Regular updating the crop cultivation aspects was not being undertaken by most of the farmers. This had affected the expert while giving advisory to the farmers. However, with the newly-enabled provision of being able to make updates in the dashboard by the experts, expert will be able to give more relevant advisories.

Despite several challenges, the project has been able to accomplish enrolling 1200 farmers (400 from each district) in the multimedia agricultural advisory system using mobile application. Enthusiastic farmers have contacted the call centre during every stage of crop growth for both advisory and updating the farming activities on dashboard. The project was also successful in refining and customization of the farmers' friendly dashboard application. Apart from this, the farmers participating in the project have acquired enough knowledge on how to register themselves using mobile phone and contact the expert at the call centre for seeking advisory.

CONCLUSION

The extension services in India could be strengthened upto last mile connectivity if TNAU – IIT mobile based agro service system can be scaled up in entire country in a phased manner. Then the farm specific agro advisory services could be delivered within a short period of time through mobile in the form of visual, text, voice and video. The extension workers are also facing the problem to identify the owner of the farm in the villages who have settled in the cities or distant places with non-agri job for providing need-based extension service. TNAU-IIT prototype database model will help to identify the owner of the land and for bringing transparency in extension services to improve the farm production and productivity. The developed mobile based agro advisory services will also be a great platform for providing virtual extension services to the stakeholders.

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6

Decentralised Planning in Agriculture: Integration and Use of Micro level Databases

Sulaja O.R. and Jiju P. Alex

INTRODUCTION

The overall development of a region is directly influenced by the effectiveness of planning and successful implementation of planned activities. Of late, the conventional approach of centralized planning based on macro level assessment of development needs and resources is being increasingly replaced by specifically planned interventions at the micro level. Micro level planning is being advocated with a view to ensure sustainable, area-specific participative and inclusive development that would take into account the needs of local people (Dutta et. al., 1997). It is widely appreciated that effective micro level planning would bring about faster socio-economic development of rural areas (Dutta and Singh, 2007). Agriculture being highly location specific and diverse, micro level planning has been suggested as the best way to plan agricultural development projects. Kerala showcases a very good example of decentralised development planning.

Similar to macro level planning, the vision of the planners and the resources available for effecting changes would be invariably significant in grassroots level planning as well. At the same time, optimum utilization of resources would be possible only if reliable data on growth potential and available resources are made available to the planners and other stakeholders. What is the status of data on different sectors of development at the grassroots level? It is observed that while macro level information in development would be available, it is difficult to obtain data at the micro level. This has necessitated a

detailed enquiry into the different micro level institutions generating relevant data which can be used for planning. The inventory of local resources of data was helpful in formulating the specifications of an integrated information system for micro level planning in agriculture.

METHODOLOGY

The study was conducted in Kerala State using purposive sampling method. Village level institutions like Panchayat office, Krishi Bhavan, village office, veterinary hospital, primary health care centre, anganawadis, electricity office, block development office etc. were surveyed to collect the type of data available and extent of use of data. The 'Exploratory Research Design' was used for the study. The interview was done personally by the investigator to collect the data maintained in office registers. The responses received were processed and tabulated.

RESULTS AND DISCUSSION

Stakeholders involved in micro level planning mechanism

Information requirement of different categories of stakeholders are different, as the roles and related perceptions are different. The different stakeholders involved in micro level planning in agriculture and allied sectors are listed. Issac and Franke (2002) had compiled various sources of information used for micro level planning during IXth Plan period. Each of these stakeholders requires different types of data in their respective domain. Moreover, these stakeholders also maintain different types of data that could be used for micro level planning.

Table 1. Type of data available from various sources

Sl. No	Institution	Type of data available
1	Krishi Bhavan	Cropping pattern, production and productivity of crops, fertilizer and pesticide use, soil quality, irrigation, distribution of farms by land use
2	Grama Panchayat	Receipts and expenditure of the panchayat, number of roads by type and length, number of public taps, ponds, wells by ward, no. of street lamps, buildings and houses by types, no. of voters, vital statistics, types of institutions, list of merchants
3	Soil Survey Department	Slope, erosion, vegetative cover, agricultural land percentage, soil characters, hydrologic group, rock outcrops, stoniness, socio economic condition, water, climate and digital data processing
4	Kerala State Land Use Board	Cadastral maps of 1:5000 scale including survey number and soil characteristics, thematic maps on land use, details of water resources, forest area, MGNREGS workers, land use map of whole Kerala state, maps on assets, land capability map, micro level watershed atlas, maps on geo morphological units at 1:50000 scale, river basins etc.
5	Village Office	Details of owner, acreage of garden land, wet land, fallow land, amount of tax, details of tax and address, survey no., name and address, amount remitted, map with survey no. of plots, schools, ponds etc., field map, litho map, register for luxury tax, register of surveyor etc.

Sl. No	Institution	Type of data available
6	Veterinary Hospital	Records of artificial insemination given to livestock and the medicines, general morbidity pattern of livestock and the trends in artificial insemination, livestock census give data on livestock population in the panchayat.
7	Minor Irrigation Department	Details of irrigation schemes and ayacut areas, acreage of irrigated area in a panchayat
8	Anganwadis	Records of death registration, feeding mothers and schedule of immunization programmes for children. Also details of teenage girls which include their educational qualification, job, health aspects like haemoglobin content, blood group etc.
9	Primary Health Care Centre	Nutritional status of children, pregnant women and lactating mothers and the extent of immunization.
10	Ground Water Department	Record of ponds, open wells, tube wells and water table of specific locations. Data of observation wells.
11	Vegetable and Fruit Promotion Council of Kerala	Details of inputs (seeds, organic manures) distributed to farmers; market details of vegetables, types, quantity marketed, price of vegetables, processing of vegetables etc.
12	Block Panchayat	Compilation of all data of grama panchayats coming under the block

Sl. No	Institution	Type of data available
13	District Panchayat	Compilation of all data of block panchayats coming under the district
14	Office of the Assistant Director of Agriculture	Compilation of all data of Krishi Bhavans coming under the office of ADA
15	Office of the Principal Agricultural Officer	Compilation of all data of Office of ADA coming under the office of PAO
16	Dept. of Economics and Statistics, Government of Kerala	Yearly publication of area, production and productivity statistics in the state, consumer price index of the state, price trends in Kerala etc.
17	Census of India (District Census Handbook)	Yearly publication of demographic statistics in the country, house listing and housing data, geographical code directory, meta data etc.
18	Survey of India	Maps and data- open series maps (OSM), political map, road map, railway map, state maps, educational map series, district planning map series etc.
19	Department of Survey and Land Records, Government of Kerala	Provide maps, doing resurvey of Kerala using Global positioning systems, electronic total stations and CAD software

These different agencies generate enormous amount of data both at micro and macro level. Now the researcher is curious to know that whether these data are being utilized for micro level planning.

Extent of use of databases in micro level planning

The extent of use of databases in planning process at the local body shows that only 20 percent of the data is effectively used for planning process.

Extent of data usage in micro level planning

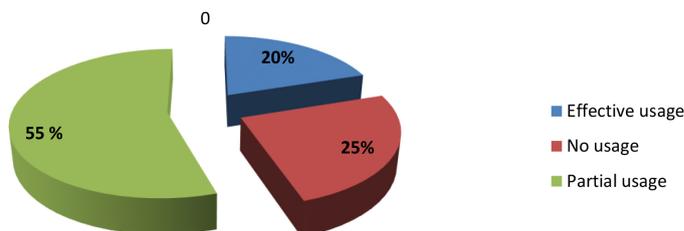


Figure 1. Extent of data usage in micro level planning

About 55 per cent of the data is partially used and 25 per cent of the data is not at all used. This clearly indicated the need for enhancing quality decision making backed up by objective information and the need for updating and creating databases.

Constraints perceived by stakeholders in maintaining and updating databases

Extension Personnel and People's Representatives involved in micro level planning have expressed difficulties in maintaining and updating databases. Open ended questions were asked to the respondents to know the constraints faced by them. The constraints were ranked based on the importance attached to each one and the frequency of citation by respondents. Composite scores were calculated to rank the constraints. Ranking of constraints has revealed that the lack of mechanisms for regular updating was considered to be the most severe constraint in maintaining registers. This is in fact reported to be the result of shortage of staff and the heavy work load borne by limited staff.

Lack of coordination among different departments has been reported to be the third most important constraint experienced by respondents. Lack of standardized formats for collecting data has reported to be the fourth important constraint experienced by personnel involved in maintaining databases. It has also been observed that databases are given least preference in the process of planning as the people involved in the process are not concerned about informed decision making. It has also been observed that keeping records is a time consuming activity and this is the reason why records are not maintained and updated properly. The ranks assigned to the major constraints listed are given below:

Table 2. Constraints perceived by Extension Personnel and People's Representatives in maintaining and updating databases

Sl. No.	Item	Rank
1	Lack of mechanism for regular updating	I
2	Difficulty by staff shortage and work load	II
3	Keeping records is time consuming and require constant updation	VI
4	Lack of co-ordination of different government departments	III
5	Maintenance and updating of databases are given the least priority by the departments	IX
6	A complete, adequate and systematic format is not available for maintaining the dabases (need of software for updating data)	IV
7	Lack of awareness regarding the modern tools for maintenance and updation of databases	VII
8	Databases are given the least priority in micro level planning which leads to negligence of databases (lack of experts in handling data)	V
9	Computerization is not completed in all departments	VIII
10	The relationship between block level and gram panchayat level agencies are to be smoothed and streamlined	X
11	Lack of supervision	XI
12	The department schemes are not decentralized and do not have micro level planning	XII

Lack of awareness regarding the modern tools for maintenance and updation of databases is another constraint. As computerization is not completed in all departments, data handling has become more difficult to the stakeholders.

In addition to these constraints, the respondents expressed that maintenance and updating of databases is given the least priority by the departments. In this context, it has also been recommended that, the relationship between block level and gram panchayat level agencies are to be smoothed and streamlined, for easy maintenance of databases.

Lack of supervision has also been perceived as another constraint in keeping databases. The state sponsored, and centrally sponsored schemes are allotted to particular Krishi Bhavan by the Department of Agriculture. The modes of operation of these schemes are different from that of projects in micro level planning.

Suggested framework of the content and hierarchy of Integrated Information System for Micro Level Planning in Agriculture

Observations on the pattern of information requirement in micro level planning and the gaps thereof have necessitated a new pattern for Integrated Information System for Micro Level Planning in Agriculture. A new framework has been suggested for a prospective Integrated Information System in Agriculture which can be used for obtaining access to various data and information for ideal micro level planning in the context of decentralized planning. A pictorial representation of the framework suggested is provided as Fig. 2.

The major framework consists of information on 14 different domains of knowledge/ information/ data required to plan development interventions at the micro level. Each domain shall be considered as a repository of data and information on various related aspects. The major domain about which data are required for micro level planning are, natural resources, technology, government programmes, policies, crops, mechanization, climate, market, infrastructure, institutions, demographic characteristics, socio-economic characteristics, existing perspective plans, project monitoring etc.

All these domains have been found to be important both by the judges selected for evaluation as well as by exploring the possibilities of using information in micro level planning. The projects formulated by local bodies were examined in detail to find out the possibilities of data support for planning them in ideal situations. The possibility of linkages between the different domains are depicted as lines that connect each domain with the other. The lines do not represent the degree of importance or direction. The lines indicate only the logical linkages between different types of data.

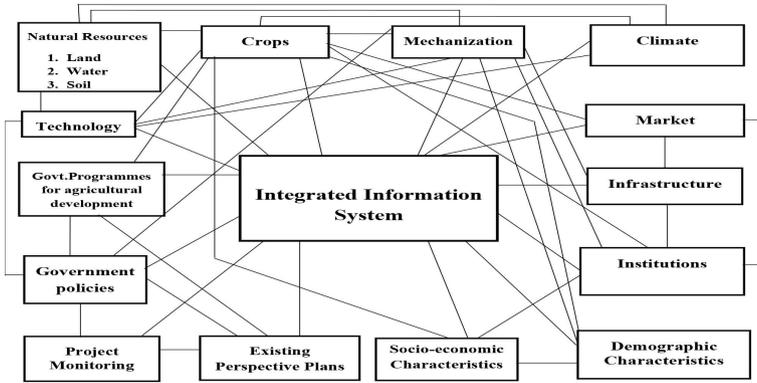


Figure 2. Conceptual Framework of proposed Integrated Information System for Micro Level Planning in Agriculture

CONCLUSION

The study attempted to identify the databases required for carrying out micro level planning being implemented in Kerala. It was identified that, 19 different agencies/ institutions are providing micro level data comprising of different domains useful for plan formulation. The institutions were Krishibhavan, Gram Panchayat, Soil Survey Department, Kerala State Land Use Board, Village Office, Minor Irrigation Department, Ground Water Department etc. The typology of data varied from statistics of crop production, productivity, soil types, irrigation sources, land use pattern to demographic characteristics, SC/ST population, MGNREGS workers, livestock population, cadastral maps etc. The extent of usage of data in micro level planning was studied. It was found that only about 20 per cent of available data was fully utilised, whereas 55 per cent was partially used and 25 per cent of data was not at all used in planning process. The constraints perceived by Extension Personnel and Peoples' Representatives in maintaining and updating databases was analysed. Ranking of constraints has revealed that the lack of mechanisms for regular updating was considered to be the most severe constraint in maintaining registers. This is in fact reported to be the result of shortage of staff and the heavy work load borne by limited staff. NIC(2014) observes that improvement in information system is

necessary to make the process of development planning effective at various levels. This study proposes the different domains in which an integrated information system should necessarily have data to support micro level planning in agriculture. The major framework consists of information on 14 different domains of knowledge/ information/ data required to plan development interventions at the micro level. Each domain shall be considered as a repository of data and information on various related aspects. The conceptual framework gives a possible linkage among the different domains of data/ information required for micro level planning.

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Solomon Four Group Research Design: An appropriate design for social science research

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INTRODUCTION

The Solomon four-group design, developed by Richard Solomon in 1949, was devised to overcome the problem of pre-test sensitization and to eliminate the influence of confounding variables and extraneous factors in influencing the results. Pre-test sensitization occurs when participants' scores on a post-test are influenced as a result of a pre-test being administered. The central feature of the Solomon four-group design is that participants are randomly assigned to either receive or not to receive a pre-test and then randomly assigned to either a treatment or a comparison group. All participants then receive a post-test. This approach enables researchers to acquire the benefits of using a pre-test, while also allowing an assessment of pre-test sensitization.

Pre-test and Sensitization Effect

Researchers implement pre-tests with the goal of obtaining information regarding baseline levels of specific variables of interest (e.g., self-esteem, knowledge) prior to the implementation of an experimental stimuli or intervention which provides a comparison point for post-test data. Though the benefits of a pre-test include greater control over an experimental or quasi-experimental design, it leads to pre-test sensitization. The pre-test sensitization occurs when the implementation of the pre-test leads participants to respond to the stimuli or the post-test assessment differently than they would have otherwise. The problems associated with pre-test sensitization are

manifold. Firstly, a pre-test can alert participants to the questions that are likely to appear on the post-test. Another possibility is that the students will focus only on the aspects of the educational intervention that were covered on the pre-test, thus resulting in scores that they would not have received if they did not have prior knowledge of questions on the post-test. In other instances, the pre-test could make the participants aware of outcomes that researchers are hoping to influence, regardless of whether they intended to do so.

Solomon Four Group Research Design Elucidation

The Solomon four-group design was devised to overcome the problem of pre-test sensitization while maintaining the benefits associated with conducting a pre-test. The design achieves this aim by randomly assigning participants to either receive or not to receive the pre-test and then to receive or not to receive the treatment. By randomly assigning these two factors of treatment and pre-test, four conditions are created. Researchers can readily distinguish the influence of the pre-test by contrasting differences in post-test scores between both groups that received the treatment (one of which received a pre-test) and the two groups that did not receive the treatment (one of which received a pre-test). In addition to this, the design has (a) an internal validity, (b) it has a built in replication mechanism, (c) it eliminates the influence of confounding variables and extraneous factors in influencing the results, and (d) randomisation affords valid statistical treatment of data.

Application of Solomon Four Group Research Design in Agricultural Extension Studies

The Solomon four-group design has historically been used more in experimental studies conducted in laboratories where variables can be carefully manipulated and controlled. Most social science research involves human subjects, and it is more challenging in use of this design. Though, the design has been used in educational technology research, nursing research and medical research, its usage in agricultural extension research is rare.

An experimental study was conducted during 2013-14 to explore the potentiality of Programmed Instruction (PI) as an extension method in comparison with lecture method to teach extension functionaries on

new agricultural subject-climate smart agricultural technologies. The experiment was conducted by applying Solomon four group research design and the respondents were 240 extension functionaries of the Karnataka State Department of Agriculture.

The PI is a learning methodology proposed by the behaviourist Skinner (1958) based on 'Operant Conditioning' theory, which states that the learning is change in the behaviour, i.e. the individual's response to events or stimuli. Behaviour can be conditioned by rewarding the right stimulus-response patterns. The PI is a method of presenting new subject matter to learners in a graded sequence of controlled steps. Learners work through the programmed material by themselves at their own speed and after each step, test their comprehension by answering questions as well, they can find the correct answers immediately.

Further, the effectiveness was measured considering extent of learning in different sub-domains of cognitive and affective domains. The cognitive domain according to Bloom (1956), involves knowledge and the development of intellectual skills. This includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills. There are six major sub-domains of the cognitive domain namely, (a) knowledge, (b) comprehension, (c) application, (d) analysis, (e) synthesis and (f) evaluation, starting from the simplest behaviour to the most complex.

The affective domain (Bloom et al. 1964) includes the manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasm, motivations, and attitudes. There are five sub domains of the affective domain namely, (a) receiving phenomena, (b) responding to phenomena, (c) valuing, (d) organisation and (e) internalising values which are arranged in the increasing order of difficultness. The learner has to be mastered on the lower ones before the next ones can take place.

In the study, The PI was considered as one stimulus (stimulus-1) and lecture was considered as another stimulus (stimulus-2). To know the effect of each stimulus, four groups of respondents having 30 members in each group were considered as experimental groups. Thus, there were 120 respondents for stimulus-1 (PI) and 120 respondents for stimulus-2 (lecture) accounting to total of 240 members as the respondents for the study. The information from the respondents was

collected using the developed and standardised scales to measure the cognitive and affective domains at pre-test and post-test stages of the experiment as per the experimental design.

During the experimentation, firstly, the information was collected from the respondents using the standardised questionnaire from two groups where pre-test was necessary. As a second step, stimulus was given for two groups. In stimulus-1, the standardised PI material on the climate change subject was given to go through the material and complete the process. In stimulus-2, lecturing was done on the climate change subject using the standard procedure. As a third step, post test was conducted for all the groups using the standardised questionnaire.

To summarise the experimentation, out of four groups, one group (G1) received pre- test (Yb) followed by administration of stimulus (X) followed by post test (Ya). The second group(G2) received pre-test (Yb) and post-test (Ya) without stimulus. The third group (G3) received stimulus(X) followed by post-test(Ya). Fourth group(G4) had only post-test (Ya). The effect of each treatment/stimulus (X) was worked out using the following formula.

$$d1 = (Ya - Yb)G1 - (Ya - Yb)G2 \quad (\text{gives stimulus effect} + \text{sensitizing effect})$$

$$d2 = (Ya - Yb)G1 - (Ya - Yb)G3 \quad (\text{gives sensitizing effect})$$

$$Z1 = (d1 - d2) \quad (\text{gives stimulus effect})$$

$$Z2 = (Ya)G3 - (Ya)G4 \quad (\text{gives stimulus effect})$$

$$\text{Stimulus effect } (X) = \frac{Z_1 + Z_2}{2}$$

where,

d1 = difference 1

d2 = difference 2

Ya = observations recorded after the treatment

Yb = observations recorded before the treatment

G1, G2, G3 and G4 = 1st, 2nd, 3rd and 4th groups respectively

Z1 = stimulus effect 1

Z2 = stimulus effect 2

The results indicated that the mean effectiveness scores of PI in different sub-domains of cognitive domain ranged from 37.17 to

52.33 indicating substantial influence of PI in all the sub-domains of cognitive domain. The very significant methodological superiority of using Solomon four group design in assessing the actual effect / real effect of PI was exhibited in the results of the study. Most of the researchers use before-after experimental design to assess the impact of any stimulus. If we assess objectively, the actual effect of stimulus will be different. Example, the difference between post and pre test scores of G1 in respect of knowledge sub-domain was 84.67 which is normally considered as the effect of stimulus. But, the actual effect of PI is 47.83. The difference of 36.84 is attributed to sensitisation effect of pre-test and other natural causes. Similar differences were observed in all other sub-domains of cognitive domains. The mean scores recorded were 31.37, 31.83, 40.83, 26.00, 27.67, while, the difference between post and pre test scores were 69.67, 69.0, 78.0, 73.0, 80.0 in respect of comprehension, application, analysis, synthesis and evaluation respectively. Here, the differences between the actual scores and difference between post and pre test scores were 31.17, 31.83, 31.0, 24.83 and 27.67 respectively which are attributed to sensitization effect.

The PI had considerable effect on extension functionaries in affective domain also. The actual scores of receiving phenomenon was 38.00 followed by 39.60, 42.87, 51.00, 35.33 for responding to phenomenon, valuing, organisation and internalising values relating to the technology presented to them. Whereas, the difference between post and pre test scores were 69.47, 71.33, 71.06, 75.2 and 69.47 indicating a sensitization effect of 31.47, 31.73, 28.19, 24.2 and 34.14 for receiving phenomenon, responding to phenomenon, valuing, organization and internalizing values respectively. Similar results were observed in lecture method also in both cognitive and affective domains.

Overall, the results revealed that, the mean effectiveness scores of PI in respect of cognitive domain was 45.17 with a range of 37.17 to 52.33 in different sub-domains. Similarly, the mean effectiveness scores of affective domain were 41.36 with a range of 35.33 to 51.00 in different sub-domains. The mean effectiveness score in lecture method for cognitive domain was 32.83 with a range from 25.67 to 37.17 in different sub-domains. For affective domain, it was 35.43 with a range from 29.60 to 42.13, indicating PI was more effective than the lecture method.

CONCLUSION

Solomon four-group design is considered to be one of the most rigorous and prestigious designs, and gives explicit consideration of external validity of the treatment effect. The design is flexible in nature and can be utilized in both true experimental and quasi-experimental studies. This rigorous design gives the researcher confidence in the significance of the study results since it guards against both threats to internal and external validity. Hence, use of the Solomon four-group design is recommended for consideration of use by social science researchers as we strive to expand our knowledge and science, and through advancement in the use of rigorous research methodology.

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Krishi Vigyan Kendra – Innovation in Farmers Advisory

Philip H. and Sriram N.

INTRODUCTION

Tamil Nadu Agricultural University (TNAU) established during 1906 became state agricultural university during 1971. Most of the SAUs including TNAU are autonomous organizations with state-wide responsibility for agricultural research, education and training or extension education. The establishment of the SAUs, based on a pattern similar to that of the land-grant universities in the United States, was a landmark in reorganizing and strengthening the agricultural education system in India. These universities became the branches of research under the ICAR and became the partners of the National Agricultural Research System (NARS). The green revolution, with its impressive social and economic impact, witnessed significant contributions from the SAUs, both in terms of trained, scientific work force and the generation of new technologies for the benefit of the farming community in India.

Tamil Nadu Agricultural University has been playing a significant role in the agricultural development of Tamil Nadu for the past five decades. The University is responsible to a great extent in the modernization of agriculture sector and as a premier institution, provides agricultural education, research and extension services at the state level. TNAU generates much needed quality human resources for the development of agricultural sector in Tamil Nadu, besides training thousands of farmers and development department personnel on improved farm technologies and practices. It also provides various extension services to all the stakeholders.

Tamil Nadu Agricultural University (TNAU) is the only State Agricultural University in Tamil Nadu spearheading agricultural research, education and extension activities for productivity enhancement and diversification of Tamil Nadu agriculture. The comprehensive initiatives taken by the TNAU have led to notable accomplishments in achieving food security, natural resource management, input use efficiency, climate resilience, secondary agriculture and economic transformation of farmers through technological interventions. TNAU is always working for the development of the farmers through their active participation. TNAU is connecting the farmers very effectively by employing different mechanism and schemes and services in Tamil Nadu.

Connecting Farmers through TNAU Extension Service

The Directorate of Extension Education (DOEE) is the nodal agency of TNAU for promoting agricultural development in the state through quick transfer of technology by providing training, consultancy and farm information to line departments' professional extension personnel and farmers. It also involves the assessment, refinement and adoption of technology through on-farm testing and front-line demonstrations.

KVK to connect Farmers and Extension Personnel

Krishi Vigyan Kendras are functioning in all the districts of Tamil Nadu except Chennai and Tirupur. Out of 30 KVKs, 14 KVKs are under Tamil Nadu Agricultural University and are located in Madurai, Sirugamani, Tindivanam, Vriddhachalam, Vamban, Virinjipuram, Pechiparai, Sandhiyur, Ramnad, Sikkal, Tirur, Needamangalam, Aruppukkottai and Papprapatti, Three ICAR KVKs (Kancheepuram, Namakkal and Sivagangai) under TANUVAS, 11 ICAR KVKs under Non-Governmental Organizations (NGOs) and 2 ICAR KVKs (Coimbatore and Dindigul) under Deemed Universities.

The Tamil Nadu Agricultural University has a Directorate of Extension Education through which innovative agriculture technologies are disseminated to the farming community through organizing On and Off campus trainings, vocational training programmes and conducting seminars, conferences, workshops, farmers mela and exhibitions. Technology backstopping along with

close monitoring of KVK activities is being effectively done by the Directorate of Extension Education. Technology Backstopping on district wise cropping system, technological interventions, farm management strategies for KVK farm, database management for KVK, Soil health management, agro forestry, bioenergy, agriculture machinery and value addition are being provided to all the TNAU KVKs including other ICAR KVKs in Tamil Nadu and Puducherry.

