

ROLE OF AGRICULTURAL EXTENSION SERVICE IN THE ADOPTION OF INTEGRATED PEST MANAGEMENT PRACTICES AMONG COCOA FARMERS IN ONDO STATE, NIGERIA.

Akinwalere. B.O

Department of Agricultural Extension and Communication Technology, Federal University of Technology, Akure, Ondo State, Nigeria.

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Abstract: The study was on the adoption of Integrated Pest Management (IPM) Practices among Cocoa Farmers in Owo Local Government Area, Ondo State, Nigeria. Specifically, the study aimed at ascertain the socio-economic characteristics of the respondents in the study area, assess the level of awareness of integrated pest management practices available to the respondents and evaluate the effectiveness of agricultural extension services in information dissemination of Integrated Pest Management practices. Primary data were collected by administering a well-structured questionnaire consisting of closed and open-ended questions. Multistage sampling was employed in the study for the selection of 100 cocoa farmers in the study area. Data were analyzed using descriptive and inferential statistics. The results showed that majority (84%) of the farmers were male, the mean age of the respondents was 47 years with an average household size of 7 members. The major educational qualification of the respondents was secondary school (47%). Ninety-four percent of the respondents practiced Integrated Pest Management (IPM) and 89% have access to extension services also affirmed that IPM techniques are part of the services rendered by the extension workers, out of which 78% implemented one of more of the techniques recommended by the extension workers in the study area. The most significant impact of extension services was felt in the area of improved collaboration and networking ($\bar{x}=2.03$.) and increase in the utilization of biological and traditional methods of pests control ($\bar{x}=1.96$.) The study recommends that government and agricultural agencies should establish comprehensive training programs focusing on simplifying IPM practices and providing hands-on training. Also, provision of affordable credit facilities and subsidies to cocoa farmers to alleviate the high cost of implementing IPM practices.

Keywords: Extension Services, Adoption, Integrated Pest Management, Cocoa farmers

INTRODUCTION

Cocoa cultivation is not only a significant agricultural activity but also an area of intense research due to its nutritional properties and economic importance. Studies have highlighted the health benefits of cocoa consumption, including its potential cardiovascular, cognitive, and metabolic effects (Davison et al., 2020; Ding et al., 2019; Hamedifard et al., 2022; Lamport et al., 2021; Mastroiacovo et al., 2019). However, cocoa, derived from the seeds of *Theobroma cacao*, holds significant economic and nutritional value. Extensive research conducted since 2019 has elucidated various aspects of cocoa, ranging from its phytochemical composition to its potential health benefits (Ding et al., 2019; Mastroiacovo et al., 2019; Davison et al., 2020; Lamport et al., 2021; Hamedifard et al., 2022). Cocoa is renowned for its high content of flavonoids, particularly flavanols, which exhibit antioxidant properties and have been associated with cardiovascular health benefits such as improved endothelial function and blood pressure regulation. Additionally, cocoa consumption has shown promise in enhancing cognitive function and mood regulation, as well as improving metabolic health by positively influencing insulin sensitivity and lipid profiles.

Despite its nutritional and economic significance, cocoa cultivation faces challenges from pests and diseases, which can severely impact productivity and quality. Integrated Pest Management (IPM) offers a sustainable approach to

pest control in cocoa farming by integrating various control tactics, including cultural, biological, mechanical, and chemical methods. IPM strategies tailored to cocoa cultivation aim to mitigate pest damage while minimizing environmental impacts and ensuring the safety of cocoa products. Therefore, this study focused on the factors influencing the adoption of IPM practices among cocoa farmers. Economic factors, such as cost-effectiveness and access to financial resources, play a crucial role in farmers' decisions to adopt IPM (Dhara et al., 2021). Knowledge and awareness about pests, beneficial organisms, and ecological processes are essential for effective IPM implementation (Gautam et al., 2020). Technological innovations, including remote sensing and decision support tools, enhance the precision and efficiency of IPM practices (Bengochea-Guevara et al., 2019). Policy and institutional support, along with social and cultural factors, also influence the adoption of IPM among cocoa farmers (Hussain et al., 2020; Vanlauwe et al., 2020). Understanding these factors is essential for promoting the widespread adoption of IPM practices and ensuring the sustainability of cocoa production. By addressing barriers to adoption and facilitating the integration of IPM into cocoa farming systems, stakeholders can enhance pest management practices, improve cocoa yields and quality, and contribute to the long-term viability of cocoa cultivation. However, this research work fills the huge knowledge gap by analyzing the adoption of IPM among cocoa farmers in the study area. Specifically, this study intends to:

- ascertain the socio-economic characteristics of the respondents in the study area.
- assess the level of awareness of integrated pest management practices available to the respondents, and;
- evaluate the effectiveness of agricultural extension services in information dissemination of Integrated Pest Management practices among the respondents.

