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Views expressed in the articles are of
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-Editor

Innovative Extension Models in promoting Climate Change Adaptation in Agriculture

N. Balasubramani¹ and Sreenath Dixit²

Abstract

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

Keywords: Climate change, Extension Models

Introduction

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

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

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

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

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

(i) Extension Model adopted under NICRA

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

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

The Technology Demonstration Module consists of four modules.

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

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

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

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

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

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

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

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

(ii) Village Knowledge Centre – ClimaAdapt

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

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

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

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

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

HARITA (Harmonized Information of Agriculture, Revenue and Irrigation for

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

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

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

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

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

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

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

Summary and Recommendations

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

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

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

11. Incentives may be provided to the farmers for switching over to Resource Conservation Technologies, which may encourage more farmers.
12. A strong social security net should be put in place as part of adaptation strategies such as timely and appropriate compensation for loss of crop / livestock due to extreme events, insurance and pension to the farmers *etc.*

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Knowledge and Adoption level of Improved Animal Husbandry Practices by Milk Producers in Chhotaudaipur district of Gujarat

B.L. Dhayal¹ and B.M. Mehta²

Abstract

Livestock are an integral part of agriculture in India and are likely to be the instruments of future growth and development of the agricultural sector. They generate employment, provide draught power, manure and earn foreign exchange through exports. Additionally, livestock make substantial contributions to environmental conservation and provide domestic fuel to save on the use of petro-products. Although the per capita consumption of food of animal origin is low in India, demand has been rising due to the growing human population, sustained growth in per capita incomes and increasing urbanization. Dairying is an integral part of the Indian economy providing subsistence to small and marginal farmers and landless laborers. Most of the rural farmers, who keep dairy animals, do not follow modern dairy management practices. This study was conducted on knowledge and adoption level of improved animal husbandry practices and constraints faced by farmers. Result revealed that majority of dairy farmers (53%) had medium knowledge level, whereas 22 per cent and 25 per cent of dairy farmers were having low and high knowledge level about improved animal husbandry practices, respectively. Majority of the members (51%) were found to be medium adopters, while 27 per cent were low adopters and 22 per cent of the members were high adopters.

Keywords: Animal Husbandry practices, milk producers, knowledge, adoption

Introduction

Dairying provides millions of small and marginal farmers and landless laborers means of their subsistence. Most of the rural farmers, who keep dairy animals, do not follow modern dairy management practices. There is an urgent need to sensitize dairy farmers about modern technologies and scientific interventions in dairy production, in order to enhance milk yield and milk quality from dairy animals. Dairying is an integral part of the Indian economy, more so, the rural

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economy. The contribution of this sector to the national income is invaluable, estimated to be about eight per cent of the Gross Domestic Product (GDP) and about 16 per cent to agricultural economy (Rajagopalan, 1996, Bhasin, 1997 & India, 1998). At the household level, dairying plays an important role in improving the economic condition of 70 million farm families. This sector provides insurance against crop failures and helps directly in increasing crop production by making available draft power, organic manure and cash income on a regular and day to day basis. Low production in India is mainly due to low level of knowledge about improved dairy husbandry practices of the dairy farmers. Hence, this study was conducted with the following specific objectives.

- (i) To assess the level of knowledge of improved animal husbandry practices.
- (ii) To find out the extent of adoption of improved animal husbandry practices among the farmers.
- (iii) To ascertain the association between selected independent variables and extent of adoption of improved animal husbandry practices.
- (iv) To identify the constraints being faced by the farmers in improved animal husbandry practices.

Agriculture and allied sectors like forestry, logging and fishing accounted for 17 per cent of the GDP and employed 49 per cent of the total workforce in 2014. As the Indian economy has diversified and grown, agriculture's contribution to GDP has steadily declined from 1951 to 2011, yet it is still the largest employment source and a significant piece of the overall socio-economic development of India. Crop yield per unit area of all crops has grown since 1950, due to the special emphasis placed on agriculture in the five-year plans and steady improvements in irrigation, technology, application of modern agricultural practices and provision of agricultural credit and subsidies since the Green Revolution in India. However, international comparisons reveal the average yield in India is generally 30 per cent to 50 per cent of the highest average yield in the world. The states of Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Andhra Pradesh, Telangana, Bihar, West Bengal, Gujarat and Maharashtra are key contributors to Indian agriculture.

Research Methodology

The study has been conducted in Chhotaudaipur district of Gujarat. Five talukas of Chhotaudaipur district were selected randomly.

S. No.	Name of Taluka	Total Number of Villages	Total no. of Panchayats	Total no. of Dairy (in Taluka)	Total no. of Dairy Farmers
1	Chhotaudaipur	202	44	51	4593
2	Kawant	173	46	45	4056
3	Naswadi	275	60	50	4774
5	JetpurPavi	257	91	146	16092
6	Sankheda	318	92	159	21251

A village wise comprehensive list of dairy families residing in different villages was prepared with the help of Dairy Cooperative, village Patwari and the local leader. Two villages were selected from each taluka. Thus a total of ten villages were selected from the five talukas of the district.

Name of Tehsil selected	Total no. of Villages	No. of villages selected	Name of selected villages	Total no. of Milk Producers	No. of farmers selected
Chhotaudaipur	202	2	Raisinghpura	103	6
			Dhandhoda	134	7
Kawant	173	2	Krjwant	173	9
			Raypur	162	9
Naswadi	275	2	Akona	213	11
			Colamba	193	10
JetpurPavi	257	2	Kallarani	268	14
			Haripura	74	5
Sankheda	318	2	Sundarpura	362	19
			Ambapura	187	10
		10		1869	100

From the 10 selected villages a sample of 100 dairy farmers was selected in such a manner that the number of milk producers selected from each village was proportionate to the total number of dairy farmers of the respective village.

Results and Discussion

1. Measurement of Knowledge Level of Dairy Farmers about Improved Animal Husbandry Practices

According to the methodology the minimum and maximum score, a respondent could secure on knowledge level was 0 to 110, respectively. It was revealed that the dairy farmers secured knowledge score between 50 and 85 on improved animal husbandry practices. The farmers were grouped into three categories, using mean $(75.24) \pm$ standard deviation (7.83) . Members who scored below 67.41 were

grouped under low knowledge level, the members who scored from 67.41 to 83.06 were considered under medium knowledge level and those who obtained a score above 83.06 knowledge score were categorized under high knowledge level about improved animal husbandry practices.

Table 1. Knowledge level of dairy farmers about improved Animal Husbandry Practices

(n=100)			
Knowledge score	Knowledge level	No. of respondents	Per cent
Below 67.41	Low	22	22.00
From 67.41 to 83.06	Medium	53	53.00
Above 83.06	High	25	25.00
	Total	100	100

$X=75.24$, $\sigma = 7.83$

The data in Table 1 reveals that majority of dairy farmers (53 per cent) had medium knowledge level, whereas 22 per cent and 25 per cent dairy members were having low and high knowledge level about improved animal husbandry practices, respectively.

Individual practice wise knowledge of dairy farmers was measured and Mean Percent Score (MPS) was calculated. As many as six practices were included to assess the knowledge level of respondents as given in Table 2.

Table 2. Knowledge level of Dairy Farmers about improved practices

S. No.	Improved Practices	Dairy farmers (n 100)	
1.	Improved breeds	51.76	VI
2.	Breeding	76.38	II
3.	Feeding	64.45	V
4.	Management	67.87	III
5.	Milking	80.28	I
6.	Health care	67.70	IV
	Overall	68.07	

Table 2 indicates that dairy farmers possessed maximum knowledge about milking of animals with mean per cent score (MPS) of 80.28. They possessed less knowledge about improved breeds of animals with mean per cent score (MPS) of

51.76. The table indicates that knowledge of respondents regarding other aspects like breeding, management, health care and feeding were found to be 76.38, 67.87, 67.70 and 64.45 MPS, respectively.

Table 3. Knowledge of livestock keepers about improved practices

(Practices wise)

A. Improved breeds				
		Total score	MPS	RANK
1.	What are the important local breeds of cattle for higher milk production? (4) (a) Gir (b) Sahiwal (c) Kankrej (d) Dangi	210	52.50	I
2.	What are the important exotic breeds of cattle for milk production? (3) (a) Jersey (b) Reddane (c) Holstein Friesian	153	51.00	IV
3.	What are the important breeds of buffalo? (4) (a) Jaffarabadi (b) Surti (c) Banni (d) Mehsani	204	51.00	III
4.	Why are the recommended breeds important? (4) (a) For higher milk production. (b) For higher fat percentage. (c) For good draft power. (d) For early and regular breeding programmes	209	52.25	II
Over All MPS (15)*100(Farmers)		776	51.76	VI
B. Breeding				
5.	What are the possible ways by which animals can be bred? (a) A.I. (b) Natural	76	76.00	IX
6.	What is the age of puberty in animals? (2) (a) Buffalo 3-3.5 yrs. (b) Buffalo 4-4.5 yrs. (c) Cattle 1.5-2 yrs. (d) Cattle 2-2.5 yrs.	175	87.50	IV
7.	What is the age of first calving of the animals? (2) (a) Buffalo 3.5-4 yrs. (b) Buffalo 4-4.5 yrs. (c) Cattle 3-4 yrs. (d) Cattle 4-4.5 yrs.	152	76.00	VIII
8.	What are the advantages of A. I.? (4) (a) Quick or faster results in progeny improvement. (b) Milk production will be increased. (c) Avoiding transmission of diseases. (d) Better utilization of proven bull.	350	87.50	III

9.	What are the symptoms of animal in heat? (4) (a) Bellowing. (b) Mucous discharge from vagina. (c) Restlessness and frequent urination. (d) Mounting on other animals.	340	85.00	IV
10.	What is the appropriate time for mating? (1) (a) Beginning of oestrus (b) Middle of oestrus (c) End of oestrus	80	80.00	V
11.	Mention the characteristics of sire to be used for breeding (5) (a) According to its pedigree performance. (b) Good in phenotype. (c) Free from anatomical defects and fit for breeding. (d) Free from communicable diseases. (a) Proven sire.	460	92.00	I
12.	Please indicate after how many days an animal repeats heat? (2) (a) Buffalo 21 days (b) Buffalo 30 days (c) Cattle 21 days (d) Cattle 30 days	120	60.00	X
13.	How much time is required for animals to conceive after calving? (2) (a) Buffalo 60 to 80 days (b) Buffalo 80 to 100 days (c) Cattle 60 to 80 days (d) Cattle 80 to 100 days	90	45.00	XIII
14.	What should be done if the animal does not come in heat? (3) (a) Consult veterinarian (b) Feed such things which have heating effect like roughage, minerals etc. (c) Traditional medicine inducing. (d) All the above.	230	76.66	VII
15.	If the placenta is not shed when should it get removed 36 to 48 hours? (1) Yes/No	90	90.00	II
16.	Is there need of sire in the village even if A.I. is practiced? (1) Yes/No	50	50.00	XII
17.	Do you know that the chance of conception by A.I. is less? (1) Yes/No	54	54.00	XI
18.	Which service helps in preventing diseases of reproductive organs? (1) (a) Natural (b) A.I.	80	80.00	VI

19.	How many times a sire can service for better conception? (1) (a) Once a day (b) Twice a week (c) Once a week (d) Twice a week	40	40.00	XIV
20.	Which type of bull should be used for breeding? (1) (a) Exotic (b) Pure bred (c) Cross bred (d) All the above	90	90.00	II
21.	What is the pregnancy diagnosis time? (1) (a) After 2 months of insemination (b) After 3 months of insemination (c) After 4 months of insemination (d) After 6 months of insemination	80	80.00	VII
22.	What should be the calving interval in cow/buffalo? (1) Buffalo: (a) 12-15 months (b) 15-18 months (c) Above 18 months Cow: (a) 11-12 months (b) 13-14 months (c) Above 15 months	40	40.00	XV
Over All MPS (34)*100(Farmers)		2597	76.38	II
C. Feeding				
23.	How much quantity of ration is necessary for milch animals? (3) (a) Green fodder (20-30 kg) (b) Concentrates (2-4 kg) (c) Dry fodder (Not more than 10 kg)	162	54.00	V
24.	What is good ration for dairy animals? (1) (a) Only concentrates and straw. (b) Some green fodder + straw. (c) Only green fodder + concentrate. (d) Balanced ration including plenty of green fodder and dry roughage + concentrate.	70	70.00	IV
25.	Why is green fodder necessary for animals? (3) (a) Increase Milk Production. (b) Improve the health of the animal. (c) Increase digestibility and palatability of dry fodder.	230	76.66	III
26.	What are the methods used to increase the utilization of fodder?(3) (a) By way of chopping. (b) By way of treating fodder with urea and molasses. (c) By way of feeding mixed fodder (Green + dry).	260	86.66	I
27.	What are the fodder crops grown in your area? (4) (a) Lucerne (b) Maize (c) Oat (d) Jowar	327	81.75	II

28.	What type of ration should be feed to a cow/buffalo just after calving? (1) (a) Laxative concentrates rich bran Bajra and Maize. (b) Any concentrates. (c) Only green fodder. (d) Only dry fodder.	52	52.00	VI
29.	When should a newly born calf be allowed for sucking its mother's milk? (3) (a) Within one hour (b) Within 1-2 hours (c) After two hours	92	46.00	VIII
30.	How much colostrum should be given to new born? (1) (a) 1/10 th of its body weight per day two times. (b) 1/20 th of its body weight per day one time. (c) 1/30 th of its body weight per day one time. (d) 1/40 th of its body weight per day one time. (e) Not Known	51	51.00	VII
31.	Is Feeding minerals and salts essential to animals? (1) (a) Yes (b) No (c) Not known	54	54.00	V
32.	What is the common method of fodder conservation in your area? (3) (a) Silage making (b) Hay making (c) Not known	120	40.00	IX
Over All MPS (22)*100(Farmers)		1418	64.45	V
D. Management				
33.	Name of the type of house for keeping animals (2) (a) Loose housing (b) Conventional (c) Both	129	64.50	V
34.	How are all the cows/buffaloes kept in housing system? (1) (a) All the cows/buffaloes are kept together. (b) The animals are divided into different categories and kept separately.	60	60.00	VII
35.	What are the qualities of a good house of animals? (4) (a) Saving of labour. (b) Comfortable to animals. (c) Less construction cost. (d) Protection against adverse climatic condition.	310	77.50	III
36.	Weaning is a good practice (1) (a) Yes (b) No (c) Not known	40	40.00	VIII
37.	What type of housing is most appropriate for animals? (1) (a) Kaccha (b) Pucca (c) Semi Pucca	60	60.00	VII

