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COMPARATIVE ANALYSIS OF VIDEO MEDIATED LEARNING AND FARMER FIELD SCHOOL APPROACH ON ADOPTION OF STRIGA CONTROL TECHNOLOGIES IN WESTERN KENYA

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A B S T R A C T

Video Mediated Learning is currently promoted as a communication approach to disseminate agricultural information. Since it is an emerging tool, an evaluation to reveal effectiveness is crucial. Farmer Field School(FFS) is one of the most active extension methods used in Kenya and this study sought to compare and provide evidence on the effectiveness of video Mediated Learning. Rachuonyo Sub-County was purposively selected where a sample of 119 maize farmers selected through Systematic random sampling. Three farmer groups were established then trained on Striga weed management using video, FFS and a combination of video and FFS approaches. A survey was conducted to assess the implementation of disseminated Striga control technologies on farmers' fields. Results indicated that a combination of Video Mediated Learning and FFS greatly influenced farmers to implement Striga control technologies at 46.2%, 42.5% for video alone and 35% for FFS. Regression analysis revealed that socio-economic factors had little influence on uptake of agricultural messages. From the results, Video Mediated Learning alone could be better than FFS. However, efforts to promote learning and dissemination of' agricultural messages should target the use of combination of video and FFS to scale up uptake as the two approaches complement each other.

Keywords: Striga, Video Mediated Learning, Adoption, Farmer Field Schools, Kenya.

INTRODUCTION

Maize is one of the most important cereal crops grown in Kenya. It is considered as a principal staple food in Kenya. Usually, its consumption is greatly complemented by wheat and rice while sorghum and millet remain substitutes (Nzuma, 2008). However, its production faces a number of challenges that hamper increase in yields for present and future needs. For instance, small scale farmers in western Kenya face a problem of infestation by Striga hermonthica (Nambafu *et al*., 2014). According to Esilaba (2006), farms infested by striga weed usually experience yield losses ranging from 65% to 100% depending on the level of infestation; hence a coping strategy is urgent need.

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Research conducted over several years has led to development of striga control technologies such as push pull, Imazapyr resistant maize (IR), and herbicides among others. However, there is low uptake of these technologies among maize farmers who prefer using traditional striga control strategies such as uprooting and weeding (Nambafu *et al*., 2014). As a result, volumes of maize produced and supplied cannot meet the market demand. The low adoption has been attributed to the conventional extension approaches embraced to spread messages on technologies (Murage *et al*., 2012). Some of these approaches are not working out as they are overstretched due to limited resources (Albert *et al*., 2014). In addition, the ratio between extension officer to farmers is low as it stands at 1:1,500 in Kenya (Africa Science News Saturday, 16 November 2013), while other countries like Uganda the ratio stands at 1:2500 against the FAO recommended ratio of 1:400 (Cristina & Caitlin, 2013). This scenario depicts low coverage of extension services in third world Countries; included Kenya.

To bridge the above gap, agricultural extension sector in the third world countries is currently seeking faster and appropriate approaches to improve diffusion and adoption of various technologies through dissemination of appropriate knowledge and information (Bentley *et al.,* 2015). One promising area is development in Information Communication Technologies (ICT) that presents incredible opportunities for farmers education. According to Asenso & Mekonnen (2012), ICT tools such as radio, television, videos can be used to share agricultural information in multiple formats to meet information needs of the farmers.

Video Mediated Learning is an emerging communication approach that is currently being promoted as a alternative dissemination pathway in agricultural extension sector. The farmer to farmer video is made in a manner to support cross-cultural learning (Bentley & Van Mele (2011), Farmer learning is critical in fostering agricultural productivity through provision of knowledge and information. Available platforms for video integration in Kenya include laptop project which is believed to empower Kenyan people including farmers to be competitive globally for decades to come, the introduction of digital content in education sector, the rural electrification programmes that aim at promoting electricity access among rural people and lastly high rate of mobile phone technologies penetration, which is 80.% with 32.8 million Kenyans possess mobile phone and about 22.3 million Kenyans using internet (Communication Authority of Kenya, 2014).

