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Farmers' Utilization of Indigenous Knowledge Techniques for the Control of Cocoa Pests and Diseases in Ekiti State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author KEO designed the study, the methodology and wrote the first draft of the manuscript. Author JOO affirmed the methodology and corrected the first draft of the manuscript. Author KEO did the data analysis and wrote the final draft of the manuscript. Author JOO corrected and certified the final draft of the manuscript.

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ABSTRACT

There is a high level of pests and diseases infestation in cocoa farms in Nigeria which has resulted in a huge loss in cocoa output. Extension has been found as a veritable and vital source of technical and useful Agricultural information towards sustainable Agricultural development, but its activities are being curtailed by its low number compared to farmers' population in the country. It is in view of this that the study examined farmers' utilization of indigenous knowledge techniques for the control of cocoa pests and diseases in Ekiti State Nigeria. The study spanned through January 2011 and July 2012. It specifically ascertained the socio-economic characteristics of the cocoa farmers in the study area, the indigenous control practices of the farmers, sources of information on indigenous methods of cocoa pests and diseases control and examined the effects of extension activities on the utilization of indigenous methods for cocoa pests and diseases control. A purposive random sampling technique was used to select 120 cocoa farmers in the study area. Data was collected using a validated questionnaire and data collected was analysed

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using means, frequencies, percentages, chi- square and Person product moment correlation. Findings from the study revealed that majority (81 percent) of the farmers were males, 60 percent was above 50 years of age, and majority (75 percent) was married. A large percentage (75.8 percent) of the farmers had formal education. A large percentage (88 percent) received information on indigenous control methods from their parents and grandparents. The result from the study revealed that there was a significant relationship between sex (X^2= 4.253, P≤0.05) and the religion (X^2=19.160, P ≤0.05) of the respondents and the use of indigenous control methods. Similarly, findings revealed that there was a significant relationship between yield(r= 0.325, P ≤0.05), cost of pesticides (r= 0.258, P ≤0.05), income (r= 0.276, P ≤0.05) and farm size (r= 0.828, P ≤0.05) of the respondents and the use of indigenous methods of controlling diseases. There was no significant relationship between extension activities(r= 0.716, P ≤0.05) and farmers' use of indigenous knowledge. There is the need for extension workers and policy makers to study the farmers' attitudes, cultural universe and skills in order to deal with them effectively for improved cocoa production.

Keywords: Indigenous knowledge; cocoa; diseases and pests control.

1. INTRODUCTION

Cocoa is a perennial tree crop produced in many tropical countries, most especially in the West African countries of Ghana, Ivory Coast, Liberia, Nigeria and Cameroon. These countries collectively accounted for 68 percent of world production [1]. In the recent times cocoa production has being on decline due to many factors one of which is the problem of cocoa pests and diseases. Studies have revealed that pests and diseases have largely contributed to the declining productivity of cocoa in Nigeria. About 25 – 30% loss in yield of cocoa has been attributed to the cocoa mirids, *Sahlbergella singularis*, 17% is lost through the feeding of the cocoa pod borer *Characoma strictigrapta* while losses attributable to the major disease of cocoa (the black pod disease caused by *Phytophtora megakarya*) range from 30 – 90% in Nigeria [2].

The use of chemical pesticides (copper and metalaxyl-based fungicides) is short term solutions, but seems to be the most reliable and popular with farmers because of their quick, effective action. But it is now known that with non-target effects and resistance of the pathogens, the risks to human lives and to the environment is so great that there is no longer any question about the necessity to change to crop protection techniques which are less dependent on chemicals [3]. The problems associated with spraying include excessive tree height which makes infected pods disperse inoculum from the canopy, cost of chemicals, labour and poor cocoa prices. Also in wetter areas the chemicals are often washed off by heavy rains and need to be repeated. Cocoa farmers using these pesticides (containing different active ingredients) face constant exposure to these pesticides [4]. Human exposure to pesticides usually results in serious health problems such as epilepsy, stroke, respiratory disorders, cancer, leukemia, brain tumors and in some cases death [5]. The environmental impact of pesticides manifests in the disturbance of the ecosystem, principally in the form of water pollution (ground water, river water, drinking water) soil and air pollution, reduction of fish and wildlife populations and destruction of natural vegetation [5]. Therefore this control method is not entirely effective; it is expensive for the small scale farmers and not economically feasible [6].