38.	At what age should male calf be castrated? (1) (a) Within 6 months of age. (b) Within 9 months of age. (c) Within 12 months of age. (d) Within 15 months of age.	70	70.00	IV
39.	What stage of pregnancy should one stop milking of a cow? (1) (a) Two months before calving. (b) Three months before calving. (c) Four months before calving. (d) Five months before calving.	80	80.00	I
40.	What makes a good house for animals? (3) (a) It must be well ventilated. (b) House with close confinement. (c) Open house system.	190	63.33	VI
41	What type of flooring should be there for animals in a shed? (1) (a) Kaccha (b) Pucca (c) Semi pucca	79	79.00	II
Over All MPS (15)*100(Farmers)		1018	67.87	III
E. Milking				
42.	Which is the correct method of milking? (1) (a) Full hand method (b) Knuckling (c) Stripping method (d) Do not know	89	89.00	I
43.	After how many days is the colostrum free milk available from animals?(1) (a) 3-5 days (b) 6-8 days (c) 9-11 days (d) 12-14 days	81	81.00	II
44.	What are the points related to clean milk production? (5) (a) Cleaning the udder with clean water. (b) Use of clean utensil. (c) Washing the hand before milking. (d) Use of milk filter. (e) Hygienic milk storage.	392	78.40	III
Over All MPS (7)*100(Farmers)		562	80.28	I
F. Health care				
45.	Name some of the important diseases of animals. (4) (a) F.M.D. (b) H. septicemia (a) Black quarter (d) Rinderpest	141	35.25	VI

46.	What safety measures are to be taken to keep the animal house hygienic? (4) (a) Good drainage facility. (b) Drain and gutter with more exposure to sunlight. (c) Daily cleaning. (a) Regular spraying of disinfectant.	260	65.00	V
47.	How should the cow/buffalo be treated when they suffer from external parasites (<i>i.e.</i> ticks)? (1) (a) Housing remedies (b) By washing animals with clean water (c) Applying insecticides (d) By dipping in dipping water tank	80	80.00	III
48.	If the animal is suffering from diseases then what should be done? (4) (a) Take veterinary help. (b) Timely vaccination against contagious diseases. (c) Isolation of diseased animals. (d) Give comfort to animals.	300	75.00	IV
49.	How can you say that the animal is ill? (3) (a) Animal becomes lazy. (b) Stops rumination. (c) Stops feeding.	280	93.33	I
50.	What is the best time for vaccinating animals against infectious diseases? (1) (a) May-June (b) July-August (c) Sept-October (d) Jan-Feb	90	90.00	II
	Over All MPS (17)*100(Farmers)	1151	67.70	IV

2. Extent of Adoption of Improved Animal Husbandry practices among dairy farmers

(A) Distribution of Dairy Farmers according to the extent of Adoption

According to the methodology the minimum and maximum score, a respondent could secure on the extent of adoption was 0 to 55, respectively. It was revealed that the members secured adoption score between 26 and 48. The respondents were grouped into three categories, using mean $(41.36) \pm$ standard deviation (4.07). Respondents who scored below 37.29 were grouped under low adoption, the respondents who scored between 37.29 to 45.42 were considered under medium extent of adoption and those who obtained score above 45.42 were categorized under high adoption of improved animal husbandry practices.

Table 4. Distribution of Dairy Farmers under different categories

(n=100)

Adoption score	Extent of adoption	No. of respondents	Per cent
Below 37.29	Low	27	27.00
From 37.29 to 45.42	Medium	51	51.00
Above 45.42	High	22	22.00
	Total	100	100

 $X = 41.36, \quad \sigma = 4.07$

The data in Table 4 shows that majority of members (51 per cent) were found to be medium adopters, while 27 per cent members were low adopters and 22 per cent of the members were high adopters.

(B) Extent of Adoption of improved animal husbandry practices by Dairy Farmers

Extent of adoption individual practices-wise was worked out. For this, mean per cent scores (MPS) were calculated for each practice and the statistical data have been presented in Table 5.

Table 5. Extent of Adoption of improved animal husbandry practices by Dairy Farmers

(N=100)

S. No.	Improved practices	Dairy farmers	
1.	Breeding	64.25	III
2.	Feeding	71.15	I
3.	Management	55.24	V
4.	Milking	67.75	II
5.	Health care	59.22	IV
	Overall	63.54	

The data in Table 5 indicates that dairy farmers adopted Feeding of animals to the highest extent with MPS 71.15 (Rank I). The table further shows that Management ranked last with MPS 55.24.

The data reveal that dairy farmers had adopted practices like milking, breeding and health care, with 67.75, 64.25, and 59.22 MPS, respectively.

The overall adoption of improved animal husbandry practices by dairy farmers was 63.54.

Conclusion

Since majority of the respondents had medium knowledge level about improved animal husbandry practices, efforts are needed to bring about change in knowledge of respondents from low to medium and medium to high levels. The milk producers are required to increase their knowledge about improved animal husbandry practices in Feeding and Health care practices. Hence, it is suggested that frequent training should be organised on need based aspects. Farmers had very low adoption rate of management practices so there is need for capacity building among farmers so that they easily adopt good and beneficiary practices.

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Stakeholder Participatory Design and Development of an Agri-Infotech Portal

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Abstract

The Agri-Infotech Portal (www.celkau.in), developed by Centre for e-learning of Kerala Agricultural University (KAU) is an ICT enabled bi-lingual platform for demand-driven technology information and advisory services in the agri-front, covering agriculture, animal husbandry, fisheries and allied aspects. It also acts as a platform for online course management in agriculture. As on August 2016, the portal had nearly 16 lakh hits within four years, which show a geometric progression. Besides, the portal won two international awards, one national award and the Kerala Government's e-governance award. This paper analyses the methodology followed for designing and developing this high-end utility web portal. To accomplish this, a basic research mode work on user-centred design, testing, refining and launching of the portal was adopted, as it would match the priorities of its end-users. The utility was ensured by testing and fine-tuning from its designing stage itself. Creating a working model (prototype) before developing the actual portal was the first stage. To generate content, the information needs of the users were identified and prioritized through questionnaires, brainstorming sessions, and focus group discussions. Interpretations based on the priorities, suggestions from the users, and desktop analyses of various similar portals across the world, led to designing of the first prototype. This prototype was subjected to a process of criteria/trait based evaluation by the end-users for further refinement leading to the second prototype. This second prototype was demonstrated before various categories of end-users and stake holders for final fine-tuning.

Keywords: Agro-tech portal, portal development, website, user centred design

Introduction

In India, due to the wide ratio of farmer to extension worker availability, timely access to relevant information has always been a setback. The availability of information and authentic farm advisory services lacked in several aspects. It has been a long felt need of Kerala's Agricultural Extension System in general, and

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that of the four decades old Kerala Agricultural University (KAU) in particular that an interactive website be launched as part of strengthening its extension activities. The KAU Agri-Infotech Portal (www.celkau.in), developed by the Centre for e-learning of KAU is an Information and Communication Technology (ICT) enabled platform for demand-driven technology information and advisory service for farmers, field extension workers, researchers, students and all other stakeholders of the agri-front. This makes agricultural knowledge, technology and best practices available at the fingertips of users on a 24X7 basis through an indigenously designed and easy to use bi-lingual (English and local language, Malayalam) platform. It aims at knowledge empowerment and skill upgradation of people who want to come to the farm front as practicing farmers and agripreneurs in frontier areas of agricultural technology.

Need for an Agri-Infotech Portal

The prime goal of the extension wing of an agricultural university is technology pooling, assessment, diffusion and handling the “feed-forward and feedback” mechanisms. In the scenario of an unwieldy number of farmers per extension worker, it is practically impossible for the extension system to cover all the needy farmers. At the same time, the research system has a treasure of information and innovations which need to be transferred to farmers and extension workers as well. This made it an urgent need to develop a demand-driven agricultural information technology portal.

User-centred design of Portal

To accomplish a high-end utility web portal, the philosophy of User-Centred Design (UCD) was adopted as it would match the priorities of its end-users. The only way to ensure such utility is to test the web portal and fine-tune from its designing stage itself (Krug, 2005). Creating a working model before developing the actual site would allow saving time and money by perfecting the features before major changes are found difficult to be implemented. Thus, our first attempt was for a prototype built to test a concept or process to be replicated or learned from. It was with this grounding that the baseline work was initiated.

In the present project, the problem was identified as the absence of a proper multipurpose, multimodal tech portal, especially in the Kerala context. The available websites on agriculture did not provide much space for adequate and timely information on agricultural technologies and extension activities. This lack,

together with the long felt need of Kerala state to have an interactive tech portal, led to the basic research mode work on user-centred design, testing, refining and launching of the tech portal. The concept of UCD was earlier adopted by ISO 13407(1999) and followed by Mridula (2014). In this project, a UCD methodology, which is much more extensive and elaborate was adopted for portal development.

Collection of data was an important step in deciding what actions are to be taken. To generate content for the portal, the information needs of the users were identified and prioritized through questionnaires, brainstorming sessions, and focus group discussions. Interpretations based on the priorities, suggestions from the users, and desktop analyses of various similar portals across the world, led to designing of the first prototype.

This prototype was subjected to a process of criteria/trait based evaluation by the end-users for further refinement. Criteria/traits adopted by Koshy (2013) were used with modifications. Scores were given to web/portal assessment traits, the major areas being: design and layout, content coverage and accuracy, interactivity and navigation, links, site organisation, readability and contrast, user-friendliness, and information retrievability. Based on the scores, suggestions and constraints reported by the users, the prototype was refined leading to the second prototype of the portal. This second prototype was demonstrated to various categories of end-users and stake holders including academicians, researchers, extension workers, administrators and farmers for the final fine-tuning.

Information Authenticity

The contents published in the portal are based on the recommendations of Kerala Agricultural University's Package of Practices and of institutes under Indian Council of Agricultural Research. The contents were fine-tuned through stepwise content generation process involving user need identification, content development by graduates in agriculture, content editing by agricultural experts, content purification by teachers of KAU, end user evaluation of different stakeholders, and the final fine tuning by the KAU scientists and researchers. To achieve this, a series of participatory workshops separately for agricultural experts, scientists, extension workers, farm graduates, farmers, agriprenuers and IT experts were organized. The services of the scientists and the researchers of Kerala Agricultural University were also used for refinement ensuring content accuracy. Thus the information in the portal is highly authentic.

Launching of the portal

The portal was ceremoniously launched in a state level function on 1st November, 2012. Wide propaganda was given globally. The print, radio, TV, and Social media gave publicity to the KAU Agri-infotech Portal.

Features and Uniqueness of the Portal

The web URL of the portal designed and developed through stake holder need analysis, participation and use of user centred design is www.celkau.in. This is a highly authentic bilingual information source on technologies and scientific practices comprising farming practices, agri enterprise management, plant protection, weather information, mechanization, processing and value addition, and marketing in an easy to use manner. It also has an on line course management platform (*e-krishipatashala*) of Kerala Agricultural University.

The portal contains category wise information on agriculture, animal husbandry and fisheries. The 'crops section' of the portal covers more than 140 crops with different sections in crop production and management, crop protection, harvest and post-harvest. For each crop, links for climate, soil, cropping pattern, varieties, seed production, field operations, manuring, irrigation, plant protection, weed management, integrated pest and disease management, harvesting and processing/post-harvest management have been given. Regarding animal husbandry, the portal contains information and technologies on major animals, and birds -their breeds, characters, special features, housing, feeding, upkeep, and disease management with practical tips and illustrations. The fisheries link comprises of fresh water, back water and marine fishes; capturing and culturing of fishes, aquarium fishes, aquarium plants, fish breeds and characteristics, fish rearing, feeding, management and disease prevention and protection.

The portal acts as a platform for operating some Agri-software (Decision Support Systems/Agri-e-Experts). The KAU Fertulator, a fertilizer calculator for crops based on the farming area/ number of plants is a software that easily calculates the fertilizer dosage recommendations with just two user inputs. The farmer can choose the recommended N:P:K fertilizer available in the market. The software is highly useful to the Agriculture Extension workers also, to recommend the fertilizer. The KAU E-Crop Doctor is a software that prescribes remedies against pests, diseases and weeds. The Crop Health Diagnoser, a flash based software for the farming community helps the user to identify the disease or pest that affected their crop with the help of user inputs, and to get solutions.

Further, highly interactive and illustrated e-resources have been embedded in the portal, which include *e-Kaarshikajalakam*, a built-in Interactive Digital Information Guide in Malayalam with simple Decision Supporting System (DSS) software; *Haritha Keralam*, an interactive sub portal with illustrated multimedia based agricultural information; Interactive multimodal Digital Guide for Vegetable Cultivation; Digital Library on Farm Mechanization, an interactive digital guide on farm mechanization that includes specifications, price, use, working and details of manufacturers, mode of operation, work efficiency, operational cost and brands; Agri almanac, a dynamic and interactive digital crop calendar of farm activities; Agri-Inputs Availability, an interactive database for location based Agri Inputs availability in Kerala; Agri Directory, a detailed directory of agricultural input dealers, suppliers and stakeholders; Agri –Videos, (a collection of over 200 videos on agriculture and enterprises). The portal also acts as a platform for running online courses in agriculture.

Facilities for open discussion on agriculture and related matters, a repository of agricultural technology problems and FAQs, Success stories of farmers and contemporary farmer-led innovations, advanced materials and guidelines for agricultural researchers, a categorized collection and set of dynamic direct links to hundreds of websites related to agriculture and general areas, dynamic links to major media (newspapers, television, radio, forums, blogs and other publications) on agriculture are also available on the portal.

The entire website is also made available in the vernacular language (Malayalam) using Unicode fonts. (See <http://celkau.in/Default2.aspx>)

Technology Platform

The technology used to develop the platform is Microsoft products. The choice of Microsoft technologies was based on easiness of the product and the availability of technology among the common people. The web platform is built in ASP.Net and uses MS SQL Server for data storage. The major software like e-Crop Doctor and KAU Fertulator were created using MS-Excel, which can be downloaded and can work offline. The multimedia software was developed using Adobe flash. Some software are embedded in the web portal which are easily downloadable for keeping in their system to work offline. The entire portal was fully indigenously built. No part of the portal and e-Learning platform were outsourced.

Accessibility and User - friendliness of the Portal

In designing the portal, effort has been to follow the Principles of Accessibility guidelines which lay the foundation necessary for anyone to access and use the content.

1. **Perceivable** - Information and user interface components are presented to users in ways they can easily perceive.
2. **Operable** - User interface components and navigation are operable. The interface does not require interaction that the user cannot perform.
3. **Understandable** - Information and the operation of user interface is easily understandable. The content and operation are not beyond their understanding.
4. **Robust** - The contents are reasonably robust enough that it can be interpreted reliably by a wide variety of end-users.

Communication and Dissemination Strategy and Approach

The KAU Agri-Infotech Portal is basically for the farming society and learners across the world who want to understand and practice scientific agriculture and enterprises. To promote the tech portal, publicity was given through local media and a number of workshops, trainings, and demo sessions conducted across the state. Social media like face book, you tube, and google plus is also being used for promotion. The portal is actively linked to sites of other line departments and farm websites like Farm Information Bureau, Association of Agricultural Officers of Kerala, Kerala Agricultural University, Indian Agricultural Statistics Research Institute, Bioinformatics Centre of KAU and the like. More uniquely, the online course platform available in the portal is a promotional medium.

Extent of Reach of the Portal

The end-users span the world. People, farmers, farm enterprises, agricultural institutions and extensionists - can use the portal for one purpose or the other. Within just four years of its launching, the tech portal has been used nearly 16 lakh times.

