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Determinants of Women's Participation in Agricultural Extension Services among Rural Women Farmers in Yilmanadensa District, Northwest Ethiopia

Birhane Anagaw Abebe¹ & Biruk Yazie²

Abstract

Women play a very significant role in agricultural production in Ethiopia by contributing between 40-60 per cent of labour to agricultural production. Despite this, rural women farmers in Ethiopia including Yilmanadensa district rarely enjoy extension services and have little contact with extension service organizations. The low participation of women farmers in agricultural extension services in Yilmanadensa district is the main reason for conducting this study. Therefore, this study is conducted to investigate the determinant factors of women's participation in agricultural extension services in Yilmanadensa district. The study adopted cross-sectional survey research design. The paper is based on a review of literature and an analysis of data collected from 127 sample respondents using a semi-structured questionnaire. Qualitative data were collected through key informant interviews and focus group discussions. Binary logit regression was employed to analyse the collected data. It was found that farming experience, sex of the development agent and access to credit shows significant and positive relation with participation whereas, time spent on domestic activities and sex of the household headship shows significant and negative relationship with women's participation. Thus, appropriate number of female agricultural extension workers should be assigned, labor saving and women friendly technologies should be promoted and disseminated through the extension system.

Key Words: Rural Women, Participation, Agricultural Extension Services, Yilmanadensa District, Ethiopia

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Introduction

Women being an integral part of a farming household provide 60 to 80 per cent of all agricultural labor. Various researches conducted on the contribution of women to agricultural development in the developing countries (FAO 2011a) suggest that women's contribution to the farm work is as high as between 50 and 75 per cent of the total farm task performed and 79 per cent of women in least developed countries who are economically active report that agriculture is their primary economic activity (Doss, 2011). The contribution of the women ranges from tasks such as land preparation, planting, weeding, fertilizer application, harvesting, threshing, storing, food processing, milling, transportation and marketing as well as the management of livestock (World Bank, 2010, Rahman & Ibrahim, 2007). However, their contribution is often overlooked due to some social barriers and gender bias.

Rural women in Ethiopia play a dominant and important role in agricultural production in the country. In Ethiopia, women take the leading role in agricultural activities, making up to 60-80 per cent of the labour force (FAO, 2010a; Cohen and Lemma, 2011; CSA, 2014). Rural women are intimately involved in all aspects of agricultural production such as land preparation, hoeing, weeding, harvesting, threshing, transportation and usage (Cohen and Lemma, 2011; CSA, 2014). This contributes to ensure food security, suppress inflationary pressure and supply inputs for industry (CFGB, 2015).

They are however accorded little attention. Consequently, there are some constraints facing the rural women's adoption of agricultural innovation which include failure of extension workers to reach them, lack of incentive for adoption of innovation, limited access to credit inputs and lack of access to membership in cooperatives and other rural organizations (Ogundiran, 2013; FAO, 2010b).

The role of extension today is not only technology transfer and training of farmers but also includes food security, empowering farmers, dealing with marketing issues, addressing resource conservation and nutrition issues. Moreover, the extension system should tackle the hurdles that women face in agricultural production, as these services provide a means for women to learn

new or improved production techniques, empower them to receive training and advice, to organize themselves (Ogundiran, 2013; Ijeoma & Adesope, 2015; apantaku & Oyegunle, 2016).

However, women rarely enjoy extension services and have little contact with extension service organizations. Empirical studies revealed that women received only five per cent of the total extension resources all over the world dedicated to programs for female farmers. Women form just 15 per cent of extension personnel in the world and their roles also remain largely unrecognized and they have been virtually ignored by agricultural intervention programs (World Bank, 2010; Ogundiran, 2013). The failure to recognize the different roles of males and females is costly because it results in misguided projects and programs, foregone agricultural output and incomes, and food and nutrition insecurity (FAO, 2010b; Apantaku & Oyegunle, 2016).

The National Policy of Ethiopia on women, formulated in 1993, ensures gender equality in programme implementation at all levels of government. The government introduced PASDEP (Plan for Accelerated and Sustained Development to End Poverty). Annual progress report 2007/8 states that PASDEP aims to reach all female headed households and 30 per cent of married females in agricultural extension programs. However, according to the Growth and Transformation Plan-I (GTP-I) document of the Ethiopian government, increasing extension services to female farmers in rural areas remains challenging (Mengistie, 2015).

In rural Ethiopia in general rural women farmers in the study areas in particular have limited participation in agricultural extension services (Quisumbing et al. 2014). That is why, traditionally women are not considered as “farmers” which is a predominant problem in many developing countries (World Bank, 2010; Cohen and Lemma, 2011). Even if females do participate in extension services, they may not be given equal recognition for their responsibilities and skills. They are also restricted and marginalized in terms of providing equal responsibilities, decision making power and access and control over resources. This is because farmers and farming activities continue to be perceived as “male”

by planners and agricultural service deliverers, thereby ignoring the important and increasing role females play in agriculture. Moreover, technology packages delivered by extension services sometimes reinforce stereotypic divisions of labour (Manfre et al. 2013). The annual report of Yilmanadensa district indicated that women farmers rarely participate in agricultural extension services in the district (District Agricultural Office, 2018). Therefore, this study seeks to investigate the determinate factors influencing rural women's participation in agricultural extension services in Yilmanadensa district.

Research Methodology

The study was conducted in Yilmanadensa district, Amhara region, Ethiopia. The district is 441 km away from Addis Ababa, capital city of Ethiopia and 42 km from Bahir Dar, the regional capital. Geographically, the study area lies within 11°38' 24'' - 11°42'0'' N latitude and 37°28'48'' - 37°32'24'' E longitude with an area coverage of 99180 hectares. The altitude of the district is between 1800 and 3200 m.a.s.l with average rainfall of 1270mm/year and average temperature of 16°C (District Agricultural Office, 2018). The total population of Yilmanadensa district is 222631, of which 108159 are males and 114472 are females. Agriculture is the predominant occupation of the people in the district (ibid).

This research employed both qualitative and quantitative approaches. The study adopted cross-sectional survey research design and employed three stage sampling.

Among the 35 rural kebeles in the district, three rural kebeles (the lowest level of government in terms of geographical jurisdiction in Ethiopia headed by the Kebele chairperson) namely Debrermewi, Adethana, and Kelilet were selected using simple random sampling technique. The households were stratified based on the participation in agricultural extension services, as participants and non-participants. Then, simple random sampling technique was used to select participants and non-participants from the list available with the development agents in the three rural kebeles. Probability proportion to size technique was

used to determine the sample size from each selected kebele. The sample size for collecting quantitative data for this research was determined based on the formula proposed by Cochran (1977).

$$n = \frac{N}{1 + N(e)^2}$$

Where n= the sample size

N = total number of households

e = marginal error or degree of accuracy 8% (given by researcher)

1= designates the probability of the occurrence of event

$$n = \frac{N}{1 + N(e)^2} = \frac{695}{1 + 695 (0.08)^2}$$

$$= 127$$

Therefore, a total of 127 women were selected from a total of 695 households. The details of the selected sample household are presented in Table 1.

Table 1. Details of total number of households and sampled households

Study area	Sampled kebeles	Total number of HHs			Sampled household heads		
		Participants	Non-participants	Total	Participants	Non - participants	Total
Yilman adensa District							
	Debremewi	150	72	222	27	13	40
	Kelilet	182	48	230	33	9	42
	Adethana	87	156	243	16	29	45
Total		419	276	695	76	51	127

Source: Yilmanadensa District Agriculture office (2018)

Data were collected from both primary and secondary sources. Primary data were collected from primary sources by using semi-structured interview schedule, focus group discussion and key informant interview. The details are given in Table 2. The secondary data were collected through a review of relevant reports of district agricultural offices, published and unpublished sources.

Table 2. Data collection methods and tools

SN	Type of respondents	Method of data collection	Tool used to collect data	Number of respondents
1	Women farmers	Interview	Semi-structured interview schedule	127
2	Development agents	Key informant Interview	Interview guided check list	5
3	Women affair office Experts	Key informant interview	Interview guided check list	3
4	Kebele administrators	Key informant	Interview guided check list	2
5	Selected participants and Non-participants	Focus Group Discussion	Checklist	18

Source: Developed by the researcher, 2018

Model specification

The dependent variable is whether or not the woman participates in any agricultural extension service. The dependent variable in this case is a dummy variable (binary), which takes a value of 1 for participants and 0 for non-participants. Therefore, a binary logistic model was employed to identify determinate factors that affect rural women farmers' participation in agricultural extension services.

The decision to participate in AESs is therefore dichotomous between two mutually exclusive alternatives: either to participate or not to participate. The probability that an individual makes a particular choice is influenced by a vector of explanatory variables. A particular choice is made when the combined effect of the vector of the explanatory variables reaches the critical level (breaking

point). Thus, a decision to participate in AESs will occur only when the combined effect of the explanatory variables ($X_i'\beta$) reaches a certain unobservable critical value Y_i^* . So that:

$$Y_i = 1 \text{ if } X_i'\beta > Y_i^* \text{ OR } Y_i = 0 \text{ if } X_i'\beta < Y_i^* \dots\dots\dots (1)$$

Where Y_i^* is a latent variable and represents the unobserved level of participation in AESs. By the application of probability theory, the probability that a given woman participates in AESs is given by

$$P = \text{Prob} (Y_i=1) = f (X_i' \beta) \dots\dots\dots (2)$$

and the probability that a given woman does not participate in AESs is given by

$$1 - P = \text{Prob} (Y_i=0) = 1 - f (X_i' \beta) \dots\dots\dots (3)$$

In this study, binary logit is employed to estimate the probability of participation in AESs. The logit model specified for the study is stated as

$$L = \text{Log} \left[\frac{p_i}{1 - p_i} \right] = \beta_0 + \sum \beta_i X_i + U_i \dots\dots\dots (4)$$

Where: p_i = the probability that women actively participate in agricultural extension services, the binary variable, $p_i=1$ for participant women and $p_i=0$ for non-participant women; β_0 = the constant term; β_i = a vector of β unknown coefficients of the determinants of participation in AESs; X_i = a vector of independent variables that determine participation in AESs; U_i is the stochastic error term and $i = 1, 2, 3 \dots N$ observations. The Z statistic is used to test the significance of the individual parameters. The likelihood ratio test (LRT) is employed in testing the fitness of the model. In this study the multi-collinearity problem among explanatory variables was checked before conducting the analysis. Variance Inflation Factor (VIF) is used to test the existence or association among the continuous explanatory variables and contingency coefficient (CC) for dummy variables. In this study, Statistical Package for Social Science (SPSS) version 22.0 computer software was used to run the analysis.

Table 3. Definition of variables and its hypothesized effect

SN	Independent Variables	Type of variable	Description of variable	Effect
1	Age of respondent	Continuous	Age of household head in years	-
2	Level of Education	Dummy	Literate / Illiterate	+
3	Number of dependents	Continuous	Measured as number of dependents in the family: children below 15 years and aged persons above 65 years of age in a HH	-
4	Sex of Household head	Dummy	Male headed/Female headed	-
5	Land holding	Continuous	Measured as land size owned/rented in hectares	-
6	Livestock holding	Continuous	Measured by TLU; Size of livestock owned by HHHs	+
7	Farming Experience	Continuous	Number of years involved in vegetable production (measured in years)	+
8	Access to credit	Dummy	Takes 1 if the respondent had access to credit and 0 otherwise	+
9	Sex of Development agent	Dummy	Sex of extension agent, if Female =1 otherwise=0	+
10	Contact with development Agents	Dummy	If contact with extension agent, takes a value of =1 and otherwise =0	+
11	Access to Mass Media	Dummy	If had access to mass media 1; otherwise 0	+
12	Participation in Community Affairs	Dummy	If woman participate = 1, otherwise=0	+
13	Distance from FTC center	Continuous	HHs proximity to the FTC center measured in km	+
14	Distance from market center	Continuous	HHs proximity to the nearest market center in km	+
15	Access to input	Dummy	If woman had access =1 otherwise=0	-
16	Mobility Constraint	Dummy	Takes a value of 1 if a woman had a mobility constraint and 0 otherwise	+
17	Reproductive role	Dummy	If the women farmer influenced by their role in reproductive activities 1 and 0 otherwise	-
18	Time spent in domestic activities	Continuous	Total time devoted by the woman in doing Household activities	-
19	Access to labor saving household technology	Dummy	If women had access to modern cooking fuels like Improved stoves without fumes, Biogas, Solar cookers, Modern bio-fuels (e.g. ethanol, plant oils), Electricity take a value of 1 and otherwise 0.	+

Results and Discussion

Determinants of Rural Women's Participation in Agricultural Extension Services

The binary logit model results revealed that rural women's participation in agricultural extension services was determined by the interaction of different demographic, socio-economic, institutional and women related factors. The results of the Binary Logistic regression model estimate indicate that out of the explanatory variables included in the model, the coefficients of the seven explanatory variables were found to be significant indicating that any change in this variable will substantially influence on the probability of being a participant in agricultural extension services.

The variables viz., land holding, farm experience, sex of development agent and access to credit show significant and positive relation with participation. This indicates that any increase in any of these variables will increase the probability of women's participation in agricultural extension services.

On the other hand, time spent on domestic activities, sex of household headship and mobility constraints show significant and negative relationship with women's participation. The negative relationship implies that an increment in any of these variables will reduce women's participation in agricultural extension services among women farmers studied.

Discussion

Land Holding Size: The effect of land holding size significantly influences the probability of participation. The coefficient of this variable is positive and significant at less than 5 per cent probability level towards participation. For a unit increase in farm size, the odds of participating in agricultural extension services significantly increases by a factor of 1.23 times. This means that households who have access to more farm land are more likely to participate in agricultural extension services as compared to households who have less land. This finding is in line with the finding of Martey et al. (2013) who observed

Table 4. Binary Logistic regression estimates of determinants of rural women's participation in agricultural extension services

Variables	B	S.E.	ALD	DF	SIG	EXP(B)
LEVEL OF EDUCATION	.242	.733	.084	1	.772	.809
TOTAL NUMBER OF DEPENDENTS	.424	.292	2.113	1	.146	.654
SEX OF THE HOUSEHOLD HEAD	2.480	.977	6.442	1	.011	.084**
FARM EXPERIENCE	.156	.039	15.606	1	.000	1.169***
LAND HOLDING	.207	.097	4.595	1	.032	1.230**
TOTAL LIVESTOCK HOLDING	.443	.438	1.022	1	.312	1.557
ANNUAL INCOME	.000	.000	1.592	1	.207	1.000
ACCESS TO CREDIT	1.585	.783	4.099	1	.043	.205**
SEX OF DEVELOPMENT AGENTS	2.467	.830	8.829	1	.003	11.783***
CONTACT WITH DEVELOPMENT AGENTS	1.443	1.163	1.539	1	.215	4.233
DISTANCE FROM FTC	.398	.503	.626	1	.429	.672
ACCESS TO INPUT	.861	.758	1.290	1	.256	.423
MOBILITY CONSTRAINT	1.121	.654	2.939	1	.086	.326*
REPRODUCTIVE ROLE	.944	.675	1.953	1	.162	2.570
TIME SPENT ON DOMESTIC ACTIVITIES	.566	.190	8.835	1	.003	.568***
CONSTANT	4.455	2.725	2.673	1	.102	86.099

Dependent Variable Participation in Agricultural Extension Services

Note *, ** and *** = Significant at 10, 5 and 1% respectively

-2Log likelihood = 75.456^a

Cox & Snell R square = .540

Nagelkerke R square = .729

Chi-square = 102.380

Sign. = .000

that farm size positively influenced the household heads decision to participate in agricultural projects.

Sex of the Household Head: The coefficient of this variable is negative and significant at less than 5 per cent probability level towards participation. The result indicates that, women in male- headed households were .084 times less likely to participate in agricultural extension services than women-headed households. It implies that women in male-headed households have a less probability of participation than women headed households. Perhaps, this could be due to the reason that women in male headed households have to get the permission from their husband. In male-headed households, the head of the family mostly takes all the responsibilities outside the home and thrusts all the household work to the women.

This finding contradicts with the finding of Berger et al. (2014) who reported that women who are heads of households will have even greater difficulty in attending trainings and study tours, since their workloads are heavier and they do not have access to additional family labour to perform agricultural tasks in their absence.

Farming experience: It reflects the number of years since the farm operator first began farming. Farming experience was positive and significant at less than 1% level of significance. With increasing experience, a woman farmer may be able to better assess benefits of agricultural extension service. Women with more farming experience were more likely to participate in agricultural extension services than those who have less experience. The results also reveal that for one-unit increase in farming experience, the odds of being able to participate in agricultural extension services significantly increases by the factor of 1.169 times. Therefore, women's experience in farming increases their probability of participation in agricultural extension program. This confirms the finding of Chioma (2014) who reported that farming experience was found to be positively associated with participation. This contradicts with the finding of Rehman & Ibrahim (2007) who indicated that farming experience had no significant effect on the farmers' access to agricultural information.

Access to credit: Access to credit helps them by easing financial constraints to purchase farm inputs such as seeds, fertilizers etc. The coefficient of access to credit is positive and significant at less than 5 per cent probability level. As shown in Table 4, women who had better access to credit were .205 times more likely to participate in agricultural extension services than women who had no credit access. This implies that women who have access to credit have a better possibility of getting farm inputs.

The result is consistent with the finding of Martey et al. (2013) who reported that access to credit enables farmers to overcome their financial constraints associated with production and adoption of innovations.

Sex of Development Agents: The beta coefficient is positive and significant at less than 1 per cent probability level. The result of logit model showed that those women farmers who have contact with female development agents were 11.783 times more likely to participate in agricultural extension services than those who had no contact. It implied that female extension workers are often in a better position to help female smallholder farmers in the adoption of innovations.

This finding is consistent with the report of Swanson et al. (2011) which stated that the presence of women extension agents was a factor in increasing women farmers' participation in extension activities. The Swiss Agency for Development and Cooperation recommends women-to-women extension for better transfer of information to women farmers (SDC, 1995).

Time spent on domestic activities: As expected, the beta coefficient for time spent on domestic activities is negative and significant at less than 1 per cent probability level. The relationship is negative, which means that the women who spent more time in domestic activities, are less likely to participate as compared to women who have leisure time. The result indicates that as time spent on domestic activities increases by one hour, the probability of women participation in agricultural extension services decreases by a factor of .568 units while other variables are kept constant. The possible explanation for this result is that respondents who spent more time on domestic activities had less probability to participate in agricultural extension services.

Women and girls are traditionally tasked to do all domestic maintenance work, hauling water, firewood gathering, food processing and preparation, cooking and other domestic chores. Household work done by women is characterized by long and strenuous days with very few relevant and affordable technologies to ease their workload and drudgery. The heavy workload already imposed on women often prevents them from adopting improved technology that requires additional labour inputs.

Studies across a wide range of developing countries show that rural women spend a significant amount of their time on reproductive and household activities, increasing their daily hours of work in comparison to men. It is estimated that women spent 85–90 per cent of their time on childcare, water and food collection, cooking and other care activities (FAO 2011b; Flavia et al. 2015).

Mobility constraints: The coefficient of mobility constraints is negative and significant at less than 10 per cent level of probability. As mobility constraint decreases by one unit, it is 0.326 times more likely that the women participate in agricultural extension. This implies that as mobility constraints decrease by one unit the odd ratio increases by the factor of .326. Those women who have no mobility constraints can participate in any association, development intervention, etc. Time and mobility constraints may prevent women from accessing public extension and formal agricultural information services. In such situations, women rely extensively on their female social networks to learn about new agricultural technologies.

However, the remaining six explanatory variables were found to have no significant influence on the probability of participation in agricultural extension services. The non-significant variables were education, number of dependents, livestock holding, annual income, contact with development agents, distance from FTC, access to input and reproductive role. These variables, therefore did not determine women farmers participation in agricultural extension services in this study.

Conclusion and Recommendation

The results of the Binary Logistic regression model estimate indicate that out of the 12 explanatory variables included in the model, the coefficients of the six explanatory variables were found to be significant in determining the probability of women farmers being a participant in agricultural extension

services. Sex of the development agent, farming experience, land holding size and access to credit shows significant and positive relation with participation. This implies that any increase in any of these variables will increase the probability of women's participation in agricultural extension services. On the other hand, time spent on domestic activities, mobility constraints and sex of household head shows significant and negative relationship with women participation. The negative relationship indicates that an increment in any of these variables will reduce women's participation in agricultural extension services among studied women farmers.

In the study area, majority of the respondents have no contact with female agricultural extension workers. This implies that the linkage between the women farmers and the DAs is very weak. Therefore, to improve the rural women's participation, assigning and allocating appropriate number of female agricultural extension workers (DAs) is recommended. The district agricultural extension office needs to plan a mechanism that can encourage women farmers to participate in AES. Participation in agricultural extension services may further increase women's workload. All stakeholders should give great attention and priority to reduce the workload of women by providing access to labour saving household technologies.

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Determinants of Food Security in Tach Gayint District in Ethiopia

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Abstract

An understanding of the determinants and causes of food insecurity is important for interventions aiming at minimizing food insecurity. Therefore, this study was conducted to measure the determinants of food security in the case of Tach Gayintworeda, Amhara regional state, Ethiopia. Interventions aimed at planning and reducing food insecurity at micro-level need information on the causes of food insecurity in that specific area and its determinants. The study was conducted mainly by collecting quantitative data from 200 respondents selected from three kebeles; primary and secondary data were collected from various sources. Kebeles were stratified first, then simple random sampling was employed to select the sample kebele, and systematic random sampling was used to select respondents. Semi-structured questionnaires and key informant interviews were conducted and analyzed using descriptive and inferential statistics such as T-test, Chi-square tests as well as logistic regression. The survey result shows that about 56.2 per cent of sample respondents were food insecure, while only 43.8 per cent were food secure. Variables such as land holdings, possession of oxen and farm production of households have been found significant in determining the food security status of households. The cultivated land size was also found to be significant. Intensified agriculture and livestock production have to be introduced and implemented in the area to combat the food insecurity situation of the study area.

Keywords: Food insecurity, land, oxen, production, education, technology, Ethiopia

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Introduction

Background and Justification

Over the last ten years, there has been increasing evidence that production and productivity are increasingly influenced by the changing frequency and intensity of extreme weather events (IPCC, 2007). It has been argued that unless more sustainable management of food production is adopted prices will rise and become increasingly volatile and the damage to the environment will continue to increase (Nellemann, et al. 2009). The development and widespread adoption of integrated, diversity-rich options for sustainable agriculture and food security will require a holistic, interdisciplinary, ecosystem and biologically-based approach that takes account of the social, economic and cultural aspects of agriculture (IAASTD, 2009). It acknowledges the interconnectedness of biodiversity, food security and human and ecosystem health and in so doing indicates the requirement to involve a range of stakeholders (farmers, consumers, agricultural and food industries and researchers) in interdisciplinary interventions.

More than one billion people suffer from food insecurity and malnutrition in the world (IAASTD, 2009). Out of this number, 900 million people are living in developing countries where 250 million of them reside in Sub-Saharan Africa (FAO, 2010). Ethiopia has about 20 million food-insecure people (ATA, 2010). About 83 per cent of the population of Ethiopia depends directly on agriculture for their livelihoods (WB, 2007) while many others depend on agriculture-related cottage industries such as textiles, leather, and food oil processing. Agriculture contributes 46.3 per cent of Gross Domestic Product (GDP) and up to 90 per cent of foreign export earnings. Ethiopia has ample resources for agriculture. It has 111.5 million hectares of land. While the country has 74 million ha of total arable land, only 13 million ha are being used. Agriculture is a key driver of Ethiopia's long-term growth and food security. Ethiopian economy is dominated by the agricultural sector accounting for 39.7 percent of the national GDP. The sector is a key supplier of inputs for food processing, beverage and textile industries. Ethiopian agricultural sub-sector

is dominated by cereal crop production constituting a significant proportion of the sub-sector (MoFED,2013).Although the agriculture sector plays a crucial role for the economy and livelihoods of the majority, its performance remained poor and could not feed the growing population which has an annual increment of two million people (FAO, 2012). In addition, rapid population growth challenged the achievement of food security and poverty reduction efforts in Ethiopia. This research would contribute to filling the gap and design solutions based on reality and felt needs of farmers, help policymakers design and implement more effective pro-poor food security policies and programs and thereby pave the way to improve agricultural productivity and food security. This research was also conducted to clearly identify common determinants of food insecurity and provide clear insight for development stakeholders in order to intervene and to find a remedy for the respective malady. This paper also aims in contributing to the literature on determinants of food security in Ethiopia, particularly in the Amhara region where 45 per cent of rural households have been reported to be food insecure. The study will assess the situation of food insecurity and the determinant factors that contribute to food insecurity of the research area.

Research Objectives

1. To asses food security status of households (HHs) in the study area
2. To identify determinants of food security in the study area

Research Methodology

Description of the study area

The research was conducted in Amhara region, South Gonder zone, Tach Gayint *woreda** located 761 kilometers away North West of the capital, Addis Ababa. TachGayint lies between 11° 22'11° 42' N Latitude and 28° 19' 28° 43' E Longitudes. It is delineated by North Wollo administrative zone in the North;

*Woreda is an administrative unit lower than zone and higher than kebele(smallest administrative unit in Ethiopia)

in the South by Simada *woreda*, East by South Wollo administrative zone and in the west by Lay Gayint *woreda*. The total area of the *Woreda* is 994.84 Sq. Km. There are three agro-ecological zones in the *Woreda*, namely warm low land (*kola*) that covers 23 per cent of the total area, warm and humid mid-high land (*Woinadega*) which covers 61 per cent and wet high land (*Dega*) covering 16 per cent of the total area. The topography of the *Woreda* is characterized as 23 per cent mountainous, 22 per cent plain with gentle slope, 28 per cent rough terrain and 27 per cent rugged and gorge. It has an altitude range of 1500-2800m above sea level, the temperature ranges from 13c to 27c and rainfall is from 900mm to 1000mm per annum and the forest coverage reached 13.85 per cent (GTP Report December 2014, Bahir Dar. The population of the study area is 109, 109 (CSA, 2008). Fifty two per cent of the population of the region is between 15 and 64 years old age which is a very productive age. The average family size in the study area is 5 people per house hold (TGWoA, 2012).

Study Design and Sampling Procedure

The choice of the methods of a particular study depends on the purpose of the research to pursue. In a given research, the choice of methods influences the way in which the researcher collects and analyzes the data. However, there are no strict rules as such for the choice of the method but a researcher needs to strike a balance between the cost and time available for the research, and depth and breadth of information needed to be analyzed by a qualitative and quantitative method. Taking this into consideration, the researchers employed both qualitative and quantitative research methods. Regarding the sampling techniques, both probability and probability sampling techniques were applied. Non-probability sampling techniques such as purposive sampling was used to select the key informants, probability sampling techniques such as stratified random sampling was used to classify *kebeles* based on agro ecological zone, simple random sampling was used for selection of *kebeles* and systematic random sampling was applied for the selection of HHs. Quantitative data such as age, sex, and household size, landholding, soil erosion, livestock holding, education, and supporting services and institutions such as marketing, extension,

health, and education. The status of HHs food security and its determinants in the *woreda* are studied in this paper. The data collected for this study was mainly quantitative while some qualitative data was also collected. To know the status of food security seven days food consumption data which includes the number of meals, type of dish and type and quantity of food consumed per week per household was collected and converted to energy consumption per day per Adult Equivalent (AE) in kcal. Demographic and socio-economic data collected from rural HHs was used to study the determinants of food security and coping strategies. These data include age, sex, size of HHs in age group, educational status, size of landholding, land cultivated and the amount produced, livestock holding, sources and amount of income for food including own production, off-farm income, remittances.

