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Preventive Measures Adopted by Nigerian Farmers for the Environmental Hazards in Cocoa Plantations

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Abstract

The study investigated the adoption of environmental hazards preventive measures among cocoa farmers in Nigeria. It specifically identified and evaluated the preventive measures adopted by the farmers against environmental hazards associated with cocoa farming. A multistage sampling procedure was used in selecting 600 respondents from five geo-political zones where cocoa is commercially grown in the country. Results revealed that cocoa farming was dominated by male farmers (94%) with a mean age of 48.6±14.0 years, while 81.5% were literate. Fifteen environmental hazards preventive measures were adopted by the farmers, of which the highest adopted preventive measures were hygiene practices on the farm (48.8%) and use of disease resistant varieties (48%). The farmers indicated that they (61.5%) never allowed crops to be less vulnerable, 57.8% never adhered to cocoa certification procedure and55.7% never practiced integrated pest management techniques. On the whole, however, 28.8% fell into high adoption category. The study further showed that there was a significant and positive correlation between adoption of environmental hazards preventive measures and farmers' yield at ($r = 0.936$; $p<0.05$).This implies an increase in the yield of cocoa production vis-à-vis the adoption of environmental hazards preventive measures among the Nigeria cocoa farmers.

Keywords: adoption, environmental hazards, preventive measures cocoa farmers

Introduction

Among other crops of economic importance, cocoa is the largest non- oil export crop in Nigeria produced by smallholder farmers. Over 200,000 households in the 14 cocoa producing states in Nigeria depend on the crop as a source of livelihood (National Cocoa Development Committee (NCDC), 2008). Though Nigeria contributed 11% of the World's 3.5 million tons cocoa supply in 2005 (Nzeka, 2005), its benefits and contributions to the country's economy and people's health cannot be overemphasized. In 2002, it contributed 2% to the national export earnings (NCDC, 2008). Also, Agboola and Ochigbo (2011) claimed that Cocoa and cocoa preparations contributed $533.4 million to Nigeria non-oil export earning between January and June 2011, Agbota (2014) claimed that cocoa contributed $900m to Nigeria's economy in 2012. Studies have shown that the

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consumption of cocoa products performs the following health benefits: reduces fatigue, prevents malaria, diabetes and hypertension, among others (International Cocoa Organization ICCO, 2008).

However, cocoa production is faced with lots of problems of which insect pests and diseases are of paramount importance (Asogwa and Dongo, 2009, CRIN, 2010 and Iremiren, 2011). In an attempt to solve the various problems associated with cocoa farming, cocoa farmers engage in indiscriminate use of chemicals such as pesticides, insecticides, fungicides, and fertilizer which have always led to environmental hazards (Famuyiwa *et al*, 2013). As important as food is for human survival, there is a multi-directional relationship between agriculture that produces food and health. Gillespie, Ruel and Braun (2008) reported that agriculture is fundamental to good health while good health plays an important role in agricultural production; in term of quality labour. Most major health problems facing the world in recent times such as, inter alia, under nutrition, malaria, obesity, AIDS, food borne diseases, diet – related chronic diseases and a range of occupational health hazards are associated to agriculture that produces what we consume. On the other hand some of these major health problems can be corrected by food. To solve this problem, ICCO recommended best practices for cocoa bean to meet the stipulated European Union (EU) Maximum Residue Level (MRL) of 0.1mg and to avoid rejection of Nigerian cocoa bean from the World Market (Mohit, 2008). In achieving the stipulated EU recommendations, environmental hazardous preventive measures were recommended (ICCO, 2008).

Prevention is a phenomenon, which according to advanced learner dictionary (2000) is described as stopping bad from occurrence. However, Block (2004) explaining in terms of medical sciences described prevention as an investment to be leveraged rather than a cost to be justified. The cost of prevention is usually lower than the cost of cure. Among models of prevention, Diffusion of innovation has been a long standing theory on the spread of new ideas among groups of people or community and also the core of agricultural extension. Rogers (1960) defined diffusion as a process by which an innovation is communicated through certain channels over time among the members of a social system. The diffusion leads to individual innovation decision process which results to adoption categories and individual behavioral change. Famuyiwa and Torimiro, (2011) asserted that the key antecedents of behavioral change include knowledge, belief and attitudinal change. Foregoing indicates that to achieve best practice hence meeting the Minimum Residue level (MRL) of 0.01mg and a resultant cocoa farming that leads to sustainable standard in the aspect of economy, social, and environmental sustainability; it is germane to study the cocoa farmers' adoption levels on preventive measures against hazardous practices. This will create a gap for cocoa farmers training needs and capacity building, which are consequential to assure consumers of cocoa and cocoa products safety of consumption.