Tamil Nadu KVKs' plan to connect the farmers

- Farm specific extension services will be strengthened through by forming block-specific multi-disciplinary team. Block-wise multi-disciplinary teams have already formed by TNAU with help of agriculture department, private agencies, NGOs and progressive farmers to provide customized farm extension services to farming community.
- Block specific agricultural information will be scouted and updated in the TNAU Agri-tech portal. The block specific information like technologies, availability of inputs, agro services, availability of farm tools/machineries, block specific schemes, credit information, market information etc., will be scouted and added in the Agritech portal.
- Innovative/Progressive farmers will be identified and trained for three months at TNAU and will be appointed as para-extension workers in each village to provide extension services. KVK system will give technical backstopping to para-extension workers then and there for updating their knowledge, skill on latest technologies.
- Farmer Discussion Group will be restarted for facilitating the *farmer vs farmer mode of transfer of technologies* and having more interpersonal interaction between farmer, extension worker and scientist for effective TOT activities.
- Market-led extension services will be strengthened for promoting market-led agriculture system in Tamil Nadu for tripling the profitability of the individual farmers. Supply chain management for all important crops will be strengthened through commodity group/ cluster level/farmers' association.
- TNAU's scientists will be deployed for pre-seasonal campaign

at each village for refreshing the farmers' knowledge and skill on respective crop cultivation for improving the productivity and profitability.

- Hi-tech horticulture cum agriculture technological interventions will be further strengthened in agriculture and horticulture crops for doubling the productivity and increasing the income of the farming community. Cash crops like cotton, sugarcane, banana and pulses will be promoted through precision agriculture system.
- TNAU will coordinate and facilitate for scouting of Individual farmer's farm database through ICT tools. These data will be processed and uploaded either in agrisnet or agritech portal for providing farm specific agro advisory services, virtual extension services and to bring cent percent e-governance in agriculture extension system.
- Mobile based agro advisory system will be further strengthened by integrating the information in the agrisnet and agritech portals for delivering the timely need based information to farmers' doorstep.
- Virtual extension training centres will be developed by installing video conferencing facilities at each village and it will be integrated with agrisnet/agritech portal for instant interaction and retrieval of need based information.
- District-wise agribusiness centre will be established through partnership mode. Scientists from TNAU will lead the centre and District level Agricultural Marketing Department, KVK, Research Station, Department of Agriculture and Department of Horticulture will be involved as members in the agribusiness centre.
- Expert system for all agriculture and horticulture crops will be developed and installed in the extension workers' tablets for using as extension tool for agro advisory services.
- Farm specific "Crop Management Extension System" software will be developed for providing customized crop management advisory services to the farming community. The software can be installed in the extension workers' tablet.

- State level Export Facilitation Centre will be established for facilitating the farmers' produces for export. The centre will take care of entire logistics for exporting the farmers' produces.
- Block wise demo farm will be developed through participatory farming system for using as model farm or training ground for the respective block.
- Seed Hub Centre is going to be established at selected KVKs to promote quality pulses seeds for improving the pulses production in Tamil Nadu.
- Secondary agriculture or value addition with complete value chain of the products will be produced with help of KVK, Sales Centre and farmers groups or farmer producer organizations.
- KVK is also adopting the villages and introducing the need based and possible TNAU / ICAR technological interventions for improving the particular village agricultural production, productivity and livelihood of the farmers. The successful adopted model village will be replicated in the rest of the villages through public private partnership for achieving the sustainable agricultural development.

Farmers' Fair and Field Days

The Directorate is engaged in refining and disseminating agricultural knowledge to farming communities through a network of KVKs in various agro-climatic zones. The Directorate organizes farmers' fairs and field days for the active participation of farmers and farm women. These activities give farmers and the public an opportunity to witness the latest, proven technologies. Exhibitions on the latest technologies are organized for face-to-face interactions between farmers and scientists. The sale of the latest varieties of plants and vegetable saplings creates a large amount of publicity. On-the-spot technical solutions are demonstrated at visits of experimental sites.

Capacity Building of Farmers and Extension Personnel

Human resource development is an important mandatory activity of the university's extension education system. The DOEE is organizing various national-level, state-level and in-house personnel trainings, model training courses, faculty development courses, winter and summer schools, etc through Training Division working under DOEE. The directorate is also organizing vocational trainings for economic empowerment and livelihood security for farm families. Short-term trainings for farmers, farm women and rural youth on new production technologies are organized regularly at the directorate.

Training Programs for Farmers and Farm Women: The directorate is organizing inter-state and state-level short-term courses for practicing farmers and farm women on crop production, horticulture, plant protection, animal production, home science and other related disciplines. These training programs are sponsored by line departments of agriculture, horticulture, soil water conservation and NGOs. These trainings not only provide the participants practical exposure but also give an opportunity for participants to raise their incomes by adopting new technologies. These trainings are organized on the principles of "Learning by Doing" and "Seeing is Believing."

TNAU University Training Centre

TNAU is committed to provide complete agriculture and allied activities related technical backstopping to the Agriculture Department, Line departments, farmers and other stakeholders. TNAU KVK is functioning in the District; the technical backstopping cum training is taken care. If the TNAU KVK is not present in any district, the stakeholders are facing difficulties while getting technical backstopping. To solve this issues, the TNAU is planning to establish University Training Centre wherever TNAU KVK is not functioning so that the agriculture stakeholders will get immediate technical backstopping to improve the agriculture production, productivity and improvement of the livelihood status of the farming community. The University Training Centre will function like KVK and implement all the mandates except OFT and FLD activities. Right now 14 districts sanctioned with TNAU KVKs, remaining districts will get University Training Centre very soon in Tamil Nadu for further improvement of Tamil Nadu Agriculture through TNAU interventions.

Market Led Extension

In the present scenario, Market led Extension is the perfect blend for reaching at the door steps of our farmers. With globalization of the market, farmers need to transform themselves from mere producers-sellers in the domestic market to producers cum sellers in a wider market sense to best realize the returns on their investments, risks and efforts. Besides the production technologies, the extension workers now have to get equipped with market information which requires imparting new training skills to the extensionists.

The focus of the extension functionaries need to be extended beyond production. Farmers should be sensitized on various aspects on quality, consumer's preference, market intelligence, processing and value addition and other marketing information. This will help the farming community to realize high returns for the produce, minimize the production cost and improve the product value and marketability. In this regard the organization of such training programmes is not only timely but also extremely effective in reorientation of the farming community to market driven agricultural practices.

The Department of Market Extension functioning under this Directorate is responsible to organize the market-led extension activities, framing strategies, organizing the mela/seminar on market-led extension and organizing capacity building programme on market-led extension for the benefit of the farmers, extension workers and other stakeholders. This department is also committed to develop the cropping pattern, cultivation strategies based on the market-led extension approach and is being recommended to the farmers, extension workers and other stakeholders.

Farm Journalism

Uzhavarin Valarum Velanmai is responsible for publishing monthly agri journal in the name of Uzhavarin Valarum Velanmai in vernacular language for the benefit of the farming community. Need based topics with farmers success stories, season specific agro advisory and lead articles by top scientists are the important features in the journal. It is also planning to publish this farm journal through on-line in near future for wider outreach.

e-Extension Services

The world is in the midst of a knowledge revolution, complemented by opening up entirely new vistas in communication technologies. Recent developments in the field of Information and Communication Technologies (ICT) are indeed revolutionary in nature. ICT, when used as a broad tool for educating the communities especially knowledge intermediaries (extension officials), graduates and farmers, heralds the formation of a new class of society—the Knowledge Society. Knowledge thereby becomes the fundamental resource for all economic and societal developmental activities in the highly competitive and pluralistic world.

An exclusive outreach portal covering farming and allied sectors includes Agriculture, Horticulture, Agricultural Engineering, Agricultural Marketing, Seed Sector, Sericulture, Fisheries, Forestry and Animal Husbandry has been created under NADP (RKVY). The portal was developed based on the series of meeting with meetings with different stakeholders, contents scouted from different research institutions and other authenticated stakeholders and brainstorming session output provided by farmers, extension officials, scientists and other stakeholders. It is bi-lingual (Tamil and English) covers around 75,000 web pages, approximately 3.5 lakh pages. The portal is an open access and viewed by <http://agritech.tnau.ac.in>.

An expert system is called a knowledge based system with computer designed programme to facilitate the problem-solving in a narrow domain or discipline. Directorate of Extension Education has developed the expert systems or crop doctors for crop (paddy, sugarcane, ragi, coconut and banana) and animal enterprises (cow, goat, poultry) which is facilitating the instant decision-making process of the farmers through ICT enabled mechanism. The mobile apps of the expert system converted and uploaded with help of CDAC, Hyderabad for the benefit of the larger stakeholders.

The multi-lingual (English, Tamil, Malayalam and Kannada) Crop Doctor is also synergized with the existing KVK system for its implementation. The Artificial Intelligence is a platform of off-line mode click and get interface with visual and video-based Knowledge and Skill decision making components. The similar type of crop doctor for rest of the crop could also be developed in regional languages on sponsorship mode or payment mode.

TNAU has server based Multi Point Video Conferencing facility to invite, share, interact and educate farm information among scientists, extension officials and farmers linking with 60 Centres of TNAU. It is possible to connect 96 locations simultaneously and possible to hold 24 parallel session with farmers and different stakeholders to disseminate farm and allied sector information. The Video conferencing facility will facilitate the virtual class room like situation for facilitating the virtual trainings, virtual agro advisory services etc., for the benefit of the farmers, extension workers and other stakeholders.

Educational Media Centre

Educational Media Centre at TNAU is producing a lot of need based agriculture and allied subject related video programmes for telecasting through various TV channels. Video lessons on various agricultural subjects are also produced for the benefit of the farmers, extension workers, students and other stakeholders and being used for transfer of technologies. Audio lessons for the AIR or exclusive Farm School on AIR are also produced and broadcast through various AIR stations for the benefit of the farmers.

EMC is also having plan to document various video lessons or video programmes on agricultural and allied activities through public-private partnership mode in near future for further strengthening of the TOT activities in Tamil Nadu. Paid mode training on participatory video production, editing, pre-production and post-production is also undertaken for the benefit of the various stakeholders.

Agricultural Technology Information Centre

The Agricultural Technology Information Centre (ATIC) is intended to provide linkage mechanism, beyond individual units of research institutions in contributing towards dissemination of information. The ATIC will serve as a single window system with an objective to help the farmers and other stakeholders both to provide solutions to their location specific problems and make available all the technological information along with technology inputs and products for testing and use by them. ATIC is selling all the TNAU inputs, seeds, bio-fertilizer etc., to farmers and other stakeholders. ATIC is also planning to sell all TNAU products through on line or cashless mechanism in near future.

Recognizing the Achievements of the Farmers

KVK successful farmers, agripreneurs and agricultural mechanization practitioners are being honoured with Velanmai Chemmal award and Best Agripreneurs award by TNAU every year during Farmers day or any other important functions happening at TNAU.

Farmers Facilitation Centre

TNAU has recently established Farmers Facilitation Centre in addition to the ATIC centre to facilitate the farmers to get the need-based information from the different subject matter specialists as one-stop information centre.

Social Media

The social media tools are effectively used to monitor the KVK activities as well as to provide guidance, technical backstopping interventions etc. All the TNAU KVKs have been connected with WhatsApp group and being monitored KVK wise as well as individual scientists wise progress of works. The Social Media tools are also going to be effectively utilized to form farmers groups, networking the commodity groups, to provide farm specific advisory services or diagnosis of farm related problems etc., with less investment.

e-Community Radio Programme

Transfer of technology plays a vital role in increasing the farm productivity, resulting in enhanced profits to small and marginal farmers. Mass medium is very effective in widespread of farm technologies. Among the mass media, radio renders tremendous support for the large scale adoption of agro technologies for the benefit of farming community. To fully address the local needs and concerns of the community, emerged Community Radio- ‘Voice of the Voiceless’, need centric and need based. One such initiative is “TNAU Vivasayee CRS 107.4 MHz”, set up with the aid of Media Lab Asia in collaboration with World Development Foundation, New Delhi under the aegis of the Ministry of Information and Broadcasting, Government of India.

It is functioning since December 2010 with a reach of 15 kms radius covering approximately 22 villages with more than 10000 farm

families. Currently, the transmission is for four hours (10 to 12.00 noon and 2.00 to 4.00 PM).

Domestic and Export Market Intelligence Cell (DEMIC)

The Domestic and Export Market Intelligence Cell (DEMIC) has been established in the Centre for Agricultural and Rural Development Studies (CARDS), TNAU in order to forecast the supply and demand of important agricultural commodities in Tamil Nadu; to forecast future prices of major agricultural commodities; to study the state and national market situation related to important commodities; to disseminate the market and price information on to the farmers for planning, production and holding stocks; and to suggest policy measures to the Government of Tamil Nadu.

The main activities of DEMIC include forecasting price for agricultural commodities such as cotton, banana, chillies, turmeric, maize, small onion and gingelly based on the past price data collected from various major markets of Tamil Nadu and also based on the traders survey; maintaining a website www.tnagmark.tn.nic.in; developing and maintaining data base on commodity prices, area, production and productivity details; running an E-newsletter i.e., DEMIC info Series; dissemination of agricultural commodity prices to farmers through newspapers and website; and offering export related information to traders. The forecast reveals that cotton prices would remain firm for the rest of the season in Tamil Nadu.

Farm Degree Programme for Farmers through ODL

This Open and Distance Learning Directorate of TNAU concentrates its effort on distance education in addition to non-formal and continuing education for the benefit of the farmers and other stakeholders. The Directorate of Open and Distance Learning, one of the constituent units of the TNAU was started during April, 2005 by renaming the Directorate of Publications. This Directorate has started offering certificate courses, PG Diploma, PG Degree courses, Diploma and Bachelor of Farm Science/ Master of Farm Technology courses for farmers, farm youth, rural women and entrepreneurs through Distance Learning Mode and online mode for those aspiring for self employment opportunities.

Connecting the Farmers through Weather Forecast

Success of monsoon based agriculture depends on the climate that prevailed during the particular cropping season. Providing real time weather information to the farmers for making crop management decision can minimize the risk and losses due to extreme climate. In order to improve the accuracy of present weather forecasting, weather information are required at high spatial and temporal resolution. Installation and interlinking of automatic weather stations (AWS) at block level will be helpful to avoid climate risks and increase the productivity by timely weather based agro advisory. In this context, Government of Tamil Nadu under National Agricultural Development Project (NADP) have funded for establishing Tamil Nadu Agricultural Weather Network (TAWN) by installing 385 AWS, 224 in the first phase and 161 in the second phase.

The Agro Climate Research Centre (ACRC), Directorate of Crop Management (DCM), Tamil Nadu Agricultural University (TNAU), Coimbatore in collaboration with Department of Agriculture, Tamil Nadu established the TAWN. In the network, 10 types of agricultural related weather parameters from 385 AWS are collected at hourly interval and hosted in this website. The medium range weather forecast developed by using these weather parameters is also hosted. Using this information, the agricultural officers will develop weather based agro advisories at block level for the farmers. It is first of its kind in India, such a denser weather network has been established and is expected to help in monitoring the global warming and climate change impacts on Tamil Nadu agriculture.

CONCLUSION

The Vision 2023 targets agriculture sector in Tamil Nadu to achieve five percent annual average growth. The objective for the agriculture sector to achieve the Vision 2023 target will be “To achieve the best in class productivity in key agricultural produces and to be a global supplier with robust infrastructure”. This vision imperative calls for setting up of robust support infrastructure for planning, production, processing, storage, distribution, marketing and sales of agricultural produce. Tamil Nadu Agricultural University is implementing a lot of innovative schemes and services in coordination and collaboration with Tamil Nadu Government, Government of India, International

Development Agency, NGOs and other stakeholders to connect farmers effectively with Research and Extension system so as to deliver need based technologies and interventions to the farmers' doorstep timely and efficiently for improving their productivity thereby doubling the farmer's income.

9

Role Performance and Role Expectations of the Officials of the State Department of Agriculture Under Reorganized Extension System

Parthasarathi S. and Ganesan R.

INTRODUCTION

To develop farmers, specially small and marginal farmers as agripreneurs and making farming a profitable enterprise, the state sponsored extension machinery will have to take lead with completely changed focus and attitude towards their roles and responsibilities. A new agenda for Human Resource Development for agricultural extension personnel in terms of required competencies in knowledge and skills such as technical, organizational, managerial, communication and business skills will be required in order to meet challenges of new millennium. Hence, studying their role performance and expectations are essential to upgrade the function of the officials.

METHODOLOGY

The extension officials available in the 13 blocks of Cuddalore district comprising Assistant Director of Agriculture, Agricultural Officer/Dy.Agricultural Officer and Assistant Agricultural Officers were studied to assess the role performance and role expectations of their prescribed roles in the reorganized extension system. Role performance was operationalized to the extent to which an extension worker is able to effectively carry out his roles prescribed in the job chart. In order to assess the role performance self-rating method was followed. Gap in role performance refers here that the difference that exists, if any, between role expectation and role performance of

officials. Self-rating method was employed to get the responses. Role expectation is operationally defined as the degree to which an extension worker feels a particular role is important. In order to measure the role expectation the officials were asked to indicate their opinion about the importance for the roles given on a three point continuum. The quantification of the data was carried out by the following scoring procedure adopted by Balakrishnan (1997).

RESULTS AND DISCUSSION

The association and contribution of role performance with the profile characteristics of officials in the block agricultural extension center is presented below.

1. Association and contribution of profile characteristics of ADAs and their role performance: The correlation and regression analysis of profile characteristics of the ADAs and role performance were carried out and presented in this section.

Table 1. Association and contribution between profile of the ADAs and their role performance (n=12)

Sl. No.	Variables	‘r’ value	Partial regression co-efficient	Standard error	‘t’ value
1.	Age	0.544 NS	0.240	1.314	0.183 NS
2.	Experience	0.786*	-0.558	1.014	2.550*
3.	Workload Perception	0.532*	-0.120	0.806	-0.149 NS
4.	Job Involvement	0.346*	-0.012	0.092	1.135 NS
5.	Job Stress	-0.327 NS	0.393	0.895	-0.136 NS
6.	Time Management	0.538*	-0.311	0.807	2.386*
7.	Organizational Climate	0.748**	0.085	0.187	2.454*

R ² = 0.850	** - Significant at 0.01 level
F = 1.665	* - Significant at 0.05 level
Standard Error = 1.086	NS- Non significant

From Table 1 it could be observed that the correlation analysis indicated the variable organizational climate was found to be significantly associated with role performance at one percent level of probability. The variables viz., experience, workload perception, job involvement and time management were found to have positive and significant relationship with the role performance of the ADAs at five percent level of probability.

The guidance and supervision, inter personal relations, team work and proposed facilities to be established in the BAECs, made them to realize conducive organizational climate might have resulted the positive contribution of this variable with the role performance of the ADAs. By virtue of experience at various cadre and effective in managing their time towards various activities would also have resulted into a positive relationship with the role performance.

Table 1 reveals that the computed 'F' value was 1.665, which was positive, and significantly influence at one percent level. The regression analysis indicated that all the independent variables taken together explained a significant amount of variation on role performance. The R² value reveals that all the seven independent variables explained to the extent of 85.00 percent of variation in role performance of ADAs.

The variables viz., time management and organizational climate exhibited positive and significant contribution towards the role performance of ADAs. This indicates that an increase in organizational climate by one unit would increase the level of ADAs role performance. Similar is the case with other variable time management.

2. Association and contribution of profile characteristics of AOs/ Dy.AOs and their role performance: The association and contribution of each of the selected profile of the AOs / Dy.AOs with their role performance have been represented in the form of correlation and regression coefficient and the same has been given in Table 2.

Table 2. Association and contribution of profile characteristics of AOs / Dy. AOs and their role performance (n=21)

S. No.	Variables	'r' value	Partial regression co-efficient	Standard error	't' value
1.	Age	0.348 NS	0.577	0.344	1.674 NS
2.	Experience	0.674**	-0.423	0.327	2.294*
3.	Workload Perception	0.455*	0.337	0.399	0.845 NS
4.	Job Involvement	0.582*	-0.092	0.062	-1.476 NS
5.	Job Stress	-0.087 NS	-0.051	0.139	-0.370 NS
6.	Time Management	0.452*	-0.264	0.373	-0.707 NS
7.	Organizational Climate	0.540**	0.185	0.107	3.724**

R ² =0.634	** - Significant at 0.01 level
F =1.932	* - Significant at 0.05 level
Standard Error = 3.621	NS- Non significant

It could be observed from Table 2, variables viz., organizational climate and experience found to have positive and significant relationship at one percent level of probability. The independent variables such as workload perception, job involvement and time management exhibited significant relationship at five percent level.

The reorganized setup of the department would give them more focus in their activities. Thus the AOs / Dy. AOs feel a conducive organizational climate. The experience gained by them would also help to perform their role effectively. Effective time management, work commitment also makes them to deliver their role effectively.

Table 26 indicates that the 'F' value was found to have positive and significant influence at five percent level of probability. The R2 value

shows 63.40 percent of contribution by the seven independent variables. Data in Table 2 shows the contributed variables viz., organizational climate and experience found to have positive and significant at five percent and one percent level of probability of regression coefficient respectively.

This would be inferred that the experience would pave way for better performance of their assigned role. The favourable organizational climate also paves a platform for them in delivery of role. It could be inferred that a unit increase in experience would lead to an increase in a unit of role performance of the AOs / Dy.AOs.

3. Association and contribution of profile characteristics of AAOs and their role performance: The correlation and regression analysis on characteristics of AAOs with their role performance were carried out. The results are presented in Table 3.

Table 3. Association and contribution of profile characteristics of AAOs and their role performance (n=21)

Sl. No.	Variables	'r' value	Partial regression co-efficient	Standard error	't' value
1.	Age	0.184 NS	-0.136	0.316	2.430*
2.	Experience	0.386*	0.196	0.338	0.579 NS
3.	Workload Perception	-0.135 NS	-0.177	0.258	-0.686 NS
4.	Job Involvement	0.287*	0.088	0.103	2.559*
5.	Job Stress	0.087 NS	0.005	0.186	0.028 NS
6.	Time Management	-0.224 NS	0.376	0.558	0.674 NS
7.	Organizational Climate	0.463**	0.227	0.129	2.755**

$R^2 = 0.627$	** - Significant at 0.01 level
$F = 1.971$	* - Significant at 0.05 level
Standard Error = 4.821	NS- Non significant

It could be observed from the Table 3 that out of seven variables taken for the study one variable namely organizational climate was found to have positive and significant association with the role performance of AAOs at one per cent level of probability. The independent variables viz., experience and job involvement were found significant at five percent level of probability.

The new working environment under the restructuring would give ample scope for effective interaction with the officials at block level. Further, they were encouraged to work in a team and orientation was also given to them. The BAECs could help the line department officials to share the common problems also and contribute a favorable organizational climate to perform the role effectively.

Data in Table 3 reveals that high level of work experience and their interest makes more involvement in delivering their duty. Thus, experience and job involvement exhibit the contribution in the role performance positively.

The results of multiple regression analysis as explained in the Table reveals that of all the independent variables taken together explained a significant amount of variation on effectiveness of role performance. The R² value reveals that all the seven independent variables explained to the extent of 62.73 percent of variation in the role performance of AAO.

The variables viz., experience, job involvement and organizational climate showed positive and significant contribution towards the role performance. This indicates that an increase in experience by one unit would increase the level of role performance. Similar is the case with other two variables viz., job involvement and organizational climate.

High experience in job would help the AAOs to become aware on their role and they may easily accommodate with the restructuring. The medium level of job involvement by the AAOs due to their commitment, conducive organizational climate under restructuring could be the possible reasons for the significant contribution.

4. Analysis of gap in role performance and role expectation of officials:

Gap in role performance refers here to the difference that exists, if any, between role expectation and role performance of officials. Self-rating method was employed to get the responses.

4.1 Analysis of gap in role performance and role expectation of ADAs The approved and prescribed job chart for ADAs under the restructured system has been considered for identifying the different roles to evaluate the role performance. The following results are derived by self-rating method for ADAs.

Table 4. Role performance and role expectation of ADAs (n=12)

Sl. No.	Roles	Role Expectation		Role performance	
		Mean	Rank	Mean	Rank
1.	Implementing all agricultural schemes	2.83	I	2.72	III
2.	Convening Block Technical Team for ATMA	2.53	VII	2.66	IV
3.	Supervising seed production schemes	2.64	IV	2.75	II
4.	Authority to settle all input equipments and implements and other contingencies	2.58	VI	2.66	IV
5.	Controlling all block level staff	2.66	III	2.66	IV
6.	In charge of farms, input production unit, coconut nurseries, saline and alkaline reclamation unit, soil survey and land use organization etc.	2.66	III	2.66	IV
7.	Annual verification, Surprise verification of AECs.	2.58	VI	2.42	VI
8.	Reconciliation of statement or receipts and expenditure	2.58	VI	2.72	III
9.	Supervision of field level activities	2.75	II	2.83	I
10.	Transfer of Technology at field level	2.58	VI	2.58	VII
11.	Publicity works	2.58	VI	2.66	IV
12.	Supervising input management	2.66	III	2.66	IV

13.	2 acres wasteland distribution	2.61	V	2.53	V
14.	Review of field level staff	2.83	I	2.72	III
15.	Conducting training	2.75	II	2.75	II
Overall mean score		2.716		2.67	

The above Table 4 revealed that the ADAs role expectation was high, since the overall mean score was 2.72 for the given 15 roles. The role expectation was high for the roles like Implementing all agricultural schemes, review of field level staff, controlling the subordinates and supervision of field level activities. The other roles, which had high, mean score were supervising seed production schemes, two acres wasteland distribution, Transfer of Technology at field level, publicity works and settling all input equipments and implements and other contingencies.