Previous studies have revealed that using agricultural videos increase training quality (Van Mele, 2011) and they can also be very persuasive (Lie & Mandler, 2009). This technology combines pictures and words in motion. Learning takes place through seeing and hearing. It is believed that when both seeing and hearing senses are engaged, farmers can learn better and acquire knowledge faster. This is due to the fact that images and words in motion tend to appeal to visual and audio senses respectively (Bentley *et al.,* 2014). Besides this, agricultural training videos focus on farmers themselves within their local context. Farmer to farmer training videos therefore, leverage conditions to enable farmers to talk to each other as they share their farming experience (Gandhi *et al*., 2009). A scenario similar to FFS.

Farmer Field Schools (FFS) are practical-based, which involves farmer group discussions on a particular topic followed by on-farm experimentations is a discovery learning that benefit farmers who attend (David & Asamoah, 2011). FFS participants usually learn by doing and criticize some of the group findings. The FFS graduates therefore, tend to have an in-depth understanding of the technologies learnt. In addition, FFS has been found to convey complicated agricultural information (Bentley *et al.,* 2015). This implies that both Video Mediated Learning and FFS are powerful communication pathways for sharing knowledge and information. Past study by Asenso & Mekonnen (2012), has identified knowledge and information as prime drivers of socio-economic development in the world. Knowledge triggers action, which involves decision to uptake various striga control technologies disseminated.

However, efficiency of FFS has been low due to limited resources including man-power. This situation is seen as a barrier for enhancing effective learning and subsequently, the uptake of agricultural information (Tripp *et al.,* 2005). In addition, previous studies have shown that only poor-resource farmers participate in FFS activities as wealthier farmers perceive such activities as a waste of time (Davis, 2010). When FFS activities are captured by village elites, learning process may exclude disadvantaged households (Kamanga, 2011). Past studies by Waddington *et al.* (2014) also depicted inability of FFS graduates to successfully share knowledge gained with other farmers to foster adoption. A situation which is similar to Video Mediated Learning.

According to Karubanga *et al.* (2016), Video Mediated Learning cannot stand alone in both knowledge acquisition and application. Access to agricultural videos by rural farmers also remains a big challenge (Okry et al., 2014). Most rural farmers in third world counties like Kenya have little access to source of power and possess ordinary mobile phones without internet and memory card features; a fact which affects visualizations of the farmer-to-farmer video (Zossou *et al*., 2009). Further, lack of adequate access to video related accessories in most rural areas make it difficult for famers to embrace Video Mediated Learning (Zoundji *et al*., 2016).

Nevertheless, Video Mediated Learning features only participation of familiar farmers, content is localized to improve the spread of agricultural messages and reduce the agricultural expert support required for each farmer Gandhi *et al.,* (2009); features that prompted this study.

Information was therefore gathered to find out farmers perspectives regarding their experiences with FFS and Video Mediated Learning, the rate at which farmers were influenced to adopt striga control technologies disseminated using the two approaches and the influence of farmer socio-economic factors on adoption. The focus of study was to provide evidence whether Video Mediated Learning could be an alternative effective communication pathway for disseminating agricultural information.

METHODOLOGY

Study Area: The study was conducted in Rachuonyo South Sub-county of Homa-Bay County, Kenya. The county was purposively selected because it is one of the regions highly infested by striga weed resulting in huge yield losses. The area covers a total of 509.75km square, and divided into two divisions namely Kasipul and Kabondo. It was curved out from the former Rachuonyo district which lies between longitudes 34˚25 and 35˚0 East and latitudes 0˚15 and 0˚45 south. Its altitude ranges from 1,135m above sea level to about 1300m above sea level and rivers drain in Lake Victoria river basin. The main food crops grown include maize, beans, sweet potatoes, not; sorghum and vegetables. Farmers in this area have small farm sizes averaging at two acres per households. The soil is deep, well-drained and relatively fertile. Agriculture is the main economic activity, however, people also engage in lumbering, mining and transportation as the area is served with tarmacked road (County Government of Homa-Bay, 2013).