The recent advocacy for production of organic cocoa has raised the issue of an alternative means to cocoa pests and diseases control which is environmentally friendly and effective. The use of different methods to disseminate information and impact knowledge in the farmers has led to the establishment of framer field school. There is a reservoir of valuable and largely untapped natural resources and indigenous knowledge that could be developed and used towards pests and diseases constraints in Nigeria [7].

It is unfortunate that despite the importance of indigenous knowledge to Cocoa pests and diseases control, it is still under-utilized as many farmers still rely solely on the use of modern approaches for controlling pests and diseases. Information on Indigenous Knowledge practices have been on decline due to lack of appropriate documentation and oral transfer of information from one generation to the next. It is also to be noted that indigenous knowledge information that

is being lost, could provide basis for many scientific study and solution to problems of cocoa pests and diseases among farmers in Nigeria. In view of the above, the study asked the following questions:

1. What are the socio-economic characteristics of the farmers in the study area?
2. Which indigenous methods do respondents use to control cocoa pests and diseases?
3. What are the sources of information on the indigenous control methods?
4. How do extension activities affect the utilization of indigenous methods for cocoa pests and diseases control?

1.1 Objectives of the Study

The general objective of this study was to determine the various indigenous methods for controlling pests and diseases of cocoa among farmers in Ekiti State, Nigeria.

The specific objectives were to:

1. Ascertain the socio-economic characteristics of the farmers in the study area.
2. Examine the indigenous control practices used by the farmers to control cocoa pests and diseases.
3. Determine the respondents' sources of information on pests and diseases control.
4. Examine the effects of extension activities on the utilization of indigenous methods for cocoa pests and diseases control.

1.2 Hypotheses of the Study

Ho_1: There is no significant relationship between farmers' socio economic characteristics and their use of indigenous control methods for cocoa pests and diseases.

Ho_2: There is no significant relationship between extension agents' activities and the use of the indigenous control methods by the farmers.

1.3 Significance of the Study

Nigeria's annual cocoa production has dropped sharply and various researchers have connected this poor trend to the problems of cocoa pests and diseases among others. Both localized and more generalized studies have revealed that indigenous knowledge is a veritable tool in controlling cocoa pests and diseases, it is therefore necessary to examine the various indigenous methods that farmers use in controlling cocoa pests and diseases in the study area as this will enable researchers and policy makers to realize that farmers in rural communities have detailed information that can help scientists in their approach to develop new ideas that will be culturally compatible, economically feasible and socially accepted to the farmers and it will provide basis for further research and extension information package to enhance cocoa production.

2. METHODOLOGY

This study was carried out in Ekiti State, Nigeria. The state is located in South Western Nigeria with forest vegetation. The people are mostly farmers cultivating food crops like cassava, yam, maize and tree crops like cocoa and kolanut among others. A multistage random sampling procedure was used. Firstly, One Local Government Area was purposively selected in each of the three Senatorial Districts in the state being the major cocoa producers in the three senatorial districts. They include Ise- Orun from Ekiti South, Oye Ekiti from Ekiti North and Ado from Ekiti Central. Secondly, two (2) communities were selected randomly from each of the three (3) Local Government Areas making a total of six (6) Communities. Each of the selected communities was divided into four (4) Wards. Out of which two wards were randomly selected making a total of eight (8) Wards. Lastly, fifteen (15) Farmers were randomly selected from each of the wards, making a total population of 120 farmers which were used for the study. A well structured, validated and pre-tested questionnaire containing both open -ended and closed- ended questions and interview schedule were used to collect primary data from the respondents with the help of trained enumerators and personal effort.

