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Original Research Article

Impacts of Extension Methods on Women Small Scale Farmers Adoption of Conservational Agriculture in Nakuru County, Kenya

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Abstract

This research paper analyzed the impacts of extension methods on adoption of conservation agriculture by women smallholder farmers in Nakuru County. Conventional agricultural practices have had serious effects on food production and biodiversity loss. To address environmental degradation, conservation agriculture (CA) has been proposed to solve food insecurity problem and biodiversity loss. In the study area, 70% of the farmers are women in small scale farming. The adoption of CA by women small scale farmers is very low and there is inadequate research documentation to explain the low adoption of CA. To find out why there is low uptake of CA by women farmers, a sample size of 360 women smallholders from 120, 000 women farmers was taken for survey. Purposive sampling was used for selecting three study sites and simple random sampling was used to select 120 respondents from each study site; Njoro, Naivasha, and Rongai. Descriptive survey design using structured questionnaires; interviews, personal observation and focus group discussion were used to collect data. Statistical Package for Social sciences (SPSS version 20) was used in the data analysis. Descriptive statistics; frequency distributions, means, proportions, percentages and inferential statistics; Chi-square, ANOVA, at alpha value= 0.05 ($p < 0.05$) level were employed to test the hypothesis. The findings concluded that extension methods significantly influenced women farmers' adoption of CA. CA adoption was low and it was found that, some of the extension methods were not effective and not CA oriented. It was recommended that, use of sharing videos, ICT, schools and smart phones use be encouraged to improve effectiveness of extension methods.

Key words: Adoption, Conservation agriculture, Extension methods, Small-scale farmers

INTRODUCTION

In a worrisome and degrading global environment, Conservation Agriculture (CA) has become a better option in mitigating environmental problems due to conventional practices and to create sustainable environment. To increase food production, better standard of living and protect biodiversity appropriate agricultural technology is of great essence and farmers knowledge base enhanced (Derpsch et al., 2011; Marongwe et al., 2011; FAO, 2011). Seline et al, (2014) and Rogers, (2003) have explained processes that lead to successful adoption of new innovation by farmers. Most of the delivery mechanisms of agricultural extension services are available to conventional farmers in many parts of the world but not CA farmers (Tangcalagan et al, 2014). It has been observed that, an innovative approach towards farming is being practiced in India for dissemin-

ating agricultural information. But the farmers facilitated are only resource rich while small and marginal farmers were not able to be part of this extension model from the government efforts (Sigh, 2011).

Conservation agriculture adoption in most parts of the world is low. The widespread distribution of CA indicates that most countries particularly developing ones have not adopted CA on a full scale. The study showed that, the percentage global area under CA are; South America, with 46%, Europe, 5%, North America, 32%, Australia 24%, Asia 5% and Africa less than 1% (Kahimba et al, 2014). This means that, Africa South of Sahara lags behind CA adoption. Only a few countries such as Malawi, Zambia, Zimbabwe, Ghana and Nigeria and Burkina Faso are already embracing CA technologies on a wider scale. The results from CA practices in these countries are yielding good results and more farmers are taking up the innovations to improve their lifestyles (Ngwira, et al, 2014). There are numerous factors both intrinsic (attitudes, perception, knowledge,) and extrinsic (culture, income, religion, size of farms, age, land tenure, education level) influencing farmers adoption of CA technologies (Katelyn, et al, 2016). In Africa, factors such as s, climate change, global warming, loss of soil fertility, diseases, acid rainfall, droughts are significantly affecting farmers efforts to adopt CA technologies., . Efforts to create awareness to farmers on the appropriate technologies to improve the situation has been less received (Pelum, 2013)

Despite all the efforts to improve food production through CA adoption, there is a greater need to educate and equip farmers through various approaches that will enable them accept and implement the technologies towards maximizing food production and at the same time protecting environmental integrity for sustainability of life (Katelyn, 2016). To speed up adoption of CA by farmers, it is essential to develop strong and desirable agricultural extension methods geared towards reaching out to farmers in the most effective and efficient way. Farmers uptake of an innovation depends on extension education method and services such as women to women farmer education contact, Chief Barazas, field days visits, extension agents advice, Radio, TV shows, agricultural shows, reading agricultural materials, ICT, smart phones, sharing videos among others.