Sampling Procedure and Data Collection: The study adopted a quasi-experimental in which participants were assigned to experimental groups based on the village where they reside. A multistage sampling procedure was employed to divide the sub-county into smaller admintrative units. This was due to fact that multistage sampling procedure facilitates sequential sampling across two or more hierarchical levels (Cochran, 1977). To achieve this, area administrators were contacted with the help of experienced extension officers where the sub-county was first divided into divisions, then to locations and finally villages. Ten villages were out of 50 villages randomly selected using random number table.

In order to arrive at a specific respondent, a list of registered maize growing farmers from the department of Social services was drawn with the help of local administration (area agricultural extension officers) from Oyugis Integrated Project (OIP), a local NGO that works to uplift the livelihood of people within the sub-county. A total of 173 farmers who were on the list and work closely with OIP formed a sampling frame. Using a simplified formula for proportion by Yamane (1967), a sample size of 120 households was obtained from the list of 173 farmers. Random sampling technique was then employed to select the respondents. The first 120 farmers on the list were selected because the sampling interval (K) was one (1). With the assistance from two extension officers the selected farmers were put into three experimental groups as outlined in Table 1. These extension officers further assisted in identifying learning sites and conducted actual training. The groups differed from each other based on the method of training they received. Each group had forty (40) farmers. Also, they were far apart to avoid exchange of ideas among themselves.

Table 1. Study Experimental design.

Training method	Cluster	Order of training components	Facilitators
Video Mediated Learning	Ringa	1. Video watching 2. Farmer group discussion	Extension officer from OIP
Farmer Field School	Kodera	1.Facilitation and discussion 2. Field demonstrations	Extension officer from ICIPE
A combination of Video and FFS	Mirondo	1.Video watching 2. Facilitation and discussion 3. Field demonstrations	Extension officers from OIP and ICIPE

The first group of farmers from Ringa cluster watched video clips on striga control technologies with low intensity of discussion. A series of ten video clips entitled 'Fighting Striga' was obtained from Access Agriculture (http://www.accessagriculture.org). These clips included (i) Striga Biology which explains how the weed develops from tiny seeds, not from the roots, as many people think.(ii) Integrated approach against striga, which combines manure application, hand pulling, fertilizer application among others (iii) Composting to beat striga which gives tips on making compost from manure and crop residues, especially in an arid conditions. (iv) Micro-dosing which involves application of smaller amounts of fertilizer to the base of the plant, instead of spreading it over the whole field to improve yields and at the same time saves money.(v) Let's talk money; a clip which shows a brief view of costs and benefits under farmer practice and integrated Striga and soil fertility management.(vi) Succeed with seeds; describes how to test crop varieties to find the ones that are the most resistant to striga and adapted to farmers' real conditions. (Vii) Joining hands against striga; a clip which emphasizes team work to beat striga. Other clips were; Animals and trees for a better crop, Grow row by row which talks about intercropping and crop rotation with legumes to improve soil fertility.

The second group of farmers from Kodera cluster was subjected to striga control technologies under FFS lectures and demonstrations. The extension officers first presented the theory underlying the training topic, which was followed by field demonstrations where technologies such as push-pull, intercropping were practically shown in farmers' field. Other striga control technologies presented within the FFS class included crop rotation, fertilizer application, weeding, uprooting and compost manure application.

While the last group of farmers from Mirondo cluster were trained via a combination of Video and FFS methods. This group was shown a series of ten video clips, each clip of 5-8 minutes on striga control technologies, the same as discussed in the first group (video alone group). They were then taken through a series of FFS lectures on striga weed management which was closely followed by field demonstrations on technologies such as push-pull, intercropping and manure application.

Close to five months after training, (June to November, 2016), a survey was carried out to assess the implementation of disseminated striga control technologies among the project participants. Primary data were collected using semi-structured pre-tested questions administered through interview guide to enable clarification and probing of the respondent for accurate answers. Pre-testing was done by interviewing 60 selected farmers, 20 from each group by the help of Enumerators. Questions captured farmer socio-economic characteristics, access to extension services and adoption rates. However, one interview guide from a combination of video and FFS group was incomplete; data were then obtained from 119 farmers who successfully completed interviews.