3. RESULTS AND DISCUSSION

3.1 Socio Economic Characteristics of Respondents

The socio economic characteristics of the respondents shown in Fig. 1 revealed that eighty one percent of the respondents were male while only 19 percent were female revealing the

dominance of male gender in cocoa production in the study area; this could be attributed to the drudgery nature. It should also be noted that male headed households usually out-number female headed households in most communities in Nigeria [8]. About 39.2 percent of the respondents fell within the age bracket of 51-60 years that is above the mean age which was 51 years. The implication is that older people who are the embodiment of indigenous knowledge are gradually falling out of farming leading to loss of information on indigenous knowledge practices if it is not transferred orally to the next generation. The result shows that 65 percent of the respondents have a farm size of between 0.1-2.5ha while 35 percent of them have farm size of 2.6-5ha according to [9] classification. The average farm size was 2.5 hectares. It implies that majority of them were small scale farmers. It should also be noted that the respondents have more than one farm located in different areas in their locality. The Figure shows that majority (75 percent) of the respondents were married indicating that we have more married farmers in the study area. The study further shows that only 24.2 percent of the respondents had no formal education this may be due to location of farm holdings which are usually far from school locations. Majority (75.8 percent) of them had formal education which implies that majority of the respondents were literate and as such able to incorporate their indigenous knowledge into their farming activities. The result implies that farmers were not ignorant but were aware of a wide range of plant species with pesticide effects and animal species which controlled harmful insects. They were also aware of various materials which could be used to trap, chase or destroy the pests or keep the pests away from their crops. The result also points that 40 percent of the respondents have been in farming for 21-30 years and 22.5 percent of them have being in farming for 11-20 years while 20 percent and 7.5 percent of them have being engaged in farming for 31-40 years and 1-10 years respectively. It implies that majority of the farmers have enough experience about their farming activities and might have acquired overtime the necessary indigenous knowledge needed to practice their farming business successfully. The result also shows further that majority (85 percent) of the respondents were farmers, 12.5% were traders and 2.5 percent were into produce processing. This result is in agreement with the finding that a greater percentage of people in the developing countries are engaged in agriculture [7].

3.2 Respondents' Sources of Information on Indigenous Methods of Controlling Cocoa Pests and Diseases

The results in Fig. 2 show that majority 74 percent of the respondents obtained information on indigenous methods of controlling cocoa pests and diseases from their grandparents and parents and about 10 percent obtained information from their friends. This result supports the fact that indigenous knowledge has been institutionalized, built upon and passed down from one generation to the next orally and that Indigenous Knowledge System is a systematic body of knowledge acquired by local people through the accumulation of experiences and informal experiments in an effort to cope with their agro- ecological and socio-economic environment [10,7].

The result from Table 1 reveals that pruning (59.2 percent) and shade management (19.2 percent) were the major indigenous methods used by respondents to control cocoa mirids or capsids in their cocoa farms. It was also found that complete, frequent and regular harvesting (70.8 percent) and pruning (23.3 percent) were the major indigenous methods used by respondents to control cocoa pod borer in their cocoa farms. The Table shows further that burying of cocoa husk (57.5 percent), chupon management (28.3 percent) were the major indigenous methods used by respondents to control scale insects in their cocoa farms. Only few (9.2 percent) and (5.83 percent) used cutting affected trees and temporary shading with banana and plantain respectively to control the pest. The table also points that planting barrier crops such as cocoa yam (72.5 percent) and avoiding trees that act as hosts to pathogens and pests (17.5 percent) were the major indigenous methods used by respondents to control stem borer in their cocoa farms. Very few (2.5 percent) were using uprooting and burning affected trees to control the pest.