The null hypothesis for the study stated that there was no significant relationship between the socioeconomic characteristics of the farmers and adoption of Integrated Pest Management (IPM) in the study area.

METHODOLOGY

This study was carried out in Owo Local Government Area (LGA) in Ondo State, Southwest of Nigeria. Cocoa farming, in particular, plays a crucial role in the local economy, providing livelihoods for a significant portion of the population. Other agricultural activities in the area include palm oil production, yam cultivation, and poultry farming.

The primary data employed in this study were obtained with the aid of a well-structured questionnaire. Multi-stage sampling technique was used to select 100 respondents in this study. In the first stage, five communities were randomly selected and 20 respondents were also randomly selected from each community. Descriptive and inferential statistics were used for the analysis.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Respondents in the study area

The result from the data analyzed showed the mean age of the respondents to be 47 years. This implies that most of the cocoa farmers in the study area were in the middle age class., between 45 and 54 years of age, representing 37% of the population. The finding of this study corroborates the report that the majority (78.5%) of cocoa farmers in Osun State, Nigeria were above 40 years (Faloni et al, 2022). Greater proportions (84%) of the farmers were males while about 16% were females. This implies that most of the cocoa farmers in the study area were predominantly male, which confirms the findings of the findings of Akinwalere et al. (2024) that farm work is skewed towards men because of gender inequalities.

The results further revealed that a greater proportion (90%) of the respondents were married, indicating that most farmers in the study area had dependents, and this could boost productivity thereby increasing their earnings. On the other hand, approximately 6% were widowed, 3% were divorced and 1% were single. The dominant religion among the respondents was Christianity as seen in Table 1 below. However, about 47% of them completed secondary school, indicating that most of the cocoa farmers are moderately literate and will be able to practice Integrated Pest Management (IPM).

The mean household size was 7 persons. The finding implies that farmers in the area had a fairly large household size which is expected to increase their access to farm labour. This finding supports the result of the assertion of Akinwalere, (2019) that relatively large household size enhances the availability of family labor which reduces labor costs in agricultural production. In addition, the results showed that 98% of farmers had a farm size between 0.0-9.9 hectares. This finding could be attributed to the fact that small-scale farming largely dominates the agricultural sector in Nigeria. Also, the findings show that 74% of the farmers had an annual income between one to thirty million naira, implying that the cocoa farmers in the study area are financially buoyant while approximately 71% of the farmers had an annual expenditure between one to five million naira.

Table 1: Respondents Socio-Economic Characteristics in the study areas

Variables	F	%	Mean
Age (Years)			
25-34	10	10.0	47
35-44	30	30.0	
45-54	37	37.0	
55-64	13	13.0	
65-74	9	9.0	
75-84	1	1.0	
Sex			
Male	84	84.0	
Female	16	16.0	
Marital status			
Single	1	1.0	
Married	90	90.0	
Divorced	3	3.0	
Widow/Widower	6	6.0	
Religion			
Christianity	72	72.0	
Islam	21	21.0	
Traditional	7	7.0	
Level of education			
No formal education	1	1.0	
Adult education	1	1.0	
Attempted Primary school	2	2.0	
Completed primary school	22	22.0	
Attempted secondary school	1	1.0	
Completed Secondary school	47	47.0	
Attempted tertiary institution	3	3.0	
Completed tertiary institution	23	23.0	
Household Size			
0-4	26	26.0	7.0
5-9	58	58.0	
10-14	15	15.0	
15-19	0.0	0.0	
20-24	1	1.0	
Farm Size (Hectares)			

0.0-9.9	98	98.0	3.1
10.0-19.9	1	1.0	
20.0-29.9	1	1.0	
Annual income (Naira)			
1-30000000	74	74.0	26,010,160.00
30000001-60000000	15	15.0	
60000001-90000000	9	9.0	
90000001-120000000	1	1.0	
120000001-150000000	1	1.0	
Annual expenditure (Naira)			
1-5000000	71	71.0	4330,175.00
5000000-10000000	22	22.0	
10000001-15000000	6	6.0	
15000001-20000000	1	1.0	

Source: Field Survey 2024

Level of Awareness of Cocoa Farmers of Integrated Pest Management (IPM)

The result of the farmer's distribution based on the level of awareness of cocoa farmers about IPM is presented in Table 2. It shows that a greater proportion (91%) of the farmers were aware of the practices which may be due to governments, NGOs, and agricultural organizations conducting awareness campaigns and training programs on IPM, leading to a higher level of knowledge among farmers and agricultural stakeholders. 67% of the farmers understood Integrated Pest Management as sole reliance on chemical pesticides; this may be because farmers might not fully comprehend the full concept and approach of IPM, which combines physical, cultural, biological, and chemical controls of pests.

