RESEARCH ARTICLE

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The nexus between information sources, gender and adoption of fall armyworm management practices in Southern Ghana

Ebenezer NGISSAH[1]

[1] Knowledge Technology and Innovation Chairgroup Wageningen University and Research, Netherlands

Abstract

The impact of Fall Army Worm (FAW) infestation on the livelihood outcomes of farmers in Africa is an issue of critical concern. Specificities of information sources and their efficacy in the management of Fall Armyworm remain crucial. Yet still, the nexus between farmers' information sources and the management of Fall Armyworm appears scarce in the related literature pertaining to the global south. This article answers the research question: What is the relationship between specific information sources and the management practices of Fall Army Worm in Ghana? Using cross-sectional data on 340 smallholder farmers, the findings showed that information derived from peer farmers, Agricultural extension officers, and the media related to the adoption of fall armyworm management practices. Additionally, information from agricultural extension agents has a significant relationship with the use of pesticides, handpicking, and frequent weeding. Generally, the majority (97%) of smallholder farmers remained aware of the presence of FAW and had been negatively affected. We recommend that peer-to-peer extension be harnessed and scaled up in the dissemination of useful agricultural information given the shortfall in adequate agricultural extension officers in Ghana and most countries in Sub-Saharan Africa.

Keywords: Fall Armyworm, Information sources, Management practices, Gender, Ghana

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Corresponding Author:

Ebenezer NGISSAH

E-mail: ngissahebenezer23@gmail.com

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INTRODUCTION

This article addresses the research question: what is the relationship between information sources and the management practices relating to FAW? We premise this question within the context of maize farmers in southern Ghana. In Sub-Saharan Africa (SSA), maize remains the leading and most widely grown staple food crop. It serves as a food source and a secured livelihood for over 208 million people, covering over 36 million hectares of land (Macauley, 2015). In Ghana, maize constitutes a vital staple crop, accounting for half of the cereal production, and it is grown in all agroecological zones (Acquah et al., 2020). However, Ghana's maize yield (1.95Mt/ha) falls below the expected (5.5Mt/ha) (FAOSTAT, 2022.). Deutsch et al. (2018) attributed the destruction caused by insect pests as a significant cause of low maize production. Koffi et al. (2020) indicated that the FAW (Spodoptera frugiperda) constitutes one of the most destructive insect pests. For instance, The Center for Agricultural and Bioscience International (CABI)) in 2017 indicated losses of about 22% - 65% and 25%- 50% were recorded in Ghana and Zambia. In 2018, the value of maize loss resulting from FAW infestation in Ghana was extrapolated to USD 177 million (Day et al., 2017; Kansiime et al., 2019). That same year, the Government of Ghana spent over GHC 15 million (USD 1.2 million)

in various attempts to curb FAW infestation. Its destruction in Africa was initially reported in Benin, Nigeria, Togo, and the island of Sao Tome in 2016 (Goergen et al., 2016). Between 2016 and 2018, the FAW spread to 44 African countries, including Ghana (Longari, 2019). The spread and destruction caused by the FAW have rendered millions of subsistence farmers food insecure and continue to threaten future livelihood outcomes in Africa (Tambo et al., 2020). It can therefore be concluded that the impact of FAW infestation on the economy of Ghana and the livelihood of the individual maize farmers are crucial and hence cannot be ignored. However, this impact on livelihood can also be related to other crop pests; therefore, tackling FAW means tackling other crop pests.

The availability and timely access to sources of information needed to fight the FAW remains essential in managing FAW and yet crucial in the fight against any other crop pest. Adekambi et al. (2020) and Mittal and Mehar (2015) indicated that specific information sources affect farmers' attitudes and practices differently; however, it is unclear how different information sources relate to farmers' attitudes and, consequently, their FAW management practices. Farmers in different geographical zones have different relevant sources of information in Ghana. It is, therefore, relevant that research is conducted on the different geographical zones to identify information sources available to farmers and how this influences their management of FAW infestation. Studies have found that information sources relate to farmers' practices differently in different situations and geographical zones. Adekambi et al. (2020) and Mittal and Mehar (2015) found that access to AEAs relates to farmers' adoption decisions differently in different locations. To this end, the importance of information sources and how it relates to farmer practices differently cannot be over-emphasized.

