

JOURNAL OF AGRICULTURAL EXTENSION MANAGEMENT

Vol. XX

July - December 2019

No. 2



**National Institute of Agricultural Extension Management
Hyderabad**

Views expressed in the articles are of the authors
and not necessarily of the Institute.

- Editor

JOURNAL OF AGRICULTURAL EXTENSION MANAGEMENT

Vol. XX

July - December 2019

No. 2

CONTENT

- | | | |
|----|---|-----|
| 1. | Factors affecting the Practice of Sustainable Land Management
in East Gojjam Zone North west Ethiopia
<i>Biruk Yazie Wubetie and Birhane Anagaw Abebe</i> | 1 |
| 2. | Entrepreneurship through Market-Linked Extension:
Role of Institutional Innovations
<i>Patrick Cudney, Thomas S Lyons, Erin Moore, Sethuraman Sivakumar,
Jiju P Alex, K C Gummagolmath, Sunil Madan and Shalendra</i> | 17 |
| 3. | Determining Nutritional Status of the Rice Farmers Participating in
IFAD-VCD Programme in Niger State of Nigeria
<i>M.S Sadiq, I.P Singh, M.M Ahmad, B.I Usman, J.B Yunusa and
U. Ahmad</i> | 29 |
| 4. | Women participation in Agriculture in Developing Countries:
A systematic Review
<i>Beatrice Mbakaya, Dominique Ndegu and Balwani Mbakaya</i> | 43 |
| 5. | Farmers' Perception and Adoption of Soil Health Cards in Guntur District
<i>G. Sivanarayana and A.Lalitha</i> | 75 |
| 6. | Adoption of Improved Sericultural Technologies among
Farmers of Mizoram State
<i>J. Parameswaranaik , Lalhriatkima, G.R. Manjunatha
and V. Sivaprasad</i> | 83 |
| 7. | Constraints in Adoption of Extension Approaches by the Animal Husbandry
Department as perceived by Veterinary Officers in Four Indian States
<i>P. Lakshmi Manohari, Shahaji Phand and M. A. Kareem</i> | 91 |
| 8. | Standardization of Training Modules on Mushroom Cultivation Technology
<i>Mahantesh Shirur, Anupam Barh and Sudheer Kumar Annepu</i> | 103 |
| 9. | Impact of Dairy Cooperative on Women Empowerment:
A case of Nani Borvai village in Gujarat
<i>K.R. Sreeni</i> | 119 |

Factors affecting the Practice of Sustainable Land Management in East Gojjam Zone, North West Ethiopia

Biruk Yazie Wubetie¹ and Birhane Anagaw Abebe²

Abstract

Land degradation is a serious problem in Ethiopia in general and in the study area in particular. Although efforts have been made to achieve the objective of the sustainable land management program, the success is not comparable with the efforts the country has made; as a result the community's livelihood is highly affected and many households cannot always ensure their food security. Therefore, this study was conducted in East Gojjam Zone of Ethiopia with the objective of identifying factors affecting sustainable land management practices. To achieve this objective, a household survey was conducted by collecting primary data from a randomly selected sample of 140 household heads. Descriptive statistics like mean, percentage and standard deviation along with F- tests, χ^2 - test and binary logistic regression model were employed to analyze the data. The survey results indicated that about 40 per cent of the sample respondents were maintaining the available land management measures regularly, whereas 60 per cent of them did not volunteer and hence were not interested to maintain different mass constructed land management structures. The results also revealed that educational level, awareness on land degradation, participation, labor availability, extension contact, farm size and slope of the land owned were found to be positively and significantly affecting sustainable land management practices. Finally, community empowerment, genuine community participation and appropriate sustainable land management technologies specific to each agro-ecosystem zone of the area are recommended.

Keywords: Sustainable land management, Soil and water conservation, Binary logit model, East Gojjam

¹ Lecturer, Department of Rural Development and Agricultural Extension, College of Agriculture and Environmental Sciences, Bahir Dar University, Bahir Dar, Ethiopia

Corresponding author Email: birukyazie@gmail.com

² Lecturer, Department of Rural Development and agricultural Extension, college of Agriculture and Environmental Sciences, Bahir Dar University, Bahir Dar, Ethiopia

Received Date: 29-11-2019

Accepted Date: 11-12-2019

Introduction

Managing the land degradation has been the critical challenge for the economy in Sub-Saharan African countries including Ethiopia since their economy is highly dependent on subsistence rain fed agriculture. According to previous studies, Africa loses over 50 tons of soil per hectare and nearly 4 million hectares of forest land annually and these evidences indicate that the natural resources in the continent have been excessively exploited and resulted in land degradation which in turn affects their livelihoods (FAO, 2011).

The growing demand for natural resource bases leads to erosion, deforestation and other forms of land degradation, and the resultant global climate change are some of the key challenges in fragile mountain ecosystems to implement sustainable development and ensuring food security in Ethiopian highlands (Simane, 2012). Especially in the northern highlands of Ethiopia, the hills and mountains have suffered from loss of vegetation cover and fertile topsoil that only bare stones are left behind. It is evident that the thick masses of soil have been taken away by major rivers such as Blue Nile whose major tributaries originated from Ethiopian highland Mountains. Therefore, FAO has estimated an average rate of soil loss of 100 tons per hectare per year across the Ethiopian highlands (Simane, 2012).

The communities livelihood in the study area is highly dependent on agriculture, however, the development of this sector is hampered by land degradation mainly due to soil erosion and it accounts for the lion's share in reduction of agricultural production and productivity and food insecurity problem in the region. These problems are aggravated mainly due to new human settlements and intensive cultivation which are common on steep slopes and the farmers are highly dependent on traditional farming system with poor land management practices (Mitiku et al., 2006). Land management through soil conservation programs in the highlands of Ethiopia were premised on the notion that farmers did not perceive erosion and had little or no interest in combating it and hence, conservation programs relied on coercive approaches and performed poorly (Yohannes and Herweg, 2000). Failure to balance land management interventions with the current level of land degradation is still a growing challenge to smallholder farmers on the hill slopes to meet both immediate economic benefit objectives and a sustainable environment.

According to Kassie, et al. (2008), sustainable land management practices are knowledge intensive and soil and water conservation investment in the Nile basin of Ethiopia performed differently in different rainfall regions. This underscores the importance of geographical specific intervention when promoting land conservation technologies. The Ethiopian highland mountain range is the water tower of the region which is serving as the catchment of the upper Blue Nile basin to contribute more for the Ethiopian great renaissance dam. Many of the tributaries of the Blue Nile originate from these mountain ranges which include among others Gilgel Abay, Birr, Abaya, Gedeb, Chemoga, and Muga rivers. It is therefore the actual water tower of the Blue Nile that is the lifeline for the millions of people in Ethiopia, Sudan, and Egypt (Simane, 2012).

Traditional land management, including appropriate agricultural practices as well as good forestry practices have extensively protected the watersheds from accelerated erosion in the past but today's land abandonment as well as forest mismanagement has dramatically increased the frequency of intensive soil erosion events. Moreover, in the area there is high population growth which leads to expansion of cultivation of marginal lands and there is a new human settlement in a very mountainous area which depletes the main water tower of the watershed and biodiversity that leads to severe land degradation in the study area. Due to this reason the natural resource base mainly land, water and biodiversity are under intense pressure and the farming communities of the area are facing problems of food insecurity. In order to manage this problem, appropriate land management measurements particularly soil and water conservation intervention is plainly justifiable. However, despite the magnitude of the land degradation problem and the efforts made to address the issue in this area mainly in the past few decades, conservation technologies and practices are still not widely adopted and the success is not comparable with the efforts made. Thus, studies on the determinants of sustainable land management practices have significant importance. Specifically this study tries to address the following objectives:

1. To examine the level of community participation in sustainable land management activities on their farm lands and
2. To identify the major factors that affect sustainable land management practices.

Materials and Methods

Study Area

This study was conducted in East Gojjam Zone, Amhara Regional State, Ethiopia. As per the 2015 population projection using 2007 Census, East Gojjam Zone has a total of 2,496,325 (1,221,255 males and 1,275,070 females) population (Alemu et al, 2017). East Gojjam Zone has a total of four town administrations and 16 rural districts. The area includes the Choke Mountain watersheds found in the Blue Nile Highlands of Ethiopia, which extends from tropical highland of over 4000 m elevation to the hot and dry Blue Nile Gorge, including areas below 1000 m below sea level. Based on different parameters and characteristics like farming system, temperature, rainfall, soil type, adaptation potential and constraints, the area is divided into six agro-ecosystems with its respective characteristics. These include Lowlands of Abay valley (AES1), Midland plains with black soil (AES2), Midland plains with red soil (AES3), Midland plains with brown soil with sloping lands (AES4), Hilly and mountainous highland (AES5) (Simane, 2013).

Sampling Procedure and Sample Size

This study employed multi-stage sampling frame by considering agro-ecosystem zones of the study area rather than considering its geographical location. Therefore, firstly five agro-ecosystem zones (Lowland and valley fragmented, Midland plains with black soil, Midland plains with brown soil, Midland sloping lands and Hilly and mountainous highland) were purposively selected from six agro-ecosystem zones of the region for its relevance to the study; the sixth agro-ecosystem zone (Afro alpine- Choke protected area) was not considered since there is no human settlement there and it is also a protected area. Then one kebele (the smallest administrative unit in Ethiopia, equivalent to a ward) from each agro- ecosystem zone i.e. a total of five kebeles were selected randomly. A total of 140 sample household heads were selected randomly based on the size of each kebele i.e. proportional numbers of respondents were taken from each kebele.

Data Collection Methods

As a source, both primary and secondary data were used; primary data were collected through semi-structured interview schedule, focus group discussion, key informant interview

and direct field observation. These primary data were supplemented by secondary data mainly from books, journals and official reports.

Data Analysis Methods

The data were analyzed by frequency, percentage, mean, standard deviation, cross tabulation along with F-test; Chi-square test and binary logistic regression model.

The binary logistic regression distribution function for identification of factors which affect sustainable land management practices can be defined as:

$$Li = \ln \left[\frac{p_i}{1 - p_i} \right] = Zi = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_m X_m \dots \dots \dots (5)$$

β_0 Is the intercept, X is the explanatory variable, β_i is the slope while Z_i represents dependent variable. Multicollinearity test among explanatory variables was checked by variance inflating factor and condition index for continuous variables; and contingency coefficient for categorical independent variables were employed to check their collinearity. Finally, the parameters of the model were estimated using the iterative maximum likelihood estimation procedure.

Results and Discussion

Demographic Characteristics of Respondents

As shown in Table1, the survey result indicated that among the total sample household heads, 95 per cent were male and 5 per cent of them were female. The mean age of sample household heads was 46 years with standard deviation of 9.14. The family numbers of the sample households range from 2 to 9 persons, with a mean of 5 persons and standard deviation of 1.32. About 85 per cent of the total sample households have a family size of 4 and above persons per household head. The survey results also showed that almost 95 per cent of the respondents were married.

As the education level of household heads increases, it is expected to increase the ability of farmers to obtain, process and use relevant information to apply improved agricultural technologies in general and land management practices in particular. Concerning the educational level of sample household heads, the survey results indicated that about 45

per cent of the total respondents were illiterates, while the rest 55 per cent of the respondents could read and write; and no one has attended either primary school or secondary and above.

Table 1. Demographic characteristics of the farmers

Household characteristics		Percentage	Mean	St. deviation
Age		-	46	9.14
Family size		-	5	1.32
Sex	Male	95		
	Female	5		
Marital status	Married	95		
	Unmarried	1.7		
	Divorced	0		
	Widowed	3.3		
Religion	Orthodox	100		
	Muslim	0		
	Protestant	0		
Educational status	Illiterate	45		
	Read and write	55		

Economic and Land Characteristics of the Farmers

The annual income from crop production, livestock and income generated from non-farming activities was considered to enumerate the average income of the community. The results showed that, the highest income was generated from farming income (both crop and livestock) followed by non-farming activities. This indicates that the majority of households almost entirely live on cultivation of plots and growing various crop types. Across agro-ecosystem zones there were significant differences in land size, farming income and income from off-farm activities at $P < 0.01$, 0.01 and 0.05 probability levels respectively. This shows that there exists plot size dynamism which resulted in variation in productivity and income level as a whole.

The maximum income from crop (Ethiopian Birr 49,948, for which exchange rate is US \$ 0.031 or Indian Rs. 2.23) was obtained by those households who live in agro-ecosystem II (Mid land with black soils) (Table 2). This is because teff (*Eragrostis tef*), a staple crop for humans and also a forage crop is the major crop in this agro-ecosystem which is intensively produced and outweighs other crops in price. On the other hand, farmers who gain the minimum crop income (ETB 9,479) were those who dwell in agro-ecosystem IV (mid land with sloping lands). The reason for this is attributed to the fact that this zone is probably the most degraded with infertile and non-productive red soils.

Table 2. Economic Characteristics of Farmers across Agro-eco system zones

Note: *** and ** represent levels of significance at 1% and 5% probability

Agro-eco system	Economic Parameters		
	Mean(SD) Land Size (ha)	Mean(SD) annual Farm income (ET Birr)	Mean(SD) annual Off-farm income (ETB)
AES-1	1.78 (1.03)	26,880.91 (11,409.03)	4,28.57 (223.24)
AES-2	2.07 (1.25)	49,948.39 (29,928.80)	153.85 (81.23)
AES-3	1.74 (0.68)	22,277.32 (16505.80)	1,900.50 (907.62)
AES-4	2.39 (1.67)	9,479.09 (6,884.18)	1,609.73 (121.84)
AES-5	1.15 (0.34)	14,215.00 (10,655.08)	300.00 (101.45)
Total	1.85 (1.15)	22,807.96 (20,860.82)	1,183.02 (680.10)
F-Value	5.89***	28.54***	3.58**

Farmers' Awareness on Land Degradation Problems

Farmer's awareness about the existence of land degradation problems makes them construct and maintain Soil and Water Conservation (SWC) measures to manage their land. As high as 80 per cent of the households were aware about the severity of land degradation problem while the remaining 20 per cent of the households had no awareness about the problem of land degradation and its impacts. However, different evidences indicated that farmers awareness on land degradation has significant impact for sustainable land management practices.

Level of Land Degradation across Agro-ecosystem zones

The survey results revealed that farmers who reside in lowland and fragmented valleys (AES-1), midland with sloping lands (AES-4) and hilly and mountainous highland (AES-5) were found to be faced with severe erosion problem than farmers who are from other agro-ecosystem zones (AES- 2&3 which is midland plains with black soil and midland plains with brown soil respectively). The study results also indicated that farmers in different agro-ecosystem zones have different perception levels about land degradation severity; when the farmers perceive the land degradation problem, they are more likely to use different land management (soil and water conservation) measures on their land. The Chi-square test - (73.9***) indicated that land degradation levels across agro-ecosystem zones were significantly different in which agro-ecosystem 1, 4 and 5 have experienced high land degradation problem compared with other agro-ecosystem zones in the study area (Figure 1). Based on the information gained during the focus group discussion, deforestation, over grazing, over cultivation, poor agricultural practices and poor SWC measures were some of the major causes of land degradation problem explained by the respondents, of which deforestation, over cultivation, poor agricultural and SWC practices and over grazing were central to respondent's rankings.

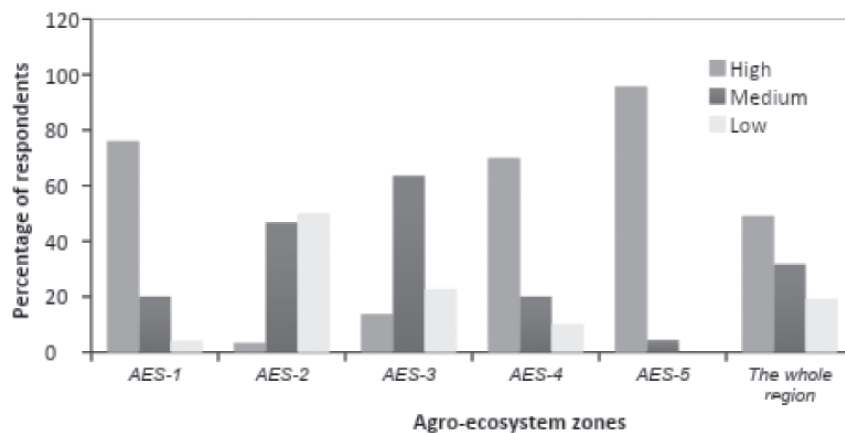


Figure 1: The level of land degradation across Agro-ecosystem zones

Community Participation in Sustainable Land Management Activities

Land management work is really worthy when it is effective and sustainable; and to be effective, it has to be carefully engineered; and to be sustainable, genuine community participation is imperative and in need indeed (Bewket, 2003). This study has understood that only 39 per cent of the households participated in sustainable land management practices particularly in soil and water conservation campaign voluntarily, whereas the rest 61 per cent of the sample respondents were forced to do the campaign work in mass by frustrating them as they were denied access to different agricultural inputs and other services. Among farm households who maintain conservation structures regularly, 88 per cent participated in sustainable land management works voluntarily. This implies that voluntary participation of communities is a vital component of sustainability of land management practices. Those farmers who participated willingly were more interested in the maintenance work of conservation structures than farmers who were forced to do so by external bodies (Bewket, 2003).

As shown in Figure 2, the participation level of respondents at planning stage of SLM programs was found to be low in the study area. The χ^2 -test showed that the participation levels of respondents at the planning stage between the two groups were also found to be significantly different.

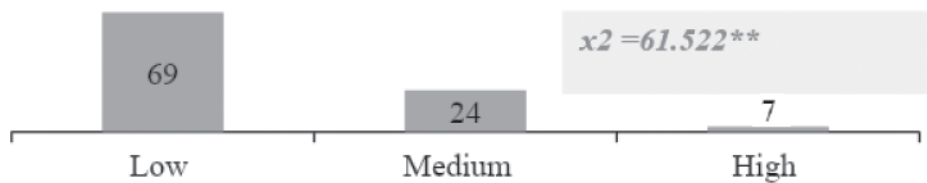


Figure 2: Community participation at planning stage of SLM practices

Current Sustainable Land Management Practices in the Study Area

Different types of sustainable land management measures were introduced to the study area with the objectives of conserving, developing and rehabilitating degraded agricultural lands and increasing food security through increased food production/ availability. Land conservation programs mainly targeted on farm lands, degraded lands and rehabilitation of gullies. The farmers are aware of different soil and water conservation measures such as soil bunds, stone bunds, fanya juu, bench terraces, contour cultivation, compost making, crop rotation, inter cropping. However, they are practicing only a few of them like crop rotation, cut of drain, intercropping, stone and soil bund, fanya juu and compost.

Benefits of Soil and Water Conservation in Crop Production and Productivity

Conservation is much more than a mere erosion control exercise but rather it has to have a wider scope of addressing agricultural production and productivity. The statistical t-test result showed that all crop type mean production in quintals were found to be significantly different at 1 per cent and 5 per cent level before and after the implementation of conservation structures in the same plots of land. The focus group discussants also reported that there is crop production and productivity increment after they practice soil and water conservation measures (Table 3).

Table 3. Crop Production per unit area before and after SWC works measured by Farmers view

Main Crop type	Cultivated land size (Hectare)	Total Production before SWC (Quintal)	Total Production after SWC (Quintal)	No.of Respondents	%	t-value
Teff	72.51	721	749.5	118	98.33	-2.865***
Mean	0.61	6.11	6.35			
S.D	0.47	4.22	4.24			
Maize	15.64	395.95	411.75	67	55.83	-2,129**
Mean	0.23	5.91	6.15			
S.D	0.12	4.34	4.38			
Wheat	24	349	365	56	46.67	-2.468**
Mean	0.43	6.23	6.52			
S.D	0.45	3.79	4.02			
Barley	8.64	128.5	138.25	28	23.33	-2.1738*
Mean	0.31	4.58	4.94			
S.D	0.19	2.05	2.15			
Sorghum,	13.33	207	222	24	20	-3.292***
Mean	0.56	8.62	9.27			
S.D	0.22	3.05	3.18			

, * significant at 5% and 1% level

Major Constraints of Current Land Conservation Practices

Regardless of a high level of perception about soil erosion problems, many farmers still have not adopted different land management technologies. Farmers were experiencing different challenges while practicing conservation technologies. During focus group discussion, the farmers pointed out that conservation structures have a problem of wasting of farmland, difficulties in turning oxen during ploughing, harbor rodents especially rats, and its labor intensiveness during construction and maintenance activities are among the frontline challenges raised by the farmers.

Logistic Regression Analysis on Factors affecting Sustainable Land Management Practices

Fourteen variables were hypothesized to affect sustainable land management practices in the study area and based on the output of the model through estimation of maximum likelihood, six variables were found to have significant impact on the SLM practices, whereas the remaining eight variables such as age, sex, family size, land ownership, off-farm income, and access/ use of credit, awareness on land degradation and distance to market were found to have insignificant impact. The results are interpreted through odds ratio and only those variables which have significant impacts on sustainable land management are discussed below.

Table 4. The Maximum Likelihood Estimates of the Model

Variable Name	Estimated Coefficient (B)	Significance level (sig.)	Odds Ratio Exp (B)
Educational status	1.014	0.045**	8.665
Farm size	-2.581	0.058*	32.323
Slope of land	2.073	0.016**	13.410
Participation on SLM	3.515	0.005***	21.9374
Labor availability	2.147	0.004***	24.172
Contact with extension agents	0.868	0.039**	6.335

***, **, * Indicate significance at 1%, 5% and 10% significance level respectively

Pearson chi-square _____ 115.06***

Hosmer and lemeshow test _____ 0.91 = significance level

-2 log likelihood _____ 49.653

R² _____ 78% - Prediction success

Based on the model output, education affects sustainable land management practices positively at 5 per cent significance level. The probability of educated farmers to use and

maintain land conservation structures were about nine times better than illiterate farmers and it can be justified that education influences technology adoption tendency of farmers by enhancing their ability to understand the practices and by improving their overall managerial ability in advance. These inferences confirm with the conclusions of the study by Getachew (2005).

Voluntary participation of the community in public campaign work of land management practices was found to be significant at 1 per cent level. By holding other variables constant, the probability of maintaining conservation structures was 22 times higher by volunteer participants than those of unwilling participant farmers. It implies that genuine participation of the community is an input for sustainable land management practices in deed and it is in line with the finding of Bewket (2003).

In this study it was found that, land size of the households has a negative correlation with sustainable land management practices at 10 per cent significance level. It implies that smaller the farm size, more likely that they manage their land better than their counterparts with larger farm size. It can be justified, as farmers are more likely to invest in managing the land when it is too small so as to reduce the risk of reduction of production due to degradation. This finding contradicts the findings of Aklilu (2006), who reported that farmers who hold large farms were found to be more likely to invest in land conservation and management technologies. Extent of slope of land was also associated with land conservation practices positively and significantly at 5 per cent significance level. The odds of farmers who cultivated sloping lands are 13 times more likely to manage their lands than those farmers who are cultivating relatively level/plain lands. This implies that farmers cultivating erosion vulnerable plots are alert to construct different conservation measures and further maintaining it to sustain their livelihood through sustainable management practices. Labor availability was found to have positive and significant association with land management practices and the finding indicated that more the labour available for the household, the more likely they are to engage in land conservation works. As the household labour is increased by one person, the probability of the household to engage in the land management work is increased with the factor of 24 as shown in the model output above. Frequency of extension agent contact was also found to have a positive relationship and it is significant at 5 per cent significance level. By keeping other variables constant, increasing

the frequency of contact by one term in a month, the probability of farmers to maintain land conservation structures will be increased by a factor of 6. Regular contact of the farmer with extension agents increased the probability of practicing land management technologies. A previous pocket study conducted in Ethiopia by Wagayehu (2003) reported that if there is close contact with the extension agents, the farmers are more likely to receive better information and technologies regarding sustainable land management.

On the other hand, age, sex, family size, land ownership, off-farm income, access/ use of credit, awareness on land degradation and distance to market were found to be less important factors in determining farmers' decision for sustainable land management practices.

Conclusion and Recommendations

Land degradation problem is a main challenge of the community and they are suffering a lot to sustain their livelihood through agricultural activities. Majority of farmers in the study area have perceived the problem of land degradation on their farm lands, however, it is not always a guarantee for adoption of sustainable land conservation and management practices. The levels of land degradation particularly soil erosion were significantly different across agro-ecosystem zones in which AES-1 and AES-5 were more vulnerable in respect of severe land degradation. Voluntary participation of the community in the process of public campaign work of land management practice through SWC was found to be low and hence local administrators forced them to do so as a mandatory work. Therefore, the practice was not participatory; particularly the planning stage of the practice lacks the active involvement of the local community at the grass root level. Sustainable land management practice is influenced by a couple of factors among which, education level, farm size, participation, labour availability and contact of extension agents were found to significantly influence farmers practices in the study area.

This study gives the direction for concerned stakeholders to design a strategy that can assure genuine local community participation at all levels of the process of land management intervention programs which is a vital instrument for sustainable management of natural resources including land and water. Further, to sustain the land management practices, current conservation technologies and practices should be delivered by considering the

specific agro-ecosystem nature of the area by avoiding the blanket supply/command for all areas because the severity and the nature of the problem is quite different across agro-ecosystem zones of the region.

Acknowledgement

I would like to thank and acknowledge my data collectors and supervisors for their great contribution in collecting my data genuinely.

