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ADOPTION CHALLENGES OF INTEGRATED PEST MANAGEMENT (IPM) TECHNOLOGY AND COCOA PRODUCTION IN CROSS RIVER STATE, NIGERIA: THE ELUCIDATION AND WAY FORWARD

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Abstract

Efforts to mitigate the effect of pest had been through the use of chemicals, which often leave residues in cocoa beans. The International Institute of Tropical Agriculture (IITA) in collaboration with Sustainable Tree Crop Programme (STCP) promoted Integrated Pest Management (IPM) in Nigeria. There is dearth of information on the challenges confronting cocoa farmers to use IPM hence a need for investigation. The study utilised a three-stage sampling procedure to select respondents from Cross River state. Trained farmers (10%) were selected using a systematic random sampling to obtain a total sample of 271. Field data were collected with Interview schedule on socio-economic, enterprise characteristics, and challenges faced by respondents in IPM adoption. Analysis was done with descriptive and inferential statistics. Pearson Product Moment Correlation (PPMC) was used to test hypothesis. The male respondents were 83.4% while the female were 16.6%. Very few (2.6%) of the respondents produced more than 4,000 kg of cocoa beans per annum. Age of farm with a weighed score of 244.5 was rated as the highest severe factor affecting IPM adoption. Negative relationship exists between challenges and adoption behaviour which was significant (r=-0.236, p=0.000). Challenges had high effect on adoption of IPM by cocoa farmers and yield was low. There is need for farm rehabilitation due to old age to boost yield and sustain cocoa production in the study area.

Key words**:** *cocoa production, insect pest, farmers, sustainable, yield*

INTRODUCTION

Cocoa is native to the Amazon basin and other tropical areas of South and Central America. Cocoa bean is used to produce chocolate and cocoa powder [11]. Apart from serving as source of livelihood to smallholder farmers, it plays tremendous role in the health sector. Lots of discoveries through researches reported that the consumption of cocoa products reduces fatigue, prevents malaria, diabetes and hypertension among others [6].

Globally, cocoa production increased from 4,651 million metric tonnes in 2017/2018 to 4,745 million metric tonnes in 2019 with a production forecast of 4,824 million metric tonnes in 2020 [12] (Table 1). However, there is no linear change in production but there was fluctuation in various patterns among different regions. Africa has remained the main cocoa producer with West Africa: Cote d' Ivoire, Ghana, Nigeria and Cameroon, together account for about two-thirds of world cocoa production. Other notable producers outside West Africa are Indonesia, Brazil, Malaysia, Ecuador, and Papua New Guinea [10].

In the 70s, Nigeria used to be the second leading cocoa producer in the world but due to varied factors, such as farmers' inadequate fund to acquire inputs, ageing cocoa farmers and ageing cocoa trees which occupy a large proportion of established plantations led to decrease in cocoa production [15]. In Nigeria, the decline in cocoa production is mainly due to the incidences of insect pests and diseases along with other factors [7]. The major insect pests of cocoa are brown mirids; *Sahlbergella singularis and* black mirids; *Distantiella theobroma.* The damage caused by the aforementioned pests is up to an estimated loss of 100,000 tonnes. The main disease of cocoa is the 'Black pod' caused by *Phytophthora palmivora* and *Phytophthora megakarya* which resulted to 100% total loss

in some cocoa producing countries and in Nigeria with a loss of 75% [7].

Table 1. Production of cocoa beans (thousand tonnes)

	2017/18		Estimates		Forecast	
			2018/19		2019/20	
Africa	**3,496**	**75.2%**	**3,624**	**76.4%**	**3,693**	**76.6%**
Cameroon	250		280		290	
Côte d'Ivoire	1.964		2,154		2,180	
Ghana	905		812		850	
Nigeria	250		250		250	
Others	127		128		123	
America	**836**	**18.0%**	**838**	**17.7%**	**853**	**17.7%**
Brazil	204		176		190	
Ecuador	287		322		325	
Others	345		340		338	
Asia & Oceania	**319**	**6.9%**	**283**	**6.0%**	**277**	**5.7%**
Indonesia	240		200		200	
Papua New Guinea	36		40		35	
Others	43		43		42	
World total	**4,651**	**100.0%**	**4,745**	**100.0%**	**4,824**	**100.0%**

Source: ICCO, 2019/20.