Sampling Design

The degree of precision, desired methods of analysis, objectives of the research, cost and time determine the type of sampling design to be adopted. The study *woreda* (*TachGayint*) was selected purposively. The researcher observed the persistent and deep-rooted food insecurity problems, despite efforts made both by the government and NGOs. Considering this the study area was selected and then *kebeles* were stratified into *dega* (highland) *Weinadega* (mid-land) and *kola* (low land) based on agro-ecological zone. From each agro-ecological zone, three *kebeles* were selected randomly by a simple random sampling method, one from each agro-climatic condition. Out of 1800 HHs in all *kebeles*, 200 households were selected proportionally by systematic sampling method proportionate to each agro-ecology.

Data Collection Method

Before conducting the actual survey, semi-structured and structured interview schedules were prepared. Permission was sought from all participating households before proceeding with interviews. The survey was conducted in two rounds to avoid a long time interviewing and keep the recommended schedule for collecting consumption data. In the first round, socioeconomic and

demographic data were collected through interviewing and observation techniques. Food consumption data which includes the number of meals consumed, type of dish consumed at each meal and type and amount of food consumed per week was collected in the second round. The second-round survey was conducted in July second week up to August fourth week as food consumption data for studying food security status has to be conducted 5-6 weeks after the main harvesting season. Interviewing the women responsible for preparing food and using a balance measuring the amount consumed in the last seven days in each HH was the technique used to collect the data.

Interview for Household Heads

To know the status of food security, seven days food consumption data which includes the number of meals, type of dish and type and quantity of food consumed per week per household were collected through interview and converted to energy consumption per day per AE in kcal. Demographic and socio-economic data were collected from rural households to study the determinants of food security in the district.

Secondary Data Collection

Secondary sources contributed much for the preliminary knowledge essential to supporting the findings reported in the study. Secondary data both published and unpublished were reviewed from various sources, including regional, zonal and *woreda* sector bureaus and offices (agriculture and rural development, health, education, food security and disaster prevention, CSA and local NGOs). The data includes information on physical and demographic characteristics, systems, procedures, food aid, Productive Safety Net Program(PSNP), availability, and accessibility of food.

Description of variables and expected signs

- 1. Household Size:** Theoretically size of the HHs can have a positive or negative relationship with food security status depending on the age of the HHs. With increasing number of members in the HHs who are actively

involved in providing labor for production, the relation could be positive or negative otherwise. This is the total family size who live together under the same household adjusted to AE. The expectation is that as the family size increases the probability of the household to be food insecure increases. This is because the household head will be burdened to feed members of the family and face shortage of food. Therefore, family size is expected to have a negative relationship with the food security status of the households.

2. **Age:** Age of Household Head measured in years is expected to have a positive correlation as experience and knowledge increases with age. Age is a continuous explanatory variable peculiar to the household head. In most rural households, food production and animal rearing are carried out by the head of the household. This is because of the fact that once his/ her children reach marriageable age, they leave the house making their own house. So that age of the head of the household is important with regard to the availability of the required food for the survival of the family. As the age of the head of the household increases, there is a more probability of that household to be food insecure, since the older aged HHs are unable to work hard for the survival of their family members. In light of this, the age of the head of the household and food security is negatively correlated.
3. **Educational level:** Household head's educational level measured in numbers of years in schooling is expected to have a positive correlation as experience and knowledge increases with education level. The better the educational level of the household head, the higher the chance to maintain the food security status of his family with for instance diverting to other income-generating activities besides farm operation in the study area. The level of education of the household head has a significant effect on food security. Thus, this variable is expected to have a positive relationship with the food security status of the HHs.
4. **Sex:** Access to different resources and role in productive activities varies with sex. Male headed households have better access to resources and are engaged in productive roles than female counterparts. Therefore gender is expected to affect HHs food security either negatively or positively depending on whether the household head is male or female. Male headed HHs can be more food secure relative to female-headed.

5. **Number of Oxen Owned:** Oxen is used as a draught power and the most important means of cultivating land. Therefore, HHs owning more oxen are able to cultivate and produce more land and produce more crop output and hence have a better chance to be food secure than those who possess none or fewer oxen.
6. **Landholding:** landholding is a major socio-economic asset determining food security status. Access to agricultural land plays an important role in reducing food insecurity. Some better-off and landless farm households cultivate more land than they own, acquiring land by sharecropping plots on a seasonal basis from other HHs. In addition, farmers who have land but lack labor, oxen and inputs such as seed, fertilizer did cultivate smaller proportion of their land. Therefore, the amount of land cultivated is expected to have a positive correlation with food security.
7. **Farm Production:** Farm production is consistent with farm income, which is spent to improve the food security situation of households. HHs depend on sources of income to purchase food and agricultural inputs. Therefore it is expected that HHs with better production will have better income and are less insecure as compared to those with lower production and income.
8. **Technology (fertilizer and improved seed use):** Chemical fertilizer increases crop production through increasing nutrient availability to plants. Therefore, the amount of fertilizer use is expected to increase the probability of a HH to be food secure. Improved seeds are released for one or more characters as high yielding potential, disease or pest resistance, high response to input use and adaptation.
9. **Distance to Nearest Market:** Proximity to market centers creates access to additional income by providing off-farm/non-farm employment opportunities, easy access to inputs and transportation. It was, therefore, expected that households nearer to the market center have a better chance to improve household food security status than those who do not have proximity to market centers. Proximity to market centers was measured in kilometers and it was reported that market distance has a significant effect on food security.

Methods of Data Analysis

Both descriptive and inferential analysis methods were employed. Food security status of the district was computed through the analysis of quantitative and qualitative data that were collected on food consumption pattern of households. The households' food security status was measured by a direct survey of consumption. Household caloric acquisition is a measure of the number of calories, or nutrients available for consumption by household members over a defined period of time. The principal person responsible for preparing meals was asked how much food was prepared for consumption over a period of time for a day.

The daily wage rate of the cash transfer is calculated on the basis of the cost of buying 3 kg of cereals and 0.8 kg of pulses per day (15kg of cereal and 4kg of pulses per person per month) in the market (TGWOA, 2012). Food security status at a household level can be measured quantitatively by a survey of income, expenditure, and consumption. In this study, calorie consumption per day per adult equivalent was used to measure whether a household is food secure or food insecure. A household was categorized as food secure if consumption per AE is equal to or greater than 2200 kilocalorie (kcal) and insecure if consumption was less than 2200 kcal per day per adult. The household food consumption in calories was calculated from the data collected through a survey on the type and amount of food consumed within seven days prior to data collection. Data on available food for consumption, from home production, purchase and /or gift/loan/wage in kind for the last seven (7) days before the survey day to the household was collected. This seven days recall period was selected due to the fact that it is appropriate for exact recall of the food items served in the household within that week. If the time exceeds a week for instance 14 days, the respondent may not recall properly what he or she has been served two weeks earlier. This method was also applied in the poverty and livelihood studies conducted at the national level by Addis Ababa University in collaboration with the International Food Policy Research Institute (IFPRI) and other international organizations.

The amount and type of food consumed per week per household were converted to the amount of energy in kcal consumed per AE per household in the following steps.

- A) The amount of food consumed per week per household was converted to the amount of energy in kcal consumed per week using household food composition table for use in Ethiopia.
- B) The size of the HHs was converted to adult equivalent using AE conversion factor.
- C) The amount of energy consumed per week per HH was divided into seven to know the amount of energy consumed per day per household.
- D) Fourthly, the amount of energy in kcal consumed per day per household was divided to the size of household in AE to find energy consumption per AE per day. After calculating the amount of energy consumed per day per AE for each household, the result was compared with the standard recommendation for use in Ethiopia i.e. 2200 kcal so as to sort food secured and insecure HHs. Accordingly, 95 households found to consume less than the cut-off, 2200 kcal per day per adult equivalent were rated as food insecure. Seventy four Households whose consumption equal to and above 2200 kcal were rated as food secure.

A binary logistic regression model was applied as the dependent variables of the study in a regression model are dichotomous and measured as a dummy (food secure (1) and food insecure (0)). The model measures the effect of different socio-economic and demographic independent variables on the status of food security. Chi-square and T-test were also used to compare the differences and associations between food secure and insecure groups on the socio-economic and demographic variables.

Results and Discussion

Food Security Status of the Households

The households' food security status can be measured by a direct survey of income, expenditure, and consumption. In this study, households' food or calorie acquisition/consumption per adult per day was used to identify the food secure and food-insecure households. The calorie consumed by the household is compared with the minimum recommended calorie of 2200 kcal per adult per day. If the consumption/acquisition is less than the recommended amount then, the household is categorized as food insecure and if greater than the recommended amount, as food secure. The reason for the use of this measure was that it produces a crude estimate of the amount of calories available for consumption in the household. Moreover, it is not obvious to respondents how they could manipulate their answers. As the questions are retrospective, rather than prospective, the possibility that individuals or households will change their behavior as a consequence of being observed is lessened (Hoddinott, 1999). In addition, the reliability of income data in subsistence farming where record-keeping is limited is always questionable.

The households' food security status was measured by a direct survey of consumption. Data on the available food for consumption, from home production, purchase and /or gift or aid/loan/wage in kind for the previous seven (7) days before the survey day by the household was collected. Then the data were converted to a kilocalorie and then divided into household size measured in AE. Following this, the amount of energy in kilocalorie available for the household is compared with the minimum subsistence requirement per adult per day (i.e. 2200 kcal). As a result, of all respondent households, 95 households were found to be food insecure and 74 were food secure. It means that (56.2%) of the respondent households were food insecure and (43.8%) of them were food secure. The socio-economic characteristics of the household heads are briefly described in terms of their age, sex, education, landholding, livestock possession and access to credit. The distribution of the age of the household heads indicated that about one-fourth of them are of ages between 20 and 39

years. Over half were aged between 39-60 years and the remaining one fourth was more than 60 years. The size of the HHs in number varies from one to eleven with an average of 5.68 HHs members living in a household. Of the total sample, 9.2 per cent; 58.8 per cent and 32 per cent of HHs had 1-4; 4-6 and 6-11 household members. The landholding of a household took into account all types of land (homestead, farmland, fallow and pond) that a household owns either through gift, long year rented and tenured. While 55.7 per cent had less than one ha, the remaining 44.3 per cent of HHs possess more than 1 ha of land. The average landholding of the sample respondents is 0.84 ha. Living in the mixed farming system, the main sources of income of sample HHs are crops, livestock and off-farm income. By 2014/15 the average contribution of crops, livestock and off-farm income to the gross income were 70, 22 and 8 percent, respectively. The main crops grown in its order of area coverage in the specified crop year were wheat, *teff*, potato, barley, maize. Depending on the HHs livestock possession the contribution of livestock to the gross income varies from zero to 22 percent. The livestock possession also varies from zero to 12 with an average holding of 2 in TLU.

The type of crops used to prepare food recipe consumed in its order of caloric contribution, as the survey result reveals, include cereal (triticale, *teff*, wheat, barley, maize, sorghum and millet) 34 per cent maize 37 per cent wheat, 10 per cent *teff*, 10 per cent sorghum, 3 per cent potato and 4.14 per cent pulses. Animal products (milk and milk products, butter, eggs) contribute one per cent, sugar, alcoholic drinks, and others to the calories consumed. Food composition receipt table prepared for use in Ethiopia used to convert food consumed into a calorie, and the size of each household is changed to its adult equivalent using a conversion factor to know kcal/AE/day. On these bases, the status of food security for 170 households was assessed. Only 74 (43.8%) HHs are food secure and the rest 95 (56.2%) consuming less than 2200 kcal are chronically and/or seasonally food insecure. The amount of calories consumed per AE varies from 925 kcal /AE per adult from food-insecure category to 3180 kcal from food secure category and 78 (82.3%) consume less than 1650 kcal and are chronically food insecure. The average energy consumption of the

sample is 2052.5 kcal per day per AE (Table 1) lower than both the recommended daily allowance (2200kcal) and the average consumption of Amhara region i.e., 2058 kcal (CSA, 2007).

Table 1. Energy consumption in kcal per AE per day per sample household

Energy available in kcal	Food secure		Food Insecure		Total	
	No	%	No	%	No	%
<1500			29	30.5	29	30.5
1500-1799			48	50.5	48	50.5
1800-2199			18	18.9	18	18.5
2200-2399	47	63.5	—	-	47	63.5
>2400	27	36.5	—	-	27	36.5
Mean	2052.5					
Maximum	3180					
Minimum	925					

Source: Own survey, 2017

Association of independent variables between groups of food secured and insecure households

T-Test and chi-square test were used to find the association between the independent variables across the groups of food security and insecurity.

Discrete variables

Sex: The number of female respondents account for 12.5 per cent (15) and male respondents were 87.5 per cent (155) and the number of male respondents is 11 times greater than female respondents (Table 2). The proportion of food insecure women is much greater than their counterpart that is food secure women. From the total female sample HHs only 21 per cent of them are food

secure. The other 79 per cent of women are food insecure. Pearson chi-square test was conducted to examine whether there was a relationship between sex and food insecurity. The results revealed that there was a significant relationship between the two variables (Chi-square value = 4.295, $p = 0.038$) (see the Table). This indicates that there is significant relationship between sexes in terms of food security status of households.

Education: Educational level was categorized as literate and illiterate. From the total sample HHs, 118 respondents (70.4%) were illiterate and 50 respondents (29.6%) were literate. In addition to these, 56 (63.6 %) food insecured are illiterate and 32 (36.36%) were literate. Chi-square test was appropriated to measure the relationship between education and food insecurity. The test was conducted to examine whether there was a relationship between education and food insecurity (Chi-square value =4.853). The results revealed that there was a 5 per cent significant relationship between the two variables.

Marital status: Regarding marital status of the sample HHs in the study area, 153 (90.5%) HHs are married, 10 (5.8 %) are widowed and 5 (3 %) are divorced. The correlation of the two dependent and independent variables were tested. The result indicates that there was 7.4 per cent significant relationship between the two variables. The households explained that widowed households and divorced HH heads shouldered more responsibility than married household heads, which leads to the reduction of capacity and increases vulnerability to shocks. Thus, from the total widowed and divorced HHs 11 of 15 or (73%) are food insecure.

Landholding size: Out of the total sample HHs in the study area 83(49.1%) respondents had less than 0.5 ha, 74 (43.7%) had greater than 0.5 and less than 1 ha of farmland and the rest 12 (6.35) had greater than 1 ha of farmland. The Chi-square value test was conducted and the results were indicated as chi-square =25.057 and the association of land size and food insecurity are significant in the study area; as the land parcel increases, food insecurity decreases. The size of landholding is the determinant factor that limits the food insecurity situation of the HHs. Farmland is the major productive asset in the rural community in

general and in the study area in particular. Households that own a larger plot of land can produce more crops and possibly diversify their crop enterprises and income sources. The land is perhaps the single most important resource, as it is a base for any economic activity especially in the rural and agricultural sector. Farm size influences farmers' decision to use or generate new technologies. 92.8 per cent of the respondents in the study area had less than one ha.

Oxen and other livestock possession: In the district 66.4 per cent of the sample HHs had oxen, 18.8 had two oxen, 34.6 per cent had no oxen, 82.4 per cent had domestic animals and 17.6 per cent had no domestic animal. Like the other parts of Ethiopia, animal resources play a great role in improving HHs food security in the study area. Animals provide milk, cheese, eggs, and other products. In addition, animals especially sheep, mule and cattle are sold directly in the market and are the swift sources of income to purchase food, agricultural inputs such as fertilizer, seed, etc. Cow dung and other animal faeces are inputs for preparation of compost and manure to increase fertility of the soil which has positive contribution to improve food security status. For some farmers, animals are the main sources of income. In the study area, from the total sampled HHs, 33.2 had no oxen, 48.2 per cent had only one ox per HH, 18.45 per cent had two and more. Only 6.5 per cent of food insecure households had 2 oxen. The relationship between the two variables was tested through chi-square test. The result showed that there is less than 5 per cent significant relationship between food security status and oxen possession (chi-square value = 8.063); the possession of oxen determines the capacity of HHHs to produce. The households cited that in addition to providing draught power, livestock also helps households by providing a source of farmyard manure, fuel, food and an asset against shocks. Thus, the possession of livestock and oxen is a key determinant of household capacity and which reduced food insecurity in the study area. The sample respondents also reported commonly used livestock ownership as a key criterion for wealth ranking among sample households. In the districts livestock production is equally important as crop production in terms of achieving household food security. Moreover, 47.3 per cent of the

Table 2. Chi-Square test for discrete variables					
Discrete Variables		Food security		Chi-square value	Significance
		Food in secure	Food secure		
Sex	Male	77	78	4.295	0.038**
	Female	11	3		
	Total	88	81		
Education	Literate	32	18	4.853	0.05**
	Illiterate	56	62		
	Total	88	80		
Marital status	Married	76	77	5.199	0.074*
	Divorced	5	0		
	Widowed	6	4		
	Total	87	81		
Land holding size in ha	<=.0.5	32	51	25.057	0.000***
	>0.5-1	54	20		
	>1	2	10		
	Total	88	81		
No. of oxen	One	51	30	8.063	0.018**
	Two	11	20		
	Total	62	51		
Production	1—3ql	28	34	8.625	0.035**
	4—8ql	53	36		
	9-10ql	6	6		
	>10	0	5		
	Total	87	81		
Technology	Yes	37	30	1.454	0.483
	No	51	50		
	Total	88	81		
Market access	Yes	17	25	3.039	0.219
	No	70	55		
	Total	88	81		

Source: Own Analysis, 2017 ***,**,* significant at 1%, 5%, and 10%, respectively

households have proposed livestock as a primary source of income and thus as a coping mechanism during the critical period of food insecurity. Almost all sampled households noted that a pair of oxen is a requisite input for ploughing during crop production .

Farm production: Among the total sample HHs 151 (89.9%) of the HHs produce annual crop production that ranges from 1-8 q/ HH/yr, 14 (8.2%) of the HHs had got 9-10 q/HHs/yr and the other 5(2.9%) produce more than 10 q/ HHs/yr. In addition the average mean of crop production in the study area was 5.5 q /HHs /year. However the average adult equivalent family size of the sample HHs in the study area was 5.68. The projected national and international food grain requirement for the person per year was 2.29 q/ yr/person USAID (2009). The actual mean grain available for the sample of households in the study area is 0.98q/L per year per person, which is much less than the national and international average by 44.6 per cent. This, implies that there was a relation between production and food security status and was less than 5 per cent significant and the result of the chi square test equals to 8.625.

Technology: In the study area, 37(42%) of respondents who are food insecure and 30 (37%) of food secure respondents applied agricultural technologies. However, the proportion or the rate and the method were not as per the standard. The correlation between dependent and independent variables were tested through chi-square test. The result of the test implies that there is strong correlation between variables (chi-square=1.454) and the result is insignificant.

Market access and Food insecurity: 73.9 per cent of the respondents in the study area did not have enough market access. Only 26.1 per cent had enough access to a Market information system, marketing facilities, and marketing organizations. Distance from the market is among the few marketing features influencing household economy in general and food security in particular. Where markets are too far to sell agricultural outputs and purchase inputs, the price is inefficient giving less incentive to farm producers. Where markets are near,

market information is available to both sellers and consumers' price incentives are better. In highlands, access to major food items was found higher in immediate post months than during planting time and pre-harvest months. About 90 per cent of HHs reported that Output from crop production was not enough to feed all the year round. Therefore, farm HHs purchase maize, millet, sugar, common salt for consumption in addition to agricultural inputs and non-food items throughout the year. Local markets must stock needed food and make it available at prices that surrounding customers including farmers can afford. These customers must have cash or tradable assets, including labor. To get cash income for purchasing these goods and for other social expenses farm HHs sell animals and animal products, crops such as potato, teff, wheat and labor, sheep and goat are mainly kept for cash income.

Continuous Variables

Age: The age of respondents ranges from 20 to 77 years and the mean age is 48.5 years. The majority of the respondents were between 39-60 years old. When age increases, food insecurity increased due to two reasons: as the age increases the number in the family also increases without increasing the farm land; and as the age increases even the available land is fragmented as land continues to be shared among members of the growing family (Table 3).

Family Size: It is supported by relevant literature that the size and composition of a family is associated with household income and food insecurity. This variable directly affects the dependency ratio of the household. The data revealed that the mean sample household size is 5.68 individuals, while some families were as small as two or as large as 11. When family size increases, the level of food insecurity increases.

Table 3. T-Test for continuous variables

		Sig.	T	df	Mean Difference	Std. Error Difference
AGE	Equal variances assumed	.778	-1.267	166	-.10795	.08521
	Equal variances not assumed		-1.270	165.705	-.10795	.08499
FAMILYSIZE	Equal variances assumed	.074*	1.385	166	.30105	.21743
	Equal variances not assumed		1.373	154.410	.30105	.21931

Source: Own Analysis, 2017 ***, **, * significant at 1%, 5%, and 10%, respectively

Estimation Result of the Logistic Regression Model for Determinant of Food insecurity in the Study Area

The binary logistic regression model is used to estimate and identify socio-economic determinants of food security in the area. While food security status that is being food secure (1) or being insecure (0) is treated as a dependent variable, socio-economic factors are used as explanatory variables in the model, as some of the socio-economic variables can explain other variables. Gross income per AE either explains or is explained by gross farm and off-farm income, therefore it is not important to use all the three variables to identify the determinants; rather using either gross income per AE or gross farm income is important. Out of 10 variables expected to affect food security status at the household level using the binary logit model, only 3 variables are estimated to affect food security status significantly (Table 4). Landholding size, draught power possession, and production are found to affect food security in the area.

Table 4. Binary Logistics Regression Model Output

Variables	B	Exp(B)	S.E.	Sig.
SEX	-1.229	0.293	1.969	0.532
AGE	0.652	1.919	0.445	0.143
EDUCATION	0.220	1.246	0.512	0.667
MARITALSTATUS	0.505	1.657	1.102	0.646
FAMILYSIZE	-0.180	0.835	0.159	0.255
LANDSIZE (in ha)	-1.278	0.279	0.488	0.009***
PRODUCTION	0.627	1.872	0.362	0.083*
NO. OF OXEN	1.777	5.912	0.598	0.003***
TECHNOLOGY	0.113	1.120	0.452	0.803
MARKETACCESS	-0.378	0.685	0.515	0.462
Constant	-1.200	0.301	2.153	0.577

Log Likelihood = 149.720; Pseudo R² = 0.194, Wald test= 1.328

***, **, * significant at 1%, 5%, and 10%, respectively

Source: Own Survey Result, 2017

Educational level of the household head: The educational level of the household head had insignificant impact on the food security status of the HHs in the study area. Unfortunately, the result of the logit model revealed that the sign was negative and insignificant. This was due to the unfavorable environment to benefit from the qualities of education. This means that even if the household head was educated, there were no opportunities to be benefited from. Insecure access to food may influence school attendance and achievement, reproductive decisions, migration strategies, employment options, and overall health and well-being. Schooling by itself is not a sufficient engine of growth for food security and also because farm households who are food insecure look for labor employment for their children to secure some cash or crop in order to increase access to food in their family. This leads to low quality education and school interruption due to which the effects of education on

food security is not sound. This means that even if the household head was educated, there were no opportunities to benefit from.

Technology: It is the collection of techniques, skills, methods and process used in production of commodities which is not significant in the study area because of two reasons; 1: majority of HHs in the study area are food insecure and unable to afford the cost of applying agricultural technology and afraid of risks. 2: Farmers did not apply the technology as per the standard and the way they used the technology is not right. For instance fertilizer application is not based upon the recommendation.

Distance to nearest market: Proximity to market centers creates access to additional income by providing off-farm and farm employment opportunities, easy access to inputs and transportation. It was, therefore, expected that households nearer to the market center have better chance to improve household food security status than those who do not have a proximity to market centers. Proximity to market centers was measured in kilometers. Market information system, marketing facilities, marketing organizations and distance from the market are among the few marketing features influencing household economy in general and food security in particular. Where markets are too far to sell agricultural outputs and purchase inputs, price is inefficient giving less incentive to farm producers. Where markets are near, market information is available to both sellers and consumers and price incentives are better. However, the market did not have significant effect on food security in the study area. Since the study area is small in size and has an all weather road, the impact of distance is not strong on the variables affecting the living condition of farmers of the study area, as farmers at far distances are in a better condition as compared to those at middle distances regarding the above mentioned price of grain and fertilizer. However, the probable reason for this finding is that they are at a distance when compared to the center of the district.

Age: In the study area, age is not a significant variable for food security because HHs at different age groups are affected by food insecurity. Land distribution in the study area was conducted in the study area 25 years ago in 1983. During

that time age was the first criteria to get land; youth whose age was above 25 years had got land. Individuals below this age did not, and due to this reason majority of productive HHHs whose age ranges from 20-50 are landless today and exposed to food insecurity. Majority of the land holders are above 65, old and less capable of producing and sharing for/with their young and adults and practice share cropping and are prone to food insecurity which exacerbates food insecurity. Besides, older people have more access to land than younger people as young people have to wait for land redistribution or they have to share with families. Food insecurity is found in all age strata. Owing to this the researchers inferred that age is insignificant for food insecurity in the study area. Mishra (2015) found that gender of the household head and age are statistically insignificant.

Marital status: The primary data shows that 90.6 per cent of sampled household heads were married, 5.9 were widowed, and 3.5 per cent were divorced. Since widowed and divorced sample HHs were very limited in number, there was insignificant variation in marital status of the sample household heads across study districts. However, married HHs have large families which requires high food consumption expenditure and leads to food insecurity in one way and in another way marriage could have accelerated change in status of food security or reduced level of food insecurity.

Sex of household head: is related to household food security in many ways. Culture, access to different assets and resources, multiple roles of women are some of the factors attached to sex in determining food security status of HHs. In this study, out of 170 sample HHs, 15 (8.8%) are female and 155 sample HHs or 91.8 per cent are male headed. The number of food secure female HHs varies from food secure male headed HH. Of the total 95 food insecure farm HHs 10 (11%) are female and the remaining 85 (89%) are males., This maybe simply due to high sample size of male headed HHs. 66.7 per cent of female headed HHs are food insecure. The proportion of food secure female headed HHs to total female headed sample is 33 per cent. The proportion of food secure male HHHs, in the same way equals to 45.16 per cent. These values shows that not only more proportion of male HHHs are food secure but also

male headed HHs have higher probability to get more calorie per day per AE for its HHs members related to female headed ones. 54.8 per cent of male HHs are food insecure which is based on food consumption survey. However, the model result shows that sex has insignificant effect on food insecurity.

Drought: In the past few years, Ethiopia has been particularly afflicted by both manmade and natural disasters. Drought, flooding, war and conflict, epidemics, and pestilence have been the major disaster risks. Drought is the leading cause of disaster in Ethiopia and almost all drought periods were recorded as famine periods. Both droughts and the resultant famines have been the major causes of social and economic crisis in the country in general and in the study area in particular. Famine has also contributed to the death of millions of people and animals over the last half century. The impact of drought is different throughout the country and depends on the vulnerability factors of the households. The populations of Wollo in Amhara Regional State, Tigray Regional State, and Hararge in Oromiya Regional State have historically been most affected by drought. Research has revealed that the recurrence of drought and famine is due to the country's economic structure, which is highly dependent on subsistence rain-fed agriculture. As the agricultural sector is dependent on erratic rainfall and traditional management, it is highly vulnerable to the occurrences of drought. In the study area, 85.29 per cent of the respondents reported that drought is one of the major causes of food insecurity.