References

- Aklilu, A and Jan de, G., (2006). Determinants of adoption and continued use of stone terraces for soil and water conservation in an Ethiopian highland watershed. *Ecological Economics* in press Pp.69-83.
- Alemu et al. (2017). Spatial variations of household food insecurity in East Gojjam Zone, Amhara Region, Ethiopia: implications for agro-ecosystem-based interventions, *Agriculture and food security*.
- Bekele, S. (1998). Peasant Agriculture and Sustainable land use in Ethiopia. Economic Analysis of Constraints and Incentives for Soil Conservation. Agricultural University of Norway. Dissertation no: 1998:1.
- Bewket, W. (2003). Land Degradation and Farmers' Acceptance and Adoption of Conservation Technologies in the Digil Watershed, Northwestern Highlands Ethiopia. Social Science Research Report Series –no 29. OSSERA. Addis Ababa.
- De Graaf, Jan (1996). The Price of Soil Erosion: An economic evaluation of soil conservation and watershed development. Tropical Resource Management Papers No. 14. Wageningen Agricultural University, Department of Irrigation and Soil and Water Conservation, Wageningen, The Netherlands.
- FAO. (2011). Sustainable land management practices. Available at: www.fao.org/docrep/014/i1861e/i1861e.pdf . Accessed on September, 2017
- Getahun Degu (2004). Assessment of factors affecting adoption of wheat technology and its impacts: The case of Hula Woreda. An M.Sc.Thesis Presented to the School of Graduate Studies of Alemaya University.24pp.
- Hurni, H. (1993). Land Degradation, Famine and Resource Scenarios in Ethiopia. In: Pimental, D. (ed.), *World Soil Erosion and Conservation*. Cambridge University Press, Cambridge.

- Kessler, CA. (2006). Decisive key factors influencing farm households' soil and water conservation investments. *Applied Geography* 26:40–60.
- Kessler, CA. (2006). Moving people-towards collective action in soil and water conservation's Experiences from the Bolivian mountain valleys. PhD Dissertation, Wageningen University. 2006.
- MoFED, (2002). Ethiopia: Sustainable Development and Poverty Reduction Program. Addis Ababa, Ethiopia.
- Simane, B. (2012). Building Climate Resilience in the Blue Nile/Abay Highlands: A Role for Earth System Sciences. College of Development Studies, Addis Ababa University, Addis Ababa, Ethiopia
- Simane, B. (2013). Agro ecosystem Analysis of the Choke Mountain Watersheds, Ethiopia. College of Development Studies, Addis Ababa University, Addis Ababa, Ethiopia
- Wagayehu Bekele (2003). Theory and Empirical Application to subsistence Farming in the Ethiopian highlands. PhD dissertation, Swedish University of Agricultural Science.
- Wagayehu Bekele (2005). Stochastic dominance analysis of soil and water conservation in subsistence crop production in the Eastern Ethiopian highlands: The case of the Hunde-Lafto area. *Environmental and Resource Economics* 32: 533-550.
- Wagayehu B and Lars D (2003). Soil and Water Conservation Decision of Subsistence Farmers in the Eastern Highlands of Ethiopia: a case study of the Hunde-Lafto.
- Yeraswork A (1988). Impact and sustainability study of WFP Assisted Project ETH 2488/II Rehabilitation of Forest, Grazing and Agricultural Lands. Addis Ababa. WFP.

Abbreviations

- AEZ: Agro-ecosystem zone
- CSA: Central statistics agency
- EDHS: Ethiopian demographic and health survey
- FAO: Food and agriculture organization
- SLM: Sustainable land management
- SWC: Soil and water conservation
- WHO: World health organization

Entrepreneurship through Market-Linked Extension: Role of Institutional Innovations

Patrick Cudney¹, Thomas S Lyons², Erin Moore³, Sethuraman Sivakumar⁴,
Jiju P Alex⁵, K C Gummagolmath⁶, Sunil Madan⁷ and Shalendra⁸

Abstract

In spite of tremendous agricultural growth, the challenge is to grow more food to feed the growing population. Innovations have the potential to offer solutions as per local needs and capacities of farming communities; though, technical innovations have to be pursued in association with institutional innovations for their inter-dependence. This paper presents some of the institutional innovations adopted by different organisations to enhance the reach of technology and services to end-users. Some of these models have their focus on innovator/ innovation while others on multiplication and distribution of technology. The focus of innovator-based models is mainly on the development of innovations while models with focus on multiplication and distribution aim at taking already developed technology to the end-users. Institutional arrangements to facilitate Scientist-Farmer interface can also help farmers collaborate to learn from each other. An analysis of the models covered under the study emphasizes on the importance of involving extension machinery in any institutional model adopted by an organisation, private or public, for both developing innovations and taking them to the end-users.

Keywords: entrepreneurship, innovations, market linked extension and institutional innovations

¹ Associate Director, MSU Extension, Michigan State University, (MSU), Michigan

² Professor and Director, MSU Product Center, Michigan State University (MSU), Michigan

³ District Director, MSU Extension, Michigan State University (MSU), Michigan

⁴ Senior Scientist, ICAR- Central Tuber Crops Research Institute (CTCRI), Thiruvananthapuram, Kerala

⁵ Professor, Kerala Agricultural University, Thrissur, Kerala

⁶ Director, National Institute of Agricultural Extension Management (MANAGE), Hyderabad

⁷ Outreach Specialist, International Programs, College of Agriculture and Natural Resources, Michigan State University (MSU), Michigan

⁸ Deputy Director, National Institute of Agricultural Extension Management (MANAGE), Hyderabad

Corresponding author Email: shalendra@manage.gov.in

Received Date: 28-11-2019

Accepted Date: 24-12-2019

Introduction

Agriculture has seen tremendous growth since independence in India. Agricultural extension has played a key role in enhancing production by providing knowledge, skills and technologies to the farmers and other stakeholders. Both public and private institutions have contributed immensely through their innovative approaches from time to time. The continuous support has helped farmers and entrepreneurs take their products to the competitive market for better price realisation. Still, the challenge is to grow more food to feed the growing population. Increased expenditure capacities of individuals on food items on account of economic growth and increased income will further expand demands. The challenges faced by agriculture are required to be addressed to achieve the goal of sustained production ensuring wellbeing of all the stakeholders.

Innovations have the potential to offer solutions as per the local needs and capacities of farming communities (Franz and Braun, 2016). Institutions can play an important role in producing innovation-oriented, yet practical solutions to local agricultural challenges (Jane, et. al., 2017). The role of institutions and partnership has also been identified by Ganguly et al. (2017) in their working paper on innovations spearheading the next transformations in Indian agriculture. Technological innovations can no longer be pursued separately from organisational and institutional innovations as each depends on the other. Institutional innovations are not only necessary to ensure the access and use of technological innovations but also to create an enabling environment which rewards grass root innovators for being creative and sharing their knowledge (Franz and Braun, 2016).

Institutional innovations are important not only in helping an innovator establish as an entrepreneur but also in enhancing the access of technology and service to a large number of end users. Taking the importance of institutional innovations into consideration, this paper attempts to compile some of the institutional innovations tried by different institutes to enhance the reach of technology and services. This will supplement the extension efforts of various departments. This compilation is based on the information shared and discussion held during the MSU-MANAGE International Conference on 'Agricultural Extension and Advisory Services - Innovation to Impact' organised during 12 - 14 February 2019 at MANAGE, Hyderabad.

MSU Product Centre

Michigan State University's (MSU) Product Centre is an outreach centre with the mission to support entrepreneurship in the food, agriculture and natural resource sectors of the Michigan economy. The Centre takes care of the skill requirements of aspiring entrepreneurs by providing them with training and coaching as per their needs at different stages of business development.

The Centre strives to build and maintain an ecosystem of support for its client entrepreneurs. At the field-level, there are appropriately trained certified Counsellors/Coaches to work with the entrepreneurs. These are Extension Educators, who dedicate a percentage of their time to the Product Centre. When the counsellors are unable to help a client with technical challenges, they refer the entrepreneurs to the Centre's Campus Staff. When the client's need goes beyond the capability of the Campus Staff, they are referred to other experts available at MSU.

The Product Centre facilitates clients in having access to University resources such as the expertise resident in the Department of Food Science and Human Nutrition, School of Packaging, Department of Agricultural, Food and Resource Economics, Eli Broad College of Business, College of Communication Arts & Sciences, College of Law and Centre for Regional Food Systems among others. The Centre has staff with expertise on a wide range of subjects enabling it to extend support to clients all along the process of business development (Exhibit 1).

Exhibit 1. Details on the expertise available at the Centre and support extended by it to clients

Expertise available at the Centre	Type of support extended by the Centre
* Agricultural Economics	* Business concept development
* Market Research	* Business planning
* Policy Analysis	* Entrepreneur coaching
* Food Science/Food Safety	* Marketing and market research

* Nutrition	* New product development and testing
* Food Processing	* Packaging
* Packaging	* Labelling (Nutrition facts and package design)
* Agri-Food Supply Chain	* Food safety
* Entrepreneur/Business Development	* Making connections with retailers and distributors
* Economic Development	* Feasibility assessments
	* Cooperative development services
	* Impact assessment

In the process, a comprehensive system has evolved with provisions for integrating information and knowledge available with different departments/organisations, thereby making the entire initiative work for the emerging entrepreneurs. The Centre has also developed a facility, called the Food Processing and Innovation Centre, with equipment, infrastructure and food safety licenses to help entrepreneurs develop and validate products and obtain consumers' feedback before making business decisions and investment. The Product Centre offers a complete end-to-end solution to help develop new ideas into full-fledged commercial sustainable enterprises.

MSU Extension's Role with Agriculture Incubators

MSU Extension, as a long-standing partner with local governments, has developed a relationship with an Agriculture Incubator - whose focus is to develop local, marketable innovations, find investors and ultimately, create thriving businesses. The Incubator was established with funding from a local government with the intent to drive job creation, and functions as a private entity. MSU Extension works with the Incubator as an established partner, representing higher education and research-based programming. The partnership model emphasizes outreach to the agricultural community and referral of agricultural entrepreneurs back to the Incubator. The initiative utilizes the long-standing relationship

and reputation that Extension Educators have with the agriculture community to reach individual local farmers for identifying innovations.

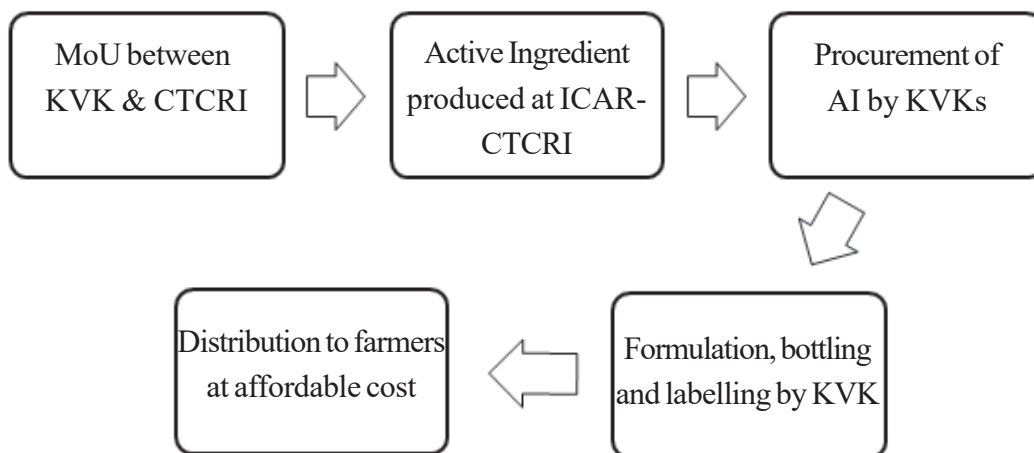
The role of an Extension Educator is to identify local innovations and refer the same to business developers for the rest of the process of development, validation and multiplication. The initiative helped in identification, validation and commercial multiplication of the technologies, though, on occasions, the process of development got deterred by lack of funds availability.

The institution with a focus on incubation has had its positive points like improved reputation but is challenged by various limitations like scarcity of local innovations, difficulty in bringing different organisations and agencies together, inconsequential differentiations of small innovations and inconsistent funding.

ICAR- Central Tuber Crops Research Institute

ICAR- Central Tuber Crops Research Institute (ICAR-CTCRI) has adopted different institutional arrangements for the commercialization of technology in agriculture. The models are being implemented by the Intellectual Property and Technology Management Unit (IPTMU) of the institute along with the Extension and Social Sciences Section. The Unit has a Committee called the Intellectual Property and Technology Management Committee (IPTMU), which is responsible for making different decisions related to IP management and transfer and commercialization of technology. The first model "Contract Manufacturing System" for the distribution of bio formulations with pesticidal properties adopted by the Institute addresses the challenge of developing cost effective production and distribution network of technology. Under the initiative, Krishi Vigyan Kendra (KVK) which is an extension agency operating at the district level, is being used for mixing and distribution of bio-formulations to farmers. Production of the active ingredients and training are the responsibility of the ICAR institute while its multiplication and distribution at affordable prices is the responsibility of the KVK. The advantage of this model is that it helps the farmers to get access to bioformulations at non-commercial prices in their locality (Figure 1).

Figure 1. Taking Biopesticides to Farmers through KVKs Contract Manufacturing System

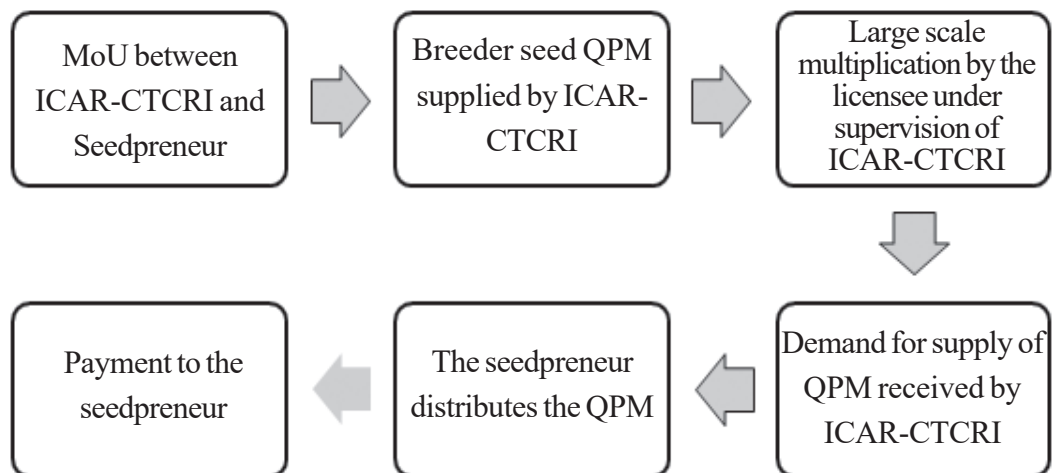


Some of the basic conditions for the association between ICAR-CTCRI responsible for research and product development and KVK responsible for production and distribution are as given below:

- * License fee - Rs 25000/- (USD 354)
- * Period - Five years
- * Technology knowhow - Formulation of Active Ingredient

Another model dwells with developing entrepreneurs for multiplication and distribution of the already developed and tested technology by the research institute. Most of the time, the research institutes are set-up with a focus primarily on research and have a weak link for commercialization of technology. ICAR-CTCRI has successfully experimented with a Public - Private - Partnership model for developing seedpreneur for multiplication and distribution of quality planting material developed by the research institute (Figure 2).

Figure 2. Creating Sustainable Seedpreneurship for Production and Distribution of Quality Planting Material through PPP Mode



The terms and conditions laid down for such association are defined as under -

- * License fee - Rs 25000/- (USD 354)
- * Period - Three years
- * Supply of seed materials by ICAR-CTCRI at current prices
- * Field supervision arranged by seedpreneur (Based on Seed Certification Standards)
- * Royalty - 2% on profit

Technology Incubation Centre is another "Pay-and-Use" model adopted by ICAR-CTCRI with focus on providing training and infrastructure support for developing value added products. The Centre provides equipment on rent for the development and testing of technologies and products before their full scale production.

Village Incubation Centre, another model, is about offering technological solutions with the locally available resources. The Centre provides local need-based training to help

participants develop solutions for their local problems and optimally utilise the available resources. Multi-Institutional Collaborative Village Incubation Centre created at Riha, Manipur (India) in 2015 is having 150 users from two villages. The Centre is generating a revenue of Rs 25000 per year (on an average) since its inception. The Incubation Centre is managed by KVK, Ukhrul, Manipur. However, a need for scaling up with strong market linkages was felt to make the technologies profitable. The multilevel engagement with stakeholders has improved technology development and its transfer process. Such models are suitable to meet demands before a full business model is worked out.

Scientist-Farmer-Interface Programme

Kerala Agricultural University has experimented with a Scientist-Farmer-Interface Programme. The Programme, facilitated by the extension workers, helps in establishing an interface between scientists and selected prominent farmers to work out solutions for local problems. Under the programme, the University organizes discussions to offer case-to-case solutions. There are prominent lead farmers selected from different Gram Panchayats under the programme. These selected farmers use the platform developed for sharing information under the Scientist-Farmer-Interface for bringing their problems as well as the local problems for discussion. The multi-disciplinary team of scientists discusses the problems shared by the lead farmers and suggests case-specific solutions. The solution emerging from the discussion is taken by these prominent lead farmers to the rest of the farmers in the locality. The model is depicted in Figure 3.

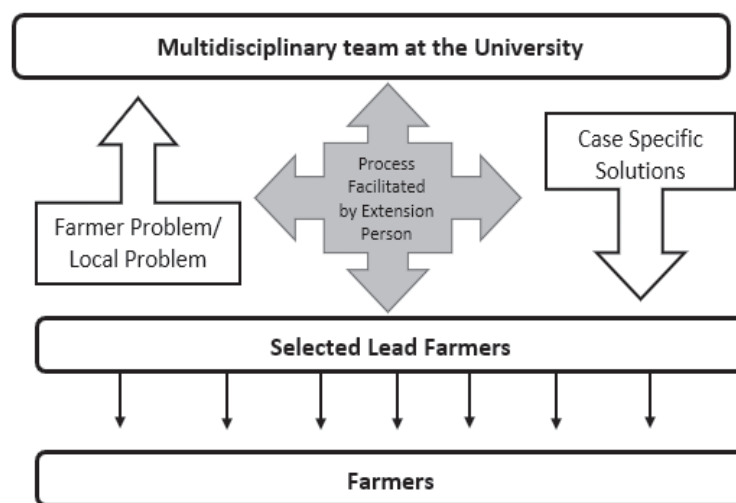


Figure 3. Depiction of Scientist-Farmer-Interface Program

It emphasises on the need of utilizing rural institutions for planning and implementation of development projects at the grass-root level. There is also a need to map the skill requirements of extension professionals in the context of grass-root-level planning and making appropriate arrangements for their training and certification.

Conclusion

Globally, the governments are trying to create a conducive environment by encouraging linkages of agriculture with commercial principles, creation of sufficient infrastructure to support processing and post-harvest management and developing partnership between different players/agencies all along the value chains as per their capabilities and strengths. However, institutional innovations are going to play an important role in the identification and validation of technology with the potential to provide localised solutions and taking the same to end users. However, it is challenging to have an arrangement with the ability to influence the entire process of development and distribution of potential technology. The different models discussed also have their own area of focus. Product Centre and MSU's extension based models have their focus on innovator/innovation. The ground level linkages established under the models in the form of certified counsellor and extension educator help in identifying the innovator/innovations and integrate the same with the rest of the process covering development, validation, multiplication and distribution of innovations. Though, the responsibility of taking the technology to the end user lies primarily with the innovator, there are provisions to provide linkages with retailers and distributors.

In contrast, institutional arrangements made by ICAR-CTCRI focus mainly on taking the technology to the end users in partnership with an agency having ground level presence. The model adopted by ICAR-CTCRI is about identifying the appropriate partner and sharing technology for multiplication and distribution. The model allows ICAR-CTCRI to focus on its strength i.e. research and outsource the component of production and distribution. Under this arrangement, two agencies with their interest and strength are coming together to efficiently deliver the technology to the end users (Exhibit 2).

The strength of innovation-based models like Produce Centre lies in having backward and forward linkages with appropriate institutes. The linkages established with ground level workers like Extension Educator/Counsellor help in identifying and linking the potential

innovator/innovation with the Centre. Its forward linkages with other resources available at the University and linkages with retailers and distributors make it a comprehensive model for identification, development, validation, multiplication and distribution of innovations. This helps in making the innovations available to masses. The entrepreneur is also able to make profits for the innovation and efforts.

Exhibit 2. A component-wise Analysis of different Institutional Models

Components	Product Centre	Extension Based Model	ICAR KVK	ICAR Entrepreneur
Focus	Innovator	Innovator	Technology distribution	Technology distribution
Process will revolve around	Technology, product or service development and its testing	Technology, product or service development and its testing	Identification of extension agency (KVK) and sharing technology for production and distribution	Identification of entrepreneur and sharing technology for production and distribution
Tools for achieving desired results	Training Product development Testing and validation	Identification Validation Multiplication	Agency identification MOU Multiplication and distribution	Entrepreneur identification MOU Multiplication and distribution
Structure	Three tier	Multi-agency	Partnership for endpoint access	Partnership for endpoint access
Infrastructure	Provide	Link to source	Technology only	Technology only
Ground Level Link	Certified Counsellor	Extension Educator	Nil	Nil

The focus of innovator-based models is mainly on the development of innovations. Multiplication and distribution is relatively a weak link in case of ICAR and similar organizations having focus on research and development of technology. Institutional

arrangements can be worked out by involving other public agencies having ground presence or private agencies for multiplication and distribution of already developed technology to the end-users. Institutional arrangements can also help farmers collaborate and learn from each other as suggested by the Scientist-Farmer-Interface of KAU which utilises farmers to take the solutions to other farmers.

Recommendations

Institutional arrangements are important in identification and development of innovations and to take developed technology or services to the end-user as a solution. Some of the recommendations based on the learnings from models discussed in the previous sections are listed below:

- (1) The innovators need continuous hand-holding through different stages of the business cycle to help them develop their idea into a sustainable business. Linkages with extension machinery present at ground along with forward linkages with knowledge centres may help an institute to offer an end-to-end solution to the innovators. An integrated approach with KVK scientists linked to knowledge centres like Universities and ICAR Institutes can help in developing a comprehensive system to nurture local innovations.
- (2) The innovators will need different sets of skills at different levels of business development. The support institute needs to have a mechanism to provide appropriate training based solution to the innovators as required by them at different stages of business development.
- (3) There is a need for different kinds of models for developing ideas coming from a wide range of innovators with potential to offer solutions to different target groups. A partnership model with public institutions responsible to develop and validate innovations and private individual or institutions responsible for distribution is suggested for this purpose.
- (4) There is need to collaborate with the rural democratic institutions under local self-governments for widening the interface between extension agencies and other user categories, particularly the small and marginal farmers.

- (5) Extension machinery is required to be roped in effectively in both kind of models. In innovation-based models, extension machinery may help in identifying innovations with potential to offer solutions to local issues. Extension system will equally be useful and effective in taking the already developed technology to end-users through multiplication and distribution.

References

- Franz W. Gatzweiler and Joachim von Braun (ed.) (2016). Technological and Institutional Innovations for Marginalized Smallholders in Agricultural Development. Springer. <https://link.springer.com/content/pdf/10.1007%2F978-3-319-25718-1.pdf>
- Ganguly Kavery, Ashok Gulati, Joachim von Braun (2017). Innovations spearheading the next transformations in India's agriculture. Working Paper 159. Centre for Development Research, University of Bonn
- Jane G. Payumo, Evelyn Akofa Lemgo and Karim Maredia (2017). Transforming Sub-Saharan Africa's Agriculture through Agribusiness Innovation. Global Journal of Agricultural Innovation, Research & Development, 2017, 4, 1-12

Determining Nutritional Status of the Rice Farmers Participating in IFAD-VCD Programme in Niger State of Nigeria

M.S Sadiq¹, I.P Singh², M.M Ahmad³, B.I Usman⁴, J.B Yunusa⁵ and U.Ahmad⁶

Abstract

Most of the research on the impact of agricultural programmes on food security of farming households in Nigeria has been centered on the expenditure without having a critical investigation of the diet composition of the farmers. It is in this context that this research was conceptualized to study the nutritional status of the rice farmers participating in IFAD-VCD programme in Niger State of Nigeria. A representative sample size of 111 active participating farmers was selected and data was collected from the chosen farmers through a structured questionnaire, complemented with an interview schedule. The collected data were analyzed using both descriptive and inferential statistics. The results showed that the programme had an impact on the nutritional status of the participants, as their calorie intake per-head/day, after participating in the programme exceeded the recommended benchmark of 2250kcal/head/day for sub-Saharan Africa by 60.82 per cent. However, the recommended calorie consumption of the farmers was observed to be affected due to large household size, high dependency ratio, fear of default and delinquency owing to credit, non-effective extension service delivery owing to poor motivation of change agent and fear of managerial inefficiency in resource allocation owing to farming experience. Therefore, the study recommends that both public and private organizations with an agricultural mandate should make provision of consumption credit so as to enhance availability, utilization and stability of farm family food security in the studied area.

Keywords: Balanced diet, Calorie, Rice farmers, IFAD-VCD, Niger State, Nigeria

¹ Principal Scientist, Department of Agricultural Economics & Extension, FUD, Dutse, Nigeria & Department of Agricultural Economics, SKRAU, Bikaner, India Corresponding author Email: sadiqsanusi30@gmail.com

² Professor, Department of Agricultural Economics, SKRAU, Bikaner, India

³ Professor, Department of Agricultural Economics, BUK, Kano, Nigeria

⁴ Lecturer II, Department of Agricultural and Bio-Environmental Engineering, Federal Polytechnic Bida, Nigeria

⁵ Research Fellow, National Cereal Research Institute, Badeggi, Nigeria

⁶ Research Fellow, National Cereal Research Institute, Badeggi, Nigeria

Received Date: 03-09-2019

Accepted Date: 11-12-2019

Introduction

The continent of Africa with 52 countries is one with incredible opportunities in the face of many challenges. Johns (2002) reported that the continent is distinct owing to its diverse land topography, various agro-ecological climates and food diversity of over 150 food crops, of which 115 are indigenous. The population at an estimated 800 million and with the youngest population bulge, has quadrupled in the last 50 years with a low life expectancy of below 50 years of age in many countries and unacceptable rates of maternal and child mortality. Furthermore, income disparity in the continent has been on the increase in the last decades which directly affected those who are food insecure and hungry.