However, access to agricultural resources, including information and information sources, is differentiated based on gender in developing countries, including Ghana. Many researchers (Anaglo et al., 2020; Anaglo1 et al., 2014) have argued that women farmers have less access to agricultural resources including information. Anaglo1 et al., (2014) found that in Northern Ghana, women farmers had less access to agricultural information compared to their male counterparts. This differentiation was also identified for other productive resources such as labour, land and credit in Northern Ghana. On the order hand, it was found that in southern Ghana, these differentiated access to agricultural resources does not exist (Ankrah et al., 2020). Yet they further argued that the gendered and ungendered access to productive resources in southern Ghana intersects with class, age, education and socio-cultural norms in shaping access to and control over resources. From these, one can argue that geographical differences plays a vital role in access to resources including information by both men and women farmers. It is, therefore, logical that initiatives targeted at delivering resources, including information to farmers, should be gender sensitive.

Despite the relevance of information sources to farmers' management practices, few studies have been conducted on FAW management practices adopted by farmers and information sources available to farmers in Ghana. The few studies (Asare-Nuamah, 2020; Tambo et al., 2020) that looked at management practices adopted by farmers to curb FAW infestation have not considered the information sources available to farmers on FAW and its control and how access to information from these sources affect farmers' decision to adopt the management practices. Neither have these studies also considered the role of gender in accessing information and how this further influences the adoption of management practices. Moreover, knowledge of how farmers manage FAW can be applied to other crop pest infestations that may occur in the future. This study, therefore, assessed management practices adopted by farmers to fight FAW, information sources available to farmers on FAW and its management practices, and how access to information from these sources affects farmers' decision to adopt management practices. It also considers the role of gender in farmers' ability to access information and how it further relates to the adoption of management practices.

Farmers' decision to adopt certain practices is essentially information-seeking and information-processing activity that clarifies the advantages and disadvantages of adopting practices (Kumela et al., 2018). In Ghana, information on the identification and management of FAW was the main message disseminated to farmers through all the information sources identified. Yet access to information is differentiated based on gender in many developing countries, including Ghana (Ankrah et al., 2020), with women farmers being in a disadvantaged position in most cases due to unfavourable gender roles in such countries. Mudege et al. (2017) and Ragasa et al. (2013) found gender norms, damaging stereotyping and more as barriers that hinder female farmers from accessing agricultural resources (including information), agricultural extension and agricultural training in Malawi and Ethiopia. Also, many other researchers (Ankrah et al., 2020; Chatterjee et al., 2020) have argued that typical traditional customs do not support the use of ICTs especially among women because of time, poverty and challenging economic opportunities. This hindrance further influenced female farmers' ability to adopt new practices. It is, however, interesting to note that other gender studies in some parts of Ghana found that women farmers have higher access to agricultural resources such as credit than their male counterparts (Anaglo et al., 2014). In terms of adoption, Muriithi et al. (2018) iterated that there exists no difference in the adoption of agricultural practices based on gender, while Gebre et al. (2019) found gender as a significant factor that affects the adoption of farming practices in Ethiopia. In the context of an emergency like a pest outbreak, knowledge of these dynamics in gender roles is entirely essential in devising policies

and strategies.

There are many sources of information for farmers. Okwu and Umoru (2009) classified three significant sources of information available to farmers: extension agents, mass media, and fellow farmers.

Agricultural extension is widely known as one of the significant sources of information available to farmers, especially in developing countries. Several studies on the adoption of farming practices have cited the information source to have influenced farmers' decision to adopt certain farming and management practices (Anang, 2018; Kotu et al., 2017; Mittal and Mehar, 2015; Onyeneke, 2017). In Ghana, the established system practice is that Agricultural Extension Agents (AEAs) are allocated to different geographical areas to assist farmers with information delivery. As a result, the government relied on this system for information delivery to fight the FAW. However, the AEAs usually cannot reach all their allocated farmers with information because they are understaffed, with the farmer to AEAs ratio being 1:1200 instead of the FAO standard of 1:400. Whereas there are no data on the disgregation of AEAs among men and women, many researchers have argued that in southern Ghana there are very few women working as AEAs. (Anaglo et al., 2020; Anaglo1 et al., 2014; Ankrah et al., 2020)