Pest infestation : Pest is a plant or animal detrimental to humans or human concerns such as agriculture or livestock production. According to the data of the United Nations Food and Agriculture Organization (FAO), annual worldwide losses amount to approximately 20-25 per cent of the potential worldwide yield of food crops. In the study area pest is one of the dominant factors that negatively affects the food security status of the HHs. About 88.2 per cent of the respondents reported that pest is the most common reason for reduction of agricultural production. Some crops such as faba bean, which were commonly grown in the study area, are going out of production.

Household size: This is explained in the negative correlation that, as household size increases food security decreases. This is due to the fact that a greater number of the family tends to share and compute for existing production and yield. This suggests that there is a pressure in terms of resource allocation from a given entitlement in this area. FAO (2012) pointed out that food security is challenged by rapid population growth in Ethiopia. Without a change in production change in increasing population growth could be the central reason for problems of food insecurity. However, the negative effect of family size is not well understood by the majority of the HHs in the study area. Still, now large families or children are considered as an asset.

Land size: The logistic regression estimation shows that a unit increase in the size of land significantly increases the food security of households by a factor of 0.279. The findings are in line with the findings of Abafita and Kim (2014).

Production: The result depicts that a unit increase in farm production, significantly increases the food security of households by 1.871 factors. The findings are in line with the results of Doroch and Rashid (2013) and CARE (2014).

Number of oxen: According to the logistic estimation result, a unit increase in the number of oxen significantly enhances the food security of households by a factor of 5.912. The findings are consistent with the findings of Astemir (2014) and Muche (2015).

Concluding Remarks

Food insecurity is normal and regular for majority of HHs in the study area, appearing every year and extends from April up to November to pre-harvest time for three to six months. The descriptive statistics show that sex, size of cultivated land, education, technology, animal resource holdings, draught power possession, access to market, improved seed use, participation in extension packages are correlated with food security status. However the result of logistic regression model revealed that among these socio economic variables only three namely, possession of oxen, total cultivated land, and

production are found to be significant in determining food security status of households. The study also indicated that annual production, oxen/ livestock possession, size of farm land have a significant and positive influence on the state of household food security. Farmers do not produce enough food even in good rainfall years to meet consumption requirements. Given the fragile natural resource base and climatic uncertainty, current policy emphases on agricultural intensification are misguided because of limited understanding of the problems, lack of resources, lack of motivation, conflicting policies and inefficient institutional arrangements. Food insecurity in the study area is seriously limiting agricultural production. Despite many efforts by the government and non-government organizations to ensuring food security in the study area, it has been a challenge over the years. This suggests that there are still plenty of problems that call for action. Identifying and examining the determinants of food security in rural farm households can be taken as a step towards the solution to the problems. In general, it is concluded that strategies should be designed in a way that would focus on and address the identified determinants as well as other factors that are useful to achieve household food security. However, it is also believed that this is not a conclusive study to come up with a solid recommendation to address the food security situation in the district under this study.

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Land Use/Land Cover Changes in a disturbed River Watershed in Njoro, Kenya

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Abstract

Drivers of land use change were captured by the use of DPSIR model where Drivers (D) represented human needs, Pressures (P), human activities, State (S), the ecosystem, Impact (I) services from the ecosystem and Response (R), the decisions taken by land users. Land sat MSS and Land sat ETM+ (path 185, row 31) were used in this study. The Land sat ETM+ image (June 1987, May, 2000 and July, 2014) was downloaded from USGS Earth Resources Observation Systems data website. Remote sensing image processing was performed by using ERDAS Imagine 9.1. Two Land Use / Land Cover (LULC) classes were established as forest and shrub land. Severe land cover changes was found to have occurred from 1987-2000, where shrub land reduced by -19%, and forestry reduced by -72%. During 2000 – 2014 shrub land reduced by -45 per cent, and forestry reduced by -64 per cent. Forestry and shrub land were found to be consistently reducing.

Keywords: Watershed, Land use\land cover change, Landsat imagery, Geographic Information System.

Introduction

Land use/Land cover change (LULCC) is continuously changing the Middle part of the River Njoro watershed, thereby threatening sustainability and livelihood systems of the people. Biodiversity is facing widespread competition with humanity as human population increases, resulting in increasing conflict between economic development and the need for biodiversity conservation.

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These environmental problems are often related to LULC changes. LULCC and human/natural modifications have largely resulted in deforestation, biodiversity loss, global warming and increase of natural disasters like flooding (Fan et al., 2007, Dwivedi, et al, 2005). LULCC plays a major role in the study of global Land use/land cover change. Coexistence between local land uses and conditions for environmental, social, and economic sustainability has not been adequately addressed. Land use/land cover change is dynamic. It is mainly driven by natural phenomena and anthropogenic activities. Seto, et al., 2002, has reported that pressure from growing population and increasing socio-economic necessities results in unplanned and uncontrolled changes in LULC. Therefore, available data on LULC changes can provide critical input to decision-making of environmental management and planning the future (Fan, et al., 2010, Prenzel, 2004).

Drivers, pressure, State, Impact and Response (DPSIR) model as a decision making tool, has been applied in numerous research efforts including Water Resources Management at various scales. It has also been used in a series of international and multidisciplinary research projects as the main analysis tool (Tscherning et al., 2012). The demand for agricultural land, energy, water, food, transport and housing can serve as examples of driving forces (Giupponi, 2002; kristensen, 2004; Wood and van Halsema, 2008). Pressures consist of the driving forces' consequences on the environment such as the exploitation of resources (land, water, minerals, and fuels), pollution and the production of waste or noise (Wood and van Halsema, 2008). As a result of pressures, the 'state' of the environment is affected; that is, the quality of the various natural resources (air, water, and soil) in relation to the functions that these resources fulfill. The 'state of the environment' is thus the combination of the physical, chemical and biological conditions. The support of human and non-human life as well as the depletion of resources can serve as pertinent examples (Kristensen, 2004). Changes in the state may have an impact on human health, ecosystems, biodiversity, amenity value and financial value. Impact may be expressed in terms of the level of environmental harm and finally, the responses demonstrate the social efforts to solve the problems identified by the assessed

impacts, e.g. policy measures, and planning actions (EEA, 1999; Giupponi, 2002, Kristensen, 2004, Wood and van Halsema, 2008).

Remote sensing and Geographical Information Systems (GIS) as a resource management tool is powerful to derive accurate and timely information on the spatial distribution of land use/land cover changes over large areas (Guerschman, et al., 2003, Rogana and Chen, 2004, Zsuzsanna, et al., 2005). GIS provides a flexible environment for collecting, storing, displaying and analyzing digital data necessary for change detection (Yomralýođlu, et al., 2000, Demers, 2005, Wu et al., 2006). The aim of land cover change detection process is to recognize LULCC on digital images that change features of interest between two or more dates (Muttitanon and Tiýpathi, 2005). This change in land use has exposed the land to various pressures resulting from poor management, low cost technologies for soil fertility management, continued use of inappropriate technologies and intensive cultivation. Therefore, there is a need to understand how land use changes had affected the environmental sustainability of the area.

Study Area

The area of study covers about 8,170 ha and lies between latitudes 0° 15' S and 0° 25' S and longitudes of 35° 50' E and 36° 00' E (Figure 1). The whole watershed has a population of about three hundred thousand (300,000) people with more than three thousand (3000) individual farm holding units (Baldyga, et al., 2003). However, according to Kenya National Bureau of Statistics, Njoro Sub County registered a population of 23,551 people having grown by 3% from a population of 22, 845 people in 1999 (KNBS, 2009). Based on the same growth rate, the watershed population may have also grown to 309, 000 people with may be 3100 households. Due to the heavy settlement in the middle part of the watershed, it is estimated to be home to about 2000 farm holding units in an area of more than 8,000 ha with slopes ranging from < 2 to > 18 % and soils that are predominantly volcanic clay loam except near the lake where silt clay is found (Mainuri and Owino, 2013).

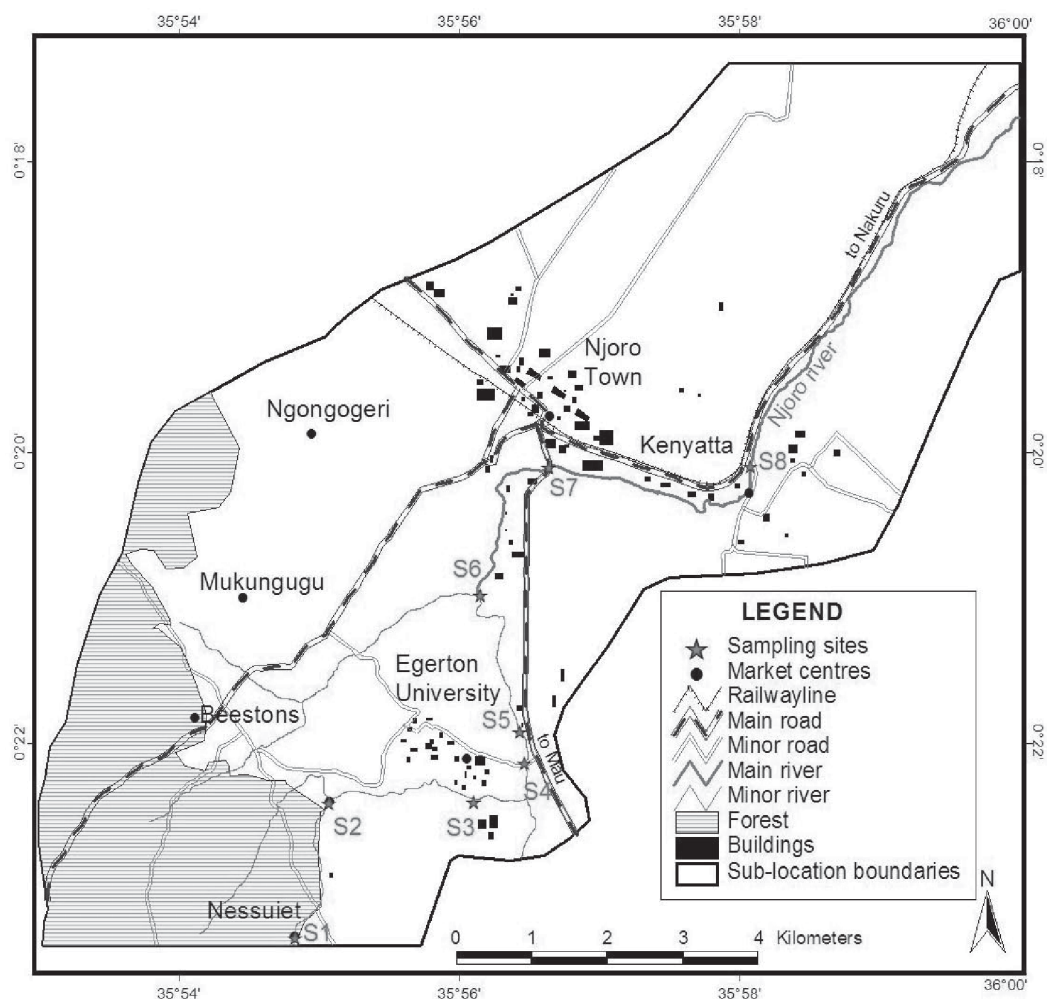


Figure 1: Middle River Njoro Watershed (Source: Mainuri and Owino, 2014)

Methods

A baseline survey at household-level encompassing socio-economic changes and impacts of land use activities in the middle part of the River Njoro Watershed was established. Additionally, information on factors influencing land use decisions, productivity factors and change in economic activities were sought through use of a questionnaire. The middle part of the River Njoro Watershed household survey was to target an area of approximately 8000ha. The Landsat scenes were selected (1987, 2000 and 2014) for this study. These dates captured

the major excision and settlement changes that have taken place in the watershed. Efforts were made to acquire imagery that corresponds with major land use/land cover changes within this period.

The study utilized 200 questionnaires which were administered to homesteads that were initially identified at random on both sides of the river. The questionnaires were subjected to scrutiny for completeness and consistency in question answering and the way they addressed the various issues intended to be captured. The questionnaires were sorted out and entered into the SPSS (version 20) work sheet. With the descriptive and categorical nature of most of the questions, simple descriptive analysis was done using SPSS and inferential statistics performed based on the results.

Image classification

Land sat MSS and Land sat ETM+ (path 185, row 31) were used in this study. The Land sat ETM+ images (June 1987, May, 2000 and July, 2014) were downloaded from USGS Earth Resources Observation Systems data. The dates of both images were chosen to be as closely as possible in the same vegetation season. All visible and infrared bands were included in the analysis. Remote sensing image processing was performed using ERDAS Imagine 9.1. Five LULC classes were established as commercial farms, forest, settlement, subsistence farms, and shrub land. Three dated Land sat images (1987, 2000, and 2014) were compared using supervised classification technique. In the supervised classification technique, three images with different dates were independently classified. A Supervised classification method was carried out using training areas. Maximum Likelihood Algorithm was employed to detect the land cover types in ERDAS Imagine 9.1.

Results

Nature and status of Land Use/ Cover during acquisition time

The study established that most of the land was under cultivation when the current owners acquired it, as the majority (31.7%) of the responses portray

it. This was closely followed by grass cover which formed 26.6 per cent of the total responses, with 19 per cent reporting that the land area was under indigenous trees when they initially moved in, while a 15.4 per cent response exhibited presence of exotic trees. However, only 7.3 per cent of the total responses reported the presence of soil and water conservation structures on the land during initial settlement period (Table 1).

Table 1. Nature/ state and extent of Land cover during acquisition by current owners

Land Use/ Cover	Responses on Land use		
	N	Per cent of Cases (interviewed)	Per cent (observed Land use change)
Presence of soil and water conservation structures	24	7.3%	12.9%
Under cropping	105	31.7%	56.5%
Under grass cover	88	26.6%	47.3%
Under indigenous trees	63	19.0%	33.9%
Under exotic trees	51	15.4%	27.4%
Total	331	100.0%	178.0%

Land use activities and factors influencing decisions

An interview was carried out on some key informants concerning the land use activities. They reported that the main environmental impacts were a general increase in agricultural activities on riparian zones. The main economic activity creating impacts to the ecosystem that was reported by these people was usually farming which resulted in the reduction of natural vegetation. However, the state of the ecosystem has remained a bit stable due to agro forestry that has contributed to planted forest which is thriving in some parts of the ecosystem. The response from those interviewed indicated that 88 per cent of those

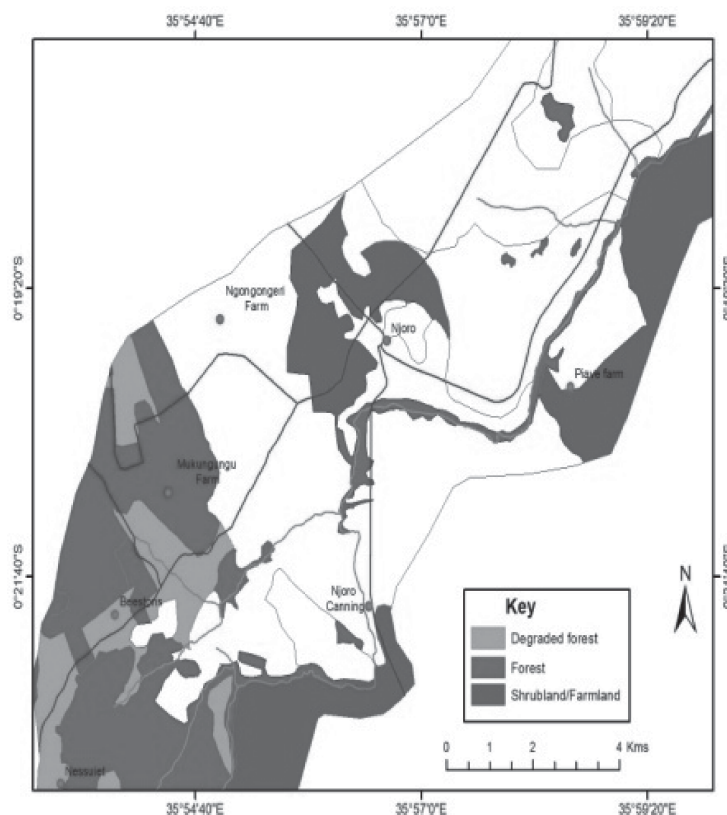
interviewed were farmers, 3 per cent were business persons, 3 per cent masons, and 3 per cent crafts men and 3 per cent teachers. Respondents' level of education refers to the actual number of years spent in school. The interview showed that 50 per cent of the respondents had obtained up to primary education, while 20 per cent have not obtained any formal education. A lower proportion (33%) had obtained secondary and post secondary level of education. Generally, 70 per cent of the respondents had primary level education and below. The finding indicates that most of the respondents in the middle part of the river Njoro watershed had low formal education and this may have affected the way in which they responded to new information on resource conservation and how they also received innovative ideas.

The respondents were interviewed on the changes in natural vegetation. A huge portion of the respondents (93%) have observed massive land use changes taking place with 7 per cent not feeling that there has been any noticeable change in land use. This possibly could be that they have recently settled in the area and since they settled there has been no change. The pressures exerted by the society through deforestation may have led to unintentional or intentional changes in the state of the ecosystem. As a result of no proper land ownership, most people are shy to invest in long term development activities and majorities are sluggish or unable to take any resource conservation measures. Assessment of driving forces behind land use change was done to capture past patterns and also be able to forecast future patterns. Driving forces on land use included most of the factors that influenced human activity that exert pressure on the ecosystem, including population increase, poverty, land tenure and markets. Also other underlying factors that drive actions like food preference demand for specific products, financial incentives and environmental state indicators such as soil quality, terrain and moisture availability played a great role in affecting the natural vegetation as shown in Table 2.

Table 2. Change detection

Class Type	1987 Area in Hectares	2000 Area in Hectares	2014 Area in Hectares	Percent change in area (2000-1987)	Percent change in area (2014-2000)
Forest	1460.898	405.351	145.712	(-1055.55)-72%.	(-259.64) -64%
Shrub land	849.281	687.820	373.150	(-161.46) -19%,	(-341.67) -45%

Increasing land use/cover changes were observed in the middle part of the river Njoro watershed ecosystem over the last twenty seven (27) years. These changes resulted from a number of factors, but mainly related to habitat loss due to various human activities. Information about changing patterns of land use/cover through time and the factors influencing such changes have been captured in the change detection maps shown in Figure 2, 3 and 4 below.

**Figure 2. Forests and Shrub Lands cover in 1987**

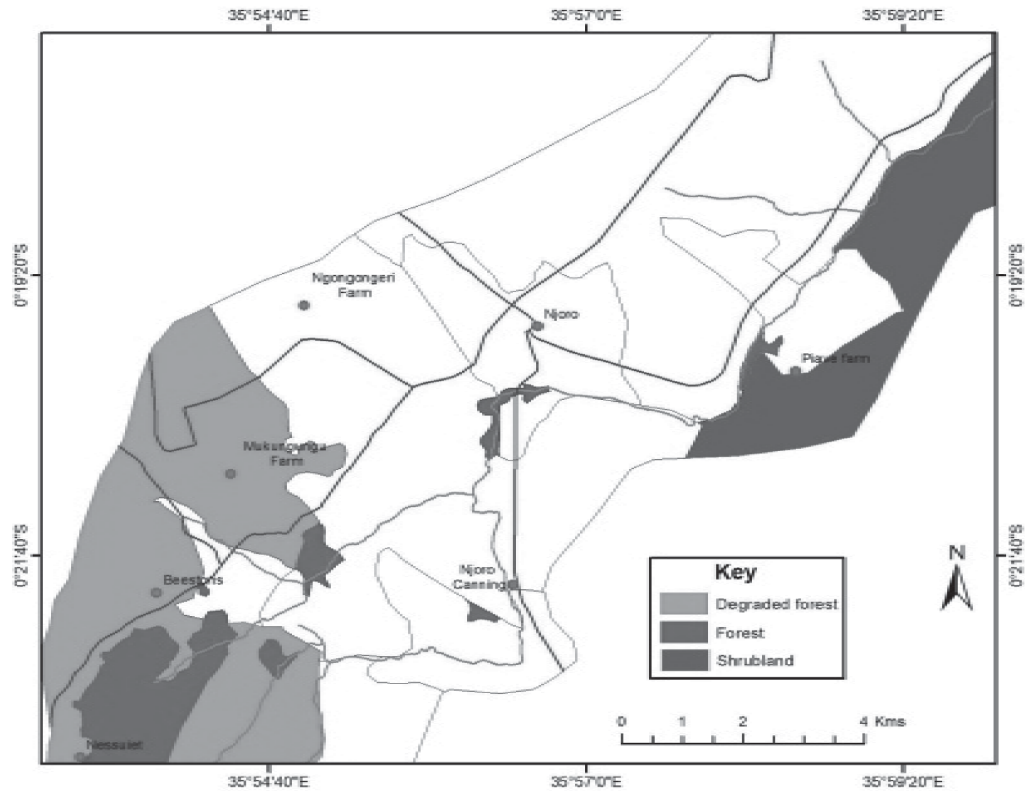


Figure 3. Reduction of Forests and Shrub Lands in the year 2000

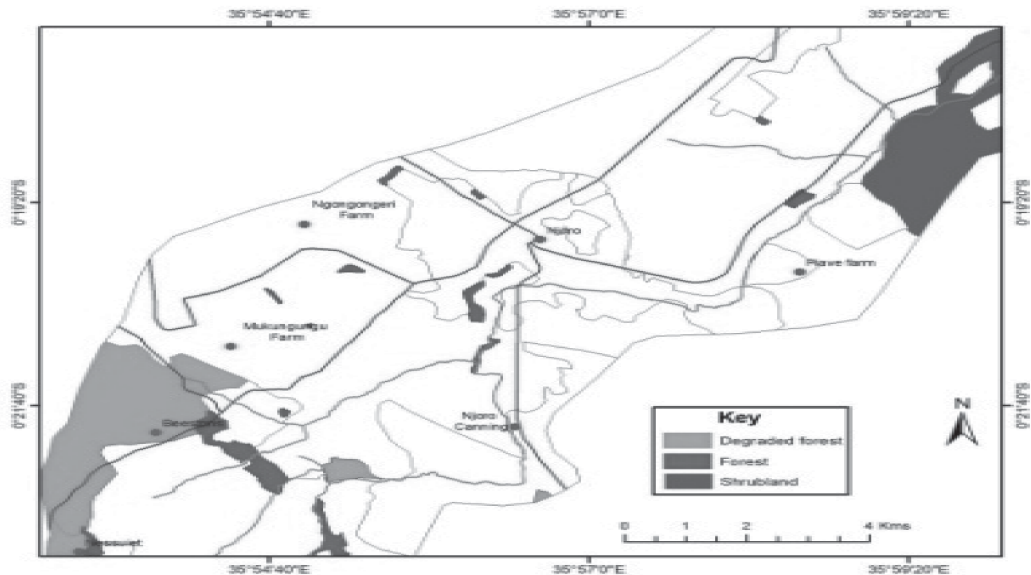


Figure 4. Reduction of Forests and Shrub Lands in the year 2014

Natural Vegetation Cover

From the study, it is evident that natural vegetation which was indicated by forest and shrub land (Table 3) has reduced over the period the respondents have resided in the area. The results from image processing and analysis for the years 1987, 2000 and 2014 portray a general reduction in both forests and shrub lands within the study area. We can therefore say that deforestation has been witnessed in the study area for the last two decades due to land use patterns.

Table 3. Respondents' view on Natural Vegetation

Year	Forest Area(ha)	Shrub land Area (ha)	Natural Vegetation Change	Frequency (Number interviewed)	Percent of respondents interviewed
1987	1460.898	849.281	Decrease	32	20.6
2000	405.351	687.820	Decrease	123	79.4
2014	145.712	373.150	Total	155	100

Reasons for Reduction in Natural Vegetation

Several activities and their impact on reducing natural vegetation were identified during the study. From Table 4, cultivation stood out to be the major driving force that led to the reduction in natural vegetation cover in these areas as reported by the respondents. This constituted 33 per cent of the total responses. Other activities included charcoal burning (11.2%), infrastructural development (10.4%), grazing (9.9%) and commercial timber production (4.7%). Collectively, these have led to deforestation in the area under study.

Table 4. Responses for change in natural vegetation

Reasons for change	Responses on Land cover change		Percent of Cases (interviewed)
	N	Percent(observed)	
Commercial timber production	18	4.7%	11.1%
Cultivation	127	33.0%	78.4%
Infrastructural development	40	10.4%	24.7%
Charcoal burning/ firewood	43	11.2%	26.5%
Grazing	38	9.9%	23.5%

Discussion and Conclusions

In order to determine the current land use and factors that influence land use decisions in the middle part of the River Njoro watershed the study sought to establish the kind of land use before the occupation of the current inhabitants. It was found that 32 per cent of the land was under cultivation when the current owners acquired it as confirmed by the interviewee. Twenty seven per cent of the respondents indicated that they occupied land that was under grass cover with 19 per cent reporting that the land area was under indigenous trees when they initially moved in, while a 15 per cent response exhibited presence of exotic trees. Driving forces on land use included most of the factors that influenced human activity that exert pressure on the ecosystem, including population increase, poverty, land tenure and markets.

Alongside determining the land use and factors influencing land use decisions, the study also looked at land use/land cover changes that were a result of land use decisions that the people made. It was noted that there were increasing land use/cover changes observed in the middle part of the river Njoro watershed over the period of study. These changes resulted from a number of factors that included increase in population, change in lifestyle and the need to provide food for the increasing numbers of people. Several activities and their impact on reducing natural vegetation were identified during the study with cultivation being the major driving forces that has led to the reduction in natural vegetation cover in these areas constituting 33 per cent of the total responses. Other activities that contributed to land use/land cover change included charcoal burning, infrastructural development and grazing and commercial timber production. Collectively, these have led to deforestation in the area under study.

Land degradation by overgrazing and intensive agriculture on marginal lands is a major driver of land cover loss in the middle part of the river Njoro watershed. In this rapidly industrializing area with dense population, demand for land for industry and residential use is driving the transformation of some of the most productive agricultural land out of production in the watershed. Policy efforts to avoid this loss of production are there but, their effectiveness in the face of

economic demand is often limited. The effectiveness of these efforts and other national efforts to reduce the negative impacts of LULCC remain to be seen. The need for greater efforts and new methods to monitor and mediate the negative consequences of LULCC remains acute and we have to sustain current and future human populations under desirable conditions. This can be realized by putting in place policies like reforestation of natural forests, mandatory planting of trees in homestead, controlled tree harvesting and restricting encroachment into the forests.

Conclusions

The factors driving land use decisions in the middle part of the River Njoro watershed include demographic and economic developments in the watershed community, and the corresponding changes in lifestyles, overall levels of consumption and production patterns. These drivers have exerted pressure on the ecosystem in the form of waste disposal, over cultivation, overgrazing and deforestation. These pressures have caused negative changes to the watershed which have caused heavy impacts mainly through removal of natural vegetation. The removal of natural vegetation (LULCC) in the middle part of the River Njoro watershed has resulted in the decrease of the forest area by 1314 ha and shrub land by 475 ha in the last 27 years. The integration of remote sensing and GIS was found to be effective in monitoring and analyzing land cover patterns and also in evaluating impacts of land use change for future land development projects by the residents of study areas.

The residents are therefore recommended to develop responses to rehabilitate the degraded environment through re-afforestation, soil and water conservation and reduction of land use/land cover change (LULCC) in order to mitigate the negative outcomes of the ecosystem changes.