The collected data were then subjected to descriptive statistic and binary regression analysis to determine factors that influence the uptake of striga management technologies disseminated during training process.

The binary logistic regression model can be expressed as in Equation (1) below:

$Y = \beta o + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots\ldots \beta\, nXn + \varepsilon$ equation1

Where: Y= uptake of striga management technologies βs are the estimated coefficients, X is a row of independent(explanatory) variables such as age, gender, land size, level of education, group membership, and is β the allowable error term.

RESULTS AND DISCUSION

Socio-economic characteristics of the respondents: Data depicted in Table 2 revealed that about 37% of respondents were in age bracket of 31-40 years, 31% were in age bracket of 41-50 years, and 18.5% were in the age between 51-60 years while only 2.5% were in the age bracket of more than 61 years. Females constituted 80% and male 20% of total sample. All men surveyed were heads of household; however, only 48.7% women were found to be heads of household. A majority of the respondents (63.9%) had primary education, followed by 31.1% attaining secondary education, 3.3% tertiary level of education while 1.7% had no formal education. From the results, most farmers had only attained primary level education. This implies that majority of the respondents could not understand some difficult terminologies used during both FFS and video trainings. In such situation, video participants only engaged their visual senses while FFS counterparts capitalized on group discussions and follow ups in order to learn and comprehend messages. In line of this, Karubanga *et al.*(2016) noted that the visual element and group discussions usually allow lowly educated farmers to acquire practical skills and relate with what they do in their own situations hence improves their understanding. The average household size was five.

In terms of land ownership, a majority of the farmers (86.5%) owned land on individual tenure basis. This was followed by leasehold 12.7% and communal (0.8%).

More than 84% farmers had less than two (2) acres piece of land, implying majority were small scale farmers. On farmer associations, this study revealed that over 80% of the total farmers belonged to various social groups such as Ondiko welfare group, Kisindi farmers associations and Miwongo women group among others. The study also found that over 90% of the respondents purely depended on agriculture as source of their livelihood. Further, the results indicated that almost half of the respondents (47.8%) were having access to the agricultural extension services. Majority (over 80%) of the respondents had been engrossed in maize farming for over ten years. This implies that these farmers had enough experience and were able to recognize the importance of striga control technologies and their embedded benefits. The study results therefore gave credence to the earlier findings by Ajayi *et al.,* (2007) who reported that majority (84 %) of rural farmers have farming experience of up to 30 years.

Table 2. Socio-economic characteristics of the respondents.

Characteristics		Percentage			Total (%)
		Ringa	Kodera	Mirondo	n=119
		n=40	n=40	n=39	n=119
Age	21-30	5.9	1.7	3.4	11
	31-40	15.1	10.9	10.9	36.9
	41-50	10.1	12.6	8.4	31.1
	51-60	5	5.9	7.6	18.5
	>61	0	1.7	1.7	2.4
Gender	Male	5.9	9.2	5	20.1
	Female	27.7	24.5	27.7	79.9
Education level	None	0	1.7	0	1.7
	Primary	20.2	25.2	18.5	63.9
	Secondary	10.9	5.9	14.3	31.1
	Tertiary	2.5	0.8	0	3.3
	University	0	0	0	0
Farming experience	1-3 years	0	0	0	0
	3-5 years	1.7	0.8	0	2.5
	5-10 years	3.4	5.9	4.2	13.5
	Over 10 years	24.5	29.4	30.1	84
Land tenure system	Individual	29.4	31.9	25.2	86.5
	Leasehold	3.4	1.7	7.6	12.7
	Communal	0	0	0	0.8
Land size	<2 acres	26.9	30.3	27.7	84.9
	2 to 5 acres	4.2	2.5	5	11.7
	5 to 10 acres	2.5	0.8	0	3.4
	over 10	0	0	0	0
Group Membership	Yes	28.6	25.2	28.6	82.2
	No	5	8.4	4.2	17.6
Source of income	Agriculture	30.3	28.6	31.6	90
	Business	2.5	4.2	1.7	8.4
	Employment	0.8	0	0.8	1.6
Access to extension	Public sector	3.4	2.5	1.6	7.5
Services (if Yes)	Private sector	15.1	13.4	11.8	40.3