There are about 1,500 different species of insect pests attacking cocoa; only less than two percent are of genuine economic importance [16]. The brown cocoa mirid, *Sahlbergella singularis*, Haglund (Hemiptera: Miridae) could derease yield as low as 30% minimum per season. So far in Nigeria, there is no organic cocoa, as synthetic pesticides spray application must be adopted to keep plantations productive. However, with the idea of IPM, the number of spray applications has been further reduced [14].

The application of IPM helps to monitor and target destructive pests and various cultural field operations including sanitation, early harvest and disease symptoms identification. The use of IPM leads to improved and safe yields from farmers' field. In order to achieve this level, some costs will be involved on the part of producers and consumers. IPM goal seeks to use research in investigating the right methodology that will assist farmers minimise regular use of pesticides. IPM practices protects the environment, promotes crop quality and profit potentials of stakeholders.

Research problem statement on IPM

Globally, insects pests and diseases cause economic loses in damages to crops such as cocoa every year [4]. Nigerian cocoa farmers use a lot of agro-chemicals (insecticides, herbicides and fungicides) to increase production, but they often do not consider the negative impacts of this on the cocoa beans and the environment. Environmental protection is now a serious problem.

This study focused on the various factors, which influence the decision of Cocoa farmers to adopt IPM practices. The research paid special attention to the implementation process of IPM and its adoption by a group of farmers whose need for the program was considered important and possibly as a test case for comparable crop growers in a vital Nigerian sector with export capability. IPM has passed through a period of rapid expansion with the development of a whole

host of agents and measures available for pest control. In recent years, there seems to have been a move towards consolidation of principles, approaches and practices in IPM. Part of this process of consolidation has focused attention on the details of individual control measures, intervention of CRIN-institutional control measures such as the Good Agricultural Practices on pesticides use and more on practical requirements of moving the ideas and the techniques to the field, and dealing with the problems of IPM implementation.

Adoption of technological innovations in agriculture has attracted much attention in literature for decades, since technologies have long been perceived as the key to rapid agricultural growth in many countries. The majority of the population in Nigeria derive their livelihood from agricultural production, and new technology offers opportunities to increase production substantially.

The study of challenges facing IPM adoption on the part of farmers is crucial to developing a practical guide to the principles, approaches and techniques involved in implementing an IPM program. Such a guide would emphasize the need for, and the means of good management, and the integration of factors necessary to produce a complete IPM program to fit the needs of farmers and their farming practices.

The general objective of the study is to assess the challenges of adoption of integrated pest management among trained cocoa farmers in Cross River State of Nigeria.

Specifically, the study addressed the following objectives:

(i) Describe the socio-economic characteristics of the respondents.

(ii) Identify the enterprise characteristics of the respondents.

(iii) Examine the challenges experienced by the respondents in adopting IPM.

(iv) Investigate the IPM adoption behaviour of the trained cocoa farmers.

Statement of hypothesis

There is no significant relationship between challenges and adoption behaviour of the trained cocoa farmers.

MATERIALS AND METHODS

A three-stage sampling procedure was used to select respondents during data collection. The study was conducted in Cross River State. It is a Tropical Rainforest zone out of three agro-ecological zones where cocoa production is prominent in Nigeria and a training on IPM was done by IITA/STCP for 2,714 farmers who were selected purposively. The next stage was to select 10% respondents from the state using systematic random sampling technique to obtain a total 271. Field data was collected with interview schedule on socio-economic, enterprise characteristics, and challenges experienced by respondents in adopting IPM.

Data collected were analysed with descriptive and inferential statistics. Pearson Product Moment Correlation (PPMC) was used to test the hypothesis of the study.

Data and description of variables

The following independent variables were used in the study: sex, age, farming experience, yield, farm size and challenges to IPM adoption while dependent variable is adoption behaviour.

Table 2. Description of explanatory variables

Explanatory variables	Type of variables	Description
Sex	Dummy	Male=1 Female=2
Age	Continuous	Actual age
Farming experience	Continuous	Actual years of experience
Yield	Continuous	Actual kg per bag (64kg bag)
Farm size	Continuous	Actual size in hectares
Challenges to IPM adoption	Categorical	Very severe=2, Severe=1, Not severe=0

Source: Field survey, 2015.