Furthermore, the results revealed that 73% of the respondents first learned about IPM from their fellow farmers, which could result from social networks among farmers, especially in rural areas which makes farmers easily accessible to each other. 63% of the farmers learned about IPM for the first time from workshops/training while 61% of the respondents learned about IPM from extension services; this may have resulted from several trainings and workshops organized by extension workers in the study area.

Table 2: Level of Awareness of the Farmers about Integrated Pest Management (IPM)

	YES F (%)	NO F (%)
Have you heard of Integrated Pest Management (IPM) for cocoa farming?	91	9
What is your understanding of Integrated Pest Management?	(91.0)	(9.0)
Sole reliance on chemical pesticides	67 (67.0)	33 (33.0)
Use of resistant crop varieties	35 (35.0)	65 (65.0)
Avoiding pest monitoring	63 (63.0)	37 (37.0)
Planting shade trees	66 (66.0)	34 (34.0)
How did you first learn about IPM?		
Extension services	61 (61.0)	39 (39.0)

Fellow farmers	73 (73.0)	27 (27.0)
Workshops/training	63 (63.0)	37 (37.0)
Media (radio, TV, internet)	21 (21.0)	97 (97.0)

Source: Field Survey 2024

Respondents Practicing Integrated Pest Management (IPM) in the study area.

The result of the farmers' distribution is presented in Table 3, showing 94% of the farmers practicing IPM, depending on their adopter categories (innovators, early adopters, early majority, late majority, and laggards). This implies that IPM adoption is high among farmers, but there is room for improvement in reducing chemical pesticide reliance. Furthermore, the results in the table showed that the average number of years of practicing IPM by the respondents was 7 years which implies that a significant proportion of the respondents have been practicing IPM over a long period. However, majority (90%) of the respondents in the study area rely only on chemical pesticides to control pests while the remaining do not. Likewise, the farmers recognize IPM's environmental benefits and potential for natural pest control. The finding supports this finding that states that IPM adoption can lead to reduced chemical pesticide use and environmental protection (IFAD) (2020).

Table 3: Result of Respondents Practicing IPM in the study Area.

	YES		NO
	F (%)	F (%)	
Are you practicing any Integrated Pest Management (IPM)?	94 (94.0)	6 (6.0)	
How long have you been practicing any of these Techniques?	F	(%)	Mean
0-4	31	31.0	
5-9	46	46.0	7.11
10-14	12	12.0	
15-19	7	7.0	
20-24	2	2.0	
25-29	1	1.0	
30-34	1	1.0	
	TRUE F (%)	FALSE F (%)	

Integrated pest management (IPM) relies solely on chemical pesticides to control pests	90 (90.0)	10 (10.0)
IPM encourages using natural methods to control pests whenever possible	83 (83.0)	17 (17.0)
IPM helps to protect the environment from harmful chemicals	82 (82.0)	18 (18.0)

Source: Field survey, 2024

Effectiveness of Agricultural Extension in Promoting Integrated Pest Management (IPM).

The results in Table 4 show that most of the respondents (89%) of the respondents have access to extension services and they affirmed that IPM techniques are part of the services rendered by the extension workers in the study area. This implied that the dissemination of information by the extension workers to the farmers has been effective. However, 78% of the respondents have implemented any of the techniques suggested by the extension workers while the remaining 22% were yet to implement the suggested techniques which can be dependent on the category each respondent fell under the adopter categories. The results further revealed that majority (76%) of the respondents had implemented the physical control techniques, followed by approximately 72% who implemented the chemical control techniques and 49% who implemented the biological control techniques.

Table 4: Effectiveness of Agricultural Extension in Promoting Integrated Pest Management (IPM) among respondents.

	YES F (%)	NO F (%)
Do you have access to extension services?	89 (89.0)	11 (11.0)
Is IPM techniques part of the service rendered by extension services?	89 (89.0)	11 (11.0)
Have you implemented any of the IPM techniques suggested by the extension services?	78 (78.0)	22 (22.0)
IPM techniques implemented		
Cultural control	33 (33.0)	67 (67.0)
Biological control	49 (49.0)	51 (51.0)
Chemical control	72 (72.0)	28 (28.0)
Physical control	76 (76.0)	24 (24.0)
Do you believe that agricultural extension programs adequately address the needs and challenges of farmers regarding Integrated Pest Management techniques?	81 (81.0)	19 (19.0)

Have you participated in any training or workshop organized by Agricultural Extension programs on Integrated Pest Management techniques? 64 (64.0) 36 (36.0)

Agricultural extension services support for Integrated Pest Management adoption

Increased frequency of training	77 (77.00)	23 (23.0)
Improve the quality of Training	67 (67.0)	33 (33.0)
Increased availability of extension agents	53 (53.0)	47 (47.0)

Source: Field survey, 2024

Impact of Extension Services in promoting Integrated Pest Management (IPM) in the study area.

