ENHANCING FARMERS' KNOWLEDGE ON CLIMATE SMART AGRICULTURE USING LEARNING VIDEOS IN IREPODUN LGA, KWARA STATE

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ABSTRACT

This paper assessed the climate smart agricultural practices using learning videos in Irepodun LGA, Kwara State, Nigeria using qualitative and quantitative methods in data collection. One hundred and forty-eighty farmers were randomly selected using interview schedule. Also, focus group discussions were conducted with 137 participants. Pairwise comparison was used to evaluate the difference between the proportion of household heads who used the videos to learn and those who did not use the videos. The study revealed that farmers have similar perception of climate change and related impacts in video-villages and in non-video-villages. However, the study revealed farmers' observation of climate change and related impacts are influenced by gender, with men perceiving more climate change and related impacts than women. In non-video villages, few respondents adopted crop rotation, intercropping, crop diversification, and improved short-cycle seed varieties as climate change adaptation strategies. Videos contribute more to the adoption of crop rotation, intercropping and fertilizer application for men than for women. Videos on accounting (managing money) enable more women than men to enhance their cost-benefit evaluation practices for income improvement. During the interviews, women farmers in video-villages were eager to demonstrate their knowledge about cost-benefit evaluation. Furthermore, the yield of sorghum, cassava and maize is higher in video-villages than in non-video-villages. Thus, using videos as an extension tool is suitable for knowledge development and leads to the high adoption of climate-smart agricultural practices for food security.

***Keywords**: Climate change, Climate-smart agriculture, Food security, Innovation, Learning video, Soil fertility management.*

https://dx.doi.org/10.4314/jafs.v20i2.5

INTRODUCTION

Climate change and increased climate variability are emerging challenges facing agriculture globally (Allen *et. al.,* 2018). While climate change impacts on biophysical parameters affecting agriculture and food production are increasingly well understood, the social and gendered impacts of climate change and climate variability remain less well understood (Jost

et al., 2018). There is a multiplicity of efforts underway to climate-proof agricultural production, including through efforts to transition to more "climate-smart agriculture" systems (Lipper *et. al.,* 2018). For instance, the New Partnership for Africa's Development (NEPAD Africa) Africa Climate Smart Agriculture (CSA) Alliance has set a target of 25 million African farmers practicing Climate-Smart Agriculture by 2025. Climate-smart agriculture is defined by the Consultative Group on International Agricultural Research **(**CGIAR's) CCAFS program and others as "agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes greenhouse gases (mitigation), and enhances achievement of national food security and development goals" (Lipper *et al.,* 2018).

Information and knowledge on climate smart agriculture are indispensable for empowering farmers across rural communities in Nigeria. But their access to adequate knowledge, improved technology and other relevant information remains a critical issue since there are not enough extension agents to reach all farmers who would like to receive extension services (Bentley *et. al.,* 2017). In Nigeria, the number of extension agents is insignificant compared to the hundreds of thousands of farmers that they should advise (Ajayi, 2017). There is therefore a limited coverage of extension services across the country and challenges in adapting technological packages to the specific and diverse needs of the communities are critical issues. When relevant agricultural information is available, most of it is published in foreign languages such as French or English and not in the local languages that rural farmers can understand and relate with. Language differences and illiteracy can impede the communication of improved technology unless they are taken into account (Chowdhury *e. al.,* 2018). To overcome the above obstacles, farmer-to-farmer learning video has been promoted as a new method for agricultural extension (Chowdhury *et al.,* 2018). This extension method, which combines visual and verbal communication channels, appears to be an appropriate extension tool for developing countries as this medium is suited for the transmission of skills, information and knowledge (Bentley, 2017). Video allows for the standardisation of information for accurate transmission, in situations where high quality trainers may not be available, and is suitable for low literacy populations when available in local languages. Several studies highlight the potential of training videos to build farmers' capacity for innovation (Chowdhury *et. al.,* 2018; Bentley *et al.,* 2017; Diiro *et al.,* 2017).

Thus, agricultural extension is more effective with the use of training videos which clarify complex agro-ecological principles (Chowdhury *et al.,* 2017).