Many researchers and policymakers have also suggested the mass media as an efficient and effective way to deliver timely information to farmers, particularly in developing countries where farmers live in widely dispersed and diverse communities. The mass media includes radio, television, mobile platforms, text messaging, and many more (Larochelle et al., 2019). In the case of FAW infestation, government campaigns were mainly sharing posters with pictures of the crop pest and how to manage it and through radio station information sharing. This strategy was expected to be effective because most farm households in the selected area of study have access to radio sets, which are treated almost as a part of farm household culture. Therefore, information through radio stations was expected to reach most farmers regardless of their economic class or educational level. These media campaigns were considered gender-neutral, and that both men and women would have access to the information being shared. However, how effective this strategy has been regarding the information reaching farmers (and if both men and women could access this) is yet to be known since FAW infestation is still a problem for farmers.

On the other hand, the peer farmer has the advantage of the social multiplier effect. It is an effective information source for educating and informing farmers about farming practices (Anaglo et al., 2020). Whereas farmer-to-farmer information sharing can be a formally organised program where farmers are trained to share certain information, the peer farmer information sources identified in this study entirely occurred by word of mouth and based on farmers' interest to share information among themselves.

METHODOLOGY

Research design

Three regions in which maize production occurs were selected. This includes the Central Region, the Bono Region, and the Ashanti Region of Ghana. Apart from the fact that the Bono Ahafo and Ashanti regions are among Ghana's major maize production areas, these three regions were selected based on a report from the agricultural extension directorate on FAW infestation in these three regions. Two districts from each region were randomly selected using a simple random sampling technique. With the Awutu Senya West and Awutu Senya East districts from the Central region, The Tein and Wenchi municipal from the Bono region, and the West Akim and the Afram Plain South districts from the Eastern region. Out of each district, the list of registered maize farmers was obtained from the district assemblies. Farmers were randomly selected using simple random sampling but with a constant sampling fraction (5%). The sample size was calculated based on the number of registered maize farmers in each selected district. This ensured that every farmer in the population had an equal chance of being selected. In the central region, 135 Farmers were sampled from the two districts, while 95 and 110 farmers were sampled from the Bono and Eastern regions, respectively. (See Table 1 for sample distribution).

This study was conducted using the survey method. A survey is used mainly for explanatory and descriptive research; it is used in research with individuals or groups as a unit of analysis. In this case, it was used to assess and describe the management practices employed by farmers in fighting FAW, sources of information available to farmers on FAW and FAW control measures, and the relationship that exists between their accessibility to information and their decision to adopt management practices, with maize farmers being the unit of analysis. A questionnaire was administered to farmers by researcher enumerators in the local language of the farmers. Researchers trained the enumerators before they administered the questionnaire" Farmers' consent was sought before they participated in this research. The purpose and use of this study were explained to the farmers before they participated. The questionnaire administration lasted one month, from the second week of January 2020 to the Second week of February 2020.

Information on the demographics of farmers was collected. Also, farmers were asked if they knew of FAW and had

experienced infestation on their farms to determine their awareness of the FAW infestation. To assess their adoption of management practices, they were asked if they had previously applied FAW management practices on their farms. Farmers who indicated they had adopted control measures were further questioned on which type of control measure they adopted with a list of control measures (Use of pesticides, Handpicking eggs and caterpillars, Frequent weeding, Traditional method; the use of sand, highly concentrated salt) identified through the pre-testing of the questionnaire and being supported in the reviewed literature being provided for them to select from.(Asare-Nuamah, 2020; Kansiime et al., 2019). Adoption in this study means a farmer applied FAW management practice on the farm to control or manage the pest.

To determine information access and information sources available to farmers, they were asked if they could access information on FAW infestation and management practices. Farmers who indicated access to information about the pest were asked to select from a list of information sources (peer farmers, AEAs, and the Media) which once again was provided to them through sources identified from the literature review and pre-testing of the questionnaire (Kotu et al., 2017).

Table 1. Study regions and districts with sample distribution

Region	District/ Municipal	N
Bono	Wenchi Municipal	57
	Tain District	38
Eastern	Afram Plains South	52
	West Akim	58
Central	Awutu Senya East	72
	Awutu Senya West	63
	Total	340

Source: Field survey, 2020.