According to Behrman et al. (2001), sub-Saharan Africa is known to be the home to some of the most nutritionally insecure people in the world, owing to poor infrastructure and limited resources, compounded with conflict, HIV and poor access to health services, thus contributing to the staggering levels of malnutrition and food insecurity in the continent. Despite these enormous challenges, some countries in Africa are making progress towards food and nutrition security, and there has never been a better time to work towards improved human development that has nutrition as a goal (Watson and Andersen, 2010).

For many years, food security was simply equated with enhancing the availability of food, and was linked to innovations in agricultural production. While food availability is clearly important to achieving food security, having the means to effectively access and utilize quality food remains central to good nutrition (Negin et al., 2009). The issue of access to high quality nutritious foods has become a major challenge for many individuals living in Africa. Most diets, in the sub-Saharan Africa consist mainly of cereals or root staple crops, and very little of animal source proteins, micronutrient rich vegetables and fruits, and quality diversity of the food basket. These foods are either not accessible because of high cost, are locally unavailable, unequally distributed within households or are not considered household priorities when incomes are not sufficient to meet the needs of a high quality diet (Chastre et al., 2007).

Most of the empirical research conducted on the impact and effects of agricultural programmes in the study area in particular and the country in general with a focus on rural

households' food security, dwell on the expenditure in determining the wellbeing of farmers without looking inward on their nutritional status, which have significant effect on the quality of their lives. Therefore, it becomes imperative to look critically into the food and nutrition of the farm family in order to have a healthy farming population, which is a precursor for productive agriculture as "good health is wealth".

Poor nutrition arises from multi-faceted and interrelated circumstances and determinants. An individual's nutritional status can be affected by circumstances within the household and the community as well. The other intermediate causes include household food insecurity through agricultural production and income, inadequate care for children and women, unhealthy household environment and lack of accessible health and education services. The immediate causes e.g. inadequate dietary intake, water and sanitation and related diseases, lack of necessary knowledge, directly affects an individual, with disease perpetuating nutrient loss and poor nutritional status. Even without the disease burden, children with inadequate nutrient intake will not grow sufficiently and are at risk of irreversible stunting (Golden, 2009; Victora et al. 2008). To meaningfully incorporate the nutrition elements into the concept of food security, it is quintessential to ensure "adequate protein, energy, vitamins and minerals for all household members at all times".

Research Methodology

Niger State is located at latitudes 8°20'N and 11°30'N of the equator and longitudes 3°30'E and 7°20'E of the GMT. The agro-ecological zone of the State is northern guinea savannah with a fringe of southern guinea savannah in Mokwa LGA. The major occupation of the inhabitants is farming and it is complemented with civil service jobs, artisanal, craftwork, Ayurveda medicines and petty trade. By using a structured questionnaire complemented with an interview schedule, field survey data of 2018 cropping season was elicited from a total of 111 rice farmers sampled through multi-stage sampling design. In the State, only five (5) Local Government Areas were chosen as the pilot phase for the programme with Agricultural Zone A (Bida) and C (Kontagora) having two LGAs each namely Bida and Katcha; and, Wushishi and Kontagora respectively, while Zone B has one participating LGA viz. Shiroro.

In the first stage, for Agricultural Zone A, one LGA viz. Katcha LGA was randomly selected; for Zone B the only participating LGA i.e Shiroro LGA was automatically selected;

while for Zone C, Wushishi LGA was purposively selected based on its comparative advantage, as rice is produced throughout the year owing to the presence of Tungan-Kawo irrigation dam. In the second stage, two villages were randomly selected from each of the participating LGAs. Thereafter, two active co-operative associations from each of the selected villages were randomly selected. It is worth to note that Microsoft excel in-built random sampling mechanism was used for the random selection of the villages and the co-operative associations. In the last stage, using the sampling frame obtained from the IFAD/VCD office (Table 1), Cochran's formula was used to determine the representative sample size. Thus, a total of 111 active rice farmers formed the sample size for the study. The collected data were analyzed using descriptive statistics, t-test and Tobit regression model. The Cochran's formula used is shown below:

$$n_a = \frac{n_r}{1 + \frac{(n_r - 1)}{N}} \dots\dots\dots (1)$$

$$n_r = \frac{(1.96)^2 pq}{e^2} \dots\dots\dots (2)$$

Where:

n_a = adjusted sample size for finite population

n_r = sample size for infinite population

N = population size

p = proportion of the population having a particular characteristic

$q = 1 - p$

e^2 = error gap (0.07)

Thus, $p = 0.40$ and $q = 1 - 0.40 = 0.60$

Table 1. Sampling Frame of Participating Farmers

LGAs	Villages	Co-operative Associations	SF	SS
Katcha	Baddegi	Managi Badeggi Farmers CMPS	24	10
		Aminci Ebanti Twaki CMPS Ltd	25	10
	Edostu	Edotsu Co-Operative Credit & Marketing CMPS	25	10
		Edotsu Jinjin WugakunYema CMPS	25	10
Shiroro	Baha	Baha Abmajezhin Cooperative Multi-Purpose Society Ltd	15	7
		Abwanubo Najeyi Development Association	18	8
	Paigado	Paigado Achajebwa Development Farmers Soc.	25	10
		Paigado Farmers Cooperative Society Ltd	25	10
Wushishi	Bankogi	Bankogi Alheri Farmers Coop. Multipurpose Soc Ltd	22	9
		Bankogi GwariNasara CMPS	16	7
	Kanko	Kanko Arewa Farmers	25	10
		Kanko Unguwar Ndakogi Cooperative Multipurpose Society Ltd	25	10
Total			270	111

Source: IFAD-VCDP farmers' database, 2018

Note: SF and SS mean sampling frame and sample size respectively.

Food Consumption Score (FCS)

In order to measure food security, the food consumption score (FCS) developed by WFP, (2009) and adopted by Rahman and Noman (2019) was used (Table 2).

Table 2. Food Groups and their Weights

Food Items	Definitive	Weight
Maize, maize porridge, rice, sorghum, millet pasta, bread and other cereals; Cassava, potatoes and sweet potatoes, other tubers and plantains.	Main staple	2
Beans, Peas, groundnuts and cashew nuts	Pulse	3
Vegetables, relish and leaves	Vegetables	1

Fruits	Fruit	1
Beef, goat, poultry, pork, eggs and fish	Meat & Fish	4
Milk yogurt and other dairy	Milk	4
Sugar and sugar products	Sugar	0.5
Oils, fats and butter	Oil	0.5
Spices, salt, fish powder, small amounts of milk for tea	Condiments	0

Source: WFP, 2009; Rahman and Noman (2019)

Specific FCS Threshold

- * Poor consumption(≤ 28)
- * Borderline consumption(≤ 42)
- * Acceptable consumption(>42)

However, Rahman and Noman (2019) decomposed the Acceptable household threshold into acceptable low (≤ 52) and acceptable high (> 52)

Model Specification

Tobit regression model

The Tobit model assumes:

$$Y_i^* = \alpha + X\beta + \varepsilon_i \dots\dots\dots (3)$$

$$Y_i^* = \alpha + X_1\beta_1 + X_2\beta_2 + X_3\beta_3 + X_4\beta_4 + X_5\beta_5 + \dots + X_n\beta_n + \varepsilon_i \dots\dots\dots (4)$$

Where:

Y_i^* = calorie intake of i^{th} household; X_1 = Yield (kg); X_2 = Marital status (married = 1, otherwise = 0); X_3 = Education (years); X_4 = Sickness of household member (yes = 1, otherwise = 0); X_5 = Extension visit (number); X_6 = Access to credit (yes = 1, otherwise =

0); X_7 = Seed variety (improved = 1, local = 0); X_8 = Gender (male = 1, otherwise = 0); X_9 = Age (year); X_{10} = Household size (number); X_{11} = farm size (hectare); X_{12} = Annual income (₦); X_{13} = Farming Experience (year); X_{14} = Non-farm income (yes = 1, otherwise = 0); X_{15} = Security threat (yes = 1, no = 0); β_0 = Intercept; β_{1-n} = vector of parameters to be estimated; and, ε_i = Error term.

Results and Discussion

Impact of IFAD on the Calorie Intake of the participating farmers

A perusal of Table 3c showed that the programme had an impact on the recommended daily dietary calorie intake of the farmers after participating in the programme, as indicated by the significance of the t-statistics at 1% probability level. It was evidently seen that the recommended daily dietary calorie intake per head/day of a farm family increased by 1675.97 kcal after participating in the programme. Before the programme, the average calorie intake per person was 1942.42 kcal, which was 13.67 per cent less than the recommended benchmark of 2250 kcal/head/day. However, after participation in the programme the calorie consumption per head/day surged to 3618.38 kcal, which was 60.82 per cent higher than the daily recommended kcal intake for sub-Saharan Africa (Table 3c).

The decomposition analysis showed a sharp decline in the percentage of those who were poor (18.02%) after participation in the programme as against 73.87 per cent observed before participation in the programme. Thereafter, there was a sharp rise in the percentage (81.98%) of those who were non-poor after participation in the programme as against the percentage of 26.13 per cent recorded before participation in the programme (Table 3a). Also, from the consumption score point of view, majority (95.50%) of the farmers fell within the poor consumption category before participation in the programme with a few percentage (4.5%) within the borderline consumption category. But after participation in the programme the percentage of the farmers in the latter category increased to 83.78 per cent while that of the former category drastically dropped to 16.22 per cent (Table 3b). Therefore, it can be inferred that the programme made a landmark by not only making the smallholding farmers food secure but also nutritionally balanced.

Table 3a. Calorie Intake of the Participating Farmers

Category	Before	After	Average kcal/ head/day
Ultra poor(<1600 kcal)	46 (41.44)	8 (7.21)	1127
Hard core poor (<1805 kcal)	15 (13.51)	3 (2.70)	1737.12
Absolute poor (<2250 kcal)	21 (18.92)	9 (8.11)	1994.73
Non-poor (≥ 2250 kcal)	29 (26.13)	91 (81.98)	3297.07
Total	111 (100)	111 (100)	

Source: Field survey, 2018

Note: Values in parenthesis are percentages

Table 3b. Percentage of Food Consumption Score of the Participating Farmers

Profile	Before	After
Poor consumption (≤ 28)	106 (95.50)	18 (16.22)
Borderline consumption (≤ 42)	5 (4.50)	93 (83.78)
Acceptable consumption low (≤ 52)	-	-
Acceptable consumption high(>52)	-	-
Total	111 (100)	111 (100)

Source: Field survey, 2018

Note: Values in parenthesis are percentage

Table 3c. Impact of the Programme on Calorie Intake of the Farmers

Items	Mean	t-stat
Before	1942.41	
After	3618.38	
Before - After	-1675.97	-16.423***

Source: Field survey, 2018

Note: *** means significant at 1%

Factors influencing Calorie Intake among the Participating Farmers

The results showed Tobit regression to be the best fit for the specified equation as indicated by the Chi2 statistic which is different from zero at 10 per cent degree of freedom. In addition, it also implied that the estimated parameters included in the model were different from zero, thus had significant influence on the nutritional status of the participating farmers (Table 4). Furthermore, the diagnostic test results showed that the residual term is normally distributed, as was evident by the non-significance of the Chi2 statistic at 10 per cent degree of freedom. Also, it was observed that there was an absence of multi-collinearity test between the explanatory variables, as indicated by their respective VIF values, which were less than the benchmark variance inflation factor (VIF) value of 10.00. Therefore, all the above evidence justifies the validity of the chosen model and the reliability of the estimated coefficients for prediction.

The results showed that the nutritional status of the farmers is being influenced by educational level, extension contact, access to credit, age of the farmers, household size, income, farming experience and security status as indicated by the significance of their respective estimated coefficients at less than or equal to 10 per cent probability level. The positive significance of the education estimated coefficient showed that farmers with high level of education were conscious of their nutritional status by maintaining a healthy status so as not to dispose their households to the consequences of malnutrition. Therefore, the probability of an increase in the educational level of a farmer will lead to an increase in his dietary intake (recommended kcal intake) by 0.0055, while the elasticity implication will be 0.006%. The negative significance of the extension contact estimated coefficient showed the consequences of political matters discussed by the extension agents with the farmers such as how to bequeath fortune in the future, sense of power and independence which are outside the mandate/scope of the change agent viz. research information outreach on farm production and rural home management makes the farmers develop misery instincts, thus affecting their household food consumption (balanced diet intake). This outcome did not come as a surprise as extension agents in the study area are in the habit of discussing political issues with farmers at the expense of their core mandates owing to poor incentives and unqualified personnel. Therefore, the marginal and elasticity implications of a unit increase in the number of extension visits received by a farmer will lead to a decrease in his household kcal intake by 0.0066 and 0.0061% respectively. The positive significance

of the sickness of household member coefficient showed how precautionary measures against ill-health among the farm families make farmers conscious in avoiding malnutrition. Therefore, the probability of a farmer with a challenge of a sick household member will make him increase his recommended dietary intake by 0.034 and the elasticity implication will be 0.0097 per cent.

Fear of default and delinquency which will lead to loss of capital and farm investment insolvency makes the farmers to be dietary deficient in kcal intake as indicated by the negative significance of access to credit coefficient. The probability of a farmer having access to credit will lead to a decrease in his recommended dietary intake by 0.045 and the elasticity implication will be 0.0027 per cent. Due to strong correlation between age and health status, the fear of deteriorating health status with ageing makes a farmer health conscious i.e. apprehensive of malnutrition, by taking the recommended dietary kcal as is evident by the positive significance of the age coefficient. Therefore, the marginal and elasticity implications of an additional increase in the age of a farmer will lead to an increase in his/her recommended dietary kcal intake by 0.014 and 0.072 per cent respectively. Malnutrition among the farmers with large household size, having high dependency ratio owing to poor farm income affected their recommended dietary intake as is indicated by the negative significance of the household coefficient. Therefore, the marginal and elasticity implications of a unit increase in a farmer's household size will lead to a decrease in his/her recommended dietary intake by 0.079 and 0.0789 per cent respectively. The positive significance of the income coefficient implied that the Marginal Propensity to Consume (MPC) of the farmers increased as their income increased. This outcome did not come as a surprise given that Keynes consumption theory stipulated that the MPC of poor people is high while that of the rich people is low as income increases. Therefore, the marginal and elasticity implications of a unit increase in a farmer's income will increase his recommended dietary intake by 0.0127 and 0.022 per cent respectively.

In order not to have their farm investment affected due to allocative inefficiency, owing to their resource-poor status i.e. paucity of capital, the experienced farmers were reserved in meeting with the recommended dietary kcal intake as is evident by the negative significance of the farming experience coefficient. The marginal and elasticity implications of a unit increase in the farming experience of a farmer will lead to a decrease in his/her daily dietary recommended kcal intake by 0.0185 and 0.047 per cent respectively. The

positive significance of the security threat coefficient implies that the farmers with little or no security threat challenges have their recommended dietary nutrient intake unaffected as compared to their counterparts with security challenges, which has consequences on their economic, social, health and psychological status. The probability of a farmer not having security challenge will make him increase his dietary recommended kcal intake by 0.246 and 0.0014 per cent respectively.

Table 4. Factors Determining Calorie Consumption of IFAD Rice Farmers

Variables	Coefficients	t-stat	Elasticity	VIF
Constant	6.8080(1.6331)	4.169***	-	-
Yield	0.1487(0.1662)	0.894NS	0.15315	1.569
Marital status	0.1059(0.1502)	0.705NS	0.01293	1.657
Educational level	0.0055(0.0032)	1.718*	0.00634	1.194
Sickness	0.0342(0.0201)	1.710*	0.00965	1.921
Extension visit	- 0.0065(0.00142)	4.570***	-0.00607	1.439
Access to credit	- 0.04543(0.008615)	5.273***	-0.00266	1.360
Seed variety	- 0.04909(0.13107)	0.374NS	-0.00636	1.095
Gender	0.15419(0.1946)	0.792NS	0.01829	1.444
Age	0.0140(0.0063)	2.237**	0.07214	3.209
Household size	- 0.0789(0.0163)	4.852***	-0.07888	2.285
Annual income (₦)	0.01269(0.006708)	1.892*	0.02169	1.623
Farm size	0.03558(0.09845)	0.361NS	0.00538	1.862
Farming experience	- 0.01849(0.00725)	2.551**	-0.04679	3.891
Non-farm income	0.00840(0.08489)	0.099NS	0.00041	1.194
Security threat	0.2464(0.1268)	1.942	0.00139	1.247
Chi2 test	95.425***			
Normality test	2.864 [0.238]***			

Source: Field survey, 2018

Note: *** ** * & NS means significant at 1%, 5%, 10% and non-significant respectively.

The values in () and [] are standard error and probability value respectively.

Conclusion and Recommendations

The empirical evidence showed that the programme had an impact on the recommended calorie consumption of the participating farmers, as their kcal/head/day was 60.82 per cent higher than the recommended benchmark of 2250kcal/head/day for sub-Saharan Africa. However, factors viz. extension visit, access to credit, household size and farming experience were identified to be the factors affecting the intake of the recommended calorie among the participating households. Therefore, the study recommends that both the public and the private organizations with an agricultural mandate should sensitize the farmers on the importance of keeping a sustainable household size so as to enable them meet the recommended balanced diet. In addition, apart from the production credit, consumption credit should be given to the farmers in order to dissuade them from fear of loss of farm capital due to default, which has a negative consequence on the calorie consumption. Well trained extension personnel coupled with proper incentives should be put in place so as to make research-extension-farmers linkages viable and efficient in the studied area.

References

- Behrman, J.R. and Rosenzweig, M.R. (2001). The returns to increasing body weight, W.P.-. Penn Institute for Economic Research: Philadelphia
- Chastre, D., Duffield, A., Kindness, H., LeJeune, S. and Taylor, A. (2007). The minimum cost of a healthy diet: findings from piloting a new methodology in four study locations. Save the Children: London UK.
- Golden, M. (2009). Proposed nutrient requirements of moderately malnourished populations of children. *Food and Nutrition Bulletin*, 30(3):267-343.
- Johns, T. (2002). Plant genetic diversity and malnutrition. *African Journal of Food and Nutrition Sciences*, 2(2).
- Negin, J., et al. (2009). Integrating a broader notion of food security and gender empowerment into the African Green Revolution. *Food Security*, 1(3):351-360.
- Rahman, M.A and Noman, S.M.M.H. (2019). Poverty and food security analysis of handloom weaver households in a selected area of Bangladesh. *Journal of Bangladesh Agricultural University*, 17(1): 80-85

Victora, C., Adair, L., Fall, C., Hallal, P.C., Martorell, R., Richter, L. and Sachdev, H.S. (2008). Maternal and child under-nutrition: consequences for adult health and human capital. *The Lancet*, 371(9609): 340-357.

Watson, D. and Andersen, P.P. (2010). Nutrition situation in sub-Saharan Africa. In Andersen, P. (ed.): *The African food system and its interaction in human health and nutrition*, Cornell University Press: New York. Pp. 14-33.

World Food Programme (WFP) (2009). *World Food Programme, Food Security in Bangladesh: Papers presented in the National Workshop*. Ministry of food and disaster management, Government of the People's Republic of Bangladesh and World Food Programme (WFP), Bangladesh.

List of calories of different food items:

Food items	Gram equivalent	Calorie equivalent
Rice	100 gm (uncooked)	372
Flour	100 gm	340
Potatoes	100 gm	77
Pulse	100 gm	14
Tomato	100 gm	18
Leafy vegetables	100 gm	49
Bitter gourd	100 gm	17
Garden egg	100 gm	25
Apple	100 gm	52
Orange	100 gm	47
Banana	1 pic medium	105
Pineapple	100 gm	50
Guava	100 gm	68
Grape	100 gm	67
Beef, mutton and chevron	100 gm	187
Chicken	100 gm	110
Egg	1 pic medium	78
Milk	100 ml	44
Fish	100 gm	100

Source: FAO, 2008 (<http://www.fao.org/docrep/006/Y5022E/y5022e04.htm>)

Women Participation in Agriculture in Developing Countries: A Systematic Review

Beatrice Mbakaya¹, Dominique Ndegu² and Balwani Mbakaya³

Abstract

Despite the crucial role women play in agriculture in developing countries, they are faced with several constraints which reduce their productivity. The aim of this systematic review was to analyze women's participation in the agriculture sector in the developing world to direct policy interventions in this area. Literature search was conducted from six databases: Google scholar, EBSCO host (Econlit and Gender studies), Psycinfo, Scopus, Jstor, and Web of Science (agricultural, multidisciplinary and women studies components) covering the period from January 2009 to July 2019. This literature search employed the keywords: "Participation" or "role", "women" or "females" or "gender" or "girls", "farm" or "agriculture" or "estate" or "garden", "factors". The review was executed in three steps: 1) identification of studies, 2) content extraction and critical appraisal, and 3) synthesis of extracted content. The quality of articles was evaluated using scoring matrices of Mixed Methods Appraisal Tool criteria. From a search finding of 1,705,928 articles, only 21 papers met the inclusion criteria. The review has demonstrated that most of the agriculture activities are done by women however they continue to face limited decision making.

Keywords: Women, Participation, Agriculture, Developing countries.

Introduction

Of the developing world's 5.5 billion people, an estimated 2.5 billion are involved in agriculture at household level, and 1.5 billion are in smallholder households (World Bank 2008). Agriculture accounts for between 30 to 60 per cent of the total

¹ District Agricultural Division Officer, Mzimba North District Agricultural Division Office.
Corresponding author Email: mbatemwa2@gmail.com

² Senior Lecturer in Educational and Social Psychology, Mzuzu University, Department of Education

³ Senior Lecturer, St John's Institute for Health, Mzuzu, Malawi.

Received Date: 11-09-2019

Accepted Date: 02-12-2019

Gross Domestic Product and employs about 70 per cent of the total workers (Essays, UK, 2018), continuing to support livelihoods of majority of people in developing countries. However, the agricultural sector in many developing countries is underperforming, in part because women, who represent a crucial resource in agriculture and the rural economy through their roles as farmers, laborers and entrepreneurs, face constraints that reduce their productivity (FAO, 2011). Strategic policy interventions informed by evidence based research are required to enhance women's participation in the agriculture sector in developing countries. However, current participation trends for women in the agricultural sector of developing countries remain relatively mixed and inconclusive (Clark 2013). A conclusive analysis on women's participation in the agriculture sector in the developing world requires a systematic approach to the review of literature to direct policy interventions in this area hence the essence of this review. Specifically, this review analyzed women's participation in the agriculture sector and identified factors influencing their participation in the sector. Findings can guide policy makers in categorizing and prioritizing activities into viable gender mainstreaming strategies when implementing interventions.

Materials and Methods

Protocol

This review was guided by the proposed guidelines developed by PROSPERO for systematic search and selection. PROSPERO is an international database for registering systematic reviews in various professions. The protocol however was not published but guidelines were adhered to. In addition, a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram was used in this study to illustrate the number of articles retrieved, retained, excluded and reasons for every action. Lastly, a Mixed Method Appraisal Tool (MMAT) was used to appraise the studies included.

Inclusion Criteria

The article inclusion criteria were as follows: (1) Studies whose participants were women or/ a mixture of gender categories; (2) Studies conducted in developing countries; (3) Studies whose outcomes were women or gender participation in agriculture regardless of design; and (4) Published peer reviewed papers (5) Papers written in English.

Information Source /Search Strategy

Six database sources were used to gather the required information viz., Google scholar, Web of Science (agricultural, multidisciplinary and women studies components), Psych Info via Pro-Quest, EBSCOhost (Econlit and gender studies component), Scopus, and Jstor. Efforts were made to identify both published and unpublished studies by manually checking the reference lists of articles that met the inclusion criteria. The period covered research from as far back as January 2009 to June 2019. The key search words used were: Participation or role, women or females or gender or girls, farm or agriculture or estate or garden, factors. Papers written in languages other than English were excluded. Finally, studies that were conducted in developing countries were identified.

Data Extraction Process and Data Items

The process of data extraction started with an internet search of relevant articles using search terms while following the PRISMA guidelines. The steps are: identification of records, screening to remove duplicate records, assessing for eligibility and including the records. A standardized table was used to guide data extraction from the included papers. All relevant information extracted from each study was summarized and documented. The details included: title of the study, author, year, place of study, study design, type of analysis, variables included, outcomes.

Quality Appraisal

The MMAT tool was used to appraise 21 studies included in the review. MMAT is a validated checklist used to appraise the quality of studies included in any systematic review with a quantitative, qualitative and mixed methods approach. The MMAT has two general screening questions applicable to all study designs: (1) Are there clear qualitative and quantitative research questions or objectives, or is there a clear mixed methods question or objective? and (2) Do the collected data address the research question or objective? The MMAT appraises the following study methodologies and designs: qualitative, quantitative randomized controlled, quantitative non-randomized, quantitative descriptive and mixed methods study designs. The tool is divided into five sections, with each section used to appraise a specific study design or methodology. Each section has numbered criteria for appraising studies. All the criteria per entity sum up to 100 per cent and each

criterion has 25 per cent power of quality except for the mixed methods study where the first 25 per cent is given by default (as it has three criteria) followed by topping up with assessment scores per criteria. The total score per domain is a percentile and the higher the score, the better the quality. The MMAT has a comparative advantage over other tools such as Jadad and MINORS (Methodological Index for Non-Randomized Studies) because it is efficient and can concomitantly appraise different types of empirical studies. The systematic review included studies of different designs thus making MMAT a suitable appraising tool.

