Extension For Horticultural Technologies

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EXTENSION FOR HORTICULTURAL TECHNOLOGIES

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This e-book is a compilation of resource text obtained from various subject experts of ICAR- Indian Institute of Horticultural Research, Bengaluru & MANAGE, Hyderabad on Extension for Horticultural Technologies. This e-book is designed to educate extension workers, students, research scholars, academicians related to Horticulture and extension methodologies for promotion of hortipreneurship, for value addition and doubling farmer's income. Neither the publisher nor the contributors, authors and editors assume any liability for any damage or injury to persons or property from any use of methods, instructions, or ideas contained in the e- book. No part of this publication may be reproduced or transmitted without prior permission of the publisher/editor/authors. Publisher and editor do not give warranty for any error or omissions regarding the materials in this e-book.

Published for Dr. P. Chandra Shekara, Director General, National Institute of Agricultural Extension Management (MANAGE), Hyderabad, India by Dr. Srinivasacharyulu Attaluri, Program Officer, MANAGE and printed at MANAGE, Hyderabad as e-publication.

MESSAGE

National Institute of Agricultural Extension Management (MANAGE), Hyderabad is an autonomous organization under the Ministry of Agriculture & Farmers Welfare, Government of India. The policies of liberalization and globalization of the economy and the level of agricultural technology becoming more sophisticated and complex, called for major initiatives towards reorientation and modernization of the agricultural extension system. Effective ways of managing the extension system needed to be evolved and extension organizations enabled to transform the existing set up through professional guidance and training of critical manpower. MANAGE is the response to this imperative need. Agricultural extension to be effective, demands sound technological knowledge to the extension functionaries and therefore MANAGE has focused on training program on technological aspect in collaboration with ICAR institutions and state Agriculture/Horticulture Universities, who having expertise and facilities to organize technical training program for extension functionaries of State Horticulture Department.

In India, Horticulture sector contributes the nutrition security, and steady income in case of perennial crops, utilising the marginal lands which otherwise could not have been used for demanding crops, their contribution to the nutrition security of the society cannot be discounted. The export earnings from different horticulture products and their value addition are also noticeably contributing to the National income. Amongst the Horticulture farmers the horticulture farmers suffer from glut and, during corona the direct marketing channels are yet to be structured and poor marketing facilities have led to their low income. These raised the issue of sustainability of horticulture production and marketing in spite of high demand of horticultural products. In this context the value addition in Horticulture ensures profitability and sustainability.

It is a pleasure to note that, Indian Institute of Horticultural Research, Bengaluru and MANAGE, Hyderabad is organizing a collaborative training program on “Extension for Horticultural Technologies” during 27-29 July, 2021 and coming up a joint publication as e-book on “Extension for Horticultural Technologies” as immediate outcome of the training program.

I wish the program be very purposeful and meaningful to the participants and also the e-book will be useful for stakeholders across the country. I extend my best wishes for success of the program and also I wish Indian Institute of Horticultural Research, Bengaluru many more glorious years in service of Indian agriculture and allied sector ultimately benefitting the farmers. I would like compliment the efforts of Dr. Shahaji Phand, Center Head (EAAS) & Program Coordinator (AC&ABC), MANAGE and Director, Indian Institute of Horticultural Research, Bengaluru for this valuable publication.

(Dr. P. CHANDRA SHEKARA)
Director General, MANAGE

FOREWORD

Although Indian Horticultural production has surpassed Agricultural production at a record 326mt last year ending 2019-20, and In financial year 2020, fresh fruits was the leading horticulture product exported from India based on value of over 54 billion Indian rupees. Over 819 thousand metric tons of fruits were exported that year from the south Asian country. Farmers could not get the expected prices and therefore the income increases are yet to be realised against the potential. Value addition in Horticulture through transfer of Horticultural technologies to develop hortipreneurship is a focussed area which contributes to value addition, increase in income and export oriented income through diversification, handling storage, processing and packing. The Indian Institute of Horticultural Research, hessaraghatta, Bengaluru has commercialised more than 300 technologies, through technology transfer, hortipreneurship and development of value added products for domestic and export through training, business incubation and acceleration these products and their associated technologies should be communicated to a larger audience.

In this context, ICAR-IIHR is conducting a free online training program on "E**xtension for Horticultural Technologies"** sponsored by the National Institute of Agricultural Extension Management (MANAGE), Hyderabad for the Extension officials of state/central horticulture departments, Horticulturists, faculty of SAUs/KVKs/ICAR institutes, etc. during 27-29th July 2021 through Cisco Webex Online Platform. The lectures of this online course are exactly designed to expose the participants to various aspects of hortipreneurship and value addition opportunities through extension methodologies tailor made for Horticulture technology transfer which is a different game per se, both through virtual and Real time modes of technology delivery and dissemination. I hope that the participants from different parts of the country would be immensely benefitted from this online course by interactions with expert resource persons selected for the training. I have no doubt that the course will be intellectually rewarding to the participants.

I would like to take this opportunity to congratulate MANAGE and ICAR- IIHR for their fruitful collaboration towards benefits to farmer community, and stake holders in Horticulture I also congratulated course directors and course coordinators for their untiring work, and high level of enthusiasm.

(BNS MURTHY)
Director, ICAR-IIHR

PREFACE

This e-book is an outcome of collaborative online training program on **"Extension for Horticultural technologies"** from 27-29 Jul, 2021. The editors' main aim is to provide insights to all extension workers, faculties, researchers and students about Horticultural technology and their transfer to the stake holder's right from production to value addition and export. The extension people should know the entire value chain of Horticultural produce. They can be benefitted from getting knowledge of various Horticultural technologies and products. The current information in product development will help them to do well in the extension field.

The editors felt that all the experience of resource persons of this training should be clubbed together to form a unique proposition on Horticultural Extension. Horticultural science is subjects which have different magnitudes, scale and direction coordinating both subjects from a common point was indeed a challenging job. The experts and resource persons in Horticultural science contributed immensely and tirelessly to develop various chapters of this e-book in very short span of time. They all deserve applaud. The editors extend their sincere thanks to all the experts who have contributed valuable time and put sincere efforts to produce this e-book.

The editors also thank MANAGE, Hyderabad for the financial support to the training program. The editors express gratitude towards the director, ICAR-IIHR for the constant encouragement for this training and e-book creation for the participants. The editors hope that this e-book will help participants as well as other extension people across the country to gain valuable information on horticultural production, handling, storage, processing and value addition for domestic and export markets

Editors

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Extension for Horticultural Technologies

Dr. T. Janakiram
Vice-Chancellor, Dr.YSR Horticultural University

Over the years Horticulture has emerged as one of the potential agricultural enterprise in accelerating the growth of economy. Its role in the country's nutritional security, poverty alleviation and employment generation programmes is becoming increasingly important. It offers not only a wide range of options to farmers for crop diversification, but also provides ample scope for sustaining large number of industries which generate huge employment opportunities. At present Horticulture is contributing 30.4 percent GDP.

Extension is very closely linked with Human Resource Development, which is a backbone for the success of any development programme. The success in increasing the area under Horticultural crops depends upon the active participation of a large number of farmers. Motivation & training to farmers, farm women and unemployed youth through well planned extension strategies will be successful.

I believe in "Extension works by the farmers for the farmers to the farmers" therefore researchers and extension officers if transform/ motivate few farmers, they motivate many farmers. It is the fact that how much the impact of proven profit by farmers can affect the other surrounding farmers. I consider that the extension of Horticulture technologies means" to lead farmers to make profit by Horticulture production. Introduction of new crops, varieties and techniques can attain the farmers goal earning more profit, those new techniques will be sustainably diffused to others.

Dr.YSR Horticultural university (Dr.YSRHU), 2nd of its kind in the country was established on 26th June, 2007, The University is functioning with a mandate to develop human resources through Education, Research and Extension in Horticulture and allied sectors and concentrating on extension strategies (transfer of technologies) through forty two institutes namely Krishi Vigyan Kendras (4), Horticultural Research Stations(19), Colleges of Horticulture **(8)** and Horticultural Polytechnics (11) for the benefit of farmers, rural youth and women directly through Rythu Bharosa Kendras (RBKs), District Resource Centres(DRCs) and Department of Horticulture, Government of Andhra Pradesh. Dr.YSR Horticultural University has a strong squad of Extension personnel (Scientists/ Teachers) for effective transfer technology.

Awards & Recognitions of Dr. YSRHU for extension services includes

- KVK, Venkataramannagudem received prestigious ICAR award "Pandit Deendayal Upadhyay Krishi Vigyan Rashtriya Protsahan Puraskar - 2019" at National Level

- Smt.T.Ramana, tribal women farmer under the guidance of Dr.YSRHU received ICAR award "Pandit Deendayal Upadhyay Krishi Vigyan Rashtriya Protsahan Puraskar – 2019" at Zonal level for her excellent contribution towards IFS model adoption

- Horticulture Research Station, Chintapalli received "ICAR- Fakhruddin Ali Ahmed Award-2019" for outstanding research in tribal farming systems in collaboration with ICAR-IISR.

- Dr.YSR Horticultural University received "Best Extension Education Institute Award-2021"at National level under Agri Extension Awards 2021 from Agriculture Today group.

- Dr.YSR Horticultural University received "Excellence in Skill Development-2021" at National level under Agri Education Awards 2021 from Agriculture Today group.

- Dr.YSRHU KVKs/ HRSs intervened Farmers selected for "Udyana Ratna Award" from Lt.Amit Singh Memorial Foundation.

- Smt.Madakam Venkayamma, W/o.MadakamJampala Rao, Dasiyyapalem (V), Buttayyagudem (M), West Godavari district, A.P

- Sri.Kathula Somireddy, S/o.Lachireddy, Pandirimamidikota (V), Maredumilli (M), East Godavari district, A.P

- Sri. Katta Bala Subramanyam, S/o.K.Veeraiah, Talvaipudu (V), Pellakur (M), SPSR Nellore district, A.P

- Sri.T.Bala Narasimha Reddy, S/o.T.Narayana Reddy, Vonipenta (V), Mydukur (M), YSR Kadapa district, A.P

- Sri.Kauvuri Venkata Ramana, S/o.Apparao, Raya Bhupala Patnam (V), Peddapuram (M), East Godavari district, A.P

Use of ICT and Social Media in Horticultural Extension

*V. K. Jayarghavendra Rao
Principal Scientist, IIHR

Horticulture value chains are facing growing consumer expectations for variety, food safety and security. Most horticulture supply chains operate in a push based approach rather than demand driven or pull based, which leads to a mismatch between demand expectations and supply side capabilities. In developed markets in India, horticulture supply chains are experiencing by excess capacity, lack of differentiation and lower prices and ultimately leading to glut. Last year the 326 MT of Horticultural productions for year ending 2019-20, emerging market challenges are more related to supply shortage, lack of product variety, and safety and quality of the produce. All this leads to low income among hortipreneurs, who lack visioning and strategy for production and value addition opportunities in horticulture.

This mismatch between expectation and supply calls for restructuring of the horticulture production chain from a push based system to a combined push-pull system. A combined push-pull approach ensures that market dynamics are taken into consideration when it comes to making decisions about technology adoption and production capability. The Indian Institute of Horticultural research at Bengaluru, has a basket of 300 plus technologies for commercialising and licensing to hortipreneurs, which includes varietal, production technology, crop protection, and post-harvest technology both handling, storage and processing. Hortipreneurs in India agree that achieving the optimal push-pull requires tailored business models in Horticulture through a sound DPR(Detailed Project report) and tailormade Business plans on many technologies at different scale is developed at IIHR and Hortipreneurs, will have to take advantage of it through our BPD(Business Planning and development unit. Hoe the hortipreneur approaches the business opportunity with vision and strategy has to scout for a genuinely differentiated business model. To facilitate right interpretation and understanding we define the critical components that constitute a business model, Entrepreneurial dynamics, psychology of an entrepreneur, his motive, the strength of his achievement motivation coupled with the right business model and technology holds the key for a profitable horticultural entrepreneurial venture. Changes in the business environment along with innovation procedures bring about new situations that need to be solved not just effectively but with care and in an original way and finally with added value for the customer, e.g., Probiotic Juice, novel packing in horticultural produce and processed products. In spite of a record horticultural production the Hortipreneur is not able to increase his income, because only selling fresh fruits and vegetables he has to market in a buyers' market as the production is more than the demand and supply is very huge leading to glut. So the only solution for achieving a higher income is value addition of horticulture products, and tapping the new opportunities emerging in Horticulture so that the hortipreneur is abreast with the latest Knowledge and his return on investment is ensured, enjoy through diversification and value addition and simple selling of fruits, vegetables, and flowers alone cannot increase the income of a Horticulture farmer.

Hortipreneurship is one of the key drivers for economic development. During an economic crisis, the importance of entrepreneurship development increases. Entrepreneurship has been linked

to improved growth, increased wealth and quality of life. In developing countries like India, planning and implementation for development of entrepreneurial programmes are essential for raising the living standard of the vast majority of the backward regions because of their over-dependence on agriculture for employment Thus, entrepreneurship development appears to be the best substitute to find employment opportunities, income generation, poverty reduction and improvements in nutrition, health and overall food security in the national economy. And avoiding glut experienced in fresh fruits, vegetables, and flowers in the market, and value added product marketing holds the key.

Agriculture is considered as the main economic activity which adds to the overall wealth of the country. In the past, agriculture was seen as a low-tech industry dominated by numerous small family firms, which are mostly focused on doing things better rather than doing new things. However, over the last two decades, this situation has changed dramatically due to economic liberalization and a fast changing society. Agricultural companies have to adapt to the erratic demands of the market, varying consumer habits, triggered by globalisation and exposure, stringent environmental regulations, new requirements for product quality, food safety sustainability, and so on. These changes have opened up new opportunities nd challenges the way for new entrants, are innovation, and portfolio Hortipreneurship. Farmers, researchers, agricultural business and governments have recognized this and emphasized for a more competitive Hortipreneurial environment.

The Hortipreneurial skills of farmers need to be developed and addressed by all stakeholders in the agricultural socio-economic network especially ICAR IIHR has been doing this in Horticulture production, value addition, diversifying networking and strengthening the supply and value chains in Horticulture. There are various strategies available to farmers for survival and changing their economic environment which results in business growth. For example, the farm enterprise may be expanded through tourism or other forms of non-agricultural business, or by integration of the value chain by engaging in food processing, direct marketing in times of CORONA and POST CORONA , or through organic production of Horticultural products. The social and economic environment of farming should not be underestimated when studying and promoting the development of entrepreneurial skills. Entrepreneurship can only be improved when the entire agricultural socio- technical network is involved in the process,

The business management skills, availability of funds, market availability and accessibility and technology adoption are the weak links in Hortipreneurship. Therefore triggering the minds of the hortipreneurs in spite of the low success rate in successful Hortipreneuring(around 5 percent) is the key to refresh the existing hortipreneur and the emerging hortipreneur into new vistas and opportunities in the horticulture value addition sector, a low turnout is not a testimony to stop the Horticultural entrepreneurship promotion per se. the product or service may or may not be new or unique but value must be inculcated by the entrepreneur. Entrepreneurship in Horticulture can also be defined as the formation of novel economic organization for the intention of growth under risk and uncertainty in Horticulture, employment generation, poverty reduction, improvements in nutrition, health and overall food security in the national economy especially in rural areas. In the

face of growing unemployment and poverty in rural areas, there is urgency of entrepreneurship in Horticulture for more productivity and profitability.

Use of ICT and social media in Horticultural extension

The various platforms under social media, like Facebook, WhatsApp, etc., can be used to share the latest weather condition information which is all the more important with the recent Hortipreneurship at its peak phenomena, adversely affecting agriculture. These initiatives also serve as a two-way communication, wherein farmers can post their problems and extension officer can offer solutions. The experience of various group members can also be shared for mutual advantage, apart from sharing prevailing market prices.

However, there are two issues which are to be addressed, to make social media a very useful tool in the Horticultural extension system. One is, the Governments should make provision for the extension officers to have internet access and provide charges which are not very expensive these days. There should be a monitoring mechanism at every district, to monitor contents of communication in various platforms, ensuring that social media is not used for any other purposes other than Horticulture extension.

Presently there is no public support for use of ICT and social media tools in Horticulture it is voluntary, and out of personal interest, during Lockdown Post CORONA direct marketing, networking, communication and networking have been taking place with the judicious use of media, and IIHR has developed and deployed a mobile android app called ARkA VYAPAR, for facilitating direct marketing and also in line with the new Farm Bills 2020, which promotes direct marketing using any business and supply chain models.

Integrate social media in Horticulture extension

The information and Knowledge gap arising out of the failure of traditional models, and tools, needs to be filled through exploring other options of alternate Horticultural extension service delivery mechanisms. Information and Communication Technologies (ICTs) have delivered Horticultural extension information with greater efficiency, more rapidly and with higher accuracy, especially as a resilience during lockdown and CORONA, whenever a group of trainees pass out of any online training program a WhatsApp group created for the course , continues as an integrated ICT model usually a hub and spoke with the coordinator and the resource persons as the hub and the rest to share their feedback and technology use experiences and the way forward, and unwanted messages are weeded out and some are removed from the group when it loses its focus, and becomes unprofessional, so topic wise , theme wise, crop wise, issue wise groups are performing well and it has become a powerful tool of Horticultural Extension. Horticultural Producers and FPOs networked and used for direct marketing during lockdown and it are now emerging as an alternative marketing model in Horticulture and the marketing costs have come down opine many of the producers and buyers and they can share information in multiple ways in form of texts, photos, pictures, audio, audio-visuals and web links.