Data were analyzed using the statistical package for social sciences (version 22). Descriptive statistics such as percentages, cross tabulation, frequencies, and more were used to present findings in the data. It was expected that farmers affected by FAW infestation would have a high probability of adopting management practices if they had access to relevant information on FAW and FAW management practices. The hypothesis, therefore, was that increasing access to information increased the probability of adopting management practices.

To determine if there exists a relationship between accessing information from AEAs and the adoption of FAW management practices, a chi-square analysis was conducted between 'yes access information from AEAs', no do not access information from AEAs, and yes adopt management practice and no do not access management practices. Also, between gender, access to information and adoption of management practices

RESULTS

Farmer Characteristics

Table 2, presents the demographic characteristics of respondents. The average age of the respondents was 47 years. Most farmers were males, with the percentage of males being 73% and females being 27%. It was also observed that over 69% of the farmers were above forty years old. The mean household size of respondents was few (5%) of the respondents had tertiary education; however, most farmers (62%) had primary education. This means people with primary education dominate the farmers. The farmers had an average maize farm size of 5.3 acres and a total farm size average of 7.8 acres. The average farming experience of the respondents is 22 years. Over 90% of the farmers had more than five years of experience in maize farming.

Gender and farmer demographics

Results reviewed that the gender of farmers had a significant relationship with farmer demographics in general. Men farmers were more educated than women with only 6.5% of women farmers having high school and tertiary education, 24% of male respondents attending high school and tertiary. The same pattern was identified for farming experience and maize farm size. 51% of male respondents had farm size above 20 hectares whereas the women respondents with 20 hectares and above were only 31%. Table 3 below presents the results on intersection of Gender and farmer demographics.

Table 2. Demographic characteristics

Variables		Frequencies	Percentages (%)	Mean	SD
Gender	Male	247	72.6		
	Female	93	27.4		
Age (years)	21-40	110	32.4		
	41-60	197	57.1	46.76	11.25
	Above 60	36	10.6		
Educational Level	No formal Education	61	17.9	1.07	0.723
	Basic	212	62.4		
	Secondary	50	14.7		
	Tertiary	17	5.0		
Maize farming Experience	Less than 5 years	32	9.4	22.47	12.552
	More than 5 years	308	90.6		
Maize farm size	Less than 5 Ha	186	54.7		
	5 – 20 Ha	77	22.6	5.279	6.768
	Above 20 Ha	77	22.6		

Table 3. Intersection of Gender and farmer Demographic

		Gender	
Variables		Male	Female
Maize Farming Experience	Less than 5years	43	8
	More than 5years	203	84
	Test; Chi=4.033 P=0.045 df=1		
Educational level	No formal education	33	28
	Basic	153	59
	Secondary	45	5
	Tertiary	16	1
	Test; Chi=22.107 P=0.000 df=3		
Maize farm size	Less than 5 Ha	74	33
	5 – 20 Ha	48	31
	Above 20 Ha	125	29
	Test; Chi=14.548 P=0.002 df=3		
Age	21-40	83	21
	41-60	133	63
	Above 60	28	9
	Test; Chi=8.298 P=0.040 df=3		

FAW Management Practices Adopted by Farmers

All the farmers interviewed knew of FAW, and most farmers had experienced FAW infestation on their farms. However, only a few (2.4%) of these farmers said they had not experienced infestation on their farms. Farmers adopted different management practices to fight FAW on their farms. Most farmers (74.7%) interviewed adopted one or more management practices. Out of the farmers who adopted management practices, over 69% used pesticides. Most farmers who used pesticides reported that it was effective.

Handpicking was the second management practice adopted most by farmers, with 39.2% of farmers who adopted management practices using it. More than half of the adopters of handpicking also reported its effectiveness. Frequent weeding and traditional methods (use of neem tree extract, use of ash) were the management practices, with few farmers adopting them. While frequent weeding had only 11.4% of farmers adopting it, the traditional method had about 0.6% of farmers adopting it.