The possible delivery centres of the portal include Kissan Call Centres of various states of India, Krishi Vigyan Kendras (KVKs) in all the districts of India, nearly 1,050 local level Agricultural Development Units and 152 Block level agricultural units of Kerala, Other state line Departments of Animal husbandry, Dairy and Fisheries, Commodity Boards of the country like Coconut Development Board,

Spices Board, Coffee Board, and Rubber Board, agricultural research stations in the country, NGOs and other organizations of the nation and abroad, State and Central Agricultural Universities, Colleges of Agriculture, Horticulture and Agricultural Engineering, Agri business management, and staff training colleges of many banks across the country, 260 NABARD Farmers Clubs, SHGs (comprising 1.71 lakh commercial fruit and vegetable cultivators) under the Vegetables and Fruits Promotion Council Keralam (VFPCCK), the Federation of about 250 *Swasraya Karshaka Samithis* (SKS) spanned across all the 14 districts of Kerala, 201 Akshaya E-Centres (Rural IT Centres in Kerala), agri-kiosks, libraries, Extension Training Centres and Farmers Training Centres, the 375 Vocational Higher secondary schools spread across the 14 districts of Kerala state and all the schools in India which promote IT@ school.

Other categories of users comprise agricultural entrepreneurs, Kudumbashree (an SHG based rural development programme for women empowerment in Kerala) units of 152 Blocks and 978 grama panchayats (village panchayats) of Kerala, agricultural input dealers, farm journalists and media, local self-government agencies, NABARD and banking institutions, agricultural insurance companies, Farm Information Bureaus of various states, agricultural exporters, importers and members of agriculture self-help groups. Thousands of farmers, farm youth, agricultural extension workers, students and agri entrepreneurs are regular users of the portal.

Different categories of users use this portal for different purposes. Some use this as a learning platform. Some use it for teaching, imparting lessons and practicals and demo. Some use this for advisory services and decision support. The platform is also referred as a unique and evolutionary way of communicating with the farmers in the process of technology transfer and solution of location specific problems instantly.

Proof of value and accomplishments of USD

The portal is highly relevant, useful and user friendly, mainly because of the adoption of user centred design. Hence it received wide media coverage. Since the ceremonial launching on 1st November 2012, within 4 years, the hit statistics show a geometric progression, reaching nearly 16 lakh hits. Besides, positive feedback and appreciation were received through different media like website forum, interactive forum of online courses, letters, official and personal mails, phone calls, visits, and during interfaces of online course participants (sample feedback statements

are available in the respective forum). This indigenously developed portal (KAU Agri infotech Portal) won the World Education Award-2014, the South West India Manthan Award 2014, and the Kerala State e-Governance Award 2011-13 under e-learning category. The *e-Krishi Patashala* (Online Courses in Agriculture) of the Centre for e-Learning was honoured with the DEF International Juror's Encouragement Award jointly organised by the Digital Empowerment Foundation and World Summit Award, for South Asia and Asia Pacific countries for the best digital innovations in Agriculture in 2013. Thus the portal showed value and effect of a user centred design. To suit the needs of the users, the portal is regularly refined and upgraded.

Suggestions

1. Content generation and ensuring correctness and accuracy of all the information is a herculean task. Utmost care has to be taken while including information.
2. A very important aspect is that no part of the design and development of the portal was outsourced. Designing and developing 100 per cent indigenously, makes it easy for maintenance and updating.
3. Wherever possible, this has to be developed in local language too, to be more useful to the end users, especially in the case of agri info-tech portal.
4. Team work is essential for the success of such ventures. A committed team with a highly motivating team leader should be entrusted with this.
5. Hectic and rigorous propaganda and publicity efforts would be needed during the initial period of launching the portal so as to bring in awareness among different stakeholders.
6. Series of demonstrations and training programmes have to be organized to appraise the end users about the advantage of using the portal and software.

Conclusion

Whenever portals and websites are developed, they should be based on the needs of the intended users and stakeholders. Such a website/portal would be in-depth, highly user-friendly and interactive, and would cater to the requirement of the users, which in turn would help and support the users thereby providing value to the website/portal, creating a high organisational image. Info-tech portals for the purpose of extension and outreach should compulsorily be based on the demands of the clientele. This is more important and relevant in the case of agricultural sector, which is always dynamic.

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Production System and Technology Adoption Profile of Black Pepper Cultivation in Kerala

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Abstract

Within India, Kerala is the spice garden. However, the pepper cultivation system in Kerala is now handicapped by a number of problems. The yield of this crop has declined mainly due to senile plantations and minimum input use, on account of declining market price and declining profit margin. The present study was undertaken covering three districts of Kerala through a sample survey to study the features of the production system and track major shifts, study the technology adoption profile of the farmers and identify major constraints as perceived by the farmers. Around 38 per cent of the farmers adopted organic production system and technology adoption profile showed a less input intensive approach. Even though 60 per cent of farmers practiced rain fed cultivation, 15 per cent fully irrigated and 25 per cent adopted irrigation partially. Majority of the farmers were holding land between 80 cents to 4.5 acres. Around 40 per cent of the total vine population was in the pre-bearing stage. There is slow and gradual increase in adoption rate of improved varieties and majority of the farmers sourced new planting material from own fields, showing less dependence on public and private nurseries. The major field problems reported by the farmers are pre-bearing loss of the vines, and many biotic problems like pest and disease incidence and environmental problems like shifts in climate especially rainfall.

Keywords: Black pepper production system, adoption, constraints

Introduction

Pepper, known as the King of Spices, is one of the oldest and most widely used spice in the world. Historically black pepper like other plantation crops viz., coffee, tea, rubber and cardamom, was being considered as a foreign exchange earner to overcome its acute shortage (Nayyar & Sen 1994). With socio-economic development, the household consumption of spices like black pepper, turmeric, ginger etc. is steadily increasing in all regions of the country. (Srivastava *et.al.* 2013, Yogesh *et. al.* 2013). Black pepper is mainly cultivated in the states of Kerala,

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Karnataka and Tamil Nadu. Its origin has been traced in the hills of South Western Ghats of India. It is now grown in Indonesia, Malaysia, Sri Lanka, Thailand, China, Vietnam, Cambodia, Brazil, Mexico and Guatemala apart from the country of origin. Most of these countries are new entrants in the production scenario.

In India, pepper is commonly cultivated as a “homestead crop” by small and marginal farmers or grown as an intercrop in plantations of coffee, tea or areca nut. Cultivation of pepper as a pure crop is also practiced though it is becoming rare. Kerala is the major producer with more than 89 per cent of area and 95 per cent of total production in India followed by Karnataka and Tamil Nadu. It is also cultivated in certain pockets of other states viz., Andhra Pradesh, Pondicherry, West Bengal, Odisha, Maharashtra, Goa, and Andaman & Nicobar Islands and in North Eastern States. Black pepper is one of the important crops which provides a major source of income and employment for rural households in Kerala - where more than 2.5 lakh farm families are involved in pepper cultivation (Madan. *et. al.* 2007).

In the recent past, the pepper sector in India witnessed drastic changes in area, production and exports. India's share of world black pepper trade reduced from 19.05 per cent during 1970-71 to 8.35 per cent in 2012-13 in terms of volume and from 24.1 per cent to 6.36 per cent in terms of value during the same period. In Kerala, the area under pepper is estimated at 84,065 ha and production at 29,408 tons during 2013-14 (Economic Review 2013). The area under pepper cultivation in Kerala was 90,918 hectares during 1957-58 and it increased to 2,37,998 hectares in 2005-06 and since then declined to 84,707 hectares during 2012-13. The increase in production was marginal in absolute terms and productivity was stagnant and low at 513 kg/ha. In a SWOT analysis, it is reported that low productivity of the crop is the major weakness, high intrinsic quality is the strength and increasing domestic demand for the produce is the opportunity (Spices Board 2009).

In the above explained context, a study was carried out in three districts of Kerala state with the objectives of analyzing the black pepper production system and the technology adoption profile by the farmers. The technologies considered were varietal adoption and sourcing pattern by farmers, irrigation and other scientific management practices including organic manure, fertilizers, plant protection measures like fungicide, biological control and soil amendments like liming.

Methodology

The study was conducted in the state of Kerala. Secondary data about pepper production of the last 3 years was analyzed and triennium ending (TE) average

was calculated. Idukki, Wayanad, Kannur, Kollam, and Kozhikode districts of Kerala contributed almost 80 per cent of the total area under pepper cultivation. Of the above five districts, three having a larger area under the crop were selected for the analysis. Forty respondents (pepper farmers) were selected randomly from each district making it a total sample size of 120. Primary data on specific aspects of black pepper cultivation, varietal profile, varietal sourcing pattern and socio-economic variables were collected from the respondents using a structured interview schedule. The adoption level was measured based on percentage scores for various scientific management practices including irrigation.

Results and Discussion

Pepper Production System

The data on production system, water management, age profile and area under the crop are presented in Table 1. There were significant differences in the general management practices adopted by the farmers for pepper cultivation. The organic mode of production was adopted by more than 30 per cent of the respondents. This gives an indication of less intensive nature of cultivation followed by farmers. Resmi *et.al* (2012) reported poor input use efficiency as one of the major constraints attributing to low productivity of black pepper in Idukki district. The area profile shows the predominance of farmers owning area of 80 cents to 4.2 acres (72%) and very small holdings of less than 80 cents (12%). This is also an indication of the predominance of marginal and small farm size sector.

Major area is rain fed (60%) with only 15 per cent irrigated. It is being reported that black pepper being sensitive to water shortage, protective irrigation in summer can increase yield levels (Krishnamoorthy *et. al* 2011 & 2014). Frequent droughts and fluctuating temperature adversely affect the yield of this crop. Although it is a rain fed crop, the yield can be increased by about 50 per cent through irrigation in summer. Majority of the agricultural systems (60%) were non organic with no irrigation.

More than half (53.95%) of the vines in the field were 4-20 years old, which is the productive period of black pepper. About 41.5 per cent of vines are in the pre-bearing stage which is an indication of replanting taken up by farmers every year. Maintenance of vines older than 20 years is considered unviable in the present context due to more climatic stress and other situational factors like shortage of labour. In a similar study about 35 per cent vines in the sample was reported to be in the age group of 5-15 years (Rajeev *et.al.* 2009) Empirical evidences also

suggest the influence of age of the vines on the productivity of both traditional or improved varieties (Resmi *et.al* 2012)

The availability of disease free planting material and financial assistance on easy terms is essential for realizing increased crop yield and profitability. The analysis of the source of planting material revealed that the majority of the planting material is sourced from own field (Table 2). With the prevalence of traditional varieties in the state, this is one contributing factor towards slow pace of varietal spread in black pepper. The external source of improved varieties released through research still continues to be government institutions. The private sector also supplied only few improved varieties. These findings imply a need for policy support and institutional reforms to bridge the large gap in the supply of improved varieties developed by the research stations.

Table 1. Features of Production System

N=120		
Particulars	Category	% measure
Agricultural system	Organic	31.08
	Inorganic	68.92
Water Management	Irrigated	15
	Non irrigated	60
	Partially irrigated	25
Number of pepper vines	Average number of vines per farmer	742
Age of vine in the field	Less than 4 years old	41.51
	4-20 years old	53.95
	More than 20 years	4.54
Total cultivable area	Less than 80 cents	12
	80 cents - 4.2 acres	72
	More than 4.2 acres	16

Table 2. Source of Black Pepper Planting Material

Source	Share (%)
Own field	65.50
Govt Institutions	10.36
Private nurseries	16.10
Other farmers	8.04

The wide gap among sources also indicates demand-supply disparity in black pepper planting material supply.

Adoption of Improved Varieties

The pepper varietal profile from the sample farmers in 2013-14 revealed that there had been gradual improvement in the spread of improved varieties from 2 to 12.3 per cent (Figure 1 and Figure 2). Further efforts need to be made for the fast spread of improved varieties so that farmers can derive the maximum benefit from enhanced production from improved varieties. There was a significant drop in the share of traditional Karimunda variety in the black pepper gardens reflecting a shift in acceptance of other improved varieties among the black pepper farmers. As of now traditional and Karimunda varieties dominate the farms which is also indicative of the wide gap as well as constraints in supplying planting material of improved varieties.

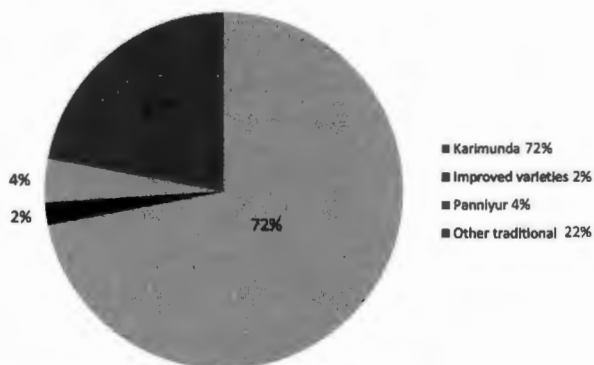


Fig. 1. Varietal Profile of black pepper (Madan and Jose, 2002)

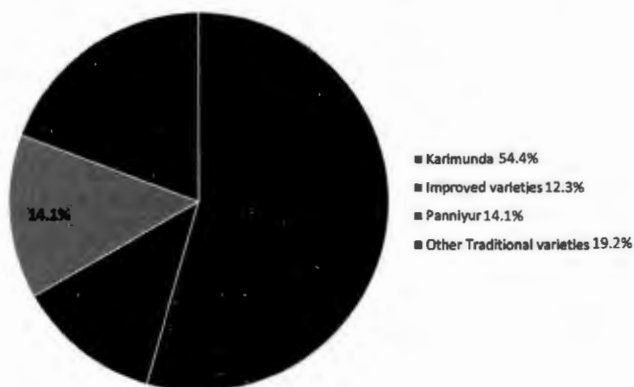


Fig. 2. Varietal composition of black pepper in Kerala 2013-14 (Rejula 2015)

Input Adoption in Pepper Cultivation

The predominant production system in the state follows a homestead farming pattern where several crop components are present in a single plot of land. Generally, the level of input use was very low with more than 40 per cent of the respondents applying no form of fertilizers for black pepper (Table 3). Major share of input use in black pepper is in the form of organic manure and 23.8 per cent of the respondents used NPK Fertilizers. Liming or soil amendments were used by 23 per cent of the respondents and only 15 per cent used fungicides or insecticides. The study infers that low input adoption might be an important reason for low yield and productivity.

Table 3. Input use in Pepper cultivation

Input use	Respondents (%)
NPK Fertilizers	23.8
Organic Fertilizers	36.3
Fungicides/Insecticides	15.1
Trichoderma	6.8
Pseudomonas	5.7
Pochonia	0.03
Liming /Soil amendments	23.0

Perceived Constraints by the Farmers

Constraints in black pepper cultivation were categorized as pre-planting loss/death of vines at pre-bearing stage, biotic constraints and institutional or environmental constraints. Major reason for pre-planting loss as perceived by farmers was climate related problems like heavy rainfall, high humidity and drought conditions in the region. Average pre planting loss estimated was 44 per cent. Though the reasons were categorized separately, the problems related to loss at pre-bearing stage are interrelated and cannot be compartmentalized. However, the information compiled provides a farmers perspective on the problem (Table 4).