The study indicates that majority (68.3 percent) of the farmers were using destruction of mounds with keeping of cut trees away from the farm to control termites in their cocoa farms while 15 percent of them farmers used weeding and about 5.83 percent and 4.2 percent of farmers used close spacing of crops and burying of used lead batteries to control termites respectively. The findings from the study points that majority (76.7 percent) of the cocoa farmers were using regular

physical removal of affected cocoa parts to control mistletoe in their cocoa farms.

The table also indicates that very high percentage (81.7 percent) of the cocoa farmers was using traps to control animal pests on their farms. Result of the study supports the findings of [6] that cocoa mirids is best controlled through pruning and shade management while, cocoa pod borer is best controlled by complete, frequent and regular harvesting insect through burying of cocoa husks in the farm and chupon management. Cocoa Stem borer is efficiently controlled by planting barrier crops such as cocoa yam in the farm and by uprooting and burning affected trees, control of termites can be achieved by destroying termites mounds, use of fufu, use of extract of lead batteries and weeding, mistletoe is also controlled by regular removal and cutting of affected trees, animal pests such as rodents are brought to the barest minimum by use of traps, weeding and pruning [6].

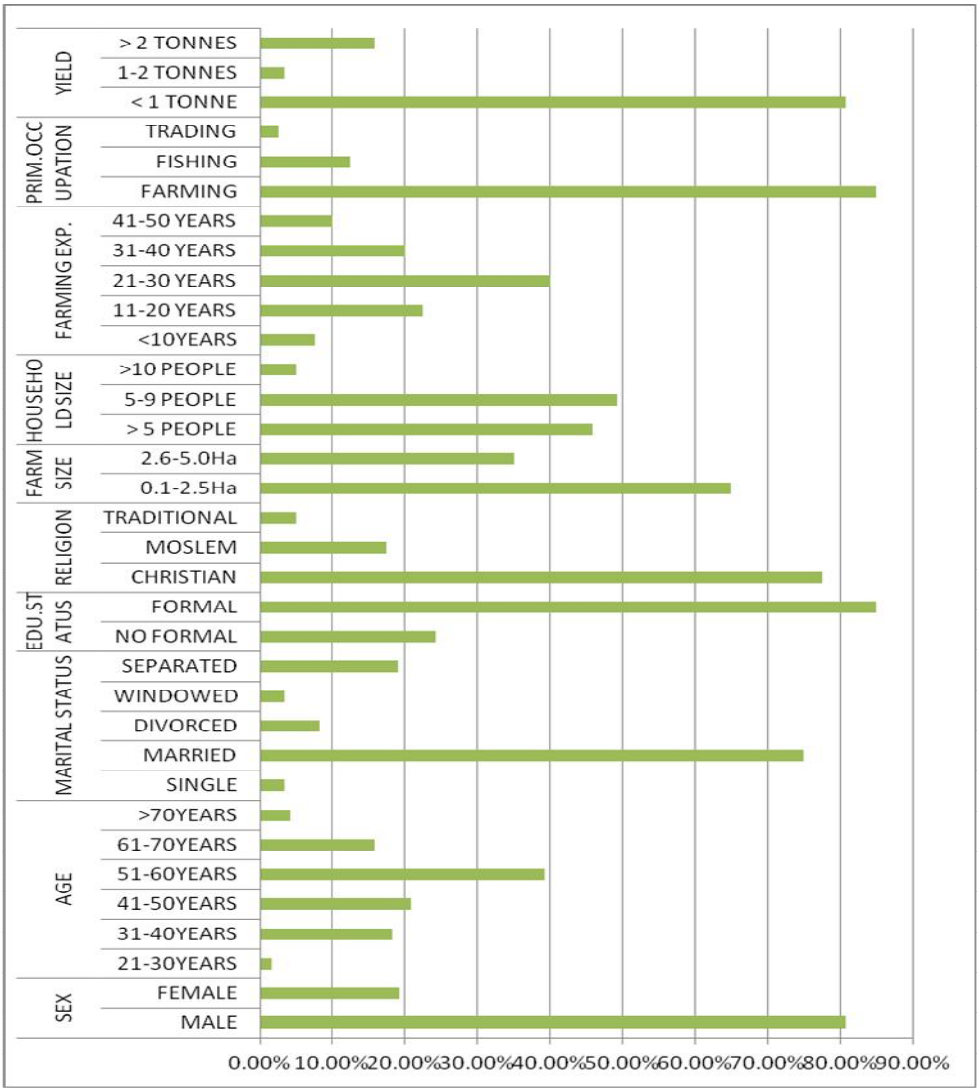

Fig. 1. Socio economic characteristics of respondents

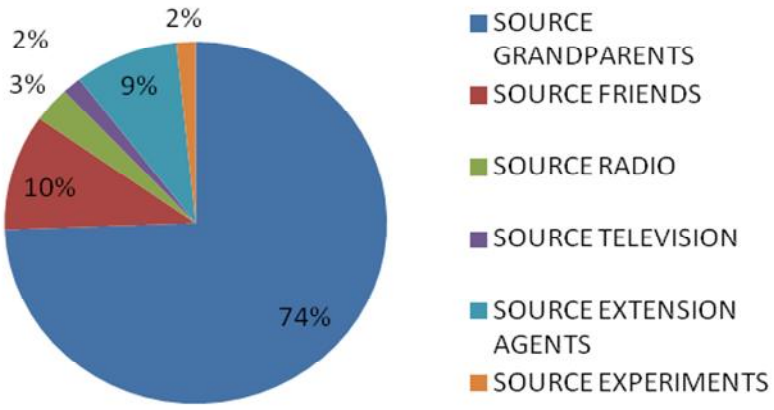

Fig. 2. Respondents' sources of information on indigenous methods of controlling cocoa pests and diseases

3.3 Respondents' Indigenous Methods of Controlling Cocoa Diseases

Table 2 shows that harvesting affected pods immediately (69.2 percent) and thinning of cocoa canopy (16.7 percent) were the major indigenous methods used by respondents to control frosty pod rot on their cocoa farms. This supports the assertion of [2] that harvesting affected pods immediately after infestation is the most efficient way of controlling frosty pod rot of cocoa. The Table