Conclusion:

Lack of organized efforts to use social media in Horticultural extension system and supported by the public system is to take off on a large scale nd it needs upscaling. Appreciably, in recent times, the Government of India including Indian Ministry of Agriculture and Commissionerate of Horticulture have given importance to Social Media. The information exchange for Knowledge in Horticulture between various stake holders is already taking place with a huge number of photos and videos of the problem, cause, and solutions in Horticulture and during lockdown it helped in direct marketing of Horticulture produce and people communicated through unconventional channels to reach their goals in Horticulture. IIHR has developed and deployed an android mobile app called Arka Vyapar for facilitating direct marketing among buyers and sellers in Horticulture (presently available in google play store). To conclude the horticultural farmers in particular have shown enough resilience in the use of social media and ICT nd have demonstrated that physical distance is only a mental barrier and bot 326mt of Horticultural production which is a record has taken place and the marketing was not affected and value addition and efficient distribution has taken place with the use of ICT and social media in Horticulture

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Innovative Models operated towards Marketing of Horticultural Produces during COVID 19 Lockdown Period 1

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Abstract

An attempt was made to document the innovative models that operated to help the farmers to market their horticultural produces during lock down period 1 of COVID 19 Pandemic. This paper discusses in brief about 10 of such models operated by development departments, farmers producers organizations (FPOs), voluntary associations and private organizations/ players. This paper also brings about the monetary benefits realized by 75 farmers, who benefitted through such models. Further, innovations adopted by these models towards organizing marketing of farmers' produce also are discussed here. Based on the understanding of such models, a strategic model has been proposed to for adoption during similar situations by the stakeholders.

Key words: Innovations, marketing, horticultural produces, lock down period, COVID 19 Pandemic.

Introduction

During the lock down period 1 of COVID 19 Pandemic (approximately during April, May and June, 2020), the farmers as the sellers of their produce faced difficulty towards marketing their produce as there were restrictions for free movement and transport. The buyers and aggregators could not move freely to collect the produce produced by the farmers. In such scenario, horticulturists had tough time to reach the consumers with their perishable commodities, especially fruits and vegetables. However, certain players such as development departments, voluntary associations, farmers producers organizations (FPOs) and private players operated in their own way to help the farmers in marketing. An attempt was made to document such innovative models that operated, especially in Karnataka and draw certain lessons that can be suggested as strategies to be adopted by the stakeholders during similar such disaster situations. This paper brings out information about such models, especially the roles played by various players, innovations adopted by them, lessons that can be learnt etc. This paper also suggests a strategic model that can be adopted by the stakeholders.

Brief Methodology

A systematic scout was made to explore the models that operated in Karnataka during the period of lock down 1 of the COVID 19 Pandemic. After coming to know about such models, survey was made with the stakeholders such as operators and farmers through personal or telephonic interview method. A total of 75 farmers were contacted in the survey apart from the office bearers of the models. A structured schedule was prepared and administered to collect the requisite information from the operators and the farmers. The data, thus collected was tabulated and analyzed using descriptive statistics.

Initiatives by Development Departments

HOPCOMS Model, Karnataka

The Horticulture Producers Marketing and Processing Co-operative Society Ltd. (HOPCOMS) is the marketing wing of Department of Horticulture (DoH), Government of Karnataka (GoK), involved in procurement and marketing of horticultural produces produced by the member-farmers of this society. It procures produce from the farmers and sell through sales outlets established at different parts of the states.

During the lockdown 1 of COVID 19 pandemic in the country, HOPCOMS came out with an innovative marketing model not only for the member-farmers but also for other farmers, who cultivate fruits and vegetables, by issuing special passes for marketing. The farmers who got the special passes supplied fruits and vegetables to HOPCOMS. HOPCOMS in turn supplied these products to more than 90 government/ private institutions such as factories, hospitals and hostels. HOPCOMS got a profit of Rs.1.5 crores by supplying horticultural produces to these institutions.

Apart from supplying to these institutions, HOPCOMS had a tie up with more than 2500 associations of apartments in Bengaluru. Through video conference mode, it collected demand from these apartments and accordingly supplied the products. Every day sales was ranging from of Rs.45000/- to Rs.60000/- during April 2020. HOPCOMS also sold the horticultural produces through its sales outlet and the sales through these outlets was double during the lock down period, over the normal period. Table 1 shows the benefit realized by the farmers during lock down period by supplying to HOPCOMS . It was ranging from Rs.2/kg of for cabbage to Rs.11/kg of coconut. The innovations that can be learnt from this model are assessing demand through video conference mode and having tie-up with apartments and government/private institutions for supply of horticultural products.

Table 1. Benefit realized by farmers during lock down period through various models (N=75)

Crops	Net Price realized		Benefit realized during Lock down Period (Rs./kg)
	Previous year (Rs./Kg)	Lockdown Period (Rs./Kg)	
HOPCOMS Model			
Coconut	10	21	11
Tomato	6	9	3
Beans	32	38	6
Capsicum	32	41	9
Cabbage	9	11	2
Ridge gourd	29	37	8
Onion	7	11	4
Brinjal	12	16	4

Mango Board Model			
Alphonso	72	86	14
Mallika	53	66	13
Totapuri	15	18	3
Neelam	32	28	-4
Puthari FPO Model			
Grapes	60	80	20
Papaya	3	7	4
Banana	3	9	6
Pineapple	4	12	8
Cabbage	3	7	4
Chilli	5	7	2
Pumpkin	3	9	6
Watermelon	4	9	5
Tomato	5	12	7
Mango	61	87	26
Sweet potato	6	9	3
Elephant foot yam	6	12	6
Yard long bean	25	27	2
Palamner FPO Model			
Mango	6	12	6
Ridge gourd	12	20	8
Tomato	3	8	5
Cabbage	3	9	6
Gongura	18	27	9
Palak	13	12	-1
Bottle gourd	8	7	-1
Raw banana	22	31	9
Chilli	15	22	7
Brinjal	13	15	2
UAS Alumni Association Model			
Grapes	51	69	18
Apartment Association, Bengaluru			
Papaya	12	21	9
Banana	47	56	9
Guava	64	64	0
Kamalam (Dragon) fruit	92	161	69
TENESIRI Vegetables Model			
Cucumber	7	12	5
Beans	*38*	*47*	*9*
Tomato	8	14	6
Ivy gourd	23	27	4
Chilli	48	49	1
Capsicum	48	57	9
Radish	13	17	4
Shenoy Fruits Model			
Watermelon	1	2	1

Guava	57	56	-1
Kamalam (Dragon) Fruit	116	116.66	0.66
Papaya	6	7	1
Rambutan	76	85	9
Lemon	31	35	4
Village Story Model			
Cucumber	2	2	0
Tomato	13	17	4
Guava	33	36	3
Grapes	98	117	19
Custard apple	78	97	19

Model operated by Karnataka State Mango Development and Marketing Corporation Ltd.

Karnataka State Mango Development and Marketing Corporation Ltd., is a unit of GoK, acts as a development department towards promotion of mango development and marketing activities through various schemes of the state. During the lockdown 1 of COVID 19 pandemic in the country, the Board came out with a model in order to support the mango growers of the state, especially in marketing their produces.

The board collected the demand from the consumers and supply details from the mango growers. Through the B2C portal maintained by the Board, the consumers registered and made order by online payment. The mangoes supplied by the farmers in pre-packed boxes were distributed by the Board through General Post Office (GPO) of Bengaluru through marketing tie-up. The farmers will be paid after the delivery and the GPO also will be paid towards transportation charges. More than 1000 tonnes of mango was sold through this model. The quantity that remain after delivery to the consumers will be supplied to the apartments in Bengaluru at a sale price fixed on mutual consensus.

The Board is also planning to have a tie-up with FLIP KART for marketing of mangoes collected from Mangaluru, Dharwad, Davanagere and Belagavi districts of Karnataka, so that marketing problem during such Pandemic situations can be managed effectively. The innovations that can be learnt through this model are having a B2C portal for assessment of demand and payment and having tie-up with organizations exclusively work for marketing such as FLIP KART. Table 1 shows the benefits realized by the farmers during the lockdown period, which was ranging from Rs.-4/kg for Neelam variety to Rs.14/kg for Alphonso.

Initiatives by Farmers Producers Organizations (FPOs)

Model operated by Puthari FPO, Kodagu, Karnataka

Puthari Farmers Producers Organization, Kodagu is a FPO functioning in Kodagu district of Karnataka to extend diversified services to the farmer-members from the district. This FPO is being promoted by *Krishi Vigyan Kendra* (KVK), Gonikoppa, Kodagu, Karnataka, which is functioning under the administrative control of ICAR-Indian Institute of Horticultural Research (IIHR), Bengaluru. The KVK extends technological backstopping to the FPO for its services to the farmer-

members and also provides space for doing business activities in agriculture.

During the lock down period, the consumers of Kodagu district were suffering from lack of supply of fruits and vegetables. Understanding this situation, the FPO initiated tie-up with horticulturists of 8 taluks in Karnataka, procured the produce and supplied to the consumers at the premises of KVK, Gonikoppa, Kodagu district. Based on this experience, KVK gave a regular space for the FPO to operate a rural mart. Also, the FPO has initiated contract farming of vegetables through farmers who had tie-up during the lock down period. Table 1 shows about the benefits realized by the farmers by selling their produce through FPO during the lockdown period. Such benefits was ranging from Rs.2/kg for chilli and yard long bean to Rs.26/kg for mango. Contract farming and establishing an exclusive rural mart at KVK are the innovations that emanated from this model.

Model operated by Palamner Farmers Producers Organization (FPO), Andhra Pradesh

Palamner FPO is serving for its producer members of Palamner taluk of Andhra Pradesh through different kinds of extension services such as supply of inputs (seeds, planting material, fertilizers, plant protection chemicals, farm tools and implements) and procurement and marketing of produces etc. The farmer-members (300-400) of this FPO had a tough time to market their produces, especially vegetables during the lock down 1 period of COVID 19 pandemic. FPO helped these farmers through Direct marketing.

Demand for vegetables was identified to supply to three companies situated in Palamner with about 7000 workers. The indent from companies were collected by the FPO and in turn informed to vegetable growers. The growers supplied vegetables to FPO. The FPO procured, graded, packed and supplied to the identified companies. Better rate than the market rate was given to the farmers and with Rs.1/ kg profit for the FPO, vegetables were distributed to the companies. Farmers were benefitted by no commission cost. Farmers started diversifying cultivation of vegetables such as green chilli, ladies finger, ridge gourd, bottle gourd, bitter gourd from merely growing tomato, cauliflower and cabbage. This has happened due to the tie-up with the companies. Every day, around 3 tonnes of vegetables were supplied to the companies. Remaining vegetables were distributed to apartments in Bengaluru and also sold through road side stalls arranged by FPO.

Vegetable growers were also benefitted through the interest free COVID loans arranged by FPO from financial organizations. As a result, the FPO is planning to establish primary processing centre and buy air-conditioned vegetable vending vans under Operation Green project of the Government of India (GoI). Table 1 shows the benefits realized by farmers by participating in this model, which was ranging from Rs.-1/kg for Palak and bottle gourd to Rs.9/kg for *Gongura*, a green. The innovations that can be learnt from this model are sale of vegetables through the brand name of FPO and plans to establish primary processing centre; purchase of AC vegetable vending van through Operations Green project.

Models initiated by Voluntary Associations

UAS Alumni Association Model, Bengaluru, Karnataka

The alumni of University of Agricultural Sciences (UAS), Bengaluru, Karnataka started the UAS Alumni Association to cater to the technological backstopping needs of officials of development departments, farmers and other stakeholders through organizing scientific forums, dialogues, lectures and other such events. This organization also does extension services to the farming community. Through the mainstream media, the office bearers of this association came to know that the grapes harvested by the grape growers in and around Bengaluru are being wasted due to lack of access towards market facilities during the lockdown period 1 of COVID 19 pandemic. In order to support the grape growers during such crisis situation, the office bearers of this association took initiative to link the farmers and consumers. They made a press release through news papers and electronic media about direct marketing of grapes to the consumers in public lay outs and apartments. They arranged transport for supply of the harvested grapes through group of grape growers and made them to sell in different apartments and lay outs directly. By this arrangement, both the farmers and consumers were benefitted. Around 400 tonnes of grapes were sold through this arrangement during April and May 2020. The average benefit realized by the farmers during the lock down period through this model was Rs.18/kg (Table 5). Here, the innovation that can be learnt is the effective utilization of print and electronic media towards awareness creation.

Model operated by Apartment Association in Bengaluru, Karnataka

During the lock down period 1 of the COVID 19 pandemic, there was a problem faced by the consumers to get the fruits sold. In order to overcome this problem, an arrangement was made by the volunteer persons (One of the Scientists of ICAR-Indian Institute of Horticultural Research (IIHR), Bengaluru and a retired bank official), who reside in around 30 apartments located in HSR layout within a radius of 7 kilo meters, to get the demand from the public and quantity that can be supplied by the farmers directly to the apartments. The communication was made through e-mail over Google spread sheets. Initially, the group of farmers themselves supplied the fruits. Then delivery boys were engaged to supply the fruits on commission basis. Online payment was made to the farmers after collecting the money from all the consumers who gave the demand. Table 1 depicts the benefits realized by the farmers through this model in supplying fruits to these apartments. The innovation that can be learnt from the model are use of Google spread sheets for arriving at demand and supply and engaging deliver boys for supply on commission basis.

Models initiated by Private Players

Model operated by TENESIRI Vegetables, Karnataka

TENESIRI Vegetables is a private initiate to link both the sellers, buyers and consumers of vegetables through its specially developed mobile app. It helps in collecting the orders from both the buyers and consumers and informing the demand to the sellers. This initiative serves both the commercial

vegetable growers and organic vegetable growers. The commercial vegetable growers are linked by B2C model of the app, whereas the organic vegetable growers linked through the B2B model of the app. The organic growers were mainly from Belagavi region and the commercial vegetable growers were from Chikkaballapur and Hosekotte region of Karnataka. During the lockdown period 1 of the COVID 19 Pandemic, this organization helped many vegetable growers, who registered through the app to sell their produce without any problem. Table 1 shows the benefits realized by farmers through this model, which was ranging from Rs.1/kg for chilli to Rs.9/kg for beans and capsicum. The innovation that can be learnt from this model is use of special mobile app to link the growers for B2B and B2C models.

Model operated by Shenoy Fruits, Karnataka

Shenoy Fruits is a private venture, which operates as a wholesale business organization for procurement of fruits for registered farmers and farmers producers organizations (FPOs). It procures produce of the registered farmers and supplies to the retailers for further sale, with the help of cold-chain operators. It procures all kind of fruits from farmers of Tamil Nadu, apples from Shimla and Kashmir, Avocado from Koorg region of Karnataka, Guava from Mysore and supplies to retailers located in Mangalore, Karnataka and such of those in Kerala. During the lock down period 1 of COVID 19 Pandemic, this arrangement was successful in helping the fruit growers without facing any difficulty. Table 1 shows the benefits realized by the beneficiaries of this model during the lock down period, which was observed to the tune of Rs.9/kg for rambutan. The innovation that can be learnt from this model may be procurement and supply of produce with the collaboration of cold chain partners.

Model operated by Village Story, Karnataka

Village story is yet another private initiative to unite together the farmers, buyers and consumers. This initiative has its own face book, WhatsApp and Instagram applications, which have more than 25000 clients. The profile of clients include all the stakeholders of agriculture. The clients interact among them based on their business interest and needs and thereby, benefit each other mutually, through their transactions. During the lock down period 1 of COVID 19 Pandemic, this arrangement was successful in helping the fruits and vegetable growers without facing any difficulty. Table 1 shows the benefits realized by the beneficiaries of this model during the lock down period, which was observed to the tune of Rs.19/kg for grapes and custard apple.

Model operated by Farmers of Kamalam Fruit, Bengaluru, Karnataka

Kamalam fruit (dragon fruit) is gradually becoming a preferred fruit crop for cultivation by farmers in Karnataka due to its demand from health-conscious consumers. One of such farmers is Mr. Prasad, Sira, Karnataka, who has started dragon fruit cultivation based on the demand from Mumbai markets. Usually, he sends the harvested fruits from his farm and that of nearby 5-6 farmers to Mumbai market for an average price of Rs.75/kg. Due to the lock down period 1 of COVID 19 Pandemic, they were not able to send the fruits to Mumbai market. In such scenario, purchase of fruits from a IT employee

through direct contact mooted the idea of supplying fruits to apartments. Hence, they identified a group of apartments as target community and supplied fruits (weighing 300 g and above) for Rs.130/kg, after grading, packing with their own brand. After grading, the fruits weighing below 300 g were supplied to a group of bakeries for Rs. 200/kg. Accrual of profit through such direct marketing made them to go for contract farming with about 100 farmers, in order to sustain this model of direct marketing. Also, there is a move through this initiative to establish a processing unit exclusively for kamalam fruit towards preparation of bars, jam and powder etc. The farmers were getting an additional benefit of Rs.55/kg by selling kamalam fruit through this model. The innovations that can be learnt from this model can be "selling the fruits through own brand", "grading the fruits and targeting consumers based on the grades" and "establishment of processing unit for preparation of products from kamalam fruit ".

Conclusion

Understanding the models operated by various players towards marketing of fruits and vegetables by farmers, help in generalizing certain conclusions for further analysis. These organizations very effectively utilized social media (WhatsApp, face book, instagram etc.) to communicate among the farmers (sellers) and consumers i.e. both B2B and B2C business models. They identified appropriate sellers (farmer groups or FPOs) for procurement of the produce such as fruits and vegetables. They targeted hostels/ business organizations/ restaurants and apartments. Some of them made contracts/ agreements with sellers (farmers/ FPOs) as far as fixation of price of the produce is concerned. In some cases, common online platforms operated by these operators connected the stakeholders of both B2B and B2C transactions. Some of them started grading and packing the produce in their own brand name and distributed in order to create trustworthiness among the consumers. The sellers (farmers/ FPOs) were given assured and better price than the market price and consumers were assured with supply of quality produce. They fixed the sale price after thorough discussion with the sellers (farmers/FPOs) and the consumers. The sellers (farmers/FPOs) were also benefitted by avoiding middlemen and their commission charges. Apart from the use of social media, print and electronic media were also effectively utilized to popularize the business activities of the models. Based on the analysis of different successful models, a common strategic model was arrived-at, which can be suggested for effective role play by formal and informal institutions and farmers towards marketing of horticultural produces during the similar situations of COVID 19 lockdown period 1(Fig.1).