Table 4. Reasons for pre-bearing loss

Reasons as perceived by farmers	%	Rank
Climate related problems (Heavy rainfall / high humidity/drought)	47	1
Pest and disease	39	2
Transplanting shock	11	3
Lack of care	3	4

The level of biotic constraints in black pepper production was measured as the number of respondents reporting specific biotic constraints during the last year. Quick wilt/ foot rot were the major biotic constraints in pepper cultivation followed by damage due to slow wilt (Table 5). Majority of the farmers had more than one biotic constraint in the field. Perceived change in climate pattern (42%) was a significant environmental constraint. Respondents perceived labour problem as the second important constraint in pepper cultivation (19%). All these constraints in addition to the market and price pull, explain the gradual decline in area under black pepper in the state. There is an urgent need to adopt area wide strategies for integrated pest and disease management in the crop to arrest the decline in both area and production of black pepper in Kerala. Promoting adoption of scientific inputs and improving input use sufficiency, adequate supply of planting material of improved genotypes developed by research stations, phased replanting and removal of old and senile vines, adoption of protective irrigation in summer to combat climate related stress, are some of the recommendations which emanated out of this study for the development of black pepper sector.

Table 5. Biotic Constraints as perceived by Farmers

Biotic Constraints	Per cent
Foot rot/quick wilt	45.95
Slow wilt	40.54
Pollu beetle	24.32
Leaf blight	12.16
Pollu disease	4.05
Nematode	5.41
Mealy bug	8.11
Wild life	2.70

Conclusion

The study on production systems and technology adoption profile in black pepper was carried out through a sample survey in Kerala. The results indicated a predominance of small and marginal farm sector. The analysis of production system revealed the predominance of organic production system and less intensive input use in the gardens. The proportion of farms under irrigation is meager. There is gradual shift in adoption of improved varieties over time. Majority of the farmers source the planting material from own gardens or other farmer's plots which can be attributed to slow spread of improved varieties as well as insufficient sources for

improved varieties whether public or private institutions. The adoption levels of application of manure, chemical fertilizers and plant protection measures are low to medium. Majority of the farmers reported more than one major biotic constraint in the field. These biotic constraints apart from the market and price pull explain the gradual decline in area under black pepper as reported earlier.

There is an urgent need to adopt area wide strategies for integrated pest and disease management and for combating biotic stress factors in the crop to arrest the decline in both area and production of black pepper in Kerala. Promoting adoption of scientific inputs and improving input use sufficiency, adequate supply of planting material of improved genotypes developed by research stations, phased replanting and removal of old and senile vines, adoption of protective irrigation in summer to combat climate related stress, are some of the recommendations emanating out of this study for the development of black pepper sector.

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Inclusive Strategy for Small and Marginal Farmers in Tapioca Production, Processing and Marketing

R. Sendilkumar¹ and S. Arya²

Abstract

This study was conducted to explore the post-harvest value addition opportunities for tapioca, identify the constraints faced by small and marginal farmers in processing and to suggest a strategy. Primary data from 60 tapioca farmers of Elamadu Grama Panchayath of Kollam district, Kerala were collected through interview schedule. Expert opinion was collected from the Scientists of Kerala Agricultural University (KAU), KVK, and CTCRI etc. to screen the appropriate technology for tapioca value addition. The data obtained were analysed using percentage analysis, SWOC and COWS analysis. It was found that a number of farmers were involved in tapioca cultivation and could produce marketable surplus, but were not engaged in any post-harvest value addition activities. Indeed, farmers have expressed their willingness to start value addition jointly as a group. The technocrats opined that tapioca snacks and chips are better options for value addition at farm level. The study highlighted the need for an exclusive organisation for tapioca cultivation, marketing and processing. Initiating farmer driven producer organisations and consumer linked value chain would be a promising strategy for livelihood of small and marginal farmers of tapioca.

Keywords: Inclusive strategy, production, marketing, tapioca.

Introduction

Tapioca is grown by smallholder farmers in more than 100 tropical and subtropical countries and called “food of the poor” with multipurpose utility. India is the largest producer of Tapioca in Asia with production of 8120000 MT (FAO 2013) during 2012. Major production is reported in South Indian states such as Kerala, Tamil Nadu etc. Kollam district of Kerala stands first in Tapioca production accounting for 525486.184 tons (Agricultural Statistics 2010-11). The importance of Tapioca as a food crop is well recognised in Kerala and cultivated extensively. Globally 58 per cent of tapioca produced is used as

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human food, 28 per cent as animal feed, 4 per cent in alcohol and starch based industries and only 10 per cent is spoiled (SIDO online 2001). Seventy per cent of Tapioca produced in the country is used as food either directly or in processed form (NHB, Annual Report 2013-14).

Since the major players in the production of Tapioca are small farmers and 90 per cent of the total produce is available as marketable surplus (FAO 2013), the role played by small and marginal farmers in post-harvest processing is very high. A number of products like chips, wafers, rava, pappads *etc.*, can be made with low financial and technological inputs. Converting harvested Tapioca to products with better storability will help farmers to reduce post-harvest losses and ensure economic returns. The stable quality value added products from Tapioca also open both domestic and export avenues for the products. Despite the good opportunity foreseen, the coordinated efforts in post-harvest activities and stepping to business enterprises among small and marginal farmers are very limited and not encouraging. Keeping the aforesaid discussion points, as a pivotal, this study attempted to answer the following research questions:

1. What are the constraints faced by the small and marginal farmers in production and post-harvest processing of tapioca?
2. Are we having an inclusive strategy for small and marginal farmers for Tapioca production, processing and marketing?

Objectives

Keeping in view the above research questions, the objective of the study is to identify the constraints, faced by small and marginal farmers of tapioca, in production, post-harvest processing and to suggest an inclusive strategy.

Methodology

The study was conducted in Elamadu Panchayath of Kollam District, Kerala. A sample of 60 tapioca farmers was selected using simple random sampling from the sampling frame prepared. Both primary and secondary data were used for this study. The primary data were collected through a structured pretested interview schedule, focused discussion and secondary data were collected from different sources such as print and online publications related to tapioca production and post-production aspects. The experts' opinion was also collected from the Scientists of KAU, KVK, and CTCRI *etc.* and commercial private processors engaged in value addition of tapioca in order to screen out the

appropriate technology. The data obtained were analysed by using percentage analysis, SWOC and COWS analysis. The outcome of the analyses is used for prescribing an inclusive strategy.

Results and Discussion

This section deals with exploration of findings related to key observations *viz.*, ownership and area under cultivation of tapioca, constraints encountered by tapioca farmers in production, post production and value addition, perceived benefits of post-harvest processing and collective marketing and the details are presented in Tables 1 to 6.

Ownership of Land and Area under Tapioca Cultivation

Table 1 shows that 43 per cent of the respondents have an average land holding of below 0.5 acres. Nearly one-third of the respondents (28%) have land holding between 0.5 and 1 acre. Only one-tenth of them (10%) have an average land holding of more than 2 acres. Most of the farmers have their own land for cultivation of tapioca and 10 per cent have taken land on lease. Majority of them (82%) cultivate tapioca in less than 0.5 acre of land. Very few farmers have been cultivating tapioca in 1 to 2 acres of land. From the results obtained, it is inferred that, tapioca cultivation in the study area is scattered and small land holding farmers thus seek out organised cultivation in the study area.

Table 1. Ownership of Land and Area under Cultivation of Tapioca

N = 60

Area \ Ownership	Owned	Leased	Percentage	Area under Tapioca cultivation	Percentage
Less than .5 acre	26	0	43.33	49	81.66
.5 to 1 acre	17	0	28.33	9	15.00
1 to 2 acres	7	4	18.30	2	3.33
More than 2 acres	4	2	10.00	0	0
Total	54	6	100.00	60	100

Source: Primary data

Constraints in Production of Tapioca

The various constraints faced in tapioca production as expressed by the farmers are presented in Table 2. The cultivation of tapioca has continued in the study area due to many favourable factors, despite the few constraints. Even if the

available technology is suitable, the prevalence of pests and rodent attack in the field is identified as one of the major problems faced by the farmers (87%). The other major constraints identified are inadequacy of capital (73.33%) and high cost of inputs (53.33%). However, constraints like technology is not adequate and non-availability of inputs are comparatively less expressed. The constraints discussed above are supported by Bahari Yatim (2002), who also reported the same.

Table 2. Constraints in Production of Tapioca

		N = 60					
Sl. No.	Constraints	SF		SWF		NF	
		Nos.	%	Nos.	%	Nos.	%
1	Inadequacy of capital	44	73.33	14	23.33	2	3.33
2	Irrigation facility is not adequate	29	48.33	16	26.66	15	25.00
3	Pest and rodent attack	52	86.66	8	13.33	0	0.00
4	Technology is not adequate	19	30.00	13	21.66	28	46.66
5	Non Availability of inputs	8	13.33	12	20.00	42	70.00
6	Cost of inputs is high	32	53.33	21	35.00	7	11.66

Source: Primary data Note: SF – Strongly Felt, SWF – Somewhat Felt, NF – Not Felt

Post Production Constraints of Tapioca Farmers

The farmers expressed constraints in the post production process of tapioca and these are listed in Table 3.

Table 3. Post production Constraints

		N = 60					
Sl. No.	Constraints	SF		SWF		NF	
		Nos.	%	Nos.	%	Nos.	%
1	Inadequate storage facility	27	45.00	17	28.33	16	26.66
2	Low quality of the product	31	51.66	14	23.33	15	25.33
3	Marketing challenges	6	10.00	11	18.33	43	71.66
4	Low prices received	37	61.66	20	33.33	3	5.00
5	Difficulty in Transportation	13	21.66	19	31.66	28	46.66

Source: Primary data Note : SF – Strongly Felt, SWF – Somewhat Felt, NF – Not Felt

The low return of the commodity is always a problem for the farmers and it is reflected in the case of tapioca also. Nearly two-third of the farmers (61.66%) are not satisfied with the price realized for the product and have shown mismatch

between cost of production and price realisation. This calls for establishing price guarding mechanism for tapioca farmers. Table 3 shows that, farmers have been marketing their products through retailers, agents or on their own, which implies that adequate demand existed for the products. Majority of the farmers (72%) expressed that, they didn't face any challenges in marketing due to large industrial demand. Low quality of the product (51.66%) and inadequate storage facilities (45%) were identified as major post-harvest constraints.

Constraints in Value Addition of Tapioca

The farmers in the study are yet to practice post-harvest processing in tapioca and the constraints faced in value addition are given in Table 4. This might be due to lack of knowledge on the value addition process and opportunities. The major constraints identified for post-harvest value addition were unawareness regarding technologies (73.33%), lack of time (60%) and inadequate capital (68.33%). Majority of the respondents (73%) opined that lack of awareness on processing and value addition technology was their major constraint in value addition. Almost half of the respondents (45%) opined uneconomic holding of resources as a constraint for starting a venture in value addition. A similar kind of result was reported by Mohammad Jalal-Ud-Din (2011) such as lack of awareness regarding newer technologies, lack of training and information, inadequate financial resources *etc.* contributing in the process of adoption of technologies.

Table 4. Constraints in Value Addition

		N = 60					
Sl. No	Constraints	SF		SWF		NF	
		Nos.	%	Nos.	%	Nos.	%
1	Inadequacy of capital	41	68.33	12	20.00	7	11.66
2	Fear of loss	24	40.00	17	28.33	19	31.66
3	Unawareness regarding technologies	44	73.33	16	26.66	0	0.00
4	Lack of time availability	36	60.00	13	21.66	11	18.33
5	Uneconomic holding	27	45.00	18	30.00	15	25.00
6	Lack of interest	12	20.00	16	26.66	32	53.33

Source: Primary data Note : SF – Strongly Felt, SWF – Somewhat Felt, NF – Not Felt

Perceived Benefits of Post-Harvest Processing in Tapioca

The respondents in the study area are hardly familiar with post-harvest processing. However most of them were aware about value added products of tapioca. Most of

the respondents (92%) strongly felt that post-harvest processing would enhance the demand for tapioca and majority (82%) believed that income level of the farmers would also increase. A majority of the respondents (85%) also agreed that value addition reduces storage losses and fetches high prices (72%). In total, the farmers have a positive perception towards post-harvest processing, but the uncertainty of the market is still an obstacle and a challenge. Only 52 per cent believed that that post-harvest processing could ensure more markets. Chakrabarti *et al* (2014) also remarked that value addition should improve the returns from the crop and also increase the demand for the product.

Table 5. Perceived Benefits of Post-Harvest Processing in Tapioca

		N = 60					
Sl. No.	Perceived benefits	SF		SWF		NF	
		Nos.	%	Nos.	%	Nos.	%
1	Value added opportunities are more in Tapioca	11	18.33	49	81.66	0	0
2	Value added products fetch high prices	43	71.66	17	28.33	0	0
3	Value addition reduces storage loss	51	85.00	9	15.00	0	0
4	Income level of farmers would enhance due to value addition process of Tapioca	49	81.66	11	18.33	0	0
5	Demand for Tapioca would increase	55	91.66	5	8.33	0	0
6	Could ensure more market	31	51.66	29	48.33	0	0

Source : Primary data Note : SF – Strongly Felt, SWF – Somewhat Felt, NF – Not Felt

Perceived Benefits of Collective marketing

Table 6 depicts the perceived benefits of collective marketing. Smallholding farmers are mostly scattered and, therefore, generally there is a need to bulk their produce in order to access urban markets or to meet the requirement of the processing industry. Bulking can be done through different modalities and by different players in the value chain, like middle-men and traders, processing companies, State Marketing Boards or collective marketing interventions. Fifty three per cent of the respondents strongly felt that collective marketing would result in a better price and 48 per cent of the farmers somewhat felt that collective marketing would result in reduced expenditure. Seventy eight percent of the respondents strongly agreed that collective marketing would help in collective bargaining for better pricing.

Table 6. Perceived Benefits of Collective Marketing

N = 60

Sl. No.	Perceived Benefits	SF		SWF		NF	
		Nos.	%	Nos.	%	Nos.	%
1	Collective bargaining	47	78.33	13	21.66	0	0
2	Better price	32	53.33	28	46.66	0	0
3	Huge quantum of production	19	31.66	27	45	14	23.33
4	Large scale distribution	21	35	19	31.66	20	33.33
5	Reduced expenditure	16	26.66	29	48.33	15	25.00
6	Others	0	0	0	0	0	0

Source: Primary data Note: SF – Strongly Felt, SWF – Somewhat Felt, NF – Not Felt

Based on the inputs derived from the above discussed findings, SWOC and COWS analysis were performed and the outcome is presented in the form of an interactive matrix (Fig. 1 and Fig. 2) to work out an inclusive strategy.