Outcomes of farmers' responses to these extension services depend on the quality of deliverables, the contents of the materials, cost, time and the frequency of exposure to the methods (Kassam et al, 2015; Toza, 2016). In India, Sigh (2011) reported that farmers, access information from other progressive farmers, input dealers, mass media, public extension workers, cooperatives, output buyers/processors, Government demonstrations, village fairs, study tours, and private companies. But, the most important sources of information are progressive farmers, input dealers and mass media. Ravinder and Vister (2010) found that, Mobile application plays a key role in fulfilling the agricultural information needs of the farmers as it has many advantages such as easy to access and reach areas where there is no ICT infrastructure like internet, fixed lines or any other communication (Ganesan et al, 2015)

Over the years, Kenya has embraced extension services as a means through which information is passed on to farmers (Kimani et al., 2015). Historically, crop-based or livestock extension services have been advanced through the Ministry of Agriculture. There are now many types of extension service providers, which include commodity-based organizations targeting specific crops like tea, sugar, coffee among others (Yatich et al, 2014). The issue of whether the extension approaches employed have been mindful of the different gender roles and needs is considered in this review (Kingiri and Nderitu 2014). Some of the extension approaches being used in Kenya include; Focal area approach (FAA), common interest group, farmer field schools (FFS), ICTs, farmer-farmer extension, training, value chains, NGOs, Self Help Groups, farmer cooperatives and community groups. Of these, the ones used to reach rural women are mainly targeted courses, farmer Field Schools (FFS). Some of the approaches have been successful while others have weak structures creating less impact on food production (Kingiri and Nderitu, 2014). It has been observed that, a combination of different extension and advisory methods that complement each other yield better results than a single one. It was found that, the nature of extension methods used must be specific to the community being addressed in terms of content and presentation because farmers are sensitive to several factors such as cultural values. Women also require follow-up support on a continuous basis to see any long-term benefits and change factors in realizing food production (Kingiri & Nderitu 2014.

In Nakuru County, Kenya, it has been observed that, extension services are available but are not well structured and their operations lack policy guidelines. Smallholder farmers particularly women are less disadvantaged, due to Government poor agricultural policies and improperly structured extension services targeting them. There is little information and lack of research documentation regarding the impacts of extension methods on women smallholders on CA adoption in the study area (NCR, 2015; Kassam et al., 2015). This study s addressed the impacts of extension methods on adoption of conservation agriculture by women small scale farmers.

Statement of the Problem

There is increase in environmental degradation caused by adoption of poor agricultural methods, lack of clear government policies on agriculture, and ineffective extension methods. This has resulted in environmental

problems such as, low food production and loss of biodiversity among others. Conservation agriculture is a good option to mitigate some of these problems. It is generally believed that women small scale farmers' participation in agricultural extension services and education could enhance the adoption of conservation agriculture. This study examined the impacts of extension methods on CA adoption by women small scale farmers in Nakuru County, Kenya.

Specific Objectives

1. To find out the effects of socioeconomic factors, on adoption of conservation agriculture by women smallholders in Nakuru County, Kenya.
2. To analyze the impact of extension methods, on adoption of conservation agriculture by women smallholders in Nakuru County, Kenya.