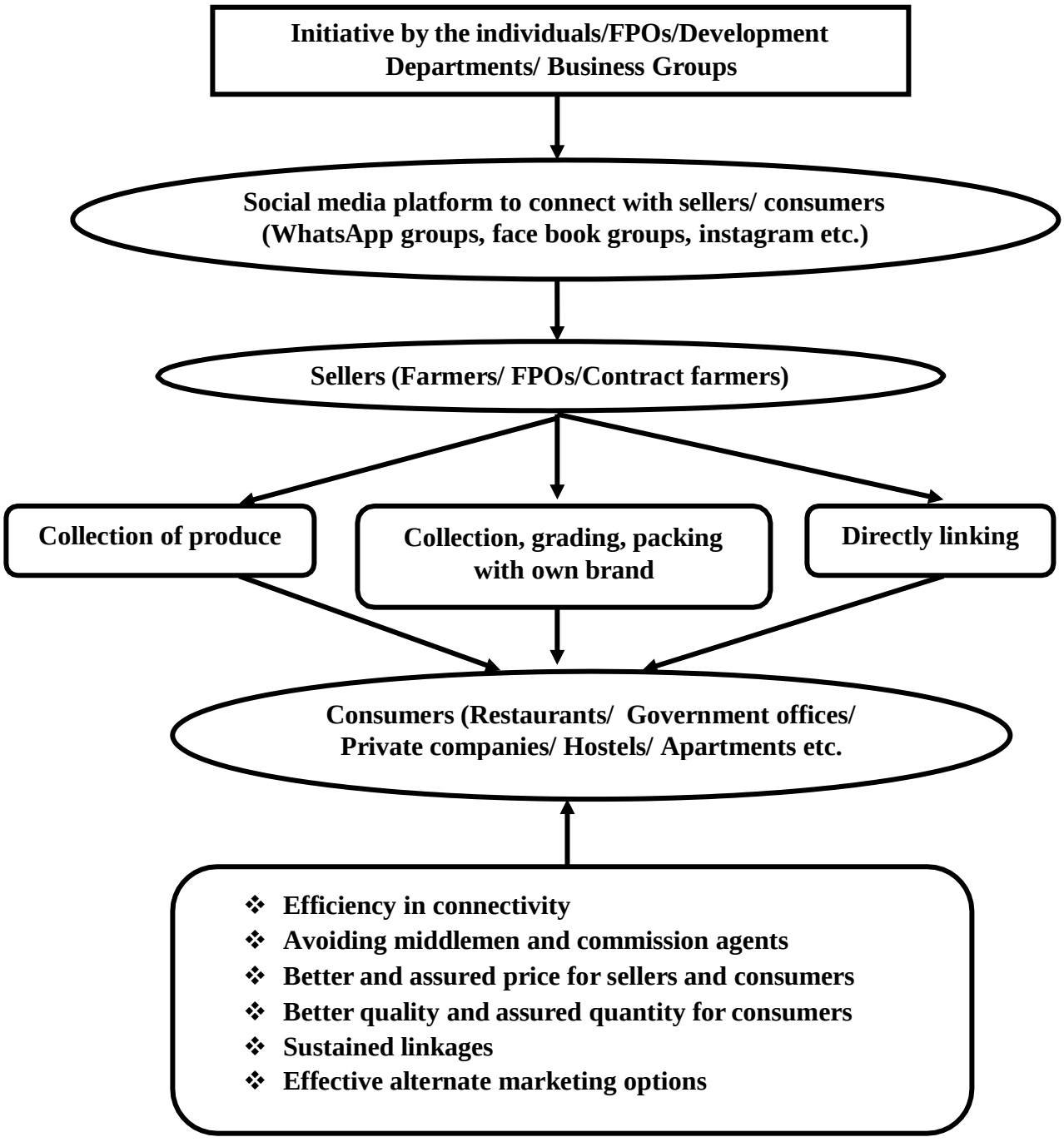

Fig.1. Strategic model for effective role play by stakeholders for marketing of horticultural produce during similar situations of COVID 19 lockdown period

Horticultural Extension in Remote Areas – A case of Puthari FPO

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Horticultural extension also known as a horticultural advisory services plays a crucial role in boosting horticultural productivity, increasing food security, improving rural livelihoods and promoting horticulture as an engine of economic growth in rural areas. Horticultural Extension needs to provide a critical support service for rural farmers at the same time meeting the new challenges faced by them in their farming. Horticultural extension in remote and hilly terrains is difficult and time consuming, requiring some innovative methodologies to meet the farmers needs and expectations. At KVK we decided to experiment with an idea of a farmers collective organisation, established and nurtured right from the beginning at KVK itself with support from its host organisation (ICAR-IIHR, Bengaluru) and NABARD, Kodagu. There was lot of talk of FPOs during that period (2015-17) from the Govt, also as a gamechanger in the farmers lives for their economic sustenance. The ICAR-KVK, Kodagu, conducted a seminar on 'Farmer Producer Organisations' with the help of NABARD in September, 2016. After the seminar, a few like-minded, enterprising farmers and youth came forward to immediately put the idea into action. At that point the seeds were sown for the birth of Puthari FPC in December, 2016.

In the formation and sustainability of FPOs as a producer company, the role of extension is of paramount importance. The extension roles identified in formation of FPOs are locating farming community, awareness creation and community mobilisation, organising community meetings through local leaders, social capital formation, facilitating formation of core group, capacity building of farmers, facilitating registration, arranging trainings for Board of directors (BOD) and chief executive officers, technical support and ensuring market access.

About Kodagu district in brief :

Kodagu is a part of mountain zone of western Ghats having **hilly terrain and valleys**. The district falls under the Sub-tropical humid zone with very high **rainfall ranging from 1200 mm to 6100 mm**. The district consists of 3 Taluks namely Virajpet, Madikeri and Somwarpet having 16 hoblies and 302 villages. The district is entirely depending on rains of southwest monsoon with protective irrigation during for horticultural crops .

Major Production System of the District:

In the District **70%** of the area under cultivation is occupied by **coffee interplanted with Black Pepper and paddy being cultivated in low laying areas**.

- **Agriculture crops** : Paddy, Maize, cowpea
- **Horticulture Crops** : Coffee + Black Pepper, Arecanut, Ginger, Coorg Mandarin
- Cardamom, Banana, Chilli and Horticulture nurseries
- **Animal Husbandry** : Piggery, Dairy, Poultry, Goat rearing and Inland Fisheries

- **Other Enterprises** : Mushroom cultivation and Bee keeping

Socio-economic problems of Kodagu district

- The district being in hilly western ghat region with high rainfall faces very unique problems posing unique challenges to the extension system.
- The major cropping system of the district is coffee based (70%) and the coffee prices are stagnant for the past 20 years.
- The labour cost and input cost have gone high for the farmers.
- So, the farming income is declining and most of the youths are not interested in taking up agriculture as a profession.
- Since the forest area is high in the district and located in western ghat, the man - animal conflict is also high. Farmers are looking for alternative remunerative crops.

Some of the constraints/ opportunities faced by the farmers in remote areas, motivating them to form farmers collectives are:

- Lack of adequate marketing facilities and consequently getting lower price for their produce.Lack of opportunities to learn from better practices of other farmers.
- Lack of a forum to discuss about the farming problems and solutions among the farmers.No organised mechanism to provide need based training programmes.
- Lack of adequate bargaining power due to lack of collective organisations.Lack of availability of quality inputs in time.
- Agricultural input dealers selling to farmers, what gives them more margin.
- For small and low volume items prices are often inflated by small traders as there is not much competition.
- The main problems confronted by Rural farmers located in remote corners of the country are - inaccessibility to markets as one of the major impediments in raising their living standards through farming.
- Low population densities in rural areas, remote location, high transport costs, lack of understanding ofthe markets, limited business, negotiating skills and lack of an organization that can give the farmers bargaining power, larger and stronger market are some of the major constraints faced by the farmers.

Opportunities

Farmer collectives are an important element in linking smallholders with modern markets (input and output) as they provide many benefits.

Benefiting from the agribusiness facilitation of various government organisations, that will enable them to operate as businesses and make their farm operations sustainable and profitable.

It will enable them to explore agribusiness opportunities in the areas of technology penetration, improving productivity and access to inputs and services, and increasing incomes for a sustainable agriculture-based livelihood.

In rural areas farmers do not have access to organized credit. With significant movement of rural labor from farm to non-farm activities, labor scarcity has emerged as one of the biggest constraints to agricultural production in the country. Mechanization of agriculture is the only solution to improve farming and this can be effectively achieved by FPOs by their custom hiring centres.

Although cheaper agricultural machineries are available if we scout from individual entrepreneurs, but their transport to areas where they are required is not happening due to lack of collective demand and higher transportation costs.

Why Farmer Producer Organisation?

The importance of mobilising farmers into groups is being increasingly recognised by farmers and policy makers in India. While earlier efforts focussed around organising producers into cooperatives, the current emphasis is on establishing Farmer Producer Organisations (FPOs). Over the past few years the National Bank for Agriculture and Rural Development (NABARD) and the Small Farmers Agribusiness Consortium (SFAC) have supported the organisation of FPOs, and have created a special fund called the 'Producer Organisation Development Fund (PODF) and Produce Fund' for this. In Karnataka State itself, NABARD has promoted about 197 FPOs with total farmer membership of more than 67,000 members under its Produce Fund (https://nabfpo.in)

What are Producer Organisations?

It is formed by a group of producers for either farm or nonfarm activities.
It is a registered body and a legal entity.
Producers are shareholders in the organization.
It deals with business activities related to the primary produce/ product.
It works for the benefit of the member producers.
Portions of profit are shared amongst the producers and the balance goes to the share capital or reserves.

PUTHARI FARMERS PRODUCER COMPANY LIMITED (PFPCL)

Karnataka State accounts for 85 per cent of the coffee crop in India with the remainder coming from Kerala and Tamil Nadu. In Karnataka, Kodagu, Hassan and Chikkamagaluru are the major coffee growing districts. Kodagu district is famous for the vast areas of coffee grown here in an eco-friendly way since decades. The ICAR-Krishi Vigyan Kendra, Gonikoppal, Kodagu, hosted at the ICAR-Indian Institute of Horticultural Research, Bengaluru, has been promoting an FPC as the Producer Organisation Promoting institution (POPI) with support from NABARD since 2017, for the coffee, pepper and paddy farmers of Kodagu district. This FPC was registered as Puthari Farmers Producer Company Limited (PFPCL) under the Companies Act in December 2016 with 15 promoters. Farmers having record of rights, tenancy and crop information (RTC or Pahani) as proof, and growing any crop, were taken as member.

Registration

Initial founder members contributed INR 5000/person as share capital and the process for registration of FPC was started under the Companies Act. Meanwhile KVK and NABARD-Kodagu

tried to get NABARD funding under the Produce Fund of NABARD, and it materialised in March 2017. NABARD agreed to fund the FPO for two years under its Produce Fund. In the first year the number of shareholders was 173. Staffing With funding support from NABARD, the company recruited a Chief Executive Officer (CEO), and minimum manpower to start an office for the FPO. KVK provided office space inside the campus at Gonikoppal itself to have better coordination and to reduce initial expenses.

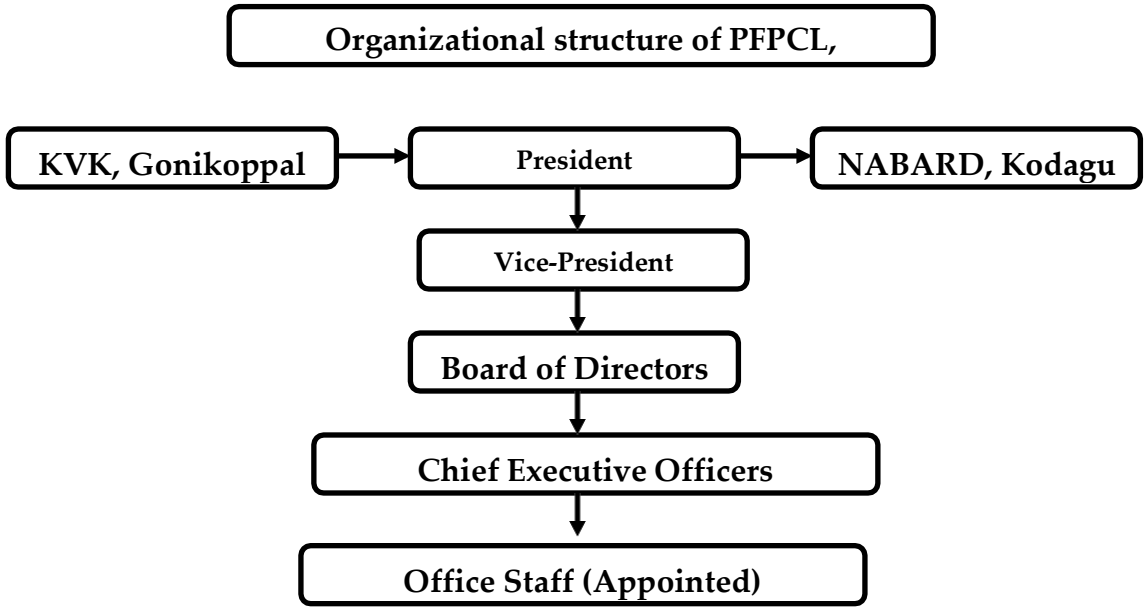
Interventions:

Retailing The company initially started with retailing of basic farm inputs such as most-used fungicides and insecticides, irrigation equipment, coffee picking mats, shadenets, etc., required by coffee and pepper growers. The FPO formally launched its first retail outlet in September 2017. It was a big success. The company, which started with 15 products in the beginning, today has about 300 products in its kitty, catering to the needs of coffee, pepper and paddy farmers. With increasing membership along with the need to cater to the needs of far-flung members, the second retail outlet was started in Virajpet town on 22 August 2019. The company has achieved a turnover of INR 1.72 crores in its second year of operation, mainly through its retail business.

Impact

Membership After seeing its progress, the membership of FPC started growing. Today, as on July 2021, the membership stands at 1100, which effectively translates into an acreage of more than 6200 acres, thus making it as one of the largest farmer organisations in the area of plantation crops. With the addition of more members every month, the PFPCL is targeting a total membership of 2000 by December 2021. The organisational structure of PFPCL is given below (**Figure 1**).

Figure 1: Organisational Structure of PFPCL, Gonikoppal



Market interventions Together the members of PFPCL produce about 12,000 tonnes of Robusta Coffee Cherry in one year. Moreover, farm inputs supplied to farmers are at much cheaper rate than in the market, as the FPC charges only minimal administrative costs and margin. There was always a problem for farmers in procurement of bulk farm inputs, such as dolomite and lime, which are basic farm inputs for any plantation crop. Now most of the farmers get their soil tested by labs either in KVK or Coffee Board and have with them soil health card. The FPC brought in a supply of such certified bulk inputs to the farmers' doorsteps, thereby eliminating a major headache for farmers on the quality and content of lime and dolomite. Just in lime and dolomite itself, farmers started saving about Rs 2,000/acre because of the intervention of the FPC. Capacity Development Apart from retailing, the FPO has also focussed on providing regular training programmes to its members and handholding of young farmers, in order to guide them towards standardized scientific farming practices. Many educated young farmers are coming back to farming and for them this kind of an FPC provides vital support in their initial years of struggle with farming. They are found to be the most enthusiastic takers for capacity building programmes conducted by the KVK. The capacity building programmes focus on bringing uniformity and scientific orientation, in the package of practices followed by farmers, which will later help the FPC in the marketing of member produce, particularly coffee. This is because international buyers prefer to buy a produce where there is uniformity in production practices, and the origin of the produce can be traced back to the estate.

Reducing cost of cultivation and enhanced adoption of technologies: The cost of cultivation has been brought down by 15 to 20 per cent for farmers through supply of quality cheaper inputs. This was the first major impact created by the FPC that attracted new member farmers to the FPC. The inputs to be put up on the shelf are decided by a team of KVK scientists and experienced farmers. There is a separate retail team in the Board of Directors (BOD) who takes the final decision based on the inputs from the scientists. The number of applications of plant protection chemicals also has been streamlined. This has resulted in better control of pests and diseases in coffee, pepper and paddy, which are the major causes of loss for farmers.

Future Roadmap for PFPCL: Kodagu's plantation economy is going through a crisis due to declining prices of coffee and black pepper and increasing labour wages and costs of other inputs. The FPC is committed to providing support mechanisms for keeping this eco-friendly practice of cultivation, and giving the farmers a higher price for their eco-friendly coffee along with looking at options to reduce the cost of cultivation. With regard to labour scarcity the organisation is working on options for adopting mechanisation wherever possible, and pooling labour resources for labour-intensive work, such as weeding, harvesting, pruning, etc

Reference:

Saju George and Prabhakar, B (2019). KVKs in support of Producer Companies. Available online at https://www.aesanetwork.org/kvks-in-support-of-producer-companies/

Horticultural Extension: Experiences from a KVK perspective

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ICAR-Indian Institute of Horticultural Research (IIHR), Bengaluru

Introduction

India has the second-largest arable land resources in the world. With 20 agri-climatic regions, all the 15 major climates in the world exist in India. The country also has 46 of the 60 soil types in the world. India is the largest producer of spices, pulses, milk, tea, cashew, and jute, and the second largest producer of wheat, rice, fruits and vegetables, sugarcane, cotton, and oilseeds. Further, India is second in the global production of fruits and vegetables and is the largest producer of mango and banana.

Contribution of Horticulture to the nation's food kitty has been showing increasing trends in recent years, surpassing the agriculture sector (Cereals, pulses, oilseeds, etc.). India's horticulture production is expected to increase by 2.93 per cent to a record level of 329.86 million tonnes in 2020-21 (320.47 MT in the year 2019-20), according to the second advance estimate of horticulture production released by the Ministry of Agriculture recently. Whereas, the total food grain production is estimated at 305.44 million tonnes, as per the third advance estimates of production of major agricultural crops, for the same year, by the Ministry. The horticulture sector is showing almost 8% higher production than the agriculture sector. The increase can be seen mainly in all horticulture crops such as fruits, vegetables, aromatic and medicinal plants, spices and plantation crops, except flowers.

The KVK perspective

Though one could correlate this development with the improved technological advances in the sector, we cannot nullify the contribution from extension sector for this stupendous success. Unless, there is a strong extension support for reaching the technologies to the doorstep of farmers, there could not be a continuous trend like this in the sector. Though there are various documentations of the efforts taken by state and central governments at macro level, there are only few studies that highlight the micro level strategies executed by local level government bodies like Krishi Vigyan Kendras (KVKs). This is one such documentation that would outline the prospects of experience by ICAR-KVK, Tumakuru, under ICAR-IIHR, Bengaluru, in meeting the demands of horticultural farmers through the process called Horticultural Extension.