SWOC Analysis of Tapioca Cultivation and Value Addition

Fig. 1. SWOC Matrix Analysis

STRENGTH	WEAKNESS
- Tapioca grows and produces best under warm humid tropical conditions where rainfall is well distributed and fairly abundant. Hence it is well suited for Kerala's climate and soil. - The raw material required for Tapioca such as planting material, equipment <i>etc.</i>, are affordable and hence the cost of production is possibly low. - Primary data analysis revealed that inputs required other than labour are abundant and easily available. - The supportive secondary data showed that processing of tapioca didn't require a huge investment and could be carried out without much difficulty.	- Tapioca products are not as widely accepted as the other products in terms of taste and not enjoyed by all kinds of customers. - Tapioca contains a poisonous substance called cyanogenic glucosides (compounds of cyanide and glucose) which hinder the processing of tapioca. - The farmers are cultivating different unorganised varieties of tapioca, which leads to difficulty and poses challenges in standardisation and value addition.

OPPORTUNITIES	CHALLENGES
• Tapioca has huge value addition opportunities and most of them are not yet exploited much. • Collective marketing will provide promising scope for marketing of tapioca. • The newly standardised and quality value added opportunities established will open a new arena of export and domestic markets. • More research and development activities evolve new cultivation practices, varieties and more value addition opportunities for tapioca.	• The dynamic growth of food industry attracts many players. Competition from similar value added products of other agricultural products are high. (The tapioca fried chips have competitions from banana chips, potato chips etc.) • Tapioca growers are not organised hence resulting in scattered production of tapioca. • The farmers are not aware about value addition opportunities and technologies available. Hence they are less motivated towards post-harvest processing of tapioca. • Continuous rodent and pest attack of tapioca plant affects the yield

Source: Primary data

Fig. 2 COWS Matrix Analysis

	OPPORTUNITY	CHALLENGES
STRENGTHS	• Formation of farmer producer organisations to carry out value addition and collective marketing • Conduct training programmes and workshops to familiarise with value addition techniques. • Cultivation of hybrid varieties of tapioca to ensure good quality and high yield. • Conducting research programs to identify new value added products and more markets for the products. SO (Maxi – maxi strategy)	• Popularize value added products of tapioca by conducting exhibitions. • Organise farmers and cultivate the same variety for getting consistent quality products. • Conduct awareness campaigns to carry out post-harvest processing at farm level. • Use of modern rodent and pest control mechanisms developed by research institutions. ST (Maxi – mini strategy)
WEAKNESS	• Extend the area under cultivation of tapioca. • Linkage and co-ordination mechanism for cultivation and marketing of tapioca. • Standardisation and certification process to ensure quality of the products. • Ensure continuous demand and supply of Tapioca. WO (Mini – maxi strategy)	• Identification of proper and regular marketing channels through stakeholders participative value chain development. • Conduct research programmes to reduce poisonous effect of tapioca. • Total quality control mechanism for consistent quality and taste. WC (Mini – mini strategy)

Source: Primary data

Conclusion

Based on the derivation of findings, SWOC and COWS analysis carried out, the small and marginal farmers' inclusive strategy for tapioca production, processing and marketing has been drawn and given below:

1. The farmers can cultivate improved varieties (short duration and high yielding) meant for value addition developed by CTCRI and KAU.
2. The research and extension institutions should take initiative to create awareness among small and marginal farmers regarding value addition of tapioca and its benefits.
3. Motivation and promotion of Farmer Producer Organisations for tapioca farmers to start post-harvest processing and enhance farm income.
4. Conduct awareness campaigns to carry out post-harvest processing at the farm level.
5. Conduct training programmes and workshops to familiarise with value addition techniques.
6. Establish standardisation and certification process to ensure quality of the products, by advocating Good Agricultural Practices (GAP) and Good Management Practices (GMP).
7. Motivate and empower the farmers to become active players in the verticals of tapioca value chain through human resource development programme.
8. Nurturing exclusive agri-business incubators for small and marginal farmers of tapioca in processing, value addition, and marketing by attracting investment through Corporate Social Responsibility (CSR) and Public Private Partnership (PPP) mode.
9. Initiating farmer driven producer organisations and producer-consumer linked value chain would be a promising inclusive strategy for livelihood of small and marginal farmers of tapioca.
10. Ensure the livelihood of small and marginal farmers of tapioca through active convergence of resources of stakeholders' institutions towards achieving sustainable development goals.

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Role of Plant Diagnostic Laboratory for Identification and Management of Insect Pests of Paddy in Kapurthala District

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Abstract

Paddy is grown under different agro-climatic conditions and the crop is damaged by more than 100 species of insect pests and infested by varied diseases. These insect pests cause enormous grain yield losses, which may vary from 20 to 50 per cent if not managed in time. During the last 3 years i.e. from 2013 to 2015, a record of all the visiting farmers was maintained in the plant health diagnostic laboratory at the Krishi Vigyan Kendra, in which complete details of the farmer with address and contact number was maintained. It was noticed that majority of the farmers (80.5%) visited during the month of April and only 19.5 per cent visited in the month of May as sowing of paddy nursery starts from the first week of May every year. The crop was also found to be prone to micro nutrient deficiency and showed deficiency symptoms in iron and zinc. It was inferred that before the sowing and harvesting of the crop, the farmers queries were maximum due to the fact that majority of insect pest attack takes place near maturity of the crop which results in huge loss, if not taken seriously. As Krishi Vigyan Kendra imparts short duration training to farmers from time to time, it can be concluded that KVK staff should provide training relating to the above mentioned technological problems in a particular month.

Keywords: Seed Treatment, Sheath blight, Leaf folder, sucking insect pests, micro nutrient, paddy, basmati.

Introduction

Paddy cultivation is best suited to regions of high temperature, high humidity, prolonged sunshine and assured water supply. A temperature range of 20 to 37.5°C is required for its optimum growth. The crop requires a higher temperature at tillering than during early growth. The temperature requirement for blossoming ranges between 26.5 and 29.5°C. The humidity needs vary according to the variety. For early types, the favourable range of humidity is 83 to 85 per cent and for the late ones, it is 67 to 68 per cent. In Punjab, the rice season extends from May to November. During the year 2014-15, paddy was cultivated in 28.94 lakh ha with

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total production of 166.61 lakh tonne of paddy. The average yield of paddy was 57.57q per hectare. Paddy is grown under different agro-climatic conditions and the crop is damaged by more than 100 species of insect pests and infested by varied diseases. These insect pests cause enormous grain yield losses, which may vary from 20 to 50 per cent if not managed in time.

It was noticed while working with farmers that in spite of tremendous progress made by the farmers of Punjab, there was still a wide gap between the potential of the technology and the results achieved by the farmers. Sharma (2015) reported major bottlenecks in the adoption of feeding practices by the dairy farmers in the district. Similarly, Singh (2013) indicated that most of the recommended brands of the pesticides were not available in the market. As a result, farmers were helpless in adopting the recommended spray schedule for the control of attack of various insect pests and diseases on various crops.

Every crop has its own complex of insect pests and diseases. The attack of insect pests and diseases is season specific. The same crop may be attacked severely by one insect pest or disease in one year and in another year some other insect pest or disease may be prevalent on the same crop in severe form. At the same time, attack of one insect pest in severe form may occur year after year on the same crop as is the case of attack of white-fly on cotton in the *Malwa* belt during the year 2015 and 2016.

Therefore, it was planned to ascertain the areas in which farmers made most of the queries so that the Kendra could make changes in the action plan for the benefit of maximum number of farmers. Hence the study was conducted to classify the data pertaining to number of farmers who visited the plant disease diagnostic laboratory at the KVK to get the paddy samples diagnosed for the attack of insect pests and diseases and its probable remedial measures.

Materials and Methods

During the last 3 years *i.e.* from 2013 to 2015, a total of 606 farmers from different villages and blocks of Kapurthala district visited the Plant Disease Diagnostic Laboratory established at the Krishi Vigyan Kendra, Kapurthala. Of these, 299 farmers visited regarding wheat and other *Rabi* oilseed crops, 95 for vegetables and fruit cultivation and 212 farmers for paddy and basmati cultivation. From the data analysed, a gradual increase in the number of farmers' visits was envisaged during the study period. A record of all the visiting farmers including complete details of the farmer with full address and contact number was maintained. Similarly, the

purpose of visiting the KVK was recorded date wise by the KVK scientist and at the end of each month, a summary was prepared and analysed for severity of the attack of insect pests and diseases. The data were classified month wise, problem wise, crop wise *etc.* to note down the extent of damage caused by the insect pests, diseases or other agencies. The probable solution of the problem diagnosed was given to the farmer.

Results and Discussion

Month wise farmers visit at KVK

Data showed that out of 168 farmers who visited the KVK, per cent values for the months of April, May, June, July, August, September and October were 19.6, 8.3, 4.2, 14.3, 22.0, 22.6 and 8.9 per cent, respectively (Table 1). It is inferred that before the sowing and harvesting of the crop, the farmers queries were maximum due to the fact that majority of insect pest attack takes place near maturity of the crop which results in huge loss, if not taken seriously.

Table 1. Month wise Farmers visit to KVK (average of 3 years) for solving their Technological Problems in Paddy

Sr. No.	Crop - Paddy	April	May	June	July	Aug	Sept	Oct	Per cent Farmers
1	Seed treatment of paddy	80.5	19.5	0.0	0.0	0.0	0.0	0.0	24.4
2	Sheath blight	0.0	0.0	0.0	13.3	40.0	46.7	0.0	17.9
3	Attack of Leaf folder	0.0	0.0	0.0	25.0	46.4	28.6	0.0	16.7
4	Attack of brown plant hopper	0.0	0.0	0.0	0.0	36.0	20.0	44.0	14.9
5	Iron deficiency in paddy	0.0	0.0	60.0	40.0	0.0	0.0	0.0	6.0
6	Iron deficiency in nursery plot	0.0	85.7	14.3	0.0	0.0	0.0	0.0	4.2
7	Attack of stem borer	0.0	0.0	0.0	50.0	12.5	37.5	0.0	4.8
8	Sheath rot	0.0	0.0	0.0	50.0	16.7	33.3	0.0	3.6
9	Empty panicles due to wind storm	0.0	0.0	0.0	0.0	0.0	50.0	50.0	2.4
10	Zinc deficiency	0.0	0.0	0.0	66.7	33.3	0.0	0.0	1.8
11	Attack of grasshoppers	0.0	0.0	0.0	0.0	0.0	50.0	50.0	2.4
12	Attack of brown spot disease	0.0	0.0	0.0	0.0	0.0	100.0	0.0	1.2
Total		19.6	8.3	4.2	14.3	22.0	22.6	8.9	100.0

Seed Treatment

A total 168 farmers visited the KVK with queries pertaining to the paddy crop during April to October in which 24.4 per cent of the farmers enquired about seed treatment in Paddy (Table 1). It is a known fact that seed is treated to give the plant, protection against attack of bacterial leaf blight and other soil borne diseases. It was observed that farmers were unaware about the name of the chemical to be used, its quantity and method of application.

Further, normally farmers use 10 to 12.5 kg of paddy seed but recommendation is for 20 kg to sow one hectare of area. Similarly, for seed treatment, the recommendation is to use 12.5 g of Emisan-6 + 2.5 g of Streptocycline in 25 L of water and to keep the 20 kg paddy seed in this solution for 6-8 hours. Hence, farmers wanted to know whether 25 L prepared solution would be sufficient for 10 kg seed or whether they would have to reduce its quantity by half (because they would use only 10 kg seed). Likewise, whether the prepared solution can be used to treat the second lot of seed or would they have to prepare the fresh solution time and again for treating the new lot.

It was also noticed that majority of the farmers (80.5%) visited during the month of April and only 19.5 per cent visited in the month of May due to the reason that sowing of paddy nursery starts from the first week of May every year as per Punjab Government notification. Later on, no farmer enquired about seed treatment in paddy.

Sheath Blight

About 30 farmers (17.9%) came to the KVK with plant samples (Paddy) infested with sheath blight (*Rhizoctonia solani*). Symptoms of the disease were greyish green lesions with purple margin developed on the leaf sheath above the water level. Later, the lesions enlarge and coalesce with other lesions. Farmers noticed this disease in the month of July (13.3%) but maximum number of samples were diagnosed in the month of August (40%) and September (46.7%). The probable reason could be that although the disease started appearing in the field in the month of July but the symptoms were usually not distinct till flowering, hence more number of samples were brought by the farmers in the month of August and September.

Farmers use Tilt 25 EC @ 500 ml/ha to control this disease as and when its symptoms appear in the field. Tilt 25 EC being broad spectrum in nature, takes care

of other diseases also particularly brown spot disease and sheath rot. This may be the reason why only 6 (3.6%) and 2 (1.2%) farmers brought samples infested with sheath rot and brown spot disease, respectively.

It was also found that farmers generally use 100 L of water for spraying the fungicide whereas the recommendation is to use 200 L of water in order to give complete coverage to all the parts of the plant which results in good control of the disease. Due to the fact that farmers were using less water for spray of fungicides this resulted in partial control of the disease and hence the disease reappeared in the field and the farmer had to apply one or two more sprays of the fungicide which increased his cost of cultivation.

Leaf folder

The third problem faced by the farmers was the attack of leaf folder *Cnaphalocrocis medinalis* (Guenee) and stem borer, *Scirpophaga incertulas* (Walker) during July to September as 28 farmers visited the KVK with samples (16.7%) infested with the attack of leaf folder and 8 farmers (4.8%) with the attack of stem borer. Stem borer larvae feed inside the stem causing drying of the central shoot or dead heart in young plants and drying of the panicle or white ears in older plants. As paddy varieties suffer less damage due to stem borer, this may be the reason for less number of samples diagnosed with attack by this pest. Farmers generally go for granular application of insecticides for the management of this pest at 30, 60 and 90 days after transplanting which is effective but not economical, while spraying with any of the recommended insecticides proves both efficient as well as economical. Farmers must go for spray when the damage reaches 10 per cent Economic Threshold Level for leaf folder and 5 per cent for stem borer with 170 g of Mortar 75 SG (cartap hydrochloride) or 350 ml of Sutathion 40 EC (triazophos) or 560 ml of Monocil 36 SL (monocrotophos) or 1 litre of Coroban/Dursban/Lethal/Chlorguard/Durmet/Classic/Force 20 EC (chlorpyrifos) in 100 litres of water per acre.

Attack of Sucking Insect Pests of Paddy

Two insects *i.e.* brown plant hopper (*Nilaparvata lugens*, Stal) and white backed plant hopper (*Sogatella furcifera*, Horvath) are most important. Maximum number of farmers (25 farmers) brought samples (14.9%) infested with the attack of brown plant hopper during August to October months. Its nymphs and adults suck cell sap from the leaf surface and tend to congregate on the leaf sheath at the base

of the plant. The attacked plants ultimately dry up without producing ears. The attack appears in patches. The samples were received in the months of August (36%), September (20.0%) and October (44.0%). Maximum number of samples were diagnosed in the month of October due to the reason that farmers usually prefer Pusa 44 variety in rice-wheat crop rotation which is of long duration and matures in the month of October. By this time, brown hopper shifted from all other short duration varieties harvested in the last week of September to first week of October, to this variety and resulted in more number of samples during October. The suggested control measure is by spraying 40 ml Confidor 200 SL / Crocodile 17.8 SL (imidacloprid) or 800 ml Ekalux/Quinguard 25 EC (quinalphos) or one litre Coroban/Dursban 20 EC (chlorpyrifos) in 100 litres of water per acre which should be repeated if required. For better effectiveness, spray should be directed towards the base of the affected plants. If the damage is noticed at hopper burn stage, the affected spots should be treated along with their 3-4 metre periphery immediately as these spots harbour high population of the insect.