indicates that majority (52.5 percent) of the respondents used cutting off affected trees to control witches broom. It was found that 74.1 percent of the respondents used pruning of affected branches while only 4.3 percent used harvesting of harvested pods to control vascular streak die back. The Table indicates that regular harvesting (69.2 percent) and removal of infected pods (16.7 percent) were the major indigenous methods used by the farmers to control black pod disease of cocoa and few (8.3 percent) used regular removal of mistletoe. This agrees with the findings of [11,6,12] that black pod disease can be best controlled through regular harvesting of infected pods, Black pod disease through weed control by slashing of the weed pruning and removal of epiphytes and parasites such as orchids and mistletoe. The study also found out that majority (68.3 percent) of the respondents used uprooting and burning of affected trees to control cocoa swollen shoot virus. The result supports the recommendation that cocoa swollen shoot virus can be best controlled by uprooting and burning affected trees [11]. The eradication/removal of infected trees has been the basic method of control for CSSV infected trees in Nigeria since 1946. This is done by uprooting all the obviously infected trees and surrounding area of up to 30m.

3.4 Respondents' Indigenous Methods of Controlling Stored Cocoa Pests

Results in Fig. 3 revealed that the use of traps (65.8 percent), followed by proper drying of cocoa beans before storage and regular sanitation of stores (26.4 percent) were the major indigenous methods used by the farmers to control stored cocoa pest, only few (4.2 percent) used dray poking, while about 3.3 percent used camouflages. The findings supports the assertion that cocoa rodents under storage are best controlled with the use of traps, regular sanitation of stores, dray poking and use of camouflages (11. About 14.2 percent of the farmers utilize regular sanitation of stores, 50 percent use effective cleaning of bags before loading and 4.2 percent burn off old residual grains in controlling stored cocoa beetles, moths and weevils.