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Risk Attitudes of Rice Farmers Participating in IFAD-VCD Programme in Niger State of Nigeria

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Abstract

Weather vagaries, inconsistent government policies and market imperfections make things difficult for smallholder farmers to predict the future with certainty, thus, there is a need to understand their behavior towards risk. It is in the light of this that this study was conceptualized to determine risk attitudes of rice farmers participating in IFAD-VCD programme in Niger State of Nigeria. Cross-sectional data of 2018 cropping season was collected on a fortnightly basis from 110 IFAD rice farmers through a structured questionnaire complemented with an interview schedule and the collected data were analyzed using safety-first rule approach and Tobit regression model. The empirical evidence showed that most of the farmers were risk-averse owing to lack of complete market information in spite of the technical and input-output market support offered by IFAD programme in the study area. However, the major factors identified to be affecting farmers' preference for risk in rice production were the problem of glut which causes price dampening and high agro-input prices in the studied area. Therefore, the study recommends the need to strengthen the linkage between the farmers and off-takers, subsidizing farm inputs and also providing farmers with adequate market information in order to allay the fear of market imperfection in the studied area.

Keywords: Risk attitude, Safety-Approach model, IFAD, Farmers, Niger State

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Introduction

The fear of capital loss by small-scale farmers in Nigeria owing to lack of economic capital, and agricultural enterprise being bounded by uncertainty e.g. weather vagaries, the spread of pests and diseases etc., has been a serious threat to agricultural investment in the country. Amaefula *et al.* (2012) cited that small-scale farmers are naturally keen to avoid taking a risk which might threaten their livelihoods due to the potential negative outcomes of risk, thus they are willing to sacrifice their potential income to avoid risk or uncertainty. This behaviour influences the levels and types of farm inputs used by them and the aggregate levels of output they produce. The consequences of this risk and uncertainty phenomenon have kept productivity in agricultural enterprises low, despite all interventions aimed at ensuring food security. Therefore, due to this inherent risk associated with agricultural production, these farmers, especially the smallholder category, are not able to meet-up with their basic household needs. According to Mosley and Verschoor (2003), the vicious circle of poverty takes many forms but one key element in many versions of the spiral in many environments is risk aversion. If poor people are risk-averse to the extent that they are unwilling to invest in the acquisition of modern inputs because it involves risks, they will remain poor.

Picazo-Tadeo and Wall (2011) reported that agricultural production being subject to risk has a direct consequence on the farmers' attitudes towards risk as it influences their input choices owing to production risk. The time-lag characteristics associated with agricultural production activities inhibits accurate prediction of expected output and their prices, thus increasing the concern of risks and uncertainty (Amaefula *et al.*, 2012).

Literature has shown strong evidence of resource-poor farmers being averse to risk (Moscardi and de Janvry, 1977; Binswanger, 1980; Antle, 1987) due to the associated impacts of risk and uncertainty on the households' production and consumption decision. Besides, Abayomi *et al.* (2013), reported that in recent years, risks have rivaled profitability as a measure of performance for producers. These general conclusions and observations have stimulated

considerable research into the effects of risk on farmers' economic decisions. To add to the current literature, more needs to be done because research on the economics of risk in farming businesses has not been explored and documented in some places.

In Nigeria, particularly the study area, to the best of our literature review horizon, there is little or no documented empirical evidence on studies involving risk in crop farming business supported by International Fund for Agricultural Development (IFAD) agricultural programme. Moreover, knowledge of how smallholder farmers make economic decisions under risk is important in determining the strategies and policies to be formulated for agricultural development. It is in view of this that the need to determine the risk attitudes of rice farmers participating in the IFAD programme in Niger State of Nigeria was conceptualized.

Objectives

The specific objectives were:

1. To determine the risk attitudes of the participating farmers and the
2. Factors influencing the risk attitudes of the farmers in the studied area.

Research Methodology

Niger state is located on 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 Local Government Area (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 viz. 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 chosen participating LGAs. Thereafter, two active co-operative associations from each of the selected villages were randomly selected. It is worth noting that Microsoft excel inbuilt 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 International Fund for Agricultural Development - Value Chain Development (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 for the study. The collected data were analyzed using a multiple regression model (OLS) and safety-first rule approach in conjunction (first objective), and Tobit regression model (second objective). 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 $q = 1 - 0.60 = 0.50$

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 Gwari Nasara 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.

Model Specification

The multiple regression model estimated by ordinary least square (OLS) is presented below:

Implicit form

$$Y = f(X_1, X_2, X_3, X_4, \dots, X_n) \dots \dots \dots (2)$$

Explicit form

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 \dots \dots + \beta_n X_n + \varepsilon_i \dots \dots \dots (3)$$

Where;

Y = Output of rice (kg)

X_1 = Farm size (ha)

X_2 = Seeds (kg)

X_3 = NPK fertilizer (kg)

X_4 = Urea fertilizer (kg)

X_5 = Herbicides (ltr)

X_6 = family labour

X_7 = Paid labour (manday)

X_8 = depreciation on capital items (₦)

β_0 = Intercept

β_{1-8} = Regression coefficients

ε_t = Stochastic

The functional forms fitted into the specified equation are as follow:

(a) Linear function

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n + \varepsilon_t \dots \dots \dots (4)$$

$$MPP = \beta$$

$$Elasticity = \beta * \bar{X} / \bar{Y}$$

(b) Semi-log function

$$Y = \beta_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \dots + \beta_n \log X_n + \varepsilon_t \dots \dots \dots (5)$$

$$MPP = \beta / \bar{X}$$

$$Elasticity = \beta / \bar{Y}$$

(c) *The Cobb Douglas (double log) function*

$$\log Y = \beta_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 \dots \dots \dots + \beta_n \log X_n + \varepsilon_t \dots \dots \dots (6)$$

$$MPP = \beta * \bar{Y} / \bar{X}$$

$$Elasticity = \beta$$

(d) *Exponential function*

$$\log Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \dots \dots \dots + \beta_n X_n + \varepsilon_t \dots \dots \dots (7)$$

$$MPP = \beta * \bar{Y}$$

$$Elasticity = \beta * \bar{X}$$

Safety-first Approach Method

Following Moscardi and deJanvry (1977), the safety-first approach used to generate risk aversion parameter (K_s) for each farmer is shown below:

$$K_s = \frac{1}{\theta} \left[1 - \frac{P_i W_i}{P_y \beta_i \mu_y} \right] \dots \dots \dots (8)$$

Where; K_s is the risk index of i^{th} farmer; θ is the variance parameter; P_i is the unit price of the chosen most influential input for i^{th} farmer; W_i is the quantity of the chosen most influential input of the i^{th} farmer; P_y is the unit price of the output of i^{th} farmer; β_i is the elasticity coefficient of output with respect to the chosen input; and, μ_y is the mean of the output. The researchers did not adopt the classification developed by Moscardi and de Janvry as the mean and the standard deviation ($\bar{X} \pm 0.5 * SD$) of the risk aversion parameter K_s were used to classify the farmers in the studied area into three (3) distinct categories as presented below:

$0 < K_s < 2.286$ = Low risk aversion/ Risk-preference

$2.286 < K_s < 2.305$ = Intermediate risk aversion/ Risk-neutral

$2.305 < K_s < 2.329$ = High risk aversion/ Risk-averse

Tobit regression model

The Tobit model assumes:

$$Y_i^* = \alpha + X\beta + \varepsilon_i \dots \dots \dots (9)$$

$$Y_i^* = \alpha + X_1\beta_1 + X_2\beta_2 + X_3\beta_3 + X_4\beta_4 + X_5\beta_5 + \dots + X_n\beta_n + \varepsilon_i \dots \dots \dots (10)$$

Where:

Y_i^* = Risk Index value for 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} = Annual income (₦); X_{12} = Farming Experience (year); X_{13} = Non-farm income (yes = 1, otherwise = 0); X_{14} = language spoken (number); X_{15} = Security threat (yes = 1, no = 0); X_{16} = Household commercial index (HCI); X_{17} = Seed cost (high = 1, low = 0); X_{18} = NPK fertilizer cost (high = 1, low = 0); X_{19} = Urea fertilizer cost (high = 1, low = 0); X_{20} = Herbicides cost (high = 1, low = 0); X_{21} = Human labour cost (high = 1, low = 0); X_{22} = Kcal consumption (recommended ($\geq 2250 \text{ kcal}$) = 1, otherwise 0); X_{23} = Poverty depth (poor = 1, otherwise = 0); X_{24} = Food security status (secured = 1, otherwise = 0); β_0 = Intercept; β_{1-n} = vector of parameters to be estimated; and, ε_i = Error term. In partitioning the operating capital cost items this formula: $\bar{X} \pm 0.5 * SD$ was used, where the value $\geq \bar{X} \pm 0.5 * SD$ was considered high while the value $\leq \bar{X} \pm 0.5 * SD$ was considered low.

Results and Discussion

Risk Attitudes of the Participating Farmers

The linear functional form was chosen as the best fit among all the functional forms fitted into the specified equation as it satisfied the economic, statistical and econometric criteria of the method of estimation used i.e. ordinary least square (OLS) (Table 2). Furthermore, the estimated coefficient of farm size

Table 2. Production determinants of rice output among IFAD beneficiaries

Inputs	Ordinary least square (OLS)				Col. Test VIF (+)
	Linear (+)	Exponential	Semi-log	Double log	
Constant	106.127(380.503) [0.2789] ^{NS}	7.584(0.0721) [105.2] ^{***}	-9553.19(3611.59) [2.645] ^{**}	6.188(0.617) [10.04] ^{***}	-
Farm size	1475.41(438.83) [3.362] ^{***}	0.292(0.0831) [3.516] ^{***}	2109.97(677.51) [3.11] ^{***}	0.435(0.116) [3.760] ^{***}	3.988
Seeds	3.98472(2.28357) [1.2134] ^{NS}	0.00048(0.001) [0.481] ^{NS}	331.64(321.99) [1.030] ^{NS}	0.054(0.055) [0.978] ^{NS}	2.817
NPK	6.0322(2.0268) [2.976] ^{***}	0.0011(0.00038) [2.927] ^{***}	1117.24(479.31) [2.33] ^{**}	0.214(0.082) [2.618] ^{**}	3.039
Urea	2.05026(1.9673) [1.045] ^{NS}	0.00042(0.00075) [0.555] ^{NS}	839.34(516.13) [1.62] ^{NS}	0.120(0.088) [1.362] ^{NS}	3.413
Herbicides	28.129(81.0175) [0.347] ^{NS}	0.00818(0.0153) [0.533] ^{NS}	582.72(473.85) [1.23] ^{NS}	0.083(0.081) [1.020] ^{NS}	2.526
Family labour	7.4674(2.8184) [2.649] ^{***}	0.00057(0.00053) [1.074] ^{NS}	144.91(163.02) [0.89] ^{NS}	0.018(0.028) [0.649] ^{NS}	2.483
Paid labour	6.6226(3.588) [1.846] [*]	0.00069(0.00068) [1.016] ^{NS}	105.21(156.26) [0.67] ^{NS}	0.002(0.027) [0.074] ^{NS}	1.266
Depreciation on capital items	-0.01606(0.0149) [1.142] ^{NS}	-2.842E-6(1.31E-5) [0.216] ^{NS}	96.48(288.22) [0.33] ^{NS}	-0.0011(0.049) [0.022] ^{NS}	2.288
$\sum \beta$	0.98				
R ²	0.728	0.680	0.660	0.675	
Adjusted R ²	0.706	0.655	0.633	0.649	
F-stat	33.74 ^{***}	26.80 ^{***}	24.47 ^{***}	26.20 ^{***}	
Heteroskedasticity (B-G)	2.645{0.234} ^{NS}	80.61{0.0006} ^{***}	77.53{1.5E-13} ^{***}	52.20{1.5E-8} ^{***}	
Normality test	13.16{0.0013} ^{***}	3.865{0.144} ^{NS}	17.40{0.00016} ^{***}	3.07{0.214} ^{NS}	

Source: Field survey, 2018

Note: * ** * NS significance at 1%, 5%, 10% and Non-significant respectively.

Values in (); []; and { } are standard error, t-statistic and probability value, while Col. = Collinearity

was found to be the *primus inter pares* among the least-squares found to have a significant influence on the rice output, thus chosen as the factor to determine the risk attitude coefficient of the participating rice farmers in the studied area. The results showed that majority of the participating farmers were risk-averse (64.0%) owing to incomplete market information as the programme input supplier and off-taker linkages supports are not reliable given that they operate in the same environment that is subject to market imperfection (Table 3). However, 30.6 per cent identified to have a preference for risk is due to the confidence they have in the technical support, input and output linkages provided by the programme in the studied area.

Table 3. Risk attitudes of rice farmers

Category	Frequency	Percentage
Risk-preference ($0 < 2.286$)	34	30.6
Risk-neutral ($2.286 < 2.305$)	6	5.4
Risk-averse ($2.305 < 2.329$)	71	64.0
Total	111	100

Source: Field survey, 2018

Factors influencing Risk Attitudes of the Participating Farmers

The diagnostic test statistics viz. test for normality of the residual showed that the model failed the test of normality given that the error term is not normally distributed. However, this is not considered a serious case given that naturally in most scenario data are not normally distributed. In addition, the test for multicollinearity of the explanatory variables showed the absence of a collinear relationship between the variables as the explanatory variables variance inflation factors (VIF) were less than the value of 10.0. Furthermore, with the significance of the estimated Chi^2 value at less than 10 per cent degree of freedom, this indicates that the Tobit regression model is the best fit for the specified equation

and the estimated parameters included in the model are different from zero i.e. they exert influence on the risk attitudes of the farmers in the studied area (Table 4).

A cursory review of the results showed that risk attitudes of the farmers were influenced by nutritional status, yield, educational status, access to credit, seed variety, commercialization index, language spoken, household size, cost of seeds, cost of NPK fertilizer, cost of urea fertilizer and cost of herbicides as indicated by their respective estimated coefficients which were different from zero at 10 per cent degree of freedom.

The negative significance of the nutritional status coefficient indicates that the farmers were nutritionally balanced i.e. those that meet the recommended kcal intake of 2250 kcal had a preference for risk. Therefore, the marginal and elasticity implications of a unit increase in the kcal intake of a farmer will make him reduce his aversion towards risk by 0.007 and 0.0004 per cent respectively. The negative significance of the coefficient for household member sickness showed how a case of non-ill health among the farm family of participating farmers encouraged them to have a preference for risk as his capital is not affected by medical expenditure coupled with no psychological trauma. Thus, the marginal and elasticity implications of a participating farmer with no case of ill-health among the farm family will lead to a decrease in risk aversion by 0.0019 and 0.00095 per cent respectively.

Farmers who used improved variety other than the local variety have a preference for risk due to the tendency of having a high yield which will translate to a high income if the prevailing market is remunerative as shown by the negative significance of the estimated coefficient for seeds variety. Thus, the marginal and elasticity implications of a farmer who used improved variety will make him reduce his risk aversion by 0.0076 and 0.0035 per cent respectively. The negative significance of the household size coefficient revealed that a large farm family composed of able-bodied people has a preference for risk due to multiple income streams which accrue to the household owing to income remittance by the household members. Therefore, the marginal and elasticity

implications of a unit increase in the household size of a farmer will make him decrease his risk aversion by 0.00017 and 0.00063 per cent respectively.

The negative significance of the estimated coefficient of language spoken showed how communicating in more than one language enables a farmer to integrate into the global farming community *viz.* having adequate information about innovations and market information, thus making him have preference for risk as compared to his counterpart who will remain confined to his immediate farming environment if he speaks only one language. The marginal and elasticity implications of an additional language spoken by a farmer will make him decrease his risk aversion by 0.00098 and 0.0013 per cent respectively.

Farmers with a good market for their product have a preference for risk as indicated by the negative significance of the estimated coefficient for commercialization index. Therefore, the marginal and elasticity implications of a unit increase in a farmer's marketed surplus will make him reduce his aversion for risk by 0.0072 and 0.0021 per cent respectively. Low costs of operating capitals owing to subsidy encouraged the participating farmers to have a preference for risk as indicated by the negative significance of the estimated coefficients associated with the operating capitals. The marginal implication of low costs associated with seed cost, NPK fertilizer cost, urea fertilizer cost and herbicides cost will decrease the risk aversion attitude of a farmer by 3.59E-7, 3.398E-7, 6.74E-7 and 9.998E-7 respectively. In addition, the elasticity implication of low costs associated with seed cost, NPK fertilizer cost, urea fertilizer cost and herbicides cost will decrease the risk aversion attitude of a farmer by 0.0031 per cent, 0.0055 per cent, 0.0059 per cent and 0.0034 per cent respectively.

The positive significance of the yield coefficient showed how fear of glut in the market which dampens the market price makes farmers risk averse. Thus, the marginal and elasticity implication of a unit increase in the yield of the farmers will increase their risk aversion by 7.45E-06 and 0.0119 per cent respectively. The positive significance of the education coefficient revealed

Table 4. Factors influencing risk attitude of IFAD rice farmers

Variables	Coefficients	t-stat	Elasticity	VIF
Constant	2.34008 (0.01533)	152.6***		-
Yield	7.624E-6 (1.36E-6)	5.626***	0.0118944	1.703
Marital status	-0.00083 (0.0044)	0.187 ^{NS}	-0.0002941	1.743
Educational level	1.84E-5 (1.10E-5)	1.673*	0.0001246	1.433
Kcal consumption	-0.00685 (0.00277)	2.478**	-0.0004988	1.827
Sickness	-0.0019 (0.00077)	2.468**	-0.0009449	2.214
Extension visit	-0.000195 (0.00031)	0.624	-0.0006487	1.558
Access to credit	0.00077 (0.00195)	0.395	0.0001499	1.627
Seed variety	-0.0076 (0.0046)	1.668*	-0.0034502	1.266
Gender	-0.0064 (0.00595)	1.081 ^{NS}	-0.0027118	1.638
Age	-9.39E-5 (0.00017)	0.551 ^{NS}	-0.0016703	3.408
Household size	-0.000169 (0.00005)	3.38***	-0.0006249	4.367
Annual income (₦)	-7.07E-10 (2.61E-9)	0.270 ^{NS}	-0.0001548	1.986
Farming experience	8.92E-5 (0.00019)	0.460 ^{NS}	0.0009016	4.184
Non-farm income	0.00011 (0.0020)	0.053 ^{NS}	0.000056	1.469
Language spoken	-0.00098 (0.000177)	5.54***	-0.0013223	1.659
Security threat	-0.0036 (0.0043)	0.834 ^{NS}	-0.0000633	1.375
CI	-0.0072 (0.00155)	4.645***	-0.0020922	1.604
Poverty depth	0.00312 (0.00251)	1.241 ^{NS}	0.000305	2.084
Food security status	-0.00345 (0.00225)	1.535 ^{NS}	-0.0004708	1.937
Seed cost	-3.59E-7 (1.24E-7)	2.885***	-0.0031	3.852
NPK cost	-3.39E-7 (9.78E-8)	3.475***	-0.0054811	3.547
Urea cost	-6.74E-7 (1.87E-7)	3.616***	-0.0059841	3.779
Herbicides cost	-9.998E-7 (3.97E-7)	2.517**	-0.0033658	2.676
Hired labour cost	-2.69E-8 (3.71E-8)	0.723 ^{NS}	-0.0004084	1.698
Chi ² test	535.62***			
Normality test	58.36 [2.1E-13]***			

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

how lack of complete market information owing to market imperfection made the educated farmers to be apprehensive of risk. Therefore, the marginal and elasticity implications of a unit increase in the educational level of a farmer will make him increase his/her risk aversion attitude by $1.84E-5$ and 0.00013 per cent respectively. The positive significance of the credit estimated coefficient indicated how fear of loss of real capital due to default and delinquency by farmers with access to credit makes them averse to risk. Therefore, the marginal and elasticity implications of a farmer with access to credit will make him/her increase his aversion to risk in rice production by 0.00077 and 0.00015 per cent respectively.

Conclusion and Recommendations

It can be inferred that most of the participating farmers were apprehensive to risk in rice production owing to the problem of glut which causes price dampening and high cost of agro-inputs, and all are directly related to lack of complete market information in the studied area. Therefore, the study recommended the need to strengthen the linkage between the farmers and off-takers, provide input subsidies and adequate market information to the farmers in order to allay the fear of market imperfection among the farmers in the studied area.

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Urban farming: Knowledge Management and Impact – Lessons from twin cities of Hyderabad and Secunderabad

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Abstract

Urban farming is now seen as a way to nutritional security of the burgeoning city masses and a means to daily sustenance. Most of the population in the cities have started practising agriculture on the spaces available to them. Urban agriculture is catching up in most of the Indian cities such as Chennai, Bangalore, New Delhi, Mumbai and Pune etc. In Hyderabad as well, increased access to information and extension advisory services of the Urban Farming Division (UFD) of Horticulture Department, Hyderabad have induced most of the urbanities to practice agriculture. Urban farming has a positive impact on both the practitioners and the city. In view of this, a study was taken up on Urban farming: Knowledge management and impact – Lessons from twin cities of Hyderabad and Secunderabad to understand information sources for urban farming practitioners and impacts of urban farming on cityscape. The study revealed that online content and virtual knowledge were found to be the most important sources of agricultural knowledge. A variety of ICT services were used by the urbanites for sourcing the information, which include Facebook groups, online agri store, WhatsApp groups etc. In the same way, neighbours with similar interests were one of the major sources for crop production knowledge. The study further observed that Urban Farming is capable of recycling the wastes, restoring the urban ecosystem and stabilising the health of both human and urban city scape. It is believed that the results of the study would help the scientific community, general public, extension functionaries to understand the importance of urban farming as well as to upscale good practices.

Key Words: Urban Farming, Information and Impact

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Introduction

Urban farming is capable of bolstering more social and political inclusion and is capable of sustaining the environment, facilitating economic progress, aiding water and land use management of the urban landscape. Urban farming also paves a way to nutritional security of the population and ensures access to daily sustenance of food and nutritional needs. According to the FAO report, 2015, urban garden lands are 15 times more productive than the rural holdings and further, the study noted that one square meter of the urban farm is capable of producing 36 heads of lettuce every 60 days, 10 cabbages every 90 days and 100 onions every 120 days. Further, FAO articulates that, of the 54.29 per cent of the urban population, 10.66 per cent of (0.8 billion) of the population is found to be involved in urban farming and believed to have produced one-fifth of the world food production.

Most of the population in the cities has started practising agriculture on the spaces available to them. They also source information from a variety of domains and platforms. The information sources that the urbanites tap into are unique as they use different cognitive approaches to learn and share information related to farming and crop production. In Hyderabad as well, increased access to information and extension advisory services of the Urban Farming Division (UFD) of Horticulture Department, Hyderabad have induced most of the urbanities to practice agriculture. The initiatives and a broad range of extension services of the Urban Farming Division of Horticulture Department have played a major role in creating awareness about agriculture among the urbanites. This coupled with, the rural farming background of most of the urbanites has kindled interest among them to pursue the noble profession of agriculture. These twin characters have led to large scale adoption of agriculture by most of the urbanities.

Overall, urban farming has a walloping positive impact on both the practitioners and the city as a whole and it also comes at a time when the cities have become a prey to the growing industries, tanneries, concrete jungle, pollution and booming population. In view of this, a study was taken up on Urban farming: Knowledge management and impact – Lessons from twin cities of Hyderabad

and Secunderabad to understand information sources for urban farming practitioners and impacts of urban farming on cityscape. The outcome of the study is expected to help the scientific community, general public, extension functionaries to understand the importance of urban farming and to upscale it across the cities and cosmopolitans with suitable extension strategies. The study has documented about 25 urban agricultural practitioners and their knowledge sources regarding agriculture and the impacts of urban farming/agriculture with the following objectives:

Objectives

1. Identification of sources of information followed by urbanites on urban crop production
- 2 Analyzing the impacts of urban farming.

Review of Literature

Urban farmers are from all age categories and all walks of life (women, men wealthy, poor, locals and immigrants) and most of them are from low income households (FAO, 2014 and Robertson, 2013). The location, is either in the midst of the city or alongside or periphery of the city or intra-urban or inter-urban (Van Veenhuizen, Moustier and Danso 2007 and Lynch *et al*, 2001). As far as crops included in urban farming, the urbanites practice urban farming essentially to meet their own food requirement (Devenish, 2006; Veenhuizen, Moustier and Danso, 2006). Many of the urban cities, have a family farm that includes production of foods for self-consumption and sale of the surplus to the markets for some income (Moustier and Danso, 2006). The Mexican city has produced an annual average of 15 000 tonnes of vegetables from 22 800 hectares of land. In the Peru capital Lima, 5 000 ha of irrigated land is utilised for short-cycle vegetable crops for sale in city markets. The urban dwellers of Hyderabad city cultivate mostly para grass accounting for 65.00 per cent of the urban produce followed by leafy vegetables and one per cent of fruits, crossandra and jasmine flowers (Buechler and Devi, 2002).

As far as information sources for urban farming are concerned, 88.00 per cent of the vegetable farmers in the urban part of Accra, Ghana have radio as a source of information followed by friends (64.00 %), extension agents (52 %), agro-chemical shops (45.00 %), television (37.00 %) and others (27.00 %) regarding farming and 68.00 per cent of the urban vegetable farmers use information on application of fertilisers followed by 63.00, 62.00, 56.00, 32.00, 31.00 and 30.00 per cent of them using information on organic farming, weedicides, soil improvement, pest management, market price, and pesticides respectively. (Osei *et al*, 2017). About 77.20 per cent of the livestock keepers of Kinondoni and Morogoro urban areas of Tanzania depend mostly on veterinary shops for their information and almost 63.80 per cent of them contact extension officers for information followed by 40.20, 39.80, 29.10 and 12.60 per cent of the livestock keepers who access information from fellow livestock keepers, print media, agricultural exhibitions and meetings/seminars (Angello *et al*, 2016).

Material and Methods

An ex post facto research design was followed in this study. The respondents were selected by using the snowball sampling method. The case study analysis was also followed to study the good practices of urban farming. The information was collected using a semi-structured interview schedule and focus group discussion. Simple percentage analysis was used to assess the degree of impact of urban farming.

Background of urban farming practitioners

The study was carried out among 25 urbanites who are residents of Hyderabad. Most of the urbanites who have been interviewed were retired employees of both public and private sectors. Some of them are working in banks, private sector (Consultancy, engineering etc.). These urbanites have been habituated to work in (urban) garden as it gives a soothing impact from their “business as routine”.

Knowledge Management

Real time and virtual contacts for venturing into Agriculture- the first step to success

One of the major requirements of urban farming is the medium/culture for the production of crops. Urban agriculture is practiced in a variety of ways, unlike, rural agriculture, where the soil is the substance which is utilized as the growth medium/culture by virtue of its nature. In the urban landscape, the practitioners are dependent on the “kits” provided by the UFD. It has soil mixed with organic matter, seeds, and grow bags of different sizes. Likewise, the awareness of the urbanites about various online markets has helped them to purchase the inputs which are essential to the production of crops. All the more, the usage of these inputs is being learnt from social media like Facebook and WhatsApp besides the neighbouring practicing urban farmers, books and magazines. It was observed during the study that 15 of the 25 urbanites have purchased the urban farming kits at subsidized rates. These kits encompass crop production inputs including seeds (mostly vegetables and greens). Although the initiative of UFD has met the necessary inputs of agriculture, most of the urbanites have said that some of the online sites are selling the quality seeds with background information on the seeds (Table 1). The following are the most trusted online sites for the purchase of the seeds.