Any KVK in the country has the basic mandate of technology assessment, refinement and dissemination. They conduct main activities like On Farm Testing (OFT), Front Line Demonstration (FLD) and Trainings (Capacity development). Few KVKs do give importance to other mandated activities like working as resource and knowledge centre of agricultural technology, creating awareness about improved technology through extension activities and production of seeds, planting materials and other inputs to be made available to the farmers. These are the specific activities, upon which the KVK has built their strategies. Here the focus is on the concept called Horticultural Extension, which is specifically envisaged owing to the specific nature of horticultural crops that ultimately resulted in measurable outcome.

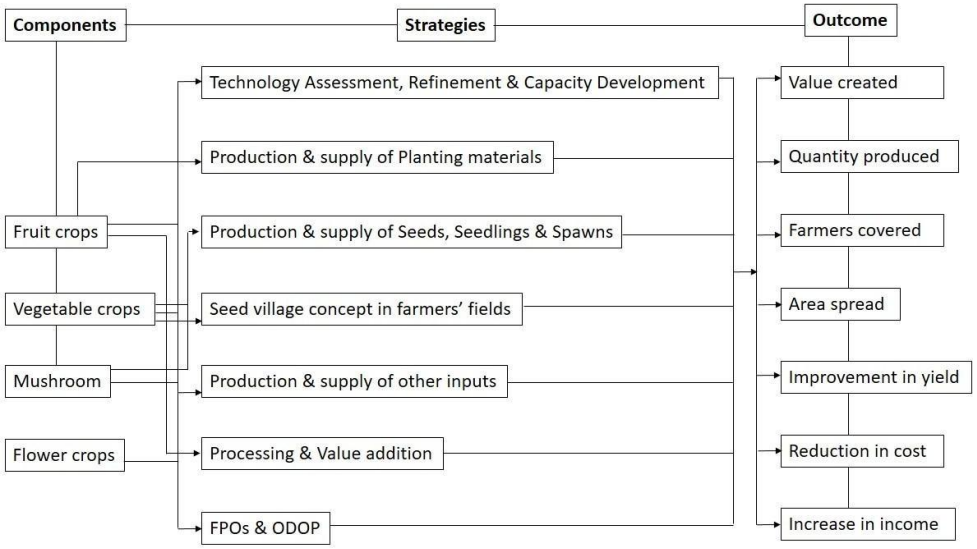
The Horticultural Extension concept

The concept of Horticultural Extension may best be described in the model which is depicted below. Unlike major agricultural crops, horticultural crops are of high value-low volume in nature. They have some specific features like - perennial nature (fruit crops), water, inputs and labour intensive (vegetables), high scope for processing and value addition (squash and candies) and more opportunities in non-farm sector (mushroom production). Considering the commodity based approach with which the recent developments are taking place in the country (Farmer Producer Organisations, One District – One Product concept), there is a much need for horticulture specific extension to be practised among the farmers. So, keeping these features in mind, a model of extension is developed.

The strategies

As mentioned earlier, horticulture, as a domain covers crops of fruits, vegetables, aromatic and medicinal plants, spices and plantation crops and flowers. Considering the vastness of this crops, only four specific components – Fruit crops, Vegetable crops, Flower crops and Mushroom were considered under this model. Hence, the extension strategy put forth by the KVK upon these components have some specific strategies as follows: 1. Technology Assessment, Refinement and Capacity Development, 2. Production of planting materials of improved fruit and plantation crops and meeting the farmers' demands, 3. Production of improved vegetable seeds of Arka varieties of ICAR-IIHR and mushroom spawns, at KVK farm and farmers' fields (under seed-village concept) 3. Production and supply of Arka technological products like AMC (Arka Microbial Consortium), Micro-nutrient specials, Bio-pest control measures etc., 4. Processing and value addition of fruits, 5. Approaching the farmers through Horticultural FPOs and that of ODOP concept.

The outcome of these strategies can be measured in terms of quantity of seeds, planting materials and other inputs produced, farmers covered (entrepreneurs emerged), area spread, value of the technological products created, yield improved, cost reduced and income increased.







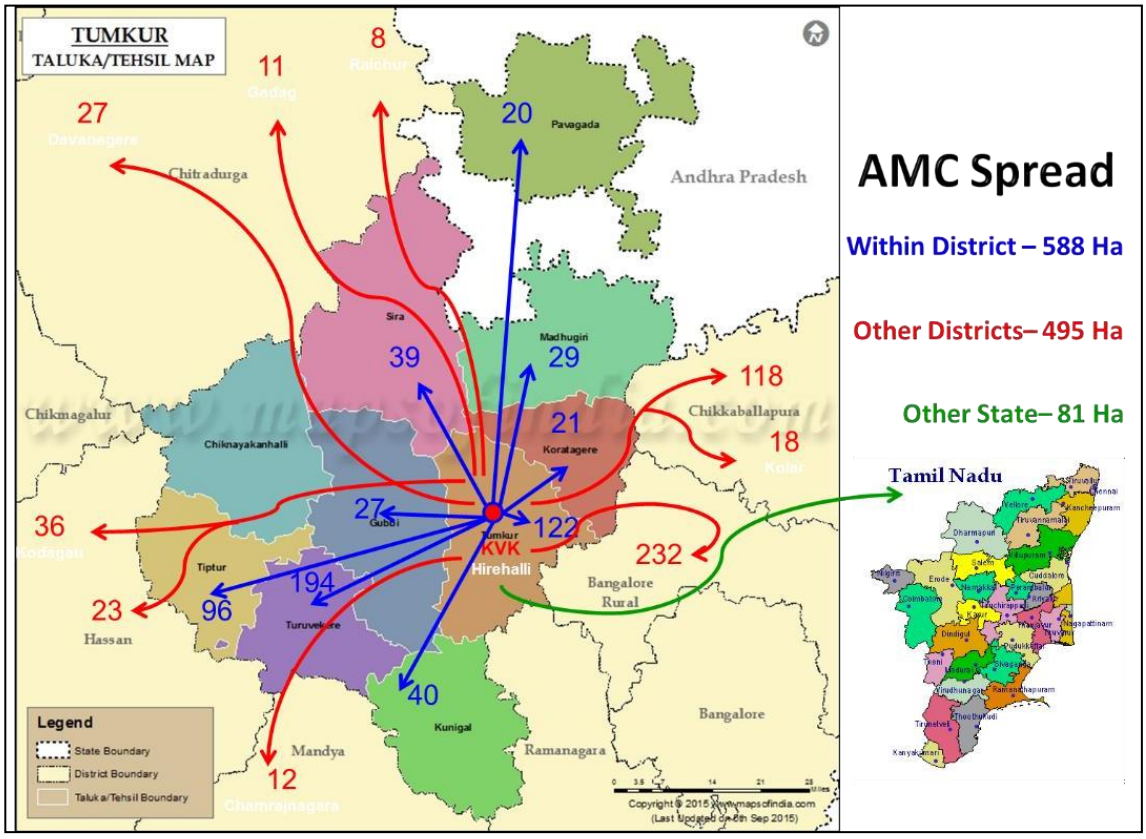

Arka Kalyan







A Rural Mart supported by NABARD


TUMKUR
TALUKA/TEHSIL MAP
AMC Spread
Within District – 588 Ha
Other Districts– 495 Ha
Other State– 81 Ha
Tamil Nadu
Andhra Pradesh
Chitradurga
Chikmagalur
Chiknayakanhalli
Tiptur
Hassan
Sira
Madhugiri
Pavagada
Koratagere
Chikkaballapura
Kolar
Gubbi
Tumkur
KVK
Hirehalli
Turuvekere
Kunigal
Bangalore Rural
Bangalore
Ramanagara
Mandya
Chamrajnagara
8
11
27
20
39
29
118
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96
23
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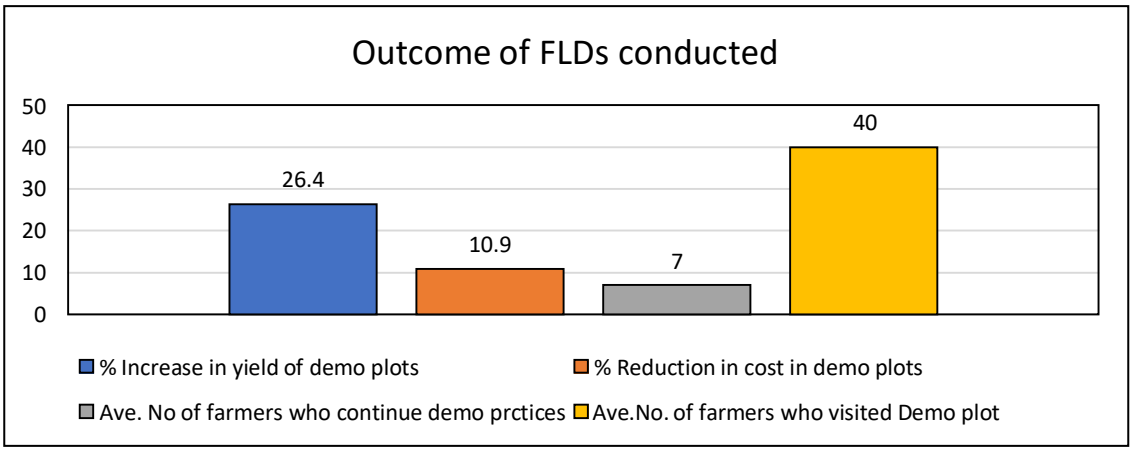
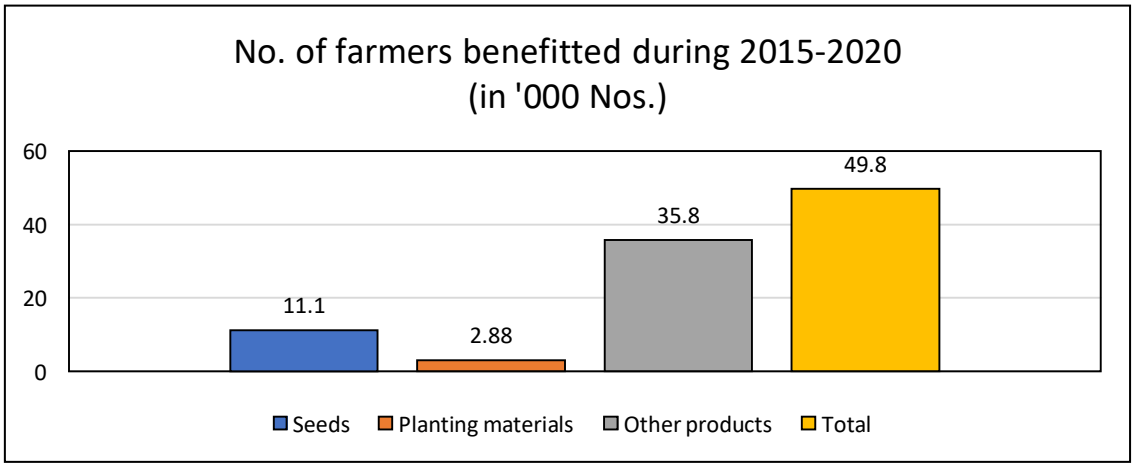
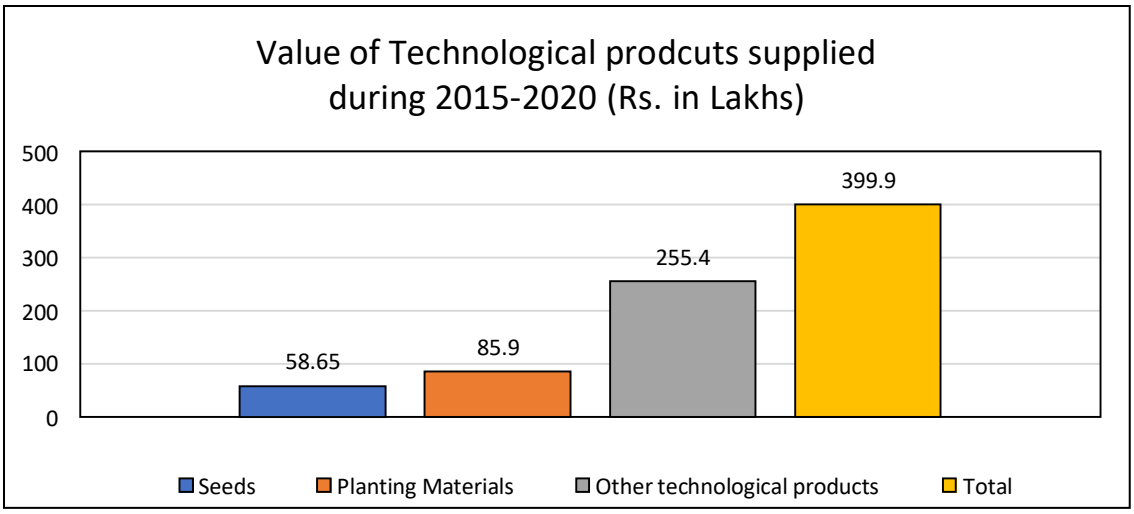
12
Legend
State Boundary
District Boundary
Taluka/Tehsil Boundary


Outcome of FLDs conducted
50
40
30
20
10
0
26.4
10.9
7
40
% Increase in yield of demo plots
% Reduction in cost in demo plots
Ave. No of farmers who continue demo prctices
Ave.No. of farmers who visited Demo plot





Conclusion

The strategies followed have brought some visible outcome in the lives of farmers. About Rs.58.70 lakhs worth of seeds, Rs.86.0 lakhs worth of planting materials Rs.255.0 lakhs worth of other technological inputs were produced and supplied to the needy farmers during 2015-2020. The analysis of outcome of results by following the above mentioned strategies revealed that the OFTs conducted by the KVK showed an increase of about 33.04% in the yield in farmers' fields where KVK technologies were adopted, compared to the farmers' practices. With reference to selected FLDs conducted, about 26.4% (on an average) is the percentage of increase in yield as a result of FLD in demo plots, compared to farmers' practice. Similarly, there is a reduction of 10.9% in cost of cultivation for the farmers in case of their adoption of KVK FLDs. Almost seven farmers tend to continue the FLD, even in case of withdrawal of the support from the KVK staff. Almost 40 stakeholders tend to visit the demo plot while FLDs are being conducted. The spread of technologies were found to be in an area of 828 ha, 1,802 ha and 569 ha under IPM in Mango, ICM in Onion and ICM in Tomato, respectively.

Horticultural Outreach - Lessons & Experiences of National Horticulture Fair

M. R. Dinesh
Ex-Director, IIHR

The ICAR-Indian Institute of Horticultural Research, Hessaraghatta, Bengaluru, organized five- day National Horticulture Fair (NHF 2021) from February 8th to 12th with the theme 'Horticulture: for start-up and stand-up India' in collaboration with several agencies. The fair was held on a dual mode with the approaches of virtual and physical. The virtual event was attended by officials of ICAR Institutes, Horticulture Universities, Directors of State Horticulture Departments, Heads of KVKs and representatives from private industry, press personnel, farmers and students. There were 255 demonstration plots of various varieties/ technologies developed by the Institute. A total viewing of 54 lakhs was recorded during the five days of this event. The footfall for the physical fair was 56,000.

Any extension activity basically involves extending the technologies from the 'Centre of Development' to the 'Centre of application'. Although there are several methods the main principle is that 'seeing is believing'. Field days in the farmers' plot will have the limitation of having one technology at a time or at the most two or three. The participation is also limited, and not many regions are covered. However, these disadvantages are not there in a fair and in addition to this active interaction between the stakeholders can take place and a large number of technologies can be displayed in one place. This event also promoted 'Atmanirbhar Krishi' as many private and other public institutions displayed their technologies.

The **fair** had the following **components**;

- Live crop cafeteria within the campus & showcasing the technologies taken by the farmers in their field
- The live crop cafeteria included 255 demonstration plots of various varieties/ technologies developed by the Institute.
- Virtual E-conference was conducted along with Scientist –farmers' interaction
- Knowledge sharing on innovations in horticulture through physical platform.
- Common virtual platform was given to the service providers in the area of horticulture viz., ICAR institutes, SAUs, developmental departments, financial institutions, private industries, NGOs, FPOs and market functionaries etc., for interaction with the farming communities.

It had virtual platform for one way viewing as well as for two-way interaction. Over 22 cameras were connected to live console integrated with far end live feed. The master feed from PCR (Production Control Room) broadcasted live on satellite as well as two-way feed to all the KVKs and FPO's in the country. Anyone to view the program could do by logging in by registering using their mobile number. There were 11 technical sessions with the subject matter experts.

Lessons learnt

Organizing the fair taught several lessons not only for the future conduct of the fair but also with regard to the feedback. Some of the lessons learnt are given below.

Publicity through print & electronic media especially use of animated films is vital for this kind of an event as it helps in reaching large number of stake holders. Collaboration & coordination among the various departments is very important viz., State Depts/Univ/KVK/FPO's etc. To showcase the technologies, it's very important to have good demonstration plots and stalls are a must both for financial support as well as for ensuring the display of various inputs and other technologies.

Breaking the **language barrier** through moderators is essential as farmers and the technology seekers would prefer the information in their local languages.

Digital technology has a very important role to play as through it large groups can be reached which otherwise would not be possible.

Problem solving happens without the geographic barrier as through the fair > 700 centres with groups of farmers could be reached and in this kind of dissemination **KVK's, FPO's** can play a very great role.

Apart from the virtual mode, **physical mode** is equally important as it can cater to regions located nearer to the place of the fair. Through the physical mode **awareness creation** for the number of technologies especially farmer, consumer & ecofriendly ones would be easy. **Workshops & training** program during this fair can become very effective in developing certain skills. **Motivation for entrepreneurship promotion** will be easy and adoption also becomes easy as practically these are demonstrated. It becomes a good platform for **farmer identification & felicitation** to encourage them as well as to encourage them to display their innovations and also to display native varieties, which they have conserved. This would give an opportunity to certain cases to link it to livelihood security. Creating awareness about the use of small-time **farm machinery** as well as **big one** at the present time when there is a shortage of labour will be an added advantage.