3.5 Extension Agents' Visit to Respondents

The result in Fig. 4 indicates that majority (77 percent) of the respondents were not visited by extension agents, implying that extension activities in the area of study is poor. This lay the credence to continuous use of indigenous method only by the farmers. During Focus Group Discussion with the farmers' majority of the farmers asserted that they received information about indigenous knowledge from their parents and grandparents and only very few of them got information from extension agents as shown in

Fig. 2. This confirms [13] assertion that Indigenous Knowledge is transferred orally from one generation to another in South Western Nigeria and that the extension system is inefficient to introduce modern farming techniques to the farmers.

3.6 Respondents' Perceived Effects of Extension Activities on their Output

Results in Table 3 shows that the farmers agreed that Extension agents' activities has no improved their income ($\bar{X}$:1.77), farm sanitary practices ($\bar{X}$:1.80) and their access to information on different type of indigenous methods for controlling cocoa pests ($\bar{X}$:1.91). This is because the extension activities in the area are at the lowest ebb and as such do no impact on the farmers, indigenous knowledge or new technologies. The result supports [14] report that there has been a serious decline in extension activities to the farmers in South Western Nigeria due to constraints such as poor funding facing the extension agents and as such rarely provide farmers with needed information as at when required.

Table 1. Respondents' indigenous methods of controlling cocoa pests

Pests	Frequency	Percentage (%)
Cocoa mirids		
Pruning	71	59.2
Shade management	23	19.2
Cutting affected trees	8	6.7
Opening affected pods immediately	10	8.3
Weeding	8	6.7
Cocoa pod borer		
Complete, frequent and regular harvest	85	70.8
Pruning	28	23.3
Avoiding heavy shade	7	5.83
Scale insect		
Burying of cocoa husk	69	57.5
Chupon management	34	28.3
Cutting affected trees	11	9.2
Temporary shading with plantain and banana	7	5.8
Stem borer		
Planting barrier crops such as cocoyam	87	72.5
Uprooting and burning affected trees	21	17.5
Harvesting affected pods immediately	9	7.5
Uprooting and burning affected trees	3	2.5
Termites		
Destruction of mounds	82	68.3
Weeding	18	15.0
Close spacing of crops	7	5.83
Burying of use torchlight batteries	5	4.2
Burying dead animal visceral	4	3.3
Use of cassava slurry(fufu)	4	3.3
Mistletoe		
Regular removal	92	76.7
Cutting affected trees	20	16.7
Avoiding trees that act as hosts	6	5.0
Avoiding heavy shade	2	1.6
Rodents		
Use of traps	98	81.7
Weeding	8	6.7
Use of camouflage	5	4.2
Pruning	4	3.3
Use of sound	2	1.7
Use of pineapple leaves	2	1.7
Use of wood ash	1	0.8