In order to enhance the knowledge of farmers on climate smart agriculture for ensuring food security, a comprehensive series of five learning videos related to climate change adaptation and resilience, mitigation and productivity impacts were developed by the learning resource unit, training technology department of the Agricultural and Rural Management Training Institute (ARMTI), Ilorin, Nigeria. These videos were produced according to the zooming-in, zooming out method (Diiro *et al.,* 2017) whereby underlying scientific principles of technologies and local innovations are explained by a narrator in easy-to-understand language, interspersed with farmer interviews. In each video at least 2 experienced men and women farmers show and explain various aspects of the techniques. The aim of the videos was to strengthen farmers' capacity to adopt climate smart agricultural practices to enable them have increased crop yield, productivity, and increased resilience against climate change by reducing yield variability. Farmers were not aware of many of the climate smart practices before watching the videos but after watching the videos, they had better understanding of a number of climate smart practices they could engage in on their farm to improve their productivity significantly.

The study therefore sought to assess climate smart agricultural practices using learning videos in Irepodun LGA, Kwara State, Nigeria. Specifically, the study sought to: examine farmers' observation of climate change and related impacts; assess farmers' practices towards sustainable productivity and incomes; and examine farmers' responses to food security under climate change condition.

METHODOLOGY

Irepodun is a Local Government Area in Kwara State, Nigeria. Its headquarters is in the town of Omu-Aran. The local government is located on 8.5381º N, 5.1431º E. It has an area of 737 km^2 and an estimated population of 208,610 (NPC, 2018). The field work involves the selection of four villages (Idofian, Esie, Oko and Ijan-Otun) where the videos had been intensively shown (video villages) in late 2020 and two control villages (Oro and Jimba-oja) where no videos were screened (non-video-villages). Villages were selected based on the preponderance of cereal crop farming and the accessibility of the village. This study included

semi-structured interviews with 148 farmer household heads who participated on a voluntary basis.

The sampled households comprise farmers who had live d all or most of their life in the selected villages, and were able to observe changes in the climate. Household head interviews were combined with focus group discussions (FGD) organised in each selected village to compare information. The FGD group consisted of village heads, women's representatives, village counsellors, youth representatives and other persons involved in agricultural decision-making at the local level. Three FGD were organised with an average of ten farmers in each village. We conducted 14 FGD with 137 participants. All respondents were of age 30 or above and their main economic activity was farming. Key informant interviews were conducted with 26 extension workers, field officers from ARMTI, representatives of institutions and non-government organisations working with farmers in the selected villages. Interviews with extension workers were used to triangulate the information from household interviews and Focus Group Discussions.

Qualitative data were analysed using climate-smart agriculture framework (APM) as developed by Food and Agriculture Organization in 2010. For quantitative data, pairwise comparison was used to evaluate the difference between the proportion of household heads who used the videos to learn and those who did not use the videos. The correlation between video watching and adoption of climate-smart agricultural practices was evaluated with Chi-square tests. This was also performed on a contingency table of gender and climate-smart agricultural practices to evaluate the dependence between these variables. For cereal yields, ANOVA (General Linear Model) was performed to assess the difference between the household types and gender. When significant difference between types of household was found, a Student-Newman and Keuls test (SNK-test) was applied in the R package agricolae. All the statistical analyses were performed using R 3.4.

RESULTS AND DISCUSSION

Socio-demographic Characteristics of the Respondents

Majority of the household heads interviewed were men (60.1%). The result is understandable considering the fact that males are considered to be heads of households in rural Nigeria (Ajayi, 2017). Also, majority of the household heads (44.6%) were between 30 and 40 years

old. This indicates that a significant number of the household heads in the study area are youthful and vibrant, indicating continued and increased agricultural production in the area. The result negates the findings of Alalade *et al.,* (2019) who motioned in their study that farmers in the rural areas are aging with the young ones not interested in taking up the farming profession.

Few of the household heads (14.8%) received basic education (primary school) and 61.5% had no formal education. This shows the importance of making farmers' training materials in their own language, using the spoken rather than the written word. The socio-demographic characteristics of household heads are summarised in Table 2.

Farmers' Observation of Climate Change and Related Impacts

Before embarking on this study, 81% of male-headed households and 32% female-headed household had heard of climate change. The women said that they were unaware of climate change because the agricultural extension services do not always consider them to be farmers and women are left out of the community discussions or meetings organised by the extension workers. In a similar vein, Diiro *et al.,* (2013) reported that women do not benefit from extension programs for farmers in Mali. Furthermore, social norms in most West African countries constrain many women from communicating freely with men who are not from their families. In order to overcome this gender gap in accessing extension services, policy makers must promote the use of videos which facilitate information access to all rural people irrespective or gender or cultural inclinations (Zoundji *et al.,* 2017).