RESULTS AND DISCUSSIONS

Sex of Respondents

Result in Table 3 revealed that 83.4% were males while 16.6% were females. This is an indication that more males practiced IPM technology than the females. This finding is in line with [2] who opined that rural women farmers are constrained by social and institutional factors including access to inputs, modern technologies, education and land ownership.

These factors limit rural women's ability to adopt improved agricultural technologies which affects their contributions to agricultural production.

Age of respondents

Table 3 reveals that few of the respondents (29.5%) were between the ages of 21 and 40 years, (8.5%) 61 and 80 while majority (62.0%) were between 41 and 60 years which indicates that most of them are still in their prime age and would be ready to learn and apply IPM techniques on their farms.

Youths are more zealous to acquire information than older farmers and are likely to take risk in implementing new technologies utilization.

Older farmers tend to adhere to their conservative ways of farming and are hardly convinced to adopt newly introduced technologies [1] posited that younger farmers have much more energy and are more likely to invest in long term production.

Farming experience of the respondents

Respondents' farming experience as shown in Table 3 reveals that some (46.9%) had between 11 and 20 years of experience. Adoption of IPM technology could be affected moderately due to the fact that older farmers with long years of experience want to avoid risk and are not likely to be flexible than younger farmers and thus have a lesser likelihood of information utilization. According to [5] the relationship between adoption of agricultural technologies and farming experience remains mixed.

Table 3. Percentage distribution of respondents' according to socio-economic characteristics

Socio-economic variables	(n=271) Frequency	Percentage
Sex		
Male	226	83.4
Female	45	16.6
Age		
21-40	80	29.5
41-60	168	62.0
61-80	23	8.5
Farming experience		
1-10	66	24.3
11-20	127	46.9
21-30	62	22.9
31-40	13	4.8
41-50	3	1.1

Source: Field survey, 2015.

Respondents' enterprise characteristics

Respondents' yield

The result in Fig. 1 shows that majority of the farmers are small scale farmers as 61.9% of the respondents produced less than 1,000kg in the last one year.

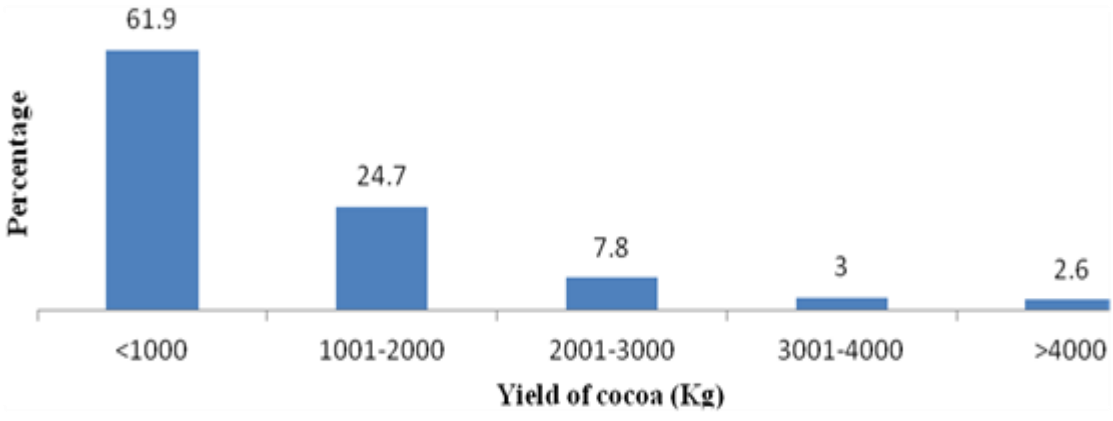

Fig. 1. Percentage distribution of respondents according to yield
Source: Field survey, 2015

The result also reveals that 24.7% produced between 1,001-2,000 kg/annum, 7.8% between 2,001-3,000 kg/annum, 3.0% between 3,001-4,000 kg/annum while very few (2.6%) produced more than 4,000 kg/annum.

The low yield of cocoa could have been affected by the level of IPM adoption by the respondents. This result is corroborated by [8] that production of cocoa farm is low due to inappropriate use of chemical, farm age and age of trees.