Synthesis of Results

The extent of women's participation in agriculture in Developing countries was identified. The meaning of participation in this review focused on the role played by women in agriculture activities along various agriculture value chains and its related decision making processes. This study went further to analyze factors and constraints affecting women participation in these two areas. A narrative synthesis was conducted based on the content analysis of the included articles. The papers were synthesized, rated and finally, the results were put in Table 1 below:

Table 1: MMAT Details

Title	Author & Year	Design	Country	Study Participants	Intervention	Setting	Outcome	Unit of Measuring Participation	Major Findings, Factors and Constraints
Women Farmers' (Dis) Empowerment Compared to Men Farmers in Ethiopia	Solomon Petros, Fetien Abay, Girmanesh Desta, and Cheryl O'Brien, 2018	Quantitative descriptive	Ethiopia	240 Men and women (52% women), 0.55ha of land, family size-4.9, average livestock size/ hh-3.2 units	N/A	Selected villages	Gendered participation in post-harvest practices-chickpea, sesame, maize, and wheat enterprises	% performed by women.	-Women's role increased significantly (to as much as 88 per cent) in the post-harvest phase compared to land preparation, sowing and cleaning, intercultural farm activities and post-harvest activities which had 41%, 61% and 73 % -Lack of access to technologies was a major constraint
Sowing seeds of empowerment: effect of women's home garden training in Bangladesh	Marie Antoinette Patalagsa, Pepijn Schreine machers, Shahana Begum and Shawkat Begum 2015	Mixed methods	Bangladesh	Women farmers-456, land < 0.4 ha, 1 child < 5, experience in veg cultivation but not received similar intervention	Nutrition and garden establishment training	Villages in rural Bangladesh	Effect of training on women participation in vegetable production decisions	% of participation (Control, intervention, men) in household decisions	-Women who had received the training had more freedom to decide over most gardening tasks such as crop choice, planting and harvesting times, crop management, and inputs to use. -There was a significant ($p < 0.05$) difference between the intervention and control groups in all five aspects. -Most decisions were jointly done (men and women). -Training was a major factor
The Hidden Economic Backbone - Women in Agriculture	Sidra Mazhar, Mysbah Balagam wala and Haris Gazdar 2017	Quantitative descriptive secondary survey data	Pakistan	1151 (Females, 15-49 years)	-	Rural communities	Enumeration and analysis of women's work in Agriculture	% participation	Two-thirds of the women had done some agricultural work (67%), 46% some farming, 60% livestock. Male outmigration, increase in commercialization of agriculture, pandemic diseases that disproportionately affect more men (like HIV), conflict, climate change and technological innovations, Competing claims on time, unequal access to resources and opportunities, wealth status, education and reproductive roles are the factors that affected women participation.

Title	Author & Year	Design	Country	Study Participants	Intervention	Setting	Outcome	Unit of Measuring Participation	Major Findings, Factors and Constraints
Tribal Farm Women's Participation in Agriculture and Factors Influencing it: Evidence from West Bengal, India	A. Shamma, P. Biswas, S. K. Jha, S. Sarkar, and Sh. Kumar, 2018	Quantitative-descriptive	India	110 tribal families	-	Rural setting	women's participation in farming activities	Man-days spent by tribal women in agricultural activities	Participation of farmwomen in farming activities was much less than an average women laborer who gets 60 to 125 man-days of work per year. Age, education, social participation, economic motivation were the factors that had significant relation with participation of farm women. Constraints to women's participation were: Lack of education/Literacy level, too little Income, Lack of child care facilities, Lack of knowledge and skill, Lack of training, Doubts regarding the women capabilities, Loans are not sufficient, Family restriction: (a) Husband, (b) Elders, Partiality of government officials, Conflicts with other workers, Caste system in the village, Ego problems of men folk, Lack of freedom to take decision, Confining the role of women to household activities
Contribution of Rural Women in Vegetable Cultivation in Home gardens of Nainital District, Kumaun Himalaya, India	Kiran Bangali, Vibhuti and Charu Shahi, 2015	Quantitative-descriptive	India	100 rural women	-	Rural setting	Extent of women's participation	Participation Index	Rural women in the plantation activity had highest participation index (PI= 338) and ranked 1st while participation in marketing of home garden products had lowest participation index (PI=100) and ranked 10th. Time, Distance from market, Irrigation facilities, Availability of market, Availability of Capital, Transportation, Lack of knowledge, Shortage and lack of planting material, Other problems affected women participation.

Title	Author & Year	Design	Country	Study Participants	Intervention	Setting	Outcome	Unit of Measuring Participation	Major Findings, Factors and Constraints
Women's empowerment and gender equity in agriculture: A different perspective from Southeast Asia	Sonia Akter, Pieter Rutsaert, Joyce Luis, Nyo Me Htwe, Su San, Budi Raharjo, Arlyna Pustika, 2017	Qualitative-descriptive	South east Asian countries: Myanmar, Thailand, Indonesia and the Philippines.	37 FGDs with 290 female farmer	-	Rural settings	Women's role and decision making power in rice production	%	Task division between husband and wife in the field is similar, although the intensity of the role played by men and women to perform each task varied. Men take a lead role in land preparation, pesticide and fertilizer application, while women were predominantly involved in crop establishment, weeding, harvesting and post-harvest activities.
Gender Participation and Decision Making in Crop Management in Great Lakes Region of Central Africa	Justus Ochieng, Emily Ouma Eliud Birachi, 2014	Quantitative	Rwanda, Burundi, and the Democratic Republic of Congo (DRC)	1,493 men (56 per cent) and 1,172 women (44 per cent) respondents	-	Rural households	Examines the degree to which women participate in farm management and decision making for crop production activities, and the socioeconomic factors that influence their participation	%	Farms managed by women are cultivated much less intensively than male-managed farms, because of the limited ability of women to acquire technological inputs such as fertilizers and improved seeds. While legumes are grown by both men and women, cassava seems to be "a women's crop," both in terms of cultivation and harvesting. Accessibility to rural credit, extension services, social capital in the form of groups, and engagement in off-farm activities are critical for stimulating women's participation in crop production activities. Limited ability to acquire technological inputs was the only constraint reported to affecting women participation.

Title	Author & Year	Design	Country	Study Participants	Intervention	Setting	Outcome	Unit of Measuring Participation	Major Findings, Factors and Constraints
Understanding women's participation in irrigated agriculture: a case study from Senegal	Marcia L. Nation, 2010	Quantitative	Senegal	Women from 30 hh	N/A	Rural areas	Examining gender relations within the household regarding the allocation of labor, time, and capital to agricultural production.	%	Labor for irrigated agriculture came from reallocating certain household and agricultural tasks to daughters and from lessening labor inputs to some rain-fed production, women gave up some control, overproduction in exchange for fewer demands on their time and labor, decisions about women's allocation of their own labor are shaped not only by relationships with husbands and other household members but are also embedded in larger struggles regarding the use of land, commodity prices, and input charges. Control of hh labour, access to capital and the returns to capital investment, Access to land, control over irrigation technology, conjugal relations of cooperation and conflict shape their decisions. Agricultural marketing, Lack of transportation, Limited business and negotiation skills, Family opposition and limited product were the constraints that affected women participation.

Title	Author & Year	Design	Country	Study Participants	Intervention	Setting	Outcome	Unit of Measuring Participation	Major Findings, Factors and Constraints
Roles of women in agriculture: A case study of rural Lahore, Pakistan	Wajha Ishaq and Shafique Qadir Memon, 2016	Quantitative	Pakistan	207	-	Rural union councils	Highlight the enormous roles of the rural women in agriculture, determine the causes for women participation in agricultural activities, investigate different constraints faced and explore different factors which determine their empowerment	%	The average working hours of the respondents were calculated as 9 hours per day, Out of all the pre-harvesting activities, 94.2% positive responses were recorded against seed bed preparation. A majority of rural women (85.02, 88.88 and 95.65%) were involved in shed cleaning, dung collection and fodder cutting, respectively.
Contribution of rural women to rice production activities in two different areas of Bangladesh	F Rahman, SA Shammi, MT Parvin, N Akter, MS Khan, S Haque, 2016	Quantitative	Bangladesh	123 women	-	Rural areas	To identify the core contribution of women in the rice production activities, identify the wage gap between male and female laborers and factors influencing women's	Contribution of rural women in rice farming by analyzing the average time allocation (hours spent/day) by males and females on agricultural activities.	In terms of contribution, nearly 43% and 42% of the total works were done by rural women in rice farming activities in Nilphamari and Mymensingh district, respectively. It was found that male workers spent 228.2 hours and female workers 174.5 hours per season in Nilphamari region compared to 270 hours and 197.3 hours per season in Mymensingh region, respectively. The average wage rate in Nilphamari district was BDT 241/day for male and BDT 175/day was female. Similarly, in Mymensingh district the average wage rate for male and female

Title	Author & Year	Design	Country	Study Participants	Intervention	Setting	Outcome	Unit of Measuring Participation	Major Findings, Factors and Constraints
Beyond crop production	Nathalie Me-Nsope and Michelle Larkins, 2016	Quantitative	Malawi	329(6 seed actors, 260 seed producers, 30 producer cooperative, 19 retailers and local processors, 10 local buyers and traders, 4 export market buyers and traders.)	-	Rural areas	participation in rice farming at household level in Bangladesh.	%	workers was BDT 281/day and BDT 162/day, respectively. Distance of the rice field from the home, the number of available technologies used and the number of adult male labour significantly affect the women's participation in farming activities. Communication in marketing, physical weakness, use of modern technologies, lack of access to technology, training facility and information on farming were the constraints reported to affect women participation. Participation rate of approximately 60% for women in pigeon pea farming, i.e. about 60% of those who grow pigeon pea are women, women comprise between 90-95% of local processors in Malawi. There are no women who act as large-scale exporters. Significance of the crop in helping women fulfill their responsibility of providing food (relish) for their families, local processing essentially involves cooking of the legume, a task perceived to be suitable for women, and one that they can easily perform with the assets available to them. Access to finance/cash is an important requirement to participate as a retailer. Unfortunately, unlike

Title	Author & Year	Design	Country	Study Participants	Intervention	Setting	Outcome	Unit of Measuring Participation	Major Findings, Factors and Constraints
Cassava entrepreneurship and gender participation in Udi Local govr area, Nigeria.	Christopher Ogbonna Emerole, Anderson Nwalozie Chidozie Onyedikachi Anyiro, Victor Ebong, Charles Kelechi Osondu, 2014	Quantitative	Nigeria	30mhh, 30fhh	-	Rural areas	Gender Leadership and Participation in Household cassava Enterprises	%	their male counterparts, women retailers had less income/cash generating opportunities -men retailers were more likely to be involved in other income generating activities (mostly as hired farm labor or other non-farm income opportunities), women's physical abilities (in terms of lifting and protecting themselves from theft) impact their participation in large scale market activities, cultural restrictions on their time and mobility are a factor in market participation at a local level.
									Amongst the female-headed households, marital status, adult number of females in the households, and frequency of extension contact had very high ($P < 0.001$) influence on the participation female household heads in own cassava enterprises. In addition, status of health of household members, weekly time spent on cassava activities and annual net enterprise profit had moderate ($P < 0.05$) influences on participation of female heads of cassava enterprise households.

Title	Author & Year	Design	Country	Study Participants	Intervention	Setting	Outcome	Unit of Measuring Participation	Major Findings, Factors and Constraints
Determinants of female headed hhs participation in Peri Urban Modern SSI in Ethiopia: the case of kobo town	Goitom Sisay, 2018	Quantitative	Ethiopia	333 (113M, 220W) participants and non-participants	-	Peri urban areas	Identify the determining factors influencing female-headed households' participation in periurban modern small-scale irrigation projects	% participation	Educational status of the household head, family size, livestock holding, access to credit services and distance from the nearest market centers have a significant and positive impact on participation.
Education and agricultural inputs use by female farmers in Zikhali and Zimbabwe	Innocent Matshe, Precious Zikhali and Pius Chilonda, 2019	Quantitative	Zimbabwe	-	-	Communal and resettlement areas - rural Zimbabwe	-	% participation	While 89% of parcels owned by male-headed households received chemical fertilizer, only 81% of parcels owned by female-headed households did, hired labour was used on 67% of male-headed households' parcels and 58% of parcels owned by female-headed household
Gender and development: roles of rural women in livestock production in Pakistan	Humera Amin, Tanvir Ali, Munir Ahmad and Muhammad Iqbal Zafar, 2010	Quantitative	Pakistan	768 respondents	-	Rural areas	Investigate the role of rural women in the livestock production	% participation	Education significantly raises the probability of female farmers' use of both chemical fertilisers and hire Out of total 768 respondents, more number of wives (37, 5%) participated in livestock production activities as compared to the husbands (17%). Role of rural women in livestock production was higher in activities such as fodder offering, cleaning of sheds, watering to the animals, milking, poultry raising, ghee and egg selling and raising

Title	Author & Year	Design	Country	Study Participants	Intervention	Setting	Outcome	Unit of Measuring Participation	Major Findings, Factors and Constraints
Gender involvement in manual material handling (mmh) tasks in agriculture and technology intervention to mitigate the resulting musculoskeletal disorders.	Dr Suman Singha, Dr Neelima Sinwalb, 2012	Quantitative	India	100 agriculture workers	-	manual material handling tasks in rural communities	To study gender participation in agricultural activities involving manual material handling tasks.	-	of goats and sheep, whereas the role of husbands was higher in fodder cutting and transportation of fodder. Age, education, social participation, economic motivation had significant relation with participation of farm women In Agriculture female respondents played a key role in mmh tasks in land preparation, manuring, sowing, fertilizer broadcasting. The results revealed greater susceptibility of females to musculoskeletal problems in most of the household and animal husbandry tasks.
Gender Participation in Economic Activities and Decision Making in Keffi Area of Nigeria	Hassan Ishaq Ibrahim, Napoleon Danbeki Sangbe, Zubairu Ajiya Abdulkadir, 2012	Quantitative	Nigeria	60 men and 60 women	-	Rural setting	Assessed gender participation and decision making role in economic activities	Means	The participation by women was frequent in post-harvest activities (mean = 2.88) and poultry management (mean = 2.48). Women participation was occasional in home gardening (mean 1.58), local food processing (mean = 2.06), goat rearing (mean = 1.86), trading (mean = 1.97) and hair dressing (mean = 1.72). Educational level, years of experience, personal income and credit obtained significantly influenced the level of gender participation in economic activities.

Title	Author & Year	Design	Country	Study Participants	Intervention	Setting	Outcome	Unit of Measuring Participation	Major Findings, Factors and Constraints
Women's involvement in livestock care	Adeela Manzoor, Izhar Ahmad Khan, Hira Ashfaq, Norina Jabeen and Ashfaq Ahmad Maan, 2018	Quantitative	Pakistan	600	-	Rural areas	Analyze women's involvement in livestock care and management and its implications for their social life	-	Women of the Punjab province actively participated in livestock-related activities i.e. milking, feeding and watering, treatment, fodder cutting, cleaning sheds, grazing, making dung-pads, rearing and bathing the animals. Due to cultural milieu of the Punjabi rural society, women were involved in doing this difficult job. Cultural milieu was a major constraint.
Rural women's participation and constraints in agricultural activities: a case study of district nankana sahib, Punjab	Siddra Nazir, Izhar Ahmed Khan, Babar Shahbaz and Farkhinda Anjum, 2013	Quantitative	Pakistan	120 women	-	Rural areas of Punjab, province of Pakistan	-	-	Majority (81.7 %) of the respondents had participation in harvesting and picking activities. About 70.8 % of respondents in the research area participated in sowing. More than half (54.2%) of the respondents were involved in processing related activities like winnowing, drying of grains cleaning of grains. Slightly more than half (52.8%) were participated in marketing of livestock products and about 50.8% of the respondents participated in packing of vegetables. About 37.5 % of the respondents told that they participate in cultural practices (transplanting, manure application, fertilizer application, weeding, thinning, gap filling, irrigation and plant protection measures such as insecticides and pesticides). Areas where the participation of rural women was found to be least are leveling and cleaning of agricultural fields as only

Title	Author & Year	Design	Country	Study Participants	Intervention	Setting	Outcome	Unit of Measuring Participation	Major Findings, Factors and Constraints
									35.0% of the respondents said that they participated in these activities. Looking after children, Serve in laws, parents, Looking after yourself, Household chores, Meeting with relatives, Participation in ceremonies were the major constraints
What factors explain women's empowerment? Decision-making among small-scale farmers in Uganda	Mila Sella, Nicholas Minoth, 2018	Quantitative	Uganda	1440 hh	-	Rural local councils	The aim of this study is to examine some of the key determinants of women's empowerment relating to an agricultural context in Uganda	%	There is very little difference in the self-reported participation of men and women in food production (94% of women and 92% of men). 57% of both women and women report input into all or most decisions on food crop production. For cash-crops the difference is larger (46% of women and 68% of men). Only 41% of women report input into all or most decisions on use of income from cash crops compared to 74% of men. Age, male-female educational differences, remoteness, and location, the individual and household characteristics affected women participation.
Participation and role of rural women in decision making related to farm activities: A study in Burdwan district of West Bengal	Subhadip Pal and Sourav Halder, 2016	Quantitative	India	100m, 100w	-	Rural areas	-	-	Men and women respondents took joint decisions in 33.18% cases. Age, education, caste type and size of the family, size of land holding, socio-economic status of the families, education level of rural women have significant influence on the involvement in decision-making

Results

Search Outcome

An initial search of the databases and other sources yielded 1,705,928 articles. The titles of the identified articles were assessed, and 1,705,658 articles were removed because they were either duplicates or did not meet the inclusion criteria. Of the remaining 270 articles, 163 articles were excluded because they were abstracts only and efforts to find the complete articles proved futile. Eighty-six [86] articles were removed because the studies were not conducted in developing countries. The remaining 21 articles met the inclusion criteria (see search strategy table 2 below).

Table 2. Search Strategy

DATABASES	SEARCH	SEARCH WORDS	NO OF RETRIEVED STUDIES	NO OF QUALIFIED STUDIES
Google scholar	full	"Participation" or "role", "women" or "females" or "gender" or "girls", "farm" or "agriculture" or "estate" or "garden", "factors".	478,000	11
Ebscohost		"Participation" or "role", "women" or "females" or "gender" or "girls", "farm" or "agriculture" or "estate" or "garden", "factors".		
(1)Econlit	Full article	"Participation" or "role", "women" or "females" or "gender" or "girls", "farm" or "agriculture" or "estate" or "garden", "factors".	35,137	1
(2)Gender studies	Full article	"Participation" or "role", "women" or "females" or "gender" or "girls", "farm" or "agriculture" or "estate" or "garden", "factors".	2,778	1
Scopus	Full article	"Participation" or "role", "women" or "females" or "gender" or "girls", "farm" or "agriculture" or "estate" or "garden", "factors".	871,000	3
Jstor	Full article	"Participation" or "role", "women" or "females" or "gender" or "girls", "farm" or "agriculture" or "estate" or "garden", "factors".	184,540	1

DATA BASES	SEARCH	SEARCH WORDS	NO OF RETRIEVED STUDIES	NO OF QUALIFIED STUDIES
Web of science	Full article	"Participation" or "role", "women" or "females" or "gender" or "girls", "farm" or "agriculture" or "estate" or "garden", "factors".		
(1) Agricultural multidisciplinary	Full article	"Participation" or "role", "women" or "females" or "gender" or "girls", "farm" or "agriculture" or "estate" or "garden", "factors".	11,007	3
(2) women studies components)	Full article	"Participation" or "role", "women" or "females" or "gender" or "girls", "farm" or "agriculture" or "estate" or "garden", "factors".	13,216	1
Psco socio info	Full article	"Participation" or "role", "women" or "females" or "gender" or "girls", "farm" or "agriculture" or "estate" or "garden", "factors".	109,980	0

Quality of the Studies

In this review, 19 articles were quantitative (descriptive), one was mixed method and one qualitative. Based on the score allocation as described in MMAT, 20 studies scored 100 per cent, one study scored 75 per cent. Therefore, this means that the included studies are of good quality. Three review authors independently assessed the risk of bias in the studies included by considering the clarity of questions (objectives) in the articles and whether the data collected addressed the research questions. For all the quantitative studies, the risk of bias was assessed by looking at the following: Is the sampling strategy relevant to address the quantitative research question (quantitative aspect of the mixed methods question)? Is the sample representative of the population under study? Are measurements appropriate (clear origin, or validity known, or standard instrument) and Is there an acceptable response rate (60% or above). For the qualitative study, the risk of bias was assessed by looking at the following: Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (objective)? Is the process for analyzing qualitative data relevant to address the research question (objective)? Is appropriate consideration given to how findings relate to the context, e.g., the setting, in which the data were collected? Is appropriate consideration given to how

findings relate to researchers' influence, e.g., through their interactions with participants? and finally, for the mixed method study, the risk of bias was assessed by looking at the following: Is the mixed methods research design relevant to address the qualitative and quantitative research questions (or objectives), or the qualitative and quantitative aspects of the mixed methods question (or objective)? Is the integration of qualitative and quantitative data (or results*) relevant to address the research question (objective)? Is appropriate consideration given to the limitations associated with this integration, e.g., the divergence of qualitative and quantitative data (or results*) in a triangulation design?.

Study Characteristics

The studies included in this review were conducted between 2010 and 2019. Four studies were carried out in Pakistan, 5 studies were from India, one study was from Uganda; 2 studies from Nigeria ; 2 studies from Ethiopia , one study from (Burundi, Rwanda and DRC), one study from Malawi, one study from (Philippines, Myanmar, Indonesia and Thailand), one study from Zimbabwe, 2 studies from Bangladesh and one study from Senegal. In terms of study designs, one study was a mixed method study, 1 qualitative and the rest were quantitative (descriptive studies).

Study Participants

Study participants in the selected articles were males and females.

Study Intervention, Control and Setting

All studies included in the review were conducted in developing countries. Twenty out of the 21 studies, were conducted in rural/community/village setting, one [1] study indicated that it was conducted in a peri-urban setting. One out of the 21 studies had a training intervention.

Key Findings of the Study

The common outcome measure among the reviewed articles was women's participation in agriculture and factors affecting their participation. However, they were different in terms of their focus in the agriculture value chain activities. Areas of focus include: participation of women in implementation of activities of crop and livestock related enterprises and factors affecting their participation. It was noted that assessment of women's

participation in these studies, much as it could focus on selected crop enterprise in a setting, this was in the background of multiple cropping systems (upland and irrigated). A departure from a focus on women's participation in crop and livestock related enterprise activities was one study which assessed women's participation in agriculture activities involving manual handling of quipment and lastly one study on women's participation in agriculture had an intervention of training in home gardens where the effect of training on women's participation was evaluated. Participation was measured mostly in terms of percentage of women participating in various activities. Other participation measures include: man days spent on agriculture (1 study), participation index (1 study), average time allocated (1 study) on agriculture and means (1 study).

Presentation of Results

Studies included in this review were analyzed based on two outcomes: women's participation in agriculture, and factors influencing women's participation in agriculture. These sub-categories were generated from the objective of the study. Presentation and interpretation of the results follow these categories as narrated below.

Women's Participation in Agriculture

In a study by Solomon et al (2018), focusing on chickpea, sesame, maize and wheat crop enterprises in Ethiopia, results indicated that women participated at every level of agricultural production across all the surveyed regions. Findings also indicated that women's role increased significantly (to as much as 88%) in the post-harvest phase (storage) compared to land preparation, sowing and cleaning, intercultural farming activities which had 41 per cent, 61 per cent, and 73 per cent respectively. Post-harvest losses activities evaluated were: harvesting, handling, threshing/chipping, drying, transport, distribution/marketing, storing, and processing. Lack of access to technologies exacerbated by limited access to extension services pegged at 92 per cent for men compared to only 43 per cent for women was reported as a major constraint hindering participation of women in post-harvest practices. Despite the key role women played in post-harvest losses, Solomon et al (2018) further report women's lack of decision making power compared to men in post-harvest decision making. Women could be informed, consulted, or in some cases even veto decisions regarding post-harvest activities. In contrast in some

regions of Ethiopia, women were mostly informed of post-harvest decisions, with few women reporting to be consulted in decision making regarding storage, use, and marketing.

Rahman (2016), measuring the contribution of rural women in rice farming, analyzed the average time allocation (hours spent/day) by male and female farmers on agricultural activities. Results also indicated that comparatively female workers were more involved in post-harvest operations than male members. Beside household activities, women were engaged in almost all agricultural activities like seedling nursing, weeding, threshing, cleaning and sorting of grain, boiling of grain, drying of straw and rice storing. However considering man hours spent by each gender category on rice production activities, less amount of working hours for women was reported compared to men 228.2 hours and 174.5 hours per season for men and women respectively in Nilphamari region compared to 270 hours and 197.3 hours per season in Mymensingh region, for men and women respectively. Of course significant differences between these participation levels between the gender categories were not reported. A drop in the number of hours among women than their male counterparts was traced to the time women devote to household chores. Distance of the rice field from the home, the number of available technologies used and the number of adult male labor significantly affect women's participation in farming activities. Constraints reported to have an effect on women's participation in rice production activities include: communication in marketing, physical weakness, use of modern technologies, lack of access to technology, training facility and information on farming.

In a study by Akter et al (2017) where rice was a major crop, in all the study sites, task division between a husband and wife in the field was similar, although the intensity of the role played by men and women to perform each task varied. Men took a leading role in land preparation and pesticide and fertilizer application, while women were predominantly involved in crop establishment, weeding, harvesting and post-harvest activities. In areas such as the Philippines, where manual transplanting is a common practice of crop establishment, women's drudgery was much more acute than in areas such as South Sumatra and Thailand where broadcasting method is practiced. Low level of mechanization is reported to affect women work load during peak seasons.

Singha et al (2012) in their study on gender participation in agricultural activities involving manual material handling tasks, also revealed a low level of mechanization by female

respondents in agriculture activities. Female respondents played a key role in manual material handling tasks in land preparation, manuring, sowing, fertilizer broadcasting and the results revealed greater susceptibility of females to musculoskeletal problems in most of the household and animal husbandry tasks. In terms of decision making, women's decision making power in rice farming varied substantially across and within the study sites. It was reported that in South Sumatra (Sumatra, Indonesia) and Myanmar, men take a lead role in the field. Nonetheless, men listen to women's opinions and in many of the FGDs (50%), participants mentioned that husbands and wives make decisions jointly. In contrast, in Yogyakarta (Java, Indonesia), decisions regarding rice farming are made by the community or farmer groups instead of households (78% cases). Women in these locations were reported to have minimal influence on community-level decision making. The highest amount of women's involvement in decision making in rice farming was observed in Thailand and in the Philippines. In Thailand, in half of the FGDs, participants mentioned that they have sole decision making power in rice farming, while in the remaining half of the cases, decisions are jointly made with their husbands. In the Philippines, all rice farming decisions are jointly made by husbands and wives.