Table 5 shows the opinions of the respondents regarding the impact of the organized extension programs on the promotion of IPM in the study area. The results were measured with their respective mean scores, indicating the extent to which there is an impact. The mean scores are ranked based on their levels of impact. The significant impacts were improved collaboration and networking ($\bar{x}=2.03$), increase in the utilization of biological and traditional methods to control pests ($\bar{x}=1.96$), availability of demonstration and practical sessions on Integrated Pest Management ($\bar{x}=1.88$), access to training and capacity building on Integrated Pest Management ($\bar{x}=1.83$), adoption of sustainable and environmentally friendly processing practices ($\bar{x}=1.79$), increase in production of Cocoa cultivation ($\bar{x}=1.78$), and an increase in awareness of Integrated Pest Management ($\bar{x}=1.59$). The findings imply that extension services significantly contribute to the promotion and adoption of Integrated Pest Management (IPM) practices among cocoa farmers. The results suggest that extension services enhance collaboration, utilization of eco-friendly pest control methods, and access to training, leading to increased awareness, adoption, and sustainability of IPM practices. A study by Misango et al (2022) revealed that "demonstration plots and practical sessions on IPM significantly enhance farmers' knowledge and adoption of sustainable pest management practices which complies with the findings of this study. Cocoa Research Institute of Nigeria (CRIN) (2018) highlighted that "extension services enhance farmers' awareness and knowledge of IPM, resulting in increased adoption and sustainability of eco-friendly practices".

Table 5: Impact of Extension Services in promoting Integrated Pest Management (IPM).

	Not effective F (%)	Slightly effective F (%)	Moderately effective F (%)	Effective F (%)	Very effective F (%)	Mean
Effectiveness of Extension Services in promoting IPM	12 (12.0)	15 (15.0)	21 (21.0)	26 (26.0)	36 (36.0)	3.69

Areas of Effectiveness of Extension Services	Strongly agree. F (%)	Agree F (%)	Disagree F (%)	Strongly disagree. F (%)	Mean
Improved collaboration and networking.	33	45	8	14	2.03

Increase in the utilization of biological and traditional methods to control pests.	41	(33.0)	(45.0)	(8.0)	(14.0)	1.96
Availability of demonstration and practical sessions on Integrated pest management.	48	(41.0)	(36.0)	(9.0)	(14.0)	1.88
Access to training and capacity building on Integrated Pest Management.	41	(48.0)	(28.0)	(12.0)	(12.0)	1.83
Adoption of sustainable and environmentally friendly processing practices.	50	(50.0)	(32.0)	(7.0)	(11.0)	1.79
Increase in production of Cocoa cultivation.	49	(49.0)	(34.0)	(7.0)	(10.0)	1.78
Increase in awareness of Integrated Pest Management.	62	(62.0)	(26.0)	(3.0)	(9.0)	1.59

Source: Field survey, 2024

CONCLUSION AND RECOMMENDATIONS

The study revealed that majority of the cocoa farmers adopted Integrated Pest Management (IPM) practices in the study area. They recognized the value of IPM and are willing to adopt these practices. However, challenges such as complexity, cost, and resource limitations need to be addressed. Encouragingly, some farmers believe agricultural extension programs meet their IPM needs, and were willing to adopt these practices. To enhance adoption rates and effectiveness, it is crucial to simplify IPM practices, provide adequate training, offer financial supports and resources, strengthen extension services and programs, and promote peer-to-peer learning and knowledge sharing. The findings provide valuable insights for policymakers, extension agents, and other stakeholders seeking to promote sustainable agricultural practices in Nigeria. Based on the findings of this study, the following recommendations were made:

- Policymakers and stakeholders should develop and implement policies that promote sustainable cocoa production, including incentives for farmers who adopt IPM practices, regulations on chemical pesticide use, and support for organic farming initiatives.
- Agricultural extension services should be strengthened to provide regular support and guidance to cocoa farmers on IPM practices.
- The government and private sector should promote farmer associations and cooperatives to foster collective action and support, peer-to-peer learning, and knowledge sharing among cocoa farmers through farmer field schools, workshops, and demonstration plots.
- The government and agricultural agencies should establish comprehensive training programs for cocoa farmers, focusing on simplifying IPM practices and providing hands-on training.

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