Table 4 revealed that the ADAs role performance was high, since the overall mean score was 2.67 for the given 15 roles. The role performance was high for the roles like supervising of field level activities, conducting training and supervising seed production schemes. The other roles which had mean score above the average mean score includes conducting training and review of field staff, implementation of all agricultural schemes, reconciliation of statement or receipts and expenditure as expressed by the ADAs.

The block team leader ADAs were holding responsibility and accountability of the work carried out by their subordinates. Hence, they are so vigilant in delivering work, control the subordinates by means of effective supervision and guidance. The experience over years as AOs makes them understand the field problems and official problems and solve them effectively. The above said reasons would have contributed for such a higher mean score for their role performance.

Having occupied the higher post in the block level the ADAs were interested to show their better performance. Hence they try to improve themselves in certain key roles, thus a high mean score was arrived in the role expectation of ADA. Their focus on better implementation of schemes through proper review of field staff and conducting need based training would result in a good role performance as expressed by the ADA.

As the calculated value of Kendall's coefficient of concordance ($K_c=0.135$) is less than the table value, the role expectation and role performance of ADA do not differ with each other as expressed by themselves.

4.2 Analysis of gap in role performance and role expectation of AOs / Dy.AOs The results of the role performance and role expectation of AOs / Dy.AOs are presented in Table 5.

Table 5. Role performance and role expectation of AOs / Dy. AOs (n=21)

Sl. No.	Roles	Role Expectation		Role performance	
		Mean	Rank	Mean	Rank
1.	Assessing the Area coverage, production and productivity for all Agri. Crops	2.52	V	2.52	VI
2.	Operating the schemes at villages	2.71	II	2.66	III
3.	Operating Agricultural Extension Centers in the jurisdiction	2.85	I	2.85	I
4.	Maintain the accounts, physical verification, cash and stock entries etc.	2.57	IV	2.57	V
5.	Supervise the seed farms and procurement made as per target	2.57	IV	2.38	VII
6.	Technical guidance to AAO	2.52	V	2.85	I
7.	Organize trials and demonstrations	2.66	III	2.71	II
8.	Conducting crop cutting Experiments	2.52	V	2.52	VI
9.	Conduct Pest Surveillance plot and Roving survey	2.57	IV	2.57	V

10.	Identification of beneficiaries for schemes	2.66	III	2.66	III
11.	Any other job assigned by ADA	2.52	V	2.61	IV
12.	Technical advice to farmers	2.85	I	2.71	II
Overall mean score		2.59		2.52	

The Table 5 revealed that the role expectation of AOs / Dy.AOs was fairly high, since the overall mean score was 2.59. Operating the agricultural extension centers in their jurisdiction, providing technical advice to farmers, Operating the schemes at villages, organizing trials and demonstration identifying the beneficiaries for schemes and convening the applications for the distribution of subsidized inputs under various schemes and assessing the area converge, production and productivity for all agricultural crops and carrying out any other job assigned by ADAs were roles expected to be performed better.

It could be observed from Table 5 that the role performance of AOs / Dy.AOs was fairly high, since the overall mean score was 2.52. Operating the agricultural extension centers in their jurisdiction, technical guidance to AAOs, organizing trials and demonstration, technical advice to farmers was found to be high. The other roles such as identification of beneficiaries for schemes and assessing the area coverage, production and productivity for all agricultural crops and carrying out any other job assigned by ADAs were found to be high in role performance.

Introduction of schemes like SRI, precision farming etc. need more technical support. It attracts special attention from the AOs/Dy.AOs like conducting demonstrations and trials, guidance to AAOs for a better adoption. Hence, these roles were given priorities by the AOs / Dy.AOs for better role expectation.

It is a challenging task for any AOs / Dy.AOs to show their ability in transferring the technology to the farming community. Hence, they are trying to perform the role in an effective manner. The guidance from their supervisors, the queries from the farmers' side entuse them to perform better. Further the restructuring provides the chance for meeting officials as and when required, introduction of schemes which need higher technical guidance from the officials might also

be the contributory reasons for such high performance of the AOs / Dy.AOs.

As the calculated value of Kendall's coefficient of concordance ($K_c=0.275$) is less than the table value, the role expectation and role performance of AOs / Dy. AOs do not differ with each other as expressed by themselves. Hence there was no gap existing between the role performance and role expectation of AOs / Dy. AOs.

4.3 Analysis of gap in role performance and role expectation of AAOs The results pertaining to the self-rating of role performance and role expectation of the AAOs are presented in Table 6.

Table 6. Role performance and role expectation of AAOs (n=21)

Sl. No.	Roles	Role Expectation		Role performance	
		Mean	Rank	Mean	Rank
1.	Area coverage, Production & Productivity for all Agricultural Crops	2.71	II	2.61	III
2.	Arrange group meeting field days, seminars, pre-season campaigns etc.	2.80	I	2.71	I
3.	Attend monthly review meeting conducted by AO/DY.AO and Assistant Director of Agriculture	2.61	IV	2.57	IV
4.	Distribution of all inputs in time to the targeted once	2.47	VII	2.38	VII
5.	Canvassing applications for the distribution of subsidized inputs under different schemes	2.47	VII	2.47	VI

6.	Conduct of CC Expenditure for crop insurance scheme	2.61	IV	2.61	III
7.	Responsible for area coverage figures after attending the meeting with V.A.O.	2.57	V	2.47	VI
8.	Assistance for implementation of watershed development schemes	2.38	VIII	2.38	VII
9.	Assist in the layout of A.R.Ts, CC expenditure & Minikit	2.66	III	2.47	VI
10.	Watching the demand for the different types of inputs like seeds, fertilizers and pesticides	2.80	I	2.66	II
11.	Collections of soil samples and furnishing the result of analysis to farmers and follow up in farmer's field.	2.61	VI	2.52	V
12.	Distribution of Azospirillum B.C. packets and other Bio fertilizers	2.28	IX	2.28	VIII
13.	Assessing the area of damage caused to various crops in his jurisdiction during drought/flood etc.	2.57	V	2.47	VI

14.	Implement the programmes like NADP, ATMA, and ISOPOM schemes and other state and centrally sponsored schemes	2.38	VIII	2.28	VIII
15.	Assist in 2 acre scheme, farm ponds	2.47	VII	2.28	VIII
16.	Any other work assigned by the competent authority	2.76	II	2.61	II
17.	FIG formation	2.52	VI	2.47	VI
18.	Advise farmers where inputs are available and their costs	2.80	I	2.66	II
Overall mean score		2.60		2.49	

Table 6 revealed that the AAOs role expectation was fairly high, since the overall mean score was 2.60.

The role expectation was found to be high for the roles like advise the farmers about input, arrange meetings, seminars, field days, assess the demand for inputs. The work assigned by the competent authority, collection of soil sample and follow up, area coverage, production and productivity implementation of the programmes like NADP, ISOPOM were the other roles expected to be performed better as expressed by the AAOs.

It could be observed from the Table 6 that the role performance of AAOs was found to be fairly high, since the overall mean score was 2.49. The role performance was found high for the roles like arranging meetings, seminars, field days, advice to farmers about input, assess the demand for inputs. Assessing the area coverage, production and productivity, attend monthly review meeting conducted by AOs / Dy. AOs and ADAs, the work assigned by the competent authority, collection of soil sample and follow up were the other roles performed better as expressed by the AAOs.

The introduction of new schemes, which derives the attention of farmers, fixed target, review by officials were the forcing factors for AAOs to get involved in these schemes. Frequent update of

knowledge by AOs / Dy. AOs and field trainings to AAOs were the contributing factors for such high level of role performance and also role expectation.

As the calculated value of Kendall's coefficient of concordance ($K_c=0.512$) is more than the Table value, there was a difference found between role expectation and role performance of AAOs. Hence there is a scope to improve the functioning of the field extension officials i.e., AAOs. They should further be trained adequately to cater the needs of the farming community.

It could be observed from the results of the gap analysis of the ADAs and AOs / Dy. AOs the restructuring provided them a platform to improve their role performance, in the case of AAOs there is a need to improve the functioning of them.

CONCLUSION

The performance of an individual in any agency had become an important variable as the production of an agency depends to a greater extent on the performance of its employees. This is the case with all other organizations. Role expectation and role performance of employees are the two important factors in determining the effectiveness of an organization. The present study found that organizational climate was the only variable common to all the three categories of officials. Hence, it is important to keep a conducive climate for an effective role performance of the officials.

10

Dynamics of Adoption of Agromet Advisories Services through the Innovation Decision Process: Integration of Adoption Theories

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Ravi Shanker K., Raju B.M.K. and Ravindra Chary G.**

INTRODUCTION

Climate change has been the focus of action for over two decades by governments, since the signing of the United Nations Framework Convention on Climate Change in 1992, and increasingly since the late 1990's by business (Kolk et al., 2008). Technological innovation has been a key response to sustainability challenges, including climate change (EIT, 2014, Morand and Barzman, 2006). As such, technological innovation, through the concept of climate resilient agricultural technology and practices, represents one response to the challenges faced by agriculture. There are several potential adaptation options to reduce moderate to severe climatic risks in agriculture.

Some of the climate resilient technologies are climate-ready crop varieties, water saving technologies, changing planting dates, conservation agriculture, zero tillage (ZT) with residues recycling, laser assisted precision land leveling, direct drilling into the residues, direct seeding of rice, brown manuring with sesbania, unpuddled mechanical transplantation of rice, raised bed planting, crop diversification, and associated component technologies like site-specific nutrient management, integrated farming system, integrated pest management, crop insurance, improved weather-based agroadvisory, improved nutrient management, water harvesting technologies etc. Agro met Advisory Services is a vital tool which

provides the valuable information about all agricultural operations from land preparation sowing to harvest based on weather forecasting. In this, weather is a key element which controls the success or failure of agricultural crop productivity. The main aim of Agromet Advisory Services is to conserve the natural resources effectively and call for minimizing the weather hazards. It is a fact that AAS can be modified or may be the agricultural operations can be reoriented to the forthcoming weeks (3-10 days forecast) (Jagadeesha et al 2010).

Rogers' "diffusion of innovation theory" has played central role in extension theory and practice (Roling, 1988). The process of diffusion of an innovation occurs when it is "communicated through certain channels over time among members of the social system" (Rogers, 2003). Adoption is not a point happening but a series of continuous process. It is useful to distinguish between adoption, which is measured at one point in time, and diffusion, which is the spread of a new technology across a population over time. Hence, diffusion can be interpreted as aggregated adoption. Observed diffusion patterns depend critically on complicated and sometimes unobservable relationships between different elements such as the risks associated with various technologies, the nature of farmers' attitudes to risks, the existence of fixed adoption costs and the availability of cash resources. Similar innovations may therefore experience different adoption patterns in different areas and by different groups of farmers (Feder et al., 1982).

Diffusion of innovation theory seeks to explain how, why, and at what rate new ideas spread through a population. A diffusion of innovation lens allows examination of why some innovations spread more quickly than others (and why some are rejected or fail to scale), what characteristics of individuals or communities make them likely to adopt an innovation, and the relative importance of innovation design and communication pathways in promoting adoption. Adoption studies in the recent times have been concentrating only on adoption rather than considering it as a continuous process. The present study provides a conceptual framework to study the process of adoption taking innovation decision process as base and integrating the relevant theories.

MATERIAL AND METHODS

The aim of the paper is to present a framework to study the dynamics of innovation decision process in the light of various theories present. Extensive review of literature on the innovation decision process and recent developments in the field of adoption studies were carried out. The review was done with the objectives firstly, to identify the theories applicable to adoption process; second to categorize them according to the stages of IDP process. After identifying and categorizing the theories, a framework was developed to integrate them in a generic framework, using the IDP as the base.

RESULTS AND DISCUSSION

Conceptual framework

Diffusion of Innovations (DOI) is one of the most widely researched theories in the social sciences, and Rogers' text has been considered as the definitive presentation for decades (Gluesing, 2012). The discipline aligns with neoclassical economics and modernization theory, which at their most basic level assume that humans behave as "rational actors" and thus predictably pursue self-interest.

However, at its heart, diffusion research has kept true to the linear Lasswell formula, with a linear understanding of diffusion from the inventor to the late adopters, with a static understanding of the innovation and with a passive perspective on the user, whose only choice of action lies between adoption and rejection (Karnowski et al, 2011). This approach has the advantage of opening diffusion research to other approaches that work based on binary variables, such as Social Network Analysis or the Theory of Planned Behavior. we consider theories and findings from other research traditions that are highly compatible with Diffusion of Innovations Theory and that may aid our understanding of "adoption at the implementation stage, as change that has really happened" (Rogers, 2003, p. 181). Theories like Social Network Analysis (SNA, (Valente, 2006) help to trace the channels through which innovations spread within interpersonal networks. Behavioral theories from social psychology, such as the Theory of Reasoned Action (TRA, cf. Fishbein & Ajzen, 1975) and the Theory of Planned Behavior (TPB, cf. Ajzen, 1985), facilitate the modeling of factors that influence the individual's adoption decision.

Social Network Analysis (SNA)

The concept of social networks was latent in the very first diffusion studies, insisting on the interpersonal influence between adopters (Ryan & Gross, 1943), but was only explicated and differentiated as SNA matured. In general, the major contribution of SNA to diffusion theory is that this framework offers an extremely sharp set of empirical and analytical instruments permitting to differentiate, measure and predict interpersonal influence in the diffusion process. We define a social network as a set of actors or nodes (individuals, agents, or groups) that have relationships with one another (Hanneman and Riddle 2005; Marin and Wellman 2010). Social networks evolve due to ties between actors, which may arise because of kinship, affection or familiarity between them (Easley and Kleinberg 2010).

Socio-psychological Theories of Behavior

Both Diffusion of Innovations and Theory of Planned Behavior are concerned with the perceptions of the decision maker. Thus, we posit that the characteristics of Theory of Planned Behavior complement the characteristics presented in Diffusion of Innovations to offer additional explanatory power regarding the decision to adopt an innovation (Weigel et al., 2014). To better describe individual adoption decisions from a potential user's point of view, diffusion theory has been complemented by behavioral theories considering beliefs and evaluation towards adoption. While Theory of Reasoned Action (TRA) by Fishbein and Ajzen (1975) was the first approach applying this concept to explain behavior, most empirical studies today rely on the enhanced TPB (Ajzen, 1985). These approaches have also explicitly integrated elements from Diffusion of Innovations theory, especially innovation attributes (Moore & Benbasat, 1991; Venkatesh, Morris, Davis, & Davis, 2003). These studies' contribution to diffusion theory is twofold: They have brought elaborated models on the causes of adoption, allowing differentiation between factors, and interrelations beyond simple two-variable-generalizations to be empirically identified. They have also led to standardization of empirical instruments, permitting competition and evolution of models. Ajzen's Theory of Planned Behavior (TPB) is a socio-psychological model which postulates that a person's/ decision making unit intention to enact a given behavior is the strongest predictor of that behavior. Through the conceptual extension of this theoretical model, a model

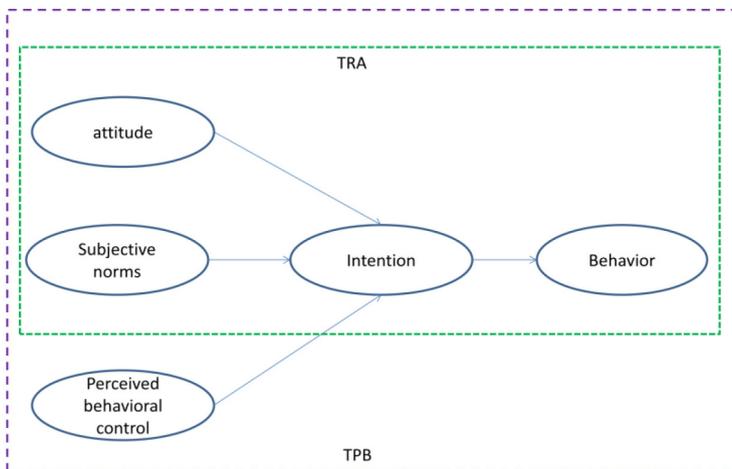


Fig 1. Theory of Planned Behavior (TPB) and Theory of Reasoned Action (TRA) Source: Adapted from Ajzen 1991

for farmers’ decision-making in the adoption of an Agromet advisories services has been constructed in this paper. This model allows us to incorporate psychological factors and external factors into the same analytical framework.

Social Learning Theory Research

The diffusion of innovation theory shows evolution of cumulated adoption decisions over time, but it requires a reduction of the farmers’ activity to a simple dichotomy between adoption and rejection. Consequently, the way of overcoming the limitation of dichotomy is by taking into account the various theoretical approaches from outside Diffusion of Innovations Theory which is a less linear understanding of communication. It was suggested by Rogers (2003) that as reinvention happens at the implementation stage, so it is important to measure adoption at implementation stage. As implementation process is quite complex it should go beyond the binary logic of adoption i.e. adopt or reject. Hence, Cultural Studies (Hall, 1980; Silverstone & Haddon, 1996) and Social Learning Theory (Bandura, 1977) aid our understanding of “adoption at the implementation stage, as change that has really happened” (Rogers, 2003. Cultural Studies emphasizes the importance of interpersonal communication when

adopting innovations and consider the creativeness of an adopter during the diffusion process. As with the concept of Re-Invention, Cultural Studies point out that an innovation doesn't necessarily have to be understood and "appropriated" by the adopter in the way intended by the developer. Rather, each adopter has a unique style of appropriating a certain innovation, depending on the second point brought up Cultural Studies: the negotiation of meaning. Social learning theory research into diffusion at the implementation stage involves analysis of the spread of certain forms of behavior. Social Learning Theory is based on the idea of vicarious learning (i.e., adopting certain forms of behavior) by observing modeled behavior supported by different motivational aspects.

Integrated Theory of Diffusion and Adoption (ITDA)

Considering all the above points we have constructed a framework called the Integrated Theory of Diffusion and Adoption (ITDA) (Fig 1). This framework integrates the recent theories of adoption in the Roger's Innovation of Decision Process. The theory explains that social network analysis can help in studying the knowledge and particularly the persuasion stage of IDP. The decision to adopt or reject an innovation which happens at the decision stage can also be studied by complementing it with the theory of planned behavior which helps to study the intentions. Social learning theory and cultural study will help to study the implementation stage where reinvention of the innovations takes place.

CONCLUSION

Diffusion of Innovation theory has been the basis of various adoption studies in agriculture and still it holds its relevance. Although centennial in age, it is undergoing major theoretical and methodological evolutions in the recent times. These are driven by influences from SNA—as the complementary approach most considered within Diffusion of Innovations Theory so far—but also from socialpsychological behavior theories, Cultural Studies, Uses-and-Gratifications and Sociology of Technology(von Pape et al, 2009). Hence, the present paper is an attempt to integrate the newer relevant theories in IDP to robustly examine the adoption of Agromet advisories services by farmers. An Integrated Theory of Diffusion and Adoption (ITDA) have been proposed as a theoretical

framework to study the adoption process in agriculture. It will help the academicians and researchers to incorporate various dimensions to study the adoption process.

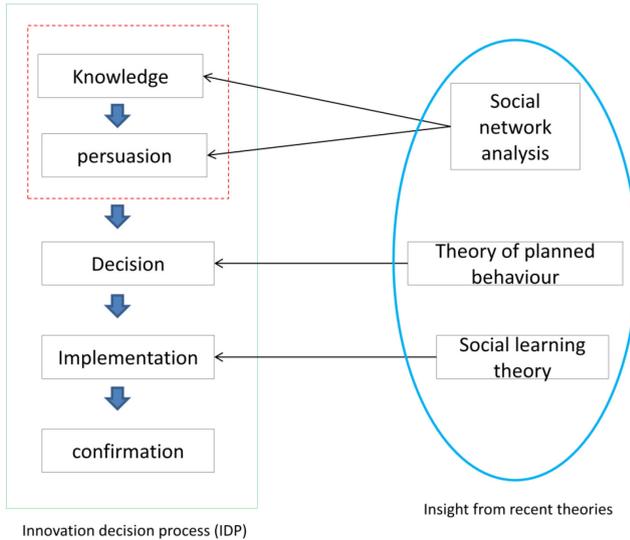


Fig 2. Integrated Theory of Diffusion and Adoption (ITDA)

Source: Authors

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Capacity Building Program for Improving Water Use Efficiency – Drip Irrigation Case Study from Tamil Nadu State

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INTRODUCTION

Though the potential benefits generated by the drip irrigation method are apparent, the adoption of drip irrigation is yet to be widely promoted across different regions and states in India. Several factors such as huge initial investment, small size of holding, lack of technical support, nature of cropping pattern, access to water and socio-economic conditions of farmers etc. (Namaract al, 2005, Suresh Kumar, 2012) are constraining adoption of drip irrigation. In some cases, even after the adoption of drip irrigation, the farmers, particularly, the small farmers have often discontinued use of drip irrigation for several reasons such as due to lack of maintenance, irrelevant cultural background, and unreliable water supply (Kulecho and Weatherhead, 2005). A study in Coimbatore district of Tamil Nadu found that huge initial investment and small size of holding are the major constraints limiting the adoption of drip technology (100 percent of farmers), lack of access to subsidy (46.87 percent of famers) and lack of technical support for follow up action (28.85 percent of farmers) (Suresh Kumar, 2008).

The Intervention- The drip capacity building program

To minimise dis-adoption rate of drip irrigation by farmers International Water Management Institute (IWMI) under its IWMI-

TATA program initiated efforts at addressing those issues which lead to dis-adoption of drip technology by farmers. A capacity building program TND RIP was undertaken in selected districts in Tamilnadu. The drip irrigation capacity building and management initiative for maximizing productivity and income (TND RIP initiative) was implemented in Coimbatore district, Tamil Nadu state, India during 2010 in 100 villages covering about 800 farmers who had adopted drip fertigation technology for various crops. The drip farmers were selected randomly for the training program 25 one day training programs, were organized in 25 villages of Coimbatore district. The training was imparted through lectures, field demonstrations and question – answer sessions between the resource persons and the trainees.

The contents of the training mainly focused on the operation and maintenance practices of drip irrigation system besides fertigation and irrigation scheduling practices. In addition, the farmers were given hand outs (in Tamil version) regarding fertigation demonstration, cleaning sand filters, cleaning the PVC pipes (sub-mains and laterals), cleaning the screens and disc filters, and cleaning the drip system using acid. Tamil booklets regarding drip fertigation and irrigation scheduling to crops and farmers cost of cultivation under precision farming in Tamil Nadu were also given to the trainee farmers. This helped the farmers in a big way to learn the drip and fertigation technologies and their maintenance. The TND RIP project work was completed in Coimbatore district by the end of 2011.

The study was conducted in the Coimbatore district of Tamil Nadu state where the TND RIP capacity building program was conducted during 2009-2011. In order to examine the impact of capacity building program on resource use, agricultural production and awareness and adoption of drip and maintenance practices, the drip farmers who participated in the capacity building program were studied. Of the total 800 drip farmers trained, employing random sampling procedure, 500 trained farmers from 25 villages covering 10 blocks were selected and studied. This is about 62 percent of the total farmers trained. In order to make comparative study, 250 drip farmers who have not participated in the capacity building program were also selected and studied as control. Thus, a sample of 750 farmers was studied for the purpose. The needed information from the respondent group was gathered by personally administering the interview schedule. The primary

information collected from the farm households included details on the well investment, groundwater use, extraction and management, crop production including input use and output realised, adoption of drip irrigation and investment on drip irrigation. In addition, the details on the trainings attended, subject matter learnt during the training program were collected from the respondents. The base line data (before the program) were collected during October 2009 and post project data were collected during November 2011 one year after the implementation of the TNDRIP capacity building program thus allowing sufficient time to see the impact of the training on the farmer's drip irrigation and crop production practices. A resurvey was also done during March 2012 to validate the data collected in 2011.

Impact of the Program

Between 5 to 65 percent of the trainees had begun to adopt various drip maintenance practices after attending the training program (Table 1). Few practices were adopted by a relatively higher proportion. These practices were cleaning the laterals (65%), cleaning the sub-mains (58%) and thatching the drip system (41%). The importance of these three maintenance practices was felt by the farmers due to their participation in the training. Hence a considerable proportion of the trainees had adopted these practices immediately after the training. More than one-third of farmers had begun to adopt the practices such as pressure regulation (39%), cleaning the filters (37%) and placing the laterals in shade (32%). Those farmers who were offered the pressure gauge apparatus sourced from the project were found to adopt the practice of regulating the pressure in the drip laterals. Cleaning the filters regularly once in two days, was also adopted by the farmers as a result of their learning and conviction from the training program. A considerable proportion of the trainees had expressed their intention to adopt the practices namely keeping the laterals under shade (56%), pressure regulation (53%) and acid treatment (45%). Rest of the practices were intended for adoption in near future by about one-fifth of the trainees. Probably the appropriate time/stage of the crop in the field and level of conviction over the practices limited the adoption of maintenance practices immediately by the farmers.

Table 1. Response to the drip training program

Practices	Practicing prior to training		Began to practice after attending the training		Intend to practice in future	
	No.	%	No.	%	No.	%
Fertigation*	78	52	40	26.7	32	21.3
Cleaning screen/disc filter	64	42.7	56	37.3	30	20
Cleaning sand filter	..	..	..	..	..	..
Cleaning sub mains	22	14.7	88	58.7	40	26.7
Cleaning laterals	22	14.7	98	65.3	30	20.0
Acid treatment	10	6.7	32	21.3	68	45.3
Pressure regulation	..	..	59	39.3	79	52.7
Thatching the drip systems	32	21.3	62	41.3	46	30.7
Valve protection	18	12.0	12	8.0	40	26.7
Laterals in shade	8	5.3	48	32.0	84	56.0
Irrigation scheduling	..	..	7	4.7	40	26.7

*Fertigation was followed without scientific basis and after the training these farmers used to adopt the fertigation in a scientific manner.