Implementation of Striga Control Technologies Disseminated: On uptake, the study revealed that 42.5% farmers who participated in video trainings put into use hand pulling, compost manure, intercropping, push- pull, inorganic fertilizer and IR- maize technologies. On average, 51% of video participants adopted hand pulling technology, 21% compost manure, 7% inorganic fertilizers, 5% weeding, 3% intercropping, 5% push-pull, 2% crop rotation and 2.5% IR- maize as indicated in (Figure 1). Interestingly, the intensity of uptake was low than expected. However, more than half (over 50%) of those who had not implemented such technologies noted that they were in the process of adoption while others claimed lack of reliable weather as it delayed to rain.

In regard to FFS approach, this study revealed 35% of FFS participants adopted striga control technologies such as use of inorganic fertilizers, compost manure application, push-pull, use of IR-maize uprooting among others. Averagely, the study revealed that 47.5% of the respondents who participated in FFS training adopted hand pulling, 16% compost manure, 3% inorganic manure, 6% weeding, 5% intercropping, 5% crop rotation, 5% IR-maize and 10% push- pull as shown in (Figure 1).

Nevertheless, 46.1% of a combination of video plus FFS participants were found implementing striga control technologies such as push-pull, manure application, intercropping, uprooting and inorganic fertilizers. Further, the results showed that 40% of the respondents who received a combination of video plus FFS trainings adopted hand pulling, 27.5% compost manure, 5% inorganic manure, 2.5% weeding, 7.5% intercropping, and 7.5% crop rotation 0% IR-maize and 10% push- pull (Figure 1).