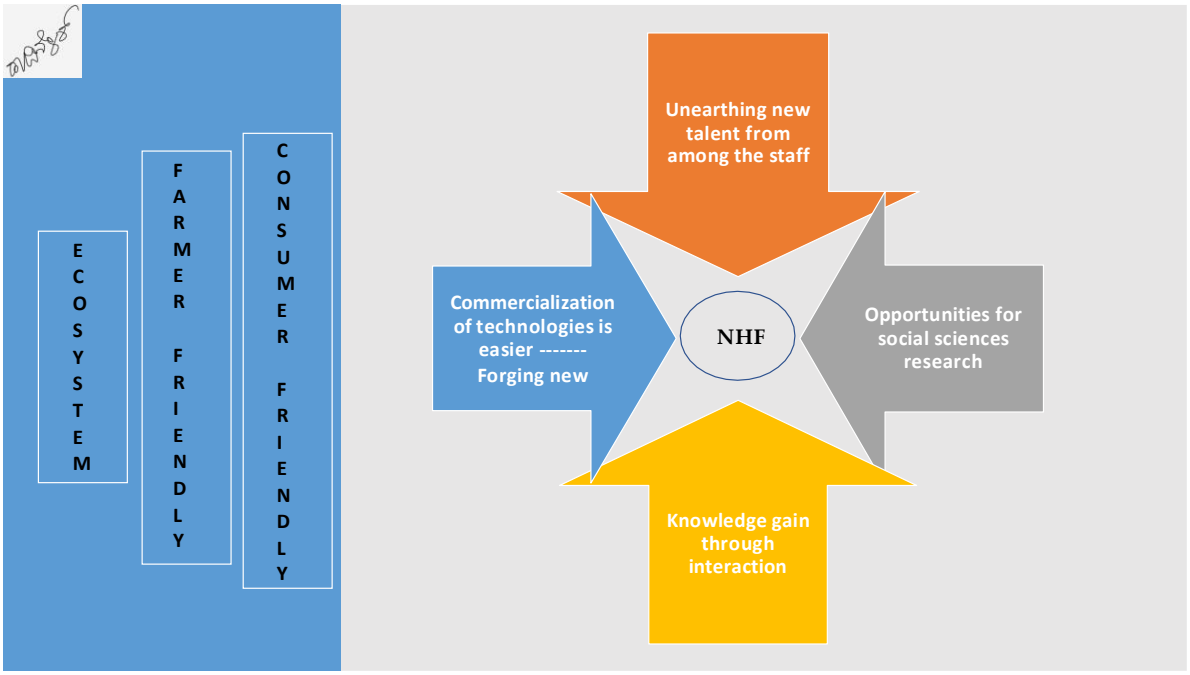
Introduction of **new technologies viz., protected cultivation with pollination** for certain crops, which would help them to grow the crop during 'off season' and learning the techniques of **Urban & peri-urban horticulture,** to grow their own crop on their terraces by the use of growbags can become a reality.

Experiences & possibilities

Organizing and taking part in the fair was a great experience. It provides a great opportunity for getting a **feedback on the technologies** thus giving a chance for the developer to refine it further as per the user's information. Since, the Scientists would have face to face with interaction with the stakeholders from different regions, they would come to know the feasibility of the adoption of the technology. A real fillip possible for **processing & value addition** to become more widely acceptable as well as to be adopted as an industry by many stakeholders.

There is a great interest for organic farming everywhere as it helps in ecosystem services. However, the platform of the fair was used to drive home the message of using **resistant** varieties as a basic need for **organic farming.** The concept of **soil fertility** supplementation with **plant health management** was a good experience in that vast majority appreciated the efforts. The possibility for

the farmer to get his **problems on crop cultivation at the grassroot level** through interaction and the demonstration plots having GAP and package of practices in harnessing quality production was satisfying. **Technology dissemination & marketing of the products** becomes faster and doubling of the farmers' income can become a reality in this set of crops. The enhancement in the **Visibility of the Institute** is satisfying along with the spread of the technology. Field days conducted in various farmers' fields and the work carried out by the KVK's can go a long way in popularizing the technologies.



Summary

All in all, it was an exhilarating experience of this fair, which can be explained thus; It helped in spreading ecosystem, farmer and consumer friendly technologies benefitting all the stakeholders. The fair helped in commercializing the technologies by forging new relationships, it helped in unearthing young scientific talent who helped in organizing, excellent knowledge gain through interactions and it provided an opportunity for social sciences research. It helps in bridging the gap for GAP among the stakeholders.

Extension Strategies for Technology Application in Horticulture

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The strategy for technology development and the strategy for technology dissemination are not mutually exclusive. Agricultural extension is a process of bringing about innovation and change. There is an inherent degree of overlap among them; however, the fundamental point is that they are potentially useful in joint assessment, diagnosis, planning, implementation, monitoring and evaluation. Research and extension linkages were theoretically possible in inter- personal mode, in the new regime, effective linkages of production systems with marketing, agro-processing and other value-added activities have acquired greater importance. In the present competitive environment, the research and extension service must be reoriented to overcome the exclusive focus on production that ignored market demand, profitability, and institutional arrangement in the past.

The Horticultural Challenges are fourfold:

- Need for **enhanced production and productivity** to feed the growing population and to retain the economic viability of horticulture as a profession.
- Need for **address issues of equality and uneven development** so that gains of growth are more equally shared across regions and people.
- Need to understand and address issues of **sustainability**; **environmental, production, institutional and fiscal.**
- Need to **enhance profitability in horticulture** in the light of liberalization process and open international markets.

The following constituents contribute for the agricultural development

- Farmers
- National Agricultural Research System comprising of State Agricultural Universities and ICAR Research Institutes.
- Krishi Vigyan Kendras (KVKs).
- State Development Departments (Agriculture, Horticulture, Agricultural Engineering and Animal Husbandry)
- Commodity Boards and Agencies (Horticulture Board, Coconut Development Board, Coconut Board, Spice Board, Tea Board, Coffee Board etc.,)
- Private input agencies

Among these constituents other than farmers and private input agencies all others are public

enterprises, which jointly work as partners for agricultural development. **Public–Private Partnership of this nature feeds the nation, which cannot happen in any other industry than horticulture.**

The saga of Indian horticulture is **complex, diverse and risk prone**. The developmental activities in the horticulture sector should address all these three issues for sustainable livelihood security for the farmers.

In this industry the producer i.e., the farmer is the main partner. He should be provided with quality and time bound technological inputs, services, and information. Apart from that, the following strategies are to be given more thrust for the development of horticulture sector.

- Harnessing the value of cutting-edge technologies for technological transformation.
- Natural resources management and conservation for sustainability.
- Rational and judicious use of farm resources and inputs to increase net income of the farm.
- Effective and timely horticultural operations through mechanization.
- Forecasting and forewarning for combating characterized risks.
- Focus on entrepreneurship development through secondary and specialty agriculture.
- Promotion of farmers' innovations for location specific technology development.
- Act as pivotal centre for exchange of information for future research and development.

Development in the horticulture sector can happen in three phases namely **3 S**.

i. Stress or Primary Horticulture
ii. Secondary Horticulture
iii. Specialty Horticulture

Stress or Primary Agriculture - refers to production of agricultural commodities.

Secondary Agriculture - is the process of making money with the agricultural commodities through processing, value addition and marketing.

Speciality Agriculture - emphasis of specialty agriculture is adding value to a product or process

Keeping in view the above, there is a need to change and change for better than the best. That change will happen with a clear understanding of Specialty Agriculture by **Frontline and Field Extension Systems** for Horticultural Technologies.

Speciality Agriculture – Concept Clarity

Status of present farming include,

- *smaller acreage farms, compared to national average.*
- *increasing land prices per acre.*
- *increasing production costs.*
- *growing disconnect between value of farm production and retail food prices.*

For this we should concentrate more value per unit area, which in turn refers to Speciality Agriculture which is briefly described as

- *non-traditional agribusiness products, including commodity items not traditional.*
- *value-added agribusiness products or processes.*
- *traditional agribusiness products which are marketed or distributed using new / innovative channels.*

Importance of Specialty Agriculture

- *potential for greater return on investment or greater return per acre than traditional commodity items,*
- *allows agribusiness producers to take advantage of competitive advantages gained through diversification and/or differentiation.*
- *greater long-term growth potential for specialty agriculture products than traditional commodity items.*

Specialty Agriculture trends around Creating and Capturing value**.**

- **Capturing value** is a function of altering the distribution of value in the agricultural production chain, or by cutting costs *(vertical integration, FPOs)*.
- **Creating value** is a function of altering the actual or perceived value to a customer *(unique or branded products, identity preserved or specialty products, bundling such as agri-tourism).*

Vision of Specialty Agriculture

- *confines to precision agriculture (protected environment, assured production, hi-quality products, assured market, higher rates) as compared to traditional farming (depends on nature, uncertainty of crop, low quality produce, non-remunerative prices, lack of markets).*
- *to develop business through hi-tech farming (labour, power and input management, women empowerment through SHGs, ensure a net income of Rs. 1000 per day per family from 1 acre land and the best relationship between urban & rural people).*

Under this situation, to help our hard-working horticulture growers, attention to **soil health care, water harvesting and management, credit and insurance, quality and safety, technology and inputs and farmer-friendly marketing** are very much essential. Thus, to serve the growers and save them from increasing distress, a model of **Farmers' Corporate and a well-defined technology delivery system** are very much essential.

Why Farmers' Corporate?

- Quantity of produce
- Quality Resource mobilization
- Lack of transport facilities
- Lack of negotiating power for better price
- Middleman

- Lack of market information
- Lack of awareness on institutional support
- Marketing

Current Scenario: Farmer is the only category in the economy who *buys every input in retail* (paying the cost added by everyone in the input supply chain) and *sells every produce thru wholesale* (everyone adds the cost after him) loosing at both the ends.

Future Scenario : The farmer should *buy inputs collectively from the manufacturer* and *sell the produce in retail, direct to consumers with a brand of their own*

Is Entrepreneurship quality among possible in Hoticulture ??????

- Is it possible in the context of *divided mind set of farmers* ?
- Does this mechanism suit for *small illiterate* holders?
- *Corporate culture* to farming sector ? Remote possibility!
- Poor or *no entrepreneurial skills* with farmers?
- How do they *compete* with corporate?
- Where are the *success models?*

YES, ..If Farmers mindset is changed

- Their illiteracy , never be a limitation
- They can assume corporate responsibility
- Can exhibit entrepreneurial capability
- Can compete with corporate

Cases of Success cases are:

Erode Precision Farm Producer Company Ltd., (2008) Erode district

- *1000 Small Farmers*
- *Rs.95.00 lakhs paid up share capital*
- *Seed Processing Unit*
- *Ero Pome Fresh*
- *Input supply service*
- *Fuel station service*
- *Non-Toxic Food Centre*

Kovai Farmers Producers Company Ltd.,, Pollachi

- 1000 farmers as members
- The price for their produce is fixed by the association once in 15 days
- 6 MT cold storage infrastructure
- Focus crops : Snake gourd, Ribbed gourd and Bitter gourd

- E.R.S Puram *Uzhavar Santhai* Showcase and sale of value added products from all FPOs
- Bitter Gourd powder
- Bulk supply to exporters
- Two input shops
- Non-toxic food Centre

Ayakudi Guava and Fruits Producers Company Ltd.,

- Export to Gulf thru Pollachi exporter: 3.5 MT/day
- Own whole sale and retail out let
- Supply directly to Department stores
- Agri Input shop
- Price stabilised at Rs.60.00 from Rs.15 per kg
- *Unnatham Uzhavar Angadi* at A.Vellode

TN Banana Producers Company Ltd., Trichy

- *Thottium* Producer Group: value addition of banana fruit in solar dryers (Amazon.in)
- 50 FIGs and Societies with 1000 farmers
- MoA with Rudram Foundation, France
- Export to Europian Countries thru M/S Nader and
- Ebrahim Co , Phillipines and regular export to Iran

Krishnagiri Mango Producer Company Limited

Krishna brand mango

Ramanathapuram Chillies Producer Company Limited

- Year: 2004-05
- No. of farmers: 1000
- No. of FIG's: 50
- Facilitated direct sales,
- Process, Value addition and Marketing

Pudukkottai Coconut Farmers Producer Company Ltd.

- Year: 2015 – 16
- No. of farmers: 1000
- No. of FIG's: 60
- Nuts, Copra, Neera and Seedlings
- Value added coconut products etc.

Technology Development and Delivery System

In the Technology Development and Delivery System, it is envisaged that the research in

horticulture will orient towards location, situation and system-specific technology generation, testing, and refinement. In this task, private sector involvement will be mutually beneficial. As regards private sector research, proprietary technologies can directly go to farmers and others as per agreements/understanding can also flow to KVKs for integration. Technology transfer will be through field extension. Knowledge empowerment of the whole system (research and technology transfer) will be through the *Horticulture Tech Portal*, which should be interactive. Knowledge management includes HRD, policy, and national and international perspective related information and products. KVKs will provide capacity development. With high connectivity in terms of computers, internet, telephone, etc., it would be linked to state horticulture departments. At the village level, there will be Farmer Interest Groups (FIGs) and Farmers Organization (FOs). The FIGs are informal, voluntary, and self-governing associations of farmers and farmwomen, while FOs are federations of FIGs, mandated to support the cause and activities of member FIGs.

Re-Envisioning Extension System

Extension strategy for horticultural production technologies should be all inclusive in which basic concept of extension to be re-looked from persuasive technology transfer originally conceived, to the model of interdependence within specific innovation system framework of the stakeholders and institutional context based on the strengths of both public and private sector. Technology dissemination process approach should be unified production system, knowledge centric and research-extension-farmer interface.

Conclusion

Appropriate framework for technology development and dissemination in horticulture would be very much needed for transforming horticulture sector from the present approach of its sustenance as a way of life to a vibrant economic activity with a sense of pride for future generations. Support to Farmers Producer Organizations (FPOs) for building a strong foundation of producer initiative and ownership. They need long-term efforts and provision of hand holding support. The FPOs should be linked to the markets through public-private partnership mode.

To Reach the Unreached Extension Strategies of Dr.Ysr Horticultural University

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Dr.YSR Horticultural university (Dr.YSRHU), 2nd of its kind in the country was established on 26th June, 2007, The University is functioning with a mandate to develop human resources through Education, Research and Extension in Horticulture and allied sectors and concentrating on extension strategies (transfer of technologies) through forty two institutes namely Krishi Vigyan Kendras (4), Horticultural Research Stations(19), Colleges of Horticulture (8) and Horticultural Polytechnics (11) for the benefit of farmers, rural youth and women directly through Rythu Bharosa Kendras (RBKs), District Resource Centres(DRCs) and Department of Horticulture, Government of Andhra Pradesh.

Dr.YSRHU Extension strategies

The university is effectively reaching the unreached by following extension strategies

1. Farmers Advisory Cell (FAC)

Established FAC at univeristy head quarters which is acting a Co.ordinating Centre for 42 institutes under Dr.YSRHU IN transfer of technology. A Mobile Number (9618021200) is specifically allotted to FAC and popularized this mobile number among farming community for regular adivisories, besides regularly organizing.

2. Plant Protection Advisory Cell (PPAC)

Created PPAC at university head quarters for regular advisories on plant protection and for pest & diseases monitoring & forecasting.

3. Horticultural Skill Training Centre (HSTC)

Horticultural skill training centre located at university head quarters is regularly providing skill training programmes to farmers, rural youth & women on following Ten modules.

1. Dry flower technology (3 days)
2. Mushroom production technology (4 days)
3. Scientific bee keeping (6 days)
4. Nursery management (4 days)
5. Production of Bio agents (4 days)
6. Fruits & Vegetable processing (3 days)
7. Vermi compost preparation (3 days)
8. Horti-Millet products (3 days)
9. Integrated farming system (3 days)
10. Terrace gardening (2 days)

4. Horti Business Incubation Centre (HBIC)

HBIC at university head quarters is functioning with a mission to guide Horti/ Agri students, rural youth and women to become Horti entrepreneurs and thereby to create an "Employer Culture", by providing services viz., Counseling, Technical mentoring, Business mentoring, Capacity Building, Consultancy, Business Plan Preparation, Incubation and Pilot Scale Production.

5. Dr.YSRHU Udyana Mitra

Established sophisticated electronic wing facility at university museum where regular recording of videos on latest technologies in Horticulture & allied sectors by subject experts (Scientists/ Teachers) is being carried out under "Dr.YSRHU Udyana Mitra" Programme for dissemination of technologies & information to farmers, students and stake holders and also through Rythu Bharosa Kendra's (RBKs) channel.

6. Farmers Awareness Creation Centre (FACC)

Established FACC at university museum & displayed information of released varieties, latest crop production and protection technologies with good diagnostic symptoms in various horticultural crops.

7. Community Radio Station

Established Community Radio Station at university head quarters every day broad cast of programmes on weather forecast, monthly operations in Horticultural crops & adversaries are being carried out under " Dr.YSRHU Udyana Vani – 90.8 FM".

8. Vice-Chancellor to Village Programme

Village adoption programme under "Vice-Chancellor to Village Programme" adopted 42 village in 13 districts of Andhra Pradesh by 42 institutes under Dr.YSRHU and effectively transferred technologies.

9. Dr.YSRHU Year with an intention to give crop wise priority in Research, Extension and related activities announced year 2020-21 as **"Dr.YSRHU year of Coconut 2020-21"** under this activity, all the 42 institutes under Dr.YSRHU have implemented year around programme as per the action plan given by the university. Similarly year 2021-22 declared as **"Dr.YSRHU year of Citrus 2021-22"**

10. Dr.YSRHU Phone-in programme

Scientists & Teachers of Dr.YSRHU are participating every day Phone-in programme. The schedule of Phone-in programme will be published in News papers/ monthly magazines/ whatsapp groups well in advance.

11. Dr.YSRHU Udyana Varthalu

Ongoing activities of Dr.YSRHU are being broad casted one in a week under

"Dr.YSRHU Udyana Varthalu" also posted in Dr.YSRHU Youtube channel, whatsapp group & Dr.YSRHU website.