During the survey it was also found that the protection of valve in the drip system from physical damage needs considerable amount of money towards labour to undertake structural modifications in the drip system and hence half of the farmers were not ready to adopt the practice. One-fourth of the farmers were reluctant to adopt the acid treatment practice for want of investment on the venturi unit without

which the technology can't be adopted. The overall picture indicates that the TNDRI training has made significant impact among farmers to adopt the drip maintenance practices in varied proportions. Practices such as cleaning the filters, sub-mains and laterals, pressure regulation, acid treatment, thatching the drip system, placing the laterals in shade etc., were either adopted or intended to be adopted by a majority of the farmers as a result of their participation in the training.

The two types of farmers were compared to make an assessment of the net impact due to capacity building program (Table 2). For instance, the yield of banana-1 is 45.9 t/ha for the control (non-participating) farmers before the capacity building training period. The yield of banana-1 for the same set of farmers after the capacity building training period is 47.7 t/ha, thus the increase in yield of banana-1 among the farmers who have not participated in the capacity building program is 1.8 t/ha.

Table 2. Crop yields under drip training and no training

Crops	Type of farmers	Number of farmers	Mean yield (t/ha)	Minimum yield (t/ha)	Maximum yield (t/ha)	Std Dev.
Banana 1	Control-Before	172	45.9	37.1	57.3	3.8
	Control-After	172	47.7	38.5	66.7	4.6
	Trained-Before	172	65.2	55.6	85.0	3.6
	Trained-After	172	69.6	55.3	94.2	4.6
Banana 2	Control-Before	93	22.3	17.3	59.3	4.4
	Control-After	93	25.1	18.0	31.9	24.2
	Trained-Before	93	32.5	29.1	79.0	5.2
	Trained-After	93	37.1	29.9	42.4	10.0
Sugarcane	Control-Before	198	116.3	98.8	143.3	10.3
	Control-After	198	120.0	98.8	145.7	9.9
	Trained-Before	198	153.6	123.5	182.8	15.2
	Trained-After	198	160.3	130.9	192.7	15.5

Turmeric	Control-Before	91	6.3	5.2	8.3	0.8
	Control-After	91	6.4	5.2	9.4	0.9
	Trained-Before	91	8.7	6.9	11.4	1.4
	Trained-After	91	9.0	7.1	13.6	1.4

Note: Banana-1 : Variety Robusta; Banana-2 : Variety Nendran

The impact of the drip capacity building program in terms of yield increase was 2.5 t/ha for Banana 1, 1.8 t/ha for Banana 2, 3.3 t/ha for sugarcane and 0.3 t/ha for turmeric (Table 3).

Table 3. Comparison of crop yields under drip and drip capacity building program

Crops	Increase in yield of drip farmers without training (t/ha)	Increase in yield of drip farmers with training (t/ha)	Impact of training on crop yield (t/ha)
Banana 1	1.8	4.3	2.5
Banana 2	10.2	12.0	1.8
Sugarcane	37.2	40.6	3.3
Turmeric	2.4	2.6	0.3

Scaling up

Drip capacity building program has produced a significant impact on yield of crops such as banana and sugarcane. Compared to the cost of the training (Rs. 110/ha), the additional yield has resulted in an additional per ha gross margin of Rs.14000/-, Rs.32015/-, Rs.1650/-, and Rs.14893/- respectively under Banana 1, Banana 2, Sugarcane and turmeric. Given this cost effectiveness of the capacity building programs, it is suggested to introduce more number of drip capacity building programs across regions where drip irrigation is being practiced. This will further have multiplier impact in terms of bringing new farmers under drip irrigation as well as effective use of fertilizers.

Sir Ratan Tata Trust (SRTT) has extended the TNDRI program for another 3 years to cover more districts in the state (2013-2015). It is expected that number of farmers to be covered will be around 10,000. The spill over impact (off shore impact) will be about 50,000 farmers (at the rate of 5 farmers covered per trained farmer).

The drip suppliers should come forward to incorporate the training component as one of the main components of the drip installation program.

All stakeholders (i.e., drip manufacturers, govt departments (agriculture, horticulture particularly NHM, agroforestry, local dealers and farmers) should be involved in the scaling up and scaling out of the drip capacity building programs. Policies such as Drip Promotional Initiatives (targeting higher drip area and crop productivity) can be initiated in each state by developing public private partnership involving all the stakeholders.

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Data Processing and Analysis in Social Science Research

Preethi and Pankaja Manjunatha H.K.

INTRODUCTION

The data need to be processed and analyzed in accordance with the research outline laid down for the purpose at the time of developing the program plan. The data collected for research in social sciences generally require some processing before its analysis. These processing tools should be thought of at the time of preparing the instruments for data collection which shall ultimately save time and labor in processing data. Analysis is done to convert data to intelligible and interpretable form so that the research problems can be studied and tested. Keeping these aspects in view, the present study was carried out with the objective to review the Data analysis techniques used for Master's, Doctoral research in Agricultural Extension Department of UAS, GKVK, Bangalore and UAS, Dharwad.

Data Processing, Data Analysis - Concept

Data processing is the process through which facts and figures are collected, assigned meaning, communicated to others and retained for future use. Hence, we can define data processing as a series of actions or operations that converts data into useful information. We use the term 'data processing system' to include the resources that are used to accomplish the processing of data.

Data Analysis means it is the process of considering something carefully or using statistical methods in order to understand it or explain it. Analysis is the scientific process of examining something in order to find out what it consists of or examine in detail.

Elements of Data Processing

Various procedures can be applied on the data to get useful information. Data processing may involve various processes viz. data summarization, data aggregation, data validation, data tabulation and statistical analysis.

Data Processing Activities

1. **Editing:** Editing of data is a process of examining the collected raw data (specially in surveys) to detect errors and omissions and to correct these when possible. As a matter of fact, editing involves a careful scrutiny of the completed questionnaires and/or schedules. Editing is done to assure that the data are accurate, consistent with other facts gathered, uniformly entered, as complete as possible and have been well arranged to facilitate coding and tabulation. With regard to points or stages at which editing should be done, one can talk of field editing and central editing.
 - Editors must keep in view several points while performing their work:
 - (a) They should be familiar with instructions given to the interviewers and coders as well as with the editing instructions supplied to them for the purpose.
 - (b) While crossing out an original entry for one reason or another, they should just draw a single line on it so that the same may remain legible.
 - (c) They must make entries(if any) on the form in some distinctive color and that too in a standardized form.
 - (d) They should initial all answers which they change or supply.
 - (e) Editor's initials and the date of editing should be placed on each completed form or schedule.
2. **Coding:** Coding refers to the process of assigning numerals or other symbols to answers so that responses can be put into a limited number of categories or classes. Such classes should be appropriate to the research problem under consideration. They must also possess the characteristic of exhaustiveness (i.e., there

must be a class for every data item) and also that of mutual exclusivity which means that a specific answer can be placed in one and only one cell in a given category set. Another rule to be observed is that of uni-dimensionality by which means that every class is defined in terms of only one concept. Coding is necessary for efficient analysis and through it the several replies may be reduced to a small number of classes which contain the critical information required for analysis. Coding decisions should usually be taken at the designing stage of the questionnaire. This makes it possible to precode the questionnaire choices and which in turn is helpful for computer tabulation as one can straightforward key punch from the original questionnaires. But in case of hand coding some standard method may be used. One such standard method is to code in the margin with a coloured pencil. The other method can be to transcribe the data from the questionnaire to a coding sheet. Whatever method is adopted, one should see that coding errors are altogether eliminated or reduced to the minimum level.

3. **Classification:** Most research studies result in a large volume of raw data which must be reduced into homogeneous groups if we are to get meaningful relationships. This fact necessitates classification of data which happens to be the process of arranging data in groups or classes on the basis of common characteristics. Data having a common characteristic are placed in one class and in this way the entire data get divided into a number of groups or classes.
4. **Tabulation:** When a mass of data has been assembled, it becomes necessary for the researcher to arrange the same in some kind of concise and logical order. This procedure is referred to as tabulation. Thus, tabulation is the process of summarizing raw data and displaying the same in compact form (i.e., in the form of statistical tables) for further analysis. In a broader sense, tabulation is an orderly arrangement of data in columns and rows.

Tabulation is essential because of the following reasons.

- It conserves space and reduces explanatory and descriptive statement to a minimum.
- It facilitates the process of comparison.

- It facilitates the summation of items and the detection of errors and omissions.
- It provides a basis for various statistical computations.

Some Problems in Processing

We can take up the following two problems of processing the data for analytical purposes:

(a) The problem concerning “Don’t know” (or DK) responses: While processing the data, the researcher often comes across some responses that are difficult to handle. One category of such responses may be ‘Don’t Know Response’ or simply DK response. When the DK response group is small, it is of little significance. But when it is relatively big, it becomes a matter of major concern in which case the question arises: Is the question which elicited DK response useless? The answer depends on two points viz., the respondent actually may not know the answer, or the researcher may fail in obtaining the appropriate information. In the first case the concerned question is said to be alright and DK response is taken as legitimate DK response. But in the second case, DK response is more likely to be a failure of the questioning process. How DK responses are to be dealt with by researchers? The best way is to design better type of questions. Good rapport of interviewers with respondents will result in minimizing DK responses. But what about the DK responses that have already taken place? One way to tackle this issue is to estimate the allocation of DK answers from other data in the questionnaire. The other way is to keep DK responses as a separate category in tabulation where we can consider it as a separate reply category if DK responses happen to be legitimate, otherwise we should let the reader make his own decision. Yet another way is to assume that DK responses occur more or less randomly and as such we may distribute them among the other answers in the ratio in which the latter have occurred. Similar results will be achieved if all DK replies are excluded from tabulation and that too without inflating the actual number of other responses.

(b) Use of percentages: Percentages are often used in data presentation for they simplify numbers, reducing all of them to a 0 to 100 range. Through the use of percentages, the data are reduced in the standard form with base equal to 100 which fact facilitates relative comparisons.

While using percentages, the following rules should be kept in view by researchers:

1. Two or more percentages must not be averaged unless each is weighted by the group size from which it has been derived.
2. Use of too large percentages should be avoided, since a large percentage is difficult to understand and tends to confuse, defeating the very purpose for which percentages are used.
3. Percentages hide the base from which they have been computed. If this is not kept in view, the real differences may not be correctly read.
4. Percentage decreases can never exceed 100 percent and as such for calculating the percentage of decrease, the higher figure should invariably be taken as the base.
5. Percentages should generally be worked out in the direction of the causal-factor in case of two-dimension tables and for this purpose we must select the more significant factor out of the two given factors as the causal factor.

Statistical Package for Data Analysis in Social Sciences

- SPSS is a computer program used for survey authoring and deployment (IBM SPSS Data Collection), data mining (IBM SPSS Modeler), text analytics, statistical analysis, and collaboration and deployment (batch and automated scoring services)
- SPSS (originally, Statistical Package for the Social Sciences) was released in its first version in 1968 after being developed by Norman H. Nie and C. Hadlai Hull.
- SPSS is among the most widely used programs for statistical analysis in social science. It is used by market researchers, health researchers, survey companies, government, education researchers, marketing organizations and others.
- In addition to statistical analysis, data management (case selection, file reshaping, creating derived data) and data documentation (a metadata dictionary is stored in the data file) are features of the base software.

- MS Excel – Microsoft Excel
- Minitab
- SAS – Statistical Analysis software/system
- BMDP – Biomedical Package
- GENSTAT – General Statistical package
- STATA
- m-stat
- E-views
- Applets

Statistics included in the base software:

- Descriptive statistics: Cross tabulation, Frequencies, Descriptive, Explore, Descriptive Ratio Statistics
- Bivariate statistics: Means, t-test, ANOVA, Correlation (bivariate, partial, distances), Nonparametric tests
- Prediction for numerical outcomes: Linear regression
- Prediction for identifying groups: Factor analysis, cluster analysis (two-step, K-means, hierarchical), Discriminant Function analysis
- Percentage: It is used to make the simple comparison of different groups wherever needed
 - Mean and SD: It is used for grouping the respondents
 - Frequency: It is used to quantify dependent variable considered in the study
 - Correlation: Correlation is used to determine the relationship between two variables. Relationship between two variables is known as simple correlation and relationship between more than two variables is known as multiple correlation. Range of correlation is between -1 to +1
 - Chi square test: It is applicable when number of objects falls into various categories. It is suitable for analyzing the data of nominal type and measure the association between

two groups. This test is done either at 5% or 1% level of significance.

- T-test: It is done to test the significance difference between 2 means or to compare the mean of two independent groups.
- F-test: It is used to test the significance between two variances.
- Regression: It is used to measure the magnitude of relationship between the variables.

Analysis of awareness on usage of MS-Excel and Minitab for Data Analysis

An attempt was made to analyze the awareness of social science students and teachers on usage of various software for Data Analysis. Schedule was developed consisting of components like General Information viz, age, sex, department and designation, Awareness of different software and particular details of MS Excel and Minitab as these software were considered for the present seminar. Data was collected from 20 staff and 60 students totally 80 respondents. Purposively respondents from Social science (Agricultural Extension, Agricultural Economics and Agricultural Marketing) were selected. The Results of this study are depicted in the following tables.

Table 1. General information of Respondents (N = 80)

Particulars	Categories	Students (n ₁ = 60)		Categories	Staff (n ₂ = 20)	
		No.	%		No.	%
1. Sex	Male	24	40.0	Male	18	90.0
	Female	36	60.0	Female	2	10.0
2. Department	Extension	28	46.7	Extension	10	50.0
	Economics	20	33.3	Economics	5	25.0
	Marketing	12	20.0	Marketing	5	25.0

3. Age (years)	22-23	30	50.0	46-55	7	35.0
	24-25	14	23.3	>55	13	65.0
	>25	16	26.7			
4. Designation	Ph.D.	20	33.3	Professor	13	65.0
	M.Sc.	40	66.7	Associate Professor	5	25.0
				Assistant Professor	2	10.0

Data in Table 1 indicates that majority (60.0%) of the student respondents were female, (46.7%) of Extension department, (50%) 22-23 years aged, M.Sc. holders and ninety percent of staff respondents were male, (50%) extension department, (65%) more than 55 years of age, (65%) were professors.

Table 2. Awareness and Usage of Statistical software for Data Analysis (N = 80)

Software	Don't Know (%)		Heard about this software (%)		Know to use this software (%)		Using/used this software for analysis (%)	
	n ₁ =60	n ₂ =20	n ₁ = 60	n ₂ =20	n ₁ = 60	n ₂ =20	n ₁ = 60	n ₂ =20
	Students	Staff	Students	Staff	Students	Staff	Students	Staff
MS-Excel	0.0	0.0	100.0	100.0	98.0	90.0	83.0	60.0
Minitab	25.0	35.0	75.0	65.0	23.0	20.0	13.0	5.0
SPSS	12.0	10.0	88.0	90.0	46.0	45.0	36.0	40.0
SAS	35.0	25.0	65.0	75.0	15.0	15.0	7.0	10.0
Mstat	60.0	45.0	39.0	55.0	3.0	10.0	0.0	10.0
Others	90.0	85.0	10.0	15.0	10.0	10.0	10.0	10.0

(* Multiple Response Format)

Table 2 indicates that all the respondents (student respondents and staff respondents) were aware of the MS Excel software and also regarding usage of it for Data Analysis. The next well-known software was found to be SPSS.

Table 3. Usage of MS-Excel for Data Analysis (N = 80)

Statistical Tests	Don't Know (%)		Manually (%)		Using defined functions in excel (%)	
	n ₁ =60	n ₂ =20	n ₁ = 60	n ₂ =20	n ₁ = 60	n ₂ =20
	Students	Staff	Stu- dents	Staff	Stu- dents	Staff
Sum, Difference	0.0	10.0	7.0	25.0	93.0	60.0
Mean, SD	0.0	10.0	18.0	30.0	82.0	60.0
Chi-square test	3.0	35.0	43.0	15.0	54.0	50.0
t-test	3.0	45.0	43.0	15.0	54.0	45.0
Correlation	2.0	20.0	38.0	20.0	60.0	60.0
Regression	3.0	20.0	40.0	20.0	57.0	60.0
Others	93.0	90.0	0.0	0.0	7.0	10.0

The results in Table 3 indicated that majority of the respondents were using the defined functions in Excel for analysis of sum, difference, mean, SD, correlation and regression. As these were the major tests that will be used, most of the researchers are aware of these tests as well as the procedure in Excel to apply these tests.

Table 4. Usage of Minitab for Data Analysis (N = 80)

Statistical Tests	Don't Know (%)		Manually (%)		Using defined functions in Minitab (%)	
	n ₁ =60	n ₂ =20	n ₁ = 60	n ₂ =20	n ₁ = 60	n ₂ =20
	Stu- dents	Staff	Stu- dents	Staff	Stu- dents	Staff
Sum, Difference	40.0	70.0	43.0	25.0	17.0	5.0
Mean, SD	42.0	70.0	45.0	25.0	13.0	5.0

Chi-square test	50.0	80.0	38.0	20.0	12.0	0.0
t-test	50.0	85.0	38.0	15.0	12.0	0.0
Correlation	47.0	80.0	42.0	15.0	11.0	5.0
Regression	47.0	75.0	40.0	15.0	13.0	10.0
Others	100.0	95.0	0.0	0.0	0.0	5.0

It can be reported from table 4 that most of them are not aware of this software itself as well the procedure to be carried out for performing data analysis. The probable reason behind this may be the students and staff are using MS Excel and SPSS for doing data analysis.

Review of Data Analysis tools used in Master's and Doctoral Research in UAS(B) and UAS(D)

An attempt was made to find out the data analysis techniques used in PG studies of UAS(B) and UAS(D). A total of 231 M.Sc., 63 Ph.D. thesis of UAS(B) and 48 M.Sc., 10 Ph.D. thesis of UAS(D) was analyzed for the purpose and the results are as follows:

Table 5. Data Analysis techniques used in the Master Degree studies, Department of Agricultural Extension, UAS, Bangalore

UAS(B) MSc		1991-2005		2006-2014		Total	
N		n1=132		n2=99		N=231	
Parametric Tests		No.	%	No.	%	No.	%
1	Frequency	132	100.00	99	100.00	231	100.00
2	Mean	60	45.45	89	89.90	149	64.50
3	Standard deviation	55	41.67	84	84.85	139	60.17
4	Percentage	132	100.00	99	100.00	231	100.00
5	Correlation	86	65.15	66	66.67	152	65.80
6	Multiple correlation	0	0.00	1	1.01	1	0.43
7	Regression	21	15.91	23	23.23	44	19.05

8	Multiple regression	46	34.85	31	31.31	77	33.33
9	Pearson product moment correlation	8	6.06	4	4.04	12	5.19
10	Path analysis	1	0.76	0	0.00	1	0.43
11	t-test	25	18.94	13	13.13	38	16.45
12	paired t-test	8	6.06	10	10.10	18	7.79
13	Z-test	0	0.00	2	2.02	2	0.87
14	ANOVA	9	6.82	3	3.03	12	5.19
15	Median test	5	3.79	0	0.00	5	2.16
16	Ranks	3	2.27	5	5.05	8	3.46
17	Factor analysis	3	2.27	0	0.00	3	1.30
18	Discriminant factor analysis	1	0.76	0	0.00	1	0.43
19	Time series analysis	1	0.76	1	1.01	2	0.87
20	Logistic Regression analysis	2	1.52	0	0.00	2	0.87
21	Co-efficient of variation	1	0.76	0	0.00	1	0.43
Non-Parametric tests							
22	Chi-square	60	45.45	50	50.51	110	47.62
23	contingency co-efficient	6	4.55	3	3.03	9	3.90
24	Kruskal Wallis one-way ANOVA	4	3.03	1	1.01	5	2.16
25	Principal component Analysis	1	0.76	0	0.00	1	0.43
26	Sign test	0	0.00	1	1.01	1	0.43

27	Wilcoxon Rank sum test	2	1.52	0	0.00	2	0.87
28	Mann-Whitney U test	4	3.03	1	1.01	5	2.16
29	Kendall's co-efficient of concordance	5	3.79	1	1.01	6	2.60
30	Contingent valuation method	1	0.76	0	0.00	1	0.43

Table 6. Data Analysis techniques used in the Master Degree Studies, Department of Agricultural Extension, UAS, Dharwad

	UAS(D)M.Sc.	2004-2007		2008-2010		Total	
	N	n1 =24		n2=24		N=48	
	Parametric Tests	No.	%	No.	%	No.	%
1	Frequency	21	87.50	21	87.50	42	87.50
2	Mean	15	62.50	15	62.50	30	62.50
3	Standard deviation	15	62.50	15	62.50	30	62.50
4	Percentage	24	100.00	24	100.00	48	100.00
5	Correlation	13	54.17	10	41.67	23	47.92
6	Regression	3	12.50	0	0.00	3	6.25
7	Multiple regression	2	8.33	0	0.00	2	4.17
8	t-test	3	12.50	3	12.50	6	12.50
9	Z-test	1	4.17	0	0.00	1	2.08
10	Discriminant factor analysis	1	4.17	0	0.00	1	2.08
	Non-Parametric tests						
11	Chi-square	2	8.33	2	8.33	4	8.33
12	Wilcoxon Rank sum test	1	4.17	0	0.00	1	2.08

Table 7. Data Analysis techniques used in Doctoral Degree Studies, Department of Agricultural Extension, UAS, Bangalore

UAS(B)PhD		1990-2005		2006-2013		Total	
N		n1 =41		n3=22		N=63	
Parametric Tests		No.	%	No.	%	No.	%
1	Frequency	12	29.27	6	27.27	18	28.57
2	Mean	21	51.22	17	77.27	38	60.32
3	Standard deviation	19	46.34	18	81.82	37	58.73
4	Percentage	30	73.17	18	81.82	48	76.19
5	Standard normal variate	1	2.44	0	0.00	1	1.59
6	Correlation	34	82.93	11	50.00	45	71.43
7	Multiple correlation	4	9.76	1	4.55	5	7.94
8	Regression	27	65.85	9	40.91	36	57.14
9	Multiple regression	14	34.15	9	40.91	23	36.51
10	Pearson product moment correlation	11	26.83	5	22.73	16	25.40
11	Path analysis	12	29.27	3	13.64	15	23.81
12	t-test	13	31.71	5	22.73	18	28.57
13	Paired t-test	3	7.32	6	27.27	9	14.29
14	ANOVA	12	29.27	2	9.09	14	22.22
15	Critical difference	1	2.44	0	0.00	1	1.59
16	Measures of Normal distribution	1	2.44	0	0.00	1	1.59
17	Ranks	1	2.44	0	0.00	1	1.59

18	Bivariate frequency distribution	1	2.44	0	0.00	1	1.59
19	Factor analysis	2	4.88	2	9.09	4	6.35
20	Discriminant factor analysis	11	26.83	1	4.55	12	19.05
21	Neuman Keuls Multiple Range test	1	2.44	0	0.00	1	1.59
22	Proportion test	1	2.44	0	0.00	1	1.59
23	Co-efficient of variation	2	4.88	0	0.00	2	3.17
24	Multiple Discrimination Analysis	1	2.44	0	0.00	1	1.59
25	Multivariate path co-efficient Analysis	1	2.44	1	4.55	2	3.17
	Non-Parametric tests						
26	Chi-square	17	41.46	17	77.27	34	53.97
27	contingency co-efficient	4	9.76	1	4.55	5	7.94
28	Kruskal Wallis one-way ANOVA	2	4.88	0	0.00	2	3.17
29	Principal component Analysis	0	0.00	4	18.18	4	6.35
30	Mann-Whitney U test	4	9.76	0	0.00	4	6.35
31	Kendall's co-efficient of concordance	1	2.44	0	0.00	1	1.59

Table 8. Data Analysis techniques used in Doctoral Degree Studies, Department of Agril. Extension, UAS, Dharwad

UAS(D)PhD		2004		2005-06		Total	
N		n1 =7		n2=3		N=10	
Parametric Tests		No.	%	No.	%	No.	%
1	Frequency	5	71.43	2	66.67	7	70.00
2	Mean	3	42.86	1	33.33	4	40.00
3	Standard deviation	4	57.14	1	33.33	5	50.00
4	Percentage	6	85.71	3	100.00	9	90.00
5	Correlation	3	42.86	2	66.67	5	50.00
6	Regression	3	42.86	1	33.33	4	40.00
7	Multiple regression	0	0.00	1	33.33	1	10.00
8	Path analysis	2	28.57	1	33.33	3	30.00
9	t-test	1	14.29	1	33.33	2	20.00
10	Z-test	1	14.29	0	0.00	1	10.00
11	Discriminant factor analysis	1	14.29	0	0.00	1	10.00
	Non-Parametric tests		0.00		0.00	0	0.00
12	Chi-square	3	42.86	0	0.00	3	30.00

Data in Table 5 and 7 indicating PG research conducted in the Department of Agricultural Extension, UAS(B) revealed that majority of the M.Sc. researchers have used mean, standard deviation, correlation, regression (parametric tests), chi-square and contingency-co efficient (non-parametric tests) for data analysis whereas in Doctoral research along with the above tests they also applied path analysis and t-test.

The PG research conducted in the Department of Agricultural Extension, UAS(D) as depicted in Table 6 and 8 revealed that majority of the M.Sc. researchers have used mean, standard deviation, correlation (parametric tests), chi-square (non-parametric tests) for data analysis whereas in Doctoral research along with the above tests they also applied path analysis.

CONCLUSION

Data processing is the act of handling or manipulating data in desired fashion. Regardless of the activities involved in it, processing tries to assign full extent meaning to data. Thus, the ultimate goal of processing is to transform data into appropriate information. As it is the step at which we arrive at valid results, it is to be carried out with care by applying appropriate statistical tools and techniques suitable for the research topic.

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13

Analysis of Rural Youth in Indian Agriculture – An Overview

Radhakrishnan P. and Murugan P.P.