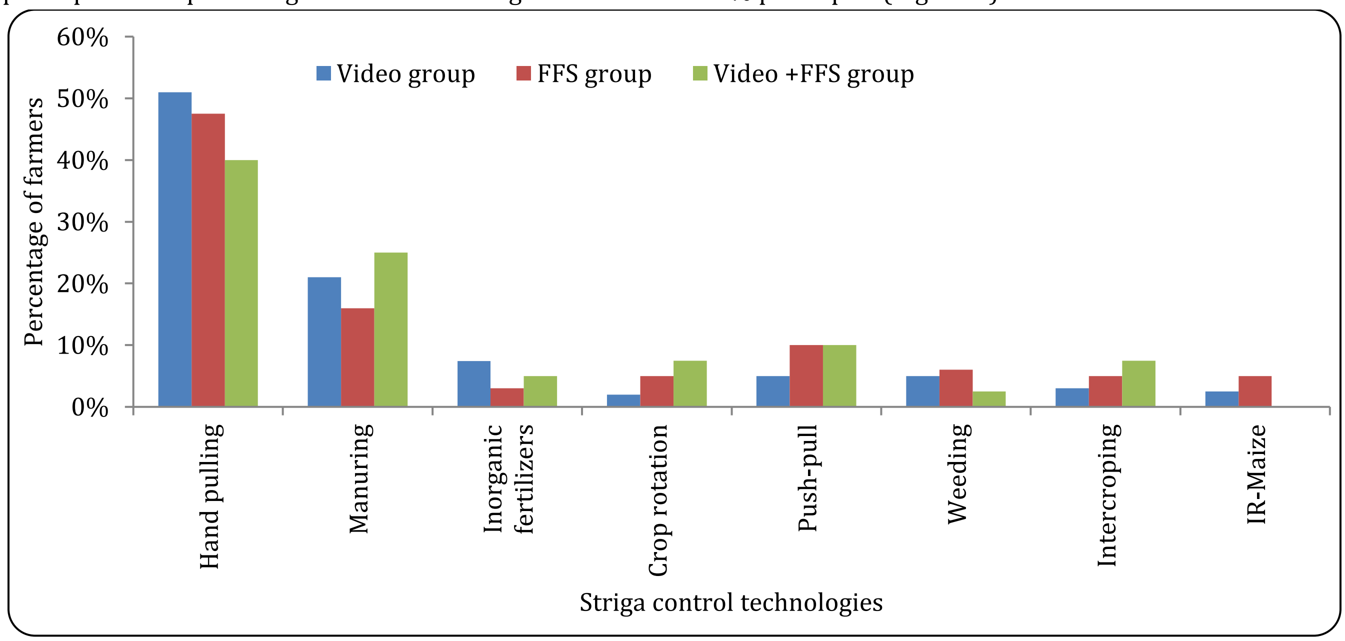

Figure 1. Various striga control technologies adopted by farmers (n=119).

From the results, there was relatively high percentage of respondents implementing striga control technologies disseminated through Video Mediated Learning as compared to FFS participants. This means that a farmer who watched agricultural videos had higher probability to implement striga control technologies disseminated without on-farm trials. This finding was consistent with earlier studies by Zossou *et al.* (2009) which found higher adoption rate among video participants compared to farmers who attended workshop training. The fact that Video Mediated Learning approach had the highest impact on possibility of farmers implementing technologies learnt could be attributed to video's persuasive nature and stimulating power. In a related study by Bentley *et al.* (2015), they noted that quality agricultural videos are more convincing as they boost farmers' self-confidence and improve understanding on farming practices and associated skills. However, these findings contradict assertion by Rogers (1983) that interpersonal channels (personal, face-to-face contacts) are more important at the persuasion stage of decision making process to uptake various innovations. Also, it contradicts earlier findings by Rickeck *et al.* (2008) who found that FFS demonstrations had the highest impact in influencing uptake of Integrated Pest Management (IPM) approaches compared with media sources such as videos.

When Video Mediated Learning is combined with FFS approach, farmers become greatly influenced to adopt disseminated technologies. This implies that Video Mediated Learning combined with face to face instructions by extension officers could be better in enhancing knowledge acquisition and subsequent uptake of agricultural technologies. Past study by Karubanga *et al.* (2016), has also underscored the fact that knowledge sharing and application among farmers can be improved when Video Mediated Learning and FFS approaches are combined together. However, in such cases, quantifying the actual impact and magnitude of individual extension approach in promoting adoption becomes difficult (Murage *et al*., 2012).

The influence of farmer socio-economic characteristics on adoption of striga control technologies: The study sought to find out the influence of farmer socio-economic factors on adoption of striga control technologies disseminated. The result obtained from binary regression model explained 73% and 75% of the variations in the likelihood of farmers, uptake various video and FFS messages respectively (Table 4). Age and level of education was found to be highly correlated when the two variables were included in the model at the same time; measuring individual influence on uptake was difficult. In this regard, we chose to drop level of education as it was insignificant.

From Table 4, the gender of the household head significantly contributed to uptake of video, FFS messages at p=0.073 and at p=0.026 respectively. The result implies that there was higher probability of uptake of video messages if the respondent was a female. This finding was not puzzling as in most developing Countries; rural women are believed to be largely involved in on-farm activities. Women provide labor during production, processing, storage and even do the marketing of the farm output. The study findings therefore corroborate with earlier findings by Oyugi *et al.* (2014) who reported that most women in rural areas are involved in production of food crops. The difference in adoption rate between women and men could be ascribed to the fact that, more males prefer gathering at various centres politicking as some move to urban areas for white collar jobs. Past studies by Onoja *et al.* (2012), have also reported a higher probability of female farmers adopting various fish practices than male headed households.

Table 4. Factors that influence farmers' uptake of striga control technologies disseminated.