Ibrahim et al (2012) in their study on gender participation and decision making role in agriculture related economic activities (pre harvest crop activities, post-harvest activities, home gardening, poultry management, goat rearing, cattle rearing, aquaculture activities, local food processing, marketing activities) among gender categories, also found dominance of women participation in post-harvest activities, however this was done in comparison with other economic activities like livestock, home gardening, local food processing, trading and hair dressing. Participation by women was frequent in post-harvest activities (mean = 2.88) and poultry management (mean = 2.48). Women's participation was occasional in home gardening (mean 1.58), local food processing (mean = 2.06), goat rearing (mean = 1.86), trading (mean = 1.97) and hair dressing (mean = 1.72). Educational level, years of experience, personal income and credit obtained significantly influenced the level of gender participation in economic activities. Compared to men, women participated more in agriculture related economic activities. But when it came to participation in decision making by the same target population, women sometimes could make some agriculture related decisions on selection of crops (26.7 per cent), home gardening (36.7 per cent), crop, cattle, goat and poultry selling (28.3 per cent). Activities such as selection of crop

variety (93.3 per cent) and crop, cattle, goat and poultry selling (60 per cent) were mostly decided by men. Level of women's participation in decision making in agriculture related activities was low compared to men; this was attributed to age and income level of respondents.

Using means, Ibrahim et al (2012), reported on men and women's participation in home gardening (1.88 and 1.86 respectively) however significant differences between these participation levels were not indicated. Bargali et al (2015), analyzing contribution of rural women in home garden vegetable cultivation, qualified the home garden activities and results indicated that majority of rural women were independently participating (60%) in home garden vegetable cultivation while 40 per cent of the women participated jointly with men. In particular, regarding plantation activity, women had the highest participation index (PI=338) and ranked first while participation in marketing of home garden products had lowest participation index (PI=100) and ranked tenth. Time, distance from the market, irrigation facilities, availability of market, availability of capital, transportation, lack of knowledge, shortage and lack of planting material affected women's participation in vegetable production. Contributing to factors affecting women's participation in vegetable production is training; Patalagsa et al (2015), found out that women who had received the training in vegetable production had more freedom to decide over most gardening tasks such as crop choice, planting and harvesting times, crop management, and inputs to use. There was a significant ($p < 0.05$) difference between the intervention and control groups in all five aspects. Most decisions were jointly done (men and women).

Taking a crop rotation cycle of rice, jute and mustard which was predominant in the study site, in Bengal India, Shamna et al (2018), quantified participation of tribal farm women during the crop seasons which was 28.3 man-days on an average. Shamna and friends argue that this is much less than an average women labourer who gets 60 to 125 man-days of work per year. It was reported that weeding, harvesting and transplantation in rice fields were done only by females. This is in line with what Akter et al (2017) reported in their study on women's participation in rice production activities in Phillipines, Thailand, Indonesia and Myammar. Participation of tribal farm women in farming activities during the jute season revealed that, overall, the contribution of tribal women in jute crop production was less when compared to the total man-days required during the season. Their activities were restricted in land preparation, weeding,

steeping and washing and drying in case of jute cultivation and lastly, in case of mustard crop, women were involved in almost all the farm operations. An interaction with farm women revealed that some of the men folk go to other states during winter season for work, especially to southern states of India. This results in a shortage of labor and, for this reason, women's involvement is a little more in the mustard crop season. Age, education, social participation, economic motivation had significant relation with participation of farm women. Constraints reported to be affecting women's participation in farming activities were lack of education/literacy level, income derived is too little, lack of child care facilities, lack of knowledge and skill, lack of training, doubts regarding the women's capabilities, loans are not sufficient, family restriction: (a) husband, (b) holders, partiality of government officials, conflicts with other workers, caste system in the village, ego problems of men folk, lack of freedom to take decision, confining the role of women to household activities.

Looking at gender participation and decision making in crop management in Great Lakes Region of Central Africa, with specific reference to banana, cassava, groundnuts, beans, and cowpeas production, Ochieng et al (2014) reports that plots managed by men were characterized with higher input use compared to plots managed by women. With regard to gender and crop management practices, there was no clear pattern in terms of gender dominance in banana production. Cassava was considered a women's crop, sowing and harvesting could be solely done by women. Cultivation of beans is done largely by both men and women except in the DRC where women grow a variety of crops but women are mainly responsible for the harvesting of beans because these are mostly used for domestic consumption and women are in charge of serving food to their household. There was no gendered pattern of cultivation and harvesting of groundnut, soybean, and cowpea in many mandate areas of Rwanda. Only in Gitega, Kirundo, North Kivu, and South Kivu mandate areas was harvesting of these crops dominated by women. Men dominate both the cultivation and harvesting activities in Bas Congo, with women confined to secondary activities. It was further reported that men in Bas Congo still played the lead role in land preparation and ploughing, while women often provide the bulk of labor for weeding, harvesting, transporting, and processing.

Regarding participation of women in decision making on crop management, 59.3 per cent of women took decisions jointly with their husbands, about 27.7 per cent of women surveyed by this study did not participate in crop management decision-making process,

and only 13 per cent took decisions independently indicating a low level of decision making among women in crop management. The low agricultural productivity of women was attributed to social and economic constraints, such as limited access to land, lack of credit and inadequate opportunities for education, and cultural circumstances that favor men. The socioeconomic factors that significantly enabled women to participate in crop management decision making included: a larger farm size, accessibility to credit, extension services, group membership, and engagement in off-farm activities. Adding to the factors influencing input use among women, Matshe (2019) compared how much plots managed by men and women received input use (fertilizer and labour); 89 per cent of parcels owned by male-headed households received chemical fertiliser, while 81 per cent of parcels owned by female-headed households did, hired labour was used on 67 per cent of male-headed households' parcels and on 58 per cent of parcels owned by female-headed households. Education was found to significantly raise the probability of female farmers' use of both chemical fertilizers and hire.

Nazir (2013) assessing involvement of women in agricultural activities in rural Pakistan reported that women are involved in a variety of agricultural activities. Majority (81.7 %) of the respondents participated in harvesting and picking activities. About 70.8 per cent of respondents in the research area participated in sowing. More than half (54.2%) of the respondents were involved in processing related activities like winnowing, drying of grains, cleaning of grains. Slightly more than half (52.8%) participated in marketing of livestock products and about 50.8 per cent of the respondents participated in packing of vegetables. About 37.5 per cent of the respondents participated in cultural practices (transplanting, manure application, fertilizer application, weeding, thinning, gap filling, irrigation and plant protection measures such as insecticides and pesticides). The areas where the participation of rural women was found to be least are leveling and cleaning of agricultural fields as only 35.0 per cent of the respondents said that they participated in these activities. Challenges faced by women respondents regarding participation in agricultural activities include: "looking after their children", serving in laws, serving parents, looking after themselves, performing house hold chores, meeting with relatives and attending different ceremonies in the family.

Taking the pigeon pea value chain in Malawi, Nsope and Larkins (2016) report a participation rate of approximately 60 per cent for women in pigeon pea farming (60% of

those who grow pigeon pea are women), 90-95 per cent of local processing is done by women, however when it came to retailing, 70 per cent was done by men; there are no women who acted as large-scale exporters. Significance of the crop to the gender categories, type of processing requirements and access to finance/cash, women's physical abilities (in terms of lifting and protecting themselves from theft), cultural restrictions on their time and mobility were reported as factors affecting women participation in pigeon pea value chain.

Emerole et al (2014) among other objectives, assessed factors that influenced participation of male and female heads of farm households in cassava entrepreneurship. Amongst the female-headed households, marital status, adult number of females in the households, and frequency of extension contact had very high ($P < 0.001$) influence on the participation of female household heads in own cassava enterprises. In addition, status of health of household members, weekly time spent on cassava activities and annual net enterprise profit had moderate ($P < 0.05$) influence on participation of female heads of cassava enterprise households. It was further indicated that, culturally, women in the study area have difficulties in accessing farmland, farm credit and other inputs and do many of the house works with little or no assistance.

Nation (2009) examined intra-household dynamics in his study on women's participation with a focus on irrigation activities in Senegal. In terms of activity implementation, in irrigated agriculture, irrigation infrastructure bound women and men together. Both were dependent on the irrigation pump and system of canals for their agricultural production, and both had to cooperate to ensure the operation of this infrastructure. Women and men, working in separate work-groups, coordinated their labor to weed and maintain the earthen canals. Irrigation group membership depended on this contribution of labor. Despite the need for collective work on the village irrigation fields, male irrigators assumed more control over the irrigation system and its technology than women did. A group of elected officers undertook the decision making for the irrigation group, making critical decisions on when and how long to irrigate the fields. These elected officers mostly were men. All of the pump operators were men, even on the women's irrigation fields. Some irrigation lands with separate women's gardens had female presidents who organized women's workgroups on the main irrigation fields. However, these women were seldom consulted

about the operation of the irrigation infrastructure. Factors that influenced women's participation in farm decision making include: access to and the returns to capital investment, access to land, control over irrigation technology, labour allocation to irrigated agriculture. Constraints included: agricultural marketing (lack of transportation, limited business and negotiation skills, family opposition, limited product).

Sisay G. (2018) also assessed women's participation in irrigation activities but the focus was on female headed households and factors facilitating their participation in Peri urban modern small scale irrigation projects. The findings indicated that female-headed households' participation in peri-urban modern small-scale irrigation projects was found to be minimal. This was attributed to educational status of household head, access to credit services, livestock endowment, farm landholding size, distance from the nearest market centre, age of household head, distance to irrigated land, and non-farm income-generating activities.

Without regard to a specific enterprise, in a study by Wajiha Ishaq and Shafique Qadir Memon (2016) out of all the pre-harvesting activities, 94.2 per cent positive responses were recorded against seed bed preparation. A majority of rural women (85.02, 88.88 and 95.65%) were involved in shed cleaning, dung collection and fodder cutting, respectively with indication of high involvement of women in mostly post-harvesting and livestock management. Higher participation of women in livestock activities was also reported in a study by Amin et al, (2010) where out of a total 768 respondents, more number of wives (37 %) participated in livestock production activities as compared to the husbands (17%). Role of rural women in livestock production was higher in activities such as fodder offering, cleaning of sheds, watering to the animals, milking, poultry raising, ghee and egg selling and raising of goats and sheep, whereas the role of husbands was higher in fodder cutting and transportation of fodder. Age, education, social participation, economic motivation had significant relation with participation of farm women. Though their participation was not quantified, a study by Manzoor et al, (2018), also indicated that women of the Punjab province actively participated in livestock-related activities i.e. milking, feeding and watering, treatment, fodder cutting, cleaning sheds, grazing, making dung-pads, rearing and bathing the animals. Due to cultural milieu of the Punjabi rural society, women were involved in doing this difficult job.

Sella and Minot (2018) from their findings in Uganda, reveal that there was very little difference in the self-reported participation of men and women in food production (94% of women and 92% of men). This implies that food production is jointly done. Fifty Seven per cent of both men and women report input into all or most decisions on food crop production. For cash-crops the difference is larger (46% of women and 68% of men), only 41 per cent of women report input into all or most decisions on use of income from cash crops compared to 74 per cent of men, implying male dominance in use of income. Factors reported to affect women's participation include: Age, male-female educational differences, remoteness, and location, individual and household characteristics.

Subhadip Pal and Sourav Halder (2016), reported on participation and role of rural women in decision making related to farm activities in their study in Burdwan district of West Bengal. Among the responding men ($N = 100$), 36 per cent were engaged in agriculture and agriculture labour and then 30 per cent in agriculture labour. There were significant differences among the responding men in relation to their occupation ($\chi^2 = 11.68$, $df = 3$, $P < 0.0005$). Moreover, there were no statistical differences between the responding women and men, ($t = 0.00$, $df = 5$, $P > 1.0000$) in relation to their occupation. In terms of decision making, Mean ($\pm$ S.E.) decision score for women respondents was 2.1 (± 0.1) and for men respondents it was 3.0 (± 0.1). Therefore, decision making power in relation to farming activities was higher among men respondents than women respondents ($t = 8.20$, $df = 10$, $P < 0.0001$) implying that men play a larger role in farm production decisions and farm women's involvement in decision making process in the agriculture field is quite minimal. Age, education, caste, type and size of the family, size of land holding, socio-economic status of the families, education level of rural women have significant influence on the involvement in decision-making.

In a study by Sidra Mazhar, Mysbah Balagamwala and Haris Gazdar (2017) with the objective of enumeration and analysis of women's work in Agriculture, 81 per cent of the women were indicated to be involved in agriculture work, 67 per cent in farming work and 70 per cent in livestock activities. In terms of women's prevalence in agriculture work, most involvement of women was in crop harvesting (39%) compared to weeding (23%), sowing and planting (15%) and carrying loads (6%). In livestock farming, women were mostly giving water to livestock (47%), fodder preparation (37%), milking (26%), fodder collection (23%), livestock care (19%), grazing 11%. Constraints to women's

participation in agriculture included: Male outmigration, increase in commercialization of agriculture, pandemic diseases that disproportionately affect more men (like HIV), conflict, climate change, technological innovations, reproductive status of women competing claims of their time, unequal access to resources and opportunities in agriculture, unequal access to land, and lack of access to technologies, agricultural innovations, government services, such as agricultural extension and financial services. They are also disadvantaged when using tools and equipment because even though they are meant to be gender neutral they are more suitable for men.

Limitations

The limitations of this review are as follows: firstly, despite including quality studies in this review, the review was limited to studies written in English. This may have led to some bias because articles in languages other than English could have contributed significantly to this systematic review in terms of study outcomes. Secondly, all the articles included in this review were conducted in developing countries as such, the review may not be generalizable to other global settings. Despite these shortfalls, this review has identified factors affecting women's participation. The trend of their participation, if taken into consideration, could enhance women's participation in agriculture.

Conclusion

This review has demonstrated that most of the activities in production of crop enterprise related activities are done by women although intensity of their cultivation is low compared to men. Women dominate especially in post-harvest handling practices in developing countries. Although variations exist among regions, this study found out that despite being key players in production activities, women continue to have a limited participation in farm decision making especially on marketing issues.

Factors affecting women's participation in agriculture include: Education levels, Age, socio participation, economic motivation, accessibility to credit, farm size, access to extension services, group membership, size of the family, marital status, engagement in off farm activities, adult number of females in the household, access to and returns to capital, innovation, access to land, control over irrigation technologies, education of household head, distance from nearest market, livestock endowments, age of household head,

distance to irrigable land, male female educational differences, remoteness, socio economic and status of the family. From all these studies, it is the training intervention only that was evaluated. There is need for an evaluation on participation of women in agriculture under other interventions that promote power relations in the household since most factors affecting women participation are skewed towards power relations in the family.

References

- Akter S, Rutsaert. P Joyce, Luis B, Htwe N.M, San S.S, Raharjo B, Pustika A (2017). Women's empowerment and gender equity in agriculture: A different perspective from Southeast Asia. *Food Policy* 69 (2017) 270-279. Available at: <https://reader.elsevier.com/reader/sd/pii/S0306919217303688?token=2E0D60DFCAF4C4EC3BFA0915EA157B162F120C959B1648077EABFC5C11F45A3F7B96C450AE50D5DD223C4242767E6186> [Online] (Accessed: 11/6/19)
- Clark (2013). Understanding the gender- based productivity gap in Malawi's agricultural sector. MSc thesis. Available at: <https://pdfs.semanticscholar.org/af72/74fc56b45a68eecdccac6d878b9f8730e5.pdf> [Online] (Viewed 20/5/19)
- Emerole C.O, Nwachukwu A.N, Anyiro C.O, Ebong V, Osondu C.K (2014). Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 14, Issue 1, 2014. Available at: http://managementjournal.usamv.ro/pdf/vol4_1/Art20.pdf [Online] (Accessed: 17/6/19).
- Essays, UK. (November 2018). The Importance of Agriculture in Developing Countries Economics Essay. Retrieved from <https://www.ukessays.com/essays/economics/the-importance-of-agriculture-in-developing-countries-economics-essay.php?vref=1> [Online] (Viewed 21/5/19)
- FAO (2011). The role of women in agriculture. ESA Working Paper No. 11-02. Available at: <http://www.fao.org/3/am307e/am307e00.pdf> [Online] (Viewed 20/5/19)
- Hassan Ishaq Ibrahim, Napoleon Danbeki Saingbe and Zubairu Ajiya Abdulkadir (2012). Gender participation in economic activities and decision making in Keffi area of Nigeria. *Asian Journal of Agriculture and Rural Development*, 2(1), 10-16. Available at: [http://www.aessweb.com/pdf-files/2-22-2\(1\)2012-AJARD-10-16.pdf](http://www.aessweb.com/pdf-files/2-22-2(1)2012-AJARD-10-16.pdf) [Online] (Accessed: 11/6/19)
- Manzoor, Adeela & Khan, I.A. & Ashfaq, H & Jabeen, N & Maan, A.A. (2018). Women's involvement in livestock care and management: Implications for their social life in the Punjab, Pakistan. *Pakistan Journal of Agricultural Sciences*. 55. 239-242. 10.21162/PAKJAS/18.5581. Available at: file:///C:/Users/HPUSER~1/AppData/Local/Temp/AS740459827695616155_3550788026_content_1.pdf [Online] (Accessed: 17/6/19).

- Matshe I, Zikhali P and Chilonda P (2010). Education and agricultural inputs use by female farmers in Zimbabwe. *Empowering Women for Gender Equity*, No. 86. Available at: <https://www.jstor.org/stable/pdf/41321386.pdf?refreqid=excelsior%3Aba1bc9eddf3a1ae1061844832632a0c> [Online] (Accessed: 11/6/19)
- Mazhar S, Balagamwala M and Gazdar H (2017). The Hidden Economic Backbone - Women in Agriculture. Paper presented at the LUMS International Conference on Gender, Work and Society. April 2017. Available at: http://researchcollective.org/Documents/The_Hidden_Economic_Backbone_Women_in_Agriculture.pdf [Online] (Accessed: 11/6/19)
- Mila Sella, Nicholas Minotb (2018). What factors explain women's empowerment? Decision-making among small-scale farmers in Uganda, *Women's Studies International Forum* 71 (2018) 46-55. Available at: <https://reader.elsevier.com/reader/sd/pii/S0277539517301000?token=7A133084BE4762EB533EE4265416095367D3452F5E01DE48634458BBA83B37D382200EEEF631AB639F47E7709104D6A7> [Online] (Viewed, 13/5/19)
- Nathalie Me-Nsope1 and Michelle Larkins (2016). Beyond crop production: Gender relations along the pigeon pea value chain and implications for income and food security in Malawi. *Journal of Gender, Agriculture and Food Security*. Available at: <http://agrigender.net/uploads/JGAFS-132016-1-Paper.pdf> [Online] (Accessed: 17/6/19).
- Nation, M.L. (2009). Understanding women's participation in irrigated agriculture: a case study from Senegal *Agric Human Values* (2010) 27: 163. <https://doi.org/10.1007/s10460-009-9207-8> (Accessed on 11/6/19)
- Ochieng J, Ouma E & Birachi E (2017). Gender Participation and Decision Making in Crop Management in Great Lakes Region of Central Africa. *Gender, Technology and Development*, 18, 3 (2014): 341-362. Available at: <https://www.tandfonline.com/doi/pdf/10.1177/0971852414544007?needAccess=true> [Online] (Accessed on 11/6/19).
- Pal S and Halder S. (2016). Participation and role of rural women in decision making related to farm activities: A study in Burdwan district of West Bengal'. *Economic Affairs* 61(1): 55-63. Available at: <http://ndpublisher.in/admin/issues/EAV61N1h.pdf> [Online] (Accessed: 28/4/19)
- Patalagsa M.A, Schreinemachers P, Begum S and Begum S (2015). Sowing seeds of empowerment: effect of women's home garden training in Bangladesh. *Agriculture & Food Security* 20154:24 Available at: <https://agricultureandfoodsecurity.biomedcentral.com/track/pdf/10.1186/s40066-015-0044-2> [Online] (Accessed: 17/6/19).

- Rahman S.A (2008). Women's involvement in agriculture in northern and southern Kaduna State, Nigeria. *Journal of Gender Studies*. <https://doi.org/10.1080/09589230701838347> [Online] (Viewed 6/7/17).
- Sella M, Minotb N, (2018). What factors explain women's empowerment? Decision-making among small-scale farmers in Uganda. *Women's Studies International Forum* 71 (2018) 46-55 Available at: <https://reader.elsevier.com/reader/sd/pii/S0277539517301000?token=10EBE1381BE55C244C84CF8F2705F684F25126441FC318FAB34F75B36646D2C99717F54C7F300C7462FDDDFB92DBC57> [Online] (Accessed on 6/6/19).
- Shamna, P. Biswas, S. K. Jha, S. Sarkar, and Sh. Kumar (2018). Tribal Farm Women's Participation in Agriculture and Factors Influencing It: Evidence from West Bengal, India. *J. Agr. Sci. Tech.* (2018) Vol. 20: 911-922. Available at: <http://jast.modares.ac.ir/article-23-19812-en.pdf> [online] (Accessed: 17/6/19).
- Singh S, Sinwal N, Rathore H. (2017). Gender involvement in manual material handling (mmh) tasks in agriculture and technology intervention to mitigate the resulting musculoskeletal disorders *Work* 41 (2012) 4333-4341. Available at: file:///C:/Users/HPUSER~1/AppData/Local/Temp/Gender_involvement_in_manu_al_material_ha-1.pdf [Online] (Accessed: 11/6/19).
- Sisay G (2018). Determinants of female-headed households 'participation in peril urban modern small-scale irrigation projects in Ethiopia: the case of kobo town†. . *Irrig. and Drain*. 67: 670-683 (2018) Available at: <https://onlinelibrary.wiley.com/doi/epdf/10.1002/ird.2283> [Online] (Accessed: 10/6/18)
- Subhadip Pal and Sourav Halder (2016). Participation and role of rural women in decision making related to farm activities: A study in Burdwan district of West Bengal <http://ndpublisher.in/admin/issues/EAV61N1h.pdf> DOI: 10.5958/0976-4666.2016.00008.5
- Solomon Petros, Fetien Abay, Girmanesh Desta, and Cheryl O'Brien (2018). Women Farmers' (Dis) Empowerment Compared to Men Farmers in Ethiopia. Available at: <file:///C:/Users/HP%20USER/Documents/scopusstpaul/Women-Farmers-DisEmpowerment-Compared-to-Men-Farmers-in-Ethiopia2018World-Medical-and-Health-Policy.pdf>. *World Medical & Health Policy*, 10:3 Accessed on 13/5/19
- World Bank. (2008). 'World Development Report 2008: Agriculture for Development Washington, DC: Oxford University Press for the World Bank'. [Online], available at: https://siteresources.worldbank.org/INTWDR2008/Resources/WDR_00_book.pdf. (Accessed: 22/4/19)

Farmers' Perception and Adoption of Soil Health Cards in Guntur District

G. Sivanarayana¹ and A.Lalitha²

Abstract

Perception and adoption of 102 farmers regarding soil health card information and recommendations were studied during 2016-17 in Guntur district. Results revealed that more than three-fourth (>75%) of the farmers had moderate perception about Soil Health Card (SHC) information and recommendations and medium adoption to SHC recommendations. More than fifty percent of the farmers adopted recommended N, P, K, organic manures, micro nutrients and gypsum as suggested in Soil Health Cards (SHCs).

Keywords: profile, perception, adoption, soil health cards.

Introduction

Soil testing is known as a precise method for determining and assessing soil fertility that enables farmers to assess the nutrient status and the impact of soil management and identify what nutrients are needed each year. The quantity of available nutrients in the sample determines the amount of fertilizer that is recommended, helps in correct diagnosis of soil health and appropriate doses of nutrients that can be added to get optimum crop yield. Soil Health Cards (SHCs) provide timely information and calculate the use of major fertilizers and also make farmers aware of the micro nutrients, which could be added to balance the soil health. It also aims at helping the farmers get better agricultural yield. Government of India initiated Soil Health Card scheme in the year 2015 encouraged by the Department of Agriculture, Cooperation and Farmers Welfare under the Ministry of Agriculture and it is implemented through the Department of Agriculture in all the States and Union Territories. The SHCs contain information on what kind of fertilisers should be

¹ Principal Scientist (Extension) Regional Agricultural Research Station, ANGRAU, Guntur - 522034

² Scientist (Extension) AI & CC Lam, Guntur, Regional Agricultural Research Station, ANGRAU, Guntur - 522034. Corresponding author Email: lalithareddy6@gmail.com

Received Date: 04-12-2019

Accepted Date: 07-01-2020

used for getting better productivity from the field. Moderate to high perception about SHC scheme can lead to the adoption of SHC recommendations by the farmers and may also lead to regular soil testing, once in every three years. Keeping in view the above facts, the present study was conducted with the following specific objectives:

1. To study the personal, socio-economic characteristics of the respondents and
2. To find out the perception and adoption level of farmers regarding utility of Soil Health Card.

Material and Methods

The study was conducted in Guntur district of Andhra Pradesh purposively with ex-post facto research design, following proportionate random sampling method. The study is based on primary data collected for the year 2016-17 and was conducted in two mandals viz., Mangalagiri and Kollipara. A total of 102 respondents were selected randomly from four villages: Chinavadlamudi (16), Pedavadlamudi (8), Nuttakki (30), Atmakur (21) of Mangalagiri mandal and two -Athota (12) and Kollipara (15) villages of Kollipara mandal. A structured interview schedule was developed to collect data from the respondents by personal interview method and was pre-tested. The data so obtained was analysed with the help of descriptive statistical measures such as frequency, percentage, mean and standard deviation. The findings were interpreted and necessary conclusions and inferences were drawn.