Table 1. Online sites for seed purchase for urban farming

S.No.	Online sites	Images	Available seeds
1.	www.ugao.com		Seeds of all vegetables, greens, fruits and flowers available.
2.	www.trustbasket.com		Almost all varieties of vegetables, fruits and leafy vegetables are available. However, most of them are hybrids.
3.	https://www.facebook.com/intipanta.in/		Shares the availability of images and seeds pertaining to urban farming
4.	https://seedbasket.in		Seeds of all vegetables, greens, fruits and flowers available.
5.	www.niamigarden.in		Seeds of vegetables, greens and fruits and to some extent ornamental flowers . The most noteworthy is that the online shop sells only the open-pollinated variety and non-hybrids seeds and local cultivars of years old. Hence, all of these seeds are organically viable and germinal.

A start-up on the website for Urban Farming Kits – A case of Mrs Vijayalaxmi

The seeds for Mrs Vijayalaxmi's farming were purchased from various parts of the country, through her friends i.e., seeds of vegetables and leafy vegetables from local farmers at Pune and Jammu. However, in due course of time, Mrs Vijayalaxmi has started selling her own seeds, which were produced from her garden, through the online website www.MyEdibleGarden.in and [facebook.com/MyEdibleGardenIndia](https://www.facebook.com/MyEdibleGardenIndia). Besides, she maintains a wide range of gardening materials, equipment, tools and crop inputs required for practising agriculture on her website, thereby enabling the urbanites to procure all the necessities of gardening on a real time basis. The chief aim of starting the sites is that every urban dweller can become a producer rather than just a consumer. These online

sites and novel initiatives may help the urbanites to become self-sufficient in seed production, in particular, the areas adjoining Sainikpuri, Secunderabad. What is more important is that, by now, these urban farmers have started producing seeds of their preference and suitability, thereby creating a new domain “Seed Urban”. The initiative was found to be more successful as the access to quality and preferable seeds are now at the hands of urbanites. Hence, the extension functionaries of both the State Agricultural Management and Extension Training Institute (SAMETI), in Hyderabad and urban farming division need to popularise such innovations across the twin cities (Hyderabad and Secunderabad). Extension strategies may also be developed to upscale the practice to the other cities of the country.

“Home Made Remedy” for the Management of Crops

Plant protection plays a crucial role in the management of crops. Due to the cent percent literacy of the practitioners (respondents of the study), the management of crops be it protecting the crops from insects and pathogens or watering the plants or manuring the crops, the practitioners are largely dependent on various platforms. Many times, the urbanites have also sourced the information from the neighbours regarding the preparation of Farm Yard Manure (FYM), Terracotta composting, common bin method (dumping of kitchen wastes and other wastes), vermicompost, fish tank water etc.

Urbanites have started preparing homemade pesticides such as bio liquid, bio liquid extract, Amrithapani etc. and, water management is done with the help of wastewater, greywater, recycled water etc. Thirteen of the 25 urbanites in the study use the hose for watering, the bucket method, rose cane watering method are also wisely used by the urbanites (Table 2). Crop management is done by both men and women alike in the urbanscape of Hyderabad and Secunderabad.

Table 2. Method of Irrigation

n=25

S.No.	Method of Irrigation	Urbanites	Per cent
1.	Hose watering	13	52.00
2.	Bucket watering	4	16.00
3.	Drip irrigation	3	12.00
4.	Rose cane watering	1	4.00
5.	Hose watering + Bucket watering	2	8.00
6.	Hose watering + Rose cane watering	2	8.00
Total		25	100.00

Social media as a virtual learning platform for urban farming

Virtual learning has also gained momentum among the urbanites as it reduces time and makes the learning easier and simpler. Several social media platforms are used by the urbanites to source information concerning crop production. Among them, Facebook groups, YouTube channels etc., have increasingly been used by the urbanites. However, the print medium has not lost its vibrancy owing to its established credibility among urban readers.

Table 3. Connecting through Virtual Platforms

S.No.	Sources	Remarks
I	YouTube channel	There are a variety of YouTube channels which have served as the source of information for crop production in urban farming.
1.	eTV Abhiruchi (https://goo.gl/oH8Zfu)	The famous Telugu YouTube channel with the subscription base of 80,000 mostly focusses on the kitchen recipes of Telangana and Andhra Pradesh. Besides, it features successful kitchen

	gardening of Hyderabad and Secunderabad cities and their good practices. Therefore, many of the urbanites who are in need of information in urban farming can view the related information by searching in the search box provided e.g. Rooftop gardening.
2. Nature's Voice (https://goo.gl/Y14rE7)	It has more than 11,000 subscribers and it brings out the farming practices done organically and with nature. It covers farmers who have been successful in natural farming. Importantly, it covers urban farming also so as to help the urbanites who are interested or practising farming at their terrace, garden, backyard, etc.
3. Gardens of Abundance (https://goo.gl/FkiE2K)	It posts the videos related to urban farms which are under permaculture. It covers farming done on rooftops, balcony, terrace, backyards and so on.
4. Kitchen Garden (https://goo.gl/PGthVz)	It posts videos related to basics on the know-how of soil, compost, pot preparation for urban farming, gardening and how to grow care crops.

II	Facebook groups	There are some urbanites whose source of information on urban farming are the following Facebook groups
5.	Intipanta - organic kitchen/terrace gardening (https://goo.gl/dr7qPh)	The membership of this Facebook group is about 34,000 and this group shares the information through experience and query posts, photos and videos related to organic urban farming. Members of the group update the site with the products they cultivate from their own households, pest and disease affected plants so as to get the responses on organic control measures from the respective members in the group; the procedures of preparation of bio and organic pesticides and manures like bio-enzymatic cleansers. Articles on urban organic farming and related posts released elsewhere are made available on the pages of group members. Besides, the demos conducted elsewhere are made available so as to inform the other members of this group, if they were not able to attend the demonstration on preparation of organic fertilisers and pesticides for example.

6.	MyediblegardenIndia (https://goo.gl/wNvJZD)	Website created by Mrs Vijayalaxmi, a retired teacher residing at Sainikpuri, Secunderabad (Telangana State) It deals with day to day garden practices and posts information related to crop production, seeds and materials needed for urban farming, news and events related to urban farming.
III Newspapers		Information and articles about successful urban farming initiatives are covered in newspapers.
7.	Sakshi	A few of the success stories of urban practitioners, case studies etc., relating to urban farming are circulated in these newspapers
8.	Eenadu	

Virtual -extension- A case of Sainikpuri garden club

Urban farming facilitates people of all classes, castes, creed, education and occupation to unite together under one umbrella “urban farming”. This is evident from a WhatsApp group of Sainikpuri garden club, Secunderabad. It was established among the urbanites who maintain either a backyard garden, or a rooftop garden or kitchen garden. The group is two years old. It is one of the effective WhatsApp groups as claimed by the administrator of the group, Mrs Deepa Shailendra. The members of the group share information on production practices of various crops of vegetables, greens and fruits. The members also post pictures of the crops affected by pests and diseases to identify and to recommend advisory measures to control them on a daily basis. The administrator of the group opined that it is extremely supportive at the time of sudden outbreak of pests and diseases during peak season.

The members of the group respond to the queries as soon as they see the posts. The Sainikpuri Garden club also shares information like exhibitions, trainings, workshops, seminars, meetings and other similar activities related to urban farming. As the members (Mrs. Sudha Gorthi, Mrs Vijayalaxmi and Mr V.S. Moorthy) of this group claimed, many a times, they have come to know about exhibitions and meetings pertaining to urban farming through this group. Above all, this group shares information about availability of seeds of various vegetables, fruits and greens available with them along with the images of the seeds. Thus it is facilitating the members to approach the concerned persons to get the seeds. Whenever there is a bulk yield of crops, it is shared on the WhatsApp group and those who require can buy them.

Therefore, the WhatsApp group-Sainikpuri Garden Club is immensely helpful to the members of Sainikpuri colony who have been practising urban farming for some time now.

Besides, urban farming, it facilitates people of similar interests to discuss various practices and methods related to urban farming. It is evident from Habsiguda urban farming, wherein the urbanites like Er. Babu. P. John, Mr Hemanth V. Mulay, Mr Mallikarjuna Rao, Dr K. Sudhakar Reddy and Mr K. Bhaskar, have united on the common grounds of urban farming, irrespective of the fact that they are from different locations of Habsiguda, Hyderabad. Moreover, they have been planning to take urban farming to the next level and are discussing various innovative practices and technologies that can be employed in urban farming, thereby making urban farming more viable and in harmony with nature.

Therefore, it is observed that urban farming has paved the way for these urbanites to have a common forum of discussion and conversation. However, many of the urbanites have no access to these groups neither have they heard about the existence of the WhatsApp group and other groups on Facebook like www.facebook.com/intipanta/. [www.facebook.com/Grow your own food/](https://www.facebook.com/Growyourownfood/). Therefore, the Urban Farming Division of Horticulture Department, Hyderabad, Telangana, may create awareness among the other potential urbanites and can make use of mass media for wider publicity about these groups.

The groups' activities may be telecast and broadcast through television and radio respectively. The information about these social media sites initiated by the urbanites may be displayed at horticulture and agriculture exhibitions along with the technologies and innovations pertaining to urban farming and gardening practices. As these groups are effective in spreading knowledge and hands-on experience, sharing the stories of successful practitioners of urban farming, innovations and localised practices etc, can help scale them up. Similarly, the Urban Farming Division of Horticulture Department, may also start a Facebook page, WhatsApp group and YouTube channels on Urban Farming, so as to make available good practices and information related to urban farming anytime, anywhere and to the concerned urbanites. Thus, the development of the social media groups would not only help the government to share and get feedback but also help learn about the real time problems faced by the urbanites regarding the practices and management of crop production.

Impact of Urban Farming

The following elucidation gives an idea to what extent urban agriculture sustains the city atmosphere and how it impacts the landscape of cities.

Impact of urban farming on the environment of the cityscape

The environment is largely encompassed with natural resources. However, in the course of time, the natural resources like soil, air and water as well as flora and fauna have been ruined on account of anthropogenic activities like over-exploitation of natural resources for the development of various industries. Moreover, the increasing population has led to the inevitable burden on both the availability and use of water, food and shelter. The water has become scarcer and food availability has turned out to be uneven and the spatial area for shelter has been hampered. These are more pronounced in urban areas.

As far as the impact of the urban farming is concerned, most of the practices included in urban farming are done in close proximity with nature. Similarly, several of those practices are capable of even offsetting ruined nature. Urban

farming is a way for a sustainable city environ, as it thrives under the conceptual framework of cultivation by conservation. Starting from the location of the urban farm to the harvesting of crops, urban farming encompasses innumerable good practices, for instance, the location for establishing urban farms is mostly rooftops, backyards, terraces, balcony and the exclusive land area which are mostly vacant and unused. Therefore, it makes use of the vacant area and transforms the cityscape into farms of greenery.

The advantages of establishing rooftop and terrace gardens are two fold; firstly it is able to prevent the penetration of scorching sunlight into the house directly and the other is the crops which grow on the rooftops/terrace are able to absorb and use the sunlight effectively for their metabolism. Moreover, when it comes to soil, the predominant soil used is red soil and it is generally taken from the lakes and ponds available in the city, (in this case the lakes of Ramanthpur and Himayatsagar) which deepens the lakes thereby helping to hold more water during the rainy season. However, one of the urbanites has even invented a novel method of growing crops, - the Compost of Coco Peat (CCP) Ravichandra's Growth Culture recognized by the Government of India. It has even reduced the exploitation of the soil medium as this growth culture has replaced the need of soil for crop production. More importantly, most of the growing medium is available at household levels, such as, waste buckets, containers, mud pots, waste tyres, broken aluminium vessels and so on, as observed among all the 25 urbanites who have used one or the other growing medium mentioned above.

Thereby, urban farming is an effective measure of reusing the plastic and other petrochemical materials used in the households which are otherwise dumped in the waste bins or thrown away.

Similarly, for the production of crops, urban farming does not use chemical fertilisers as is evident from the 25 urbanites, who use mostly homemade fertilisers like compost and vermicompost or the Coco Peat and cow dung from the Goshala. Again, in the preparation of the fertilisers, like compost and vermicompost, these urbanites make use of all the kitchen wastes, fruit peels,

rotten vegetables and fruits, leaf litter, waste paper and so on. Therefore, almost all of the household's wastes are converted into manure, through composting. Therefore, it is yet another way of conserving the environment. Urban farming follows organic farming method. In this way, urban farming has reduced the use of synthetic pesticides.

The pests and diseases are mostly controlled by using homemade pesticides or neem oil or other natural pesticides purchased from the markets. It is also evident from the urban farming models of Mr Vijay Uppal, Mrs. Vijayalaxmi, Mrs. Deepa, Mrs. Lalitha Iyar, Mr. V.S. Murthy, Mrs. Susie Tharu, Mrs. Beyniaz Edulji of Sainikpuri, Secunderabad and Mr. Ravichandra Kumar of Dilsukhnagar, Mr. Subba Rao of L.B.Nagar, Hyderabad that they have their own unique ideas for preparation of bio-liquid pesticides and bio-liquid extract. These bio/organic pesticides are also prepared using materials mostly available at the household level and kitchen waste. Therefore, it is not only effective against the pests and diseases of the crops but also protects the environment, in particular, the land, water and air from the waves of chemical pesticides and pollution.

Impact of urban farming on dwindling water resources and increasing power consumption

Urban farming is a unique farming model in the 21st century. It functions against the odd rule of exploitation of nature but for conserving and sustaining nature. As it is evident from the urbanites practising urban farming, in particular from the case of Mr Daniel and Mrs Vijayalaxmi of Sainikpuri, Secunderabad, and Mr Ravichandra Kumar of Dilsukhnagar, Hyderabad. In the case of Mr Daniel, it is unique as his backyard garden is irrigated only with rainwater harvested during rainy days in a special cement tank. Mrs Vijayalaxmi has also been irrigating the crops with the rainwater harvested in the tank. The most unique model in the conservation of water is the practice of Mr Ravichandra Kumar of Dilsukhnagar. Though the water source is municipal water, he recycles the water for more than 6 months. In this method, the water is lifted to the fish tank placed at the corner of rooftop on the stand and the water is carried to the crops through the PVC pipes connected with the fish tank. The valve is used for

opening and closing the release of water from the fish tank. The water is drained from the holes at the bottom of every growth medium through the pipes connected with the hole in each growth medium and gets collected in a common pool. The water is then filtered using filters. The filtered water is again carried to the fish tank and the cycle continues for about 6 months. Thus, these practices are not only effective in conserving water but also in recharging the groundwater. However, most households are not involved in rainwater harvesting and the water is being wasted as runoff and eroding the good mineral soil along with it. The government must make necessary efforts to make rainwater harvesting pits compulsory in every house on a priority basis. Besides, the government and other organisations may encourage the urban households to adopt and practice recycling of water. Moreover, the practices followed in urban farming increases the visits by birds into the household and the city more than before.

Impact on health

Urban farming is another way of improving health. All 25 urbanites perceived that after eating the produce from their own garden/farm, their asthma, blood pressure and thyroid have reduced as they have been cultivating their crops organically and do not use synthetic pesticides to control pests and diseases. According to the urbanites, these organic produce are better in taste and flavour. The greater advantage of urban farming is that it improves access to fresh and green vegetables. Most of the urbanites cultivate even Cole vegetables like cabbage, broccoli etc. As a result, these serve as a natural medicine to arthritis and diabetes. On health impacts, Mrs. Deepa Shailendra of Sainikpuri, Secunderabad, spoke about it as, “it gives exercise to the human body as farming requires a fair amount of activity that is to be done in order to maintain the farm; besides, urban farming is a stress buster, maintains the blood pressure and diabetes at perceivable level”.

Impact on monetary savings

It was observed during the survey that the practitioners have also recorded monetary savings apart from the health benefits. The study results show the

impact made by urban farming on reduced purchase of vegetables, greens and fruits, and the savings thereof. The following table gives the illustration of savings on the reduced purchase of vegetables from the market.

Table 4. Vegetable Crops cultivated in Urban Farming n=24

S.No.	Vegetables	Urbanites	Percentage
1.	Tomatoes	17	68.00
2.	Brinjal	16	64.00
3.	Bhendi	14	56.00
4.	Chilli	14	56.00
5.	Bitter gourd	9	36.00
6.	Bottle gourd	7	28.00
7.	Ridge gourd	7	28.00
8.	Snake gourd	5	20.00
9.	Cluster bean	3	12.00
10.	Pumpkin	3	12.00
11.	Kovakkai	3	12.00
12.	Broadbean	2	8.00
13.	Lab lab	1	4.00

*Multiple response

Table 5. Impact on savings of vegetables n=24*

S.No.	Savings on expenditure on vegetable purchase (INR) /month	Urbanite	Per cent	Yearly saving (INR)
1.	About 200	11	45.84	26400
2.	400	6	25.00	28800
3.	600	2	8.34	14400
4.	800	1	4.16	9600
5.	1000	2	8.34	12000
6.	2000	1	4.16	24000
7.	50	1	4.16	600
	Total	24	100.00	115800

* One of the urbanites (Mrs. Beyniaz Edulji of Sainikpuri, Secunderabad) interviewed did not have any vegetable but has only fruit crops

It is noted that 45.84 per cent (11 of 25) urbanites have been able to save about Rs. 200 every month on the purchase of vegetables. Similarly, 25 per cent (6 of 25) urbanites saved about Rs.400 every month on vegetable purchase and that is about Rs. 28,800 every year. Another two urbanites saved Rs.600 on an average every month on vegetable purchase and two saved about Rs.1,000 every month on vegetable purchase. One urbanite saved about Rs.2,000 every month. Put together, all of these 25 urbanites together saved about Rs. 115,800 every year. (Table 5) Public and private extension systems need to create awareness and upscale the existing strategies on urban farming.

The government may take necessary efforts to promote urban farming across the city. This could ensure food and nutritional security of the mounting urban population.

Impact of savings on greens

Greens are the major nutritious source of human diet. Greens have long been considered to be the supplier of energy and fillip to the metabolism of the human body. Moreover, greens are always a part of Indian cuisine. In this backdrop, the survey result encompassed the savings out of cultivation of greens under urban farming.

Table 6. Leafy vegetables in urban farming n=24

S.No.	Leafy vegetables	Urbanites	Per cent
1.	Spinach (Palak)	14	56.00
2.	Hibiscus (Gongura)	10	40.00
3.	Fenugreek	8	32.00
4.	Coriander	7	28.00
5.	Mint	6	24.00
6.	Lettuce	5	20.00
7.	Basil	4	16.00
8.	Amaranthus	4	16.00
9.	Curry leaf	4	16.00
10.	Ponnaguni keera	3	12.00

11.	Chukka	2	8.00
12.	Bachalakura	2	8.00
13.	Drum stick	2	8.00
14.	Turnip	1	4.00

Table 7. Impact of Urban Farming on Monetary Savings on Greens n=24*

S.No.	Savings on expenditure on greens purchase (INR) /month	Urbanite	Per cent	Yearly saving
1.	About 100	15	62.49	18000
2.	200	5	20.83	12000
3.	300	0	00.00	-
4.	400	1	4.17	4800
5.	500	1	4.17	6000
6.	25	1	4.17	300
7.	50	1	4.17	600
	Total	24	100.00	41700

* Mrs Beyniaz Edulji has not been taken into account since she has no greens except fruit crops

It is noteworthy that, growing of greens has led to considerable savings that 62.49 per cent (15 of 24) of the urbanites saved about Rs.100 every month on purchase of greens. In total, these 15 urbanites saved about Rs.18,000 every year. On the other hand, 5 of 25 urbanites saved Rs.300 every month on purchase of greens i.e., they have saved about Rs.12,000 every year. One of the urbanites saved about Rs.400, another saved Rs.500 on the purchase of greens every month, while a minimum of Rs.25 and Rs.50 had been saved by the respective urbanites who have been cultivating greens on a small scale. Put together, these urbanites who have been growing greens have saved up to Rs.41,700 every year. The government and Metropolitan Development Authorities of the twin cities of Hyderabad and Secunderabad have to take more steps towards establishing urban farms in all households. Also, urbanites who have no interest in urban farming should be encouraged to cultivate at least greens on a small scale.

Impact of Savings on Fruits

When it comes to savings on fruit purchase, all urbanites have not been able to make monetary savings as made with respect to vegetables and greens. However, Mrs Beyniaz Edulji does not depend on the market for fruits, as fruit crops grown in her household are sufficient to meet her household demand and saves about Rs.2,000-2,500 on a monthly basis.

Impact of Urban Farming on the Avian Activities in the twin cities

Modern urban conglomeration and unplanned developmental activities have halted the presence and mobilisation of birds to a greater degree. In this backdrop, urban farming is considered to be a fillip to the birds to revamp their activities in the urban areas, as it was observed that birds are seen more in households where urban farming has been practised. As a result of urban farming, these birds come to the plants and search for food from the crops grown either on the rooftops or terrace or the backyards. Besides, all of these urbanites have a water dip (a bowl containing water at an accessible point to the birds) for the visiting birds to quench their thirst. Mrs Kaniza Yosaf Garari of Sainikpuri, Secunderabad, grows pearl millet exclusively for the birds visiting the terrace farm. Major Vijay Uppal of Sainikpuri, Secunderabad, has water and provision for the birds to build their nests in his backyard and surrounding garden in the house. Similarly, Mr Mallikarjuna Rao of Habsiguda, Hyderabad has a water container on his rooftop urban garden which serves as the water feed for the birds. Mrs Deepa Shailendra had built shelters for birds to nest and rest after seeing that the birds' movements have greatly increased on account of urban farming. Therefore, urban farming has become not only beneficial to human beings but also has become an abode of shelter to the birds. The government must take necessary steps to bring more urban farming into the city so as to enhance both the welfare of city dwellers and nature, including birds. Besides, urban farming has increased the activities of several butterflies as indicated by the urban farming practitioners.

Conclusion

It is evinced from the study that a number of information sources are utilised by the urbanites to learn and practice agriculture in the urban landscape. Urban farmers have their own way of sharing and receiving information pertinent to these practices which include social media like Facebook, YouTube channels and WhatsApp groups that have been serving as an effective way of getting and sharing information effectively among themselves. The information sources have led to the adoption of various good practices. On the other hand, these good practices followed in the urban landscape are capable of conserving the natural resources of the city landscape, saving the daily food basket expenditure, enhancing the health benefits and transforming the concrete jungle into greenery.

Recommendations

1. It was observed that, lack of scientific information as to how these practices are done is unknown. Thereby, efforts could be taken by the government, State Agricultural Universities (SAUs), to document the procedure and application of the practices followed in urban farming.
2. On the other hand, both the central and state Government could include promotion of urban farming as one of the mandatory activities of Krishi Vigyan Kendra(KVKs)/Agricultural Technology Management Agency (ATMA) in particular the KVKs/ATMAs located near the city or urban or sub-urban areas. Moreover, the government may possibly allot funds to KVKs to document and validate the novel practices followed in urban farming by various urbanites and conduct various training programmes to diffuse the knowledge of the same to the other urbanites who are in need of good practices for establish urban farms.
3. In the same way, the Agricultural and Horticultural universities and other institutes which are closely working with agriculture may take up projects and research on urban farming practices and information approaches across the country. This would bring to light more unseen and unexplored practices and information approaches followed in urban farming.

4. Moreover, video modules and models of good practices and information approaches are to be documented. These are to be uploaded on a common domain under Urban Farming (UF) either by Urban Farming Divisions or Department of Horticulture. Moreover, an exclusive website, Facebook page, Youtube channel may be created to host all of these practices and information approaches so as to make urban farming more viable and practically applicable in coming days. The Sainikpuri Garden club WhatsApp group approach in urban farming could be used as a model for creating ICT based groups in the near future.
5. The state and central government may perhaps take more steps toward implementing urban farming in schools located in both urban and sub urban regions in the country. It may not only help the school students to understand the importance of urban farming, but also kindle their interest and knowledge about the nutritive value of the crops right from the beginning.

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Commodity Based Associations – Offering Potential for Farmers' Prosperity

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Abstract

The paper analyses the impact of Commodity Based Associations (CBAs), grassroot level autonomous registered bodies established around a single enterprise, on income enhancement, employment generation and social status of the member producers. The results revealed that, the mean annual net income of the members before their participation in CBAs was Rs. 55,171 which rose to Rs. 70,378 after their membership. The mean annual employment generation was 390.28 mandays and 437.20 mandays during pre and post formation of CBAs, respectively. The mean social status score of CBA members before their participation was 7.80 while it was 15.08 after their membership. Indian farmers are facing many problems such as decreased profit margin, lack of employment, poor market linkages, etc. on account of issues like continuous fragmentation of land holdings, emergence of nuclear family system, steep increase in cost of production and others. This has led to large scale migration particularly of farm youth to urban areas. Findings suggest that producers associations have the potential to help farmers overcome many challenges and continue in farming through enhanced income, better living and ensured food security.

Keywords: Commodity Based Associations, impact, annual net income, employment generation and social status

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Introduction

The Green Revolution has been the cornerstone of India's agricultural achievement transforming the country from food deficiency to self-sufficiency during 1960s. Thereafter, the agriculture sector in India has been successful in keeping pace with the ever increasing food demand of the growing population. Food grain production has increased more than five folds since 1950s from 51 million tons to 277.49 million tons during 2017-18 (Anon, 2018) whereas the population has increased about four folds from 36 crores to 135 crores during the corresponding period. In spite of this achievement, the living conditions of farmers have declined continuously. Given the choice, a large chunk of farmers want to leave farming and look for opportunities in non-agriculture sectors. As per 59th round of National Sample Survey on the Situation Assessment Survey of farmers (2003), 40 per cent were of the farmers households were of the opinion that, given a choice, they wanted to look for vocation in non-agricultural sectors. Migration of farm youth in India was 45 per cent, leaving many Indian villages as old age homes. In the days to come, if no corrective measures are taken for the development of farmers, the number of farmers looking for non agriculture vocations is likely to increase. Therefore, it is appropriate and timely to know why farmers are losing interest in farming and come up with appropriate remedial measures to help them continue in farming.

The increase in population, subdivision and fragmentation of land holdings due to breakdown of joint family system encouraging conversion of semi-medium and medium group of farmers into group of small and marginal farmers, resulted in un-economic land holdings (Singh, 2012). As a result, the growth of agriculture considerably slowed down. Both the labour productivity as well as land productivity have fallen by half in the last three decades and capital-labour ratio has doubled in agriculture (Behera, 2012). The decrease in production, increase in cost of production and bare minimum increase in Minimum Support Prices have made the agricultural activity unremunerative. As a result, indebtedness in agriculture has increased (Mahajan, 2015). The New Agricultural Technology has not made any significant impact on the conditions

of rural labourers. All indicators related to the well being of rural labourers have suggested that New Agricultural Technology has worsened the lives of rural labour instead of improving (Jha, 1997). The cumulative effect of all these factors has adversely affected farmers' interest and confidence in farming. In this backdrop, the Rural Bio-Resource Complex (RBRC) Project was implemented by University of Agricultural Sciences, Bangalore during 2005-2010 with the support of the Department of Biotechnology (DBT), Government of India to address the aforesaid issues in evolving lasting solutions to the farmers' problems by promoting need based producers associations. The present paper aims at analyzing the impact of CBAs on annual income, employment and social status and to find out the relationship between the selected traits of CBAs members with three major aspects considered for impact evaluation i.e. income, employment and social status.