13. e-KIOSK

Latest technologies on horticultural crops are uploaded in e-KIOSK and made it available to all by planning in Farmer Advisory Cell.

14. Dr.YSR Technical support to Dr.YSR RBKs

- Crop wise – Technology wise advisories
- Expert scientist at Integrated Call Centre
- Scientists (Subject experts) for RBK channel
- Awareness on technologies in horticultural crops among village Horticultural/ Agricultural Assistants of RBKs
- Scientists Participation in Dr.YSR Rythu Bharosa Chaitanya Yatralu and Thotabadi programmes

15. Year round Training Calendar

Year round training programmes farmers, rural youth & women in Co.ordination with Scientists/ Teachers of Dr.YSRHU IN 42 institutes under Dr.YSRHU.

16. Dr.YSRHU you tube channel

Created Dr.YSRHU Youtube channel and being uploaded all e-extension activities.

17. Crop-wise & Technology-wise whatsapp groups

Created whatsapp groups with farmers, rural youth & women crop wise and technology wise and providing regular advisories.

18. Dr.YSRHU Udyana Sandarshana

State level Kisan Melas are being organized every year at university head quarters in Co.ordination with Department of Horticulture VHA/ VAA of RBKs for the benefit of farmers, rural youth & women on the name "Dr.YSRHU Udyana Sandarshana".

19. Diagnostic Visits

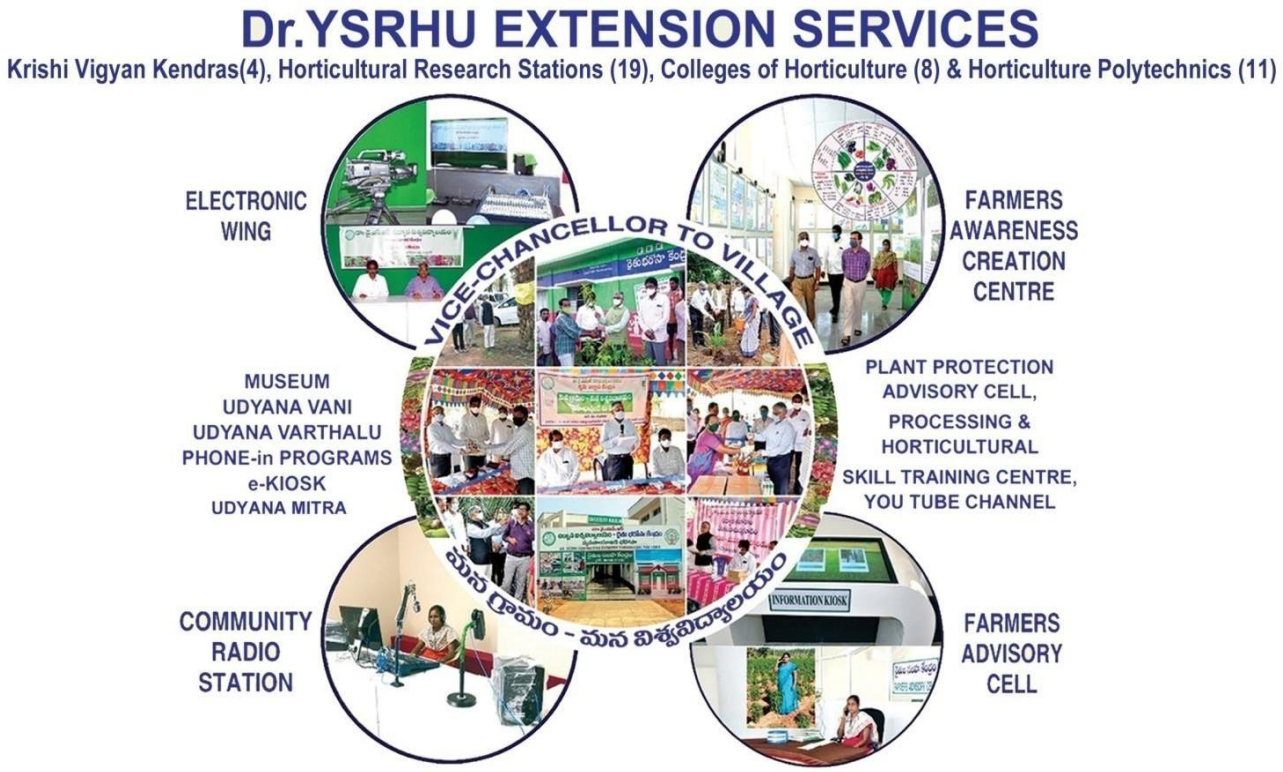
Scientists/ Teachers of Dr.YSRHU are involved in Diagnostic visits.

20. On-Farm trails & Front line demonstrations

Validation & popularization of technologies by way of OFTs & FLDs

21. Dr.YSRHU Website

Updation of latest technologies & ongoing activities with good photographs.



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Technology Application, Refinement and Transfer: The Indian Experience

V. Venkatasubramanian, Sajeev M.V. & A.K. Singha

Introduction

India has made considerable progress in improving its food security. The agricultural development strategy pursued in the country, particularly since the mid-sixties, is recognized and appreciated world over. The integration of agricultural research with quality education and a properly planned extension education system has been one of the fundamental foundations of this developmental strategy, which also led to revolutions in many other sectors of agriculture and allied enterprises. As a part of this strategy, several programmes of transfer of technology from research stations to farmers' fields were launched in the country. These included National Demonstration Project, Lab to Land Programme, Operational Research Project and Krishi Vigyan Kendras (Farm Science Centers). The programmes were continuously reviewed from time to time and reformulated for their effectiveness. Presently the Krishi Vigyan Kendras (KVKs) have been recognized as an effective link between agricultural research and extension system in the country (Venkatasubramanian *et. al.*, 2009).

Krishi Vigyan Kendras (Farm Science Centers), an innovative science-based institution, were established in India mainly to impart vocational skill training to the farmers and field-level extension workers. The concept of vocational training in agriculture through KVK grew substantially due to greater demand for improved/agricultural technology by the farmers. The farmers require not only knowledge and understanding of the intricacy of technologies, but also progressively more and more skills in various complex agricultural operations for adoption on their farms. The effectiveness of the KVK was further enhanced by adding the activities related to on-farm testing and front-line demonstrations on major agricultural technologies.

With the consolidation of other front-line extension projects of the Council during the Eighth Five Year Plan, such as National Demonstration Project (NDP), Operational Research Project (ORP), Lab to Land Programme (LLP) and All India Coordinated Project on Scheduled Caste/Tribe, the mandate was enlarged and revised to take up on-farm testing, long term vocational training, in service training for grass root extension workers and front-line demonstrations on major cereal, oilseed and pulse crops and other enterprises.

The application of technology in the farmers' field is achieved through conducting of On-farm trial which include technology assessment and refinement. The proven and recommended technologies are then introduced in the system through conducting of frontline demonstrations followed by training programmes to empower the farmers, field extension personnel and rural youths for its adoption. The extension activities such as field day, exhibitions etc are conducted to disseminate the technologies across the system.

The KVKs have witnessed several changes in their functions over the years. Accordingly their functional definition also has radically got refined so as to meet the new challenges in agriculture. “KVKs are grass root level organizations meant for application of technology through assessment, refinement and demonstration of proven technologies under different ‘micro farming’ situations in a district” (Das, 2007). As of January, 2020, 716 Krishi Vigyan Kendras were operating in 732 districts of India (ICAR, 2020).

It should be clearly understood that transfer of technology is not a primary function of KVKs and the same is the responsibility of State departments. The KVKs on the other hand will assess (and if needed refine also) the newly released technologies, demonstrate the proven ones and train farmers and extension workers of the district on the same.

Role of KVKs in the context of Agricultural Extension in India

Extension in India is largely deployed by government, implemented mainly through government institutions and to some extent through non-government agencies. Krishi Vigyan Kendras (KVKs) or Farm Science Centres as institutes of inducing behavioural change, are being managed by both government and non-government organizations. Literally, Krishi Vigyan Kendras have to serve as repository of scientific knowledge that is useful to the entire district, which is its jurisdiction. In India, agricultural/fisheries extension and extension education are interchangeably used with the same connotation as used in American tradition, meaning “Extending Information” as a means of educating people to solve their problems. As a result, agricultural/fisheries extension in India is more of “Informative Extension” than “Emancipatory Extension”.

In India, the extension efforts, particularly transfer of technology efforts, have largely been taken up by the state departments of agriculture and other disciplines as a state subject. The Indian Council of Agricultural Research (ICAR) as the apex body to provide new technologies in agriculture and allied aspects has its own transfer of technology activities too. The extension efforts of ICAR have evolved through National Demonstration Projects, Operation Research Projects, Lab to Land Programmes, and integrating of these approaches to Krishi Vigyan Kendras (KVKs) since 1974.

Technology and farm technology

Technology is any systematic knowledge and action applicable to any recurrent activity. Technology involves application of science and knowledge to practical use, which enable man to live more comfortably. The Merriam-Webster dictionary offers a definition of the term: "the practical application of knowledge especially in a particular area" and "a capability given by the practical application of knowledge”.

Technology can be most broadly defined as the entities, both material and immaterial, created by the application of mental and physical effort in order to

achieve some value. In agriculture/fisheries, the term technology often confuses practitioners. This is because farm technology is a complex blend of materials, processes and knowledge. Swanson (1997) has classified farm technologies into two major categories: 1) Material technology, where knowledge is embodied into a technological product; and 2) Knowledge based technology, such as the technical knowledge, management skills and other processes that farmers need for better farm management and livelihood support.

KVK scientists need to have clarity over the technologies which they are assessing and refining in response to a specific problem in a specific micro-location. For example, a KVK Subject Matter Specialist may be assessing the efficacy of a particular management practice on a crop/fish's yield or growth in the KVK district. Such management practices can be broadly classified as Knowledge based technology. Alternatively, all technological products tested and demonstrated under OFT and FLD fall under material technology. Ex: Seeds/fish seeds, pesticides, fertilizer, farm machinery, irrigation systems etc.

Agricultural Technology Development

Technology Development (also called technology innovation) in agriculture/fishery is a process consisting of all the decision and activities which a scientist does from recognition of a need/ problem with planning, testing, conducting research, verification, testing and dissemination for adoption. During the same time, some problems on the technology might get back to the scientist for solution thus resulting in refinement of the same. Thus, technology development is a continuous process. The KVK scientists have to equip themselves for 'technology application' - a process which includes the above mentioned processes; thus contributing their part in the overall process of agricultural/fishery technology development.

Agricultural Technology Management

Technology management can be defined as the integrated planning, design, optimization, operation and control of technological products, processes and services. A better definition would be "the management of the use of any technology for farmer advantage." The KVK role under fishery technology management is very huge where-in it selects latest fisheries technologies, tests them for suitability in different micro-locations of the district and demonstrates the proven ones to farmers and extension system.

Technology fatigue in agriculture

Linkages between the laboratory and farmer fields have weakened and extension services often have little to extend by way of specific information and advice on the basis of location, time and farming system. Good quality seeds at affordable prices are in short supply and spurious pesticides and bio-fertilizers are being sold in the absence of effective quality control systems. Farmers have no way of getting proactive advice on land use, based on meteorological and marketing factors. No

wonder the prevailing gap between potential and actual yields, even with technologies currently available, is very wide (National Commission on Farmers, 2007). In case of KVKs, it was found utilizing old and obsolete technologies for OFTs, FLDs and training programmes thus resulting in poor feed-forward to the extension system. A knowledge deficit as mentioned above coupled with the usage of obsolete technologies and package of practices together leads to a situation called 'technology fatigue'. Indian agriculture, particularly agriculture/fishery by resource poor farmers in rural areas is now bearing the brunt of technology fatigue. The KVK role lies in providing timely supply of proven technologies specific to various micro-locations of the district thus alleviating the technology fatigue existing in the district.

Technology Gap

Technology Gap is the gap between the level of recommendation and the extent of adoption (against recommendations). Technology gaps are a major source of concern for extension system. The successes of traditional transfer of technology (TOT) models were mainly evaluated on the basis of the extent of narrowing down in technology gaps achieved by them. KVK system being primarily focused on assessment, refinement and demonstration of new technologies, its role lies in feeding proven technologies to the main extension system. Thus, the primary focus of KVK should not be mistaken as reduction of existing technology gaps. Rather, they are meant at alleviating "technology fatigue" by providing timely supply of proven technologies specific to various micro-locations of the district. Alleviation of technology fatigue is accomplished through processes of technology and methodology backstopping.

Agricultural Technology backstopping

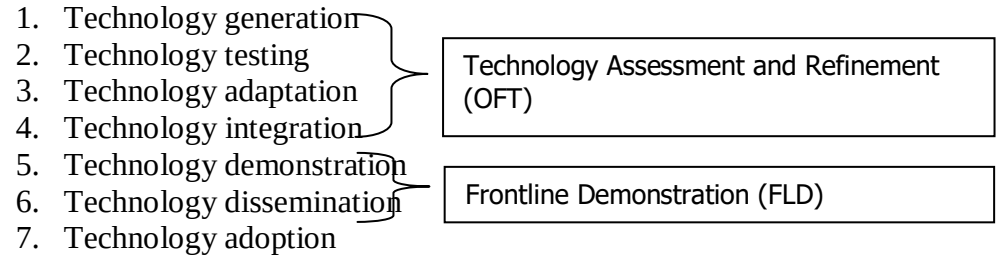
Backstopping refers to any precaution taken against an emergency condition. Accordingly, agricultural technology backstopping can be defined as any technology precaution taken to combat technology fatigue in agriculture. In simple terms agricultural technology backstopping is the process of making available ready to use technologies for farm families through assessment, refinement and demonstration processes in order to combat the existing/forecasted technology fatigue.

Agricultural Methodology backstopping

This is a process almost similar to agricultural technology backstopping but differs with respect to the kind of technology solution offered. Instead of material technology, methodology backstopping aims at assessment, refinement and demonstration of knowledge based technologies often referred to as methodologies/package of practices. It provides detailed procedures to carry out the technology application functions by the extension personnel in the field. It includes methodologies for conducting OFT, which includes TAR, demonstrations, training, conducting surveys, impact assessment and evaluation etc.

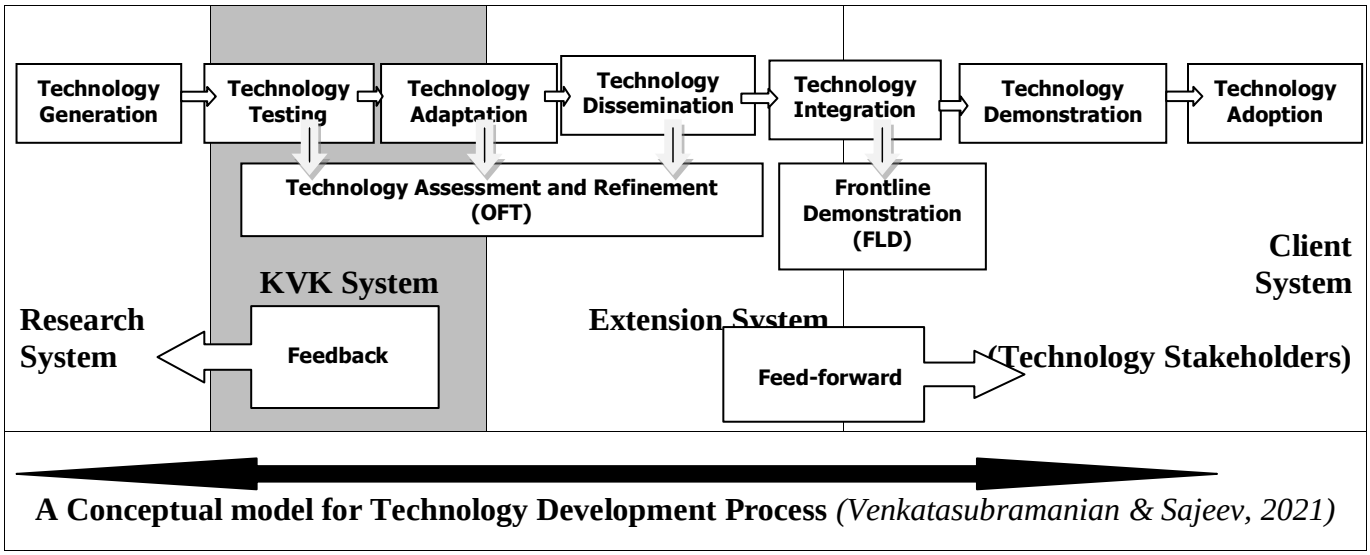
Conceptual paradigm of Agricultural/Fishery Technology Development

Understanding technology development process in agriculture/fishery and its components is vital for success of KVK scientists. Farm technology development basically constitutes seven processes. They are:



Technology generation, the starting point of technology development process is mainly a function of agricultural research system. Testing, adaptation and integration processes constitute technology assessment and refinement which KVK system executes through OFTs. The feedback is passed over to research system. KVK system also involves in technology demonstration through FLDs. Feed-forward from successful OFTs and FLDs is communicated to the extension system for mass popularization in the district. Technology adoption; the final act, occurs among the members of client system i.e. farmers.

We are presenting a new conceptual model of fishery technology development process depicting the various components and actors involved for the benefit of fisheries technology stakeholders. The role of KVK system between research system and extension system with respect to technology application is identified and highlighted here. Research system generates new technologies. In India, research system comprises of ICAR institutes, SAUs, Fishery Universities, departments like DBT, DST, other Science and Technology Institutions and Commodity boards. NGOs, Corporate and farmer innovators also contribute to technology generation. Extension system comprises of State departments of agriculture, animal husbandry and veterinary, fisheries, sericulture etc. SAUs, ICAR institutes, commodity boards, NGOs and Corporate sector also contribute to extension system. Earlier, due to the primary focus on vocational training, KVKs were categorized under extension system itself. But today, with mandates being focused on assessment, refinement and demonstration of frontier technologies, the KVK system positions itself clearly between the research and extension systems thus acting both as a feedback and feed-forward mechanism. In this paradigm, it is necessary to understand the pathways or passage of technology through KVK system.