METHODOLOGY

The researcher obtained the approval and research permit from NACOSTI. The research permit was presented to the Ministry of agriculture Nakuru County to be given permission to conduct research within the county. The researcher proceeded to the field and reported to the department of agriculture in the three sub-counties Njoro, Rongai and Naivasha where the study was being conducted. The three agricultural officers introduced the researcher to the women self-help groups, and churches where the samples were drawn. The selected self-help groups and churches provided the respondents which formed the study target. The researcher administered the questionnaire with the help of two trained research assistants. Data was collected by use of custom made structured questionnaires, interview schedules and personal observation guides. The questionnaires (appendix1) were used to collect data from the key respondents. Personal observation technique was used to confirm ideas that the respondents had given in the questionnaires and for the researcher to get firsthand information on the type of agricultural practices being undertaken in the study area. It also supplemented the information gathered from the respondents. Interview guides included structured (close ended) and unstructured (open ended). This was essential since it allowed for face to face interactions between the researcher and the respondent in the course of oral discussions. The questions had the following features: several response options hence respondents were able to identify with the preferred response accordingly.

During the tour, the researcher made observations and asked questions using the guide and recorded responses from the respondents. The technique was helpful in clarifying the answers given. The researcher spent forty five minutes in administering questionnaire for each respondent in average while others took at least one hour. The results were check-listed using other information analyzed from literature review and recorded farming practices. The data collected through the questionnaire addressed the specific objective in the study namely effectiveness of extension methods among women farmers in Nakuru County. Focused Group Discussions (FGDs) views were used to confirm or cross check the information obtained through other data collection methods. Data obtained through participant observation acted as a check against participants' subjective, reporting of what they believe and do. Participant observation was useful for gaining an understanding of the physical, social, cultural, and economic contexts in which study participants live. Secondary data was included in the study from publications and official reports. Information from websites was useful to enrich the data.

Validity and Reliability

The instrument was subjected to the right questions in terms of accuracy and meaningfulness based on research results (Mugenda and Mugenda, 2003).

Piloting was used in this study to measure the reliability of the instrument employing split half method. This method was used because it has a major advantage of eliminating chance error caused due to differing test conditions. Cronbach's alpha Coefficient of 0.80 was used to estimate the reliability of the instrument. Different collection methods were used to ensure reliability and validity of the instruments. After piloting, the tools were refined and some of the ambiguous or not clear were excluded in the final questionnaire. This was done after the researcher had discussed with the university academic supervisors. After testing the collection tools and determining their reliability and validity the researcher administered questionnaires to the small scale women farmers. The women farmers selected for the pilot study and the focus group persons were not included in the main study. To select for the sample size, Self-help groups and churches were used and selected by snow ball method. Interview schedules targeting women farmers were administered to self-help groups and church leaders. Three focus group discussions were held in the three sub counties chosen purposively. To improve on the reliability of the research instruments, a pilot study was conducted in Rongai, one of the sub counties of Nakuru County. The researcher practically toured the respondent's farm together with the respondents to make use of the tools concurrently. My university supervisors went through researchers' instrumentation to ensure that they were valid.

The collected data was coded, cleaned and finally

Table 1. Age of the respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
18-25	52	14.4	14.4	14.4
26-35	50	13.9	13.9	28.3
36-45	53	14.7	14.7	43.1
46-55	182	50.6	50.6	93.6
56 and above	23	6.4	6.4	100.0
Total	360	100.0	100.0	

Table 2. Education level of respondents

	Frequency	Percent	Valid Percent
std 1-5	54	15.0	15.0
std 6-8	78	21.7	21.7
some secondary	153	42.5	42.5
Tertiary	75	20.8	20.8
Total	360	100.0	100.0

entered in a computer system using Statistical Package for Social Sciences (SPSS version 20). The target population units analyzed in this study were women farmers (adopters, incomplete adopters and non-adopters) in Nakuru County.

The quantitative data collected was tabulated and analyzed according to their frequency and percentages. The data was analyzed according to the hypotheses stated in the research study. Qualitative analysis involved measure of central tendency (Cross tabulations, proportions, means and percentages). Chi- Square was used because the data were categorical and showing if there would be any relationships between the variables. ANOVA model was used to determine the statistical significance of the means at $p < 0.05$ level and whether to reject or accept null hypotheses. *Post hoc* tests were used to test if the mean differences really existed. Qualitative data was analyzed by determination of patterns and trends from the open ended test items and interviews from respondents. The analyzed data were then presented in tables, graphs and charts.