Rural Bio-Resource Complex (RBRC) Project

The Department of Biotechnology (DBT), Government of India launched Rural Bio-resource Complex (RBRC) project on a pilot basis at five selected centers across the country and one such centre was provided to the University of Agricultural Sciences (UAS), Bangalore. The project was conceptualized during 2004 by a team of interdisciplinary scientists with a view to revisit the existing agricultural development strategies and to suggest a model for enhancing income and living standard of farmers. The project was implemented in Tubagere Hobli of Doddaballapur taluk in Bangalore Rural district of Karnataka State, covering 8340 farming and non-farming families spread over 75 villages, from April 2005 to March 2010. Baseline information was collected from all the families before the project implementation to know the status and opportunities for sustainable development.

The project envisaged to enhance the income and standard of living of people by promoting integrated farming system as well as addressing end to end issues. The project has formulated five pronged development strategies namely; (1) Promotion of capsule of sustainable technologies, (2) Providing effective information support system, (3) Ensuring quality critical inputs and custom

hire services of farm machineries, (4) Effective functional linkage with various institutions, (5) Market empowerment.

Efforts were made to implement the above defined strategy along with diversification towards sustainable options during the first year of the project resulting in enhancing the production and productivity. There were a series of deliberations on the scientific marketing of all the produce such as grading, packing, branding and linking to the market. It was realized by the end of the first year that the produce could not be marketed profitably by the small and marginal farmers. Even large farmers found it difficult to market their produce efficiently for various reasons like exploitation by middlemen, heavy overhead expenditure, lack of storage facilities and long distances to travel.

Marketing has always been one of the weak links mainly due to size of land holdings. However, recently some successful examples have emerged where farmers have come together in groups to market their produce efficiently. There are so many successful examples of farmers coming together in groups like Grape Growers in Maharashtra but such initiatives are mostly operating in isolation due to lack of support and proper policies of the Government. In this context, the project took the initiative to promote CBAs in the project area. There were a series of deliberations involving all the stakeholders. There were further discussions on the feasibility of the associations for individual enterprises. Finally, the concurrence of the university and funding agency was obtained to start CBAs on selected enterprises from the beginning of 2007.

Commodity Based Associations (CBAs)

Commodity Based Associations are the grassroot level autonomous registered bodies established around a single enterprise or a group of related enterprises to offer end to end solutions to a group of producers in order to improve production efficiency, minimize cost of production, facilitate value addition and enhance the profit margins. These associations are essential where a large number of producers are taking up a particular intervention/enterprise in a given locality/region with reasonable surplus produce for sale. The CBAs will address a majority of the issues related to backward and forward linkages which is a prerequisite for profitable farming.

The CBAs enable farmers to demand rightful services from concerned institutions, profitable use of farm machineries, adoption of shared labour concept, undertake value addition and processing of the produce, create additional employment opportunities for the farmers, develop leadership qualities and professionalism in marketing by farmers, help to improve bargaining power, network and share experiences.

Methodology

The study was conducted in purposefully selected Tubugere Hobli of Doddaballapur taluk in Bangalore rural district of Karnataka state. A total of 250 members from ten CBAs established under Rural Bio-Resource Complex Project were selected based on proportionate random sampling technique. To know the relationship between the characteristics of farmers and the impact of CBAs, correlation and regression analysis was used.

In order to quantify the impact of CBAs, three dependent variables namely; annual income, employment and social status were considered. Sixteen independent variables used for analysis were age, education, farming experience, family dependency ratio, land holding, social participation, cosmopolitaness, management orientation, deferred gratification, achievement motivation, innovativeness, mass media participation, participation in training programme, extension participation, farm scientist contact and contact with extension agency.

Impact of CBAs on Annual Net Income

The annual income was operationally defined as the total annual net income realized in rupees due to participation in the CBA activities by the members. Procedure followed by Vinay Kumar (2008) was used to measure the annual net income of the members. Annual net income (ANI) is measured using the following formula:

$$\text{ANI} = \text{Gross income} - \text{total expenditure}$$

The impact on annual income of CBA members was calculated by comparing the means of annual net income before and after their membership in CBAs.

Impact of CBAs on Employment Generation

Employment generation was operationally defined as the number of mandays of employment generated annually in the member's family as a result of participation in the activities of CBAs. Procedure followed by Vinay Kumar (2008) was used to measure the employment generation. The mandays of employment generated was calculated by collecting the data on all the possible sources of employment generation such as agriculture, subsidiary activities, business, salary, daily wages and other possible sources. The sum of mandays of employment for each respondent was used for analysis. The impact on employment generation on the CBA members was computed by comparing the means of employment generation in mandays before and after their participation in the CBA activities.

Impact of CBAs on Social Status

Social status is defined as "the extent to which the status of a farmer has improved in the social system in which he lives as a result of his involvement in a programme (Linton, 1996). Social status is operationally defined as the improvement in position or the rank of the member due to his/her participation in the activities of CBAs. The scale developed by Narayana Gowda (1992) was used with suitable modifications to measure social status of the CBA members.

The scale consists of 14 statements indicating changes which occurred due to the participation in CBAs. The responses were collected on four point continuum namely; 'always', 'frequently', 'occasionally' and 'never' with a score of 3, 2, 1 and 0, respectively. The maximum and minimum score a respondent could obtain under this variable was 42 and 0, respectively. The score obtained on the basis of responses for each statement was pooled to find out the total score of the respondents. The impact on social status of CBA members was calculated by comparing the means of social status score before and after their participation in CBA activities.

Results and Discussion

Impact of CBAs on Annual Income, Employment Generation and Social Status of its Members

Impact on Annual Income

It is evident from the findings depicted in Table 1 that the mean annual income of CBA members before their membership was Rs. 55,170.80 and after their membership it was Rs. 70,377.88. The annual income has increased by 27.56 per cent. The important contributions to enhance the income of the members were, reduction in the marketing cost through pooled marketing, minimization of exploitation by middlemen, reduction in production cost through bulk purchase of certain critical inputs, sharing of successful experiences and interaction effect of all these factors.

The elimination of middle men has helped in enhancement of producer share in the consumer rupee. The association has promoted direct marketing of jack fruit, bio-fuels and their value added products, maize, ragi and their value added products, banana, flowers and vegetables. Due to constant guidance and sharing of information, there is considerable increase in the productivity of crops as well as other enterprises and cost minimization leading to increased income among the members. Similar results were also reported by Sailaja (2002) on empowerment of rural women through participation in cooperative institutions and Josily Samuel et al. (2011) in their study on impact of microfinance on rural women.

Table 1. Impact of CBAs on annual income, employment generation and social status. (n=250)

Sl. No.	Impact	Mean values		Mean enhancement	Percentage of Increase	Paired 't' value
		Before	After			
1.	Annual Net income (Rs)	55170.80	70377.88	15208.84 ±25468.31	27.56	10.49**
2.	Employment generation (Mandays)	390.28	437.20	46.916±29.28	12.03	9.44**
3.	Social status (Score)	7.80	15.08	7.28±5.73	93.23	19.73**

** : Significant at 1 per cent level of probability.

Impact on Employment Generation

The data in Table 1 reveals that the mean annual employment generation of CBA members before their membership was 390.28 mandays and after their membership the annual employment generation rose to 437.20 mandays.

The interventions adopted by CBA members have made significant contribution to employment generation. About 47 mandays of increased annual employment was seen in the members after CBA membership. One of the mandates of the project was to provide gainful employment to the entire family through the introduction of improved technology as well as new enterprises besides their active involvement in value addition, processing and direct marketing of farm produce. These initiatives were able to provide employment not only to the elders but also to the farm youth. Employment opportunities were distinct in case of members who participated in Bio-fuel Growers Association, Fish Growers Association, Jack Fruit Growers Association, women federation engaged in processing and value addition of Ragi and Maize and vegetables and fruit growers association. The results are in conformity with the findings of Vinay Kumar (2008) on impact of RBRC in Bangalore rural district and Dabali (2010) on socio-economic evaluation of SHGs in Karnataka.

Impact on Social Status of the Members

Table 1 revealed that the mean social status score of CBA members before their membership was 7.80 and after CBA membership social status score was 15.08 with an increment of 93.23 per cent.

Continuous technical guidance has been provided to the Commodity Based Associations through scientists from the agricultural university because it was easy for scientists to reach the office bearers of these association directly or over mobile. Even the office bearers were contacting the concerned scientists

directly to seek additional information, new information and for clarifications. These office bearers used to share the information with fellow members and even vice-versa. Due to their distinct achievement, they were recognized by the university, development departments and fellow local leaders. Increase in income resulted in better food habits, better schooling for their children, enhanced household gadgets and suitable offers to their children and migration of farm youth from these families has reduced in view of increased employment opportunities. The members have been considered resource persons in the village by fellow villagers. All these factors have contributed to the increased social status of the members after CBA membership. Other researchers such as Ritu Jain et al (2003) also reported similar results in their study on impact of SHGs, Arunkumar (2005) in his study on swa-shakti groups and Bharathi and Chaya Badiger (2008) in their study on SHGs in Karnataka.

Relationship between Identified Traits of CBA Members and their Annual Income/ Employment Generation and Social Status

Relationship between identified traits of CBA members and their Annual Income/ Employment Generation and Social Status is presented in Table 2. The table reveals that only education out of five traits identified under personal variable category is found to be significantly related with Annual Income/ Employment Generation and Social Status. Under socio-psychological variables, all were found significantly related with identified parameters except deferred gratification and social participation. In case of communication variables considered under the study, all the variables were found to be significantly related with Annual Income/ Employment Generation and Social Status of the CBA members except mass media participation in case of employment generation.

The core objective of the RBRC project was to make farming a profitable venture so that farmers stay back in farming. For this purpose, the project has taken many initiatives which include training of farmers, promoting participation of

members in different extension activities and continuous technical guidance to the members. All the efforts made by the project resulted in increased achievement motivation, education, management orientation, farmer scientist contact, extension contact and extension participation which in turn resulted in increased annual income of the members. The training received by members resulted in the development of farm management skills, improved motivation levels, acquire innovation skills, more cosmopolitaness and enhanced their contact levels with the farm scientists. All these factors have resulted in building the confidence to start new enterprises and to acquire skills to enhance employment opportunities. The changes that have been brought out by the project staff in terms of educational activities, training of famers on different technologies and farm management activities, improving the farmers cosmopolitaness particularly on campus training and guidance from farm scientists has brought increased knowledge and skills which has been duly recognized by the other farmers. Hence, the above said variables were found significantly related to the social status of the members. Results are in line with the findings of Vinay Kumar (2008) study on impact of RBRC on beneficiaries in Bangalore rural district.

Table 2. Relationship between identified traits of CBA members and their Annual Income/ Employment Generation/ Social Status (Correlation Coefficient)**(n=250)**

Sl. No.	Characteristics	Annual Income	Employment Generation	Social Status
I. Personal variables				
1	Age	0.086 ^{NS}	0.039 ^{NS}	0.001 ^{NS}
2	Education	0.262**	0.316**	0.318**
3	family dependence ratio	0.039 ^{NS}	0.040 ^{NS}	0.034 ^{NS}
4	Land holding	0.161 ^{NS}	0.034 ^{NS}	0.040 ^{NS}
5	Farming experience	0.092 ^{NS}	0.091 ^{NS}	0.032 ^{NS}
II. Socio-psychological variables				
6	Management orientation	0.320**	0.221*	0.431**
7	Achievement motivation	0.338**	0.199*	0.212*
8	Innovativeness	0.222*	0.250*	0.250*
9	Cosmopolitaness	0.216*	0.209*	0.387**
10	Deferred gratification	0.089 ^{NS}	0.020 ^{NS}	0.192 ^{NS}
11	Social participation	0.133 ^{NS}	0.120 ^{NS}	0.081 ^{NS}
III. Communication variables				
12	Mass media participation	0.214*	0.013 ^{NS}	0.198*
13	Participation in training programme	0.362**	0.251*	0.336**
14	Farm scientist contact	0.264**	0.212*	0.444**
15	Extension contact	0.336**	0.261*	0.479**
16	Extension participation	0.412**	0.499**	0.379**

Extent of Contribution of Personal, Socio-psychological and Communication Characteristics of Members to their Annual Income/ Employment Generation and Social Status

A total of 16 variables considered under three categories i.e. personal, socio-psychological and communication variables have explained variation to the tune of 65.0 per cent, 65.6 per cent and 77.8 per cent in Annual Income, Employment Generation and Social Status, respectively. Only one variable (education) under the category of personal variables is found to be significantly contributing to all the three parameters considered under study i.e. Annual Income, Employment Generation and Social Status (Table 3). Under socio-psychological category, variables like achievement motivation and innovativeness have been found important for all the three parameters, management orientation is important only for Annual Income and Social Status while completeness is found important only for improving social status.

All the five variables considered under the category communication are found to be contributing significantly except for the variable mass media participation in annual income and employment generation. The organized group when exposed to new information try to use the available local resources optimally through effective management. The scale of operation also helps them reduce cost and avail better access to the market. This analogy further moves to marketing management resulting in deriving higher profit margin than managing marketing individually. The participation in group and various activities which is possible due to being a member of the group provides them a better social acceptability.

Table-3. Extent of contribution of identified variables to Annual Income/ Employment Generation/ Social Status of CBA members

Sl. No.	Characteristics	Annual Income		Employment Generation			Social Status			
		Regression coefficient (b)	Standard Error of Regression coefficient (SE _b)	...	Regression coefficient (b)	Standard Error of Regression coefficient (SE _b)	't' value	Regression coefficient (b)	Standard Error of Regression coefficient (SE _b)	't' value
I. Personal variables										
1	Age	0.103	0.012	0.11 ^{NS}	0.282	0.361	1.28 ^{NS}	0.392	0.380	0.96 ^{NS}
2	Education	0.324	0.717	2.21*	0.317	0.812	2.56*	0.263	0.781	2.96**
3	Family dependence ratio	0.130	0.019	0.91 ^{NS}	0.346	0.616	1.78 ^{NS}	0.410	0.682	1.96 ^{NS}
4	Land holding	0.155	0.297	1.91 ^{NS}	0.417	0.468	1.12 ^{NS}	0.363	0.444	1.22 ^{NS}
5	Farming experience	0.375	0.417	1.10 ^{NS}	0.684	0.561	0.81 ^{NS}	0.367	0.580	1.58 ^{NS}
II. Socio-psychological variables										
6	Management orientation	0.229	0.749	3.26**	0.327	0.716	1.88 ^{NS}	0.168	0.616	3.66**
7	Achievement motivation	0.016	0.317	2.72**	0.356	0.861	2.41*	0.194	0.581	2.98**
8	Innovativeness	0.318	0.671	2.11*	0.209	0.487	2.33*	0.268	0.666	2.48*
9	Cosmopoliteness	0.277	0.258	0.93 ^{NS}	0.132	0.222	1.67 ^{NS}	0.232	0.786	3.38*
10	Deferred gratification	0.168	0.222	1.32 ^{NS}	0.375	0.361	0.96 ^{NS}	0.886	0.780	0.88 ^{NS}
11	Social participation	0.389	0.386	0.99 ^{NS}	0.078	0.123	1.56 ^{NS}	0.377	0.612	1.62 ^{NS}
III. Communication variables										
12	Mass media participation	0.200	0.212	1.01 ^{NS}	0.600	0.960	1.60 ^{NS}	0.439	0.888	2.02*
13	Participation in training program	0.291	0.818	2.81**	0.177	0.444	2.50*	0.368	0.962	2.61*
14	Farm scientist contact	0.329	0.812	2.46*	0.292	0.583	1.99*	0.188	0.786	4.16**
15	Extension contact	0.240	0.816	3.39**	0.391	0.790	2.02*	0.231	0.892	3.86**
16	Extension participation	0.286	0.916	3.41**	0.245	0.618	3.61**	0.216	0.998	4.60**
R ² /F		R ² = 0.650, F = 15.33**			R ² = 0.656, F = 13.69**			R ² = 0.778, F = 11.56**		
NS: Non-Significant; *: Significant at 5% level and **: Significant at 1% level										

Conclusion

The study suggests that the group approach promoted under the project has successfully improved the income, employment and social status of the farmers. A significant increase was observed in the annual income, employment generation and social status of the farmer after joining commodity based associations. Promotion of CBAs in case of selected commodities will make a good strategy to help farmers sustain in agriculture mainly smallholders, when majority of the farmers are operating on small and marginal land holdings. The Commodity Based Associations have made significant contribution towards increased profits by reducing the cost of production. This has improved farmers access to resources and their acceptance as resource persons in the village by fellow farmers leading to better social status of CBA members. Socio-psychological factors like management and motivation have also been found to play an important role in influencing income, employment and social status of member farmers. Accordingly, there is need to focus on components like training of farmers, promoting participation of members in different extension activities and continuous technical guidance to the members.

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Group Farming– means to end Poverty and Hunger in Villages

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Abstract

Amrita Sadivaiyal Vyavasayam Kulu, a group comprising of twenty farmers, belonging to the tribal community of Irulas, initiated organic farming at Sadivaiyal, a tribal hamlet in the suburbs of Coimbatore, Tamil Nadu. This paper explores the case of organic agriculture in a tribal village in Tamil Nadu. Amrita SeRve is an initiative launched by the Mata Amritanadamayi Math. One of its main objectives is to motivate farmers to make the transition to organic agriculture and hand-hold / mentor them as they make the switch. Amrita SeRve (Self Reliant Village project) planned and helped the farmers from tillage, collection of seeds, preparation of manures and pesticides, introduction of technological innovations, modern methods in production and processing of raw materials till the marketing of products. This experiment tried at Sadivaiyal united the farmers in a pristine culture of sharing, caring, protecting and selling paddy together. This empowered them to know and bargain for their rights. This was clearly demonstrated in their farming practices, done without any instance of money-lending or of borrowing loans from banks.

Keywords: Organic Farming, Convergence Method, tribal hamlet, Bhavani rice, Tamil Nadu, Sustainable development, Organic rice production, panchagavya, jivamritham, mulching.

Introduction

The research investigated the farming practices of small and marginal farmers involved in organic rice production in Sadivaiyal village, Thondamuthur Block, Coimbatore, Tamil Nadu, India, with the support of Amrita SeRve. Amrita SeRve is an NGO which plays important roles from organizing the farmers in groups,

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opening bank accounts, purchasing seeds, supporting capacity building and finally to branding and marketing. The study of farming practices shows that organic rice production by small and marginal farmers in Sadivaiyal is not profitable through conventional practices. Therefore, most of the farmers had stopped farming. The well-known rice-plots became corridors for wild animals like elephants, wild boars and bears.

In the absence of irrigation facilities, farmers primarily depended on rain-fed agriculture. Owing to water scarcity, annual rice cultivation became a non-profitable activity. Hence they had stopped farming for the past five years, and had resorted to daily-wage labour in the forest vicinity, for their livelihood. Consequently, many farmers were in the grip of heavy debts which they owed to the rural moneylenders. Amrita Sadivaiyal Vyavasaya Kulu (Amrita Sadivaiyal Farmers Club), a participatory system of farmers interested in organic farming was constituted. Twenty members made an initial contribution of Rs.500 each, and opened a joint bank account in Canara Bank, Alandurai. Organic agriculture was undertaken on thirty-five acres of agricultural land.

The Convergence Method of Farming drastically cut the entire cultivation costs, which resulted in substantially higher profits.

About the village

The tribal hamlet of Sadivayalpatti, is located in Madvarayapuram Panchayath, Thondamuthur block, Coimbatore District of Irula community with 44 households and a population of nearly 150. It is located about 30 km from Coimbatore on the fringes of a reserved forest area.

The cultural ethos of Irula tribes is based on living in harmony with Mother Nature. However, unfortunately, several of their generations have been victims of caste discrimination, infringement of right to livelihood, forcible encroachment, wage discrimination, and poor literacy. This has negatively impacted their confidence, health, education, and the overall living standards. Since their lands are in the reserved forest area, they do not have title deeds

(*pattayams*), thus rendering them ineligible for all the government schemes. They prefer doing jobs inside the village and do not venture outside in search of jobs. Some of the men and women are employed as daily wage workers at the forest check post. But a few families used to cultivate their lands for farming. In the months of April–May the village youth toil in menial jobs at the Velliangiri Andavar temple which is known as ‘Kailash of the South’. The able-bodied youth aid in carrying pilgrims across seven mountains to reach the temple. They also carry heavy sacks of essentials like food, water, clothes, and the like. They earn up to Rs.2000/- per day for 60 days, which is enough to support their family for half a year. But sadly, owing to alcohol addiction the earnings become futile.

About the NGO (Amrita SeRVe - Self Reliant Village project)

The hardships experienced by the villagers of Sadivayail came to the attention of Amrita SeRVe, an NGO created in 2013 by spiritual leader Sri Mata Amritanandamayi Devi, who reached out to help.

Real-time situation

When the Amrita SeRVe team first visited in May 2016, the land was almost dry. The team took a participatory approach with Sadivayail residents to incorporate their understanding, knowledge and opinions of rice farming. The village primarily depends on a rainfed system of agriculture and as there is an absence of proper irrigation facilities, rice cultivation could only occur once a year. It became apparent that after resources were allocated to increasingly expensive labour costs and inputs (such as chemical fertilizers and pesticides), agriculture was not a lucrative business. Studying their farming practices revealed that organic rice production by small and marginal farmers was not as profitable by conventional practices; therefore they had to engage in daily wage labour activities in nearby forest areas to sustain themselves throughout the year. Eventually most of the farmers abandoned farming by around 2010 and as they live in foothills under forest cover, the once well-known rice plots became

a corridor for wild animals like elephants, wild boar and bear. These wild animals are a menace which destroys rice cultivation. Storage facilities were also a matter of concern as suitable space for their product was very limited. Farmers had to sell very quickly after harvest to avoid wastage. As marketing opportunities linking the rice producers to markets in Coimbatore are numerous, fast distribution should not be a problem, however promotion of the farmer's product was not taken up by government and forest officials.

Establishing needs

Those in the communities of Sadivayail are all living Below Poverty Line (less than \$2 a day) therefore raising the standard of living and increasing food security are paramount. The aim of Amrita SeRVe was to investigate the practices of the small and marginal farmers, and determine the impact of an organic production system on farming practices in the village, and establish how they could assist in developing a sustainable and viable organic rice production operation as a stream of income for the community.

Frame Work

Using Participatory Rural Appraisal (PRA) methods such as group interviews, discussions and activities, transect walks, and livelihood analysis (Chambers 1994), it was concluded that group farming was the best method to enhance the capacity and capabilities of the villagers. When combined with support from the Government of India's (GoI's) convergence methods initiative (MRD 2010), the framework for the Sadivayail organic rice farming was set. Through the consultation process, the Amrita SeRVe team also established who wanted to engage in organic farming and who was interested in semi organic.

Group Farming

Group farming involves multiple individuals who share resources for the purpose of farming. With a focus on group functioning over individual goals (Olatunji & Letsoalo, 2013), it offers all round support that larger operations extend

such as lower costs of production, and more effective use of land, manpower, and capital. For example, if 20 farmers join together, maybe only two of those farmers own a tractor; in group farming those tractors are shared among the rest. This type of collective farming can attract higher economic returns (Galeski 1987), where a minimal initial investment can lead to an enhanced and sustainable livelihood.

Objectives of Group Farming

- Increase crop cultivation
- Market the produce collectively.
- Producing value added products for more profit.
- Reduced production expenditure and increase in income.

Benefits of Group Farming

- Creation of common assets.
- Common marketing/procurement of products/raw materials by partnerships through agreement.
- Increased access to government programs and policies.
- Profitable price realization for products.
- Technical assistance to improve the quality of products.

Convergence

Substantial efforts and investments are being made by the Government of India (GoI) to strengthen the rural economy and enhance the livelihood base of the poor, especially marginalized groups like Scheduled Castes and Tribes, and women. Taking an inter-department approach, the convergence method is the need of the hour and highly recommended by the GoI. The convergence of different government programs, technical expertise, funding, and social mobilization, enables better planning and effective investments in rural areas (MRD 2010, p.2):

“This convergence will bring in synergies between different government programmes/schemes in terms of planning, process and implementation [and] will also facilitate sustainable development”.

The underlying mechanism of Convergence Farming is to draw from various resources from the individual through to societal level, to build a solid supply and demand for nutritious food. Converging various areas of production, including training to farmers, seed purchasing, preparation of organic fertilizers and pesticides by the farmers themselves, distribution and promotional networks, can lead to not only economic independence but also social empowerment. Taking the food system as the bottom of the pyramid, an objective of the organic farming initiative, was to establish 100 per cent organic farming production within a three-year period using the convergence and group methods.

Constraints

Participatory Rural Appraisal (PRA) methods were used to gain an understanding of the challenges faced by the community and generate ideas for solutions.

i. Existing irrigation System

The agriculture is primarily rain-fed, while irrigation is completely dependent upon water from the main stream and the five borewells. Mud bunds built by the farmers help channelize water from the natural stream for irrigation. This water is diverted to a couple of nearby villages and hence is insufficient for irrigation. In spite of a proper water budgeting system in Sadivaiyal, still there is a shortage of water for paddy cultivation in the 35 acres of land. All five borewells are not operational, thus severely constraining the irrigation process. Many parts of the borewells are missing.

Amrita SeRVe aided in repairing two borewells at prime locations. The Electricity Board connection was revived after persistent efforts at various levels. But, an important concern is the extraction and repair of two submersible pumps installed at depths of about 400ft. They are unfit for use from the past seven

years. In spite of all these measures, the amount of water will not be sufficient for irrigation for the second crop during the months of February to June.

ii. Permanent Solution for water

The village is surrounded by the Western Ghats and the *Kovai Kuttralam* waterfall is three kilometers away. This natural water source situated at an elevated hillock supplies abundant water for up to eight months, provided the rainfall is normal (80cm). By constructing an overhead tank at the source the water can be channelised through the existing underground pipe-way to reach the village. Proper water management by storing at various points using silpaulin or artificial ponds will ensure its availability for second crops like vegetables, millets and pulses. The approximate cost for the suggested solution is about Rs.3 lakhs, and is presently being discussed.

iii. Wild Animals

It was expressed there was an essential need for solar fencing to assist in curbing this problem.

iv. Structural, Systemic and Institutional challenges

These include corruption and misuse of tribal funds; absence of proper land deeds so that they can apply for government loans or schemes; false promises from different agencies.

v. Social challenges

These include alcoholism, debt, lack of trust and loss of confidence in themselves.

Organic Farming Initiative

Farmer's Club and Bank Account

On 09 May 2016, a resolution was passed at the village level where twenty of the most deprived families of the village were selected to start group farming.

The first step was forming a farmer's club which was named Amrita Sadivayail Vyavasaya Kulu (Amrita Sadivayail Farmers Club). Each of the twenty members initially contributed Rs 500, and with the help of Amrita SeRve they opened a bank account at Canara Bank, Alandurai under the name of Amrita Vyavasayam Kulu. The total land holdings were thirty-five acres and all twenty farmers decided to go organic. The Amrita SeRve team worked with the farmers to address their need for self-determination and ownership, and together they defined the responsibilities and formulated guidelines for internal management.

Collaboration and Convergence

Amrita SeRve played an important role in organizing the farmers into groups and guiding them in the proper direction, starting with activities like selection and purchase of seed, soil testing, organizing tractors for primary and secondary tilling, crop planning, water budgeting and water conservation measures, setting up technical training opportunities, giving support in capacity building, and finally branding and marketing.