Size of farm

Fig. 2 shows that most of the respondents (93.0%) own farm size of between 1 and 5 ha, 5.9% had 6 and 10 ha while only 1.1% had above 10 ha with a mean value $\bar{x}$=2.97. This implies that majority of the farmers own small farms, which could have effect on IPM adoption. The farm size owned by the cocoa farmers showed that most of them were smallholders growing cocoa on less than 10 hectares of farmland. This may be attributed to land tenure system in the country which favours land fragmentation through inheritance. A farmer having large cocoa farms could harvest more cocoa which may translate into higher income for the purchase of the relevant inputs to implement the technologies. Cocoa farm size could have a positive effect on adoption due to availability of large expanse of land for cocoa cultivation resulting to increase in cocoa output and income would increase, enhancing the probability of technology adoption. This finding is similar to an earlier report by [14], who posited that 75.5% of the cocoa farmers in Nigeria were either small or medium scale farmers. Also, [3] observed that farmers own an average farm size of six hectares that are scattered in different locations in the area.

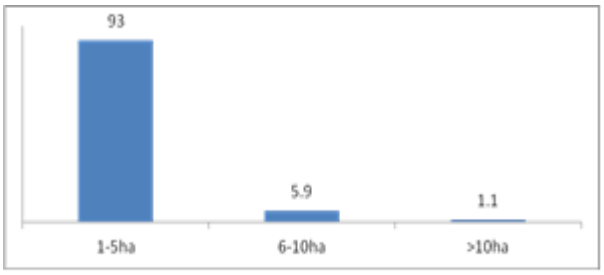

Fig. 2. Percentage distribution of respondents' according to farm size
Source: Field survey, 2015.

Respondents' challenges to IPM adoption

Table 4 shows the rating of challenges experienced by respondents IPM adoption. Majority of the respondents rated age of farm (244.5) as the highest severe factor affecting IPM adoption in the State. [13] reported that age of farmers, access to capital and farming experience could affect farming business.

Other challenges such as inadequate credit facilities (228.8), inadequate labour and extension services were also severe constraints which could be as a result of rural urban drift of the youth in search for white collar job and lack of support for extension services by the government. Increase in government support for extension services would create opportunities for farmers' access to credit facilities for cocoa production. Encouraging farm mechanization may be an option to overcome the problem of inadequate labour.

Table 4. Percentage distribution of respondents according to challenges in IPM adoption

S/N	Variables	Very severe		Severe		Not severe		Weighted score
		Freq	%	Freq	%	Freq	%	
1	Age of farm	148	54.6	50	18.5	73	26.9	244.5
2	Off farm activities	93	34.3	63	23.2	115	42.4	191.7
3	Inaccessibility to market information	64	23.6	81	29.9	126	46.5	177.1
4	Inadequate labour	93	34.3	56	20.7	122	45.0	189.3
5	Inadequate credit facilities	146	53.9	57	21.0	68	25.1	228.8
6	Inadequate contact with extension agents	115	42.4	56	20.7	100	36.9	205.5
7	Non membership of cooperative	133	49.1	49	18.1	89	32.8	216.3

Source: Field survey, 2015.

Hypothesis 1: The result reveals that negative relationship exist between constraints and adoption behaviour and was significant (r=-0.236, p=0.000) (Table 5). This shows that the higher the challenges the lesser adoption behaviour of the respondents. Despite these constraints the farmers' field schools are today reputed as places where the farmers can gain greater mastery of integrated control methods which could ameliorate the constraints being faced by farmers. According to [9] farmers with higher education have more tendency for adoption of IPM technology which is widely considered as a complex technology involving various methods including arriving at Economic Threshold level (ETL).

Table 5. Correlation of challenges and adoption behaviour

	Cross Rivers State		
Variable	**r**	**P**	Decision
Challenges	-0.236**	0.000	Significant

Source: Field survey, 2015.

CONCLUSIONS

In conclusion, most of the farmers were in their prime age and ready to learn and apply the skill of IPM techniques in their farms. Most of the small scale farmers were males with long years of farming.

Age of farm and inadequate credit facilities were rated as the most severe challenges while the average yield of the farmers was low.

Government should encourage youths involvement in cocoa production to enhance sustainability.

The farmers size of farm is small they need to be supported with soft loan to enhance increase in their hectare of cocoa farms. Yield improvement programme such as rehabilitation programme in agronomic practices should be initiated in order to increase yield of farmers. Women should be encouraged to grow cocoa and they should be given access to farm land for tree crops.

There is need to examine the factors that pose challenges to adopt IPM practices in order to design and implement proper policy measures to promote the adoption of IPM. This will lead to a paradigm shift from the primitive natural control practices previously used by the farmers.

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