Table 4. Maize Farmers' knowledge of FAW and their management practices

Maize Farmers FAW management practices	Freq. (Yes)	%
Knowledge on FAW	340	100
Experienced in farm	332	97.6
Controlled FAW	255	74.7
FAW Management Practice		
Use of pesticide	236	69.4
Handpicking eggs and caterpillars	100	29.4
Frequent weeding	39	11.4
Traditional method	2	0.6

Source: Survey data, 2020.

Information Sources Available to Farmers

Table 5 presents a summary of information sources available to farmers. The study found that most farmers (89.7%) interviewed had access to information on FAW. This information was from one or more of the sources below. Most farmers had multiple sources of information. Out of the total farmers interviewed, 76.5% indicated peer farmers as their source of information, making fellow farmers the major source of information available to farmers on FAW and FAW management practices. AEAs followed fellow farmers as an information source, with 60 % of farmers with access to information indicating AEAs as a source of information to them. This contradicts the researchers' expectations and the many reports that AEAs cannot reach farmers due to their more minor number. The media, which had 29.4% of farmers with information access indicating it as a source of information, was the source with the most minor percentage.

Table 5. Information sources

Information Sources	Frequency	Percent (%)
Access to information on FAW	305	89.7
Access to information from peer farmers	260	76.5
Access to information from AEAs	204	60.0
Access to information from the Media	118	34.7

Source: Survey data, 2020.

Access to information from AEAs and Adoption of Management practices

While the chi-square test (in table 6) showed a signification relationship between access to information from AEAs and the use of pesticides, the use of handpicking, and frequent weeding, the results revealed that there exists no relationship between access to information from AEAs and the use of the traditional method.

While the probability that a farmer will use pesticides increases with increased access to information from AEAs, the probability of farmers hand-picking eggs and larvae and using frequent weeding seems to decrease with increased access to information from AEAs. This is because the government's initial attempt to fight FAW infestation was mainly through disseminating pesticides to farmers through AEAs. AEAs, therefore mainly distributed and disseminated the use of pesticides to farmers. AEAs also reported that, due to other disadvantages of hand picking and frequent weeding, which is labour-intensive and difficult to use, they intentionally do not recommend it to farmers.

Access to information from peer farmers and the adoption of FAW management practices

A chi-square (in table 6) test showed a significant relationship between access to information from peer farmers and the adoption of management practices (use of pesticides and handpicking). The results showed that farmers had a higher probability of adopting management practices if they had access to information from peer farmers. Over 87% and 91% of the farmers who adopted pesticide use and handpicking, respectively, had access to information from peer farmers.

Access to information from the media and adoption of FAW management practices

It was expected that most farmers would have indicated the media as their source of information. Considering the government's campaign through the media, it was expected to influence farmers' decision to adopt management practices. However, the results showed otherwise; it was the source of information with the least number of farmers indicating that they sourced information. Also, the cross-tabulation showed that access to information from the

media had a significant relationship only with hand-picking, showing no significant association with the adoption of other management practices. It is pertinent to note that the result shows an inverse relationship between access to information from the media and the use of handpicking to control FAW infestation.

Table 6. Relationship between Sources of Information and Adoption of FAW Management Practices

	Use of Pesticides			**Use of Handpicking**		**Use of Frequent Weeding**		**Use of Traditional method**	
	NO		YES	NO	YES	NO	YES	NO	YES
Access to FAW information from AEAs	NO	65	71	125	11	129	7	136	0
	YES	39	165	115	89	172	32	202	2
	Test	Chi=31.605 P=0.000 df=1		Chi=49.642 P=0.000 df=1		Chi=8.926 P=0.000 df=1		Fisher's Exact Test=0.530	
		NO	YES	NO	YES	NO	YES	NO	YES
Access to FAW information from fellow farmers	NO	39	41	67	13	67	13	80	0
	YES	65	195	173	87	234	26	258	2
	Test	Chi=16.253 P=0.000 df=1		Chi=8.729 P=0.003 df =1		Fisher's Exact Test=0 .548		Fisher's Exact Test=1.00	
		NO	YES	NO	YES	NO	YES	NO	YES
Access to FAW information from the Media	NO	75	147	176	46	197	25	221	1
	YES	29	89	64	54	104	14	117	1
	Test	Chi=3.076 P=0.079 df=1		Chi=23.272 P=0.00 df=1		Fisher's exact test= 0.868		Fisher's exact test= 1.00	

Source: Survey data, 2020

Gender and Access to Information

It was found that male farmers had a higher probability of getting access to information than female farmers. There was a significant relationship between the gender of farmers and their ability to access information from all information sources. In all these, male farmers had higher access to information than female farmers. It is shown in Table 7 that 94% of male farmers had access to information from one or more of the information sources, and only 78% of female farmers had access to information from the information sources.

