PREDICTORS OF ADOPTION OF FALL ARMY WORM MANAGEMENT PRACTICES BY MAIZE FARMERS IN WESTERN GHANA

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Abstract - Fall Army Worm infestation in Africa has exposed farmers to livelihood threats through destruction to maize farms in Africa and Ghana as a country. The Ghanaian government has spent a lot of moneyin an attempt to control the pest. Farmers have suffered the devastating effect of the pest infestation hence they have adopted management practices to control this pest. The study investigates management practices adopted by farmers and factors that influence their adoption decision.

Keywords - Fall Armyworm, Ghana, Maize, Management practices, Socioeconomic characteristics

I. INTRODUCTION

First official report of FAW infestation in Africa was in the January 2016 (Geogen et al, 2016). FAW within two years of arrival in Africa had spread to over 44 countries in Africa (FAO 2018) including the island countries like Madagascar, Cape Verde, the Seychelles and São Tomé (Prasanna, 2018) FAW since its introduction in 2016 has exposed millions of subsistence farmers to livelihood and food security threat in Africa (Tambo et al 2019). This has been mainly through the devastating effect it is having on crop fields particularly to maize fields and to a lesser degree sorghum and other crops in Africa (Prasanna, 2018).

The Center for Agricultural and Bioscience International (CABI) in 2017 conducted a research in Ghana and Zambia on how maize farmers perceive losses they encountered from FAW infestation. Losses of about 22% - 65% and 25%- 50% were recorded in Ghana and Zambia respectively with a national mean of 45% and 40% (CABI 2017). Rwomushana et al., (2018) reported USD177 million as an expolated value of maize Ghana has lost through FAW infestation since it official report in Ghana. In early 2018, it was reported that, the Government of Ghana spend GHS 15,857,280.00 (US$ 4,017,654.36) in their attempt to curb FAW infestation in Ghana (Koranteng 2018a).

Kumala et al (2019) hypothesized that due to the tremendous effect of FAW on maize production hence farmer livelihood, some farmers have adopted some strategies to control and manage the FAW. Understanding farmers' FAW management practices adopted by farmers and potential constraints of the fall armyworm control are critical steps towards developing sustainable integrated management (IPM) strategies for the FAW (Kumala et al., 2019).

Despite the impact of FAW infestation on maize production inGhana, very few studies (CABI 2017, and Rwomushana et al. 2018) has been conducted on management practices adopted by farmers and factors that influence their ability and decision to adopt such practices.

Adoption of FAW management practices by farmers is influenced by their socioeconomic characteristics (Tambo, 2020). There is however very little empirical information on management practices adopted by farmers in Ghana and how their socioeconomic characteristic relate to their decision to adopt management. (Acheampong et al., 2017;Faleye, &Afolami, 2020; Konja, 2021). The objective of this study was to assess the management practices adopted by farmers in the study area and to determine the relationship between farmers' socioeconomic characteristics and their decision to adopt FAW management practices.

Region	District/ Municipal	N (%)
Bono	Wenchi Municipal	57 (19.7)
	Tain District	58 (15.6)
Eastern	Afram Plains South	47 (16.8)
	West Akim	58 (17.1)
Central	Awutu Senya East	67 (13.8)
	Awutu Senya West	53 (17.1)
	Total	340 (100)

Source: Field survey, 2020.

Table I: Study regions and districts

II. METHODOLOGY

The study was conducted in three regions in Ghana. These regions are the Central, Ashanti, and Bono regions. Two districts were purposively selected from each of the regions. Awutu Senya West and Awutu Senya East districts from the Central region, The Tein and Wenchi Municipal from the Bono region, and the EjuraSekyeredumase and the Sekyere Afram Plain districts from the Ashanti region. Farmers were then sampled using simple random

sample methods. Table I presents summary of the distribution of farmers according to the districts. Questionnaires were administered to farmers and the responses were analyzed using the Statistical Package for the Social Sciences In other to determine the individual and combine effect of the socioeconomic characteristics of farmers on their decision to adopt FAW management practices, a multiply regression analysis was conducted. Below is the regression model.

The Regression Model

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.279	.186		1.499	.135
	age	.025	.038	.036	.668	.505
	experience	-.101	.089	-.068	-1.135	.257
	access to information	.320	.076	.224**	4.199	.000
	total farm size	.103	.033	.260**	3.109	.002
	maize farm size	-.077	.032	-.204*	-2.391	.017
	have access to credit	-.053	.105	-.028	-.509	.611
	source of income	.147	.046	.168**	3.181	.002
	Level of Education	-.008	.034	-.014	-.242	.809
	household size	-.006	.052	-.007	-.122	.903
	Gender	.232	.053	.238**	4.380	.000

a. Dependent Variable: adopted management practices, Source: Field survey, 2020. $R2 = 0.163$
Adjusted $R^2 = 0.134$ $F(10, 339) = 6.417$**
** Significance at .01 level of probability
* Significance at .05 level of probability

TABLE II: Description of variables in the regression

The study assumes that farmers decision to adopt FAW management practices is not voluntary and that Socioeconomic characteristics of farmers is a major factors that could possibly account for the differences in responses among farmers. To determine the combined and individual influence of socioeconomic characteristics on farmers' decision to adopt FAW management practices, a multiple regression analysis was employed. The socio-economic factors under the regression analysis included age of farmers, gender, farmers' household size, farmers' total farm size, farmers' farming experience, farmers' maize farm size and having other source(s) of income apart from farming. The multiple regression model was as follows:

$Y = f(X_1, X_2, \ldots\ldots\ldots\ldots X_8)$

Y (Adoption) = Sum of the seven predictors

Predictors.