A Conceptual model for Technology Development Process *(Venkatasubramanian & Sajeev, 2021)*

Typology of technology passage through KVK system

KVK system has successfully established itself between the research and extension systems. Technology development process as explained earlier, invariably has assessment, refinement and demonstration components. Hence, there is a passage of technologies through various stages in a KVK system. We found that this passage doesn't follow a uniform pattern. For example, a technology may go through assessment stage and demonstration stage but not through refinement stage. Based on analysis of OFTs and FLDs conducted by KVKs, we identified five different typologies of technology passage through KVK system. A proper understanding of these typologies will help KVK personnel in deciding whether a particular technology has to go for OFT and FLDs or both. The typologies are:

1. **Source – Demonstration**

   In this type the technology from any source/provider directly goes to demonstration by KVK. This happens when the KVK is completely sure that the technology is fully suited for the district and can go directly for FLD. Here, the technology doesn't pass through assessment and refinement stages.

2. **Source – Assessment**

   In this type the technology from any source/provider goes for assessment by KVK. This happens when the KVK is not sure that the technology is fully suited for different micro-locations of the district. Here the technology fails at assessment stage itself and hence doesn't move to refinement or demonstration stages.

3. **Source - Assessment – Refinement**

This type is a variation of type 2. Here, the KVK is not sure that the technology is fully suited for different micro-locations of the district. The technology goes for and succeeds in assessment but needs refinement and hence moves to refinement stage. Here, the technology fails in refinement stage and hence doesn't move to demonstration stage.

4. **Source - Assessment – Demonstration**

This type follows type 3. This happens when the KVK becomes sure that the technology is fully suited for different micro-locations of the district. The technology fully succeeds in assessment and hence moves to demonstration stage. Here, the technology doesn't require refinement and hence move to demonstration stage.

5. **Source - Assessment - Refinement – Demonstration**

This type also follows type 3. This happens when the KVK becomes sure that the technology is fully suited for different micro-locations of the district. The technology succeeds in assessment and refinement and moves to demonstration stage. Here, the technology is successfully refined by KVK and taken to demonstration stage i.e. FLD.

FLDs are supposed to be taken up on proven technologies only. Hence, it makes obvious that once demonstrated it will go to the extension system and client system. Rarely FLDs may fail thus preventing the technology passage. But KVKs are not supposed to demonstrate such technologies which are not fully proven. The failure of FLD can be due to some extraneous factors rather than technological factors.

Client system comprises of the ultimate end-user i.e. the fish farmer/fishery technology stakeholder. Although KVK system does assessment, refinement and demonstration of new technologies as part of technology development process, some technologies get refined or rejected even in the last stage at farm/user level. Hence, client system even though being the final actor in technology development process, plays the ultimate decisive role.

Conceptual paradigm for Technology Assessment and Refinement in agriculture/fisheries

Technology Assessment and Refinement (TAR) in agriculture refers to a set of procedures whose purpose is to develop recommendations for a particular agro-climatic situation/ location through assessment and refinement of recently released technology through farmer participatory approach. It refers to the process or a set of activities before taking up new scientific information for its dissemination in a new production system. *OFTs conducted by KVKs are based on this concept and thus distinguish it from agronomic and research trials*. The process of TAR has three

components. They are technology testing, technology adaptation and technology integration. TAR should be site specific, holistic, farmer participatory, providing technical solution to existing problems, inter-disciplinary and Interactive.

This process involves Scientist-Farmer linkage in terms of sufficient understanding of the farming situations, adequate perception of farmers' circumstances and their needs, the variability of conditions on the research status as compared to farmers' fields and problem orientation instead of disciplinary approach.

Thus, Technology assessment in agriculture by KVKs should be understood as the study and evaluation of new technologies under different micro locations. It is based on the conviction that new discoveries by the researchers are relevant for the farming systems at large, and that technological progress can never be free of implications. Also, technology assessment recognizes the fact that scientists at research stations normally are not trained field level workers themselves and accordingly ought to be very careful while passing positive judgments on the field level implications of their own, or their organization's new findings or technologies. Considering the above factors, the ICAR has envisaged On Farm Trials (OFTs) through its vast network of KVKs covering almost the entire geographical area of the country (Anon, 1999).

On Farm Trials (OFTs)

An On-Farm Trial aims at testing a new technology or an idea in farmer's fields, under farmers' conditions and management, by using farmer's own practice as control. It should help to develop innovations consistent with farmer's circumstances, compatible with the actual farming system and corresponding to farmer's goals and preferences. On-farm-trial is not identical to a demonstration plot, which aims at showing farmers a technology of which researchers and extension agents are sure that it works in the area. *It should be noted that OFTs are strictly to be conducted in collaborating farmer fields and not in KVK land.*

Stakeholders of On-farm trials

There are various stakeholders in an on-farm trial. Understanding them and their roles can help KVKs to develop better OFTs. The stakeholders are:

- The farmers who are the clients for the out-coming results,
- The SMS who should help the farmers to overcome their problems and improve their economical situation. On farm trials can give them valuable information in this respect.
- The Scientist who needs to apply promising on-station results under farmers' conditions before releasing the technology to the extension service,
- The extension system and government itself, who is interested in seeing an efficient and participatory technology development model evolving, since most top-down approaches have failed miserably.

KVKs have to spend considerable time and efforts in planning and implementing OFTs. The basic principles of conducting successful OFTs are to be followed in this process. The principles are:

1.Define a clear question you would like to have an answer for:
Narrow the trial down to its simplest form; define a clear simple question to which the OFT should give an answer.

2.Keep it simple:
Limit the trial to a comparison of two (or maximum three) treatments.

3.Go step by step:
Farmers usually do not adopt entire new systems of production; they go step-by-step adapting components of the technology. Therefore the OFT should not include too many new steps/practices at once.

4.Seek help:
When the problem is clear and the idea on how to go about the trial has evolved, the SMS should contact a competent researcher to discuss the plan of the OFT. He/She can also take help from other SMS and PC of the KVK.

5.Replicate and randomize
Plan on enough field space (in farmers' field) to do more than one strip of each treatment being tested. Mix treatments within blocks.

6.Stay uniform:
Treat all the plots exactly the same except for the differing treatments. If possible, locate the experiment in a field of uniform soil type (slope, fertility etc.).

7.Harvest individual plots:
Record data from each individual plot separately. Do not lump all treatment types together or the value of replication will be lost.

8.Remain objective:
The results may not turn out as expected or planned. Be prepared to accept and learn from negative results. Negative results show that the technology under testing is not suitable in the present form for the specific micro-location of the district. Such results are equally valuable for the benefit of farming systems at large.

1. *Manage time wisely:* Expect to devote extra time to OFT during busy seasons. Make sure to can carry out the trial even though busy, or get extra help from other SMS.

The success of an OFT should not be confused with success of the technology tested. A negative result of a technology tested shows that the technology is not suited for the specific micro-location of the district. This finding also refers to the success of the trial. Some technologies may not need refinement thus qualifying directly for frontline demonstrations. Some may successfully undergo refinement and reach the demonstration stage while some technologies fail to get refined in the farmer field.

The technologies which successfully come out of On Farm Trials are then recommended for Frontline Demonstrations (FLDs).

A study conducted by National Institute of Labour Economics Research and Development during 2015 on impact of KVKs on dissemination of improved practices and technologies revealed that KVKs are having an edge over other organizations in providing technology services by virtue of their having better technical expertise and demonstration units. At national level, on an average each KVK covers 43 villages and 4,300 farmers, and it organize more field level activities than on campus activities. About 25% of the persons trained by KVKs on agri-preneurship had started self-employment venture.

Krishi Vigyan Kendra Knowledge Network Portal

Krishi Vigyan Kendra Knowledge Network Portal facilitates KVKs to update and upload all types of information so that the related information and knowledge can reach to the farming community in time. A KVK Mobile App for farmers has also been developed for Android users and is available in Google Play Store. Farmers need to register and select concerned KVK in the App for accessing information. Farmers can ask any farm related query to the experts of KVKs for solution.

Conclusion

With current reforms and policies, the public extension system would continue to play a prominent role in technology dissemination. The large scale of small and marginal farmers and landless labourers are benefited by the public extension system. The other players involved in extension/transfer of technologies such as NGOs, Farmers organisations, Private sector (both corporate and informal), para-workers etc. would actively complement/ supplement the effort of the public extension agency. Extension mechanism will have to be driven by farmer's needs, location specific and address diversified demands. There is room for both the public and private sectors in the development of a demand based and feedback driven system. Technologies required to address total farming systems are knowledge intensive. Public extension system will need to be redefined with focus on knowledge-based technologies to upgrade and improve the skills of the farmers.

Farmers' capacity building is often seen within the limited perspective of giving them the knowledge and skills required to practice crop and animal husbandry in a better way. Though, knowledge and skills are fundamental to efficiency in any enterprise, the Indian farmers need more than that because of the limitations and complexities under which they operate. The KVKs which have been mandated to work with farmers, farm workers and rural youth directly as well as through field extension functionaries have the greatest challenge to make their clients more efficient, specialized and to be economically active. The fact that the need for agricultural/fisheries and rural information and advisory services is to intensify in the immediate future exerts more pressure on KVK performance. This article has attempted to assist the extension practitioners in equipping themselves for the future

challenges by providing a conceptual paradigm regarding technology assessment and refinement, the most important mandated activity assigned to them.

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Overview on Entrepreneurial opportunities in value addition to horticultural crops

B.N.S. Murthy, C. K. Narayana, Vijay Rakesh Reddy

Production and Distribution

India is the second largest producer of fruits and vegetables in the world with a production of 320 million tonnes. Maharashtra, Andhra Pradesh, Uttar Pradesh, Gujarat and Karnataka are the leading producers of fruit (51%) and West Bengal, Uttar Pradesh, Bihar, Madhya Pradesh and Gujarat are the major vegetable producing states (55%) in India.

Market

The fruit and vegetable processing industry in India was estimated to expand at a compound annual growth rate (CAGR) of ~7.62% between FY 2018 and FY 2023 to reach a value of INR 256.4 Bn in FY 2023. Currently, commercial processing of fruits and vegetables is extremely low in India, at around 2.2% of the total production as compared to countries like Philippines at 78%, China at 23% and the United States (U.S.) at 65%. The unorganized sector witnesses a stiff competition, owing to the presence of a large number of players competing for small shares in the overall market.

Exports

During 2018-19, India exported fruits and vegetables worth Rs. 10236.93 crores/ 1,469.33
USD Millions which comprised of fruits worth Rs. 4817.35 crores/ 692.01 USD Millions and vegetables worth Rs. 5419.48 crores/ 777.25 USD Millions. Grapes, Pomegranates, Mangoes, Bananas, Oranges account for larger portion of fruits exported from the country while Onions, Mixed Vegetables, Potatoes, Tomatoes, and Green Chilly contribute largely to the vegetable export basket. The major destinations for Indian fruits and vegetables are Bangladesh, UAE, Netherland, Nepal, Malaysia, UK, Sri Lanka, Oman and Qatar.

Lack of sufficient storage facilities and improper distribution are hampering the growth of the market. Existing stand-alone and integrated companies and logistics offering cold storage and transportation solutions are unable to meet the entire demand for such services. These factors are adversely affecting the development of the fruit and vegetable processing industry in India.

Entrepreneurial Opportunities in value addition to horticultural crops

Sl.No.	Fruit	Products
1.	Mango	Pulp/Puree, juice, RTS beverages, jam, Amchur, Chutney, canned mango & pickles
2.	Banana	Chips, puree, powder, flour, dehydrated banana
3.	Papaya	Pulp, jam, tuti-fruti, nectar, canned papaya and papain.
4.	Guava	Jelly, cheese, toffee, nectar, canned guava and squash.
5.	Pine apple	Canned rings, juice, squash, and jm
6.	Jackfruit	Chips, Preserve and Pickle
7.	Passion fruit	Juice, Concentrate, Nectar and Blends.

Supply Chain of Fruits and vegetables

Supply chain of perishable food products or fresh fruits and vegetables constitute the processes from production to delivery of the agri-fresh produce (farmer to customer). The supply chain of fresh fruits and vegetables is complex compared to other supply chains due to the perishable nature of the produce, high fluctuations in demand and prices, increasing consumer concerns for safety and quality and dependence on climate conditions. The supply chain involves different people such as farmers/producers/importers, local traders/ wholesalers/ commission agents, transporters, processors, retailers, exporters etc. The fruit and vegetables reach the consumer through a chain of intermediaries who carry out different functions such as transfer of ownership of commodities, movement, maintenance or preservation of quality and quantity, payments and delivery to consumer. All these links or intermediaries constitute the supply chain of the fruits and vegetables. There are enormous opportunities for horticulture related business opportunities in supply chain management of fruits and vegetables.

Pack House Handling of Fruits and Vegetable:

The packing-house is the site or location where, postharvest treatments are applied and quality standards are monitored. Pack houses can be used by producers, importers, co-operatives or clusters, traders, exporters and processors.

Pack house have certain benefits such as; increased productivity of workers extend produce shelf life and improved produce quality. Receiving, maturity assessment,

trimming, sorting and grading, sizing, delatexing/ desapping, cleaning/washing, surface drying, waxing, ripening/degreening, curing, packaging, precooling, storage, treatments for disease control, quarantine treatments and labelling. Some examples of process flows for different fruits and vegetables are shown below.

Packhouse Operations

- Trimming
- Sorting & Grading
- Delatexing / Desapping
- Cleaning / Washing
- Curing
- Waxing
- Ripening / Degreening
- Packing
- Precooling
- Cold Storage

Processing of Fruits & Vegetables

- Canning
    - Unit Operations
        - Selection
        - Sorting & Grading
        - Washing
        - Peeling, Coring, Pitting
        - Blanching
        - Can Filling
        - Syruping and Brining
        - Lidding or Clinching
        - Exhausting
        - Sealing
        - Processing / Sterilization
        - Cooling
        - Labelling and Storage
- **Drying and Dehydration**
    - Sun Drying
    - Tray or Cabinet Drying
    - Tunnel Dryer
    - Fluidized-Bed Drying
    - Drum Drying
    - Spray Drying
    - Vacuum Drying

    - Osmotic Drying or Dehydration
- Freezing
- Juices, Pulps & Squashes
- Jams & Jellies
- Sauces & Ketchup
- Soups
- Pickles & Chutneys

Current Situation of Micro-food processing industries in India

The unorganized food processing sector comprising nearly 25 lakh units contributes to 74% of employment in food processing sector. Nearly 66% of these units are located in rural areas and about 80% of them are family-based enterprises supporting livelihood in rural household and minimizing their migration to urban areas. These units largely fall within the category of micro enterprises.

The unorganized food processing sector contributes much less in terms of value addition and output despite its huge potential. This is because of the challenges they face like lack of access to modern technology & equipment, training, access to institutional credit, lack basic awareness on quality control of products and lack of branding and marketing skills.

1. Objectives of PM-FME Scheme

a. Capacity building of entrepreneurs through technical knowledge, skill training and handholding support services

b. Increased access to credit to existing micro food processing entrepreneurs for technology upgradation

c. Support FPOs, SHGs, Producer Cooperatives & Cooperative Societies along their value chain to enable microenterprises to avail common services.

d. Support for transition of existing enterprises into formal framework for registration under regulatory frame work and compliance.

e. Integration with organized supply chain by strengthening branding and marketing.

2. Support to Food Processing Units

i. Credit linked grant at 35% of project cost with maximum grant up to Rs.10.00 lakhs to existing unorganized food processing unit's upgradation.

ii. Credit linked grant at 35% of the project cost to SHGs/FPOs/Cooperatives for capitatl expenditure with maximum limit as prescribed

iii. Seed capital @ Rs.40,000/- per member to those engaged in food Processing as a working capital

iv. Credit linked grant at 35% of the Project cost for common infrastructure with maximum limit as prescribed

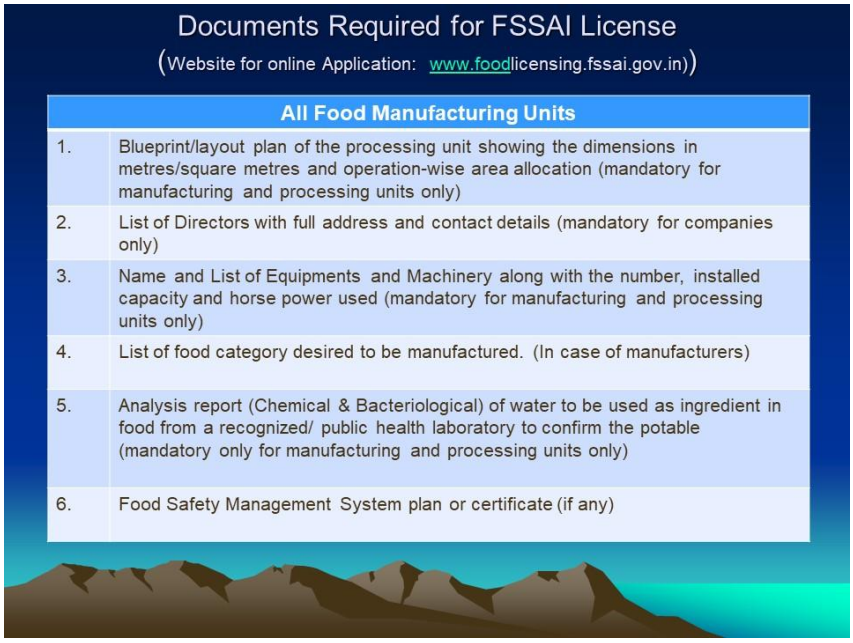
v. Support for marketing & branding up to 50% of the expenditure with maximum limit as prescribed.

Up gradation of Processing Units

i. Individual Category:

a. Individual micro food processing units would be extended credit-linked capital subsidy @35% of the eligible project cost for expansion/ technology upgradation with a maximum ceiling of Rs.10 lakhs per unit. The beneficiary contribution should be minimum 10% and the balance should be loan from a Bank.

Mandatory Licenses for starting a Food Processing Industry



Documents Required for FSSAI License

(Website for online Application: www.foodlicensing.fssai.gov.in)

All Food Manufacturing Units	
7.	Declaration Form
8.	Upload Production unit photograph
9.	Photo I.D and address proof issued by Government authority of Proprietor/Partner/Director(s)/Authorised Signatory.
10.	Proof of possession of premises. (Sale deed/ Rent agreement/ Electricity bill, etc.)
11.	Partnership Deed/Self Declaration for Proprietorship/Memorandum & Articles of Association towards the constitution of the firm
12.	Form IX: Nomination of Persons by a Company along with the Board Resolution. Note : In case of water is ground water then NOC from CGWA is necessary to be submitted.