Table 7. Relationship between Gender and Access to Information

	Access to info		**Access to info from AEAs**		**Access to info from peer farmers**		**Access to info. From the media**	
	NO	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**
Female	20	73	46	46	33	61	69	24
Male	14	233	90	158	47	199	153	94
	Chi=18.829 P=0.000 df=1		Chi=5.133 P=0.023 df=1		Chi=8.418 P=0.015 df=1		Chi=4.232 P=0.040 df=1	

Source: Survey data, 2020

Gender and adoption of FAW management practices

Results showed that the gender of farmers had a significant relationship with the adoption of management practices in general. The same results were found for using pesticides (chemicals), handpicking, and frequent weeding. In all these, the probability that male farmers will adopt the management practice(s) was much higher than that of female farmers. Table 8 shows that only 56% of female farmers adopted management practices, while 82% of male farmers adopted management practices.

Table 8. Relationship between Gender and adoption of FAW management practices.

	Adopted management practices		Use of pesticides		Use of handpicking		Frequent weeding		Traditional	
	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Female	40	53	47	46	74	19	80	13	92	1
Male	45	202	57	190	166	81	221	26	246	1
	Chi=22.148 P=0.000 df=1		Chi=23.996 P=0.000 df=1		Chi=4.974 P=0.026 df=1		Chi=0.793 P=0.373 df=1		Chi=0.519 P=0.471 df=1	

Source: Survey data, 2020

DISCUSSION

Most farmers interviewed were above forty years of age, and the mean respondent age was forty-seven. Meaning most of the farmers are middle-aged, energetic, and vibrant. Older farmers are more experienced and risk-loving, hence likely to adopt management practices (Baffoe-Asare et al., 2013). This partially explains why most farmers adopted management practices, but it also reveals that the younger generations are not engaged in farming.

Males dominate maize farming in the area. A probable explanation for this finding could be that more men are engaged in maize farming than women. This confirms what Asare-Nuamah, (2020) found that farming in Ghana is male-dominated. Sixty-two percent of the farmers had only primary education. Farmers in the area had low formal education. However, the male farmers had higher education than women. There was a difference of 2.5 acres between the mean total farm size owned by farmers and the mean maize farm size. This means respondents had extra land to cultivate other crops and diversify their sources of income as an essential strategy to increase revenue and diversify food sources. This may cushion farmers against the devastating hardship effect of FAW as they may have other crops to fall on. The average farming experience of the respondents was twenty-two years, with most farmers having ten years of experience and over. Experienced farmers are expected to be more skillful, hence should be able to adjust to unfavourable situations. This result affirms the findings of Anaglo et al. (2020), which indicated that most farmers in Ghana have over ten years of farming experience.

Farmers were well informed of the presence of FAW in their area and had experienced it on their farms. This can be explained by the fact that infestation in the area was intense, and FAW had spread to almost all farms, and this, therefore, caused most farmers to seek information on FAW. It was, therefore, not surprising that most farmers adopted management practices to curb the situation. It was expected that farmers would adopt management practices if they experienced the infestation and had access to the right information. This is consistent with Kumela et al. (2018), who confirm that farmers adopted management practices to fight FAW infestation when they experienced it on their farms in Ethiopia. The effectiveness and less-labour-intensive nature of pesticides, the fact that the government gave out pesticides to farmers for free and at a subsidised price as an intervention, and lastly AEAs recommended pesticides as the management practices desirable to be adopted by farmers explains why most farmers adopted it. This is consistent with earlier studies that reported chemical application as the main management practice adopted by farmers in other African countries such as Ethiopia and Kenya (Kansiime et al., 2019; Kumela et al., 2018).