1. Gender (X1) = Being a male or female (1= male, 0=female)
2. Level of education (X2) = Last level of education (4= Tertiary, 3= secondary, 2= basic, 1= no formal education)
3. Have other source(s) of income (X3)=Having other sources of income aside farming or not (1=Yes, 0=No)
4. Access to credit (X4) = Being able to access credit or not (1=Yes, 0=No)
5. Age (X5) = Age of respondents (year)
6. Farming experience (X6) = Number of years a farmer has engaged in farming
7. Size of maize farm (X7) = size of maize farm only (acres)
8. Total farm size (X8) = farmers' total farm size (acres)
9. Household size (X9) = Number of members in farmers household
10. Access to extension (X10)= Receive extension services or not (1=Yes, 0=No)

III. RESULTS

Description of variables in regression model

Three hundred and forty farmers (340) were interviewed, 72.6% of these farmers were males while 27.4% were females. This means maize farming in the study area is dominated by males. Farmers average age 47 years. This means the farmers were young and energetic. The results also showed that, almost 60% of the farmers were between the ages of 41 to 60 years. Most (85%) of farmers had a farming experience of Ten years and above. Also only 5% of farmers interviewed had tertiary education with most 62% having a basic education. The result also revealed that, only 5% of the respondents had access to credit with about 95% not having access to credit. 305 of the 340 respondents indicated that they had access to information on FAW. Some farmers also indicated that they had other sources of income apart from farming with petty trading being the most mentioned source of alternative income. 78% of the respondents adopted one or more FAW management practices.

Variables		FREQUENCIES	PERCENTAGES	MEAN	STD. DEV
Gender	Male	247	72.6		
	Female	93	27.4		
Age (years)	21-40	103	30.6	46.76	11.269
	41-60	197	58.5		
	Above 60	37	11.0		
Maize farming Experience	Low experience	51	15.1	22.47	12.552
	High experience	287	84.9		
Maize farm size	Marginal	107	31.5	5.279	6.768
	Small	79	23.2		
	Medium	77	22.6		
	Big	77	22.6		
Total Farm size	Marginal	60	17.6	7.768	8.00
	Small	46	13.5		
	Medium	107	31.5		
	Big	127	37.4		
Household size	Small	123	36.2	6.29	2.993
	Large	217	63.8		
Educational Level	No formal Education	61	17.9		
	Basic	212	62.4		
	Secondary	50	14.7		
	Tertiary	17	5.0		
Access to credit	Yes	18	5.3		
	No	322	94.7		
Other source of income	Yes	151	44.4		
	No	189	55.6		
Access information on FAW	Yes	305	91.3		
	No	29	8.7		
Adopted FAW management practice(s)	Yes	254	74.7		
	No	78	22.9		

Source: Field survey, 2020.

TABLE III: RESULTS REGRESSION ANALYSIS

Effect of Socioeconomic Characteristics on Adoption of Management Practices Using Multiple Regression Analysis

In other to determine the individual and combine effect of the socioeconomic characteristics of farmers on their decision to adopt FAW management practices, a multiply regression analysis was conducted. It was hypothesized that, age, gender, level of education of farmers, farmers 'household size, farmers' farming experience, total farm size owned by farmers, farmers' maize farm size, having other sources of income apart from farming, having access to credit and having access to extension will predict (influence) adoption of FAW management practices. The findings showed that, 13% of the variation in adoption of FAW management practices can be accounted for by the eight predictors collectively (R^2). F(9, 339)=4.737 P= 0.000 Looking at the individual contributions of the predictors, based on the results of the beta weights five of the ten predictive variables showed significance. They are: Gender, total farm size, maize farm size, having other sources of income and being able to access information services. The study has confirmed earlier research which found that socioeconomic characteristics farmers influence their decision to adopt farming and management practices on their farms.

(Acheampong et al., 2017; Faleye, & Afolami, 2020; Konja, 2021)

However, while total farm size, gender, access to extension, having other source of income had a significant and positive effect on farmers' decision to adopt FAW management practices, maize farm size of farmers have a negative but significant relationship with adopting FAW management practices. This is so because, having a large maize farm size would require more resources and labor to adopt

management practices and most farmers in the study area are relatively poor farmers hence would not be able to afford the cost that come with adopting management practices. This however, refute the study by Abay et al. (2018) who indicated that farmers with large land size may have a higher wealth status, and thus a higher propensity to adopt agricultural technologies

IV. CONCLUSION

The study found that, most (74.7%) famers adopted FAW management practices. Also, infestation of farmers maize field caused about 50% maize output losses. It was also found that, 13% of the variations in farmers' adoption decision could be accounted for by the predictor variables. Five of the predictor variables (gender of farmers, farmers' total farm size, and farmers' maize farm size, having access to FAW information and having other source income) had a significant relationship with farmers' adoption decision.

Conflicts of Interest

Authors declare that there is no conflict of interest.

Data Availability

Data for this study can be made available upon request.

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