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Objective

The specific objectives of the study were to:

(a) identify socio-economic characteristics of cocoa farming in the study area;
(b) determine the cocoa farmers' knowledge of environmental hazards preventive measures in the study area; and
(c) identify and evaluate the preventive measures adopted by farmers against environmental hazards associated with cocoa farming in the study area.

Hypothesis

H_o: There is no significant relationship between farmers' cocoa yield and adoption of environmental hazards preventive measures

Methodology

A multistage sampling procedure was used in selecting respondents for the study using CRIN Geographical Information System (GIS) generated land use/ land cover in cocoa farms in Nigeria. Stage one involved purposive selection of five from six geo-political zones where cocoa is commercially grown in Nigeria. Stage two involved purposive selection (based on their production levels; the highest producing state was selected) of one state from each of the five geo-political zones that support commercial production of cocoa, this gave a total number of five states (Ondo, Kogi, Abia, Cross Rivers and Taraba) from the fourteen states. At stage three, selection of two local government Areas (LGAs) which were purposively selected (on their levels of production; the highest and the lowest producing LGAs) from the list of LGAs based on their production level of cocoa to give 10 LGAs. Stage four was a random selection of one community from the lists of communities in each LGAs to give 10 communities. While stage five involved systematic selection of 60 smallholder cocoa farmers from the list of cocoa farmers in each community to give 600 smallholders as the respondents for the study. A structured interview schedule was used to elicit information from the respondents while data were analyzed using descriptive and inferential statistical tools.

Development of scale to measure environmental hazards preventive measures

From exhaustive review of literature, (Eteng, 2005; ICCO, 2008;; Tettey, *et al*., 2009; Wright and Boorse, 2010; and Ogunjimi and Farinde 2012), 15 preventive measures were identified, listed and measured against three likert scale; Never practiced with a score of 0, Seldom practiced score 1, while practiced scored 2. The mean and standard deviation were calculated and farmers grouped into categories of adopters using adoption quotient as calculated by Sengupta (1967) in Shashekala *et al* 2012, into high, medium, low and no adopters using grand mean plus/minus standard deviation.

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Results and Discussion

Socio-economic characteristics

Table 1 shows respondents' mean age of 48.57±14.08 year's standard deviation, with majority (83.1%) below 60 years. Earlier study by Asogwa and Dongo (2008) indicated age as one of the problems of cocoa production, but the study revealed that more young people are going into farming; this was corroborated by Oluyole and Sanusi (2009) that more young people were entering cocoa farming in Cross Rivers. It also indicated that cocoa farming was among male with majority (94%) supporting the claims of Oladipupo (2010) that distribution in farm work is skewed towards the male gender as a result of gender inequalities. However, it was also indicated that farmers were well experienced with a mean age of 24±14.9 years. About 32.4 per cent had between 11 and 20 years, 23.2 per cent between 21 and 30 years, 19.6 per cent between 10 and 20 years, 11.5 per cent between 31 and 40 years while 13.1 per cent had more than 41 years of farming experience. Data in Table 1 also shows the distribution of cocoa farmers according to their farm size in Ha. The data revealed that majority (74.7%) of the farmers had between 0.5 and 10 Ha, 14.3 percent between 11 and 20 Ha, 6.2 percent between 21 and 30 ha, 0.8 cultivated between 31 and 40 Ha, while 4.0 percent cultivated above 40 Ha. The mean farm size in the study area was 10.4Ha with standard deviation of 2.0. Respondents' mean farm age was 32.3± 2.2 years standard deviation. Very few (18%) had farm equal or less than 10 years of age. About 48.67% of the respondents' farms were under productive age of 30 years, while about half (51.3%) of the respondents cultivated farms that were more than 30 years old. It was further discovered that farmers' extension contact was very low with majority (87.30%) not having contact while only 12.70% had contact.