INTRODUCTION

There are over 1.8 billion young people in the world today, 90 per cent of whom live in developing countries, where they tend to make up a large proportion of the population (www.unfpa.org). Current population of India with 1.27 billion people is the second most populous country in the world. Tamil Nadu population according to the 2011 census is about 7.2 crore. More than half of them live in villages, although Tamil Nadu is fast becoming an urban state. More than half of the state population is below the age of 35. The younger generation will be interested in taking to agriculture as a profession only if agriculture becomes both economically and intellectually attractive. The future of food security in our country will depend on both the strengthening of the ecological foundations essential for sustainable agriculture, as well as attracting the educated rural youth to agriculture and allied activities such as animal husbandry, inland and marine fisheries, agro-forestry, agro-processing and agri-business.

Rural youth are migrating from rural to urban areas due to employment opportunities in urban centers and non-remunerative income from rural areas. Most of them think that they would get more employment opportunities in urban areas. If this scenario continues, all villages will be left without any youths and a village without youth will be considered as a desert, since youths are the main pillars of development. To achieve the evergreen revolution in agriculture sector, the retaining of rural youth in agriculture is one of the important tasks. Hence, this study was undertaken to know the problems of rural

youth in agriculture and identify the suggestions for retaining rural youth in agriculture.

METHODOLOGY

The study was taken up in Annur, Karamadai, Thondamuthur and Pollachi blocks of the Coimbatore district with a sample size of 200 respondents. Coimbatore district consists of twelve blocks and out of these Annur, Karamadai, Thondamuthur and Pollachi blocks were purposefully selected based on the maximum area under agricultural crops. The list of rural youth was obtained from various possible sources including State Department of Agriculture, NGO's operating in the jurisdiction and Nehru Yuva Kendra. The list of youths thus collected was arranged alphabetically and duplications were removed. The final list of rural youth was arranged alphabetically for each village. A sample of 50 youths from each block was selected by employing simple random sampling method. Thus the total sample of 200 was arrived and included in the study as the sample. By having an elaborate discussion with the planners, administrators, extension fundamentals and others directly and indirectly concerned with the development of the rural youth and also with selected rural youth members important suggestions were finalized. The response were dichotomous where 'Yes' carried a score of two and 'No' carried a score of one. Percentage analysis was done to get meaningful interpretation of the study. Data were collected using well structured and standardized interview schedule.

RESULTS AND DISCUSSION

The results are presented based on the response of the rural youth regularly on the basis of problems faced by them while engaged in agriculture.

Table 1. Problems for rural youth in agriculture n=200*

S.No	Problems	Re-spondents	Percent-age	Rank
1	Uncertainty in the nature of job	180	90.00	VIII
2	Unlimited working time	160	80.00	XII
3	Travelling distance and expenses	142	71.00	XIV
4	Expensive farm machineries	200	100	III
5	Discrimination due to language/race/caste	173	86.50	IX
6	Lack of irrigation facilities	200	100	I
7	Insufficient required inputs	190	95.00	VI
8	Price fluctuations	200	100	IV
9	Lack of extension agency contact	129	64.50	XV
10	Involvement of intermediaries in marketing	200	100	II
11	Inadequate crop insurance	200	100	V
12	Lack of village information centers	168	84.00	XI
13	Lack of knowledge about ICT	143	71.50	XIII
14	Scarcity of labour	181	90.50	VII
15	Lack of awareness about Government schemes	171	85.50	X

Multiple responses*

From the above table, it is inferred that cent percent of the rural youth reported that lack of irrigation facilities in their villages, involvement of intermediaries in marketing (100 percent), expensive farm machineries (100 percent), price fluctuations (100 percent) and inadequate crop insurance (100 percent) as constraints while engaging in agriculture.

Technological interventions in the varieties, innovative production technologies, micro irrigation systems and intensive farm mechanization for all the farm operations were felt by the rural youth in agriculture. Existence of a big gap between the farm gate price and the consumer price might be the major reason for the attitude of above the problems. Labour problem might be the major source for all these problems. On the other side, fake and poor quality of inputs supply associated with lack of required inputs as well as lack of timely availability and also for hindering the agricultural related activities have been additional problems. The rural youth in agriculture would have been analyzed for their hard work and realization of their returns in comparison of traders involved in marketing of farm produce. They would have diagnosed their own limitations of poor marketing, storages as well as poor support from the government side in terms of providing necessary infrastructure facilities and channels for securing lucrative returns from their farm. Most of the migrants in the study are temporary migrants who migrate during off-farm seasons to seek their fortune in urban centers due to uncertainty with nature of jobs. The probability of finding a suitable job with sufficient income on a temporary basis is quite difficult.

The lack of irrigation facilities may be due to the shrinking of available irrigation water and failure of monsoon routinely which forced them to seek alternate jobs in rural or urban areas. Imparting training on water management and use of improved water management practices help the rural youth to get profit in farming.

Intervention of intermediaries in market is also one of the major problems expressed by the rural youth. This is an accepted fact that the middleman always gets more benefit than the producers. Because of the non availability of good market structure, the rural youth are not able to get good remunerative price for their problems. The farmers are forced to utilize the farm mechanization due to non-availability of skilled labours in the village. But the cost of equipments (or) hire charges of farm implements were felt to be of huge cost by the rural youth. The findings are similar to the findings of Sundari and Geetha (2000) who also reported that majority of the rural youth migrated from rural area for better employment.

Majority of the respondents revealed that insufficient required inputs (95 percent) followed by scarcity of labour (90.5 percent), uncertain nature of job (90 percent), discrimination due to

language/race/caste (86.5 percent), lack of awareness about government schemes (85.50 percent), lack of village information centers (84.00 percent), unlimited working time (80.00 percent), lack of knowledge about ICT (71.50 percent), travelling distance and expenses (71.00 percent), lack of extension agency contact (64.50 percent) caused problem.

Similarly, the findings are similar to the findings of Ramasubramanian (2003) who also found out that unemployment or lesser employment (87.33%), frequent crop failures due to aberrant monsoons (84.50%), low level of income (83.09%) and lower wages (67.61%) were the major push factors reported by the migrants. Smaller land holdings (45.07%) and discrimination or inequality (40.85%) also were reported by a substantial number of respondents as push factors.

Farooq et al. (2005) also reported that 35.00 percent and 50.00 percent of the respondents' relatives migrated from rural areas due to low paying jobs and poor economic opportunities at the place of origin respectively. Moreover, 15.00 percent of the respondents reported that their relatives migrated due to being relegated to surplus labour from agriculture.

The suggestions were also obtained from the respondents to overcome the constraints to retaining rural youth in agriculture. The findings are given in table 2.

Table 2. Suggestion for retainings rural youth in agriculture (n=200)*

Sl. No	Suggestions	No.	Percentage
1	Rejuvenation of rural youth clubs	190	95.00
2	Timely input supply	166	83.00
3	Making rural youth as successful agricultural entrepreneurs	182	91.00
4	Creation of infrastructure facilities in the village	174	87.00
5	ICT based transfer of technology in agriculture	162	81.00

6	Establishment of farm machinery hub	158	79.00
7	Need for improved irrigation water management practices	195	97.50
8	Regular visit of extension official on fixed date	138	69.00
9	To develop climate resilient technologies	130	65.00
10	Regulation of prices and distribution of inputs	122	61.00
11	Strengthening of ICT in agriculture development (e-governance)	114	57.00
12	Training on current trends in agriculture	103	51.50
13	Remunerative price for farm produce	183	91.50
14	Bank loans on subsidy basis	190	95.00

Multiple responses*

Majority of the respondents (97.50 percent) suggested the need for improved water management practices in agriculture for their income generating activities. 95.00 percent of the respondents revealed that formation of rural youth clubs to develop their skill, knowledge, motivational factors etc. was necessary. Most of the respondents, 95.00 percent, suggested that they required bank loans on subsidy basis for developing and strengthening their agriculture and allied activities. With regard to price for farm produce 91.50 percent of the respondents reported that they needed to know the regular market price. Majority of the respondents (91.00 percent) expressed that need for making agriculture as business instead of agriculture as their way of life. They also insisted the need for a holistic approach to educate other people on agripreneurship.

This may be due to that improve proper and adequate water facilities, the commercial or sustainable agriculture practices may not be provide availability water decider the agriculture activities in any areas. Hence, majority of the respondents need improved water management practices in agriculture and agribusiness.

Borewell is a major source of irrigation for beneficiaries and non-beneficiaries who need to cultivate paddy, so it is necessary to have some water source for irrigation. The findings are similar to the results obtained by Sathish (2010) in his study.

Most of the respondents (87 percent) suggested to have good infrastructure facilities in the village like a community hall, library, hospitals, panchayat building etc., Timely input supply on suggestion expressed by 83 percent of the respondents. 81 percent of the respondents expressed that ICT based transfer of technology in agriculture to update their knowledge, recent agricultural technology, portals and websites were required. Establishment of farm machinery hub in the villages was also one of the important suggestions offered by 79 percent of rural youth.

Majority of the respondents 69.00 percent of the respondents expressed the need for regular visit of extension officials on fixed dates every month. This would help the rural youth to have regular contacts and the information on agriculture and allied activities. Regular visit of extension officials help the rural youth to gain confidence in agriculture and to get timely advisory. With regard to climate resilient technology, 65.00 percent of the respondents reported that climate might be the limiting factor in farming which causes unexpected crop damages to the farm produce.

More than half percentage of the respondents suggested to strengthening of ICT in agriculture development. They might have thought preciousness of time in taking up different farm operations for which ICT was made appropriate to meet the needs of youth in agriculture. With regard to training and development, 51.50 percent of the respondents have felt that they required to have capacity-building activities in the form of training programmes, method demonstrations, result demonstration, exposure visits etc., in various agriculture related activities which will develop and strengthen the potential of youth capacity to perform profitable agriculture.

CONCLUSION

On the basis of the above observations, it could be concluded that rural youth in agriculture are facing multifaceted problems with no proper solutions. In spite of their problems they youth in agriculture are striving hard and smart to overcome the problems of agriculture in India. The problem experienced by rural youth while doing agriculture

should be addressed through appropriate extension methods, policy, schemes and services to rural youth can be retained in agriculture. Suggestions quoted by the rural youth in agriculture must be thoroughly examined by all the stakeholders while framing policies, schemes, services for the benefit especially for rural youth farming community and these should be addressed as one of the important activities to retain the rural youth in agriculture.

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Promotion of Nutri Gardens among Tribal Households

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INTRODUCTION

In spite of noticeable growth in Gross Domestic Product (GDP), malnutrition rate in India is increasing day by day in rural areas, especially in tribal areas. India has one of the largest tribal concentrations in the world. Prior to the adoption of Indian Constitution, the tribes were variously termed as aboriginals, adivasis, forest tribes, hill tribes, primitive tribes etc. Now, in India, 705 groups have been notified as scheduled tribes and they form approximately 8.6 percent of the total Indian population (Census of India, 2011). Tribes are one of the most vulnerable groups in India. The degree of under-nutrition is higher among the underprivileged communities which include the tribal population of our country (Dakshayani and Gangadhar, 2008). In spite of various kinds of policies and programs, they remain the most excluded and live in miserable conditions due to various factors such as geographical isolation, poor healthcare delivery systems, beliefs and customs. Exclusion from development has adversely affected the tribal children too

An amalgamation of factors such as socio-economic condition i.e., poverty, high illiteracy, absence of safe drinking water, poor sanitary conditions and lack of awareness contribute to dismal health conditions among the tribal population in India (Basu, 2000). Consumption of balanced diet, which includes cereals, millets, legumes, fruits and vegetables, milk and milk products and oils, in proper quantities, helps to get good health. Major nutrients, mainly carbohydrates, protein, fat are available to body primarily through cereals, millets, legumes, milk and milk products and oils. Micronutrients, namely vitamins and minerals are available from fruits and vegetables.

Deficiency of micronutrients leads to many diseases such as anaemia, night blindness, rickets, scurvy, pellagra etc. Consumption of vegetables helps in diversification of diets and in combating malnutrition. Dietary diversification enhances the supply of essential micro-nutrients leading to improved health, enhanced thinking ability and increased efficiency (Jindal and Dhaliwal, 2017).

Vegetables are major source of vitamins, minerals, and fibers. Vegetables are very important part of a good diet as they contain various nutrients essential for many body functions. These vegetables also provide taste, palatability, better digestibility and increase the appetite. Vegetables are suitably grown in kitchen gardens as they are mostly short duration crops. A family can consume vegetables from these kitchen gardens round the year. The nutritional home garden or kitchen garden is generally located close to the house and is used for growing vegetables, fruits, and other food crops for the family (Jana, 2015).

There are many social benefits that have emerged from kitchen gardening practices such as better health and nutrition, increased income, employment and food security within the household. Home gardens can help in recycling of household waste especially when a compost pit is developed. One of the easiest ways of ensuring access to a healthy diet that contains adequate macro- and micronutrients is to produce many kinds of foods in the home garden. Kitchen gardening directly provides food and nutritional security by making access to food that can be harvested instantly, prepared and fed to family members, daily or whenever required. Home gardens are also becoming an increasingly important source of food and income for poor households, especially for tribal communities. Kitchen gardens can be established in the spaces available at the backyard of the house or roof or it can be established with joint efforts on a common place or land.

Kitchen garden or home garden or nutrition garden is primarily intended for continuous supply of fresh vegetables for family use. A number of vegetables are grown in available land for getting a variety of vegetables. The conceptualization of nutrition garden under a Farming System for nutrition approach aims at optimal utilization of land to grow vegetables that can contribute to the requirements of a balanced diet as well as address particular nutrition deficiencies.

Apart from having a good amount of production of vegetables at national level, the per capita availability in diet is quite low in our country. Keeping in view the importance of vegetables in daily diet and its low availability, nutri gardens were demonstrated by ICAR JSS Krishi Vigyan Kendra, Suttur with an objective to promote the production and consumption of vegetables among Jenu Kuruba tribes, during the year 2017-18.

METHODOLOGY

Nutri gardens were promoted among 20 tribal households of Solleपुरa (H.D.Kote taluk) and Hebbala (Hunsur taluk) rehabilitation centres of Mysuru district, Karnataka state. Training was conducted in these villages for the women heads of all the 20 households with an objective to upgrade the knowledge of tribals regarding the importance of the kitchen gardening and the technical aspects of its establishment. Pre and post test were done to find out vegetable consumption and knowledge on vegetable cultivation using questionnaire. Information about vegetable production in backyards and consumption by the households a period of six months was collected. Vegetable seed kit and tomato, brinjal and chilli seedlings (100 each) and curry leaves, chakramuni and drumstick plants (2 each) were provided to each household. The data was analyzed using mean, percentages and frequencies.

RESULTS AND DISCUSSION

Table 1. Pre and post test of tribal women regarding knowledge about establishment of nutri garden and consumption of vegetables.

SN	Particulars	Knowledge level (%)		Change/ difference
		Before demonstration	After demonstration	
1	Land preparation and layout	45	80	35
2	Appropriate sowing time of various vegetables and their seed rates	32	78	46

3	Use of organic plant protection measures	28	65	37
4	Use of vegetables in daily diet	35	80	45

Table 1 depicts the pre and post test results of knowledge about establishment of nutri garden and consumption of vegetables among the tribal women. Before and after the establishment of nutrition garden information was collected. The knowledge level about land preparation increased from 45 to 80 percent; with respect to sowing time of various vegetables and their seed rates there was an increase in the knowledge level by 46 percent. Similarly, 37 percent increased knowledge level was recorded on use of organic plant protection measures while the knowledge level increased from 35 to 80 percent with regards to use of vegetables in daily diet.

Table 2. Production and availability of vegetables before and after establishing nutri garden.

Parameters	Before	After	Change (%)
Production of vegetables (kg/6 months)	Nil	760	100
Vegetable availability (g/person /day)	12.50*	63.29	43.54
Vegetable adequacy (%)	2.94	14.89	80.26

*Purchased from market

Production and availability of vegetables before and after establishing nutri garden is indicated in Table 2. Vegetables grown by the families were harvested and utilized for home consumption. The average production of vegetables over a period of six months after the establishment of the nutri gardens was 760 kg, resulting in availability of 63.29 g vegetables per person. There was around 44 percent increased consumption of vegetables by the tribal households. The increased consumption of vegetables helped in increasing the adequacy level to 80 percent. The tribal families felt that because of the establishment of nutri gardens their access to fresh and organic

vegetables was possible which made it possible for them to increase their daily consumption.

Table 3. Yield and economics of the vegetable production

Vegetable yield (kg/ 6 months)				Economics of demo (Rs.)			
Highest	Lowest	Average	Check	Gross cost	Gross returns	Net return	BCR
1120	400	760	nil	8100	15190	7090	1.86

Yield and economics of the vegetables produced from nutri garden for a period of six months are depicted in Table 3. Among the 20 subjects, the highest and lowest yields were 1120 kg and 400 kg, respectively, while the average yield was 760 kg. The net return was Rs.7090, which lead to Benefit Cost Ratio (BCR) of 1.86. Because of the tangible increase in production, availability and consumption of vegetables and the perceived health and economic benefits, the tribal households have expressed to keen interest with continue to grow vegetables. They also opined that production of vegetables by self not only helps to save money, which was otherwise spent on buying it has helped build their confidence.

CONCLUSION

Nutri gardens play an important role in food and nutrition security and help to combat many of the micronutrient deficiency diseases. The study revealed that with hands-on training and guidance, it is possible to build skills among the tribal women and thereby establishment of nutri garden gardens becomes easier, which in turn contributes to improved consumption of fresh vegetables by the families leading to nutrition security. Thus, nutri gardens are simple and less expensive means of building skill and health of tribal families.

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15

Participatory Seed Production as an Effective Extension Approach for Increasing Profitability

Divya H.V., Arun Balamatti and Netravathi Yattinamani

INTRODUCTION

Rice is a major crop in India and is the staple food of the people of eastern and southern parts of the country. Rice is cultivated in Karnataka to an extent of 15,13,987 ha with a total production of 38,02,149 tons and a productivity of 2,644 kg/ha. Rice is also the major cereal crop of Mysuru district with an area of around 1,23,803ha, a total production of 3,56,604 tons and a productivity of 3,032 kg/ha (Status Paper on Rice in Karnataka 2007-08).

There are many problems that are faced by farmers in rice cultivation. Few of them are, lack of availability of quality seed in time, water scarcity, seed dropping and poor resistance to pests. Farmers mainly depend on canal water for irrigation, which is again dependent on monsoons; monsoons have been erratic in the last five years, which is a very big challenge for farmers to cultivate paddy.

In Karnataka, blast occurrence is very common and often results in severe yield losses. Among the different approaches, developing and using resistant varieties is the most practical and economical measure to overcome blast incidence. However, their use has not been completely successful due to the presence of different strains overcoming host resistance. Repeated use of same variety has compounded the problem, especially when seed replacement is undermined.

Farmers in Mysuru district have always chosen coarse varieties for market and fine varieties for home consumption. This is due to the suitability of such varieties to the district agro climatic condition (rice area in the district mostly comes under the Southern Dry Zone, Zone 6), their yield potential and the market demand. In Mysuru district, majority of the farmers prefer one particular variety, Jyothi, as it has a ready market, particularly in the neighboring Kerala state, and it fetches higher price than all other medium and coarse grain varieties. Some farmers also choose fine varieties for home consumption. The ruling fine grain varieties in Mysuru districts are Sonum, Siri etc. Due to cultivation of the same variety for long time Jyothi has become susceptible to blast disease and many other pests leading to low yields. As a result of frequent outbreak of blast disease in Mysuru and neighbouring districts, on account of mono-cropping with Jyothi variety, the State Department of Agriculture is discouraging the farmers from using the variety. The Department has, however, started distributing Jyothi seeds on subsidy during the current year 2018 again, and is not able to meet the seed demand. The farmers continue to grow Jyothi often bringing seeds from unauthorized sources, which is aggravating the blast incidence in the district (Balamatti et al., 2016).

The ICAR JSS Krishi Vigyan Kendra (KVK) in Mysuru has been addressing the yield stagnation in paddy by introducing seed production of ruling variety, which is a better means of improving the yield and income of farmers. However, the KVK has found that it is not only the varietal preference for Jyothi but also the delay in release of canal water from the reservoirs that is causing below par paddy yields. Under the circumstances, the KVK has realized that the efforts of promoting new technologies and practices to improve rice productivity will not be enough; rather, these efforts must be supplemented with introduction of specific varieties that fetch better price and better returns to farmers. Keeping this in mind, the present study was designed to compare one newly introduced fine grain, blast tolerant paddy variety viz, RNR 15048, with the ruling variety Jyothi, with an objective to assess its suitability to the district agro climatic conditions, yield performance and economics by way of promoting participatory seed production and hence to offer an alternate paddy variety to the farmers.

MATERIAL AND METHODS

Seed production is a skilled work; one must start with convincing the farmers on the need for seed production followed by building the necessary skills. Hence, the KVK used different tools to gain the confidence of farmers by rigorously training to the interested farmers. Following sensitization, once the farmers agreed to get involved in seed production, efforts of skill building were initiated. Method demo on seed treatments and market assurance for good quality seeds were given to farmers. Also, quality seeds were provided by the KVK. Periodic field inspection coupled with assistance on identification of off types, roguing the off-type plants to get better quality were provided followed by offering linkage to private trader.

This paper is based on the trials conducted on the KVK's instructional farm and in 14 farmers' fields in Mysuru district during Kharif 2018. The investigation was aimed at assessing the performance of new variety RNR 15048 versus Jyothi with regard to duration, tolerance to blast disease and other pest incidences, yield and economics. Since the farmers' primary expectation is good price and ready marketability, their most preferred variety Jyothi was assessed for price and marketability along with the var. RNR -15048 by way of seed production.

Field day was conducted in one of the farmers' fields where a seed trader was also invited along with the KVK scientists. In the field day, the trader assured a fixed price for the quality seed and explained the procedure to be followed and precautions to be observed during harvesting to avoid admixture and drying to safest seed moisture.

RESULTS AND DISCUSSION

The main purpose of the study was to compare Jyothi variety of paddy with RNR 15048 variety. The observations on yield parameters of the varieties are presented in Table 1.

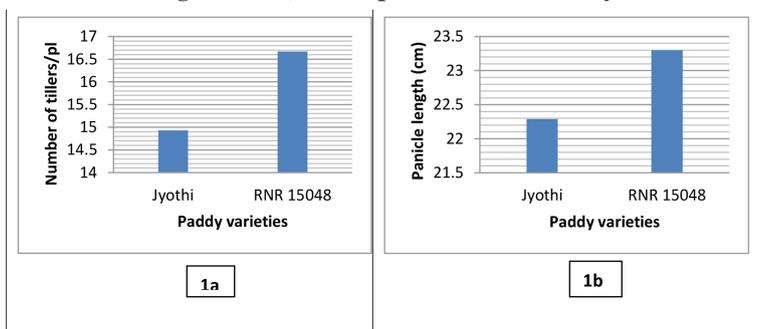
Table 1. Yield parameters of Paddy varieties

Replica- tion	Area (Ha)	No. Of Tillers		Panicle length (cm)		Height (Cm)		Yield q/ha)	
		Jyothi	RNR 15048	Jyothi	RNR 15048	Jyothi	RNR 15048	Jyo- thi	RNR 15048
1.	0.4	16	18	22.0	24.0	117	147	50.0	70.0
2.	0.4	15	17	22.5	23.0	110	130	47.5	60.0
3.	0.4	15	17	22.4	22.0	105	135	46.3	60.0
4.	0.4	14	16	23.2	23.0	98	128	45.0	57.5
5.	0.4	13	15	22.5	23.5	80	120	47.5	58.8
6.	0.4	14	15	21.7	23.0	85	115	45.0	56.3
7.	0.4	14	16	21.8	24.0	88	118	43.8	57.5
8.	0.4	16	17	21.5	24.5	98	128	50.0	60.0
9.	0.4	15	16	22.3	23.0	85	115	47.5	58.8
10.	0.4	12	15	22.0	22.5	90	120	47.5	57.5
11.	0.4	13	15	20.0	22.5	92	120	50.0	55.0
12.	0.4	17	18	23.5	24.0	102	132	47.5	62.5
13.	0.4	17	18	23.0	24.0	104	134	50.0	61.3
14.	0.4	15	17	22.0	22.5	108	138	47.5	60.0
15. (KVK)	0.4	18	20	24.0	24.0	112	142	50.0	70.0
Average	0.4	14.93	16.67	22.29	23.3	98.27	128.13	47.67	60.33

Table 2. Economics of Paddy varieties

Replication	Area (Ha)	Gross Cost (Rs)		Gross Return (Rs)@3000/q		BCR	
		Jyothi	RNR 15048	Jyothi	RNR 15048	Jyothi	RNR 15048
1.	0.4	52000	50000	150000	210000	2.88	4.20
2.	0.4	51000	48000	142500	180000	2.79	3.75
3.	0.4	40000	42000	138750	180000	3.47	4.29
4.	0.4	39000	40000	135000	172500	3.46	4.31
5.	0.4	38250	41250	142500	176250	3.73	4.27
6.	0.4	37000	40000	135000	168750	3.65	4.22
7.	0.4	41500	41000	131250	172500	3.16	4.21
8.	0.4	43000	45000	150000	180000	3.49	4.00
9.	0.4	38000	41000	142500	176250	3.75	4.30
10.	0.4	38000	40000	142500	172500	3.75	4.31
11.	0.4	38250	40250	150000	165000	3.92	4.10
12.	0.4	38000	41000	142500	187500	3.75	4.57
13.	0.4	43000	45000	150000	183750	3.49	4.08
14.	0.4	40000	42000	142500	180000	3.56	4.29
15. (KVK)	0.4	44500	46000	150000	280000	3.37	6.09
Average	0.4	41433	42833	143000	185667	3.48	4.33

Fig 1 (a to d). Yield parameters of Paddy



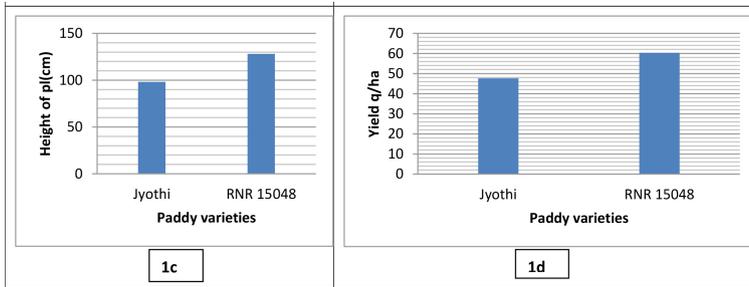


Fig 2 (a to c) : Economics of Paddy seed production

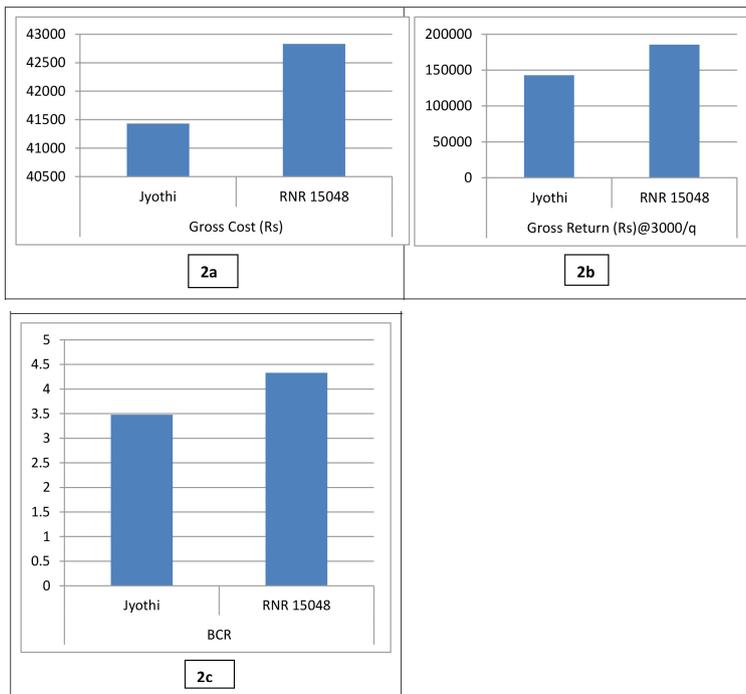


Table 3. Economics of commercial production V/s Seed production

Variety	Yield q/ha	Gross cost for commercial production	Gross return at commercial rate (Rs. 1900/q)	BC Ratio	Gross cost for seed production	Gross return as a seed (Rs. 3000/q)	BC Ratio	Additional income due to seed production compared to commercial production
Jyothi	47.67	37593	87806	2.33	41433	143000	3.48	55194
RNR 15048	60.33	38450	108594	2.82	42433	185667	4.33	77073

Growth and yield parameters of paddy varieties

The data on growth and yield parameters of paddy varieties were recorded from the trial plots during Kharif 2018 are given in Table 1.