RESULTS AND DISCUSSIONS

The data was analyzed using SPSS computer system and results presented in tables. The first to be analyzed was the socio economic characteristics of the respondents. This was important for the socio economic variables such age, education level, size of farms, ownership of farms and type of farming affect the outcome of extension methods impact on adoption of CA by women farmers in the study area. The data was also obtained from interviews schedule and focus group discussions and the results discussed. The results showed that, socio economic characteristics of the respondents influenced adoption of CA. From the results, three types of responses emerged; those who adopted CA (adopters) those who did not practice CA (non-adopters) and those who practiced both conventional and CA (incomplete adopters)

The results in Table 1 show that, most of the respondents were younger less than 50 years. Age affects adoption of any innovation. The younger the farmers the more flexible they are in taking an innovation. Older farmers are often sticking to their old methods of farming. The old people are not mobile to attend seminars or training far away from home.

Table 2 shows that most farmers secondary level of education (42%) and above while only 36 % were primary holders. Most farmers in this study area have good education. When farmers are educated, extension methods becomes easier because they can read agricultural materials, go for seminar training and watch TV and listen to Radio programs and use ICT facilities. CA adoption can be effective.

In the study area respondents had small farms. 70% of the respondents had small farms less than 3 ha while 21% had farms above 3 ha. Farmers who adopted CA had small farms. CA if well-structured perform well in small farms. Other studies confirm that CA can do well in small farms Conservation agriculture is better with small farms than large farms (Kimani et al, 2015).

Table 4 shows that most of the respondents owned family land. Land ownership is important for CA practices. Most farmers (57 %) owned land therefore were able to practice CA. Agroforestry can be possible in farms with ownership and may not be practical in rented or borrowed farms because the owners may restrict the use of their farms. Farmers may only invest in their own farms but not rented or borrowed.

Table 3. Farm size of respondents

Size of farm (ha)	Frequency	Percent
< 1.0	79	21.9
1.0-2.5	179	49.7
2.6- 3.5	26	7.2
>3.6	76	21.1
Total	360	100.0

Table 4. Ownership of farms by respondents

		Frequency	Percent	Valid	Percent
Valid	Own	204	57		57
	Rent		27		27
	Borrowed		16		16

Table 5. Types of farming of respondents

	Frequency	Percent
Conventional agriculture	204	56.6
Conservation agriculture	54	15
both	102	28.4
Total	360	100.0

Table 6. Three types of CA adoption response by women farmers

Sr	Indicators	Non adopters	Adopters	Adopters + non adopters	Significance level
		%	%	%	
1	Women to women contact	75	92.6	20.2	.000
2	Extension agents	49	66.7	62	.000
3	NGOs training +support	24.5	92	59	.000
4	Use of chief Barazas	25.5	88.9	59	.048
5	Agricultural Materials reading	37.7	85.2	21	.000
6	Use of Radio	35.3	75.9	58.9	.000
7	Field days visit	25.5	66.7	38	.048
8	Agricultural show visit	25	79.5	58.9	.000
9	Watching agricultural program	37.7	79.6	20.9	.002

Table 5 shows that 204 respondents practiced conventional agriculture, 54 practiced CA and 102 practiced both types of farming. The results mean that, few farmers in the study area fully adopted CA. The adoption of CA is low. It could be that extension methods or other factors may be contributing to the slow uptake of CA.

The second part of the analysis was on the impact of extension methods on adoption of CA by women small scale farmers in the study area. Each of the ten extension methods were analyzed using cross tabulations, means, percentages and inferential statistics analysis using Chi square overall means and ANOVA was done. The results are presented in tables.