During the interview, all respondents expressed interest in discussing climate variability and wanted to know what strategies they could adopt to increase their ability to cope with the change. However, the following changes in seasons and climate were observed over the past 10-20 years by respondents. The rainy seasons are becoming shorter and the rains start later or end earlier, as reported by most households (72%), followed by increasingly strong winds and higher temperatures, mentioned by 86% of households. Severe droughts are becoming more frequent, as reported by 71% of respondents. Farmers have observed negative impacts of climate, as disaggregated by gender in Figure 1.

Men noticed reduced crop yields and poor livestock health, soil poverty, less water availability, and more pest and disease problems (as the impacts of climate change), while households headed by women noted that cost of living increases, more migration and delayed

marriages. Men paid attention to climate change's impacts on agriculture, while women are more likely to notice social change. There are gendered patterns of impacts of climate change. This may be because in West Africa, many women do not control revenue from agriculture, but they are active in small trade (Diiro *et al.,* 2017). Farmers in the focus group discussions (FGD) identified pest and disease problems (66%), followed by reduced crop yields, poor livestock health (63%) impoverished soil and difficulties of water management (58%). Interviews with extension workers confirmed the men's observations and described declining crop yields, scarcity of water, increased pest and disease problems, deteriorating animal health and others as mainly impacts of climate change on rural development (Zoundji *et al.,* 2017).

Farmers in video-villages and in non-video-villages made similar observations of climate change and its impacts, probably because all the villages are receiving about the same quality and quantity of climate information. Household heads' observations of climate change corroborated focus group responses and confirmed what was described as climate change impacts in the study area. Farmers' must observe climate change before they can sustainably adapt to it (Bentley *et. al.,* 2017).

Farmers' practices towards sustainable productivity and incomes

Farmers use various techniques to adapt to climate change, with differences between video-villages and non-video-villages as shown in Table 3. These coping strategies build on farmers' adaptation and resilience to climate change. In the video-villages, our informants said the most common agricultural adaptation strategies include crop rotation, intercropping, fertiliser application, crop diversification, use of improved short-cycle seed varieties, tree planting and use of shallow planting pits to capture water.

Fertiliser application in shallow planting pits were not mentioned during individual and group discussions in non-video villages. Farmers had no information about this practice, but were willing to learn more about it. Very few respondents had adopted crop rotation, intercropping, crop diversification, improved short-cycle seed varieties and shallow planting pits as climate change adaptation strategies in non-video villages, which received little or no information about these innovations.

Farmers in video-villages were more likely to report easy contact with extension workers who visit the village. Video-villages were more likely to mention other adaptation methods

such as income generating activities, including savings-and-loan activities, and cost-benefit analysis before selling produce. The difference observed in video-villages and non-video-villages was explained by Mrs Bibire, of Ijan-otun village, who said "*learning videos help us to see first-hand a visual, practical and clear demonstration of innovative technology and this has helped us greatly to accepting those technologies as presented in our own local language*". Farmers' adaptation to climate change involves an array of technical and institutional responses, which can be stimulated by local or outside knowledge (FAO, 2018). The "animals and trees for a better crop" videos disseminated by ARMTI inspired farmers to integrate animal production with tree planting helping soil fertility management, off-farm activities etc. These agricultural practices are adaptive responses to climate change. However, some of these practices demand labour. For example, composting with organic matter requires work, especially to build and maintain a compost pit. Nevertheless, the use of manure has proven highly effective as a low-cost CSA practice (Jost *et al.,* 2018).

During the interview, women farmers in particular were eager to demonstrate their experiences with the analysis of cost-benefit evaluation. Some women's groups in the villages of Esie and Jimba-oja have started selling improved cereal seed since farmers' demands of it were increased after watching videos. Farmers usually spend about 3 - 4 USD to travel to a town where they could buy improved seed. So, the knowledge acquired from the videos 'Let's talk money' inspired two women's group to become seed dealers in the village. In 2019, women in Oko village also started to sell improved seed due to the inspiration received from the video they had watched. The development of improved seed trading at the village level reinforces farmers' access to improved technology and can be a strong driver in facilitating the widespread diffusion of new technologies or information for sustainable livelihoods (Dinesh, 2018). This is in line with the findings of Zoundji *et al.,* (2017) who reported that agricultural extension should not only focus on sharing information, but should also engage in development tasks such as facilitating farmers' access to inputs.