RNR 15048 (125-day duration) compared with Jyothi, which is medium duration (120 to 130-day duration) is maturity early compared to Jyothi variety. In terms of plant height, average height of RNR 15048 is 128.13 compared to 98.27 cm height of Jyothi paddy. which implies higher fodder yield. The features of grain type and grain colour clearly indicated Jyothi is long bold variety with red grains, RNR 15048 is short slender shape (New Revolutionary Rice Variety “RNR 15048” January 30, 2017 / Life of Abmatssu)

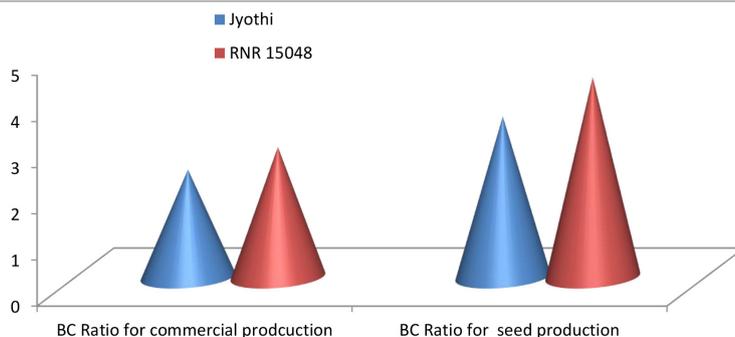


Fig 3. Economics of commercial production v/s Seed production

Yield-wise, the Jyothi average yield was 47.67, whereas RNR 15048 average yield was 60.33 q/ha. Yet, Jyothi is preferred for Kerala for parboiled rice whereas RNR 15048 is a fine variety, which is having good cooking quality, most preferred in Karnataka.

The panicle length of RNR 15048 was 23.3 cm whereas it was 22.29 in case of Jyothi. Similarly, the average number of tillers of RNR 15048 was 16.67, Jyothi had a medium number of tillers with 14.93. There was a significant difference between the varieties in tillers.

Economics of different paddy varieties

Table 2 shows data on various economic parameters of the paddy varieties. RNR 15048 had a higher cost of cultivation (Rs.42,833) on account of a high seed rate at Rs.50/kg; since the variety recorded the highest yield it also incurred a higher cost of harvesting, seed processing and bagging. Jyothi recorded the lower cost of cultivation (Rs.41,433/Ha) partly because of the seed rate and seed cost, 25kg/ac at Rs. 34/kg, but more on account of the cost involved in pest and disease control measures.

RNR 15048, being the higher yielder, offered a higher net income of Rs. 1,85,667/ha, whereas Jyothi recorded a net return of Rs.1,43,000/ha on account of seed production.

The cost-benefit analysis recorded in Table 2 revealed that RNR 15048 offered a higher benefit (4.33) compared to Jyothi, 3.48. Farmers have accepted the RNR 15048 variety due to fine grain type, market preference, self-consumption as well as for seed production since it is giving a higher price ranging from Rs.3000-5000/q as seed.

Economics of commercial production V/s Seed production

Table 3 showed data on economic parameters of the paddy varieties with respect to seed production. It is clearly showing that if a commercial paddy farmer goes for seed production in the Jyothi variety he will get an additional income of Rs. 55,194/ha. In case of RNR 15048, being the higher yielder, in case of seed production the farmer gets an additional income of Rs. 77,073. If we compare the BC ratio of both, it is low in commercial production of the Jyothi variety i.e., 2.33 and higher in RNR seed production 4.33.

CONCLUSION

The extension tools such as sensitization training, selection of interested farmers followed by skill training in seed production as also frequent visits to farmers' field and assisting the farmers in identifying the off types, precautionary measures during harvesting to avoid mixing up with other varieties during machine harvesting, together, have been helpful in helping farmers graduate from being mere paddy farmers to paddy seed producers. The combined effect of multiple extension methods such as guiding them in seed production, processing, bagging and marketing in JSS KVK brand has ensured success in achieving their goal. This has proved that participatory seed production as a process could be helpful in improving the farmers' yield and income.

The results of the study have also proved that seed production of Paddy Jyothi variety is better compared to commercial production of the same variety in terms of yield and income. Jyothi is bold, red grained variety suitable for parboiling. The large and ready market in Kerala meant that Jyothi fetched higher price. However, seed production of RNR 15048 is even better with respect to income, less risky on disease incidence -the variety being blast tolerant and has less pest incidence – and is also suitable for late release of canal water.

Thus, the study has succeeded in replacing Jyothi paddy variety with RNR 15048 among paddy farmers of Mysuru district. Since the canal water is released during mid-August 2019, more than 50 percent of the farmers have shifted to RNR 15048 variety in Mysuru district. The seeds supplied from RSK, Private traders, KSSC, NSC, JSS KVK and directly from farmers to farmers is an evidence of horizontal spread of a new variety in the district.

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Efficient Water Use for Sustainable Livestock Production

Letha Devi G., Mech A.,
Kataktalware M.A. and Niketha L.

INTRODUCTION

Water use efficiency can be defined as the net return for a unit of water used. Improvement in water use efficiency aims at producing more food, income, better livelihoods and ecosystem services with less water. There is a considerable scope for improving water use efficiency of crop, livestock and other allied enterprises at field thereby achieving sustainable food production. Water harvesting, supplemental irrigation, deficit irrigation, precision water application techniques and soil-water conservation practices are the bouquet of technology choices that we can resort to in achieving this goal. Practices not directly related to water management also impact water use efficiency because of interactive effects such as those derived from improvements in soil fertility, pest and disease control, crop selection or access to better markets.

In spite of the apparent role in supporting rural livelihoods, there are growing debates emphasizing livestock as one of the major agricultural enterprises for depletion of water and thus adding extrapressure on already scarce resources. Feed sources of Forage Based Livestock Production Systems [FLPS (grazing, mixed-irrigated and mixed-rain fed)] largely consist of pasture, crop residue and cultivated green fodder. In dryland (arid and semi-arid) eco-regions FLPS are dominantly extensive and thus the volume of water depletion for feed production is a major concern. This compels the need for better understanding of livestock water interactions and

designs for comprehensive entrypoints to improve Livestock Water Use Efficiency (LWUE).

Based on empirical evidence from different FLPS systems across the globe, we can systematically cluster these entry points for improving WUE as:

- improving the water productivity of feed
- improving livestock feed sourcing and feeding
- enhancing livestock feed use efficiencies
- enabling institutions
- market linkages to facilitate adoption of relevant technologies

Water Footprint

Water footprint measures amount of water used to produce each of goods and services we use. It can be measured for a single process, such as growing rice, for a product, such as a pair of jeans, for the fuel we put in our car, or for an entire multi-national company. Depending on the specific situation, water footprint can be measured in per ton of production, per hectare of cropland, per unit of currency and in other functional units. The water footprint helps us understand for what purposes our limited freshwater resources are being consumed and polluted.

Water footprint has three components: green, blue and grey. Together, they provide comprehensive picture of water use by delineating source of water consumed, either as rainfall/soil moisture or surface/groundwater, and volume of fresh water required for assimilation of pollutants.

Direct and indirect water use

Water footprint looks at both direct and indirect water use of a process, product, company or sector and includes water consumption and pollution throughout full production cycle from supply chain to enduser. It is also possible to use water footprint to measure amount of water required to produce all goods and services consumed by individual or community, a nation or all of humanity. This also includes direct water footprint, which is water used directly by individual(s) and indirect water footprint—summation of water footprints of all products consumed.

Types of water footprints

Green water footprint is water from precipitation that is stored in the root zone of soil and evaporated, transpired or incorporated by plants. It is particularly relevant for agricultural, horticultural and forestry products.

Blue water footprint is water that has been sourced from surface or groundwater resources and is either evaporated, incorporated into a product or taken from one body of water and returned to another, or returned at a different time. Irrigated agriculture, industry and domestic water use can each have a blue water footprint.

Grey water footprint is the amount of fresh water required to assimilate pollutants to meet specific water quality standards. The grey water footprint considers point-source pollution discharged to a freshwater resource directly through a pipe or indirectly through runoff or leaching from the soil, impervious surfaces, or other diffuse sources.

LWUE in forage based livestock systems: Challenges and opportunities

According to Serū and Steinfeld (1996) grazing, mixed-rainfed and mixed-irrigated systems are the major FLPS in dryland production environments, the intensity and purposes of production vary greatly within and among these systems. This diversity has implications for the challenges FLPS face and the prospects they have to improve LWP. For example, dry fodder and green fodder constitute the major feed ingredients in these systems. Concentrate use, even in the most intensive systems (e.g. mixed-irrigated, India), does not exceed 10% (e.g. Hailelassie et al., 2011b). As feed is an interface between water and livestock these intra- and inter-FLPS differences in feed sourcing and feeding strategy have implications for the type and the scale of importance of LWP related problem.

To improve LWUE, we need to increase the quality of locally available feed and the way we feed the animal. Such activities may involve selection, intercropping, urea treatment, chopping of coarse residues etc. For example, Hailelassie et al. (2011b) in mixed-irrigated systems showed that by improving feed quality (from 7 to 8.5 ME MJ kg⁻¹) >50 m³ of water/cow/yr can be saved. For mixed-rainfed

systems, Descheemaeker et al. (2011) reported an improvement in LWUE when crop residues were treated with urea. By limiting animal movement it is also possible to reduce the amount of energy livestock requires, leading to higher LWP values. For mixed-rainfed systems Descheemaeker et al. (2011) reported ~12% of the metabolizable energy (ME) in animals are spent walking in search of feed and water.

Method of assessment of Livestock water use

An effort was made to assess and analyze LWUE in smallholder and commercial production and to formulate for strategies for improving LWUE. Primary data was collected from small and medium sized dairy farms in Kolar and Shimoga districts, Karnataka, India. The total sample size was 240 dairy farms. The consumptive use of blue water (direct and indirect) was assessed using primary data through personal interview and observation in particular farms. Primary data from small holders and commercial dairy units in Kolar and Shimoga districts of Karnataka, India were collected. Water use efficiency (Kg/animal) was estimated and compared for small holder as well as commercial dairy production systems using the following formula.

$$WUE = (Y/U) * 100$$

Where:

Y = Marketable yield (kg/ animal), and

U = Seasonal consumptive use of water (m³)

Water use efficiency for crop biomass used as fodder = Total Biomass/water applied at different level of requirement and Mekonnen and Hoekstra (2011) method was used for calculation of LWP of feed (recommended by IWMI). Different water wastage points in different operations were identified and strategies to reduce water wastage were formulated using participatory focus group discussions.

The major challenges associated with LWU as perceived by farmers were analyzed and ranked based on rank coefficients. Scarcity of water for livestock drinking, other livestock operations and feed quality due to low water quality used for crop production were the major challenges across all the seasons.

Table 1. Problem matrix showing the scale of importance of LWU related problems across seasons

Key LWU related problems	Seasonal variations								
	Summer			Winter			Rainy		
	1	2	3	1	2	3	1	2	3
Scarcity of water for livestock drinking	✓				✓				✓
Scarcity of water for livestock operations	✓				✓				✓
Scarcity of water for feed production					✓				✓
Inefficient use of available water			✓			✓	✓		
Soil/nutrient loss	✓					✓		✓	
Poor feed/fodder quality	✓					✓			✓
High feed scarcity	✓				✓				✓
Use of common property resources	✓			✓			✓		
Post-harvest feed quality & quantity	✓				✓				✓

Table 2. Direct and Indirect Water use(litre/day/animal/kg of milk) and WUE in different dairy production systems (n1=200, n2=40)

Operations	Small holder system	Commercial dairying
Drinking	40	52
Washing shed	55	90
Washing animals	25	38
Cleaning cans and other equipment	10	25
Water contained in feed and fodder	743	740
Total	873	945
Milk yield/ day/animal	7.4	15.4
WUE= (Y/U)*100	0.85	1.62

The water intake by animals through forage and other feed ingredients are more as compared to water intake through drinking water and that used for on farm servicing operations such as cleaning etc. The average direct consumptive water use by small holder system was found to be 97 litres per day and 127 litres per day for commercial dairies. The calculated water use efficiency for small holder system was 0.85 and for commercial dairying it was 1.62. The water use efficiency was more in case commercial dairy farming and less in case of smallholder production system.

There are various factors affecting water use by livestock. The major factors are seasons, different weather parameters, fodder, feed and other inputs etc. The source of water, animal conditions like lactation stage, age, body and health conditions also play a role in water use efficiency.

Table 3. Factors affecting water use (Ranking) (n= 240)

Factors	Rank
Seasonal variation	I
Weather parameters (Temp, Rainfall, Humidity)	II
Fodder, Feed and other inputs	III

Source of water (Borewell, Canals, Ponds etc.)	IV
Animal conditions	V
Animal output	VI

The water wastage points mainly in summer season were identified, which is presented in the figure below.

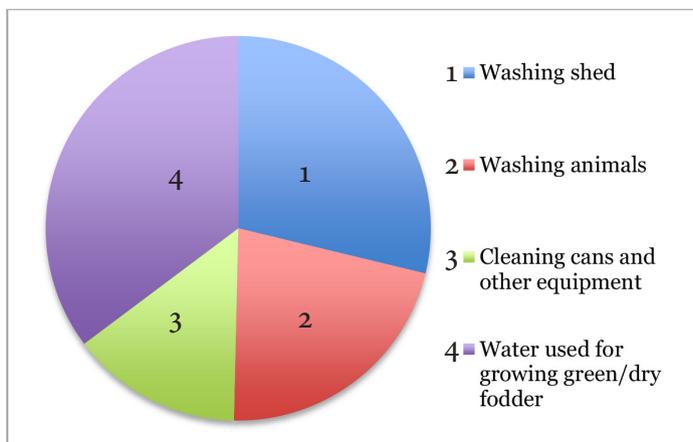


Fig 1. Perceived water wastage points in summer season
(% respondents) n= 240

CONCLUSION

Water availability and quality are the major challenges that are faced by the livestock and crop production systems in recent times. The observations in the study shows that water inputs through forage and other feed ingredients are more as compared to water inputs through drinking water and that used for on farm servicing operations such as cleaning, washing etc. Proper management strategies are highly essential for sustaining the livestock production systems and meet the food demands of growing population with the available water resources, for which water saving technologies and strategies are the need of the hour.

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Livelihood and Nutrition Support from Dairy Farming in Southern Karnataka

Kolekar D.V. and Chandre Gowda M.J.

INTRODUCTION

Cattle rearing has been a traditional livelihood in India and is closely linked to agricultural economy. India with about 190 million cattle (as per 19th Livestock Census, 2012) has 14.5 percent of the world cattle population. Of this, 73.37 percent i.e. 151 million are indigenous and 39.732 million are crossbred cattle. In 2017-18, Indian dairy sector produced 176.3 million tons of milk. The per capita availability of milk has also increased from 112 grams per day in 1968-69 to 290 gram per day in 2017-18 which is comparable to the world average of 375 grams per day (Basic Animal Husbandry Statistics, 2018). Indigenous cattle along with crossbred cattle have major contribution in the fulfilling of the demand of milk for the growing population of India. Most of the indigenous cattle (about 80%) are non-descript and only 20 percent belong to indigenous breeds. Indigenous cattle are robust and resilient and are particularly suited to the climate and environment of their respective breeding tracts. They are endowed with qualities of heat tolerance, resistance to diseases and the ability to thrive under extreme climatic stress and less than optimal nutrition (GOI, 2014).

Karnataka is an agriculture dependent state with more than 60 percent of its population living in rural areas and depending on agriculture for their source of income (GOK, census, 2011). It stands second after Rajasthan, with respect to total geographical area prone to drought and agriculture highly depends on rain. Nearly 90 percent

of the population in the semi-arid region depends on agriculture for livelihood and livestock rearing as subsidiary occupation. Eighteen of 30 districts more often experience drought. So, during drought and flood conditions, the farming community remains in economic shock. In those situations, livestock especially indigenous and crossbred cattle rescue the farmers from economic crisis. When there is a drought, there will be a decrease in the agriculture production and lesser availability of crop residues for livestock which become substantially low. So, during drought and hot environmental conditions indigenous and crossbred cattle are able to thrive on poor quality roughages and acts as the buffer in the crisis. There are six indigenous cattle breeds in Karnataka, namely, Amrithmahal, Deoni, Hallikar, Khillari, Krishna Valley and Malnad Gidda. Out of this three breeds Amrithmahal, Hallikar, and Malnad Gidda along with good number of crossbred cattle populations are found in southern Karnataka. Therefore, it becomes essential to know the exact role played by indigenous and crossbred cattle in the livelihood of poor farmers. Considering the above facts, present study entitled “Contribution of indigenous vs. crossbred cattle in the livelihood of farm households in southern Karnataka” was undertaken.

MATERIAL AND METHODS

As per National Bureau of Animal Genetics Resources (2015), there are three indigenous cattle breeds in southern Karnataka, namely; Amrithmahal, Hallikar, and Malnad Gidda along with a good number of crossbred cattle population. So, the present study was carried out purposively in southern Karnataka. The study was conducted in three districts of southern Karnataka based on the highest population of indigenous cattle. From each of the selected districts, two taluks were selected based on the highest density of indigenous and crossbred cattle in that locality. From each of the selected taluks, a cluster of three village panchayats was selected purposively, again based on population density of indigenous and crossbred cattle of that particular area. Therefore, the present study was conducted in six taluks of three districts in Karnataka. From each selected taluk, one cluster of three village panchayats made a total of 18 village panchayats for the study. From each selected cluster of villages, twenty households owning indigenous and crossbred cattle were selected. From each selected household, one adult member or head of the household actively

engaged in the management of indigenous and crossbred cattle was considered as the respondent. Thus, 20 cattle owners from each cluster of villages, made a total of cattle owners sample size to 120. The sampling scheme adopted for this study was three-stage stratified random sampling without replacement.

The data were collected through semi-structured interview schedule. The respondents were asked to give information on various livelihood security parameters. The data so collected were analyzed for estimating contribution of indigenous and crossbred cattle in livelihood security of farmers. Livelihood security is operationalized as contribution made by indigenous and crossbred cattle in terms of income generation, nourishment to the family, nutrients to farm, employment generation, security during uncertainties and social status symbol. The index developed by Biradar et al. (2013) was used with required modifications as given below:

- Contribution to the total household income: The net return was measured by collecting information on different production values of each cattle and average values of each parameter were calculated. The 'z' test was used to compare production of indigenous and crossbred cattle.
- Nourishment to the family: Based on the daily average milk consumed by the family, the nutrients were computed in terms of protein, fat and calcium as suggested by Gopalan et al. (1971). The 'z' test was used to compare nutrients of indigenous cattle and crossbred cattle.
- Nutrients to the farm: The average farm yard manure applied to their respective farm was converted in terms of N, P and K by following the conversion factors suggested by Gautam (2007), that is, one ton of farm yard manure was equivalent to 8 Kg N, 4 Kg P₂O₅ and 16 Kg K₂O. The 'z' test was used to compare N, P, K of farmyard manure of indigenous and crossbred cattle.
- Employment generation: Number of hours engaged in indigenous and crossbred cattle rearing for one year were collected. Total hours spent in a year were divided by 8 hours to convert them into man-days. Total number of man-days contributed were expressed as mean values. The 'z' test was used to compare employment generation through indigenous and crossbred cattle.

- Security during uncertainties: Number of households having used indigenous and crossbred cattle to face the uncertainties in the past two years. Percentage and X2 of each category was calculated and used for comparison of security of uncertainties in case of indigenous and crossbred cattle.
- Status symbol: The number of households who regard keeping indigenous and crossbred cattle as a symbol of social status. Percentage and X2 of each category were calculated and used for comparison of status symbol in case of indigenous and crossbred cattle.

RESULTS AND DISCUSSION

To ascertain contribution of indigenous and crossbred cattle to the farmer's livelihood, the average values of the types of contribution were calculated and presented in Table 1. From the Table 1, it is clear that net return/day per animal (Rs.11.29), per farm (Rs.14.73) and per liter (Rs.3.24) was less in indigenous cattle due to low productivity as compared to crossbred cattle (Rs. 64.81, 127.50 & 5.80 resp.). As majority of the cattle owners used own farm grown dry and green fodder to feed their cattle or from grazing. Also, dung produced used for manure of his own farm including drought power & some milk for nourishment to family. So, it will be interesting to see the economics without considering cost of fodder. Without considering cost of fodder, net return/day per animal (Rs.54.79) and per farm (Rs.77.90) was less in indigenous cattle as compared to crossbred cattle (Rs.118 & 234.88 resp.). Protein, fat and calcium nourishment per animal to the family gm/day was less in case of crossbred cattle (3.07, 3.93 & 0.16 resp.) as compared to indigenous cattle (52.56, 67.34 & 1.98 resp.). Nutrients to farm i.e. NPK kg/year/animal was more in case of crossbred cattle (73.58, 36.79 & 147.17, resp.) as compared to indigenous cattle (54.39, 27.19 & 108.77, resp.). Employment generation (man-days/year) per animal was more in case of crossbred cattle (82.89) as compared to indigenous cattle (44.05).

Security for uncertainties and status symbol was more in case of crossbred cattle (90.83% & 84.17% resp.) as compared to indigenous cattle (15.83% & 24.17% resp.). Similarly, contribution of livestock to the livelihood of farmers in Western Maharashtra has been assessed by Biradar et al. (2013). The results showed that contribution of

livestock to the household income ranged from 18.60 to 33.90 percent. The livestock contributed 34.61g protein, 52.32g fat and 1690.5 mg calcium to the daily diet of the farm household. The average nutrients required is 42.57 g protein, 64.35 g fat and 2079 mg calcium. Farm yard manure obtained from the livestock annually adds an average of 89.33 kg nitrogen, 44.69 kg phosphorous and 178.76 kg potash to the fields of each farm household. Livestock generated annual employment of 140.79 man days for adult women and 95.35 man days for adult men. Twelve percent of the households used livestock for mitigating uncertainties of farming. Sixty-three percent of the people opined livestock farming to be a symbol of higher social status and concluded that livestock system contributed economically and socially to enhance sustainable livelihoods. Chaminuka et al. (2013) studied the livelihood role of cattle in South Africa and results revealed that about 11 percent of the local household households owned cattle and cattle income constituted 29 percent of total household income. About 71 percent of households had at least three sources of income. The study also concludes that cattle production has important livelihood roles, but is not sufficient as a driver of economic development. Radder (2004) studied the livelihood systems of dairy farmers in Karnataka using Nine-Square-Mandalas' model, which revealed that dairy activities integrated into several other economic activities performed by households. The role of dairy varied from a major source of economic livelihood sustenance to the minor system of subsistence milk production. Income from dairy was the source for purchasing food grains and to meet family cash needs. The 'F' & 'Chi-square' test was used to test the difference between the types of contribution perceived by cattle owners in case of indigenous and crossbred cattle. Analysis showed that there was a significant difference between all types of contribution of indigenous and crossbred cattle.