The results of Table 6 indicate that, the number of adopters was highest in women who adopted CA and was least in non-adopters category. It can be concluded that, extension methods has significant impact on women farmers on adoption of CA. Out of the ten extension methods, women to women education contacts was most effective with 92.6 % and extension agents and field days were least effective (66.7 %). This means that for

Table 7. Overall mean Effect of Extension Method on Adoption of CA

	N	Mean	Std. Deviation
Conventional	204	3.3809	.29906
CA	27	3.8704	.15396
Both	129	3.4132	.17338
Total	360	3.4292	.28118

ANOVA

Table 8. Overall effect of extension method on adoption of CA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.764	2	2.882	45.490	.000
Within Groups	22.619	357	.063		
Total	28.384	359			

Table 9. Overall Effect of Extension Methods on Adoption of CA.-Post hoc Test

(I) type of farming	(J) type of farming	Mean Difference (I-J)	Std. Error	Sig.
Conventional	CA	-.48949(*)	.05155	.000
	Both	-.03230	.02832	.764
CA	Conventional	.48949(*)	.05155	.000
	Both	.45719(*)	.05327	.000
both	Conventional	.03230	.02832	.764
	CA	-.45719(*)	.05327	.000

*The mean difference is significant at the .05 level.

any innovation to be adopted in agriculture, women to women education contact was the most effective. Farmers trust their own colleagues and for any innovation to be accepted, women leaders or fellow farmer is very important for effective extension methods. For farmers who did not adopt CA, other reasons like age, education level, farm size, or ownership could have played a role. There could be other extension methods that may be more effective than women to women education contact. More research is needed fill this gap.

The overall mean score on the 10 items measuring effect of overall effect of extension method on adoption of CA was determined.

The results in Table 7 indicate that extension methods influenced farmers to adopt CA practices. The overall means was greater for CA than conventional or both users. However to determine whether there was a significant difference in the means, ANOVA was carried out. The results are presented in Table 5

The results in Table 8 shows that there is a significant difference in the means, $F(2,359) = 45.490$, $p < .05$. This indicates that, there is a relationship between extension methods and farmers' adoption of CA practices. Therefore the null hypothesis which stated that, there is no significant relationship between extension methods and adoption of CA was rejected. Extension methods influence adoption of CA.

To determine where the differences in the means existed, *post-hoc* analysis was carried. The results are presented in Table 9.

The findings in Table 9 indicate that there are means differences existed between farmers who adopted CA and conventional as well as those who practice both conventional and CA practices.

Effectiveness of extension methods is statistically significant and influence women farmers' adoption of CA. Extension methods are part of the farming and improves quality and quantity of results in agricultural production function.

DISCUSSIONS

From the findings, 90% of the respondents asserted that, extension methods influence adoption of CA in Nakuru County. 60% of the farmers who did not adopt CA were aware of extension methods but failed to adopt CA. The reason could be the effects of socio economic factors such as age, education level, ownership of farms and size of farms as indicated in the results in tables, 1,2,3,4, and 5. Other studies have found that, education and women to women farmer exchange of agricultural

information are key to adoption of CA (Seline et al, 2014). Extension services are effective only if specific targets are identified and appropriate techniques in a achieving the results are effectively employed. Most of the extension methods mainly target men farmers and their design of implementation ignores women issues. It was also found that, most of the extension agents reach out to male farmers more than female farmers (Kaman, et al, 2015).. Being aware of environmental changes and effectiveness of extension methods are not enough, but how these extension methods are practiced can add value to the farmers. Stakeholders participation and decision making process involving farmers is important in realizing CA adoption. This finding has been supported by others who found that, having a good field officer and/or lead farmer usually made people follow what they were taught (Pelum, 2013). In rural areas, farmers usually rely on other farmers for information. 90% of the farmers often depend on the key leaders input in any new technology in the community Etwire et al 2013). 89% of key leaders and informants interviewed said that women normally rely on women groups or what their leaders say. 45% of the focus group discussions said that only 48% of women act on information from the media such as TV, Radio or newspaper. Most women get information and implement such information through women self-help groups. Therefore women self-help groups are very powerful agents of disseminating information or new technology. From in depth information women are not like men because they do not have time to read agricultural materials or watch TV or listen to radio. Women mostly act on what they see and what happen in other women counterparts. Tangcalagan et al, 2014; Nyangah, 2014; Seline et al, 2014 confirmed these findings. The uptake of CA technology through extension methods depend on the socio economic characteristics of women famers. In this study majority of women were moderately educated, young in age and have own small farms which make them an added advantage in adopting CA practices.