Results and Discussion

Personal and Socio-Economic Characteristics of the Respondents

The study revealed that about 48 per cent of the respondents belonged to middle age followed by 41 per cent belonging to old age and 11 per cent belonging to young age (Table 1). The data revealed that less than half (40%) of the respondents had high school education and 23 per cent of the farmers are illiterates; an equal proportion (15%) of the respondents had primary school education and graduation respectively. A meagre percentage of the farmers had received intermediate education. Ninety six per cent of the respondents considered farming as their occupation and most (86%) of the farmers

belonged to open category with respect to their caste. Slightly more than half (51%) of the farmers were having more than 20 years of farming experience followed by 34 per cent having 11-20 years of farming experience (Table 1).

Table 1. Distribution of Farmers based on Personal and Socio-Economic Characteristics
n=102

S. No.	Variables	Category	Respondents	
			Frequency	Percentage
1	Age $\bar{X}$ = 45.25 α = 9.07	Young age (< 35 years)	11	10.78
		Middle age (36-58 years)	49	48.05
		Old age (>59 years)	42	41.17
2	Education	Illiterate	23	22.54
		Primary school	15	14.70
		High school	40	39.24
		Inter/Diploma	9	8.82
		Graduation	15	14.70
3	Occupation	Farming	98	96.08
		Farming+ Business	2	1.96
		Farming + Service	2	1.96
4	Caste	SC/ST	4	3.92
		BC	10	9.80
		OC	88	86.28
5	Farming experience	Below 10 years	15	14.70
		11 to 20 years	35	34.30
		More than 20 years	52	51.00
6	Land Holding	Less than 1 ha	30	29.40
		1 to 2 has	36	35.30
		More than 3 has	36	35.30
7	Annual Income	Upto 50,000	40	39.22
		50,000 to 1 lakh	38	37.25
		More than 1 lakh	24	23.53

8	Source of information $\bar{X} = 7.53$ $\alpha = 1.21$	Low (<6)	11	10.78
		Medium (6 to 9)	78	76.48
		High (>9)	13	12.74
9	Family size	Upto 5	83	81.40
		Greater than 5	19	18.60
10	Family type	Nuclear	79	77.50
		Joint	23	22.50
11	Social participation	No Membership	87	85.30
		Membership in an organisation	15	14.70
12	Extension contact $\bar{X} = 3.5$ $\alpha = 0.84$	Low (<2.7)	9	8.83
		Medium (2.8 to 4.3)	79	77.45
		High (>4.3)	14	13.72

The data presented in Table 1 also shows that slightly more than one-third (39.2 %) of the respondents had annual income below Rs.50,000/-, followed by 37.25 per cent having annual income between Rs.50,000 to 1 lakh, and 23 per cent of the respondents having annual income above Rs.1 lakh. Regarding source of information, majority of the respondents belonged to medium category followed by high and low category respectively. Further, 81 per cent of the respondents had family size up to five members and 18.6 per cent had more than five members in their family. Majority of the respondents belonged to nuclear family and 22 per cent of the respondents had joint families. Nowadays there is decline in number of joint families. Regarding social participation a great majority (85%) of the farmers do not have any membership while nearly 15 per cent of the respondents are having membership in an organisation. More than two-third (77%) of the respondents were having medium extension contact followed by high (13.7%) and low (8.8%) levels of extension contact, respectively. These results were in agreement with the findings of (Patel et al. 2017).

The results indicated that more than four-fifth (77.45%) of the respondents had medium level of perception regarding soil health cards, followed by 12.74 per cent and 9.81 per cent who had low and high level of perception, respectively (Table 2).

Table 2. Distribution of Farmers based on Perception and Adoption of Soil Health Cards
n=102

S.No	Variables	Category	Frequency	Percentage
1	PERCEPTION	Low (<22.6)	13	12.74
	$\bar{X} = 27.69$	Moderate (22.7 to 32.6)	79	77.45
	$\alpha = 5.04$	High (>32.6)	10	9.81
2	ADOPTION	Low (<7.8)	15	14.71
	$\bar{X} = 10.0$	Medium (7.9 to 12.3)	77	75.49
	$\alpha = 2.24$	High (>12.3)	10	9.80

It is inferred that majority (75.49%) of the respondents had medium level of adoption of SHC recommendations followed by 14.71 per cent and 9.80 per cent who had low and high level of adoption, respectively (Table 2). Soil health card programme was given a lot of publicity by the State Department of Agriculture and Ministry of Agriculture, therefore, more than seventy percent of the respondents fell under the categories of medium level of perception and adoption. These results draw support from the findings of Sali et al. (2016); Raghavendra and Theodore (2016) who recorded that 67 per cent of the respondents had high level of satisfaction on SHC recommendations.

Table 3. Farmers' Perception on Individual Statements Regarding Soil Health Cards
n=102

Sl.No	Perception	Agree %	Undecided %	Disagree %
1	The results given in SHC are reliable	68.6	10.8	20.6
2	The results given in SHC are useful to increase yields	63.4	23.5	12.7
3	The SHCs were distributed in time	52.9	8.8	38.2
4	The results given in SHC are useful to reduce cost of cultivation	53.9	27.5	18.6
5	SHC helps in selecting right crop suitable to my soil	66.7	14.7	18.6

6	Information provided in SHC helps to sustain soil fertility	66.7	28.4	4.9
7	Information provided in SHC is simple to understand	70.6	25.5	3.9
8	Information provided in SHC is simple to adopt	66.7	25.5	7.8
9	Micro nutrient management is possible with SHC	72.5	18.6	8.8
10	Problematic soils are easily diagnosed with SHC	81.4	14.7	3.9
11	Reclamation of problematic soils with SHC is possible	68.6	27.5	3.9

A perusal of Table 3 conveys that 81.4 per cent of the farmers agreed with the statement 'Problematic soils were easily diagnosed with SHC' as the soil tests are accurate and 72.5 per cent of the respondents agreed with the statement 'Micro nutrient management is possible with SHC'. Information provided in SHC was simple to understand was agreed by 70.6 per cent of the respondents followed by an equal percent of the respondents who agreed to the statements 'Reclamation of problematic soils with SHC is possible' and 'The results given in SHC are reliable'. The plausible reason could be that the soil health card includes a detailed report of the deficiencies in the soil and the amendments that are needed and it also contains the information pertaining to the quantity of fertilizers that need to be applied for the particular soil.

More than half (66.7%) of the respondents agreed with the statements 'SHC helps in selecting right crop suitable to the soils', 'Information provided in SHC helps to sustain soil fertility' and 'Information provided in SHC helps to sustain soil fertility'. Nearly 68.6 per cent of the respondents agreed with, 'The results given in SHC are reliable' and further, 'The results given in SHC are useful to increase yields' was agreed by 63.4 per cent of the respondents followed by slightly more than half (53.9%) who agreed that 'The results given in SHC are useful to reduce cost of cultivation' while a meagre (38.2%) of the respondents disagreed to the statement 'The SHCs were given in time'. The plausible cause could be due to the lack of adequate staff in the agriculture department hence it was not possible for them to ensure the delivery of soil health cards in time. These results are

in agreement with the findings of Patel et al. (2017) who studied 100 farmers of Anand district and reported that nearly 52 per cent of the famers had knowledge regarding high to very high level of knowledge with respect to soil testing and perception to use soil health card.

Table 4. Farmers' Adoption based on SHC Recommendations N=102

Sl. No.	Adoption	Adopted %	Not Adopted %
1	Recommended organic manures as per SHC results	67.6	32.4
2	Recommended Nitrogen as per SHC results	72.5	27.5
3	Recommended Phosphorous as per SHC results	72.5	27.5
4	Recommended Potash as per SHC results	71.6	28.4
5	Recommended Micro nutrients as per SHC results	68.6	31.4
6	Recommended Gypsum/Lime as per SHC results	59.8	40.2

The results in Table 4 indicate that majority of the respondents (72.5%) adopted recommended use of Nitrogen and Phosphorous as per SHC results and 71.6 per cent of the respondents adopted recommended Potash as per SHC results. The plausible reason could be that farmers opined that the recommended fertilizer dose is sufficient for healthy growth of their crops.

More than half (68.6%) of the respondents adopted recommended Micro nutrients as per SHC results followed by 67.6 per cent who adopted recommended organic manures as per SHC results and slightly more than half (59.8%) adopted recommended Gypsum/Lime as per SHC results. Awareness about problems associated with micro nutrient deficiencies, acidic soil and information on remedial measures was the reason behind adoption of soil amendments. The results are in line with the studies conducted by Lalatendu and Kameswari (2014) who reported that farmers of Mayurbhanj district of Odisha have medium level of adoption regarding recommended acidic soil management practices; Raghavendra and Theodore (2016) recorded that out of the 100 respondents studied, 47 of them had followed SHC recommendations all the five years.

Conclusion

Majority of the respondents had moderate perception (77.75%) of SHC information and adoption (75.49%) of Soil Health Card recommendations in Guntur district. More than fifty percent of the farmers adopted recommended N, P, K, organic manures, micro nutrients and gypsum as suggested in SHCs.

References

- Lalatendu Mohapatra and Kameswari, V.L.V. (2014). Knowledge level of soil management practices and their adoption by the farmers of Odisha. *International Journal of Farm Sciences*. 4(4): 240-246.
- Raghavendra Chowdary and Ravi Kumar Theodore. (2016). Soil health card adoption behaviour among beneficiaries of Bhuchetana project in Andhra Pradesh. *Journal of Extension Education*. 28 (1): 5588-5597.
- Patel, G.G., Lakum, Y.C., Aakash Mishra and Bhatt, J.H. (2017). Awareness and knowledge regarding soil testing and utility perception of soil health card. *International Journal of Current Microbiology and Applied Sciences*. 6 (10):329-334.
- Sali, J.R., Mokhale, S.U., Padekar, D.G and Rajput, H.K. (2016). Adoption of soil test recommendations by the farmers. *Asian Journal of Soil Science*. 11 (2): 358-360.

Adoption of Improved Sericultural Technologies among Farmers of Mizoram State

J. Parameswaranaik¹, Lalhriatkima², G. R. Manjunatha³ and V. Sivaprasad⁴

Abstract

The state of Mizoram is endowed with a very pleasant and conducive climatic condition for silkworm rearing along with fertile soil and abundant rainfall giving a favourable atmosphere for sericulture activities. Mulberry silkworm Bombyxmori is an inhabitant of the State. Mulberry is cultivated in 4094 hectares in approximately 175 villages and Mizoram occupies the third place in producing mulberry raw silk (75 MT) among the northeastern states of India. The gap between the potential and actual yield in mulberry sericulture is very wide. One major factor is attributed to be ignorance and non-adoption of improved recommended technologies. The productivity depends on the extent to which farmers adopt new technologies. With this background the present study was conducted to assess the adoption of improved technologies, with 60 sericulture farmers of three districts in Mizoram. The findings reveal that 100 percent of the respondents adopted the tray rearing method and plastic collapsible mountage and have a separate rearing house. Low level of adoption was found in integrated pest management (60 % partial and 40 % no adoption) and integrated nutrient management (75% partial adoption). Hence there is a scope for the extension agency to conduct training programs on integrated pest management and integrated nutrient management in the study area.

Keywords: Adoption, Mulberry, Sericulture, NERTPS and Mizoram State

¹ Scientist B, Central Sericultural Research and Training Institute, Berhampore, West Bengal, India
Corresponding author Email: drpnaik.csb@gmail.com

² P.G.D.S Scholar, Central Sericultural Research and Training Institute, Berhampore, West Bengal, India

³ Scientist C, Central Sericultural Research and Training Institute, Berhampore, West Bengal, India

⁴ Director, Central Sericultural Research and Training Institute, Berhampore, West Bengal, India

Received Date: 29-02-2020

Accepted Date: 17-03-2020

Introduction

Sericulture is an eco-friendly labour intensive agro-based cottage industry providing subsidiary employment to rural farmers especially the weaker sections of the society. It is the cultural heritage in the north-eastern region and is one of the most promising income source of the north-eastern region without spending much for its cultivation (Ananda Kumar 2006). The state of Mizoram is endowed with a very pleasant and conducive climatic condition for silkworm rearing along with fertile soil and abundant rainfall giving a favourable atmosphere for sericulture activities (Choudhury et al., 2013). Mulberry is cultivated in 4094 hectares in approximately 175 numbers of villages and occupies the third place in producing mulberry raw silk (75 MT) among the northeastern states of India. It has generated employment for about 4197 farmers, most of them being marginal, women and weaker sections in the society (CSB, 2019). The gap between the potential and actual yield in Mulberry sericulture is very wide. One major factor is attributed to be ignorance and non-adoption of improved recommended technologies. The productivity depends on the extent to which farmers adopt new technologies (Vijaya Kumari et al., 2015). Hence an attempt has been made in this paper to assess the adoption level of improved technologies among sericulture farmers of Mizoram state.

Methodology

The present study was conducted in three districts i.e. Aizawl, Champhai and Lunglei which were selected for the study based on the highest cocoon production in Mizoram. A total 60 sericulture farmers were selected for the study based on snowball sampling technique. The interview schedule was prepared for collecting data from the respondents. Data were collected through personal interview method; the data collected from selected sericulture farmers were coded and tabulated keeping in view the objective of the study.

Adoption among sericulture farmers was measured on a three point continuum as 'Full adoption', 'Partial adoption' and 'No adoption' by assigning the scores of 2, 1 and 0, respectively (Pramod Kumar, 2018). The important sericulture management practices were selected in the major areas like mulberry cultivation, silkworm rearing and other supportive technologies for sericulture by consulting with sericulture specialists of CSR&TI, Berhampore and review of literature. Based on total scores, the respondents were classified into three categories i.e., low, medium and high by using mean and standard deviation as a measure of check.

Results and Discussion

Adoption of Improved Sericulture Technologies in Mizoram

Adoption of improved sericulture technologies was categorised into three categories viz. Mulberry cultivation, silkworm rearing and other technologies.

Table 1. Distribution of the Respondents based on Adoption of Improved Mulberry Technologies in Mizoram (n: 60)

S.N	Statements	Full	Partial	No
Adoption of Mulberry technologies				
1.	Adoption of improved mulberry varieties (S-1635)	60 (100 %)	-	-
2.	Planting of mulberry with recommended spacing	58 (96.67%)	2(3.33%)	-
3.	Providing irrigation at the time of critical growth stage	-	-	60(100%)
4.	Integrated Pest Management practices	-	36(60.00%)	24(40.00%)
5.	Integrated Nutrient Management practices	10(16.66%)	45(75.00%)	5(8.34%)
Adoption of Silkworm technologies				
6.	Keeping only highly productive hybrids/cross breeds	60(100%)	-	-
7.	Practicing disinfection at frequent time interval (room, bed)	56(93.33%)	4(6.67%)	-
8.	Bed cleaning	46(76.67%)	14(23.33%)	-
9.	Separate rearing house	60(100%)	-	-
10.	Improved mounting practices	60(100%)	-	-
Other technologies				
11.	Usage of modern farm implements or equipments	-	27(45.00%)	33(55.00%)
12.	Vermi-composting/ Composting	2(3.33%)	58(96.67%)	-
13.	Preservation of leaf with wet gunny bags / Wet cloth	50(83.33%)	10(16.67%)	-

Adoption of Mulberry Technologies

All the respondents (100%) have adopted the improved mulberry variety S1635, as it is the recommended variety for Mizoram state. The State Department of Sericulture has been distributing the saplings of S1635 to the farmers hence all the respondents have adopted the improved variety. Regarding the spacing in hilly areas, mainly a spacing of 90cm × 90cm or 150cm × 150cm is followed in case of slope. Around 96.67 per cent of the respondents have fully adopted spacing of 90cm × 90cm or 120cm × 120cm according to the area of their field and only 3.33 per cent of them partially adopted, as due to the landscape of their mulberry field, few of the respondents find it difficult to follow the recommended spacing. However, regarding irrigation 100 per cent of the respondents did not provide irrigation at the time of critical growth stage; this is due to the fact that mulberry cultivation in Mizoram depends completely on rainfed cultivation. In addition, in the hilly areas due to the landscape, it is quite difficult for the farmers to establish improved irrigation facilities. Aswathanarayana, N. (1989) and Mattigatti R. (2001) have also come up with similar findings in their study.

Low level of adoption was found in integrated pest management practices, as the awareness about pest incidence and its management was not much known to the sericulture farmers of the study area. In addition, the knowledge about use of pheromone traps and bio-control agents in controlling of pests in sericulture is almost nil among the respondents. Majority of the respondents (65%) are under partial adoption category. Among the farmers surveyed, use of chemical fertilizer is not common. The main reason is lack of awareness about recommended dose of chemical fertilizers, due to which the respondents were very reluctant to apply chemical fertilizers. Use of organic, inorganic and bio-fertilizers together should be encouraged through creating awareness about economic and environmental advantage of integrated nutrient management practice in mulberry cultivation. Chikkanna et al. (1995) and Shinghivi et al. (1994) have also come up with similar findings in their study.

Adoption of Silkworm Technologies

A perusal of data in Table 1 shows that 100 percent of the respondents have adopted highly productive hybrid/cross breeds like Nistari × J112 for Multi × Bi and SK6 × SK7 and J112 for Bi-voltine. This is due to the fact that the State Department of Sericulture in

Mizoram has been distributing DFLs of these hybrids to the farmers hence almost all the respondents have adopted the highly productive hybrids. Regarding the practices of disinfection such as ankush, labex etc. the farmers are well aware about disinfection and its importance in silkworm rearing. Over 93 per cent of the respondents have fully adopted disinfection at regular intervals of time (four times after every moult and one at 5th instar' 4th day) and only 6.67 per cent of the respondents adopted partially. The data also revealed that 76.67 per cent of the respondents fully adopted bed cleaning practices at regular intervals of time and the remaining 23.33 per cent of the respondents have adopted partially. As the ongoing scheme like the North East Region Textile Promotion Scheme (NERTPS) and State Department of Sericulture are supporting farmers both financially and technically to build the rearing house, cent per cent of the respondents in the study area have adopted a separate rearing house. Respondents were very much aware of the requirement for a separate rearing house for harvesting a successful crop. Among the farmers surveyed, 86.67 per cent have fully adopted the improved mountage practices as the state department recommended and also provided, which were found effective due to dissemination of this technology by conducting various extension communication programs. However, 13.33 per cent are found to have adopted partially. (Philip, T. 2004; Ananda Kumar 2006 and Jagadisha, K. 1999).

Adoption of Other Technologies

Adoption of usage of modern farm implements was low among the respondents. Only 45.00 per cent of the respondents adopted partially while more than half (55%) of the respondents did not adopt modern farm implements. This is mainly due to the low economic status of the respondents due to which they could not purchase these high-cost equipment. Generally, the farmers adopt low or no cost technologies fully and those which are costly are adopted partially or may not be adopted at all (Geetha et al., 1993). This is also in agreement with the observation made by Shinghvi et al., (1994) and Dandin et al., (2004). Regarding the preparation of vermin-composting/composting a vast majority of the respondents (96.67%) adopted partially while only 3.33 per cent of them had fully adopted and were doing vermin-compost and composting. Generally, this is due to lack of awareness and in most cases farmers just dump the waste obtained from sericulture and let it decompose. The present study considers that as composting but vermin-compost is

adopted by only two respondents in the study area. Regarding preservation of leaves, most of the respondents (83.33%) have fully adopted the technology of using wet gunny cloth, which is also due to the various effective awareness measures and only 16.67 per cent have adopted partially though awareness was created. The success depends mainly on the attitude of the farmers towards the technology. (Gowda et al., 1992 and Parameswaranaik, J, 2019).

Conclusion

The adoption of any technology depends on different factors like social, cultural, economic, political and environmental. Mizoram state portrays the successful adoption of many of the improved sericulture technologies. Nevertheless the study depicts that the farmers in the study area have not been utilizing the complete resources available with them and adoption of integrated pest management and integrated nutrient management is not significant and also vermin-composting technology is not adopted by the farmers in Mizoram. Hence there is scope for the arrangement of practical training, on full utilization of available resources and also conducting extension communication programs on integrated pest management and integrated nutrient management and vermin-composting technique.

References

- Ananda Kumar, M. D., Vijaya Kumar and Ananthanarayana, S. R. (2006) Constraints in adoption, of new rearing technologies in Banaglore rural district- A study. Abstr., National Conference on New Strategies in Research and Development of Sericulture - Indian Perspective, March 9-10, Department of Sericulture, Jnanabharathicompu, Bangalroe, p. 126-127
- Aswathanarayana, N. (1989) A study on knowledge and adoption of improved silkworm rearing practices and marketing problems of sericulturists in Kolar district. M Sc. (Agri.) Thesis, University of Agricultural Sciences, Bangalore, p. 119.
- Chikkanna. Gowda, D.M.A.; Singhvi, N.R.; Srinivas, G.; Iyengar, M.N.S. and Datta, R.K. (1995). Study on adoption behaviour of sericulturists and their characteristics in Kolar district of Karnataka. *Indian J. Sericulture*, 34 (1): 10-14.
- Choudhury, B.N., Engzananga, D., Vanlallawma, C., Pachauau, L., Deori, S. & Biswas, T.K. (2013). Development of Sericulture in Mizoram: An alternative source of livelihood for the Tribal

- Communities. Souvenir and compendium, 1st Bodoland National Seminar-cum-workshop on Sericulture industry and its role in the socio-Economic Upliftment in Rural Society, 10-11 August 2013, pp139-145.
- CSB-Compendium on Seri States of India: (2018-19). Available at <http://csb.gov.in/wp-content/uploads/2019/02/Seri-States-Profiles-2019.pdf>
- Dandin, S.B., Vijayaprakash, N.B. and Hiriyanra (2004). Institute village linkage Programme for improvement in productivity and quality. Indian silk. 43: 5-8
- Geetha, G. S. (1993). Socio economic determinants on adoption - a case study in Hassan district. Dissertation, submitted to Central Silk Board.
- Gowda, B. L. R., Naika, K. V. and Jayaramaiah, M. (1992). Equipping sericulture Farmers for rural development. J. Rural Reconstruction, 25(2):53-62.
- Jagadisha, K. (1999). Constraints in adoption of improved rearing technology practices by different categories of farmers. M.Sc., Dissertation, Central Sericultural Research and Training Institute, Mysore.
- Mattigatti R., Dolli S. and Lyengar M.N.S.(2001). 'Model Co-operativeMarketing System for Sericulture : A Strategy for Development, Global Silk Scenario, published by Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1996, P. 178.
- Parameswaranaik, J. (2019). Factors Influencing the Attitude of Return Migrated Rural Youths towards Agripreneurship Development. Int.J.Curr.Microbiol.App.Sci. 8(07): 2810-2817.
- Philip, T. and Qadri, S. M. H. (2004). Study on the level of adoption and constraints for non-adoption of improved sericulture technologies by farmers in Kerala, Indian J. Seric., 43(1):46-49.
- Pramod Kumar Godara, NK Sharma and Devi Singh Rajput. (2018). Adoption of dairy management practices among the livestock owners of Bikaner district of Rajasthan. Journal of Entomology and Zoology Studies. 6(5): 843-846.
- Shinghivi, N. R., M. K. Sethu Rao, Y. R. Madhava Rao, M. N. Iyengar and R. K. Datta (1994). Knowledge level and adoption of new sericulture technology by farmers in Hunsur taluk, Mysore District, Karnataka state: An Evaluation. Indian J. Seric., 33(2), 48-55.
- Vijay Kumari N., Beula M., Priyadarshini M, and Manjula M.(2015). "Incidence of leaf webber (Diaphania pulverulentalis) on mulberry- A study. Journal of Plant Development science, 738(3)/2015

Constraints in Adoption of Extension Approaches by the Animal Husbandry Department as perceived by Veterinary Officers in Four Indian States

P. Lakshmi Manohari¹, Shahaji Phand² and M.A. Kareem³

Abstract

India is blessed with vast livestock resources in the form of varieties of livestock breeds. According to the Livestock Census (2012), India's total livestock population was 512 million and poultry population was 729 million. The country ranks 1st in buffalo, 2nd in cattle & goats, 3rd in sheep and 5th in poultry population in the world. Over the last two decades, the livestock sector has grown significantly. Presently the country stands 1st in milk production, 2nd in Chevon (Goat meat), 5th in meat and 9th in poultry meat production in the world. However, the productivity and production remained untapped in the livestock sector due to several reasons. The average milk yield of Indigenous cattle is only 03.41 kg/day/animal, that of crossbred cattle is 07.33 kg/day/animal and of Buffalo 04.80 kg/day/animal. One of the major reasons is ineffective extension services by the animal husbandry extension personnel as well as other stakeholders. As per NSSO-2005 survey, only 5.1 per cent of livestock farmers are getting any kind of information as compared to 40 per cent farmers getting information on crop production. The present study was undertaken by MANAGE to explore the reasons for ineffective extension services in animal husbandry sector and to suggest appropriate policy measures.

Keywords: livestock sector, extension approaches, extension management, extension personnel, constraints.

¹ Assistant Director (Agricultural Extension), National Institute of Agricultural Extension Management (MANAGE) Hyderabad

² Assistant Director (Allied Extension), National Institute of Agricultural Extension Management (MANAGE) Hyderabad. Corresponding author Email: shahajiphand@rediffmail.com

³ Deputy Director (Allied Extension), National Institute of Agricultural Extension Management (MANAGE) Hyderabad

Introduction

Livestock sector is an important sub-sector of agriculture in the Indian economy. According to the estimates of Central Statistics Office (CSO), the value of output of livestock sector at current prices during 2015-16 was about 28.6 per cent of the value of output from agricultural and allied sector. It contributes around Rs. 7.7 lakh crores per year to the GDP which is around 4.2 per cent of National GDP (Annual Report- DAC & FW 2016-17). It has emerged as a primary source of income for about 7 crore rural households- most of them are either landless, small or marginal farmers. In view of this background, the Government of India, has recently in 2019 created a separate Ministry for Animal Husbandry, Dairying and Fisheries, to ensure proper focus and right budget and resource allocation to this sector.