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Table 1: Respondents' socioeconomic characteristics

S/N	Variables	Percentage (n=600)	Mean	Std
1	**Age**		48.57	14.08
	20-40	36.9		
	41-60	46.2		
	61-80	15.1		
	81-100	2		
2	**Sex**			
	Male	94		
	Female	6		
3	**Years of farming experience**			
	10 - 12years	19.6	24	14.9
	11 - 20years	32.4		
	21 - 30years	23.2		
	31 - 40years	11.5		
	41 - 50years	8.1		
	51 - 60years	4.2		
	> 60years	0.8		
4	**Farm size**			
	0.5 - 10 ha	74.7	10.4	2.0
	11 - 20 ha	14.3		
	21 - 30 ha	6.2		
	31 - 40 ha	0.8		
	> 40 ha	4		
5	**Age of farm**			
	<10	18	32.3	2.2
	11 - 20 years	18.2		
	21 - 30 years	12.5		
	31 - 40 years	20.3		
	41 - 50 years	17.8		
	51 - 60 years	8.3		
	61 - 70 years	1.5		
	> 70 years	3.3		
6	**Farmers' Extension contact**			
	Yes	12.70		
	No	87.30		

Source: Field survey, 2012

Level of education

Figure 1 revealed the distribution of respondents according to their educational level. Among the respondents; 18.5% of the cocoa farmers did not have formal education,

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24.5% did not complete primary school, while 16.8% completed primary school. 11.2% did not complete secondary, 16.3% completed secondary while 7.2% did not complete secondary and 5.5% completed post secondary school. Education is significant in adoption as the process of adoption is a mental process that involves individual decision making process. Though, Deji and Enuenwemba (2005) described that low level of education is a typical characteristics feature of an average rural area in Nigeria. Consequently, this low level of education may have a negative effect on adoption of preventive measure.

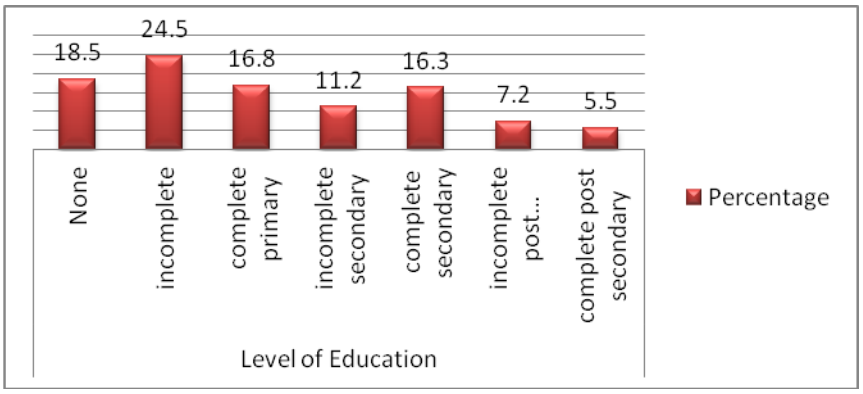

Figure 1: Showing Level of education of cocoa farmers in the study area.
Source: Field survey, 2012

Membership of cocoa organization

Figure 2 revealed that majority (68.7%) of the respondents did not belong to any cocoa organization, while only 31.3% belonged to one cocoa organization or the other. It further revealed that 16% belonged to Cocoa Association of Nigeria, while 15.3% belonged to some other cooperative local groups. The result also implies that farmers may be more exposed to environmental hazards due to their sources of information. Membership in organization allows for peer influence among members hence having a significant influence on the innovation depending on the benefits members can find in it. Oduwole (2011) attributed that one major benefit of belonging to organization is the share of knowledge on innovation; this aids adoption as information about the innovation are shared among peers.

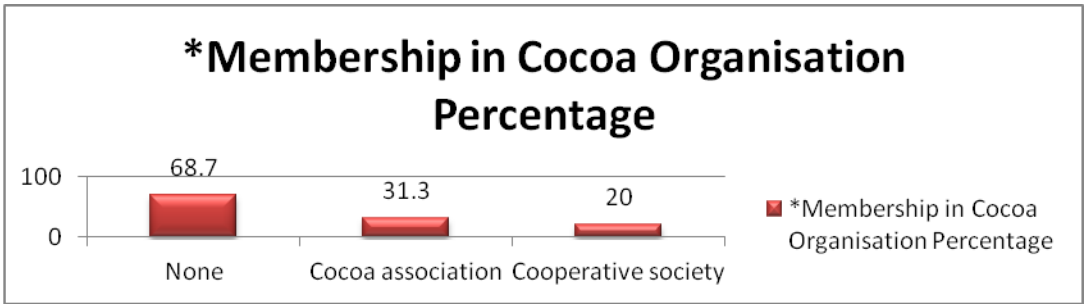

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Figure 2: Showing farmers' membership in cocoa organization
Source: Field Survey, 2012