Farmer knowledge development of CSA practices is strongly connected to an agricultural extension approach. Unsurprisingly, many farmers acknowledged the results of frequent visits from extension agents in their villages; while in the field, we met several development partners like NGOs, JDPM, ARMTI field officers, which were working intensively with farmer leaders. As explained by Mallam Alimi in Jimba-oja village, *"ARMTI field officers used to come to this village and discussed or worked with our farmer leaders and their*

relatives. We also heard that those NGOs were implementing agricultural projects with farmer leaders". So, most of information or agricultural practices promoted by development partners were not always shared with other farmers. Farmers' access to relevant CSA practices or improved agricultural technology is limited by institutions which exclude many farmers who need agricultural information. In order to overcome this constraint, learning video as an agricultural extension tool may be the best and most cost effective method to reach more farmers and to give a fair chance to anyone who is interested in agriculture (Zoundji *et al.,* 2017).

Table 3 shows that the households who viewed the videos were more likely to adopt climate-smart agricultural practices. In the video-villages, farmers are more likely to crop adopt rotation, intercropping and fertiliser application, and men are more likely to adopt than women. For accounting (cost-benefit evaluation practices), videos enable more women than men to enhance their accounting practices for income improvement.

Farmers' Responses to Food Security under Climate Change Condition

Table 4 shows that innovative practices were used by farmers to increase agricultural productivity and reduce food insecurity in the face of the newly unpredictable climate. Table 4 shows the yield of rice, sorghum and maize, which are high in video-villages and low in non-video villages. Sorghum, rice and maize yields in the video-villages have increased by 12%, 17% and 24% respectively when compared to non-video villages. There is no influence in the increase of the yield between female and male-headed households. Only the type of household (video or non-video) significantly influences cereal yields (Table 4). Increased yields would contribute to food security and improvement of farmers' social and economic status. Among the factors contributing to high productivity of cereal crops are the crop and soil management practices developed by farmers after watching the videos. Farmers recognised the increase of yield and linked it mainly to the adoption of crop rotation and intercropping with fertiliser application using composted manure. Therefore, the increases in yield might be related to the use of videos as an agricultural extension tool, which stimulates and inspires farmers to consider new ideas and apply knowledge in farming. Furthermore, in three out of four video villages, household heads explained that technologies developed in the videos are based on farmers' existing technical knowledge, thereby facilitating the adoption of technology (Bentley *et al.,* 2017). Taking advantage of farmers' existing knowledge to develop a new technology would be a key element to enhance its adoption. Jost *et al.,* (2018)

found that adoption of rippers for conservation tillage to set up seedbeds was higher in villages with experience with draught animals than where farmers used only hand hoes. Using videos as extension tools, which are based on farmers' experiences and combine visual and verbal communication methods is suitable for knowledge development and lead to high adoption of CSA practices.

CONCLUSION

Both men and women are concerned about climate change and use diverse strategies to adapt to it. The most common ones include crop rotation, intercropping, crop diversification, use of improved seed varieties, use of compost, and fertiliser application. For the farmers, it is not merely the information that is important, but also how they acquired it. The study observed that watching the videos played an important role in farmer innovation. Involving farmers in the process of screening videos may encourage them to show videos later, to other community members.

The study observed a significant difference between video villages and others as responses to climate change. Although, one of the videos on "Fighting Striga" were not focused explicitly on CSA technologies, the sustainable practices adopted by farmers did respond to climate change and CSA objectives. By managing Striga, farmers achieve agricultural resilience to climate change which improved agricultural productivity. Farmers attribute increased crop yields to the adoption of the sustainable practices of soil and crop management, contributing to food security under a changing climate. Farmers' practices are considered CSA if they maintained or achieved increases in productivity (FAO, 2018). Agricultural extension services using videos as learning tools proved successful because the learning videos went beyond showing how to use each technology and also explained why they would work. Thus, farmers went beyond just repeating what was shown in videos, and engaged in the learning process and drew lessons from their own experiences. As climate change presents challenges to farmers that demand innovative responses, using learning videos in agricultural extension to communicate climate information will increase farmers' adaptation capacities which are crucial for climate smart agriculture development.