Occurrence of Micro Nutrient Deficiency

The paddy crop was also found to be prone to micro nutrient deficiency. Iron and zinc were two nutrients to which the crop showed deficiency symptoms. Seventeen farmers (10.2% sample) came to the KVK showing iron deficiency in the samples and 3 farmers (1.8 per cent sample) brought samples found to be zinc deficient. These deficiency symptoms occurred in soils which were of light texture. The difference in the number of samples received of these two nutrients might be due to the fact that the farmer has included the application of zinc sulphate @25kg/ha at the time of puddling the field in his farming practice and hence its deficiency did not appear. The symptoms of zinc deficiency appear on lower leaves becoming rusty brown near the base and ultimately dry up.

The seedling with zinc deficiency remain stunted and tiller less. The farmers used 62.5 kg of zinc sulphate hepta hydrate (21%) or 40 kg zinc sulphate monohydrate (33%) per hectare at puddling. Hence, only 1.8 per cent farmers visited the KVK for the control of this malady and that too in the month of June (66.7%) and July (33.3%) as the symptoms of zinc deficiency appear 2-3 weeks after transplanting. This was not the case with iron deficiency. Farmers apply iron sulphate as and when its deficiency occurs in the field. In case of iron deficiency, chlorosis among seedlings appears in the youngest leaf about three weeks after transplanting. The plant dies and often the crop fails completely. The recommendation is to give 2

or 3 sprays of one per cent ferrous sulphate solution as soon as chlorosis appears. Hence, 10.4% farmers visited in the month of July and August as the symptoms of iron deficiency also appear 2-3 weeks after transplanting.

Sometimes heavy winds cause damage to the paddy crop particularly when the crop is at its reproductive stage. As and when the wind blows, it results in damage to the pollens and ultimately fertilisation is affected. This results in no grain filling and hence empty panicles. Four farmers with 2.4% samples visited the KVK with this problem.

Minor Insect Pests

Some minor insect pests particularly grasshoppers also attack the paddy crop but its attack remains confined to the peripheral region of the crop and does not go deep in the field. It becomes a pest particularly when there is no other crop to feed for this insect near the paddy and also when the bunds are kept clean of grass. This may be the reason that only 4 farmers with 2.4% samples came in the months of September and October.

Problems related to Basmati crop

The problems pertaining to basmati crop were more or less similar to paddy crop. In case of basmati, a total 44 farmers visited the KVK during April to September and 28 farmers (63.6%) to know about seed treatment (Table 2). The basmati seed is treated to give the plant, protection against foot rot disease caused by *Fusarium moniliformae* and it was found that farmers were not aware about the name of the chemical to be used, its quantity and method of application like that of paddy crop.

The foot rot disease is both seed and soil borne. The infected seedlings turn pale yellow and become elongated. Later on these seedlings start drying from the bottom and ultimately die. Regarding its management, treatment of both the seed and seedlings is important. The recommendation is to dip the seed in 50 g of bavistin + 2.5 g streptocycline dissolved in 25 L of water for 12 hours and seedling root dip in bavistin for 6 hours before transplanting. It was noted that most of the farmers generally go for seed treatment but did not perform seedling treatment. Secondly, the farmers who performed seedling treatment, did not remove mud from the roots and kept the seedlings in prescribed solution as such, which is not a good practice. For proper management of the disease, use of disease free seed, treatment of the seed as well as seedling and destruction and rouging out of the infected seedlings from nursery and field is necessary.

Table 2. Month wise Farmers visit to KVK (average of 3 years) regarding Basmati crop

Sr. No.	Crop - Basmati	Apr	May	June	July	Aug	Sept	Per cent farmers
1	Seed treatment	21.4	32.1	46.4	0.0	0.0	0.0	63.6
2	Foot rot in nursery plot	0.0	0.0	100.0	0.0	0.0	0.0	2.3
3	Foot rot	0.0	0.0	0.0	20.0	40.0	40.0	22.7
4	Iron deficiency in basmati nursery	0.0	0.0	100.0	0.0	0.0	0.0	4.5
5	Iron deficiency in basmati	0.0	0.0	0.0	100.0	0.0	0.0	2.3
6	Attack of stem borer	0.0	0.0	0.0	0.0	100.0	0.0	2.3
7	Attack of Brown spot	0.0	0.0	0.0	0.0	0.0	100.0	2.3
Total		13.6	20.5	31.8	11.4	11.4	11.4	100.0

Farmers fail to follow these steps at one or other level and thus the disease appears which was evident from the record as maximum number of farmers visited the KVK for the seed treatment of basmati rice and 22.7 per cent samples were found infested with foot rot disease. Further, two varieties namely Pusa basmati 1121 and Pusa basmati 1509 were found to be most susceptible to this disease.

Nutrient Deficiency Symptoms

The basmati crop was found to be prone to iron deficiency only. Only 2 farmers (9% sample) brought samples showing iron deficiency. The symptoms of deficiency and other problems related to this micronutrient were the same as in paddy (Table 2).

It is a known fact that basmati varieties are more prone to the attack of stem borer, but only one farmer (2.3% sample) visited the KVK regarding its management. The probable reason could be that it is grown on a much lesser area as compared to paddy in the district. Secondly, farmers generally apply granular insecticide which takes care of the stem borer. Thirdly, the attack of stem borer is not appearing in a severe form since the last 4-5 years. Further, basmati seems to be susceptible to the attack of brown spot disease and only one farmer came regarding its management. Compared to the paddy crop, situation for basmati crop was comfortable.

Conclusion

The main objective of the Kendra is to help the farmers in the command area in the field of agriculture and allied sectors so that the income of the farmer from the farming sector can be enhanced to a great extent by making available recommended technologies at his door step for its adoption at the field level. The study indicated that the farmer is always in need of some specialist working in various institutions for the management of those insect pests or diseases or nutritional deficiencies which are difficult to control at his own level or at pesticide dealer level. The samples brought were of utmost importance in diagnosing the cause and remedy of the problem, where the help of the concerned scientist was required. As Krishi Vigyan Kendra imparts short duration training to farmers from time to time, it can be concluded that KVK staff should provide training relating to the above mentioned technological problems in a particular month.

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Motivational Factors and Constraints of Dairy farmers trained by Krishi Vigyan Kendra

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Abstract

The study was conducted in Shivamogga district of Karnataka state to analyse the motivational factors, constraints and to enlist suggestions of farmers trained on dairy management practices by KVK, Shivamogga. In all 120 trained farmers from 12 villages constituted the sample for the study. The findings revealed that the factors viz., to increase income from dairy by learning new practices (76.66%), to have contact with the extension agency (55.00%), to get self-employment by attending training programmes (44.16%) motivated the respondents to attend the training. The trained farmers expressed that constraints such as, financial problems (71.67%), shortage of green fodder during summer season (59.17%), low price for the milk (44.17%) and inadequate veterinary services (39.17%) are adversely effecting the dairy enterprise. Majority of KVK trained farmers sought more number of extension activities to be organized based on the needs of the farmers (75%), followed by, remunerative price for milk (72.50%).

Keywords: Training, motivation, self-employment, constraints, dairy farmers

Introduction

Training is an important input which can help farmers to practice techniques scientifically. It is the process of improving knowledge, skills and changing the attitude of an individual for doing a specific job. As the situation changes, people also need to acquire new knowledge, skills and attitude to cope up with the changing environment. Therefore, training has continued to be the most important mechanism for developing an individual's work efficiency. In India, various training institutions, like Krishi Vigyan Kendras (KVK), Agricultural and Veterinary Universities, Rural Home Science Centres, Khadi and Village Industries Centres, Rural Development and Self-Employment Training Centres,

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Agricultural Schools, Government and Non-Government Organizations and Development Departments are involved in providing training on various aspects to the farmers. One of the mandate of KVK is to organize need based training for farmers to update their knowledge and skills in modern agricultural technologies related to technology assessment, refinement and frontline demonstrations and other modern agricultural technologies. KVK, Shivamogga, Karnataka under the umbrella of the University of Agriculture and Horticulture Sciences, Shivamogga imparted training on dairy management practices to the needy farmers in its jurisdiction. The present study was undertaken to ascertain the motivational factors for attending KVK training, to understand constraints faced by farmers and to document suggestions offered by dairy farmers for improvement of dairy enterprise.

Objectives

- 1) To study the profile of the trained farmers.
- 2) To study the motivational factors for attending KVK training.
- 3) To analyse the constraints faced by dairy farmers.
- 4) To enlist the suggestions offered by dairy farmers for improvement of dairy enterprise.

Methodology

The study was conducted in Shivamogga district of Karnataka. KVK, Shivamogga conducted seven training programmes on dairy management practices for 293 trainees during the period 2012 to 2014. A list of villages was prepared and villages were selected using the criteria of availability of maximum number of trained farmers. In all 12 villages were selected and 10 trainees from each village who had reasonably enough time to adopt the practices (1 to 3 years after training) were randomly selected. Thus 120 farmers constituted the sample for the study. The information was collected from the respondents with the help of a structured interview schedule through personal interview method in an informal atmosphere. Ex-post facto research design was employed for the study. The profile of dairy farmers may be seen in Table 1.

Table 1. Profile of Dairy Farmers

N=120

Characters	No	Per cent
Education categories		
Illiterate	4	3.33
Primary school (1-4 standard)	15	12.50
Middle school (5-7 standard)	18	15.00
High school (8-10 standard)	43	35.83
College Education	40	33.33
Family type		
Nuclear Family	88	73.33
Joint Family	32	26.66
Occupation		
Agriculture	115	95.83
Dairy	120	100.00
Others(labor, business and services)	64	53.33
Agriculture	115	95.83
Annual Income (Rs.)		
Low (up to 30,000)	16	13.33
Medium (30,001-50,000)	20	16.67
High (50,001 & Above)	84	70.00
Land Holding (ha)		
Marginal (Up to 2.50)	48	40.00
Small (2.51 to 5.00)	52	43.33
Medium (5.01 to 10.00)	15	12.50
Big (Above 10.00)	5	4.17
Marginal (Up to 2.50)	48	40.00
Possession of Dairy Animals		
Cross breed cows/Bufaloes		
1 Owned	46	38.33
2 Owned	40	33.33
3 and above	20	16.67
Local Cows /Bufaloes		
1 Owned	29	24.17
2 Owned	13	10.83
3 and above	3	2.50

Extension Contact		
Low	21	17.50
Medium	96	80.00
High	3	2.50
Age		
Young (18-30 years)	28	23.33
Middle (31-50 years)	74	61.67
Old (Above 50 years)	18	15.00
Mass Media participation		
Low	38	31.67
Medium	60	50.00
High	22	18.33
Economic Motivation		
Low	25	20.83
Medium	30	25.00
High	65	54.16
Extension Participation		
Low	37	30.83
Medium	44	36.67
High	39	32.50
Management Orientation		
Low	31	25.83
Medium	85	70.83
High	4	3.33
Scientific Orientation		
Low	16	13.33
Medium	38	31.67
High	66	55.00

Results and Discussion

Motivational Factors for Farmers to participate in Dairy Training Programme

The data presented in Table 2 reveals that majority (76.66%) of trainees attended the training with a motive to increase their income from dairy by learning new practices. Trained farmers wanted to improve their animal rearing practices. Over half of the respondents (55%) attended training to have contact with the extension agency. The probable reason might be that KVK Shivamogga, other development departments and NGOs are working closely with the farmers. About 44.16 per

cent attended dairy training to get self-employment. Majority of the respondents 35.83 per cent and 33.33 per cent are educated up to high school and college level respectively. They opined that getting a government job is a difficult task these days and hence wanted to start dairying for self-employment. About twenty two per cent of the respondents attended training for having better social status in the village. In the context of Indian agriculture, the farmers have high consciousness on social status. In the society every individual wants to be recognized by others. Social status is partly related to the individual's participation in extension programmes. The above findings were in conformity with Pujar (1993).

Table 2. Motivational factors for participation in dairy training programme

(n=120)			
Sl. No.	Motivational factor	No.	Percentage
1	To increase income from the dairy by learning new practices	92	76.66
2	To get self-employment by attending training programme	53	44.16
3	To have contact with extension agency	66	55.00
4	For better social status	27	22.50

Constraints faced by Dairy Farmers

Financial problem was regarded as a major constraint (Table 3) revealed by majority of KVK trained farmers (71.67%). Scientific dairying requires high investment for purchase of crossbred cow /buffalo, concentrate feed mixture, construction of cattle shed, purchase of milking machine and sometimes for purchase of green fodder. Procedural difficulty in getting the loan and sometimes inadequate bank finance to purchase milch animals, are the other constraints. The primary agricultural cooperative societies were lending only for agricultural purposes but not for dairying. The financial assistance given by SHGs and NGOs is not sufficient to maintain a dairy. Dairy cooperative provides supply of some inputs at a subsidized rate, but is not extending the loan facility.

The problem of shortage of green fodder during summer season was expressed by 59.17 per cent of the respondents. Majority of the farmers are having small and marginal land holdings and are cultivating commercial crops like areca nut, ginger, banana and other plantation crops. They are not devoting part of their land exclusively for green fodder. Some of the farmers are growing green fodder on the bunds of their agricultural land, but this is not sufficient to feed the animals throughout the year.

Nearly 44 per cent of the respondents expressed low price for their milk as a constraint. Majority of the farmers sell their milk either to milk producers cooperative society or to local consumers in the village. The present price of milk is as low as Rs. 30/l. This price of milk is not remunerative. The other reasons might be high competition from big dairy units, low quality milk and lack of value added products.

Table 3. Constraints faced by Dairy Farmers

(n=120)			
Sl. No.	Constraints	No.	Percentage
1	Financial problem	86	71.67
2	Delay in milk payment	11	9.17
3	Inadequate knowledge of diseases and their control	13	10.83
4	Low price for the milk	53	44.17
5	High rate of milch animals	47	39.17
6	Low milk production	37	30.83
7	Shortage of green fodder during summer season	71	59.17
8	Inadequate veterinary services	52	43.33
9	High maintenance cost	46	38.33

Inadequate veterinary services in the village were expressed by 52 respondents (43.33%). The Veterinary hospitals are established in big villages. Hence, it is not possible for dairy farmers in far away villages to get timely treatment for their animals. Non availability of full fledged staff of primary veterinary centres is the other reason for inadequate veterinary service. Local magazines on dairy are essential to get appropriate information. However, due to lack of availability of veterinary literature in the village, dairy farmers could not get technical information. This might be due to lack of awareness among the people in the village. Consultancy service of private practitioners was observed to be expensive. The other problems namely high rate of milch animals (39.17%), high maintenance cost (38.33%), low milk production (30.83%), inadequate knowledge of diseases and their control (10.83%) and delay in milk payment (9.17%) were expressed by the respondents. Cross bred animals are costly and are more susceptible to diseases. Further they require high quantity and quality feed for milk production resulting in high maintenance cost on the other hand. Low milk production is due to maintenance of local animals and poor management practices. Inadequate

knowledge of diseases and their control is due to their ignorance and low extension participation. The delay in milk payment is due to inefficient management of the office bearers of some of the milk cooperative societies. Similar constraints have been identified by Mali (2013).