Table 1. Contribution of indigenous vs crossbred cattle to the farmer's livelihood

Type of contribution	Unit	Values		P Value
		Indigenous cattle	Crossbred cattle	
Income from cattle	Net return/anim./day (Rs.)	11.29	64.81	0.000
	Net return/farm/day (Rs.)	14.73	127.50	0.000
	Net return/L (Rs.)	3.24	5.80	0.000
Income from cattle (Without considering cost of fodder)	Net return/anim./day (Rs.)	54.59	118.00	0.000
	Net return/farm/day (Rs.)	77.90	234.88	0.000
	Net return/L (Rs.)	16.08	10.52	0.000
Nourishment to the Family	Protein (gm/day/family)	52.56	3.07	0.000
	Fat (gm/day/family)	67.34	3.93	0.000
	Calcium (mg/day/family)	1971	115	0.000
Nutrients to the Farm	N kg/year	54.39	73.58	0.000
	P kg/year	27.19	36.79	0.000
	K kg/year	108.77	147.17	0.000
Generating Employment	Man days/year	44.05	82.89	0.000
Security for Uncertainties	Percentage	15.83	90.83	0.000
Status Symbol	Percentage	24.17	84.17	0.000

CONCLUSION

The significant differences in various parameters of livelihood security in case of indigenous and crossbred cattle were due to low productivity in case of indigenous cattle as compared to crossbred cattle. Also, one of the major reason for greater contribution of crossbred cattle to livelihood security was most efficient and scientific management as compared to indigenous cattle. But indigenous cattle are robust and resilient and are particularly suited to the climate and environment of their respective breeding tracts. They are endowed with qualities of heat tolerance, resistance to diseases and the ability to thrive under extreme climatic stress and less than optimal nutrition. The potential to enhance the productivity of the indigenous breeds of India through professional farm management and superior nutrition is immense. Most of the indigenous cattle possess A2 allele of beta casein as compared to exotic cattle, known to possess higher frequency of A1 type allele. It is reported that A1 milk is possibly associated with some metabolic disorders like diabetes, heart diseases etc., and A2 milk produced by indigenous breeds does not have any such association. Therefore, indigenous cattle can be improved with organized breeding programs, better management practices along with crossbred cattle to improve the livelihood security and resources of poor farmers.

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Convergence of Horticulture Extension Programmes – Experiences of ICAR-KVK, Gadag

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INTRODUCTION

Farm Science Centres popularly called as Krishi Vigyan Kendra (KVKs) in India are the innovative institutions established by Indian Council of Agricultural Research, New Delhi. The KVKs are the knowledge and resource centres for district extension system. KVKs with the mandate of Technology Assessment and Demonstration for its Application and Capacity Development has limitations to cover the entire district considering manpower and finance provided to KVKs. Upscaling of technology has become a major challenge for KVKs. There is a lot of scope to manage this challenge through convergence mode involving various stakeholders in the district. There is a need to devise mechanism to overcome the challenge on low investments and inadequate manpower.

KVK Gadag located in North-Western part of Karnataka State initiated convergence efforts involving various stakeholders who are engaged in horticulture extension programme.

Situation Analysis

Gadag district is predominantly an agrarian district having cultivable land of 3.93 lakh ha. Out of this, only 10 percent of the area is under irrigation. The district gets rainfall from South-West monsoon from June to September and North-East monsoon from October to November. Average rainfall of the district is 612 mm

which is erratic and ill distributed. Recurring droughts are common with the probability of 70-80 percent each year . Long dry spells in Kharif season and receding soil moisture in rabi season are the characteristic features of the drought resulting in adverse effect on the sustainability of crop productivity. This situation is more severe in the places where faming is practiced in red soil area. About 30 percent of the soil type in the district is red sandy loam. Majority of the farmers take up groundnut crop during Kharif season in red soil area. The average productivity of groundnut is very low at 6.75 quintals per ha and thus the farming in red soil has become a non-viable enterprise. The livelihood support system of farmers in red soil area is under threat.

KVK's Interventions

Having carried out the situation analysis, KVK prepared an action plan to address the plight of farmers in red soil-based cropping system. The action plan involved crop diversification efforts through promotion of mango and cashew in red soil areas.

Technology and Activity Details

KVK formulated various technology interventions and strategies to overcome the issue. Technological interventions were finalised with the experts' advice from Agricultural Universities and ICAR Institutes. The details of activities carried out by KVK for promotion of Mango and Cashew are presented in Table:1

Table 1. Details of activities carried out by KVK for promotion of Mango and Cashew

Mango	Cashew
Sensitization programme: KVK organised several sensitization programmes in the villages on importance of crop diversification in rain-fed areas. Farmers were made aware of dryland mango and cashew cultivation and its economics compared to cultivation of groundnut. These programmes created a lot of impact in terms of farmers' interest to take up dryland mango and cashew cultivation.	

Mango	Cashew
<p>Capacity building programme: KVK developed an integrated training module that included soil and water conservation, rainwater harvesting through digging of trenches, orchard layout, pit digging, filling and planting of grafts, staking, management of pest and disease. KVK organised 98 training courses on these modules during the last decade and trained 2733 farmers.</p>	<p>Training programmes: KVK organised Awareness cum Training programmes on cashewnut cultivation. 36 training courses have been organised for 696 farmers. Exposure visits of farmers have been organised to KVK instructional farm and cashewnut orchards established by progressive farmers under KVK guidance.</p>
<p>Front Line Demonstrations: KVK organised Front-Line Demonstrations on dryland mango cultivation in 138 hectares of area covering 17 villages. 207 farmers participated in the demonstrations. These demonstrations succeeded in creating a lot of enthusiasm and interest in farmers to take up mango cultivation.</p>	<p>Front Line Demonstrations: KVK organised Front-Line Demonstrations on farmers' fields for cashewnut promotion. During the period from 2013-14 to 2018-19, KVK organised Front-Line Demonstrations in 16 hectares of area covering 41 farmers. These demonstrations have created a huge impact in terms of farmer's interest to take up cashewnut cultivation.</p>
<p>Extension Programmes: KVK rendered farm advisory services viz., orchard layout, planting, nutrition management, pest and disease management and post-harvest management.</p>	<p>Extension Programmes: KVK organised seminars, farmer-scientist interaction, field and diagnostic visits and facilitated marketing of raw cashewnuts.</p>

Convergence strategies adopted

KVK identified partners who have similar objective of promotion of fruit crops viz., mainly mango and cashew for upscaling efforts. KVK conveyed a meeting of identified partners in order to understand the role to be played by each partner in promotion of mango and cashew. The various partner agencies identified are as follows:

Convergence Partners in Mango Promotion

- State Department of Horticulture
- Watershed Development Department
- Zilla Panchayat (through MGNREG)
- Gram Panchayats
- Reliance Foundation (NGO)
- Deshpande Foundation (NGO)
- Sujala –Watershed Development Programme
- ATMA (State Department of Agriculture)

Convergence Partners in Cashew Promotion

- State Department of Horticulture
- Reliance Foundation (NGO)
- Directorate of Cashew and Cocoa Development (DCCD), Cochin
- Sujala – Watershed Development Programme
- ATMA (State Department of Agriculture)

Apart from convergence mechanism, KVK formulated the following strategies for upscaling of technologies :

- KVK formed Mango Growers Association in Gadag block and promoted mango cultivation through training, supply of grafts, farm advisory services, post-harvest technologies and marketing
- KVK organised cashew growers into cashew Growers Association and through which KVK worked on cashew promotion with respect to technological and marketing support along with facilitation of linkage with Directorate of Cashew and Cocoa Development (DCCD), Cochin and State Department of Horticulture for availing incentive / subsidy.

KVK played a role of nodal agency having convergence with DCCD, Cochin.

- KVK promoted entrepreneurship among mango growers for marketing of fruits through branding, packing, labelling and marketing.
- KVK facilitated direct marketing of mango fruits from producer to consumer from 2014 onwards through organisation of Mango Mela in Gadag city and Buyers – Sellers meet.

Mode of convergence of various stakeholders

A brief information on the convergence partners for mutual benefit with focus on strengthening farmers livelihood through promotion of mango and cashew cultivation is presented in Table-2:

Table 2. Role of Convergence Partners

Sl. No.	Name of stakeholder	Mechanism of partnership	Funding and sharing of resources	Role of KVK
1	State Department of Horticulture	Training of farmers in dry land horticulture	Allocation of funds to KVK for training	<ul style="list-style-type: none"> • Organisation of trainings • Exposure visits • Expertise sharing • Supply of seedlings
2	Watershed Development Department	Joint implementation	Allocation of funds to KVK for training and extension service	<ul style="list-style-type: none"> • Organisation of trainings • Exposure visits • Expertise sharing • Supply of seedlings • Advisories

Sl. No.	Name of stakeholder	Mechanism of partnership	Funding and sharing of resources	Role of KVK
3	Zilla Panchayat (MGN-REGP)	<ul style="list-style-type: none"> • Training of farmers in dry land horticulture • Advisory services to farmers 	Support for training programmes	<ul style="list-style-type: none"> • Organisation of trainings • Exposure visits • Expertise sharing • Supply of seedlings
4	Reliance Foundation	Joint implementation	<ul style="list-style-type: none"> • Training support • Extension support 	<ul style="list-style-type: none"> • Imparted trainings • Exposure visits • Expertise sharing • Supply of seedlings • Advisories
5	Deshpande Foundation	Promotion of Mango	Full funding to KVK's Host Institution	<ul style="list-style-type: none"> • Implementation
6	Sujala Watershed Development Programme	Trainings	Training support	<ul style="list-style-type: none"> • Expertise sharing • Trainings • Advisories
7	ATMA	Training	Training support	<ul style="list-style-type: none"> • Expertise sharing

Sl. No.	Name of stakeholder	Mechanism of partnership	Funding and sharing of resources	Role of KVK
8	DCCD, Cochin	Joint implementation of activities for promotion of cashew	<ul style="list-style-type: none"> • Training and extension support 	<ul style="list-style-type: none"> • KVK played the role of nodal agency for implementation • Supply of grafts • Advisories

RESULTS AND DISCUSSION

Impact of KVK Convergence Activities

Enhancement of outreach was the key outcome of convergence activities. KVK's visibility has increased due to these efforts. Before convergence, KVK was working as an isolated institution with minimum reach and had to achieve the targets with available manpower and resources. Through partnership, KVK's number of training programmes and extension activities have significantly increased. KVK used to train 150-200 farmers per year on dryland horticulture before convergence. After convergence, KVK trained 400-500 farmers per year. The extension mechanism of KVK reached nook and corner of the district. Sale of seedlings was negligible before convergence. With convergence, KVK has started selling 6000-8000 seedlings per year. This has been achieved through the convergence and partnerships with different stakeholders.

Impact at field level

Comprehensive interventions of KVK with convergence mechanism has paved the way for spread of mango and cashew area in Gadag district. The details of impact of convergence is presented in Table-3:

Table 3. Impact at field level

Sl. No	Particulars	Convergence impact at field level	
		Before	After
Mango cultivation			
1	Area under mango (ha)	300	2500
2	No. of farmers covered	170	478
3	No. of villages covered	32	112
4	Average net income from 8-10 years old mango orchard (Rs./ha)	20,000 from Groundnut cultivation	80,000 from Mango cultivation
5	Marketing of fruits	Middleman	Own marketing
Cashew cultivation			
1	Area under Cashew (ha)	-	500
2	No. of farmers covered	-	386
3	No. of villages covered	-	45
4	Average net income per ha from 5 years old cashew orchard (Rs./ha)	-	75000

Data presented in Table-3 reveals that there is a significant impact of convergence activities on area expansion and farmers' income. Area under mango and cashew are increasing year after year. Forty percent of mango and 70 percent of cashew crop is yet to reach the economic bearing stage and in future both the crops would contribute significantly to the district economy.

CONCLUSION

Institutional convergence has created mutual understanding between KVK and institutional partners. The partnership was complementary in terms of sharing resources and expertise. Extension efficiency of KVK has increased with respect to horticulture promotion activities. The convergence mechanism has an output in terms of increased area under mango and cashew and 3-4-fold increased income for farmers. In the years to come, both the crops would significantly contribute to the district economy. In the present context, KVK needs to collaborate as an expertise partner which is vital for providing need-based solutions to farmers.

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Sustainability and Socio-Economic Benefits of Organic Coconut Cultivation

Darthiya M. and Mude Ashok Naik

INTRODUCTION

Dr. A.P.J. Abdul Kalam stated “Organic agriculture, a holistic system that focuses on improvement of soil health, use of local inputs and relatively high intensity use of local labor, is an admirable fit for dry lands in many ways and the dry land offer many benefits that would make it relatively easy to implement.” According to the USDA National Organic Standards Board (NOSB), organic agriculture is defined as “an ecological production management system that promotes and enhances biodiversity, biological cycles, and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain, or enhance ecological harmony”.

The coconut palm grows throughout the tropics and is widely called the “tree of life” for its important role in smallholders’ livelihoods as a direct source of cash income, nutrition and materials. The economic importance of this tree crop is evident from the fact that it is grown in more than 90 countries across the world in an area of 14.231 million hectares producing about 57.514 billion nuts or 10.52 million tonnes of copra. India ranks third on world coconut map and in recent times became the largest producer of coconut with the production of 16.9 billion nuts from acreage under plantation of about 1.89 million hectares. Even though India is among the largest producers of coconut with a distinction of having the highest productivity of 7779 nuts per hectare as against 3630 nuts per hectare

in Indonesia and 3859 nuts per hectare in Philippines, the per capita annual availability of coconut estimated to have been 10 nuts only which is quite low compared to 222 of Philippines, 145 of Sri Lanka and 55 nuts of Indonesia (Source: Coconut Development Board). So, there is a need to develop cultivation practices for a sustained and higher productivity, which should also be economically feasible to the farmers. Hence practicing organic farming becomes indispensable to fight against these challenges and also to combat threatening climate change issues.

MATERIAL AND METHODS

This survey based research was carried out in Thirupur district of Tamil Nadu, India during 2013 with the sample size consisting of 20 organic farmers and 20 inorganic farmers. The primary data were collected from the sample farmers by personal interview method. Based on the physical, cultural and socio-economic environment of farming in the study area, interview schedule was designed, pre-tested and finalized. A reconnaissance survey of the area was undertaken to explore the possibility of conducting the study. Information on family composition, size of the holding, area under various crops, inventory of resources, cropping pattern, extent of farm inputs used, cost and returns of growing coconut and organic coconut, problems faced by coconut growers were obtained. We had chosen twenty farmers each from organic and inorganic coconut growers for the survey in Thirupur region. Conventional/percentage analysis, Garrett ranking technique and feasibility analysis were the tools used for data analysis. The interpretation of information is obtained under the following major heads:

- General characteristics of the sample farmers
- Constraints faced by the farmers
- Feasibility of organic coconut cultivation
- Profitability analysis of organic coconut cultivation

RESULTS

1.1. Percentage Analysis

The general characteristics of the sample farmers include age, gender, farming experience, family details, educational status and the land holding pattern.

Table 1. Farming experience (n=40)

Farming Experience (years)	No. of organic farmers (%)	No. of inorganic farmers (%)
<15	4 (20.00)	3 (15.00)
15-25	5 (25.00)	8 (40.00)
>25	11 (55.00)	9 (45.00)
Total	20 (100.00)	20 (100.00)

(Figure in the parenthesis indicates that percentage to the total)

From the above table we can conclude that 55% of organic farmers have more than 25 years of experience while in inorganic only 45%. As we discussed above, this shows that the experienced farmers are more oriented towards organic cultivation.

Table 2. Gender of the farmer (n=40)

Gender	No. of organic farmers (%)	No. of inorganic farmers (%)
Male	17 (85.00)	19 (95.00)
Female	3 (15.00)	1 (5.00)
Total	20 (100.00)	20 (100.00)

(Figure in the parenthesis indicates percentage of the total)

From the above analysis, it was inferred that 85% of the farmers involved in organic farming are male and inorganic 95% of them are male. Females are more likely to be involved in organic farming when compared to inorganic farming.

Table 3. Qualification of farmer (n=40)

Qualification	No. of organic farmers (%)	No. of inorganic farmers (%)
Illiterate	0 (0.00)	1 (5.00)
Up to 10 th	7 (35.00)	11 (55.00)
10 th -12 th	2 (10.00)	3 (15.00)
Degree	11 (55.00)	5 (25.00)
Total	20 (100.00)	20 (100.00)

(Figure in the parenthesis indicates percentage of the total)

From the above data, we observed that 55 % of organic farmers are degree holders while in inorganic only 25% of them are degree holders. This shows that literate persons are more aware towards soil health, sustained production, and quality of the product which makes them more involved in organic farming.

2.1. Garrett Ranking Techniques

Table 4. Constraints faced by the farmers

Sl. No	Constraints	I	II	III	IV	V	VI
1.	Electricity	32.5	2.5	7.5	27.5	12.5	2.5
2.	Price Fluctuation	27.5	12.5	27.5	17.5	2.5	0
3.	Price of Nuts	22.5	42.5	22.5	0	2.5	0
4.	High Cost of Manures	0	2.5	7.5	17.5	32.5	27.5

5.	Marketing Facilities	7.5	12.5	12.5	12.5	22.5	17.5
6.	Labor	0	12.5	7.5	17.5	0	52.5

From the above analysis table, we predicted that electricity is the major problem faced by 32.5% of the farmers, price fluctuation ranked as first and also third by different population of 27.5% of the farmers, 42.5% of the farmers say price of nuts as their second major constraint, high cost of manures ranked as fifth place by 32.5% of the farmers and both marketing facilities and labor problem shares sixth place by 17.5% and 52.5% of the farmers respectively.

3.1. Feasibility Analysis

Table 5. Income comparison of organic and inorganic

Sl.No	Particulars	Organic	Inorganic
1.	No. of trees	70	70
2.	No. of nuts per tree	180	150
3.	No. of nuts/acre	12,600	10,500
4.	Price of nut	7	7
5.	Weight of Copra/100 nuts	18	15
6.	Weight of copra/acre	2,268	1,575
7.	Price of copra	43	43
8.	Income/acre (Rs.)	97,524	67,725

From the above table, it shows that in organic farming number of nuts per tree is 180 but in inorganic farming it is 150. Copra weight per 100 nuts is 18 kg in organic farming but in inorganic farming it is 15 kg. Copra weight per acre in organic farming is 2,268 kg but in inorganic farming is 1,575 kg. Income obtained from an area of one acre in organic farming is Rs.97,524/- and Rs.67,725/- in inorganic farming.

3.1.2. Benefit Cost Ratio (BCR)

BCR for Organic:

come

$$\begin{aligned} \text{BCR} &= \frac{\text{In-}}{\text{Cost}} \times 100 \\ &= \frac{97,524}{22,650} \times 100 \\ &= 4.31 (>1) \end{aligned}$$

BCR for organic coconut cultivation is 4.31 and for inorganic coconut cultivation is 1.71. So an organic farmer can fetch profit of Rs.3.31 while inorganic farmer can fetch only Rs.0.71 when they invest one rupee on their farm. It shows that, organic coconut growers can get more profit than inorganic coconut growers.

DISCUSSION

Application of organic manures such as vermicompost, crop biomass, raising and incorporation of green manure legumes in coconut basins, green leaf manures such as neem, pongamia, glyricidia, bio-fertilizers, cultural practices like mulching, half-moon bunding, catch pit preparation etc., are some of effective low cost organic practices which are effective in utilization of natural resources for enhancing coconut production in a sustainable manner.

The average water requirement of coconut is 60l/day. While on organic cultivation with proper mulching practices, tree requires 300l/10days. So, the monthly requirement in conventional farming is 1800l/month but, organic practices require only 900l/month. Adopting drip irrigation and pitcher pot irrigation method especially for dry areas are more advisable.

A farmer who is practicing organic production can adopt insitu vermiculture in his farm which much lowers the cost of production. Culturing earthworms in the field itself, by releasing earthworms @ 100gm/coconut tree (4 lac /acre), later multiplies and gives vermicompost of 6 tons/acre. Cocoa is the best suited intercrop for coconut farm which needs less care (excludes young stage) and increases organic humus content as it has high leaves withering nature. It also increases 25% of coconut nut yield.

CONCLUSION

UN report says world drylands (arid and semi-arid regions) area has taken up 41.3% of the total land surface. Hence, to fight against threatening drought in arid and semi arid regions of the world, organic agriculture will be the alternative solution and hence from the above interpretations, the organic coconut production is sustainable over a longer period of time with increased production, quality that is feasible and adoptable by the farmers for releasing more profit by social economic means.

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Cluster Frontline Demonstration: An effective Approach for Increasing Productivity and Profitability of Bengal gram (*Cicer arietinum L.*) in Hassan District

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INTRODUCTION

Pulses are an important commodity group of crops that provide high quality protein (17-25%) complementing cereal proteins (6-10%) (Veeramani et al., 2017). Although, being the largest pulse crop cultivating country in the World, pulses share to total food grain production is only 6-7% in the country. During the year 2016-17, India has achieved 23.13 million tonnes of pulse production from an area of about 29.94 million hectares with an average productivity of 786 kg ha⁻¹ (Anon. 2018), but it is far below the global average productivity of 840 kg ha⁻¹ (Raj et al., 2013).

Bengal gram is called Chickpea or Gram (*Cicer arietinum L.*) is a major pulse crop in India contributing about 30 % of total pulse acreage and about 40 % of total pulse production of the nation. It is a protein-rich supplement to cereal-based diets, especially to the poor in developing countries, where people are vegetarians or cannot afford animal protein. In India, the production of Bengal gram during 2016-17 was 11.15 million tonnes from an area of about 10.57 million hectares with an average productivity of 1056 kg ha⁻¹ (Anon, 2018). In Karnataka, Bengal gram grown in an area of about 13.75 lakh hectares with an average production of about 8.25 lakh tonnes in 2016-17 (Anon. 2018).

Cultivation of Gram in marginal land, limited area under irrigation, limited use of high yielding variety, imbalanced fertilizer application, losses due to pests and diseases and processing loss up to 6-8 percent were the major constraints for the stagnation of pulse production over the decades. In order to increase an area, production and productivity of pulses “Technology Mission on Pulses” was established by Government of India in the year 1991-92. The concept of Frontline demonstrations was put forth under this mission by scientists of Krishi Vigyan Kendra’s, SAU’s, ICAR institutes and NGOs. Interception of Cluster Front Line Demonstrations (CFLDs) concept at farmer’s field increases the area and production of pulses in Karnataka state from last few years by transfer of technologies on a large scale (cluster concept).

Over a period, a number of improved varieties and production technologies of Gram have been developed, but full potential of the crop could not be achieved due to lack of awareness on improved varieties and technologies. Therefore, efforts were made through Cluster Front Line Demonstrations to introduce innovative approaches in Gram cultivation with a view to increase its production and productivity in the district.

METHODOLOGY

The study was carried out by Krishi Vigyan Kendra, Kandali in Rabi season at farmer’s fields of Hassan district during 2016-17 to 2018-19. In this study, 134 farmers were selected from aforesaid blocks based on their active participation and feedback received during the preliminary survey and interactive meetings. All 134 demonstrations in 56.8 ha area were conducted with an objective to demonstrate the improved pulse production technologies in different cluster villages during the consecutive years of study.

The technological intervention was taken as per package of practices for improved variety of Bengal gram along with farmer’s practice as control plot (Table 1). The critical inputs (seeds of improved variety, bio fertilizers, and plant protection chemicals) for the demonstrations (Table 1) were distributed to the farmers after the training. Scientists visited regularly to the CFLD’s plots and farmers practice plots for recording the observation on growth and yield parameters, monitoring of pest and diseases in the field and also collect feedback information from the farmers for further improvement in research and extension

programmes. The soil samples from the demo plots before sowing and after harvest of the crop were collected and analyzed in soil testing laboratory of KVK, Kandali.

Table 1. Technologies demonstrated and farmer’s practices under CFLD on Bengalgram.

Particulars	Technological intervention in CFLD	Farmer’s practices
Variety	JG-11 & JAKI-9218	Annigeri-1
	Drought & disease tolerant	Drought tolerant
Seed Rate	kg/acre 25	kg/acre 30
Seed treatment	Bio fertilizers like <i>Rhizobium</i> , PSB & <i>Trichoderma</i>	No seed treatment
Fertilizer dose	kg NPK/ ha 25 :25 :12.5	Imbalanced application of fertilizers
	soiltest-based fertilizer application	No soil test
Plant protection	IPM with need based timely spraying	Improper measures & bios spraying

The grain yield of demo plots and farmer’s practice plots, extension gap, technology gap, technology index, economic parameters (Gross cost, Gross returns, Net returns, B C ratio) were recorded and analyzed (Table 2 and 3) to compare the performance of crop under demonstrations and farmer’s practice. Different parameters were calculated to find out technology gaps (Yadav et al., 2004).

Extension gap (q ha⁻¹) = Demonstration yield– Farmer’s practice yield

Technology gap (q ha⁻¹) = Potential yield - Demonstration yield

Technology Index (%) = (Technology gap/Potential yield) * 100

The extension activities i.e., awareness programmes(training), diagnostics visits, advisory services by KVK scientists to the demo farmers were carried out during the study. Finally, field day was conducted by involving demonstration farmers, other farmers in

the villages, scientists from university and ATARI, Agriculture Department officials and local extension functionaries in order to disseminate the demonstrated technologies on large scale.

RESULTS AND DISCUSSION

Results of Cluster Frontline Demonstrations conducted during 2016-17 to 2018-19 in different villages of Hassan district indicated that, the average grain yield of demonstrated plots was higher from farmer’s practice in all 134 blocks. The results revealed that, seed treatment with Trichoderma and introduction of wilt resistant varieties (JG-11 and JAKI-9218) under demonstrations will effectively reduce the percent wilt incidence (5-8%) over farmers practice (15-20%).