Although, it seems possible now that the budgetary allocation to the extension machinery of the state animal husbandry department would be given focus by this recent move, still the right orientation of the department is required so as to diversify the focus of the Veterinary officers from clinical health and reproductive management aspects to extension and advisory services.

In practice, extension organizations everywhere pursue the overall goals of technology transfer and human resource development, though within each organization there is a mix of objectives and within each country there is a mix of organizational patterns (Nagel, 1997).

An approach refers to a specific and chosen way of advancing or proceeding action. For research to be effective there must be an efficient mechanism whereby its result can be used by the end users. The process of making available the fruits of research to the stakeholders is the function of extension. Extension services frequently have many other tasks to perform, e.g. advising farmers on scientific and economically viable management practices, ensuring input availability, etc.

There are many models and types of extension activities around the world. Over the years, India has experimented with a number of extension approaches and agricultural programmes with a strong extension component. A well-recognized categorization of extension approaches is the one by Axinn (1988). His book *Guide on Alternative Extension* examines eight approaches to extension. These include:

1. *The General Extension Approach:* In contrast to several other approaches, this approach assumes that technology and knowledge that are appropriate for local people exist but are not being used by them. The approach is usually fairly centralized and government-controlled. Success is measured in the adoption rate of recommendations and increase in national production.
2. *The Commodity Specialized Approach:* The key characteristic of this approach groups all the functions for increased production - extension, research, input supply, marketing and prices - under one administration. Extension is fairly centralized and is oriented towards one commodity or crop and the agent has many functions.
3. *The Training and Visit Approach:* This fairly centralized approach is based on a rigorously planned schedule of visits to farmers and training of agents and subject matter specialists. Close links are maintained between research and extension. Agents are only involved in technology transfer. Success is related to increase in the production of particular crops or commodities.
4. *The Agricultural Extension Participatory Approach:* This approach often focuses on the expressed needs of farmers' groups and its goal is increased production and an improved quality of rural life. Implementation is often decentralized and flexible. Success is measured by the numbers of farmers actively participating and the sustainability of local extension organizations.
5. *The Project Approach:* This approach concentrates efforts on a particular location, for a specific time period, often with outside resources. Part of its purpose is often to demonstrate techniques and methods that could be extended and sustained after the project period. Change in the short term is often a measure of success.
6. *The Farming Systems Development Approach:* A key characteristic of this type of extension is its systems or holistic approach at the local level. Close ties with research are required and technology for local needs is developed locally through an iterative process involving local people. Success is measured by the extent to which local people adopt and continue to use technologies developed by the programme.

7. *The Cost-Sharing Approach:* This approach assumes that cost-sharing with local people (who do not have the means to pay the full cost) will promote a programme that is more likely to meet local situations and where extension agents are more accountable to local interests. Its purpose is to provide advice and information to facilitate farmers' self-improvement. Success is often measured by the willingness to pay.
8. *The Educational Institution Approach:* This approach uses educational institutions which have technical knowledge and some research ability to provide extension services for rural people. Implementation and planning are often controlled by those who determine school curricula. The emphasis is often on the transfer of technical knowledge Axinn, (1988).

Of late, due to the intervention of the Ministry of Agriculture and Farmers Welfare, Govt. of India, the National Institute of Agricultural Extension Management (MANAGE) came out with the Agricultural Technology Management Agency (ATMA) model of the extension system under the Innovations in Technology Dissemination (ITD) component of the National Agricultural Technology Project (NATP). The focus of the ATMA model of the extension system is mainly to shift away from transferring technologies for major crops to diversifying output in allied sectors (Gupta and Shinde, 2013). The key reforms promoted under ATMA model are broad based extension system, convergence of line departments on gap filling mode, group contact, use of ICT, gender main streaming etc. This leads to changing public extension services from narrow focus on technology transfer towards a wider focus on human and social capital formation (Leeuwis, 2003; Swanson, 2008).

The contribution of agriculture and allied sectors to the national GDP is declining year after year since independence. This may be due to inadequate attention given to allied sector activities like Animal husbandry, Horticulture, Fisheries, Sericulture etc. Due to stagnancy in agricultural production, in recent years there is more recognition given to these allied sectors to promote diversification of land use and improvement in farmer's economic status, through focused allied extension services to change knowledge, skills and attitude of the farmers.

In these respects, the present study was undertaken to understand the constraints by the officers of agri-allied sector departments i.e. Animal Husbandry, Fishery, Sericulture and Horticulture in four Indian states namely Uttar Pradesh, Odisha, Maharashtra and Karnataka in adoption of extension approaches. The total sample size for the study was 480 respondents (240 Officers and 240 Farmers). However, the present paper is focused on the constraints perceived by officers of the State Department of Animal Husbandry (SDAH) of four states in adoption of extension approaches and the total sample size was 80 officers of SDAH.

Methodology

Locale of Study

The study was conducted in 2016-17 in four Indian states and the states were selected purposively as all the four agri-allied departments i.e. Animal Husbandry, Fishery, Sericulture and Horticulture had separate organizational setup and were functioning independently in these states.

1. Northern Region : Uttar Pradesh
2. Eastern region : Odisha
3. Western Region : Maharashtra
4. Southern Region : Karnataka

Research Design

The present study was conducted using an ex-post facto research design.

Sampling Procedure

Purposive sampling technique was used to select respondents. From each state two districts were selected and from each district 10 Animal Husbandry Officers/Veterinary Officers were interviewed. Thus the sample size of each state was 20 and the total sample size from all the four states was 80 Animal Husbandry Officers/Veterinary Officers.

Data Collection

The data was collected through a pre-tested interview schedule by visiting the SDAH officers personally at their working place.

Table 1. Sampling Procedure

State		Uttar Pradesh		Odisha		Maharashtra		Karnataka	
District		Basti	Faizabad	Sonepur	Bargarh	Ahmednagar	Aurangabad	Kolar	Chikkaballapu
Respondents									
Department	Animal Husbandry	10	10	10	10	10	10	10	10
Total						80			

Results and Discussion

Constraints in Adoption of Extension Approaches

Table 2. Constraints in Adopting Extension Approaches by SDAH Officers

Sr. No	State Department of Animal Husbandry Constraints	Maharashtra (n=20)		Odisha (n=20)		Karnataka (n=20)		Uttar Pradesh (n=20)	
		Mean Score	Rank	Mean Score	Rank	Mean Score	Rank	Mean Score	Rank
1.	Lack of technical staff at the village level	4.65	1	4.9	1	4.75	1	4.35	1
2.	Recruitment of officers is not regular	4.25	3	4.9	1	4.55	3	4.2	2
3.	Inadequate knowledge and poor Communication skills of the extension personnel	1.35	18	1.5	22	1.05	25	1.25	17
4.	Communication from the field staff upwards is often defective	1.35	18	1.6	21	1.15	23	1.15	19
5.	Stress is on downward, rather than upward communication	1.2	19	1.25	24	1.1	24	1.1	20
6.	Officer with limited qualification and expertise is not able to communicate and convince the farmers	1.4	17	1.65	20	1.05	25	1.2	18

Sr. No	State Department of Animal Husbandry Constraints	Maharashtra (n=20)		Odisha (n=20)		Karnataka (n=20)		Uttar Pradesh (n=20)	
		Mean Score	Rank	Mean Score	Rank	Mean Score	Rank	Mean Score	Rank
7.	Officer is not enthused to upgrade his knowledge because of limited opportunities for career advancement	1.8	14	2.35	18	1.25	22	2.2	14
8.	Officers are technically not competent enough to solve all the problems of farmers	2.3	12	3.0	14	1.75	19	2.2	14
9.	Non-availability of funds for extension services	3.9	5	4.3	4	3.3	14	3.35	8
10.	Mobility of technical staff to the field is limited	3.2	10	3.45	11	2.4	16	3.2	10
11.	The officers are more involved in distribution of the subsidiary inputs rather than educating the farmers	1.65	15	3.55	10	2.3	17	1.2	18
12.	Estimating the input requirements and arranging for supply through proper agencies in time is more focused rather than farmer oriented activities	1.45	16	2.4	17	1.65	20	1.0	21
13.	Officers are more involved in maintaining various records, technical reports and registers rather than the extension services	4.15	4	2.95	15	3.75	9	3.05	12
14.	Extension services are sporadic, casual, occasional and highly unorganized and therefore do not effectively meet the requirements of a vast majority of farmers	3.8	7	3.95	8	3.55	12	3.25	9
15.	Extension service never got the attention it deserves and this has been one of the reasons for low productivity	3.75	8	4.1	6	3.55	12	3.8	7
16.	Breed improvement and improving the health of the fish/animals is given utmost importance and inadequate attention is given to extension services to develop knowledge and skills of farmers	4.15	4	4.5	2	4.15	5	4.15	3

Sr. No	State Department of Animal Husbandry Constraints	Maharashtra (n=20)		Odisha (n=20)		Karnataka (n=20)		Uttar Pradesh (n=20)	
		Mean Score	Rank	Mean Score	Rank	Mean Score	Rank	Mean Score	Rank
17.	Extension services to change the attitude of farmers towards newer technologies which leads to increase in production are lacking	3.85	6	3.75	9	3.4	13	3.95	4
18.	Extension services to provide information for better management in a cost effective manner is lacking	3.6	9	4.1	6	3.7	10	3.8	7
19.	Implementation of scheme or projects is the prime focus rather than developing the knowledge and skills of the farmers	4.3	2	4.25	5	4.6	2	4.2	2
20.	Under the ever changing social, economic, technological and market condition, Extension services for continuous update of knowledge and skills of farmers is lacking	3.9	5	4.35	3	3.3	14	3.35	8
21.	Irregular monitoring and field visits of the concerned authorities	2.2	13	2.95	15	2.2	18	1.6	16
22.	Preparing of training schedules for specific schemes is lacking	2.3	12	2.3	19	3.6	11	1.85	15
23.	Helping subordinates in their planning for demonstrations and other activities is lacking	1.45	16	1.45	23	1.35	21	1.25	17
24.	The trained officer's updated knowledge is not percolating down to the officers at the field	2.35	11	2.55	16	2.75	15	3.15	11
25.	The available staff is not trained in extension management	3.85	6	3.75	5	3.9	7	3.9	5
26.	Regular training of village youth to develop them as Para-vets is lacking	1.1	20	3.4	12	3.8	8	1.0	21
27.	The linkages of the extension services operating with other bodies involved in rural development have generally been poor	3.75	8	3.15	13	4.05	6	2.7	13
28.	Preparation of action plan for each village/Mandal is lacking	3.8	7	4.0	4	4.3	4	3.85	6

From Table 2 it is clear that, lack of technical staff, implementation of schemes being the major focus rather than developing the knowledge and skills of the livestock farmers; irregular recruitment, breed improvement and improving health of the animals given utmost importance rather than extension services, more time spent on paper work were the major constraints ranked in descending order respectively, by the animal husbandry officers of Maharashtra State. Benor and Harrison (1977) evaluated ministry-based extension systems and found that its poor performance was related to four leading causes. These causes included: inadequate internal organizational structures, inefficiency of extension personnel, inappropriateness or irrelevance of extension content and dilution of extension impact. Lack of regular training of village youth to develop them as Para-vets was the least ranked constraint identified by the animal husbandry officers.

Results from Table 2 reveal that in Odisha lack of technical staff and irregular recruitment, health and breed improvement of the animals was given utmost importance rather than extension services, extension services for continuous update of knowledge and skills of livestock farmers were lacking, non-availability of funds for extension services, implementation of schemes or projects being the prime focus rather than developing the knowledge and skills of the livestock farmers and inadequate attention given to the extension services were the major constraints faced by the animal husbandry officers. Communication, whether it was upward or downward was ranked as least by the animal husbandry officers. Bajwa (2004) argued that the public sector extension services do not reach the majority of small farmers due to various reasons such as inadequate funds and weak accountability system. Pratap et. al. (2012) in their study on animal health care system revealed that services provided by veterinary officers and private practitioners were demand-driven, at the same time milk cooperative doctors are relatively more proactive than other animal husbandry service providers. Gardharia (2006) reported that, majority (61%) of the Veterinary Officers had perceived heavy workload, 55.00 per cent of the Veterinary Officers had sufficient area of jurisdiction. A great majority (70%) of the Veterinary Officers had medium level of job satisfaction, (69%) had job stress, (62%) achievement motivation and (73%) job involvement.

Table 2 shows the constraints in Karnataka state where, lack of technical staff, implementation of scheme being the prime focus rather than developing the knowledge and skills of the livestock farmers, irregular recruitment of veterinary officers, lack of

preparation of action plan for each village, Breed improvement and improving health of the animals being given utmost importance and inadequate attention given to extension services, poor linkage of extension services, lack of staff training in extension management were the major constraints identified by the animal husbandry officers. Vinita A. and Vinod K. A. (2014) suggested that, the veterinary hospitals should be well equipped, furnished, updated and modernised according to field requirements and there should be proper promotional opportunities for veterinary officers.

In Uttar Pradesh it was found that, lack of technical staff, irregular recruitment of veterinary officers, implementation of scheme being the prime focus rather than developing the knowledge and skills of the livestock farmers, breed improvement and improving health of the animals being given utmost importance and inadequate attention given to extension services, lack of extension services to change the attitude of farmers towards newer technologies which leads to increase in production of livestock, available staff were not trained in extension management, lack of preparation of action plan for each village, were the major constraints identified by the animal husbandry officers.

Gardharia (2006) reported that, majority of the constraints faced by Veterinary Officers were: insufficient technical staff more reporting work, deteriorating quality of work due to excessive workload, lack of laboratory and laboratory equipment at VD centres, lack of latest instruments for diagnosis and treatment such as X-ray and sonography instruments, inadequate and non-availability of vehicle facility, insufficient supply of medicines, materials and other facilities, lack of supporting staff like peon, clerk and a dresser, lack of administrative staff, paucity of funds and excessive administrative work.

Conclusion

It is observed that, lack of technical staff at village level, irregular recruitment of officers, implementation of scheme or projects being the prime focus rather than developing the knowledge and skills of the farmers, focus on reproductive and health aspect rather than extension services to develop knowledge and skills of farmers and lack of up gradation of knowledge and skills of extension officers for effective extension services etc. are ranked most remarkable constraints faced by extension officers of SDAH. Apart from these, the lack of manpower, lack of preparation of action plan, lack of importance given to develop

the knowledge and skills of the allied sector farmers, lack of extension services to change the attitude of farmers towards newer technologies, lack of trained staff in extension management were the major constraints identified by the officers of State Department of Animal Husbandry.

It can be concluded from the above study that since the beginning the orientation of the SDAH remained confined towards giving healthcare and breeding service rather than production oriented focus. In most of the states the designation of veterinarians is Veterinary Officer (VO), Veterinary Assistant Surgeon (VAS) rather than Livestock Development Officer (LDO) which restricted their role on development aspects. Presently, on an average one veterinarian is looking after 18000 livestock population, which is nearly three times more than what is recommended under Veterinary Council of India Act 1984, i.e., one veterinarian for 5000 livestock population. The regular recruitment of officers and supporting staff along with necessary infrastructure is the prerequisite for improvement of production and productivity of livestock. The study has also revealed that, the available staff in SDAH is not trained particularly on extension management aspects. In such a situation, exploring the role of SDAH officers on development aspects, capacity building particularly on extension management through regular training programs become most important. It is a known fact that, most of SDAH do not have their own training centre for regular training of SDAH officers, particularly on extension management aspects. While the Veterinary Colleges under Veterinary/Agricultural universities and research institutes of veterinary science under Indian Council of Agricultural Research (ICAR) are mainly focusing on technical training programs, MANAGE, at the national level, Extension Education Institutes (EEI) at the regional level and State Agricultural Management and Extension Training Institute (SAMETI) at the state level are the training institutes, dedicated for capacity building of agri-allied sector officers on extension management aspect. However, it has been observed from past experiences that participation of SDAH officers in training programs of these institutes is very less. Therefore, it is recommended that, SDAH should focus on capacity building programs on extension management aspects along with other technical programs.

References

- Axinn G.H. (1988). Guide on alternative extension approaches, Food and Agriculture Organisation of the United Nations 154 p.
- Bajwa, R., (2004). Agriculture Extension and the Role of the Private Sector in Pakistan. National Rural Support Program, Islamabad, Pakistan.
- Benor, D. and Harrison, J.Q. (1977). Agricultural extension: The training and visit system. Washington, D.C.: The World Bank.
- DAC & FW (2017). Annual Report of Department of Agriculture & Farmers Welfare 2016-17 available at <http://agricoop.nic.in/annual-report>
- Gardharia H. B. (2006). Managerial Ability of Veterinary Officers working under Panchayat in Saurashtra Region of Gujarat State, Ph. D thesis submitted to Junagarh Agricultural University
- Gupta, H. and Shinde, S. (2013). Agricultural Extension in India. International Journal of Management and Social Sciences Research (IJMSSR), Vol. 2, No.11.
- Leeuwis, C. (2003). Communication for Rural Innovation: Rethinking Agricultural Extension. Blackwell Publishing, UK.
- Nagel, U.W. (1997). Alternative approaches to organizing extension. In B.E. Swanson, R.P. Bentz, & A.J. Sofranko (Eds.), Improving Agricultural Extension: A reference manual (pp.13-20). Rome: FAO
- Pratap S., Bardhan D. and Dabas Y.P.S. (2012). Can Privatization Improve Animal Healthcare Delivery System? An Ex-ante Analysis of Dairy Farmers in Tarai Region of Uttarakhand. Agricultural Economics Research Review Vol. 25 (Conference Number) 2012 pp 507-514
- Swanson, B.E., (2008). Global Review of Good Agricultural Extension and Advisory Service Practices, Food and Agriculture Organization of the United Nations, Rome.
- Vinita Agrawal and Vinod Kumar Agrawal (2014). Job Satisfaction of Veterinary Officers in Rajasthan: An Empirical Study, Asia-Pacific Journal of Management Research and Innovation, 10, 2 (2014): 157-166

Standardization of Training Modules on Mushroom Cultivation Technology

Mahantesh Shirur¹, Anupam Barh² and Sudheer Kumar Annepu³

Abstract

The training programmes on mushroom cultivation technology in India are un-identical with a vague curriculum framework. This has overarching implications for the quality of training programmes on mushroom cultivation and subsequently on the mushroom enterprises in the country. The present study was undertaken to address this concern and standardize the curriculum framework and training modules on mushroom cultivation aspects. Eight training modules based on learning needs and training feedback of different stakeholders have been proposed. The curriculum development for all these training modules was done on the basis of relevancy analysis. The standardised training modules will serve as the quality benchmark for transactions in the learning environment. The proposed training modules will also serve for institutional policy formulation for training programmes on mushroom cultivation.

Keywords: Training needs, capacity building, learning, curriculum framework, mushroom.

Introduction

Mushroom enterprise is still treated as an ancillary agri-business activity in India Shirur, Shivalingegowda, Chandregowda & Rajkumar, (2015). Favorable and diverse climate, adequate land, surplus labor and plenty of agriculture residues serve as the ideal recipe to enhance mushroom production to meet the growing demand for protein rich food. However, the production and utilization of mushrooms as a regular food in India is far less compared to many of the neighboring Southeast Asian nations (Shirur, Shivalingegowda, & Chandregowda (2017). However, of late, the edible mushrooms in India are enticing

¹ Deputy Director, National Institute of Agricultural Extension Management (MANAGE), Hyderabad, Telangana. Corresponding author Email: maha.shirur@manage.gov.in

^{2&3} Scientists, ICAR-Directorate of Mushroom Research, Chambaghat, Solan, Himachal Pradesh

Received Date: 23-12-2019

Accepted Date: 03-01-2020

the hi-tech vegetable growers and agri-entrepreneurs to venture into mushroom farming as they are getting a premium price (Shirur, Shivalingegowda & Younus, 2013). Despite many mushrooms available for commercial cultivation, the mushroom industry in India is overwhelmingly focused on white button mushroom which is a capital-intensive activity (Sharma, Annepu, Gautam, Singh, & Kamal, 2017). Besides, the lack of technical skills, low level of information supply both on production and marketing aspects are the major impairments that have constrained the spread of mushroom industry in India (Shirur, Shivalingegowda, Chandregowda & Rana, 2016). These reasons are creating an increasing need of quality training among the farmers and entrepreneurs willing to take up mushroom cultivation as an agri-business activity.

The training programmes on mushroom cultivation technology are in huge demand. Being a nodal research and training institute of India, ICAR-Directorate of Mushroom Research at Solan is receiving more applications for training than each previous year (Shirur, Annepu, Awasthi & Thakur, 2017). Even with the network of 32 centres of All India Coordinated Research Project (AICRP) on mushroom, 665 Krishi Vigyan Kendras (KVKs) / Farm Science Centres, several research institutes and State departments, the farmers and entrepreneurs willing to get trained on mushroom cultivation are not being adequately trained largely due to the huge number of applicants. Along with technical competency, the training centres are expected to possess the necessary infrastructure to impart proper training on mushroom cultivation. In the absence of technical expertise and infrastructure, several training centres and private consultants offer short term trainings of one to two days focusing on one or two edible mushrooms. This has led to unscientific and unsustainable adoption of mushroom cultivation by many farmers and entrepreneurs eventually resulting in financial loss for them.

Knowledge on any entrepreneurial venture forms an important basis for making wise decisions in an enterprise. The knowledge of mushroom entrepreneurship is still more critical considering the technical skills involved in mushroom cultivation associated jobs like; spawn production, compost preparation, environment management to suit to different mushroom varieties, pest and disease control, marketing management, processing of mushrooms, etc. (Shirur et al. 2015). While dealing with such broad subjects, training need identification and curriculum prioritisation is prerequisite to ensure the quality of training programmes (Sharma, Arora & Kher, 2010). Lynton and Pareek (1990) also

emphasised the role of training need identification in the success of training programmes. Hence, the present study was envisaged with the following objectives.

- i. To identify training and curriculum needs of mushroom growing farmers and entrepreneurs.
- ii. To standardise the training modules and prescribe relevant curriculum framework to ensure effectiveness in trainings on mushroom farming.

Material and Methods

The research study was conducted at the ICAR-Directorate of Mushroom Research, Solan, India. The erstwhile training modules on mushroom cultivation were analyzed for efficiency for two years from 2016-17. The respondents were selected from participants attending the training modules for farmers, entrepreneurs and officials. The data on post training evaluation and feedback was collected from trainees through a structured and pretested questionnaire from 100 entrepreneurs, 120 farmers and 30 officers/scientists and subject matter specialists from State Agricultural Universities (SAUs) and Krishi Vigyan Kendras (KVKs).

Based on the evaluation results of earlier training modules, eight new training modules were proposed with need based relevant course curriculum. The methodology followed for proposing the new training modules on mushroom cultivation and relevant curriculum was based on ADDIE model. The Analysis (A), Design (D), Development (D) and Implementation (I) stages completed in the first stage of module development have been presented here.

The descriptive statistical methods mean and frequency have been used for data analysis and interpretation.

Results and Discussions

Module Development

Training modules identification and curriculum framework were developed by following five stages as followed in ADDIE model (Wang & Hsu, 2009). ADDIE model is one of

the old but effective models developed for the U.S. Army during the 1970s by Florida State University's Center for Educational Technology (Fig.1) (Branson et al., 1975).

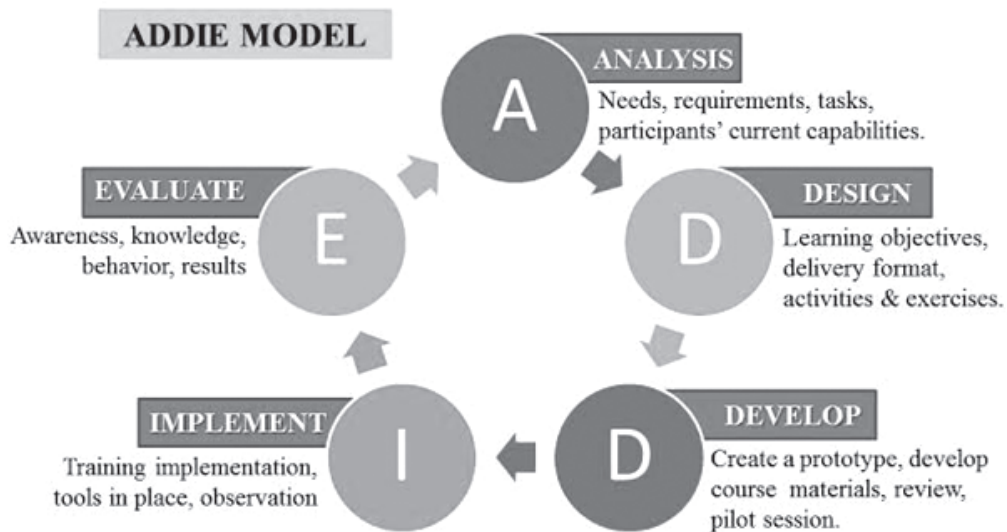


Fig.1 ADDIE Model used for Development and Standardisation of Training Modules

- i) **Analysis:** The analysis principally allows a teacher to gather information about the knowledge, skills, or attitudes the learner needs to attain and what needs to be taught to accomplish this learning (Cheung, 2016). The mushroom cultivation training modules conducted by ICAR-Directorate of Mushroom Research, Solan and its curriculum was taken as the content for analysis. These training modules of 10 days for entrepreneurs and 7 days for farmers and officials were analysed.

The new training modules were proposed based on need analysis, audience analysis and task analysis. Need analysis was done by trainees' feedback about lectures, lecture-organization, facilities, etc. Audience analysis was done on the basis of profession (Farmers, entrepreneurs, officials), money invested for training and type of exposure, mushroom variety and type of mushroom farming interested in, duration of training, methods of teaching, instructional aids used and literature support required. Task analysis was done by creation and development of different modules according to the perceived need and audience analysis output. This data was used as the basis for curriculum identification for different training modules. In the open ended responses, one major perceived barrier to learning

by the farmers and entrepreneurs was asked. Seventy eight learning barriers mentioned by these respondents were pooled under 11 headings. Frequency and arithmetic mean were used to present the evaluation results.