	Ringa group (Video alone)		Kodera group (FFS)		Mirondo (VML +FFS)	
Variable	Coefficients	P-values	Coefficients	p-values	Coefficients	P-values
Age	-2.361	0.096	-1.481	0.069	1.52	0.085
Gender	-2.953	0.073	4.169	0.026	-2.015	0.988
Household size	1.609	0.212	-2.607	0.160	1.021	0.345
Land size	2.894	0.055	1.765	0.069	2.034	0.020
Group membership	2.307	0.083	4.632	0.081	1.175	0.064
Constant	6.551	0.185	0.185	0.956	4.148	0.030
-2 Log likelihood=23.042*			-2Logikelihood=20.066*		-2 Log likelihood=24.46*	
Cox & Snell R2=0.545			Cox & Snell R^2=0.548		Cox &Snell R^2=0.486	
Nagelkerke R=.732			Nagelkerke R=.754		Nagelkerke R=.695	
Probability>Chi2=0.000,			Probability>Chi^2=0.000,		Probability>Chi^2=0.000,	
Number of observations= 40			Number of observations= 40		Number of observations= 39	

Age of the respondents influenced the uptake of the messages disseminated at (p=0.096), (p=0.069) and (p= 0.085) for video alone, FFS and a combination of video and FFS respectively. This implies that probability of younger farmers getting exposed and adopting both video and FFS messages was higher compared to their older counterparts. According to Nambafu *et al.* (2014), young farmers are currently getting more involved in farming activities and have better understanding of the emerging agricultural technologies. This promoted faster diffusion of striga control technologies leading to enhanced decision making towards uptake of such technologies.

Land size positively and significantly contributed to uptake of both video mediated learning, FFS and a combination of video and FFS massages at (p=0.055), (p=0.069) and (p=0.020) respectively. Farmers with large tracks of land were more likely to uptake various technologies due to perceived benefits attached to them. However, smallholder farmers only put into use labour intensive technologies such as uprooting due to readily available family labour (Mwangi *et al.,* 2014). A study by Simtowe *et al.* (2012) also reported a significant relationship between farm size and adoption of improved technology and stated that there was a positive correlation between farm size and adoption of improved technology.

Membership to a farmer group significantly and positively influenced the farmers' ability to uptake of video mediated learning, FFS and a combination of Video Mediated Learning and FFS massages at (p=0.083), (p=0.081) and (p=0.064) respectively. This could be due to the fact that farmer groups offered alternative learning grounds and encouraged networking amongst farmers. The finding confirms the importance of farmers' social networks in sharing agricultural information and knowledge (Gueye, 2009). Group membership was also reported to have significant and positive influence at (p= 0.027) on adoption of IR-maize technology (Mwangi *et al.,* 2014). However, a study by Murage *et al.* (2012), contradicts these findings by arguing that, farmers who belong to social groups might take longer time to uptake striga control technologies (push pull) than non-members due to negative attitude that may arise from some group members.

In short, farmer socio-demographic factors such as age, gender, household size did not contribute much to uptake of video mediated learning, FFS and a combination of video mediated and FFS messages. These study results therefore corroborate with earlier findings by Langyintuo & Mungoma (2008), which revealed that some farmer's characteristics only affect uptake of emerging technologies to some degree. Meaning, source of information whether Video Mediated Learning or FFS or a combination of the two played a greater role in influencing uptake of various technologies disseminated rather than the demographic characteristic of the farmer.

CONCLUSION AND RECOMMENDATIONS

The emergence of Video Mediated Learning offers a new platform and new opportunities for acquiring and disseminating agricultural information. This study aimed at providing evidence on the effectiveness of Video Mediated Learning (VML) in disseminating agricultural information. Study results have revealed that Video Mediated Learning approach had a greater influence on the uptake of striga control technologies disseminated than FFS. This clearly shows that Video Mediated Learning should be considered as alternative effective communication approach to FFS in enhancing the farmers' learning and capability to uptake new agricultural innovations. Further, study results have demonstrated that a combination of video and FFS approach is better and can be used in order to utilize each approach individual advantages for effective learning as the two approaches complement one another at various stages of knowledge sharing and application.

Study further concludes that source of agricultural information rather than farmers' personal and socio-economic characteristics is key in maximizing uptake of new agricultural interventions. Hence, need to create and increase farmers' awareness on Video Mediated Learning in agricultural extension. This can be done through more video screenings across various crop and livestock value-chains.

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