Table 2. Yield performance of Bengal gram under cluster front line demonstration

Years	No. of Demo	Area of CFLD (ha)	Demo variety	Average yield ((g/ha)		% yield increase	Potential yield (q/ha)	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
				Demo	FP					
2016-17	25	10	JG-11	12.04	10.34	16.51	13	1.7	0.96	7.38
2017-18	67	26.8	JAKI-9218	13.19	10.76	22.58	20	2.43	6.81	34.05
2018-19	42	20	JAKI-9218	12.46	9.68	28.71	20	2.78	7.54	37.7
Total	134	56.8	-	-	-	-	-	-	-	-

The average yield of Bengal gram under demonstrations were 12.04, 13.19 and 12.46 q ha-1 as compared to 10.34, 10.76 and 9.68 q ha-1 recorded in farmer’s practice and average yield increase over check was 16.51, 22.58 and 28.71 percent, respectively (Table 2). Similar results were in accordance with findings of other workers (Dubey et al., 2010, Singh et al., 2011). The better yield in CFLD fields may be due to awareness and adoption of improved variety along with package and practices (Table 1). The present findings are

also in accordance with the findings of Sharma (2014), who found that, the yield levels under farmer’s practices were always lower than obtained under frontline demonstration.

The technology gap of 0.96, 6.81 and 7.54 q ha⁻¹, respectively may be attributed due to non-uniformity in the soil fertility status and weather conditions (Mukharjee, 2013) (Table 2). Hence, location specific varieties and recommendation are necessary to minimize the technology gap for yield levels in different situations (Rachhoyact al., 2018).

The extension gap recorded from three consecutive years of study were 1.7, 2.43, 2.78 q ha⁻¹. This emphasized that farmers should be aware for adoption of improved production technology in Bengal gram to reverse this trend of wide extension gap. The new technologies will eventually lead the farmers to discontinue old technology and practicing the new technology (Table 1). These findings is in agreement with the findings of Hiremath and Nagaraju (2010). The technology index recorded was 7.38, 34.05, 37.7 per cent, respectively (Table 2). The technology index showed the feasibility of evolved technology at farmer’s fields and lower the value of technology index, more is the feasibility of technology (Katare et al., 2011).

Table 3. Economic analysis of the Cluster Frontline demonstrations on Bengal gram

Year	Gross Cost (Rs/ha)		Gross Return (Rs./ha)		Net Returns (Rs./ha)		B C ratio		% increase in Net Returns
	Demo	F P	Demo	F P	Demo	FP	Demo	F P	
	2016-17	23000	22500	78260	67210	55260	44710	3.4	
2017-18	34182	32000	79140	64560	44958	32560	2.31	2.01	27.57
2018-19	25100	21000	61054	47432	35954	26432	2.43	2.26	36.02
Mean	-	-	-	-	-	-	-	-	29.06

During 2016-17 to 2018-19, the cultivation of Bengal gram under CFLDs gave higher net returns of 55260, 44958 and 35954 Rs

ha-1 against farmer's practices of 44710, 32560 and 26432Rs.ha-1, respectively. It was found that, the average percent increase in net returns was 29.06 and the highest B C ratio observed in demo plots were 3.40, 2.31 and 2.43 as compared to farmer's practices, in which lowest B C ratio of 2.98, 2.01 and 2.26 was recorded. This may be due to higher yield obtained under demonstration compared to local check. These findings are in agreement with the findings of Hiremath and Nagaraju (2010), Kiresur (2011) and Kumar (2015).

CONCLUSION

It is concluded that the Cluster Frontline Demonstration is an effective tool for increasing area, productivity and profitability of pulse crop and also improving the knowledge, skill of farmers on adoption of improved technologies. The study revealed that highest yield, net returns and B C ratio recorded in CFLDs than Farmer's practice in all blocks of cluster villages which was attributed to higher potential with improved variety, timely sowing and timely supply of critical inputs, package of practices with scientific intervention. The group discussions, field days and beneficiary farmers of CFLD's also played important role in wide dissemination of demonstrated technologies to other farmers.

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Is Value Chain a ‘reality’ or ‘misnomer’ in Farmer Producer Companies (FPCs)? Facts from Field in Tamil Nadu

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INTRODUCTION

Farmers Producer Companies in recent past have emerged as an important institutional innovation in the development of agribusiness in the country. The plethora of advantages in collectiveness of farmers which starts from input purchase to marketing and value addition has been well recognized by farmers. If one could track the evolution of FPCs, it had its roots in the mobilisation of farmers groups, commodity groups, farmers interest group and the things got changed after 2013, when an act on Farmers Producers Company was passed by the Government of India through necessary amendments in Company’s act.

According to Sawairam (2015) empirical evidences from baseline study on producer companies in India show that increasingly the ideas of economies of scale as applied in industrial corporations is being mainstreamed in the domain of agricultural ecosystems including small and marginal farmers, agricultural production, agricultural value addition, agricultural marketing, and producer organizations. He recommended that FPCs were to act as a means to provide market linkages to the farmers and improve the collective bargaining capacity of the farmers. He insisted that most producer companies in India have not identified their optimal market landscape where they can optimize

their net income per unit of produce for the farmers / members of the respective producer companies.

Emergence of agreements between supermarket chains and FPOs is more likely in high-value products with high perishability and a high frequency of production (Fischer and Qaim, 2012; Hellinet al., 2009). Supermarkets are also more likely to enter into an agreement with an FPO when the specific group organizes the bulk of the production of one product in a region (Jia and Huang, 2011) or when the group provides required branding or certification of members' produce which is not otherwise available with individual farmers but important for the marketing process (Moustieret al., 2010). The case studies also suggest that FPOs with higher levels of skills and capabilities are more successful in negotiating agreements with supermarket chains (Hellinet al., 2009; Moustieret al., 2010). Because of their empowering potential for smallholder farmers in value chains, FPOs have gained renewed interest in recent years from governments, donors and NGOs alike who see them as appropriate institutions for building capacity among farmers and helping them participate more competitively in globalized market environments (Rondot and Collion, 2001; World Bank, 2007).

The supply chain and value chain management in Farmer Producer Companies have not been studied in detail and the literature is scarce in India. In Tamil Nadu sporadic studies have been attempted to study the FPCs but wholistic value chain studies are missing. In order to fill this research gap the present study has been commissioned to analyze the value chain in detail in selected FPCs in Tamil Nadu. The study was supported by ICAR through extramural grant mode and was completed during 2017. In this article important findings of the project are presented which could be organized under three objectives.

- To study the services offered by FPCs to operationalize the value chain activities
- To analyze the impact of the value chain on the agricultural activities of members of FPC
- To understand the benefits accrued by the farmers through comparing before and after joining FPC

METHODOLOGY

There are 156 Farmer Producer Companies in Tamil Nadu out of which eight best performing Farmer Producer Companies representing seven agro-climatic zones of Tamil Nadu were selected based on number of members in FPC (size) , scale of operation (quantum of business) , number of value chain activities prominence in the locality. The data pertaining to value chain was collected through the following quantitative and qualitative data collection tools which supplemented and complemented each other.

Case studies of selected ten Farmer Producer Companies (FPCs)

Interview with wellstructured Interview schedule- Twenty individual farmers in each of the FPC were contacted and totally 200 farmers were administered with the Interview Schedule

Focus Group Discussion with NGO personnel, line department officials, retailers and wholesalers and other stakeholders whoever deal with the commodity of FPC were conducted

Participatory Workshops among farmers to collect qualitative data on value chain were also conducted

The value chain analysis was carried out at every stage namely Input purchase, Production, harvesting, post-harvest handling including sorting, grading, storage, packaging, transportation to marketplace and value addition of agricultural commodities handled by the FPCs. The items namely value creation in each stage in monetary terms, nature of agreement with stakeholders, nature of integration, comparison with traditional chain, bargaining capacity and Institutional support were studied.

The impact of value chain management on the individual farmer was studied through four statements. The FPCs were categorised into Established FPCs and Progressive FPCs and 120 and 80 respondents (totally 200 respondents) in former and latter type of FPCs were selected randomly for the study. The statements related to impact on agriculture were administered among these respondents and the data was compared by using chi-square test.

Services offered by Selected FPCs to analyse the Value chain

An effort has been made to analyse the selected FPCs to see whether they have been giving various services and the data is depicted in the

following table 1. The organizational services are offered by all the FPCs selected for the study. This service refers to making the farmers enrolling themselves as shareholders and issuing share certificate and other organizational services. The production services also was found to be offered by all FPCs selected for the study. The FPCs mandate is to facilitate the farmers in cultivating crops and hence it is there in all the FPCs selected. The inputs like seeds, fertilizers and other plant protection chemicals are also an important service of FPC. Among the selected FPCs, Virudhai Millet FPC, Theni Goat FPC, Ramanathapuram Chilli FPC, Erode Precision Farming FPC, Srivilliputtur Maize FPC and Ayakudi Guava FPCs were found to offer input services. Among these FPCs, Erode Precision Farming FPC and Ayakudi Guava FPCs have got their own input shop to serve the farmers and give quality inputs for the farmers.

Table.1. Services offered by FPCs as to integrate the value chain

Services of FPCs	Virudhai Millets FPCL	Theni District Goat FPCL	Ramanathapuram Chilli FPCL	Erode Precision Farming FPC	Srivilliputtur Maize FPCL	Vaigai FPCL	Madurai Coconut FPC	Cinnamanur Vegetable FPCL	Periyakulam Mango and vegetables FPCL	Ayakudi Guava FPC
Organizational services	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Production services	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Input Supply Services	✓	✓	✓	✓	✓	-	-	-	-	✓
Marketing services	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Financial services	✓	✓	-	-	-	-	-	-	-	-
Procurement packaging services	✓	✓	✓	✓	✓	-	-	-	-	✓
Technology services	-	✓	-	✓	-	-	-	-	-	✓
Insurance services	-	✓	-	✓	-	-	-	-	-	✓
Education services	-	✓	-	✓	-	-	-	-	-	✓
Value addition services	✓	-	✓	✓	-	-	-	-	-	✓

Welfare services	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Management of Resources	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Linking services	✓	✓	-	✓	-	-	-	-	-	✓
Net-working services	✓	✓	-	✓	-	-	-	-	-	✓
Obtaining grants	✓	✓	-	✓	-	-	-	-	-	✓

As for as marketing services are concerned, it is found that all the selected FPCs have been doing it as it is one of the important mandates to give remunerative price. Many of the selected FPCs are procuring the produce and tried to sell it to fair price domestically or selling it in a market where remunerative price could be obtained. The financial services are offered by few FPCs only. They are Virudhai Millet FPC and Theni Goat FPC. Virudhai millet FPC got an interest free loan from a lending agency and distributed it to farmers so that farmers got interested to be the members of FPC

Procurement and packaging services are being performed by Virudhai Millet FPC, Theni Goat FPC, Ramanathapuram Chillies FPC, Erode Precision FPC, Srivilliputtur Maize FPC and Ayakudi Guava FPC. Virudhai Millet FPC is cleaning, grading and packaging millets to get good price in the market. Similarly Ramnad Chilli FPC is also grading and packaging chillies whereas Erode Precision Farming FPC did package attractively pomegranate to get good price. Ayakudi guava farmers learnt how to package the guava to abroad. Guava with two leaves is essential for exporting is the knowledge gained by them.

Among the FPCs only three namely Theni Goat FPC, Erode Precision FPC and Ayakudi Guava FPC were found to offer technological services to their members. Theni Goat FPC has been sending voice SMS about goats to their members in which technologies related to hygienic goat rearing are being sent. Erode Precision FPC and Ayakudi Guava FPCs are being patronized by TNAU scientists who often give technological services to these FPC members. Similarly insurance service is also being rendered by these FPCs only. Value addition services were carried out by only a few FPCs. Realising the benefit of earning substantially through value addition Virudhai Millet FPC, Ramnad Chilli FPC, Erode Precision FPC and Ayakudi Guava FPC are doing value addition. Virudhai

millet FPC is processing millets and created a brand name for itself called 'Virudhai millet'. Ramnad Chilli FPC is adding value by means of producing chilli powder and marketing it. Similarly, Erode Precision FPC is doing a lot of value added products and market it through its chain of stores by a brand name called "Annam". Ayakudi Guava FPC has been preparing value added products from guava like juice, jam and jelly.

The welfare services and management of resources has been done by all selected FPCs. Linking and networking are important for doing business. Only few FPCs are doing it for making the business flourish. Among them, Virudhai Millet FPC, Theni Goat FPC, Erode Precision Farming FPC and Ayakudi Guava FPC are prominent. They have been linking with formal and informal institutions to keep their business flourishing. Only four FPCs got matching grants and other grants from State and Central Governments. They are Virudhai Millet FPC, Theni Goat FPC, Erode Precision FPC and Ayakudi Guava FPC. The combination of above said services could see the FPC at a higher level when compared to other FPCs. The FPCs should learn from other FPCs and hence among the services, the networking and linking are found to be important. The Farmer Producer Companies which are good at these services can do wonderful business. For example Ayakudi Guava Farmers learnt to link to formal institution like Tamil Nadu Agricultural University and also link with exporting firms and export their fruits to Arab countries.

Another important service is technology and educational service which did not get attention in many of the FPCs. Only those FPCs who got a back up of technology can thrive well. The productivity of the crop can be improved, the challenges of biotic and abiotic stress can be tackled through these technological and educational services. Hence, the other FPCs should learn and adopt from other FPCs which is a prerequisite for them.

Agricultural Impact created due to Operationalising Value Chain in FPCs

The impact of value chain management in FPCs on the agricultural operations was studied using four items and the results are presented in table 2. Slightly more than half (52.20%) of the respondents equally endorsed that due to value chain integration FPCs could "improve drastically" their knowledge on choosing remunerative crops and

their knowledge on where, when and how to get agricultural inputs. Nearly one-third of the total respondents reported that there was “less improvement” in accumulating knowledge of choosing remunerative crops (38.90%) and their knowledge on where, when and how to get agricultural inputs (36.70%).

A conspicuous difference was observed between ‘established FPC’ respondents and progressive FPC respondents’ with respect to these two knowledge items. As far as the knowledge of choosing remunerative crops ‘established FPC’ (68.90%) outnumbered of progressive FPC respondents’ (35.60%) in “drastic improvement category”. Whereas progressive FPC respondents’ (57.80%) outnumbered ‘established FPC’ respondents (20.00%) in “less improvement” category. This difference was substantiated by significant chi-square value at 1 percent level of probability.

More number of ‘established FPC’ respondents (73.30 %) were found than progressive FPC respondents (31.10%) in the “drastic improvement” category for the impact of item of knowledge of where, when, and how to get agricultural inputs. In “less improvement” category for this item the progressive FPC respondents (46.70%) outnumbered ‘established FPC’ respondents (26.70%). The chi square was significant at 1 percent level of probability, which indicated ‘established FPC’ respondents and progressive FPC respondents differ in accumulating knowledge on where, when and how to get agricultural inputs as a result of being a member of FPC.

Table 2. Distribution of respondents according to the impact on agriculture due to integration of value chain

Sl. No.	Statements	Less Improvement		Improved drastically		No Improvement		Chi-square value												
		E.FPC (n=120) F %	P.FPC (n=80) F %	Total (N=200) F %	E.FPC (n=120) F %	P.FPC (n=80) F %	Total (N=200) F %													
1	Knowledge of choosing remunerable crops	24	46	57.78	70	35.11	83	68.89	28	35.56	111	55.56	13	11.11	5	6.67	19	9.33	13.544**	
2	Utility of programs of Development departments	48	40.0	27	33.33	75	37.33	56	46.67	25	31.11	81	40.44	16	13.33	28	35.56	44	22.22	6.218*
3	Cropping pattern	64	53.33	34	42.22	98	48.89	27	22.22	14	17.78	41	20.44	29	24.44	32	40.00	61	30.67	2.493 ^{NS}
4	Knowledge on where, when and how to get agricultural inputs.	32	26.67	37	46.67	69	34.67	88	73.33	25	31.11	113	56.44	0	0.00	18	22.22	18	8.89	20.135**

NS- Non significant S- Significant *- Significant at 5% **-Significant at 1%

E.FPC-Established FPC

P.FPC-Progressive FPC

It could be interpreted from table 2 that the respondents could be able to get knowledge of remunerative crops and knowledge about agricultural inputs from department officials and KVK scientists. Further the progressive FPC respondents were found to accrue lesser knowledge than 'established FPC' respondents.

One-third of total respondents each were in "drastic improvement" category (38.90%) and "less improvement" (36.70%) with respect to the impact of utilizing the benefits of programs of development departments. One-fourth (24.40%) did respond that there was "no improvement" in utilizing the benefits of programs. The observation of the table 2 revealed that there was mixed opinion of the respondents in all the three categories with respect to utilizing the benefits of programs of development departments. More 'established FPC' respondents (46.70% and 40.00%) were found in 'drastic improvement' and 'less improvement' category than progressive FPC respondents' (31.10%), (33.30%) whereas progressive FPC respondents (35.60%) outnumbered 'established FPC' (13.30%) with respect to utility of benefits of programs. The chi square was significant at 5 percent level of probability indicating significant difference between 'established FPC' respondents and 'progressive FPC' respondents in terms of utilizing the benefits of development programs. Given the distribution of the data in 'less improvement' and 'no improvement' categories put together, efforts are needed on the parts of development departments, KVKs and NGOs to sensitize the company members about the programs and make them utilize the benefits of the programs.

Majority of the respondents reported that there was either 'less improvement' (46.80%) and 'no improvement' (32.20%) with respect to the impact on cropping pattern. One-fifth (20.00%) of the respondents only reported that there was a drastic improvement in cropping pattern. The results showed that, the respondents were glued to the existing cropping pattern and reluctant to change due to their experience and availability of water. The cropping pattern which was prevalent in the study area was paddy followed by maize and millets. The respondents told the researcher that their experience they fine-tuned cropping pattern through and arrived at the appropriate one and hence don't want to change the cropping pattern. The distribution of data for 'established FPC' respondents and 'progressive FPC' respondents revealed that there was no difference between them which was substantiated by non-significant chi-square value.

Value Chain Analysis in selected FPCs

Value chain management deals with creation of value at each level of flowing of agricultural commodities from seed to marketing to value addition. The value will be created at each level of commodity movement from the input purchase, production and movement of goods to the marketing and value addition of commodities.

The members of FPCs were asked about the activities of their FPC at each stage of growth of crops. For example, some of the FPCs were found to distribute seeds, fertilizers, plant protection chemicals at a cost lesser than market price. Some FPCs like Virudhai Millet FPC used to give credit to farmers. Hence in the input stage itself the value chain starts. Next to inputs the members of the FPCs were asked about what interventions that they have done in the production stage, may be giving a particular crop advisory or provision of some agricultural Implements. Next to production stage the members of the FPCs were asked about the marketing. Majority of FPCs were intervened in the marketing only. All the FPCs were found to procure the agricultural produce, that is pooling the agricultural produce from their members and sell it at a price which is higher than the market price.

A few FPCs were found to involve in value added activities of the produce. For example, Ayakudi Guava FPC and Virudhai Millets FPC were found to be involved in value addition in the form of Guava juice, processed and packed millets and get a remunerative and attractive produce for their members and hence the members could get additional margin. The FPCs namely Periyakulam Mango and vegetables FPCL, Theni District Goat FPCL, Cinnamannur Vegetable FPCL, Srivilliputtur Maize FPCL, Virudhai Millets FPCL, Ramanathapuram ChiliFPCL, Madurai MavattaTennaiMatrumEtharaPayargalUrpathiyalargal Company Ltd., and Vaigai FPCL were contacted and their value chain is discussed in table 3. When the farmers were organized into Virudhunagar Millet Farmer Producer Company under the aegis of SEEDS, an NGO based at Virudhunagar, the way they farmed has changed. As illustrated in the figure, the important inputs like seeds, fertilizers and pesticides were sold at 2% less to farmers and they were given with credit up to Rs. 30000-Rs. 50000 @ 14% interest per annum. Further, the procured the produce from farmers and gave Rs.78, six rupees more than the market price and the company is trading it to Bangalore @ Rs.80/kg. They told that 10 tonnes was used for value added products like millet biscuits, health mix, millets flour etc., An individual farmer could earn 23.8% extra than what he earned before following conventional way of marketing. Partial budgeting of trading of blackgram through Virudhai Millet FPC has resulted in the Net change in income of Rs. 1720/acre whereas in cumbu, the net change in income was Rs. 11750.

Table 3. Analysis of value chain activities in selected FPCLs

Commodity handled	Virudhai Millets FPCL	Theni District Goat FPCL	Ramana-thapuram Chili FPCL	Neithal Sustainable Agriculture FPC	Srivilliputur Maize FPCL	Madurai coconut FPC	Cinnamannur Vegetable FPCL	Periyakulam Mango and vegetables FPCL
Facilitation through provision of inputs	Pulses, millets Credit, seeds, fertilizers and pesticides	Goat Medicines to goats	Chillies Credit	Rice Seeds and Fertilizers	Maize -	Coconut -	Vegetables -	Mango -
Facilitation in Marketing and innovation	Bulk purchase from farmers and value addition	Bulk purchase and sell live goats, correct weight	Bulk purchase from farmers and correct weight	Bulk purchase and selling red rice for higher price in other states	Bulk purchase from farmer giving more margin than market price	Bulk purchase and oil extraction	Bulk purchase giving more margin for farmers	Bulk purchase and value addition
Percentage of benefit to individual farmers	% 23.8	13%	40%	32%	7%	15%	5%	38%
Net change in income for individual farmer/acre	Rs. 11750	Rs. 10000/ farmer/20 goats	Rs. 2400	Rs. 4100	Rs. 5200	Rs. 4900	Rs. 17000	16000

Ramanathapuram Chillies FPC used to give credit 30000 to 50000 on very less interest rate, through which farmers could save 10%. From the bulk purchase of Mundu chillies the company was able to give Rs. 5 more than the market price. When the market price was 45 the company could give Rs. 50. Further, accurate measurement at company has increased the percentage of profit for the farmers. Totally 15% could be earned more through this intervention. The company also involved in value addition of chillies wherein the company produced chilli powder and sold it in the market for 10 rupees less than the market and could establish their market. The net change in income by being a member of Ramanathapuram Chilli FPC is Rs.2400/acre which is quite convincing for farmers.

In Neithal Sustainable Agricultural Farmer Producer Company the farmers told they could save 5% each in seeds purchase and fertilizer purchase. The company procures paddy for Rs. 12 (approximately) while the market price was hovering around Rs. 10. This 2 rupees a kg gave lot of scope for farmers to take care of the cost of cultivation that they have incurred for paddy cultivation. The company also ventured into red rice cultivation and motivated the members to grow red rice which has got medicinal value and preferred by many in Tamil Nadu and Kerala. The red rice fetches Rs.60/kg which is a 20% profit, which is huge for farmers. By being a member of Neithal Sustainable Agriculture Farmer Producer Company resulted in the net change in income of Rs.4100/ farmer /acre which is quite phenomenal for a farmer who could rise only one crop in his land.

The starting of Madurai Coconut FPC resulted in procurement of nut by the company due to which the coconut farmers used to get atleast 2 rupees more than what they could obtain from commission agents. This will result in 5% increased income besides another 5% from avoiding extra coconuts to be given to commission agents which is a traditional practice in the area. The company is trying to extract oil also through which another 5% is also added to the profit of the farmers. Cumulatively, fifteen percentage additionally could be earned by a single coconut farmer by being a member of the company. The partial budgeting of the company revealed that the net change in income is Rs. 4900 per farmer which he could earn from single cutting of coconut. Cumulatively it may come around 15000 for four cuttings that farmers used to do in coconut.

The women farmers attached with Theni Goat Farmer Producer Company could get 5% extra margin for selling goats. Further they could get 5% extra margin from the medicines which are being given at subsidized cost. The important advantage being the technical information which is given to these women farmers through mobile based voice messages. Cumulatively, the women farmers could get 13% increased margin from the sale of goats when compared to conventional method of selling the goats to village level merchants. Ultimately the net change in income per farmer by being a member of the FPC is Rs. 10000.

The farmers attached with Chinnamanur vegetables FPCL told that they could be able to get at least Rs. 5 more than what the wholesale merchant gave them. Supposing the wholesale merchant gives 20 rupees, the company could pay Rs. 25 for the produce. Hence, the value chain analysis revealed that an individual farmer could get 5% extra by being a member of FPC. The net change in income for a farmer who is a part of the FPC is Rs. 17000, which is not possible for him if he confined himself to be a farmer without attaching himself to the FPC.

The analysis of value chain in Periyakulam Mango and Vegetable Farmer Producer Company revealed that the farmers could get at least 20 rupees and maximum it may go up to 25 rupees. The vegetables being perishable crops the price volatility is on the rise and hence the farmers being the members of FPC could get a stabilised price. Further, the company ventured into exporting moringa/drumstick leaves to Hyderabad and Kerala for Rs. 65/kg and the seed of drumstick were sold for Rs. 270 against the market price of Rs.250/kg. Ultimately through this value chain an individual farmer could get 38% profit more than what he could realize previously as an individual farmer. The added revenue was 20000 and the net change in income by being a member of FPC was Rs. 16000 which is not possible for a farmer if he was not a part of FPC. In Srivilliputtur Maize Farmer Producer Company the member maize farmers could get Rs. 14, two rupees more for a kilogram of maize. In turn, the company sells the procured maize to Suguna Chicken company for chicks feed. This resulted in 7% additional income to the farmers as being a part of the FPC. The net change in income for the farmers is to the tune of Rs.5200 which is realized by an individual maize grower.

CONCLUSION

The study on value chain management of selected FPCs in Tamil Nadu revealed that the FPCs offered various services ranging from organisational to financial and other related services which help in operationalising value chain and ultimately improved the margin for individual farmer member. There was a drastic improvement in knowledge of choosing the crops, utilizing the schemes operated by the Government. The analysis of value chain of Virudhai Millet Farmer Producer Company situated in Virudhunagar, the company has been involved in giving credit to farmers, supply of inputs and bulk procurement and selling of value-added products. Partial budgeting revealed that the net change in income of the members of this FPC is Rs. 1720/acre for black gram and Rs. 11750 for cumbu. Ramanathapuram Chilli Producer Company used to give credit to members with little interest rate and involved in bulk purchase of Mundu Chillies. The net change in income of farmers belonging to this FPC was Rs. 2400/acre. In a nutshell, it could be observed from this study that those FPCs which arranged credit, other agricultural inputs and took care of marketing did make a greater dent in the lives of members of the FPCs.

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