The results showed that 30.77 per cent of the trainees urged to include additional practical sessions and 19.23 per cent trainees were in favour of fewer participants in each batch. About 16.67 per cent of the trainees found the sessions highly scientific/ technical and difficult to comprehend while 8.97 per cent participants perceived that the duration of the training was more than required. Of all the responses, language barrier, improper organisation of lectures and outdated lectures were mentioned as barriers to effective learning by 5.13 per cent of the trainees. Among other barriers poor presentation skills of trainers, lesser number of introductory lectures, infrastructure and logistical support and dealing with too many mushroom species in a single training were listed by the respondents (Table 1).

Table 1. Barriers to Learning Expressed by Trainees **N=220**

Learning barrier	Percentage of responses
Inadequate number of practical sessions	30.77
Too many participants in the batch	19.23
Too Scientific/ technical jargons	16.67
Duration of training too lengthy	8.97
Unsuitable medium of instruction	5.13
Improper organization of lectures	5.13
Outdated lectures	5.13
Poor presentation skills	3.85
Insufficient introductory lectures	2.56
Infrastructure and logistical shortcoming	1.28
Too many mushroom varieties	1.28

- ii) **Design:** Design is a blueprint for the training module. After the analysis of previous modules, new training modules were designed. Besides the above criteria of training analysis, institutional requirements were considered in proposing new training modules. The proposed training modules were designed to overcome the shortcomings in the existing training modules. These training modules covered the topics with varying emphasis on different aspects of mushroom cultivation.

Eight new training modules designed are presented in Table 2. MCT-ABE and MCT-SFY/MCT-GFY modules were designed to cater to the needs of entrepreneurs with huge investment capacity and farmers with low investment capacity respectively. The former module deals with bigger projects of different edible mushrooms while the emphasis in the latter module is on smaller projects on mushroom cultivation for livelihood purpose with less capital investment. MCT-GFY is the module similar to MCT-SFY but organised for targeted beneficiaries identified by the Government institutions.

Based on the demand for training on button mushrooms alone by many trainees, BMCT-ABE module was conceived and designed focusing exclusively on cultivation aspects of button mushrooms. The MCT-VDO training module was designed for trainees with basic understanding of biological science covering prime edible mushrooms. It is premised that they can comprehend the mushroom cultivation aspects simply by seeing the steps through video documentaries. In this module, video documentaries will be supplemented with discussion with the experts to answer the queries if any.

HOST-SPT and HOST-PHT modules were designed to address the concerns expressed by trainees on additional practical sessions for skill enhancement. To address the language barrier, the training modules can be organised in different languages by segregating the trainees into homogeneous groups.

Experts and trainers involved in mushroom training lack necessary expertise to deal with diverse topics such as farm design, regulation of cropping room conditions, pest and disease management, spawn production, processing and value addition in mushrooms, etc (Shirur et al., 2016). Hence, the MCT-GOV module has been exclusively designed to address the capacity building on mushroom production aspects for scientists and Subject Matter Specialists (SMS) of KVKs and line departments.

Table 2. New Training Modules Proposed on Mushroom Cultivation Technology

Modules	MCT-ABE	MCT-SFY	BMCT-ABE	MCT-VDO	HST-SPT	HST-PHT	MCT-GOV	MCT-GFY
Course title	Mushroom cultivation technology as an agri - business enterprise	Mushroom cultivation technology for small farmers and youth	Button mushroom production technology as an agri-business enterprise	Mushroom cultivation technology through video documentaries	Hands on skill training on spawn production technology	Hands on skill training on value addition and post harvest technology	Mushroom cultivation technology for scientists and Government officials	Mushroom cultivation technology under government schemes for small farmers and youth
Objective	To help industrialists and entrepreneurs establish large scale commercial mushroom units.	To help small farmers and youth to establish small and medium mushroom production units for livelihood.	To help industrialists and entrepreneurs establish large scale commercial button mushroom production units.	To help industrialists and entrepreneurs understand the basics of commercial mushroom production units.	To help the entrepreneurs to establish a mushroom spawn production facility	To help the entrepreneurs to establish a mushroom processing unit to prepare mushroom value added products.	To help the officers and trainers to become master trainers on mushroom cultivation technology.	To help small farmers and youth to establish small and medium mushroom production units for livelihood.
Method of instruction and teaching tools used	Theory/ lecture with power point presentations supplemented with demonstrations and visits to large commercial units.	Theory/ lecture with power point presentations supplemented with demonstrations and farmers' field visits	Theory/ lecture with power point presentations supplemented with demonstrations, field visits and videos.	Video documentaries followed by discussion with experts and farm visits.	Videos and Hands on practice to learn skills of spawn production in spawn laboratory.	Videos and Hands on practice to learn skills of mushroom preservation and processing	Theory/ lecture with power point presentations supplemented with demonstrations and field visits.	Same as module 2

Modules	MCT-ABE	MCT-SFY	BMCT-ABE	MCT-VDO	HOST-SPT	HOST-PHT	MCT-GOV	MCT-GFY
Literature or training material to be provided	Printed literature covering the curriculum	Printed literature covering the curriculum	Printed literature covering the curriculum	Printed literature covering the curriculum and technology documentaries	Technology documentary on spawn production and literature on spawn production technology	Video documentary on post harvest technology and value addition in mushrooms and literature on mushroom recipes	Printed literature covering the curriculum and technology documentaries	Printed literature covering the curriculum
Number of candidates/ batch	40-50	40-50	50-60	50-100	5-10	5-10	20-30	20-50
Duration in days	7	5	3	3	3	3	5-7	3-4

MCT-ABE: Mushroom Cultivation Technology for Agri-Business Entrepreneurs
 MCT-SFY: Mushroom Cultivation Technology for Small Farmers and Youth
 BMCT-ABE: Button Mushroom Cultivation Technology for Agri-Business Entrepreneurs
 MCT-VDO: Mushroom Cultivation Technology through Video Documentaries assisted learning.
 HOST-SPT: Hands on Skill Training on Spawn production Technology
 HOST-PHT: Hands on Skill Training on Post harvest technology and processing
 MCT-GOV: Mushroom Cultivation Technology for Government Officials.
 MCT-GFY: Mushroom Cultivation Technology for Farmers and Youth sponsored by Government schemes.

Table 3. Curriculum Framework Proposed for Different Training Modules on Mushroom Cultivation Technology

Sl. No	Topic	MCT-ABE	MCT-SFY/ GFY	BMCT-ABE	MCT-VDO	HOST-SPT	HOST-PHT	MCT-GOV
1	An introduction to mushrooms, principles and practices of their cultivation	✓	✓	✓	✓	✓	✓	✓
2	An exposure visit to farm facilities and cropping rooms	✓	✓	✓	✓	✓	✓	✓
3	Mushroom - An agri business activity	✓	✓	✓	✓	✓	✓	✓
4	Nutritional and medicinal values of mushrooms	✓	✓	✓	✓	✓	✓	✓
5	Mushroom culture preparation and preservation techniques	✓	✓	✓	✓	✓	✓	✓
6	Spawn production technology	✓	✓	✓	✓	✓	✓	✓
7	Quality traits in mushroom strains and acceptability	✓	✓	✓	✓	✓	✓	✓
8	Methods of compost production technologies for white button mushrooms	✓	✓	✓	✓	✓	✓	✓
9	Crop management of white button mushroom	✓	✓	✓	✓	✓	✓	✓
10	Farm design, infrastructure requirement for commercial mushroom growing unit	✓	✓	✓	✓	✓	✓	✓
11	Economics of button mushroom cultivation on a small scale	✓	✓	✓	✓	✓	✓	✓
12	Economics of button mushroom cultivation on industrial scale	✓	✓	✓	✓	✓	✓	✓
13	Cultivation & economics of paddy straw mushroom	✓	✓	✓	✓	✓	✓	✓
14	Cultivation of oyster mushroom	✓	✓	✓	✓	✓	✓	✓
15	Infrastructure, economics of oyster mushroom	✓	✓	✓	✓	✓	✓	✓

Table 3. Curriculum Framework Proposed for Different Training Modules on Mushroom Cultivation Technology

Sl. No	Topic	MCT-ABE	MCT-SFY/ GFY	BMCT-ABE	MCT-VDO	HOST-SPT	HOST-PHT	MCT-GOV
16	Cultivation & economics of milky mushroom	✓	✓	✗	✓	✗	✗	✓
17	Competitor moulds/fungal and viral diseases	✓	✓	✓	✗	✗	✗	✓
18	Bacterial diseases and abiotic disorders of mushrooms	✓	✓	✓	✗	✗	✗	✓
19	Insect, pests & nematodes of mushroom crop and their management	✓	✓	✓	✗	✗	✗	✓
20	Cultivation of shiitake mushroom	✓	✗	✗	✓	✗	✗	✓
21	Production & marketing: Global and national scenario	✓	✗	✗	✗	✗	✗	✓
22	Financial assistance available for mushroom production and project formulation	✓	✓	✓	✗	✗	✗	✗
23	Round the year cultivation of mushrooms	✓	✓	✗	✗	✗	✗	✓
24	Quality parameters and analysis of compost and casing soil	✓	✗	✓	✗	✗	✗	✓
25	Cultivation of specialty mushrooms	✓	✗	✗	✗	✗	✗	✓
26	Post harvest handling, value-addition, processing	✓	✓	✓	✓	✗	✓	✓
27	Computer use and application in mushroom enterprises	✓	✗	✓	✗	✗	✗	✗
28	Recycling of spent mushroom substrate	✓	✓	✓	✗	✗	✗	✓
29	Sources of information for various inputs	✓	✓	✓	✗	✗	✗	✓
30	Entrepreneurial attributes to succeed in mushroom entrepreneurship	✓	✗	✗	✗	✗	✗	✗

iii) Develop : In the development stage, exhaustive curriculum topics were listed from a comprehensive review of literature. Since the training needs on mushroom farming are largely dependent on the type of mushroom variety, nature of farming, investment capacity, raw materials and labour wages, input costs, etc., these topics were given for trainees for relevancy analysis based on their perceived needs. For relevancy weightage (RW), responses were recorded on five point continuum from 1-5 with 1 being the not relevant (NR) and 5 as the most relevant (MR). Relevant (R), Some what Relevant (SR) and Least Relevant (LR) were assigned 4, 3 and 2 weightages respectively.

$$RW = \frac{MR \times 5 + R \times 4 + SR \times 3 + LR \times 2 + NR \times 1}{\text{Maximum possible scores} \times \text{No of respondents}}$$

Topics with relevancy weightage value of more than 0.80 were included in the training module and the decision on left out aspects was made in consultation with subject matter specialists. The training curriculum finalised for each module is given in Table 3.

Although the curriculum of MCT-ABE and MCT-SFY/MCT-GFY modules dealt with crop production, management and processing activities, the MCT-ABE module put more emphasis on the need based detailed financial and economic principles involved in mushroom cultivation and entrepreneurial attributes to succeed in large scale mushroom enterprises. The curriculum of MCT-SFY and MCT-GFY modules will focus on teaching to engage in mushroom production activity with less capital inputs using the prevailing seasonal climatic variations. These modules will guide the small and marginal farmers to integrate the mushroom production activity with the existing cropping patterns to generate additional farm income. Further, this is in line with meeting the objectives of Skill India and ARYA (Attracting Rural Youth for Agriculture) schemes of the Government of India.

Despite the post harvest handling problems, white button mushroom has an organized market in India. The preference of the majority of mushroom consumers in favour of this mushroom has led to its buoyant demand in the domestic market. This is the reason for mushroom growers' demand for exclusive training on button mushroom alone. The button mushroom crop differs from other tropical mushrooms in respect of its requirement of

composted substrate for its growth and the temperate conditions in the cropping room. Considering these perceived needs of the trainees, the curriculum of the BMCT-ABE module has been finalised.

Both HOST-SPT and HOST-PHT modules are primarily intended to create skilled manpower who can become entrepreneurs and lead start-ups in mushroom related enterprises. Quality spawn is a critical input to succeed in mushroom entrepreneurship yet many small farmers do not produce the spawn required in their mushroom unit either due to lack of infrastructure or the lack of technical knowledge. Besides turning into entrepreneurs themselves, the participants trained through HOST-SPT module will spiral the mushroom production in the country by supporting the small and marginal farmers. The HOST-PHT module will create employment opportunities of mushroompreneurs through engaging in production of mushroom fortified products and minimising the loss on account of short shelf life of fresh mushrooms.

Recent trends in Agricultural Information Management and several advances in digital technologies have changed the way information is accessed and disseminated. To meet the expectations of the educated mass with access to information and communication tools, MCT-VDO module has been proposed through digital content delivery followed by demonstrations and discussions with experts. The proposed training module is aimed to fulfill the necessity of the new mushroompreneurs to meet their need of comprehensive information using the digital platforms. The curriculum in the MCT-VDO module is delimited to the cultivation technology of five prime edible mushrooms (*Agaricus bisporus*, *Lentinula edodes*, *Pleurotus sp.*, *Volvariella volvacea* and *Calocybe indica*) in India.

The curriculum for the MCT-GOV is borrowed broadly from the MCT-ABE module as the needs of the officials were overlapping with the demands of entrepreneurs. Moreover, with necessary expertise in large scale projects, the officials and scientists can absorb and translate the learning to direct the small farmers and youth on their needs.

iv) Implementation: The implementation stage is the road map as how the learning objectives shall be achieved by the integration of methods of instruction and delivery. The class room instruction supported by multimedia tools will be used to make up for the

temporal activities associated with mushroom cultivation practices. This will facilitate effective learning especially in teaching the distantly timed activities such as spawn preparation, compost stacking, turning, pasteurization, etc. The operation of machines and creation of infrastructure necessary for all activities in mushroom production can be shown through instructional aids and field visits. The implementation stage of new modules is aimed to reduce the slack time and increase the efficiency and intensity of trainings. The slack time is filled by video documentaries, field visits and other innovative teaching modes.

v) Evaluation: For the evaluation part, online assessments, structured questionnaire and feedback from discussion with trainees will be undertaken. The learning shall be assessed based on the pre-training and post-training tests to measure the change in the knowledge level. This will be facilitated through a teacher test that comprises questions derived from both theoretical and practical concepts taught during the training programme. To measure the behavior change, combination of results from teacher test, visual observation of trainees' behavior such as discussion, participation in skill practices and the change in opinion about different commercial mushrooms will be recorded. This will be measured by taking the opinion of the instructor of the trainee (Rafiq, 2015). This knowledge change would help to track the extent of effectiveness of training modules both during and after the training programme. The results of the future evaluation will be tested from the extent of adoption of mushroom cultivation either as an agri-business or in associated enterprises such as spawn production, compost supply, mushroom marketing, mushroom processing, spent mushroom substrate utilisation, etc. Ideally, the evaluation stage of the training modules may need two years to test them among a sizeable number of participants from 5-6 batches.

Conclusion

The new training modules on mushroom cultivation and the relevant curriculum for these modules were designed and developed methodically with an aim to accomplish effective learning. The feedback from the participants was given primacy in arriving at different training modules and accommodating their needs in the training modules. Limited resources, especially the trainers on mushroom cultivation need to be utilised rationally through the

use of digital resources and addressing training needs of larger groups at one go. Implementation guidelines of the training modules will result into quality deliverables through training programmes. The proposed study based on ADDIE model facilitates comprehensive assessment of workability of new training modules. Delineating the curriculum in minute detail will ensure the objectivity in its description. This is an important contribution of the research study that would help to shield the farmers and entrepreneurs from unqualified trainers and unskilled consultants. The proposed training modules will also serve for policy formulation in training programmes on mushroom cultivation adopted by different institutions and agencies in India.

References

- Branson, R. K., Rayner, G. T., Cox, J. L., Furman, J. P., King, F. J., & Hannum, W. H. (1975). Interservice procedures for instructional systems development.
- Cheung, L. (2016). Using the ADDIE Model of Instructional Design to Teach Chest Radiograph Interpretation. *Journal of Biomedical Education*, 2016, 1-6. <https://doi.org/10.1155/2016/9502572>
- Lynton, R. P., & Pareek, U. (1990). 1990. Training for Development. Pp.. SAGE publication, New Delhi. 184-86: SAGE.
- Rafiq, M. (2015). Training Evaluation in an Organization using Kirkpatrick Model: A Case Study of PIA. *Journal of Entrepreneurship & Organization Management*, 4(3), 1-8. <https://doi.org/10.4172/2169-026X.1000151>
- Sharma, N., Arora, R., & Kher, S. (2010). KVK trainings for the farmers in hilly areas of Poonch district - identifying need of the hour. *Journal of Hill Agriculture*, 1(2), 140-145. Retrieved from <http://www.indianjournals.com/ijor.aspx?target=ijor:jha & volume=1 & issue= 2 & article=009>
- Sharma, V. P., Annepu, S. K., Gautam, Y., Singh, M., & Kamal, S. (2017). Status of mushroom production in India. *Mushroom Research*, 26(2), 111-120.
- Shirur, M., Annepu, S. K., Awasthi, B., & Thakur, P. (2017). E-readiness of farmers participating in the training programme on mushroom cultivation technology at ICAR-DMR, Solan. In *Proceedings of the national symposium on advances in agriculture through sustainable technologies and holistic approaches (AASTHA)*.

- Shirur, M., Shivalingegowda, N. S., & Younus, I. (2013). Startup constraints in mushroom entrepreneurship: a case analysis. In Proceedings of third International conference on extension educational strategies for sustainable agricultural development- a global perspective. Bangalore: University of agricultural sciences Bangalore.
- Shirur, M., Shivalingegowda, N. S., & Chandregowda, M. J. (2017). A study on mushroom consumer behaviour: Implications for mushroom farming, marketing and public health policy. In National symposium on mushrooms: Trends and innovations in mushroom science. Solan.
- Shirur, M., Shivalingegowda, N. S., Chandregowda, M. J., & Rajkumar, B. J. (2015). Mushroom entrepreneurial behaviour?: Dimensions and measurement. *International Journal of Agricultural and Statistical Sciences*, 11(1), 61-68.
- Shirur, M., Shivalingegowda, N. S., Chandregowda, M. J., & Rana, R. K. (2016). Technological adoption and constraint analysis of mushroom entrepreneurship in Karnataka. *Economic Affairs*, 61(3), 427-436. <https://doi.org/10.5958/0976-4666.2016.00054.1>
- Wang, S. K., & Hsu, H. Y. (2009). Using the ADDIE Model to Design Second Life Activities for Online Learners. *TechTrends*, 53(6), 76-81. <https://doi.org/10.1007/s11528-009-0347-x>

Impact of Dairy Cooperative on Women Empowerment: A case of Nani Borvai village in Gujarat

K.R. Sreeni¹

Abstract

A case study on the role of small-scale dairy farming and the factors which help women was undertaken in Nani Borvai village, Aravalli District of Gujarat State, India. Data were collected through personal interview from 75 rural women who were involved in dairy farming. For analyzing the impact of dairy cooperatives on women's empowerment, this study mainly focused on Decision Making, Social Index, Economic Index and Psychological Index. The intervention helped the women to earn Rs 13000 to 16000 per month as compared to Rs 5000 per month before the intervention. Better utilization of this higher earning was observed on food, clothing, health and education of children, social gathering and festivals. The women were also able to save Rs. 60,000 per year. The interventions also helped the women to improve their decision making capacity, reduce alcoholism and domestic violence, participate in group meetings and develop self-confidence. This can be further facilitated by increasing milk productivity in every household where women dominate in dairy farming management.

Keywords: Nani Borvai village, Aravalli District, women empowerment, dairy farming.

Introduction

Amrita Milk Cooperative Society-Nani Borvai [AMCSN] was engaged in a variety of activities to provide its members an assured market for their milk. It was registered under AMUL-SABAR Himatnagar Co-operative Societies in October 2018 with seventy-five members initially and capable of handling 700 liters of milk daily. The project has made great strides in the improvement of livestock farming at Nani Borvai Village and has succeeded in integrating better technology and management in the traditional small milk holder production system. It directly and indirectly provides 100 jobs in the village and approximately distributes Rs 14 lakh among its members every month.

¹ Program Manager, Amrita SeRVe, Amrita Vishwa Vidyapeetham Amritapuri Campus, Kerala, India.
Corresponding author Email: krsreeni72@gmail.com
Received Date: 02-09-2019

Accepted Date: 16-12-2019

The milk quality was tested using MILKO Tester and Automatic Milk Collection Unit [AMCU]. MILKO Tester helps to determine the fat per cent rapidly in milk while AMCU reduced the waiting period of farmers and elimination of unfair practices. After entering the milk measurement twice every day, by the end of the week the cashier settles the account.

Study Design

The study was conducted in the year 2018-19 at Nani Borvai village, Aravalli District, Gujarat. The location was selected seeing the number of buffalos and cows and the scope for dairy farming. Most of the farmers possessed five to eight buffaloes or cows or both. There were 350 buffaloes and 75 cows in the village. Seventy-five women who were engaged in dairy farming were selected for the interview.

Impact on Women

The formation of AMCSN helped the women for systematic collection of milk, translating into increased rural incomes, reduced wastages, ensured value addition and generated employment opportunities.

The milk cooperative society consists of eleven women members headed by the president. All routine meetings are conducted in the presence of the president and the elected members. The reports are to be regularly sent to AMUL-Sabar Himatnagar .

Previous attempts to collect and market milk had been unsuccessful, largely due to the absence of a collection center. Seema Ben, a village coordinator, recalls the adverse conditions under which women and children labored to earn a few rupees. "They used to sell milk in some other villages 3 to 4 km away." She recounts, "During the rainy season, this was especially difficult, for the milk would often spoil. Either the children had to leave school to sell it or the women had to leave their household work and go themselves."

The increase in demand for milk and dairy products provides greater opportunities and potential for milk producers and for development of milk production in the village. In the backdrop of self-employment or group employment the small unit of AMCSN is seen as a potential source for driving rural economy and it brings synergy between industry and agriculture.

Women started involving themselves in day-to-day activities and supplying milk to the collection unit at a common point, which in turn resulted in gathering, more interaction and participation. Milk reading was recorded each day and proper registers were maintained and all data recorded in the computer. Due to regular activities, women came to know each other in the village. Meanwhile, unnecessary misunderstanding and conflicts were resolved. There was co-operation among the women which led to a healthy environment in the village as a whole.

Women have started interacting with government officials about their problems for a solution, without any hesitation. It helped them in acquiring freedom of speech, mobility and involvement in decision making both at home and in the community as well.

Decision Making Pattern

Five indicators have been used to measure the dimension of decision making namely Women involvement in day to day activities, taking independent decision, determining own health care, protest against alcoholism and protest against domestic violence. It could be observed that a majority of the women could take better decisions on these aspects (Table 1).

Table 1. Decision Making

Subject	Total No of women involved in Dairy Activities	Women involved in day to day household activities
Women involved in day to day household activities	75	60
Take independent decision	75	50
Determining own health care	75	60
Protest against alcoholism	75	70
Protest against domestic violence	75	60

Social Involvement

Five indicators have been used to measure the dimension of Social Involvement namely Participation in meetings, Membership in SHG or Micro finance, Governing Marriages & Divorces, Education and Nutritional standards among girls. In all the five indicators, women

were found to perform better which showed their empowerment due to their involvement in dairy cooperatives.

Table 2. Social Involvement

Subject	Total No of women involved in Dairy Activities (X)	Women involved in day to day household activities (Y)
Participate in meetings	75	70
Membership in SHG or Micro finance	75	75
Governing Marriages & Divorces	75	60
Education	75	50
Nutritional standards among girls	75	60

Economic Performance

Economic performance comprised of five indicators which include gender equality, decent work for all, food security, Earning Income and saving. Women perceived that their economic conditions have greatly improved due to their active participation in dairy cooperatives.

Table 3. Economic Empowerment

Subject	Total No of women involved in Dairy Activities	Women involved in day to day household activities
Gender equality	75	60
Decent work for all	75	50
Food security	75	60
Earning Income	75	75
Saving	75	50

Psychological Empowerment

Five indicators have been used to measure the dimension of Psychological empowerment due to involvement of women in dairy cooperatives. They were reduction in the rigidity of social and caste system, rise in household income, more time engaged in work, self

confidence and self esteem. These indicators also showed better improvement in self-confidence and self-esteem.

Table 4. Psychological Empowerment

Subject	Total No of women involved in Dairy Activities	Women involved in day to day household activities
Reduction in the rigidity of social and caste system	75	40
Rise in household income	75	75
More time Engaged in work	75	75
Self Confidence	75	75
Self Esteem	75	75

Conclusions

The study indicated that small-scale dairy farming had increased confidence and self-esteem among women. Rural women become more empowered when they have a regular job and seem to make good decisions in achieving social, economic and psychological growth. All indicators showed a positive trend that implies that all five dimensions are dynamic, interlinked and mutually reinforcing at the household level. These findings have important implications for the potential growth of small-scale dairy farming and more women may be empowered. Such economic activity gives freedom to think independently, the women have come to know each other and unnecessary misunderstanding and conflicts have been resolved. Greater cooperation, in turn, has led to a healthier village environment. The women were able to substantially allocate their earnings to children's education.

References

- Dinesh Kumar, M and Singh OP. (2017). Dairy Economy of India: Structural Changes in Consumption and Production. Discussion. Economic and Political weekly Vol 52(41), October 2017. https://www.epw.in/journal/2017/41/discussion/economics-dairy-farming-india.html?0=ip_login_no_cache%3Dc13df82de3ae5f9a528d934613f00720
- Makwana, Girish D. and Modi, Rajesh (2016). Constraints of Milk Production: A Study on Cooperative and Non-Cooperative Dairy Farms in Kheda District of Gujarat. Indian Journal of Applied Research Vol 6 (5) 2016.