From the findings, over 80% adopters and non-adopters are exposed to more than one extension methods. From the in depth interviews, it was observed that although farmers acknowledge the extension methods services, the services were not regular and unplanned. The extension agents should be increased d to take care of increasing number of farmers. Extension agents should be well trained and knowledgeable of CA practices.

Extension service is an important source of information on climate change as well as adoption options, hence farmers who have contact with extension agents are more likely to be aware of climate change and available adaptation options, and subsequently adopt these options (nNyangah, 2012), 2013). The study further observed that farmer to farmer extension is powerful and gives positive influence on the adoption of ada-ptation technologies in response to climate change which translates to adoption of CA. The effects of interactions on information and learning have always been successful among the farming groups.

Although there is a strong association between extension methods and their influence on farmers' adoption of CA, the problem is the gap between famers and community agents regarding structuring of knowledge of farmers. These findings have confirmed that, there is a fundamental gap between the perspectives framing the knowledge of farmers and those of the service sector/community agents with respect to agricultural production norms and practices (Etwire et al, 2013).

Farmers get discouraged after attending CA training because the successor field officer was not as good as the predecessor. This could have had negative effect on CA adoption. Most training and demonstrations are conducted on chiefs and headmen's farms in the promotion of CA and this discourage women farmers who view the practice as discriminating against them. Nyangah, (2012) confirmed these findings. Some of the agricultural extension staff also explained that some farmers adopted CA because they saw a chief or village headman or lead farmer practicing CA successfully. A few cases where local leadership was less supportive towards CA were also observed. In one of these areas, lead farmers confessed that it was quite difficult to mobilize farmers for CA trainings because most of the farmers seemed to follow the opinion of their local significant persons. These results show that adoption of new innovation takes place in a social context as farmers learn by observing what others were doing. This is consistent with the social learning theory (Bandura, 1977) postulating that, people also learn from each other both in formal and informal ways through observation and influence of significant persons in society.

CONCLUSIONS

The overall mean scores for the ten items showed that they all influence women farmers adoption of CA. Extension methods influence adoption of conservation agriculture by women small scale farmers. Awareness of women to women contacts and NGOs training scored the highest and were most influential on adoption of CA by women farmers. The least influential for adopters was exposure to seminars with 50.05% followed by watching TV programme. In the rural setting very few farmers have TV and seminars are held away from the farms and generally expensive limiting the women farmers attending. For any innovation regarding farming techniques, women to women contacts provide a better extension method in CA adoption. Farmers who adopted CA fully were influenced by extension methods. From Focus group discussions, women farmers were generally influenced by extension methods. There could be other

reasons why non-adopters did not adopt CA. This could have been due to age, education level, size, of farms, equipment costs among others.

Extension methods are very significant in agricultural practices because farmers awareness and in employing the right techniques lies on the agricultural services such as women to women contacts, training by agricultural experts and NGOs support. Other methods like Internet access, smart phones, knowledge in ICT, sharing videos among others were sighted as important and are emerging as new approaches in CA adoption and improving quality and quantity of agricultural production in the study area.

RECOMMENDATIONS

1. Development of more relevant and practical policies to encourage women farmers to adopt conservation agriculture.
2. The NGOs should be made to be transparent and accountable by sharing research information with extension officers and the relevant government ministries for the purposes of developing strategies' to assist women farmers especially small scale farmers.
3. Women small scale farmers seminars and training should be held within close proximity like in schools or market centers so that farmers especially women could attend with little cost. This will minimize cost for travel, meals, hotel charges and time for women who are always busy.
4. Agricultural expert groups should use religious services opportunities to sensitize farmers on CA adoption and its benefits to the farmers and environmental protection.
5. Sharing videos from Access Agriculture are proving useful to farmers and hence should be encouraged to enlighten farmers on better techniques in quality farming.

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