Holistic horticulture development through integration of technologies and institutions: Experiences of Farmer FIRST Project

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Introduction:

India is an agricultural country where in more than 2/3rdper cent of the population and their livelihood depends directly or indirectly on agriculture and other agro-based enterprises. Agriculture has been the major source of livelihood in the country.Agricultural development has received the highest priority in the programmes of planned change and generate higher income with adequate employment opportunities for the rural mass by maximizing the productivity not only in the field of agriculture but also in the allied and off farm enterprises with the special emphasis on animal husbandry and small scale agro based industries and rural handicrafts through proper identification and development of indigenous knowledge and traditional skills.

The Farmer FIRST Project (FFP) is an ICAR initiative to move beyond the production and productivity, to privilege the smallholder agriculture and complex, diverse and risk prone realities of majority of the farmers through enhancing farmer-scientists interface. The Farmer FIRST as a concept of ICAR is developed as farmer in a centric role for research problem identification, prioritization and conduct of experiments and its management in farmers' conditions. The focus is on farmers' farm, innovations, resources, science and technology (FIRST). Two terms enriching knowledge and integrating technology to qualify the meaning of Farmer FIRST in Indian context.

Farmer FIRST Programme (FFP) aims at integrating various enterprises in the farm and ensures recycling of farm wastes and utilizing all the available resources most economically and efficiently. It also aims at working out appropriate combinations of farm enterprises, resources, practices and methods. Various subsidiary enterprises like horticulture, crop husbandry,dairying, poultry, apiculture, sericulture, fisheries etc., have to be combined involving farmers in planning, implementation and evaluation of production plans to register a significant impact in terms of improving the standard of living in addition to sustained and stable income to rural poor. In this direction ICAR-IIHR, Bengaluru implemented the Farmer FIRST Programme in six cluster villages of Kanakapura taluk, Ramanagara district, Karnataka for holistic development of the selected cluster of villages through integration of technologies and institutions.We have adopted more than 800 households in a cluster of 6 villages in Kodihallihobli of Kanakapura Taluk for

implementation of a large number of technological interventions. These interventions were planned after intensive interaction and need assessment of farmers through PRA in all the selected villages. Selected technological interventions were implemented through demonstration in farmers' fields and were continuously evaluated for their performance in terms of socio-economic and technological indicators/parameters. Farmers were grouped into different groups based on the type and number of technologies implemented. Changes were observed and enhancement of yield, quality of produce and the income was assessed among each selected group.

Farmer FIRST Project of ICAR-IIHR, Bengaluru

ICAR- IIHR has developed large no of varieties and technologies in different horticultural crops, which are being spread across the country to enhance, yield, productivity, quality of produce and income of farmers. These extension activities were organized under Farmer FIRST programme. The institute is working in all the six adopted FFP villages through cluster approach for holistic development of the villages using whole family approach. During planning and implementation various technological interventions through different modules, team of scientists from 6 ICAR institutes and UAS, GKVK were intensively involved in planning and implementation of various technologies in field crops, scientific dairy farming, small ruminant management, NRM, fisheries and horticulture. In horticultural crops many improved varieties /hybrids, precision farming which comprises of INWM with application of micro nutrients, use of mulch and drip irrigation systems, IPM, IDM, GAP's in PHM and good marketing practices. All these practices were carried out so as to enhance production, productivity, quality of produce and gross and net-income of the farmers. The Farmer FIRST Project had three folded plans for doubling the income through cost reduction, production enhancement and diversification of enterprises. Along with these technologies, different schemes of developmental departments for promoting rural entrepreneurship in the adopted villages were also integrated with the project through various synergy programmes.Some of the details of villages, various technological modules, economic impact of few crops, different field based extension programmes, and few success stories of FFP villages are given in the following tables.

Table 1. Brief profile of adopted villages under FFP covered during 2016-17 to 2020-21

Name of Institute	Names of Adopted Villages	No. of Families	Population	Major crops grown	Rainfall (mm)	Major enterprises
ICAR-IIHR Bengaluru	Vasappanadoddi Yeramgere, Balepura Chiklegowdanadoddi Kebbedoddi and Hosadurga	3429	5,060	Ragi, Redgram and Field Bean Tomato, Chilli, French Bean and Tuberose	702	Agriculture Horticulture Dairy Small Ruminants Pisciculture

Table 2: Summary of activities undertaken in FFP cluster of villages

Year	NRM Module		Crop Module		Horticulture Module		Livestock &Fishery			IFS Model		Extension Activities	
	Demos (No.)	No. of Families	Demos (No.)	No. of Families	Demos (No.)	No. of Families	Demos (No.)	No. of Families	No. of Animals	Demos (No.)	No. of Families	No. of prog	Farmers (No.)
2016-17	615	508	290	155	65	57	195	160	915	48	33	07	180
2017-18	2250	1800	604	364	148	117	268	240	888	115	84	23	419
2018-19	1530	1239	996	664	135	107	342	318	1140	96	73	22	470
2019-20	240	39	560	305	165	116	85	78	273	60	47	16	450
2020-21	24	15	590	425	115	80	20	15	60	52	40	10	245
Total	**4659**	**3601**	**3040**	**1913**	**638**	**477**	**910**	**811**	**3276**	**371**	**277**	**78**	**1764**

Table 3: Economic impact of tomato hybrids of ICAR-IIHR with precision farming package

Year	No of farmers benefited	Area (ha)	Measurable indicators yield (t/ha)		% increase in yield	Economics of Demonstration plots (Rs./ha)		Economics of check plots (Rs./ha)	
			Demo	Local		Gross Return	Net Return	Gross Return	Net Return
2016-17	08	2.8	70.0	39.0	79.4	10,15,000	6,86,400	2,75,000	1,52,500
2017-18	13	7.2	71.25	38.5	85.0	10,90,000	7,21,250	3,18,750	1,78,750
2018-19	13	4.6	122.75	59.75	106.7	11,50,496	7,40,496	5,94,915	2,78,665
2019-20	12	3.2	115	63.75	80.3	13,80,000	7,43,500	7,56,009	3,52,800
2020-21	5	1.2	106	58.5	81.2	12,72,000	6,84,550	7,18,500	3,23,000
Total/Average	**51**	**19.0**							

Table 4. Details of extension activities organized during 2016-17 to 2020-21under FFP

Name of activity	2016-17		2017-18		2018-19		2019-20		2020-21		Total	
	No. of Programmes	No. of Participants	No. of Programmes	No. of Participants	No. of Programmes	No. of Participants	No. of Programmes	No. of Participants	No. of Programmes	No. of Participants	No. of Programmes	No. of Participants
Advisory Services	15	65	38	120	42	158	35	117	20	35	**150**	**495**
Celebration of important days	00	-	02	35	01	20	01	28	01	23	**05**	**106**
Diagnostic visits	06	32	15	80	18	92	15	80	5	25	**59**	**309**
Exhibition	00	-	01	30	01	40	01	35	01	19	**04**	**124**
Exposure visits	00	-	08	65	08	70	05	55	02	28	**23**	**218**
Ex-trainees Sammelan	02	18	06	45	05	42	05	40	00	-	**18**	**145**
Farm Science Club	00	-	00	-	00	-	00	-	00	-	**00**	-
Farmers' seminar/workshop	00	-	03	32	05	40	04	37	00	-	**12**	**109**
Field Day	00	-	01	82	01	90	01	95	00	-	**03**	**267**
Film Show	01	12	03	26	04	38	05	45	01	17	**14**	**138**
Group discussions	18	60	25	85	23	70	20	55	8	35	**94**	**305**
KisanGhosthi	00	-	00	-	00	-	00	-	00	-	**00**	-
KisanMela	00	-	01	48	01	55	01	60	01	25	**04**	**188**
Method Demonstrations	02	18	07	56	05	36	03	22	02	23	**19**	**155**
Plant/animal health camps	05	26	08	40	12	68	05	29	02	15	**32**	**178**
Any other	-	-	-	-	-	-	-	-	-	-	-	-
Total	**49**	**231**	**118**	**744**	**126**	**819**	**101**	**698**	**43**	**245**	**437**	**2737**

A large number of extension activities were organized to the requirement of individual farmers as well as group of farmers under FFP. These extension activities were organized to create awareness about the innovation and GAP's, to supplement the information requirement of farmers, to share the knowledge on various technologies, programmes of developmental departments, benefits of synergy programmes, to inculcate the skill required for adoption of innovations, etc. These activities were harmoniously combined to create overall impact of the FFP. These programmes were very effective tools to achieve the objectives and to reach the desired goal of sustainable socio-economic development of the selected villages.

Table 5. Details of capacity building programmes organizedduring 2016-17 to 2020-21 under FFP

Thematic area	2016-17		2017-18		2018-19		2019-20		2020-21		Total	
	Prog. (No.)	Parti. (No.)	Prog. (No.)	Parti. (No.)	Prog. (No.)	Parti. (No.)	Prog. (No.)	Parti. (No.)	Prog. (No.)	Parti. (No.)	Prog. (No.)	Parti. (No.)
Capacity Building and Group Dynamics	12	30	28	56	25	48	22	43	14	25	**101**	**202**
Crop Production	05	46	10	75	10	72	08	51	03	17	**36**	**261**
Entrepreneurship Development	00	-	07	23	05	17	04	13	01	07	**17**	**60**
Farm Implements	02	20	05	38	04	34	02	23	01	13	**14**	**128**
Livestock Production and Management	12	45	15	72	12	48	08	37	02	37	**49**	**239**
Natural Resource Management	05	68	10	120	09	112	08	105	04	58	**36**	**463**
Nutrition Security	00	-	03	50	02	45	02	43	01	25	**08**	**163**
Plant Protection	10	35	15	42	18	56	15	42	08	32	**66**	**207**
Processing and Value Addition	00	-	02	16	03	20	04	22	02	16	**11**	**74**
Production of Inputs at site	00	-	00	-	00	-	00	-	00	-	**00**	**-**
Soil Health and Fertility Management	04	40	10	96	07	68	03	37	02	23	**26**	**264**
Women Empowerment	00	-	03	38	05	52	04	45	02	25	**14**	**160**
Total	**50**	**284**	**108**	**626**	**100**	**572**	**80**	**461**	**40**	**278**	**378**	**2221**

Capacity building programmes (CBP's) are essential to create awareness about innovations and GAP's in different crops and enterprises adopted by farmers. These programmes will supplement the information requirement of farmers on various production techniques, management strategies and to share the knowledge on various technologies. All the relevant stakeholders can share the benefits of technologies and programmes, particularly by the developmental departments. FFP multi-disciplinary team of scientists also conveyed the benefits of synergy programmes to the farmers and helped them to learn different skills essential for adoption of innovations in agriculture and in all allied fields. These programmes had very huge impact in promoting various innovations and to achieve the sustainable socio-economic development of the selected villages under FFP. All these programmes wereorganized by combining different methods harmoniously to create overall impact in all the of FFP villages.

Information about combination of technological interventions implemented under FFP project

I. Change of Net-Income under different combinations of technological interventions for the project period (Year wise from 2015-16 to 2020-21)

Sl. No.	Combination of Enterprises	2015-16 (Base line data)	2016-17	2017-18	2018-19	2019-20	2020-21	No. of families covered during 2020-21	Total Area (Ha)
A. Rainfed condition									
C1	Ragi + RG + Dolichos + Oilseeds	73,220	1,48,550	1,57,105	1,82,885	1,93,850	1,99,950	190	330
C2	Ragi + RG + Dolichos + Oilseeds + Dairy Farming + Small Ruminants	1,24,060	2,24,458	2,47,385	2,47,450	3,04,700	3,19,550	106	80
C3	Ragi + RG + Dolichos + Oilseeds + Mango	1,64,070	3,13,420	3,44,385	3,48,605	4,09,510	4,02,700	60	18
B. Irrigated condition									
C4	Field Crops + French bean + Mango + Dairy Farming + Small Ruminants	2,88,660	6,09,328	7,12,635	7,34,700	7,75,060	8,23,575	12	05
C5	Field Crops + Chilli + Mango + Dairy Farming + Small Ruminants	3,50,848	7,76,385	7,82,450	8,32,978	8,88,360	9,29,800	20	06
C6	Field Crops + Tomato + Mango + Dairy Farming + Small Ruminants	5,37,910	10,95,350	11,10,578	11,79,381	12,63,860	12,06,850	08	3.5
C7	Fruits + Vegetables + Flowers	4,62,179	7,78,884	13,99,508	14,64,333	17,49,627	16,12,859	72	24

Successful technological interventions under FFP project:

A good number of technologies were found to be successful among many farmers, individually and in groups. Three such examples are given briefly in the following paragraphs and table.

1)Precision Farming of Tuberose for higher and sustain income

Impact of the intervention: Introduction of Arka Prajwal tuberose variety has changed the total scenario of cultivation of flower crops in these villages. Farmers have harvested the flowers daily. Once the crop starts yielding (4 months after planting of bulbs), it gives continuous flowers with higher yield (15 tons/ha) per annum. Average price for the flower is Rs.60 to Rs.80/kg. Hence, it is also called ATM of the flower growers, due to continuous daily income to farm families. Cost of production of tuberose crop is comparatively lower than other flower crops because this variety requires minimal care and has resistance to nematodes and wilt disease.

Sl. No.	Villages	No. of farmers benefited	Area covered (ha)
1	Adopted village	15	8.2
2	Additional area covered through horizontal spread in adopted villages	3	1.6
3	Horizontal spread in adjacent non adopted villages	4	0.6

2) Improved varieties and production techniques in field crops

Impact of the intervention: Because of these improved varieties and integrated production techniques, there was an increase in cropped area and more than 500 households used the improved varieties in field crops. Increase in yield of tuberose was 70 – 80% more as compared to other local varieties. Hence farmers were happy and it's spreading among large no of farmers.

Economics

Sl. No.	Crop	Variety	Yield (q/ha)	Gross Income (Rs/ha)	Net Income (Rs/ha)
1	Ragi	ML 365	35	1,15,500	86,000
		MR-6	33.75	1,11,375	81,875
2	Redgram*	BRG-2	16.25	1,54,375	1,18,750
		BRG-4	18.5	1,75,750	1,40,125
3	Field Bean*	HA-3	7.5	43,500	24,375
		HA-4	10	58,000	38,750

*Crops were cultivated both solo crop as well as intercrop

3) Cultivation of vegetables by adopting mulching and drip irrigation

Impact of the intervention: Good number of farmers was cultivating few vegetables in all the FFP villages. However, they were using flood irrigation, poor and inappropriate methods in management of nutrient, pest and

diseases. Hence the yield, quality and price were low. Increase in water use efficiency 90-95% over traditional flood irrigation system**.** There was saving of cost, labour and nutrients along with reduction in incidence of pest and diseases. All these finally led to **i**ncrease in yield by 70-75% as compared to regular farmers practice. It has also resulted in increase in area under double cropping and irrigated area under vegetable crops**.**

Economics

Sl. No.	Crop	Variety	Yield (t/ha)	Gross Income (Rs/ha)	Net Income (Rs/ha)
1	Tomato	ArkaRakshak	130	11,25,925	7,00,925
		Arka Samrat	115	11,75,067	7,80,067
2	Chilli	ArkaHaritha	35	6,45,750	4,45,750
3	French Beans	Arka Arjun	15.75	3,93,750	2,73,750

Farmers have expressed that they are very happy with the ICAR-IIHR varieties in different vegetable crops and ready to adopt vegetable production in larger area using drip irrigation, fertigation and mulching, but there should be extensive support to establish drip irrigation system in the fields with financial assistance from the department of horticulture along with continuous technical guidance from the scientists.One of the biggest achievements of FFP is promotion of precision farming, which helped farmers in increasing yield and income by >100% in a span of about one and a half years. This also led to change in their expenditure for family, farms, mechanization of farm activities and more participation in social activities. In totality, there was sustainable impact of ICAR-IIHR technologies.

Details about Convergence along with its economics:

Another biggest achievement of FFP is large number of convergence programme, which led to effective utilization of the benefits of many schemes and programmes of developmental departments like horticulture, agriculture, animal husbandry and veterinary services, sericulture, etc. All these converge helped the farmers of FFP villages to develop good farm infrastructure, adopt GAP's like drip irrigation, precision farming, soil and water conservation, etc. Investment of these departments also resulted in overall improvement of farms, production, gross and net-income and overall quality of life of farmers. List of few convergence programme implemented in the FFP villages are given below.

Sl. No.	Organization/ Department	Area of convergence with acreage / financial assistance	Total No. of Farm families covered in FFP villages	Approx. amount of Financial assistance / total amount of contribution from other stakeholders
1.	Department of Horticulture, Govt. of Karnataka	Establishment of drip / micro-irrigation system – 58Acres	32families	23,20,000.00
2.	- Do -	Precision farming in vegetable and flower crops – 38 acres	20 families	2,28,000.00
3.	- Do -	Micro-irrigation and Precision farming in fruit crops (Banana and Guava)- 14 acres	8 families	7,70,000.00
4.	Department of Agriculture and Watershed, Govt. of Karnataka	Development of Krishihonda (Farm ponds) and Check-dams for harvesting and storage of rainwater	40 families	16,000,00.00
5.	Department of Animal Husbandry and Veterinary Services	Organizing Animal Health Camps, Hygienic milk production, Awareness on Scientific animal management practices	185 families	2,77,500.00
6.	Milk Producers Cooperative Society of KMF – Three Nos.	Clean Milk Production, Scientific feed management	250 families	2,50,000.00
7.	Department of Sericulture, Govt. of Karnataka	Establishment of drip / micro-irrigation system – 8 Acres for mulberry orchards – 25 acres	12 families	4,80,000.00
8.	- Do -	Scientific Sericulture	60 families	6,000,00.00
9.	SCSP programme of the institute	Precision farming in horticultural crops, Mushroom production technology,		
10.	SKRDP group	Women empowerment, Mushroom production technology, Ornamental Fish production	35 families	1,00,000.00

2021
EDITION

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