Sources of information on prevention measures

Table 2 revealed that input dealers (70%), Friends and Neighbors (60%) and Radio/Television (50%) were the most frequent sources of information to cocoa farmers on environmental hazards preventive measures associated with cocoa farming. Other sources of information are other Association (45%), Newspaper (35%), Government agencies (30%), Cocoa association (25%) while Research Institute and Extension Agent/Agency were (20%) each. Uwagboe (2010) corroborated this result that 70 % of farmers in Edo State source their information from cocoa chemical dealers. The issue of information dissemination is very germane to adoption of innovation, more importantly the content and mode of the information transfer. This result implies that sources of information on issues of environmental hazards preventive measures to the respondents were not from approved sources. Hence there is likelihood for a negative influence on the adoption of preventive measures among the farmers. The result also implied that farmers may be more exposed to environmental hazards due to their sources of information.

Table 2: Distribution of respondents by sources of information on preventive measures against environmental hazards associated with cocoa farming

S/N	*Sources of information	Percentage (n= 600)
1	Extension Agent/Agency	20
2	Friends and Neighbors	60
3	Cocoa farmers' association	25
4	Other association	45
5	Radio/Television	50
6	Newspapers	35
7	Research institutes	20
8	Government	30
9	Inputs dealers	70

Source: Field survey, 2012. *Multiple responses were recorded

Production of farmers

Table 3 shows the distribution of respondents with respect to their level of production. Majority (53 %) had low yield at equal less than 393kg/ha, while 37.17% had high yield at greater than 503ka/ha, and 9.83% as medium level of yield. The mean production was 218.79 kg/ha with standard deviation of 192.63.

CRIN (2010) reported that the national average yield of cocoa/ha/year range from 393 kg – 503 kg. While the release of new eight hybrid varieties; Tc1 – Tc8 produce between 1800kg – 2000kg. This report is used in categorizing the yield level of the farmers; using

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mean+/- standard deviation. The farmers that scored equal and above 503 is rated high, below 393kg low and between 393kg – 503kg rated medium.

This implies that majority were not producing at maximum level which could be as a result of farm age, insect pests and disease incidences and not adhering to recommended practices. This result is corroborated by Asogwa and Dongo (2008) that production of cocoa farm is low due to inappropriate use of chemical, farm age and age of trees.

Table 3: Distribution of respondents by level of production of cocoa

Production Level	Scores	Percentage (n= 600)
High Level	>503kg	37.17
Medium	>393<503	9.83
Low Level	393kg <	53.00

Source: Field survey, 2012
Minimum =11.67kg/ha
Maximum =993.06kg/ha
Mean = 218.79 kg/ha
Standard deviation =192.63

Knowledge and Adoption levels of environmental hazards preventive measures among cocoa farmers in five geo-political zones of Nigeria

The respondents' knowledge on environmental hazards preventive measures was high as indicated on Table 5. The farmers that had knowledge were 80% while without were 20%. However, mean adoption score was 13.89, standard deviation 8.13, while maximum score was 30 and the minimum score 0.00. Table 5 also shows categorization of the farmers into levels of adoption; using calculated adoption quotient. It shows the respondents' distribution by level of preventive measures adopted and rank order across five geo-political zones in Nigeria. On the whole, it revealed that 28.83% had high adoption, 60.67% medium, 8.5 low and only 5% did not adopt any of the measures. Consequently, based on the adoption levels, Southeast zone scored the highest adoption zone, while Southwest took the 5th position. On the contrary, Southsouth had the highest knowledge with North central having the 5th position.

Badilescu-Biga (2013) identified that knowledge gap is a key element in adoption of innovation; while adoption is defined as a five mental process all prospective customers go through from learning to acceptance or rejection of a new product. The result shows a great variability with respect of knowledge to adoption (practice). These results support the findings of Badcock-walter (2004) who claimed that knowledge does not equal to change and Uwagboe (2010) who in a study discovered that farmers who were trained on Integrated Pests Management (IPM) did not adhere to the practice. However, Asenso-

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Okyere and Davis (2009) explained that for proper articulation of knowledge and adoption, innovation knowledge created must be accumulated, shared, used and valued.