The farmer group contributed their labour for land clearance, land development, land plotting, constructing water channel, and fencing the area. Jointly working with government departments using convergence method, the tractor for primary-tillage and cage wheel was rented from PudhuVaazhvu (Farmers' Federation), seed provided by the Tamil Nadu Agricultural University (TNAU) and also Dr Maya Mahajan project fund for organic farming, Department Of Science & Technology - Science For Equity Empowerment and Development (DST-Seed) Project (Central Government Scheme). Organic Manure and Bio-pest was prepared by farmers under the guidance of Dr Usha, Professor Organic Department, Kerala Agriculture University and Thannal an agency from Kerala.

Table 1. Tribal Farmer Beneficiaries & cultivating land

SL No	Name of Tribal Hamlet	Total No of Beneficiaries	Cultivable Area (Acres)	Under Cultivation (Acres)	Available land for utilization	Type of land
1	Sadivayail	48 house holds	40	35	5	Tribal settlement land

Initial Land Preparation

After all PRA exercises, open discussions and interviews, farmers began their organic rice production activities on June 20th 2016. The initiative used a blend of both traditional and modern technology, group farming and convergence methods for manure and pesticide application, innovation and even banking.

Compost Pits

Eight organic pits of dimension 7X7 ft were prepared 60 days before tilling the land. The pit was filled with crop residue, animal wastes, food garbage, cow-dung, and different leaves available in the forest area which easily undergoes composting.

Mulching

The top soil was covered with plant material such as leaves, grass, herbs etc. Mulching enhances the activity of soil organisms such as earthworms. It helps prepare the soil structure in such a way that plenty of small and large pores are created through which rainwater can easily infiltrate the soil, thus reducing surface run-off.

Side Protection

Infrastructure support to paddy cultivation includes strengthening and repairing of natural bunds which exist from the past ten years. They help channelize the water to reach the proper destinations without loss at any stage. It also helps to increase the ground water level because the excess water seeps through the soil.

Traditional Irrigation Systems

The existing irrigation system was repaired which enhanced the connectivity to different fields. It helped to save large amounts of water and also increased the ground water level.

Capacity Building on Organic Manure

From the very onset Amrita SeRve trained the farmers in preparing organic manures like Beejamritam, Jeevamritam, Panchanmritam and other organic pesticides.

Pest Control

The objective of natural pest control is to restore the balance between the ‘pest and predator’ by keeping the pests and diseases down to an acceptable level. The aim is not to eradicate them altogether, as they also have a role to play in the natural system. Anjilakeedaviratti is a pest control made of five sap-leaves and soaked (for 48 hrs) in water (10lts) and cow urine (5lts). Another pest control measure is a home-made mixture of tobacco leaves mixed in water (10lts) and cow urine (5lts). Green chilly (100gms) mixed with cow urine (5lts) was applied at different stages of growth. Such environment-friendly measures helped protect the flora and fauna of the forests. They also reduced the costs from Rs.10,000 to Rs.2000 per acre.

Preparation of Beejamritham Beejamritham for 50 kg of Rice: Items needed are 1 kg cow dung, 1 litre cow urine, 10 gm Lime, 5 litres water and top soil preferably below Mango/Jackfruit tree. Mix it with rice and keep for 24 hours.

Preparation of Jeevamritham Take 10 kg of cowdung, 10 litres cow urine, 2 kg Green gram/ Horse gram, 500g virgin soil, 1 kg Jaggery or 2 lt coconut water. Mix in 200 lt drum, stir clockwise three times a day and use within 10 days.

Use of Plant products These include herbal extracts *Aryaveppu*, *Karinichi*, *Thulasi*, *Koovalam*, *Manjal*, *Vinca*, *Palmarosa*, *Datura*, *Pungam*; Oil and oil

cakes (*Heem, Pungam, Marotti*); leaf extract of *Eucalyptus*, *Thulasi*, extract of *karuka* – Apply using 300 ml of liquid in 10 lit of water.

Botanical pesticides for insects: Add 500 bar soap to 500 ml warm water. When cool add 200 ml neem oil. Take 200 g garlic – grind with 300 ml water. Mix well. Add 9 lit of water, filter and spray.

Reason for Choosing Bhavani Rice

The Green Revolution witnessed the distribution of particular rice types that were amenable to technology-tweaking and higher inputs like chemical fertilizers, resulting in a decline in diversity among other varieties (Ramanjaneyulu 2015). The production and use of Bhavani rice has been on the decline over the last 10 years, however it was once a staple food of the Sadivayail village as well as Tamil Nadu. The farmers suggested that they prefer to grow Bhavani rice because of its taste, reasonable price and nutritional value. It is also in high demand among the Flattened rice (also called beaten rice) and Aval or Poha making industries. The potential for sale of by-product also increases as its hay (or straw) are also in high demand among farmers and mushroom growers. With this, the initiative is also trying to bring about good health habits and generate a traditional seed bank for Bhavani rice.

The Process

Amrita Sadivayail Vyavasaya Kulu (Amrita Sadivayail Farmers Club) purchased 590 Kg of rice from various sources using convergence method (500 kg using DST-Seed and 90 Kg from Tamil Nadu Agricultural university). For one acre of land almost 25 Kg was required and was purchased at the rate of Rs.30/Kg. Primary tillage is done using a *tooth* harrow (five tooth) to further loosen the previously ploughed land before sowing. This method is also used to destroy weeds that germinate after ploughing. At the same time as the primary tillage, seeds are kept for 24 hours soaked in a traditional Beejamritham solution for seed treatment which prevents and controls seed, soil, and air-borne diseases. Seeds are drained and dried in bags for 24 hrs in a shady area where air can circulate around the bags.

Secondary tillage using cage wheel is used to prepare the wet land and final harrowing and leveling just before sowing. It helps in breaking of clods and mixing of crop residues. Eight seed beds were then prepared at different locations. Pre-germinated seeds were broadcast in the well-leveled seedbed. The seedbed was irrigated three days after sowing with water coming from the natural main stream from the top of the hill. Farmers applied Jeevamritham, Beejamritham at regular intervals. Monitoring of the seedbed and regular visits were done to observe occurrence of pests or diseases. Twenty-six day old seedlings were transplanted to the prepared paddy. Random planting methods were used for transplantation where two to three seedlings are transplanted per hill. For one acre, an average of six women worked for one and half days. Different groups worked for fifteen days to complete all thirty-five acres of land. Water in the paddies is maintained at three to five cm depth during most of the growing period. Farmers use hand-weeding method to remove weeding at regular intervals of time. Days required for harvesting were 140 days out of which the farmers are applying organic fertilizer and pesticide for 110 days. Direct control of weeds can be done through manual weeding by hand and starts between twenty to forty days after sowing.

Cost Analysis

Cultivation of rice has many steps, starting from tilling to harvest and post-harvest processing. The steps are labour as well as input intensive. In this section expenses regarding each input at every step were gathered and finally calculated for the entire cultivation. The analysis is based upon a comparison between the expenses and income a regular conventional farmer would face (information gathered from an outsourcing company/data source (who is locally renting tractor, tiller, labour, seed, fertilizer and pesticide), and farming using the group convergence method such those in Sadiyaval. *Outsourcing* is purchasing goods and getting rented services from an organization or farmer outside the community.

Primary Tillage

Primary tillage is done to attain depths of soft soil with varying clod sizes. It also kills weeds by burrowing or cutting and exposing roots to the soil. A cultivator/ tiller is attached to the tractor and run through the field. Table 2 may be seen for a description of expenses involved in this stage of production.

Table 2. Primary Tillage

Primary Tillage							
Particulars	Out Source Rate			Convergence Rate			
	Unit		Total Rate		Total Rate	Total Rate	Amount Saved
Rate Of Diesel Per Lt	Rs	58		58			
Time Required For 1acre (Hr)	Hr	2.5		2.5			
Diesel Required Per Hr (Lt)	Lt	4		2			
Total Diesel Required Per Acre (Lt)	Lt	10	580	5	290	290	290
Driver Charge Per Hr(Rs)	Rs	150	375	50	125	250	125
Tractor Rent	Rs	200	500	0	0	500	0
Maintenance Cost Per Hr	Rs	100	250	100	250	0	250
Food Expense	Rs	200	200	0	0	200	0
			1905		665	1240	665
Total			1900		700	1200	700

Conventional singular farming methods (Outsourcing)

Data obtained from external sources state that the time taken for primary tilling is around 2.5 hours per acre of land and uses 4 litres of diesel per hour, totaling 10 litres per acre. Considering the price of diesel is Rs.58.00 per litre, then total expenses on diesel for this purpose would be around Rs.580.00 ($\text{Rs.58.00}/\text{lt} \times 4(\text{hr}/\text{acre}) \times 2.5(\text{lt}/\text{hr})$). Renting the tractor from an external organization costs around Rs.200 per hour and is required for 2.5 hours, totaling Rs.500.00. Estimated cost for maintenance is Rs.250.00. Hiring the driver costs Rs.150.00 per hour and is required for 2.5 hours, totaling Rs.375.00 for labour per acre, plus their food expense of Rs.200.00. Adding these expenses together, shows that the final cost per acre for primary tillage is Rs.1900.

Convergence and group farming

Primary tillage by the group using convergence method found the amount of diesel used per hour was just under half of the above estimated costs, i.e. 2 liters required per hour. This might be because the tractor rented could be an old model and not well maintained, whereas the tractors owned by the farmers in the group are a newer model and maintained well. Therefore the diesel cost per acre in convergence was Rs.290.00 (Rs.58 (/lit)*2 (lit/hr)*2.5 (hr/acre)). Since the tractors were owned by two of the farmers, there were no renting costs, but similar maintenance costs were experienced as in outsourcing method (Rs.250.00). Since the drivers belong to the group they charged only Rs.50.00 per hour, totaling Rs.125.00 per acre since he belongs to the same village there would not be any food expenses as they take their food in their respective houses. The final expenses show Rs.665 per acre via the method of convergence for primary tillage.

Secondary Tillage

Secondary Tillage is to improve the seedbed by increased soil pulverization, to conserve moisture through destruction of weeds, and to cut up crop residues by using various types of harrows, rollers or pulverizers, and tools for mulching and fallowing. The following Table 3 outlines the expenses of both outsourcing and convergence methods for secondary tilling.

Table 3. Secondary Tillage

Particulars	Out Source Rate			Convergence Rate		Amount Saved
	Unit		Total Rate		Total Rate	
Rate of Diesel Per Lt	Rs	58		58		
Time Required For 1acre (Hr)	Hr	14		7		
Diesel Required Per Hr (Lt)	Lt	6		6		
Total Diesel Required Per Acre (Lt)	Lt	84	4872	42	2436	2436
Driver Charge Per Hr (Rs)	Rs	150	2100	100	700	1400
Tractor Rent	Rs	200	2800	0	0	2800
Maintenance Cost Per Hr	Rs	200	2800	100	700	2100
Food Expense	Rs	200	200	0	0	200
Total			12772		3836	8936
Round-Off			13000		4000	9000

Conventional singular farming methods (Outsourcing)

In Outsourcing, the time spent for secondary tilling for one acre is approximately 14 hours and requires 6 litres of diesel per hour, totaling 84 litres ($14(\text{hr/acre}) \times 6(\text{litre/hr})$) required per acre of land. One litre of diesel costs Rs.58.00, so for 84 litres, Rs.4872.00 is required. The tractor driver charges Rs.150 per hour for secondary tilling of land, thus the total cost for the driver is Rs.2100.00. Renting a tractor from external organization costs Rs.200.00 per hour, therefore 14 hours costs Rs.2800.00. Maintenance of the tractor per hour costs Rs.200.00, leading to an expense of Rs.2800.00 per acre. Food expense for the driver is Rs.200.00. Through outsourcing the total cost that is likely to be spent on secondary tilling per acre is Rs.12772.00 which may be rounded up to Rs.13000.

Convergence and group farming

When compared with secondary tilling practice through convergence, the expenditure goes down incredibly. The outsourcing organization claims the working hours per acre to be 14 hours however the group found the actual working hours to be 7 hours. This might be due to the business tactics they follow i.e., the more time the customer rents, more the money they can claim. In convergence, there is no cost to rent the tractor, because two members of the group have a tractor and they share with other members. They found the expense for diesel is Rs.2436.00 ($\text{Rs.}58.00/(\text{lit}) \times 7(\text{hr/acre}) \times 6(\text{lit/hr})$). The driver charge is Rs.100.00 per hour since he belongs to the same group, thus the expense for total time is Rs.700.00. Money spent on maintenance of tractor is Rs.700.00 since the rate per hour is Rs.100.00. The total expenditure for secondary tillage using convergence is Rs.3836.00 rounded up to Rs 4000.

Tiller

A tiller is a small piece of equipment used with a tractor engine that is commonly operated for preparing the soil for seed beds. Seed beds are a small raised

platform of land in which the seed are first grown then transplanted to the main fields. Table 4 describes the expenses of both outsourcing and convergence methods in tiller use.

Table 4. Tiller

Particulars	Out Source Rate		Total Rate	Convergence Rate		Amount Saved
	Unit				Total Rate	
Rate Of Diesel Per Lt	Rs	58	13.34	58	13.34	0
Tractor Rent Per Hr	Rs	200	46	0	0	46
Driver Charge Per Hr	Rs	100	23	25	5.75	17.25
Maintenance Cost Per Hr	Rs	100	23	120	120	-97
Food Expenses	Rs	200	46	0	0	46
Total			151.34		139.09	12.25
Round-Off			150		140	10

Conventional singular farming methods (Outsourcing)

In outsourcing, a total of 35 acres of land needs 8 seed beds using a total 40 cents worth of seeds. Therefore, one acre of land to be planted with rice requires 1.15 cents (i.e. 40 cents/35 acres). The calculation for all the particulars used are converted from 8 seed beds to that of particulars used for the fraction of seed bed that is to be transplanted on to one acre of land. For example, 1litre of diesel is required for making 1 seed bed then diesel spent in order to prepare land for one acre is 0.23lt i.e. $8(\text{beds}) \times 1(\text{Lt}/\text{bed})/35(\text{acres})$. Thus, the money spent on diesel is Rs.13.34. Similarly, the tractor rent at Rs.200.00 per hour is converted as Rs.46.00 per acre. In the same way the driver charge, maintenance and the food expenses are calculated as Rs.23.00, Rs.23.00 and Rs.46.00 per acre respectively. All expenses combined amount to Rs.151.34.

Convergence and group farming

In the method of convergence, the above-mentioned conversion of particulars from 8 beds to the fraction of seed bed used for one acre is applicable. The expenses on diesel is Rs.13.34. Tractor rent is nullified since the tractor is owned by a member of the group. The tractor driver is from the same village so

cost is only Rs.25.00 per bed. The maintenance turned out to be higher because the tiller which the people had was not in a good workable condition, so it had to be repaired before usage. The repairing cost is included in the maintenance. Total amount spent on repairing the tiller was Rs.4000.00, when this amount is equally shared as the maintenance cost for the tiller among 35 acres, it gives Rs.120.00 per acre. This cost in the upcoming seasons will reduce to the working maintenance cost alone thus reducing the input on the category. All the expenses for tilling using the convergence method is Rs.139.09 ie. around Rs.140.

Pre-Harvesting

This section of farming is highly labour intensive and time consuming. The step includes many processes like transplantation, regular weeding, irrigation and maintenance of the crop till the harvest. Table 6 outlines the expenses of both outsourcing and convergence methods in the pre-harvesting phase.

Table 5 Cost of transplantation of crop for one acre

Cost of transplantation of crop for one acre			
Particulars	Outsourcing	Convergence	Saving
For 10 women / acre (Rs)	8000	6000	2000

Table 6 Pre-harvesting cost

Particulars	Unit	No. of Works Involved	Rate Per Work	Out sourcing	Rate Per Work	Convergence	Saving
Seed				505.7143		0	
Bio-Fertilizers	Rs			10000		2000	8000
Bio-Pest Control	Rs			10000		2000	8000
Weed Removing	Rs	20	600	12000	300	6000	6000
Transplantation				8000		6000	
Transportation				1000			1000
Capacity And Institution Building				10000		0	10000
Seed Sowing		2	600	1200	300	600	600
Irrigation							
Maintenance	Rs	20	600	12000	300	6000	6000
Nursery Maintenance		5	600	3000	300	1500	1500
Insurance	Rs			1000			1000
Total				68705.71		24100	44605.71
Round Up				69000		24000	45000

Conventional singular farming methods (Outsourcing)

In outsourcing, the seed can be purchased from the public or private seed sector and should cost approximately Rs. 500.00 per acre. Since they do not have sources to produce bio-fertilizers and bio-pest control, they are forced to buy from the Bio-Fertilizer Company. Both bio-fertilizer and bio-pest control agents cost approximately Rs.10,000.00 each. Transportation cost for the required materials like seed, bio-fertilizer and bio-pest control is approximately Rs. 1,000.00. The pre-harvesting phase also needs human labour for weed removal, transplantation and seed sowing, etc. For weed removal labour costs Rs. 600 per acre, the number of people working in the field is five per acre, and they have to remove weed four times periodically (within a harvest). This calculates to Rs. 12,000.00 ($600 \text{ (Rs/person)} \times 5 \text{ (person/acre)} \times 4$). For seed sowing the costs are Rs.600.00 as well, but requires less people therefore money spent on seed sowing is Rs. 1200.00 ($600 \text{ (Rs/person)} \times 2 \text{ (person/acre)}$). For transplantation the salary expected by the worker is Rs. 800.00 per acre, and ten people work, giving the total amount spent as Rs. 8000.00. For irrigation and nursery maintenance, people claim Rs. 600.00 per acre for both, but the required number of workers is twenty and five, respectively, which makes the total amount Rs. 12,000.00 ($600 \text{ (Rs/person)} \times 20 \text{ (person/acre)}$) for irrigation and Rs. 3000.00 ($600 \text{ (Rs/person)} \times 5 \text{ (person/acre)}$) for nursery maintenance. Capacity Building and Training require Rs. 10000. In total, the expenses for pre-harvest are Rs.68705.71. The total amount can be rounded up to Rs 70000.

Convergence and Group Farming

In convergence, since the farmers themselves save seed for the next cultivation, there is no necessity for buying the seed from an external source. They also use cow dung and urine from their cattle, which is free of cost, to make bio-fertilizers and bio-pest control. In addition to cow dung and urine, they need some fruits, jaggery, etc. which costs around Rs. 2000.00 for each. Since the material costs for purchasing inputs are reduced, there is no need for external

transportation. For labour intensive work, labour is sourced from the farmers themselves who are working for their own land, thus the amount spend on labour is reduced. Even though work required is the same in both convergence and outsourcing, the rate for the work per person is reduced by half, and the total amount is also reduced by half the outsourcing amount. The total amount spent on outsourcing works out to Rs. 68,705, whereas convergence comes in at Rs. 24100, reflecting a saving of around Rs. 44605 by group farming.

Post Harvest

Post-harvest includes getting final products from the harvested crop. Especially for rice, the choice of the product decides the expenses. Major products for paddy crop are paddy as seeds, rice (husk removed) and other value added products like poha, rice noodles, etc.

The main process in post harvest is harvesting the crop. In the outsourcing method, labour for harvesting cost about Rs.10000.00; however as the people in convergence method are of the same village, that cost is halved to only Rs.5000.00. But using a machine it cost Rs 3120 so the technology has been chosen for post harvesting . Other processes like sacking, parboiling and milling are also included in post-harvesting however these costs are not included in this analysis. After each step of processing, the value of the rice increases, thus the income covers expenses and in many cases, gives profit.

Table 7. Post-harvest cost

Post Harvesting				
Particulars	unit	Hour	Daily wages/Rent	Total
Cutting & parboiling	Acres	1	3000	3000
Tarpal Sheet	Days	2	60	120
Total				3120

Table 8. Total Expenses

Total Cost	Outsourcing	Convergence	Amount Saved
Primary Tillage	1900	700	1200
Secondary Tillage	13000	4000	9000
Tiller	150	140	10
Pre-Harvesting	70000	24000	46000
Post-Harvesting	3120	3120	0
For 1 Acre	88170	31960	56210
For 35 Acres	3085950	1118600	1967350

Table 9. Profit /Acre

Profit /Acre				
Product	Acres	Production of Rice (Kg)	Price	Amount
Paddy	1	1032	28	28896
straw	1	24000	24000	24000
Total				52896

Return to Traditional Rice

Returns from Organic Bhavani Rice production

When the crop was harvested in January 2017, the total yield from the 35 acres was 36,120 kg. On average, farmers produced 1032 kg per acre and sold it for Rs. 28.00 per kg, resulting in an average return per acre of Rs. 28896 and also return from straw is Rs 24000. As most of the farmers have one acre, the average return for each producer was Rs. 52896. With this substantial return, the farmers were able to pay off their outstanding debts. Thus it leads to the conclusion that convergence group method of farming is more preferred over individual farming and while this paper only covers the activities of the first year, the results suggest a promising future.

Analysis

In India, the Green Revolution started in the 1960s to overcome poor agriculture productivity by introducing higher-yielding strains of plants and new chemical fertilizers. After 1990 when agriculture (agri+culture) developed into agribusiness (agri+business), there was added pressure on the entire food chain system and farmers were forced to modernize. To feed the increasing population, production is expected to double in size every 10 years (even with the constraints of decreasing land size and water bodies). The existing barter / financial system completely revolves around money and neglects to acknowledge the negative impact on the environment and social systems. To protect the small farmers, the challenge is to find ways to link these growers with high-value markets. More and more people are turning away from food products grown with fertilizers and other chemicals towards organically grown food. Organic rice is growing in demand during this industrial era due to an increase in awareness of the multiple health risks of varieties grown with chemicals.

Amrita Sadivayail Vyavasayam Kulu started with 20 farmers establishing an organic rice farm at Sadivayail, a tribal village located in the sub-urban region of Coimbatore. Amrita SeRve planned and helped the villagers from tillage, collection of seeds, preparation of manures and pesticides, introduction of technological innovations and modern methods in production and processing raw materials, and marketing of the products. Using mobile application, web page and blogs, Amrita SeRve is helping farmers sell their products and by-products. This case also shows the crucial role of the market intermediary (Amrita SeRve) in helping farmers to adopt new technologies that allows for improvement in the quality of their produce.

The study covers the pivotal role played by the Amrita SeRve in the adoption of organic rice production in the villages under study. The institutional support of Amrita SeRve figured consistently as a factor in promoting organic farming in an organized way. This was done by building confidence in the farmers and teaching them how to produce organic paddy, how to produce their own organic

fertilizer and pesticide, and sell the rice at a premium price. Now farmers have the confidence to go for a second crop.

Conclusion

Amrita SeRVe aims to promote new practices where health and ecosystems are protected and ensure food security in the villages in which they operate. This analysis shows that the role of Amrita SeRVe in promoting organic production, providing technical support and a secured market, is a motor element in influencing the farmers' decision to convert to these new practices.

It is suggested that Government should support the organic farming industry by fixing a competitive price for the paddy produced by small & marginal farmers. A relatively larger initial investment is needed in organic farming thus the need for government support and a cash back policy during the critical conversion from conventional to organic, is required.

Another area for consideration is a new system of capacity building and research which blends traditional methods with technology to reduce the yield gap between organic and conventional farms which remains high.

The responsibility of narrowing that gap of three year results to convert the farmers to organic farming needs the support of civil society at large. If the price of organic rice is higher and gets the proper support of civil society in return society gets the health and environment benefits. Sharing of information and technical knowledge is required for this. The case study revealed that the convergence method is one of the best methods we can adopt for the future for the sustainable growth of agriculture and bring income stability to marginalized communities.

The project is continuing since the last three years and it is a means of livelihood and way to end poverty and hunger in villages and find new job opportunities in rural India.

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Awareness through Training Programs among Sericulture Entrepreneurs of weaker sections- a study in Anantapur district of Andhra Pradesh

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Abstract

Agriculture based Sericulture industry can be seen as an effective socio-economic tool for inclusive growth and for creation of gainful employment to the rural and unemployed youth which helps to uplift the socio-economic status of small and marginal farmers. Compared to agricultural crops, sericulture provides round the year employment and higher income to the rural entrepreneurs. Most of the families in silk industry practice it traditionally without undergoing any specific skill development training programme. As a result, farmers lose their crops and even with lesser cocoon yield, the crop stability and quality is not assured. To make it a more viable, economic and profitable enterprise skilled / trained human resource is very essential. Training provides a systematic improvement in knowledge and skills which in turn helps the trainees to function effectively and efficiently in their given task. The feedback from training organised especially for weaker sections in Anantapur district of Andhra Pradesh covering 211 farmers suggests that the training was quite useful for the farmers in mulberry cultivation and rearing of silkworms on scientific lines to ensure successful crops with higher yield.

Keywords: Sericulture, Training Anantapur, Andhra Pradesh

Introduction

Sericulture as an agriculture based industry can be seen as an effective socio-economic alleviation tool for creation of gainful employment to the rural and

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unemployed youth and helps to uplift the status of small and marginal farmers. Sericulture, a rural-agro based cottage industry, occupies the major portion of silk production, constitutes about 75 per cent of the total silk production. The economic advantages of the Sericulture industry lie in its high employment potential with low investment. Owing to the nature of back-end operations of raw silk production, women have been found to be proactive in silk production. Studies have revealed, that silk production gives higher returns compared to other commercial crops. The silk industry in India involves both on-farm and non-farm sector participation and provides employment to seven million families, from rural as well as urban populations. Compared to agricultural crops, sericulture provides year round employment and higher income to the rural entrepreneurs. Sericulture is a sustainable and commercially viable socio-economic activity requiring proper support and caring hands aimed at creation of an environment conducive to its healthy development. Most of the families in the silk industry practice it traditionally without undergoing any specific skill development training programmes. As a result, the crop stability and quality is not assured. At farmers' level crop yield and cocoon quality vary a lot from crop to crop and farmer to farmer. This variation then reflects into the reeling performance and quality of reeled yarn. To make it a more viable, economic and profitable enterprise skilled / trained human resource is very precious.

Human resource is the most precious resource for any country in general and any enterprise in particular and it is however, not the numerical but the qualitative strength of the people, which forges a country ahead towards progress and prosperity. It is basically the development of human resources that brings about socio-economic or political-cultural transformation of any society. Today the farmers are responsive to new ideas and are willing to take up improved practices. The trained human resources are more useful in ensuring success and managing the enterprise in a successful manner. Farmer training is directed towards improving their efficiency in farming. The kind of education we call as training is not only for knowing more but for behaving differently.

Training plays an important role in the advancement of human performance in a given situation. Training provides a systematic improvement of knowledge and

skills which in turn helps the trainees to function effectively and efficiently in their given task on completion of the training. Training is a process of acquisition of new skills, attitude and knowledge in the context of preparing for entry into a vocation or improving ones productivity in an organization or enterprise. Effective training requires a clear picture of how the trainees will need to use information after the training in place of local practices which they have adopted before in their situation. It is worthwhile to mention the statement of Lynton and Pareek (1990) that training consists largely of well organized opportunities for participants to acquire necessary understanding and skills.

The target population have been imparted with practical knowledge so as to make them well versed with the new technologies, rectification of common mistakes, preventive and curative measures and motivation through effective demonstrations. Such participants are expected to adopt correct and innovative practices to optimize the quantity and quality of their produce. Further, these trained personnel in turn transferred the technologies to other members and contributed to overall increase in sericulture productivity in the state of Andhra Pradesh.