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APPENDICES

Table 1: Data Collection Methods

Study Area (n=26)		Data collection methods		
		Household head Interviews (n = 148)	FGD participant (n = 137)	Ext. workers interviewed
Video-villages	Idofian	28	22	26
	Esie	25	28	
	Oko	29	20	
	Ijan-Otun	15	19	
Non-video villages	Oro	20	23	
	Jimba-oja	31	25	
Total:		**148**	**137**	**26**

Source: Field survey, 2020

Table 2: Socio-demographic Characteristics of the Respondents (n = 148)

	Variables	frequency	Percentages (%)
Age	30 – 40	66	44.6
	41 – 50	49	33.1
	51 – 60	18	12.1
	> 61	15	10.1
Gender	Male	89	60.1
	Female	59	39.9
Education	No formal education	91	61.5
	Primary education	22	14.8
	Secondary education	29	19.6
	Tertiary education	6	4.1

Source: Field Survey, 2020

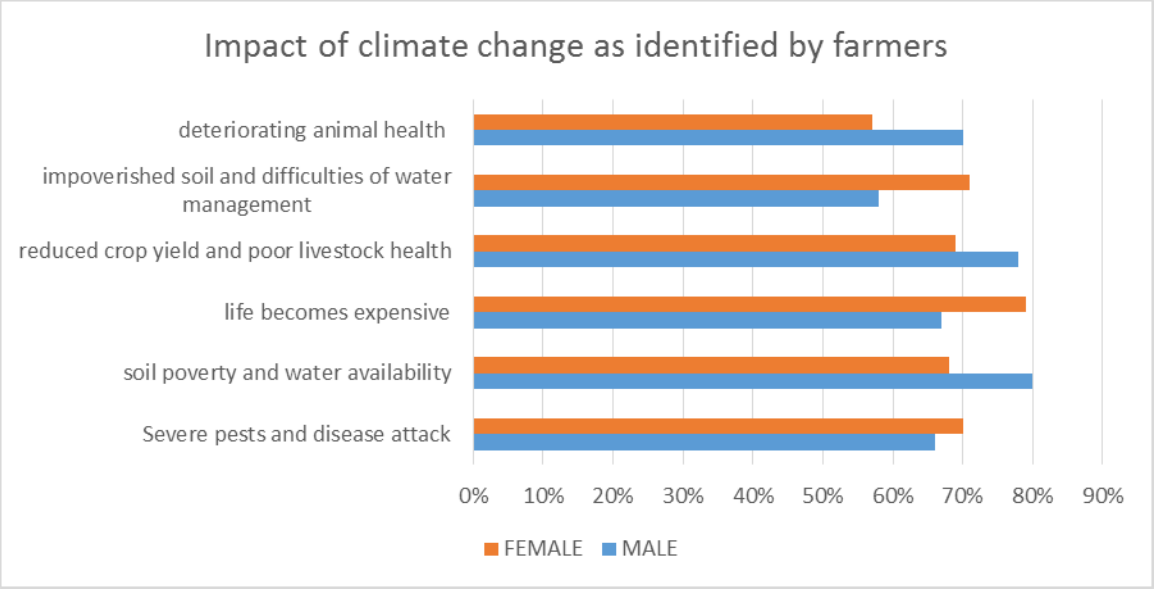

Figure 1: Impact of Climate Change as identified by farmers

Table 3: Farmers' practices towards sustainable productivity and incomes

Categorization	CSA practices	Video villages		Non-video villages	
		Women(%)	Men(%)	Women(%)	Men(%)
Crop and soil Mgt. (X-squared=17.45, df=5, p-value=0.002)	fertilizer application: adding compost, manure or micro-doses of mineral fertilizer	31	69	0	0
	Crop rotation combined with Intercropping	31	69	16	38
	Crop diversification	22	72.6	9.2	41.5
	Tree planting	16.4	59.7	6.7	43.4
	Use of improved seeds	11.2	56.9	4.4	19.1
Social learning (X-squared=0.91, df=1, p-value=0.312)	Easy contact with ext. agents	19	68.4	0	43.6
	more community meetings for knowledge exchange	7.7	62.3	2.2	34.2
Income generating Activities for empow-erment (X-squared= 12.9, df=1,p-value= 0.001)	Farmers engage in savings	34.3	3.1	18.7	2.9
	Use of accounting knowledge to analyze cost & benefits before selling products	19.8	35.7	18.5	13.1

Table 4: Farmers' estimation of crop yield (kg/ha) for growing season 2020

Crops	Video villages			Non-video villages			Mann-Whitney
	Mean	CV (%)	Median	Mean	CV (%)	Median	
Rice	2423.2±22.5	8.33	2450	2125±21.2	5.88	2165	245.2***
Sorghum	1788.3±9.9	9.24	1236	875±16.2	12.45	840	419***
Maize	1122.4±9.90	8.57	1036	799±15.6	12.28	720	96***

*** Significant at 0.001