Support sought by Dairy Farmers for improvement

Suggestions offered by dairy farmers for improvement include organization of more number of extension activities based on the needs of the farmers (75%). The extension activities organized by KVK, development departments, cooperative societies and NGOs were not sufficient to cover the entire farming community and there is no follow up programme to refresh knowledge of respondents.

Remunerative price for the milk was sought by 72.50 per cent of the respondents. Present price of milk is Rs 30/liter which is not sufficient to manage the dairy successfully. Increasing herd size, production of premium quality milk, preparation of value added products, may provide remunerative price to the dairy farmer. Seventy percent of respondents sought the loan for the purchase of dairy animals to be increased and felt the need to create awareness about government schemes (70%). As the quantum of loan sanctioned by some of the banks is less than the actual cost of the animals, it becomes difficult for the respondents to pay the difference amount. The respondents at low socio economic level are not aware of the information about government subsidy schemes. Regular and timely supply of concentrate feed at reasonable rate was suggested by 55.83 per cent of the respondents.

Majority of the respondents are not cultivating green fodder due to non availability of additional land. They depend on feed concentrate supplied by dairy cooperative society. Search for non-conventional feed resources and Government support for establishing more cattle feed plants may address the issue. The need for providing better veterinary services was expressed by 45.83 per cent of the respondents. Veterinary services are not available in some of the villages. Wherever veterinary hospitals are available, they are under staffed. Increasing the number of seats in veterinary colleges for producing veterinary professionals and mobile large animal services might help the farmers in the near future. In addition non availability of full fledged staff of primary veterinary centres is the other reason for improper veterinary service. The above findings were in conformity with Mali (2013) and Khin Mar (2005).

Table 4. Support sought by Dairy Farmers for Improvement of Dairy Enterprise

(n=120)			
Sl. No.	Suggestions	No.	Percentage
1	More number of extension activities to be organized based on the needs of the farmers	90	75.00
2	Regular and timely supply of concentrate feed at reasonable rate	67	55.83
3	Loan amount for the purchase of dairy animals to be increased and need to create awareness about government schemes	84	70.00
4	Providing better veterinary services	55	45.83
5	Remunerative price for milk	87	72.50

Conclusion

Increase of income from dairy by learning new practices and contact with the extension agency were the most important motivational factors for dairy farmers to attend training programmes. The constraints expressed by the trained farmers include financial problems, shortage of green fodder during summer season, inadequate veterinary services and high rate of milch animals. Based on the observations, constraints of dairy farmers can be addressed by strengthening institutional linkages between development departments and financial institutions. KVKs should play a facilitating role to developing backward linkages for fodder and feed supply and to develop forward linkages for marketing of milk and milk products.

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Training Evaluation of Field Veterinarians: Implications for Scaling Up

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Abstract

This paper presents the evaluation findings on effectiveness of gynecological training programmes organized for field veterinarians in Andhra Pradesh. The key evaluation questions were on training methodology, relevance of course content, knowledge and skill improvement, utility of the topics and overall effectiveness of the programmes. The findings indicated a high relevance of the contents with overall increase of 29.03 per cent knowledge and skill gain by the participants. The findings also suggested that field veterinarians' competencies have been improved using a combination of theoretical, practical and field exposure sessions in an organized way. It is recommended to standardize the curriculum and scale-up training programmes to all field veterinarians as open education resources to update their competencies.

Keywords: Field veterinarians training, gynaecology, effectiveness, Andhra Pradesh, India

Introduction

The pattern of growth in crossbred dairy cows and graded buffalos as per recent census indicates a shift towards economically more efficient species in Andhra Pradesh. The expansion in bovines is less in populations of males than females, mainly because bovine draught power is being replaced with mechanization and the importance is on producing milk (Livestock Census, 2012). This demonstrates that the livestock sector in Andhra Pradesh is both expanding and adapting to emerging socio-economic and technological forces, with firm implications for veterinary service delivery (Rao *et al.*, 2015). While the bovine sector is registering phenomenal growth, several challenges remain unaddressed. One of these includes inadequate clinical competencies among field veterinarians (Hegde, 2010). To improve gynaecological competencies among field veterinarians, the Animal Husbandry Department (AHD) had

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designed and implemented a tailor-made training programme. The present study was taken up with the objective of evaluating the overall effectiveness of the training programme.

Methodology

Residential training programmes of six days duration on 'Gynecological competencies up-gradation' were organized at State Animal Husbandry Training Centre (SAHTC), Mandapeta. A total of 212 field veterinarians were trained in 13 batches. The data on inputs used in the training programmes in terms of money, human resources and training curriculum were obtained from office records. The effectiveness of the training programmes was measured in terms of change in knowledge and skills in Gynaecology using pre and post evaluation tests. The test items consisted of 50 objective questions on various aspects of gynaecology training curriculum. The scores were converted into percentages and average scores worked out for 13 training programmes. The feedback on various aspects of the training was obtained on 1 to 5 scale. The major learning outcomes and suggestions for improvement were also obtained from the participants and summarized.

Results and Discussion

Training Curriculum: The training objectives were to:

1. Refresh on anatomy and physiology of bovine female reproductive system.
2. Refresh on palpation of female reproductive tract, detection of heat mechanism, aberrations of heat, pregnancy diagnosis and differential diagnosis in bovines.
3. Refresh on important infertility problems of bovines, and
4. Conduct village survey, collect data, analyze and interpret results on field problems.

A critical evaluation of training curriculum revealed that, core gynaecological technical competencies were covered as per the training objectives with related topics from anatomy, physiology, pathology and process competencies (Box 1).

Box 1: Gynaecology Competencies up-gradation Training Curriculum

Technical Competencies: Anatomy of bovine female reproductive organs on slaughter house specimens; Physiology of female bovine reproductive system; Ovarian development and follicular dynamics; Rectal Examination - purpose, procedure, care & precautions; Heat behaviour, heat aberrations, palpable changes and pregnancy diagnosis; Differential diagnosis; Endometritis and latest protocols in treatment of uterine pathology; Anoestrus and its management; Oestrus synchronization; Repeat breeding, and; Cryo-preservation of semen, thawing procedures and handling of AI equipment.

Process Competencies / soft skills: Indian dairy industry - present scenario and SWOT analysis; Concepts of ideal dairy, farming practices/parameters; Data collection through household survey – purpose and procedure; Data consolidation analysis, interpretations and identification of focal areas of interventions. Presentations by participants (Group work); Field visit for hands on training and practice; Veterinarians role in enhancing livestock productivity; Tips for enhancing conception at field level.

Inputs: The total money spent on 13 training programmes was Rs. 2,39,200/- (Rs. 18,400 per training) towards reading material, slaughter house specimens, field visits, training material, working lunch, snacks. There were 212 participants and five faculty members from the training centre involved in 13 training programmes.

Training Methodology: The training methodology followed in all 13 training programmes is summarized under the following heads.

Training Manual and Disc: A manual prepared by covering all the aspects of the training curriculum was provided to each participant in addition to the text material from different sources. A compact disc with notes and all class-room presentations was also given to participants.

Pre and Post Tests: To see the difference in skills and knowledge gain, pre and post training tests were conducted using similar questionnaires covering all the aspects of the training curriculum. This helped the faculty to assess the trainees' perception level and to impart training in a systematic approach covering the contents.

Expectations: At the beginning of the training, trainees were asked to give their expectations from the training programme. During the sessions, special focus was given to the expectations of the trainees. At the end, it was discussed to confirm if the expectations were met.

Theory Sessions: The theory sessions were conducted as per the curriculum designed and were dealt using participatory and interactive learning methods. All audio-visual teaching aids were practically utilized in dissemination of knowledge. Special emphasis was to cover the focal areas of trainee's specific field application issues on bovine gynaecology. A special session on ethics/ motivation was also held in every training programme.

Field Survey: A field survey in each training programme was conducted by participants to assess the reproductive status of dairy animals in villages neighboring Mandapeta (within 40 km). The survey questionnaire contained questions relating to various management practices and reproductive parameters. The data were analyzed and conclusions were drawn about the reproductive health and status of the dairy animals in that village. The critical analysis and comparison of data with reference to the ideal parameters gave an understanding of the virtual field situation and the various corrective and adoptive methods to be implemented in future. Participants made presentations in groups on each village covered during the field survey.

Practical sessions: The practical sessions under each training programme covered the following aspects:

- a. *Slaughter house specimens:* During the training days, fresh specimens of bovine reproductive system were procured from slaughterhouse and presented to the trainees for palpation and observation of the utero-ovarian physio-pathological conditions. On the last day, the trainees were asked to make a blindfold examination of specimens and later to compare the same with visual observations for self-evaluation.
- b. *Fertility Camp:* The trainees were divided into two groups in every training programme and each group attended a fertility camp organized in connection with the training program along with one of the faculty members as facilitator. The camps were conducted in the same village, where the survey was conducted. There, each trainee examined animals and got on-field training from the faculty.
- c. *Exposure to Pathology Museum:* Trainees were taken to the museum of the institution and were exposed to different pathological conditions of the reproductive organs enabling them to visualize the wide variety of diseases and disorders of rare occurrence and enough text supplements provided on-spot to answer their queries.

- d. *Diagnostic Tests and Practice:* Different diagnostic tests were demonstrated to the trainees in bovine gynaecological practice viz. Fern pattern and bamboo stick pattern of oestral discharge, White side test for endometritis, pH of vaginal, cervical and uterine discharges, Prostaglandin induced milk flow test (PGIMF), Intra Vulvo Sub Mucosal injection of Oxytocin/ PGF2- α , and examination of stained smears of cervical discharge for phagocytes/ flagellates. Trainees were practically shown the application of rope in mechanical/ manual methods of managing pre and post partum prolapse. In each training program the obstetrical maneuvering methods, especially detorsion techniques were also demonstrated.

Impact of the Training

The data in Table 1 shows the knowledge score obtained by participants during pre and post training tests. It is evident from the data that as a result of the training, the mean knowledge score of the participants rose to 77.43 from 48.39 registering an average increase of 29.03 per cent. This clearly indicates the positive impact of the training programmes in improving the gynaecological knowledge among the participants.

Table 1. Impact of the Training on improving the Knowledge level

Training Batch	Pre-training	Post-training	Gain
1	45.33	72.67	27.34
2	40.33	67.67	27.34
3	38.43	69.41	30.98
4	45.33	74.00	28.67
5	41.57	81.17	39.6
6	47.33	74.67	27.34
7	60.00	80.00	20.00
8	50.37	83.33	32.96
9	47.59	80.37	32.78
10	59.78	83.11	23.33
11	43.33	81.66	38.33
12	53.53	77.84	24.31
13	56.19	80.71	24.52
Mean knowledge and skill gain	48.39	77.43	29.03
Standard deviation	5.14	5.22	5.75

The data further revealed that feedback on the training was perceived by the participants to be at high level in different components of training (Table 2). The mean feedback rating on overall components of the training programmes was

3.42 out of maximum possible score of 5, which indicates a scope for further improvement. The greatest feedback was in the areas of usefulness of the course (3.75), relevance of the course contents (3.69) and handling of sessions (3.63). Majority of the respondents (58.02%) felt that the duration of the training programmes was short, while 36.79 per cent of respondents felt the duration as sufficient.

Table 2. Feedback on different components of Training Programme

Sl. No.	Training Component	Average Rating on '5' Scale for 13 trainings (Maximum score 5 and minimum score 1)
1	Usefulness of the course	3.75
2	Relevance of the contents	3.69
3	Practical exposure during the programme	3.01
4	Handling of sessions	3.63
5	Facilities for training	3.61
6	Library facilities	3.41
7	Boarding facilities	3.23
8	Facilities for stay	3.20
9	Fulfillment of the objectives	3.22
	Mean rating on overall training components	3.42
10	Duration of the training	Sufficient : 78 (36.79%) Short : 123 (58.02%) Long : 11 (5.19%)

The results also revealed that participants had learned a few new technical and process skills while refreshing their prior knowledge and skills (Box 2).

Box 2: Summary of Learning Outcomes as perceived by the participants

- Oestrus synchronization
- Hormonal therapy
- Repeat breeding
- Endometritis
- Importance of field data collection
- Dairy farm management practices
- Heat detection
- Pregnancy diagnosis
- Palpation of ovaries
- Follicular dynamics
- Latest technological innovations
- Reproductive pathology

The participants of the 13 training programmes made several suggestions to improve the training in future. Various suggestions given for improvement of training, are summarized and presented in Box 3.

Box 3 : Suggestions for Improvement

Technical aspects

- Avoid longer hours in class-room teaching.
- Increase the duration of the course to 10 - 15 days.
- Increase practical exposure through clinical cases.
- Add embryo transfer technology demonstration in the course.
- Oestrus synchronization to be demonstrated.
- Fodder variety demonstration in the SAHTC premises.
- Provide more slaughter house specimens.
- Introduce yoga as part of training.
- Experimental animals required during training.
- Video clippings (preferably 3D) to be shown for various topics.
- Topics on surgical approaches for obstetrical problems to be included.
- More diagnostic methods to detect reproductive problems.

Competencies of field veterinarians need to be enhanced to handle the intensive livestock farming challenges which have arisen due to increased number of crossbred dairy cattle and upgraded buffaloes. Overall, veterinarians need to provide three types of integrated support to the livestock farmers (Rao and Natchimuthu, 2015):

- i. Delivery of the technical services (gynecological, surgical and medical and para-clinical health care of livestock).
- ii. To make available and provide access to input services such as artificial insemination, vaccines, medicines, equipment, instruments, feed *etc.* (to augment production and productivity) and,
- iii. Livestock extension and advisory services as process skills (to enrich the knowledge and improve the skills of farmers).

To provide integrated support efficiently, veterinarians need to have or attain core technical competencies, remain updated on emerging technologies and

demonstrate competency in their services by attending continuing veterinary education programmes. The organization of the training programmes by the SAHTC, Mandapeta is an effort in this direction to improve technical as well as process competencies related to the subject matter of gynaecology. The Planning Commission of India (Planning Commission, 2012) also emphasized that re-training of the field veterinarians, to brace for recent developments, is paramount and they should attend mandatory refresher courses every five years during their career.

The overall effectiveness of the training programmes can be further enhanced by following adult learning principles in the delivery of technical training sessions. Constructivism, experienced learning and humanistic theories explain adult learning during training programmes. The constructivism theorist stressed that the trainee should be an actor rather than a spectator and should be actively engaged in constructing knowledge, attitude and skills (KAS) for themselves (Dennick, 2008). The constructivist implications for further improving gynaecology training effectiveness include (Festinger, 1957; Bandura, 1977; Dennick, 2008): assertion and activation of prior KAS of participating field veterinarians; build on existing KAS and challenge misconceptions; use group work to facilitate peer learning; stress the context and situation (as practiced in the field visits in the current trainings), and use active learning techniques and give responsibility to trainees for their learning.