Importance of Training in Sericulture

Andhra Pradesh has achieved distinct progress in sericulture industry and stands second in silk production in India. Adequate attention is being given to this vital socio-economic component in Government sponsored developmental activities as also in various other programmes. It is a sustainable farm based economic enterprise positively favouring the rural poor in the unorganized sector because of its relatively low requirement of fixed capital and higher returns. The changes in employment and income opportunities in rural areas may be brought about by selecting a highly labour intensive and high income yielding cropping pattern and sericulture has been identified as one such sector which plays a vital role in generating gainful employment opportunities. The less skillful labour intensive activities in both cocoon production and reeling activities compel sericulturists to hold subordinate status and hence are kept out of the interventions made for augmenting the knowledge and skills and

limited to lowly paid traditional activities. In spite of the trust laid of late, the accrued benefits and opportunities could not reach the farmers. This scenario warrants the upgradation of skills and knowledge of sericulturists on varying activities *viz.*, handling of new silkworm hybrids including usage of new disinfectants formulated combined with Integrated Nutrient, Disease and Pest Management in mulberry cultivation, disinfection, incubation of eggs, young age silkworm rearing, late age silkworm rearing, silkworm disease management, byproduct utilization etc. so as to enable them to harvest sustainable cocoon crop with higher income.

Sericulture can be promoted as a viable livelihood option among the weaker sections in Anantapur district of Andhra Pradesh. As per Directorate of Economics and Statistics in 2016, East Godavari, West Godavari, Nellore, Guntur, Prakasam and Chittoor have registered over one lakh per capita income while, Kadapa (Rs. 91,888), Anantapur (Rs. 89,084), Kurnool (Rs. 88, 308), Vizianagaram (Rs. 86,223) and Srikakulam (Rs. 74,638) were lagging with below one lakh income. Thus the training area, Anantapur district remains one of the poorest districts in Andhra Pradesh based on per capita income despite being rich in natural resources. There is a high incidence of poverty in the districts that are primarily agriculture- based economies. To make most out of the existing natural resources in agriculture, as the monsoon is becoming more and more erratic over the last 10 years, the struggles of small farmers who cannot survive on the staple crop based agribusiness have increased manifold. This is resulting in farmers abandoning farming even though there is no adequate capacity in other secondary and tertiary sectors to absorb them in gainful employment. This exacerbates the case of underemployment and unemployment leading to increased incidence of poverty.

It is interesting to note that, the production and productivity levels in sericulture have remained low mainly for want of proper adoption of improved and scientific / technological interventions. Further, improved agriculture concepts like soil fertility management, soil health care, bio-waste recycling, inter and co-cropping systems, application of green manures and bio-fertilizers, soil pH

management etc., apart from various components pertaining to silkworm rearing practices are also recommended for overall improvement in productivity and sustainability.

Sericulture R & D efforts resulted in the development of several user friendly technologies, developed particularly with breeds suited to high temperature, high humidity and also to rear in adverse conditions. These silkworm breeds and Sericulture technology need to be transferred to the field much more rapidly through technological interventions and training associated with organized support for market growth and money flow so as to support empowerment of the sericulturists economically and socially with over all development of the industry and to uplift the living standards among the rural masses. Improvement in skill and knowledge of rural folk in sericulture along with resource management can bring in substantial improvement in productivity. This leads to seri-economic advancement, which is the need of the hour particularly in rural areas. There are certain areas where technological interventions and related skill up-gradation covering mulberry cultivation and young age silkworm (Chawki) rearing and late age silkworm rearing with supportive prophylactic activities play a vital role towards production and productivity improvement.

Tailored Training Programme

Need based training was given among the weaker sections of the society and or potential entrepreneurs in Anantapur district of Andhra Pradesh so that they emerge as active and powerful value chain participants in sericulture development. This was to ensure gainful employment and enhance the net household incomes of the target group. A value chain approach was adopted to not only engage the target group as beneficiaries but also to build their capacities.

Most of the sericulturists in general and Scheduled Caste / Scheduled Tribe farmers in particular have limited exposure to recent technologies relating to increased production and labour cost reduction including disinfection, hygiene maintenance and seri-waste management. Most of the families in silk industry practice it traditionally without undergoing any specific skill development

training programme. As a result, the crop stability and quality is not assured. At farmers level, crop yield and cocoon quality vary a lot from crop to crop and farmer to farmer. This variation then reflects into the reeling performance and quality of reeled yarn. Due to lack of quality of Indian reeled silk, China silk is preferred for use in warp during weaving of silk fabric.

The productive silkworm hybrids which have been developed by the Andhra Pradesh State Sericulture Research and Development Institute (APSSRDI) and Central Research institutes of Central Silk Board (CSB) and as such these new hybrids need to be popularized among the farmers. The new breeds/hybrids, which have been released in the field, are high yielding and hold promise for producing international grade silk. This necessitates the up-gradation of technical skills and knowledge about forward and backward linkages aimed at increasing per capita income to the farmers. Realizing the importance of socio-economic empowerment of sericulturists and overall growth of the sericulture industry, the training was imparted among the sericulturists on technology demonstration and validation. During the training bottlenecks in the field of Cocoon production, Mulberry cultivation, Diseases, Pests and their control measures were addressed to a great extent. Focus was on:

- Integrated nutrient, disease and pest management in mulberry - organic farming approach
- Demonstration of handling new silkworm hybrids
- Disinfection and hygiene maintenance.
- Incubation and black boxing technology of silkworm eggs, Innovations in silkworm rearing technology and silkworm disease management.
- Latest Sericulture technologies and financial assistance available from the government.
- Supply of required tool kits to each of the trainees.

During the year 2016, a total of 211 farmers belonging to Scheduled Caste (SC) / Scheduled Tribes (ST) were specially trained for two days in five batches and tool kits were also distributed during the training programme. To upgrade the knowledge of all including progressive, middle and marginal farmers, APSSRDI is continuously making concerted efforts for the update of latest technologies and to convert the farmers on scientific lines so as to ensure financial empowerment. In almost all the cases, a need was felt to support farmers in terms of technical guidance and financially to uplift their status and their continuity in Sericulture and in turn contribute to Rural development. The activities involved in sericulture require proper time-to-time attention fitting into the instinctive qualities of rural folk. Up gradation of knowledge on certain important activities of sericulture especially covering the new and scientific technologies for cocoon production and related activities of silk production is the need of the hour.

Training programmes were conducted for the farmers of Anantapur district of Andhra Pradesh for adopting new technologies and utilizing their professional skills in different aspects of sericulture. The farmers were trained on new technologies and their knowledge updated on mulberry cultivation and silkworm rearing particularly on new silkworm races and eco-friendly disinfectants developed by APSSRDI, incubation technologies and on organic farming approach. Since the farmers are traditional in nature with respect to sericulture, most of them have knowledge on sericulture, however their awareness was updated on the latest technologies. Particularly for these farmers, an integrated approach towards success in Sericulture Industry was taught. Simultaneously the training programmes were also focused on the improvement of professional skills in different aspects of sericulture to optimize the productivity. Besides, it was also focused on crisis management in sericulture during summer and adverse environmental conditions.

The details of the training programme are as follows.

Table 1. Details of Training Programs

Batch No.	Total No. of Farmers		
	SC	ST	Total
I	24	16	40
II	23	17	40
III	26	14	40
IV	40	0	40
V	43	8	51
Total	156	55	211

Education Level of the Trainees

The trainees who participated in the training programs are in the range of illiterate to PG. About 84 per cent of the trainees were at the education level of 6th – 10th standard and certain participants are Post Graduates and are in the age group of 25 – 40 years. All the participants were actively involved in the training which has built up confidence among the farmers for successful running of the sericulture enterprise.

Sericulture Profile of the Trainees:

- i. Mulberry Acreage:** In total, 105 farmers who attended the training programme in five batches have 1 – 2 acres of mulberry garden followed by 65 farmers in the range of 0.5 – 1 acre and 41 farmers having 3 acres and above (Table 2). The training, was focused on the production of quality leaf through IPM and INM packages through eco-friendly approach, compost making, vermi compost and green manure and their effective utilization in raising quality mulberry gardens for silkworm rearing.
- ii. Mulberry variety:** 202 farmers are having high yielding mulberry variety i.e. V1 and 9 farmers are having M5 varieties. During the training, focus was on the importance of mulberry variety and their high yield through applying various manures. Further input supply of various fertilizers, their ultimate impact on the quality leaf and the importance of high yielding mulberry variety were also covered.

iii. Classification of trainees: 125 farmers who attended the training are CB rearers followed by 86 farmers rearing both CB and Bivoltine (BV). During the training, focus was on skill up gradation covering the productive aspects of sericulture including demonstration and handling of new hybrids, developed by APSSRDI for productivity, disease resistance and temperature tolerance. The common mistakes committed during silkworm rearing were taught along with the major steps to be followed during bivoltine silkworm rearing.

Table 2. Sericulture Profile of the Individual Trainees

Batch No.	Mulberry acreage (acres)			Mulberry variety			Type of farmer	
	0.5 to 1	1 – 2	3 & above	M5	V1	Others	CB & BV	CB
I	7	25	8	0	40	0	12	28
II	18	17	5	2	38	0	9	31
III	13	15	12	1	39	0	20	20
IV	15	16	9	4	36	0	25	15
V	12	32	7	2	49	0	20	31
Total	65	105	41	9	202	0	86	125

As per the training schedule and objectives of the training programme, the resource persons having vast experience and practical sericulture knowledge were invited. Further, the practical demonstration of latest technologies pertained to silkworm rearing such as black boxing of silkworm eggs, disinfection of rearing house, recording and monitoring of temperature and humidity etc. A tool kit consisting of Secature (Big), Secature (Small), Poshan (Micronutrients for mulberry), Biofertilizer and *Trichoderma viridi* were distributed. After successful completion of the training programme, feedback was collected from the trainees about the usefulness of the training programme and the method of conducting training.

Feedback of the training programme

Feedback from the trainees was also obtained after the completion of the training programme during June – July, 2017. For this purpose a questionnaire

with relevant information was prepared and the identified team of Scientists / Extension personnel from the Department of Sericulture conducted the impact assessment. The survey revealed that most of the trainees have changed from a traditional to a more scientific way of doing things and harvesting successful crops which has improved their socio economic status to the extent possible. Still there is scope to improve their status by regular guidance and with financial support for certain items. Further the trainee farmers have felt the need for organizing such similar practical oriented training programmes to update their technical skills in Sericulture.

The feedback from the trainees was obtained during the favourable season of silkworm rearing and for this purpose a questionnaire with relevant information was administered. The resource persons interacted with the trainees at their work site with a structured questionnaire to obtain feedback on the training programme. The trainees expressed satisfaction over the technical improvement in sericulture activities. In case of mulberry cultivation, the farmers could realize the importance of soil testing and based on the testing results, the application of biofertilizers, and recommended dose of fertilizers and vermicompost along with green manuring is being taken up. The farmers have realized the importance of organic farming and application of bio-control agents for control of mulberry pests. Further, agriculture and sericulture waste is being properly recycled. The training on silkworm rearing includes the incubation of silkworm eggs, block boxing for uniform hatching, tips for management of chawki silkworm rearing and late age silkworm rearing which have helped the farmers to know their common mistakes committed during silkworm rearing. The importance of disease management made the farmers realize the need for surface disinfection of silkworm eggs and the disinfection of the rearing house including hygiene maintenance.

Further they realized that the quality and quantity of mulberry leaf is influenced by the application of Farm Yard Manure (FYM) and chemical fertilizers as per the recommendation based on the soil testing. During the training, the

information for skill up gradation covering the productive aspects of sericulture including demonstration and handling of new silkworm hybrids developed for productivity, disease resistance and temperature tolerance have helped them to improve their work efficiency in various activities of sericulture. More interestingly, many of the farmers have voluntarily converted from the rearing of Cross breed silkworms to Bivoltine silkworm rearing. In the present scenario, such a phenomenon is quite useful for production of quality bivoltine silk. In total, the information collected was compiled and categorized under opinion about the training programme and their level of knowledge before and after the training programme.

Feedback from the Trained Sericulturists

More than 90 per cent of the trainees expressed their satisfaction towards the overall training programme and its usefulness for effective maintenance of sericulture enterprise. The trainees strongly felt that the objectives of the training programme were quite clear and accordingly the day wise training schedule was well planned. Further they felt that most of the resource persons encouraged them for their active interaction and participation during the training programme. About 95 per cent of the trainees felt that, the training programme is quite useful since most of the activities were focused to reduce the drudgery in sericulture which is the need of the hour. Almost all the trainees have felt that the content of the training programme was easy to follow for all.

The resource persons were well versed with sericulture with experience in their specialized fields and sharing the experiences of some of the progressive farmers helped them to understand and modify their day to day sericulture activities. During training, all the trainees were taken on field visits for exposure and to have direct interaction with the local farmers. Most of the trainees felt that the facilities and the time allotted for the training programme was sufficient. However some of the farmers felt that, a provision should be clearly made for practical demonstration of all the sericulture activities.

Impact Assessment: Evaluation of training programme is essential to judge its value or worth. Hamblin (1974) defined evaluation of training as an attempt to obtain information (feedback) on the effects of a training programme and assess the value of training in the light of the information. He felt that it is strictly impossible to measure the total value of a training programme in social as well as financial terms, as there are several levels of intermediate objectives in a training programme. However an attempt has been made in the present paper to analyze the collected information and to know the extent of meeting the objectives. The collected information about their sericulture knowledge level before and after the training and their views on the training programme were analyzed.

Technology / Knowledge Awareness level before and after the Training

1. The trainees expressed that, they were well aware of the mulberry varieties. Many of the farmers have expressed that they were hardly aware of silkworm hybrids and opined that during the training, sufficient knowledge was gained on silkworm hybrids particularly bivoltine varieties such as Single hybrids and Double hybrids which in turn helped them to choose silkworm hybrids according to different seasons.
2. Before the training programme they were of an opinion that, usage of abundant chemical fertilizers would increase the mulberry leaf quality and yield. However, during the training, they learnt that Integrated Nutrient Management (INM) is the need of the hour not only to increase the mulberry leaf quality but also for leaf yield.
3. IPM is a sustainable approach to manage pests by combining biological, cultural, physical and chemical tools in a way that minimizes economic, health and environmental risks.
4. Before the training programme their knowledge on INM and IPM packages was not much but during the training, they have gained sufficient knowledge. Among the trainees, about 78 per cent have expressed that they were

effectively following the production of quality leaf through IPM and INM packages by eco-friendly approach, compost making, vermi compost and green manures and their effective utilization in raising quality mulberry gardens for silkworm rearing.

5. Almost all the farmers have opined that before the training, they knew the importance of chawki silkworm rearing but after the training, more awareness was developed on the scientific method of rearing chawki worms. Further they learnt about the importance of procuring chawki silkworms from certified Chawki Rearing Centers (CRCs). After the training programme, most of the farmers are mandatorily bringing the chawki silkworms from the certified CRCs which has further ensured the success of silkworm rearing and also to obtain higher yields.
6. After the training programme, the knowledge on new silkworm hybrids helped them in selection of silkworm hybrids and the knowledge on their special characteristic features helped them to harvest successful crops.
7. With regard to disinfection practices, most of the trainees expressed that before the training programme they were having knowledge on the disinfection. However, after the training, they were enlightened on the effective way of conducting disinfection programme to ensure proper disinfection and to meet its purpose.
8. The trainees expressed that after the training, the importance of management of environmental fluctuations during silkworm rearing made them maintain optimal conditions which has led to harvest successful crops.
9. All the trainees opined that before the training they used to commit simple mistakes during silkworm rearing. After the training programme, the emphasis on the various important phases of silkworm rearing such as moulting, resumption from moult and spinning care have enlightened them to ensure the required optimal conditions.
10. The practice of sorting the defective cocoons and also removal of floss of bivoltine cocoons before the marketing and their proper transportation helped them to obtain maximum price for their produce in the market.

11. The most significant impact of the training programme was that the number of crops undertaken by them increased from 3 - 4 crops to 5 - 6 crops leading to an increase in the overall income per year/acre. Further the cocoon yield has gone up to an extent of 4 – 5 kgs per 100 Dfls besides crop stability.
12. The feedback also suggested that the distribution of kits along with literature used in sericulture was very helpful. Most of the farmers felt that the training programmes are to be continuously held to update their knowledge in the field of sericulture.

Since sericulture is a remunerative crop which suits all the categories of farmers from small/marginal farmers with meager resources to large farmers, and has a short gestation period, the returns are quick. Continuous training programmes are very much required to update the knowledge of the farmers which in turn ensures success in sericulture. Further it is believed that the training programmes are critical in bringing rural prosperity as training helps farmers to incorporate the latest scientific advances and technology tools into their daily operations. Further, conducting awareness programmes regularly can help ensure success in sericulture industry and economic empowerment of rural people to help realize the vision of the Sericulture Department. The results show that even though considerable efforts have been made in training of farmers in the common vocations and areas of interest, there still remains a gap which needs to be addressed. The study revealed that, training programmes help to develop a vibrant and sustainable farmer base by overall improvement in production, productivity and output quality through expansion of area under plantation in mulberry.

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Knowledge of Farm Women regarding Various Agricultural Activities

J. I. Shaikh¹ and S. B. Shinde²

Abstract

The international development community has recognized that agriculture is an engine of growth and poverty reduction in countries where it is the main occupation of the poor. However, the agriculture 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, almost everywhere face more severe constraints than men in access to productive resources. The knowledge of farm women regarding various agricultural activities was higher namely in bird watching, harvesting, intercultural operations and lower in land preparation activities, marketing, post-harvest operations, seed bed preparation and processing activities. Majority (71.50 %) of the respondents had medium level of knowledge about the different agricultural activities followed by 25.50 per cent and 3.00 per cent of the respondents with low and high level of knowledge respectively.

Key words: farm women, agricultural activities, knowledge

Introduction

The agriculture sector in many developing countries is under performing, in part because women, who represent a crucial resource in agriculture and the rural economy through their roles as farmers, laborers and entrepreneurs, face more severe constraints than men in access to productive resources. Efforts by national government and the international community to achieve their goals for agricultural development, economic growth and food security will be

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strengthened and accelerated if they build on the contributions that women make and take steps to alleviate these constraints.

The prosperity and growth of a nation depends on the status and development of its women, as they not only constitute nearly half of its population, but also positively influence the growth of the remaining half of the population.

Multi-Dimensional role of women

Agriculture: Sowing, transplanting, weeding, irrigation, fertilizer application, plant protection, harvesting, winnowing, storage etc.

Allied activities: Cattle management, fodder collection, milking, goat rearing, poultry farming, sericulture, sheep rearing, bee keeping etc.

Methodology

Ahmednagar and Solapur districts of Maharashtra State were purposively selected for the present study because of the maximum area under agriculture and allied sectors. Ex-post-facto research design was used for the study. Two tehsils namely Rahuri and Rahata from Ahmednagar district and Malshiras and Pandharpur from Solapur district were purposively selected for the present investigation, as these tehsils have maximum area under agriculture and allied sectors. From each selected tehsil, five villages were selected randomly. Thus a total of 20 villages were selected for the present study. Ten farm women from each village, who were engaged in agricultural activities were randomly selected making a total sample size of 200 farm women. They formed the respondents for the study.

Results and Discussion

Knowledge of farm women regarding various agricultural activities

Knowledge is operationally defined as the awareness gained through the experience of facts, or facts of knowing about something gained through experience. For studying knowledge of respondents, statements were collected

by referring to relevant literature, personal observation in the fields and informal interview with farm women following participatory methods. Knowledge of farm women was studied with reference to eight major concept areas related to activities in agriculture and allied areas.

The opinion of the respondents were elicited on a three point continuum i.e. whether they had complete knowledge, partial knowledge or no knowledge.

The data collected on knowledge of farm women regarding various agricultural activities are presented in Table 1.

Table 1. Distribution of the respondents according to knowledge regarding various agricultural activities

Sr. No.	Recommended technology	Complete knowledge	Partial Knowledge	No knowledge	Mean score	Rank
A	Land preparation				1.11	IV
1	Leveling of field	27 (13.50)	148 (74.00)	25 (12.50)	1.01	
2	Collection of stubbles	153 (76.50)	23 (11.50)	24 (12.00)	1.645	
3	Manure application	13 (06.50)	58 (29.00)	129 (64.50)	0.97	
4	Manure mixing	13 (06.50)	168 (84.00)	19 (09.50)	0.97	
5	Pre sowing irrigation	13 (06.50)	166 (83.00)	21 (10.50)	0.96	
B	Seedbed preparation				0.97	VII
1	Nursery bed preparation	7 (03.50)	27 (13.50)	166 (83.00)	0.205	
2	Application of fertilizer and manure to seedbed	16 (08.00)	166 (83.00)	18 (09.00)	0.99	
3	Seed treatment	8 (04.00)	172 (86.00)	20 (10.00)	0.94	
4	Sowing					
a.	Direct sowing	165 (82.50)	22 (11.00)	13 (06.50)	1.76	
b.	Dibbling	9 (04.50)	169 (84.50)	22 (11.00)	0.935	
c.	Planting	13 (06.50)	173 (86.50)	14 (07.00)	0.995	

Table 1. Contd...

Sr. No.	Recommended technology	Complete knowledge	Partial Knowledge	No knowledge	Mean score	Rank
5	Irrigation					
a.	Surface irrigation	169 (84.50)	15 (07.50)	16 (08.00)	0.995	
b.	Drip irrigation	10 (05.00)	174 (87.00)	16 (08.00)	0.97	
c.	Water application by zari	174 (87.00)	16 (08.00)	10 (05.00)	0.965	
C	Inter cultural operations				1.16	III
1	Gap filling	67 (33.50)	119 (59.50)	14 (07.00)	0.965	
2	Thinning	80 (40.00)	115 (57.50)	5 (02.50)	1	
3	Fertilizer application	14 (07.00)	169 (84.50)	17 (08.50)	0.225	
4	Weeding	174 (87.00)	16 (08.00)	10 (05.00)	1.82	
D	Bird watching	169 (84.50)	21 (10.50)	10 (05.00)	1.795	I
E	Harvesting				1.40	II
1	Cutting of crop	91 (45.50)	94 (47.00)	15 (07.50)	0.98	
2	Picking of pods/fruit/flower	177 (88.50)	13 (06.50)	10 (05.00)	1.835	
F	Post-harvest operation				1.001	VI
1	Threshing	76 (38.00)	108 (54.00)	16 (08.00)	0.95	
2	Winnowing	176 (88.00)	18 (09.00)	6 (03.00)	1.85	
3	Grading	6 (03.00)	25 (12.50)	169 (84.50)	0.185	
4	Packing/Packaging	13 (06.50)	143 (71.50)	44 (22.00)	0.995	
5	Storage	18 (09.00)	139 (69.50)	43 (21.50)	1.025	
G	Marketing	13 (06.50)	145 (72.50)	42 (21.00)	1.005	V
H	Processing	9 (04.50)	12 (06.00)	179 (89.50)	0.15	VIII

(Data in parenthesis indicates percentage)

A. Land preparation

In case of land preparation it was revealed that, 74 per cent of the respondents had partial knowledge about levelling of field, majority (76.50 %) of them had complete knowledge about collection of stubble whereas 64.50 per cent of them had no knowledge about manure application. Eighty four per cent and 83.00 per cent of the farm women had partial knowledge about manure application and pre-sowing irrigation respectively.

B. Seedbed preparation

In case of seedbed preparation it was revealed that, equal percentage of the respondents i.e. 83.00 per cent had no knowledge about nursery bed preparation and partial knowledge about application of fertilizer and manure to seedbed preparation. Majority (86.00%) of the farm women had partial knowledge about seed treatment. With respect to sowing practices 82.50 per cent respondents had complete knowledge about direct sowing, majority (84.50 %) of the respondents had partial knowledge about dibbling while 86.50 per cent of the farm women had partial knowledge of planting operation. In irrigation practices majority (84.50 %) of the farm women had complete knowledge of giving surface irrigation to crops. Around 87.00 per cent of the respondents had partial knowledge about drip irrigation activities and complete knowledge about water application by zari to different crops.

C. Inter-cultural operations

In case of inter-cultural operations it was observed that, majority(59.60 %) of the respondents had partial knowledge about gap filling followed by 33.50 per cent with complete knowledge about gap filling; 57.50 per cent of respondents had partial knowledge about thinning operation followed by 40.00 per cent of the respondents with complete knowledge about thinning operation. The majority (84.50 %) of the respondents had partial knowledge about fertilizer application

whereas 87.00 per cent of the respondents had complete knowledge of weeding operation.

D. Bird watching

In case of bird watching it was observed that, majority(84.50%) of the respondents had complete knowledge about bird watching followed by 10.50 per cent with partial knowledge and 5.00 per cent with no knowledge about bird watching.

E. Harvesting

In case of harvesting it was revealed that, 47.00 per cent of the respondents had partial knowledge about cutting of crops followed by 45.50 per cent with complete knowledge about it. Majority (88.50 %)of the farm women had complete knowledge about picking of pods, fruits and flowers.

F. Post-harvest operations

In case of post-harvest operations it was observed that, 54.00 per cent of the respondents had partial knowledge about threshing operation followed by 38.00 per cent with complete knowledge about it. Majority (88.00 %) of the respondents had complete knowledge about winnowing operation whereas 84.50 per cent of the respondents had no knowledge about grading practice. Majority (71.50 %) of the respondents had partial knowledge about packaging practice whereas 69.50 per cent of the respondents had partial knowledge about storage activity.

G. Marketing

In case of marketing it was observed that, majority (72.50 %) of the respondents had partial knowledge about marketing followed by 21.00 per cent of the respondents with no knowledge and 6.50 per cent of the respondents with complete knowledge about marketing operation.

H. Processing

In case of processing it was observed that, the majority (89.50 %) of the respondents had no knowledge about processing followed by 06.00 per cent of the respondents with partial knowledge and 4.50 per cent of the respondents with complete knowledge about processing operation.

The data in Table 1 further indicates the rank order of knowledge of farm women regarding various agricultural activities. It is arranged in descending order and presented as bird watching (1.79), harvesting (1.40), intercultural operations (1.16), land preparation (1.11), marketing (1.005), post-harvest operations (1.001), seedbed preparation (0.97) and processing (0.15).

It implies that, the knowledge of farm women regarding various agricultural activities was higher in bird watching, harvesting, inter-cultural operations and lower in land preparation activities, marketing, post-harvest operations, seed bed preparation and processing activities.

Table 2. Distribution of the respondents according to the level of knowledge about agricultural activities

Sr. No.	Knowledge of agricultural activities	Number of respondents(200)	Percentage
1	Low (Up to 27)	51	25.50
2	Medium (28 to 31)	143	71.50
3	High (32 and above)	06	03.00
	Total	200	100.00

Mean = 29.08

S.D = 2.38

The data in Table 2 shows that, the majority (71.50 %) of the respondents had medium level of knowledge about various agricultural activities followed by 25.50 per cent of the respondents with low and 3.00 per cent with high level of knowledge.

The above findings are in line with those of Wasim *et al.* (2009), Pandey *et al.* (2010), Singh, B. and Srivastava, S. (2012) and Mishra Palak (2013).

Implications

1. In order to improve women's work efficiency, Government and Extension workers should plan and execute need based training programmes.
2. Ensure coverage for Social Security and legal protection of rural women workforce, particularly women heads of household, given that women in the mentioned region participate in agricultural activities and spend a lot of time, but they do not have any support from government agencies.
3. Efforts should be made to make the males of our society sufficiently open minded to accept the ability of the women in the field of planning and managing, in case of farm related activities.
4. The findings of this study reported that majority of the respondents had medium level of knowledge about agricultural activities and allied sectors. Therefore, there is an urgent need to provide them sufficient knowledge regarding agricultural activities by means of training given by KVKs and NGOs.

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