Kumela et al. (2018) argue that access to information by farmers is an integral part of the clamour for adopting management practices. The acquisition of information about agricultural practices demystifies it and makes it more available to farmers. This explains why a significant relationship was found between access to information and the adoption of FAW management practices. Information received by farmers on FAW and its management practices may have helped farmers to understand the probable effect of the infestation and evaluate the practices and adopt them. Whereas Kansiime et al. (2019) and (Mittal and Mehar, 2015) found AEAs as a primary source of information for farmers on FAW and farming practices, Larochelle et al. (2019) argue that the Mass media is the most prominent source of information to farmers on FAW management in other African countries. Contrary to these findings, our study found peer farmers as the most common source of information available to farmers. However, our result is consistent with Anaglo et al. (2020), who found that peer farmers are the most prominent source of information available to farmers in the Eastern region of Ghana. It must, however be noted that the transfer of information between and among farmers (peer farmer source) was entirely by word of mouth and that no formally organised farmer-to-farmer training was identified. But formalised farmer-to-farmer extension helps to overcome the information access problem and enables widespread adoption of agricultural practices. Based on this we recommend that for the government to harness the full potential of peer farmer information sharing, they should adopt more formal farmer-to-farmer extension programs where farmers are formally trained to transfer information.

AEAs as an information source had a significant relationship with adopting three different management practices (use of chemicals, handpicking, and frequent weeding). This implies that the informational campaign by the AEAs on FAW management practices appears well received by the farmers. Extensive education and increased AEAs numbers are further required to improve adoption of management practices. This confirms Kotu et al. (2017) and Onyeneke (2017) found that contact with AEAs on agricultural management practices influences farmers' adoption decisions about the management practices. Also, peer farmers being the most accessed source of information by farmers, is significantly related to the adoption of two management practices (use of chemicals and handpicking). A probable explanation could be that after farmers received information from AEAs and the media, they assessed the recommended practices based on experience and their implementation, got well informed and communicated what they thought was effective (chemicals and handpicking) to their colleagues. This is supported by the findings as further probing from participants ascertains that information from peer farmers was helpful and valuable that they relied on their peers.

The study revealed that women have less access to information compared to men. A probable explanation for this could be that there exists a wide gender gap and inequalities which lead to differential access to information among men and women. For instance, it is factual that attending meetings with AEAs is seen as a designated duty of the male head of a family; hence they receive the information. Also, many other researchers (Ankrah et al., 2020; Chatterjee et al., 2020) have argued that typical traditional customs do not support the use of ICTs especially among women because of time, poverty and challenging economic opportunities. It is therefore possible that men did have owned more phones, television and other digital means through which information were being disseminated hence they had better chances of getting the information . Ankrah et al. (2020) and Mudege et al. (2017) argue that gendered access to agricultural resources though stifles growth, still exists in developing countries. This is consistent with Mudege et al. (2017) and Ragasa et al. (2013), who found that gender norms and other factors hinder women farmers from accessing agricultural resources, including information. They further argued that this affects women farmers negatively on their adoption abilities. Therefore, it was not surprising to realise that women had less probability of adopting management practices. This is also consistent with earlier studies that found gender influences adoption decisions (Anaglo et al., 2014; Gebre et al., 2019).

CONCLUSION AND RECOMMENDATIONS

Many studies have been conducted on the role of information sources in adopting farming practices and how this relates to gender. Yet very little is known about these issues in the context of emergencies. Concerning FAW management practices in Ghana, very little is known about how information access, gender, and adoption of management practices. This study further bridges the gap on how this plays out in emergencies like pest outbreaks. It further puts into perspective the role of gender in adoption and access to information in the context of pest outbreaks. However, the limitation of this study is that it is a relational study and hence cannot prove causality, though the researchers engaged in further probing to ascertain findings. Experimental studies would be needed in the future. Nonetheless based on the findings we recommend that the government consider gender roles in devising further policies and interventions. We also recommend consideration of organized peer-to-peer information sharing.

Compliance with Ethical Standards

Peer-review

Externally peer-reviewed.

Conflict of interest

The author declare that they have no competing, actual, potential or perceived conflict of interest.

Author contribution

The author read and approved the final manuscript. The author verify that the text, figures, and tables are original and that they have not been published before.

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Data availability

Not applicable.

Consent to participate

Not applicable.

Consent for publication

Not applicable.

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