Table 4: Variability in knowledge and adoption levels of environmental hazards preventive measures among cocoa farmers in five geo-political zones of Nigeria

		Geo-political zones					
		South West	North Central	South south	South east	North east	Total
Adoption Categories	**Scores**	**Percent**	**Percent**	**Percent**	**Percent**	**Percent**	**Percent**
High	>22.02	15	13.33	0	33.33	39.17	25.83
Medium	>5.76<22.02	65	70.84	80.83	61.67	53.33	60.67
Low	<5.76	11.67	10	19.17	0	7.5	8.5
No adopter	0	8.33	5.83	0	5	0	5
Total	100	100	100	100	100	100	100
Adoption rank Order		5th	3rd	4th	1st	2nd	
Knowledge of preventive measures	**Scores**	**Percent**	**Percent**	**Percent**	**Percent**	**Percent**	**Percent**
Yes	1	85	72	92	73	76	80
No	0	15	28	8	27	23	20
Total	100	100	100	100	100	100	100
Knowledge rank order		2nd	5th	1st	4th	3rd	

Mean = 13.89
Standard deviation = 8.13
Minimum = 0
Maximum = 30

Environmental hazards preventive measures in cocoa farming

Table 5 shows the rank order of means by practice of preventive measures among respondents in the study area. Among the practices, only practice of sustainable farming practices (Good Agricultural Practices) mean score 5.44 and adherent to recommended agronomic practices a mean score value of 5.44 have high scores while others have low scores. Lawal *et al.* (2005), Uwagboe (2010) and Ogunjimi and Farinde (2012) differently established that cocoa farmers do not adhere to precautionary on the use of pesticides, hence expose themselves to environmental hazards. This implies that practice of preventive measures of environmental hazards associated with cocoa production were very low in the study area.

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Prevention is a process of militating against adverse effect. Block (2004) describing prevention in medicine says is an investment to be leveraged rather than a cost to be justified.

Table 5: Rank means scores of adoption of preventive measures associated with environmental hazards in cocoa production among the respondents

S/N	Preventive measures	Mean scores	Rank order
1	Adoption of sustainable farming practices	5.44	1
2	Adherence to recommended agronomic practices	5.44	1
3	Hygiene practices on the farm	4.92	3
4	Level of education	4.82	4
5	Adherence to cocoa certification programme	4.79	5
6	Practicing of IPM techniques	4.66	6
7	Specific cultural practices and farm rehabilitation	4.1	7
8	Allowing crops to be less vulnerable	3.98	8
9	Adherence to soil erosion prevention strategies	3.71	9
10	Attendance of extension training	3.32	10
11	Testing of soil before fertilizer application	3.29	11
12	Attendance of farmers' group meeting	3.06	12
13	Use of diseases resistant varieties	2.27	13
14	Practicing of organic farming	2.16	14
15	Regular medical checkups	2.04	15

Source: Field survey, 2012

Correlation analysis

There is no significant relationship between farmers' cocoa production and adoption of preventive measures of environmental hazards associated with cocoa yield. Table 6 shows that there is positive significant relationship between farmers' cocoa yield and the adoption of environmental hazards preventive measures. At r- value (0.936, $p< 0.05$), coefficient of determination 0.876 and percentage of contribution 88%, the null hypothesis is rejected. It indicated high percentage of contribution, which implies that as practice of preventive measures increase, production increases. Adoption of new and improved ways of avoiding hazards may make farmers less vulnerable and hence increase production.

Table 6: Correlation analysis showing relationship between cocoa farmers' yield and adoption of environmental preventive measures

Variables	Pearson correlation Coefficient (r)	Coefficient of Determination (r^2)	Percentage of determination
Adoption	0.936*	0.88	88%

Source: Field survey, 2012. P< 0.05

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Conclusion and recommendation

The following implications were drawn from the study

1. Farmers' cocoa yield was low compared to recommendation from CRIN that has research mandate to improve and increase cocoa yield at a sustainable level.
2. There is need to train cocoa farmers on prevention measures against environmental hazards for improve in yield, quality of cocoa beans and safety of farmers.
3. There was poor Extension/farmers contact; there is need for concerted effort from all stakeholders to come together in an innovation platform that allows information to flow.
4. There was high variability between knowledge and adoption; high knowledge did not translate to adoption
5. Adoption of preventive measures had positive and significant relationship to cocoa yield in the study area

Intensive innovation knowledge transfer needs to be effectively carried out to increase adoption of preventive measures hence, improve certification process among farmers.

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