Experiential learning (Kolb, 1984) is very useful for training during case studies / exercises in gynaecology training sessions. The humanistic theories (Maslow, 1968; Rogers, 1983) provided the basis for trainee-centered or self-directed learning approaches to training. The implications of humanistic theories to further improve effectiveness of gynaecology training include: respect field veterinarians' background; use their KAS as a starting point for training; ensure physical and psychological conditions for learning in training; training and learning as a relationship between trainer and trainees and encourage field veterinarians to explore self-directed learning.

By following a mix of theoretical, practical and field based training methods, implications of adult learning theories have been taken care of partly by the training organization. However, training organizations need to build the capacities of trainers/ faculty from time to time in using adult learning methodologies besides technical subject matter for effective training of field veterinarians.

Conclusion and Implications for Scaling Up

The comprehensive evaluation findings on the Gynecological Competencies up-gradation residential training programmes of six days duration organized at SAHTC, Mandapeta in Andhra Pradesh are presented in this paper. The evaluation results indicated a high relevance of the training contents with an increase of 29.03 per cent of knowledge and skills among 212 participants in the areas of both technical and process competencies. To further improve the effectiveness of these trainings, the suggestions given by the participants need to be implemented wherever applicable. It is recommended to standardize and scale-up the gynaecology training curriculum using training methodologies embedded with adult learning principles.

The training programme can be scaled-up not only in Andhra Pradesh, but also in other Indian states using the training curriculum as an Open Education Resource (OER) enabled by information and communication technologies. OER generally means that the resource is freely available to others to reuse in different contexts (McMartin, 2008). Scaling up of gynaecology training programmes can follow the four 'R's (Hilton *et al*, 2010):

- *Reuse* – the most basic level of openness. The training faculty in the same institute or adjoining AHD training centres can be allowed to use all or part of the training curriculum and methodology freely in unaltered form (for example, recording the theory, practical and field visit sessions to view / listen to at a later stage or uploading all the sessions to AHD website for listening during free time).
- *Redistribute* – sharing gynaecology training sessions with other state training centres for use.
- *Revise* – adapt, modify, translate or change the form (for example, translating into other regional languages).
- *Remix* – take two or more similar gynaecology training programme contents and combine them to create a new training programme.

While progressing from the first 'R' to the fourth 'R', the openness as well as scaling up enhances and provides opportunities for new and innovative training programmes.

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Development of a Knowledge Test to Assess Knowledge Level about Improved Dairy Farming Practices among Users and Non-users of e-Agriservice in Maharashtra

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Abstract

Effectiveness of ICT-enabled e-Agriservice - aAQUA (Almost All Questions Answered) with special reference to dairy farming, was assessed in Maharashtra. Ex-post-facto research design was followed. This paper presents the procedure to develop a knowledge index for users and non-users to assess impact in terms of knowledge gain about Improved Dairy Farming Practices (IDFPs) by availing the e-Agriservice. The study was conducted in randomly selected four districts of Maharashtra. A total of 37 items or questions were framed on breeding, feed-fodder, health care and management aspects of the IDFPs. It was found that the items with difficulty index between 0.25-0.75, discrimination index above 20 and point bi-serial correlation significant at 5 per cent level of significance was selected for the knowledge test. Thus, a total of 29 items from 37 items were retained in the knowledge test. The study would be useful for researchers and academicians to develop and use the knowledge test in other areas to measure knowledge level of dairy farmers.

Keywords: aAQUA e-Agriservice; Difficulty Index; Discrimination Index; Improved Dairy Farming Practices (IDFPs), Knowledge test; Point Bi-serial Correlation.

Introduction

Agriculture plays a vital role in the Indian economy. More than 75 per cent of the rural population depend on agriculture and allied sectors as their foremost means of livelihood. In agriculture, livestock sector plays a multi-faceted role in socio-economic development of rural households and contributes about 4.2 per cent to the gross domestic product and 25.6 per cent to the agricultural gross domestic

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product in the country. In livestock, dairying has become an important secondary source of income for millions of rural families and has assumed the most important role in providing employment and income generating opportunities particularly for marginal and women farmers.

Empirical evidence indicates that livestock and dairying is an important component of the agriculture system, providing an additional source of income and nutritional cover to a large section of the rural population, particularly the disadvantaged and poor households (Rao, *et al.*, 2003; Birthal and Ali, 2005; Ravikumar and Chander, 2006; Singh, *et al.*, 2007). However, the rapid growth of milk production in India has been mainly because of the increase in the number of animals rather than that of improved productivity. This trend is mainly due to lack of knowledge about modern dairy management practices. The adoption of scientific dairy farming practices is necessary for increasing productivity and production with an aim to make dairy business more remunerative.

Adhiguru *et al.*, (2009) stated that farmers are looking for various information sources for carrying out their production and marketing tasks efficiently. In the present digital era, with the changing environment of agriculture and livestock sector, information and knowledge has increasingly become an important factor of production for effective decision-making (Birkhaeuser, *et al.*, 1991; Cash, 2001; Galloway and Mochrie 2005; Adhiguru, *et al.*, 2009).

In this backdrop, Information and Communication Technology (ICT) has the potential to change the economy of livestock and agriculture by providing information and knowledge to the farming community (Sasidhar and Sharma, 2006). ICT is necessary for accessing required information and knowledge (Richardson 1997; Chapman, *et al.* 2004; Anandajayasekeram, *et al.*, 2008; McNamara, 2009; Aker 2010). ICT based information delivery to livestock sector can significantly improve the knowledge level in livestock farming system. The Government of India has undertaken many such interventions to strengthen the information service delivery to the potential farmers. This study analyses the use of one such demand-driven ICT based information delivery system *i.e.* aAQUA e-Agriservice on various dairy farming practices. aAQUA (Almost All Questions Answered) e-Agriservice was launched by the Developmental Informatics Laboratory (DIL) at Indian Institute of Technology (IIT) Mumbai, Maharashtra in 2003 as an information system to deliver technology options and tailored information in response to the problems and queries raised by Indian dairy farmers.

Therefore, the present study was contemplated to develop and standardize a knowledge test for measuring the difference in knowledge gain of the users and non-users by availing the e-Agriservice. The study highlights the procedure for development of a knowledge test, which would contribute to scientific and policy discussions on ICT based extension delivery system.

Material and Methods

Sampling

Maharashtra state was purposively selected for the present study as the aAQUA e-Agriservice was launched as a pilot project in this state in 2003 and still continues to deliver its services to the farmers of this state. Four out of eight pilot districts (Pune, Nasik, Jalna and Amravati) were selected randomly. Thirty users of the e-Agriservice, from the beneficiaries list (provided by the service provider of aAQUA, Agrocom Software Technologies Pvt. Ltd., Mumbai) and 30 dairy farmers as non-users, , having similar kind of socio-economic status from each district were randomly identified and surveyed using pre-tested interview schedule.

Instrument

To find out the knowledge level of respondents, a knowledge test was developed after reviewing the available literature, discussion with the project staff and experts and Question-Answer forum of the aAQUA e-Agriservice particularly. “Knowledge gain” was operationalized as the amount of information possessed by the users and non-users about different aspects of IDFPs by utilising aAQUA e-Agriservice. Figure 1 shows the detailed procedure followed for the development of the knowledge test.

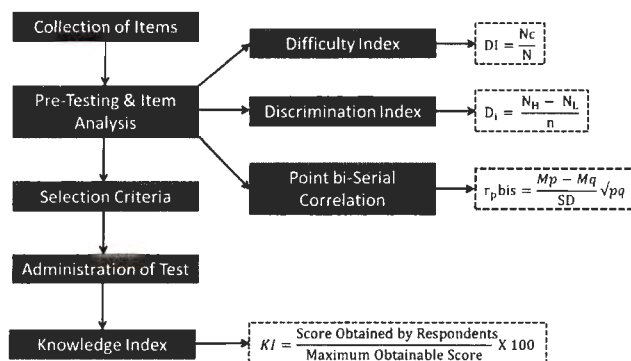


Fig. 1: Procedure followed for Knowledge Test Development

The content of the knowledge test is composed of questions called items. A comprehensive list of items about IDFPs was prepared using the following criteria: (i) It should promote thinking (ii) It should have certain difficulty and (iii) It should differentiate well informed from less informed. A total of 37 items/questions which were objective and dichotomous to facilitate easy and objective scoring were selected.

Item Analysis

A preliminary test consisting of 37 statements were administered to 40 non-sample population and their responses were obtained and subjected to difficulty index, discrimination index and point-bi-serial correlation as given below:

i) Difficulty Index: The difficulty of an item varies from individual to individual. When a respondent answers an item correctly, it is assumed that the question was less difficult for him. The assumption in this item, statistics of difficulty was that difficulty is linearly related to level of respondents' knowledge about IDFPs. The difficulty index for each of the 37 items was calculated by dividing the total correct responses for a particular question/ item by total number of respondents as follows:

$$DI = \frac{N_c}{N}$$

Where,

DI = Difficulty index

N_c = Number of respondents answering correctly

N = Total number of respondents

ii) Discrimination Index: If the item are answered by some respondents correctly and not by others, such item has greater power to discriminate more knowledgeable from less knowledgeable ones than another statement which is either answered correctly by everyone or none in the sample. In a way, the items carrying higher discrimination power implicitly indicate that such items are moderately difficult and they are the ones that discriminate between the ones who answer it correctly from those who are unable to do so. The discriminatory power of all the 37 items was worked out by the following method.

First, respondents were arranged in descending order on the basis of their performance in the whole test. Out of this list, top 25 per cent and bottom 25 per cent of the respondents were treated as high and low groups. Thus, 10 respondents' scores from each with highest and lowest group were used to evaluate the individual items. For each question, the number from both groups, who answered it correctly were counted. The discrimination index was calculated as follows:

$$D_i = \frac{N_H - N_L}{n}$$

Where,

D_i = Discrimination index

N_H = Number of respondents in 25% high groups who answered correctly

N_L = Number of respondents in 25% low group who answered correctly

n = Number of respondents in 25% sample

iii) Point Bi-serial Correlation: The main aim of calculating point bi-serial correlation was to work out the internal consistency of items that is the relationship of total score to a dichotomized answer to any given item. In a way, validity power of the item was computed by correlation of individual item of the whole test. Point bi-serial correlation for each item to preliminary knowledge test was calculated by using the following formula as given by Garrett and Woodworth (1969) and tested at $N-2$ degrees of freedom.

$$r_{p \text{ bis}} = \frac{M_p - M_q}{SD} \sqrt{pq}$$

Where,

$r_{p \text{ bis}}$ = Point bi-serial correlation

M_p = Mean of total scores of respondents (answered item correctly)

M_q = Mean of total scores of respondents (answered item incorrectly)

SD = Standard deviation of entire sample

p = Proportion of respondents answering correctly

q = Proportion of respondents answering incorrectly

Results and Discussion

After analyzing the responses, the items having difficulty index between 0.25-0.75, discrimination index above 20 and point bi-serial correlation significant at the 5% level were finally selected for the final knowledge test. Thus, finally a total of 29 items from the 37 items were retained for the final knowledge test (Table 1). For an individual dairy farmer, minimum and maximum knowledge scores were 29 and 87, respectively. Each trait was measured independently and overall knowledge was computed using the knowledge index.

$$\text{Knowledge Index} = \frac{\text{Score obtained by repondents}}{\text{Maximum obtainable score}} \times 100$$

Table 1. Difficulty, Discrimination Index and Point Bi-serial Correlation Values of Knowledge Statements about IDFPs

Sl. No.	Statements	Difficulty Index	Discrimination Index	Point bi-serial correlation
A.	Breeding Practices			
1	Name of popular cattle breed in your area	0.53	0.50	0.867
2	Name of popular buffalo breed	0.58	0.45	0.766
3	What is the correct maturity age of inseminating crossbreed heifer?	0.60	0.50	0.763
4	After how many days, a normal cow comes into regular heat?	0.50	0.40	0.532
5	What are the signs of oestrus (Heat)?	0.83	0.30	0.551
6	What is /are the breeding method(s) of improvement in your cattle and buffaloes?	0.78	0.30	0.467
7	How many times AI/ Natural service should be done in a heat cycle of dairy animals?	0.80	0.15	0.362
8	Which source is providing the frozen semen for A.I.	0.65	0.45	0.726
9	After how many days of insemination animal should be checked for pregnancy?	0.63	0.20	0.253
B.	Feeding & Fodder Production Practices			
10	How much of colostrum should be fed to newly born calf?	0.45	0.40	0.074

11	What should be fed daily to high yielding milch animals?	0.50	0.45	0.709
12	What are the different methods of enriching the poor quality wheat straw?	0.25	0.30	0.587
13	What is balance feeding?	0.60	0.50	0.763
14	How much milk is increasing by using of mineral supplementation to crossbred cows and buffaloes?	0.23	0.20	0.553
15	What is the performance of feeding mineral supplementation to cows and buffaloes?	0.33	0.30	0.654
16	Name some of the fodder crops which are highly suitable for your areas?	0.58	0.15	-0.229
17	How much average green fodder is required for an animal per day?	0.65	0.45	0.804
18	How much average dry fodder is required for an animal per day?	0.60	0.50	0.790
19	What is the Total Mixed Ration? If Yes, state some of its benefits.	0.35	0.30	0.572
20	What is the Complete Feed Block? If Yes, state some of its benefits.	0.30	0.35	0.572
C. Health Care Practices				
21	What are the common diseases against which vaccination should be done?	0.65	0.50	0.846
22	When is the vaccination done against the following diseases?	0.35	0.35	0.516
23	What are the important symptoms of H.S.?	0.48	0.45	0.879
24	What are the important symptoms of FMD?	0.53	0.50	0.867
25	What are the important symptoms of mastitis disease?	0.60	0.50	0.805
26	What are the causes of mastitis?	0.38	0.35	0.823
27	What are the different methods of disinfection?	0.68	0.50	0.858
D. Management				
28	What are the ways to resolve chronic reproductive problems in cows & buffaloes?	0.28	0.30	0.601

29	When should milking be stopped before next calving?	0.35	0.30	0.800
30	What are approaching signs of parturition?	0.23	0.30	0.587
31	What are the advantages of colostrum feeding?	0.88	0.15	0.467
32	What practices should be followed to get clean milk production?	0.73	0.45	0.805
33	What is the normal life of raw milk at room temperature?	0.43	0.45	0.790
34	What should be done to maintain the cleanliness of the cattle shed?	0.75	0.40	0.762
35	Which is the correct method of milking?	0.55	0.40	0.598
36	What is the appropriate timing for dehorning in calves?	0.45	0.45	0.843
37	Which one of these records do you know and maintain in your dairy farm?	0.85	0.15	0.441

Note: Selected statements are in bold font.

Conclusion

Information and communication technology is one of the effective approaches for agricultural development especially for agricultural extension. It is playing a significant role in supporting and facilitating demand-driven extension. To ensure the efficiency and explore the fullest potential of ICT, it is vital to know its significance among the farming communities. Therefore, the present developed knowledge test could be used to measure the farmer's knowledge gain through other ICT based projects for dairy development in rural India.

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