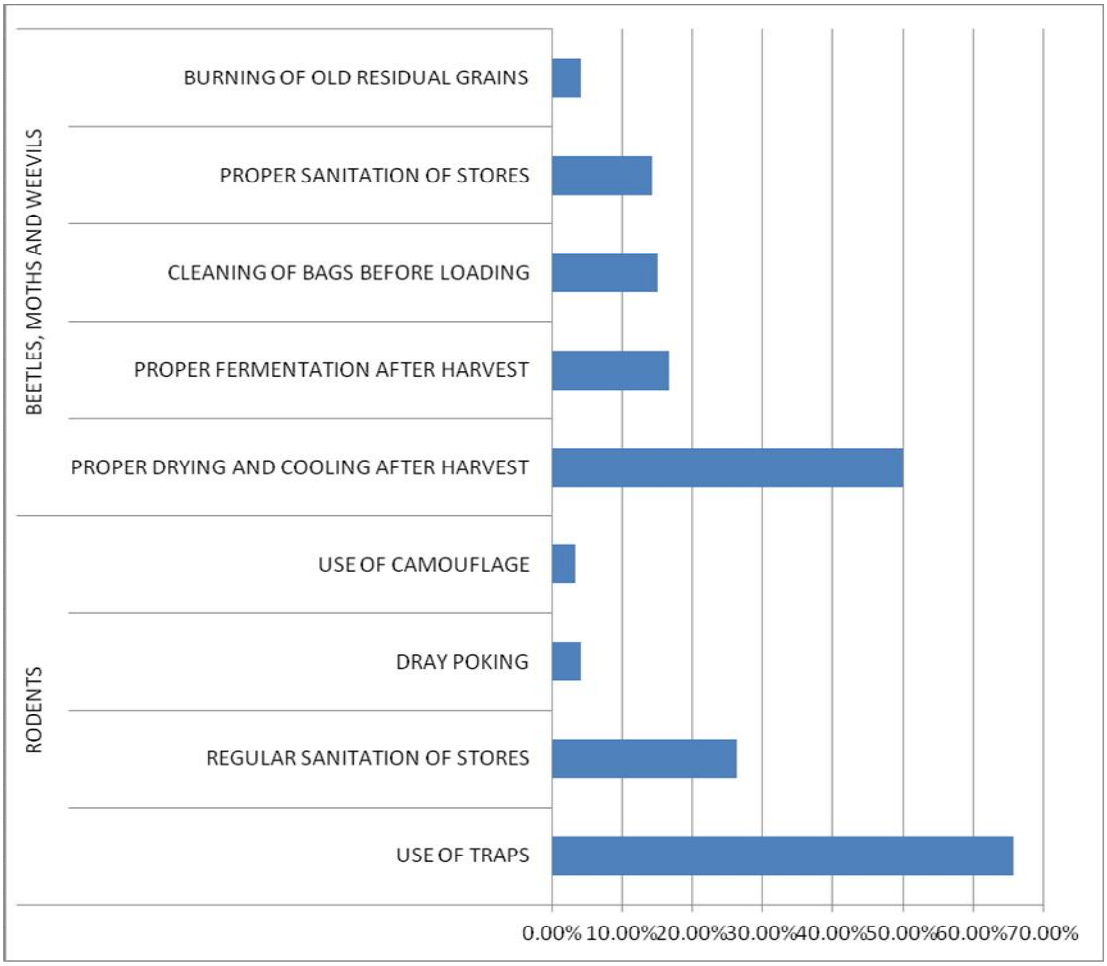

Fig. 3. Respondents' indigenous methods of controlling stored cocoa pests

From Table 3, It was also found that respondents disagreed that extension agents do not know much about indigenous methods ($\bar{X}$:1.75) discourage their use of indigenous methods ($\bar{X}$:1.88) and level of cocoa output ($\bar{X}$:3.50). The result implies that though farmers' contact with extension agents was low, but the few farmers that were visited received information on indigenous knowledge from the extension agents. This is because indigenous knowledge is localized [7] and with the extension agents visits, the information is transferred to the farmers in another location for their benefit. The consequence is that, it helps improve the farming activities of such farmers as stated by [15].

3.7 Hypotheses Testing

3.7.1 Hypothesis 1

Ho_1: there is no significant relationship between the socio economic characteristics of the respondents and the use of indigenous knowledge in controlling cocoa pests and diseases by the farmers.

The result from the study in Table 4a showed that there was a significant relationship between the use of indigenous control methods and sex (X^2=4.253, P< 0.05), religion (X^2= 19.160, P ≤0.05) and marital status (X^2= 29.244, P ≤0.05) of the respondents. But there was no significant relationship between educational status (X^2=2.773, P< 0.05) and respondents' use of indigenous methods. This implies that farmers use indigenous methods on their farms irrespective of whether they are educated or not. Similarly, the Pearson product moment correlation result in Table 4b shows that there was a significant relationship between respondents' age (r = 0.175, P ≤0.05), income (r= 0.276, P ≤0.05), yield (r = 0.128, P ≤0.05), farm size (r = 0.828, P ≤0.05), farming

experience (r=0.221, $P \leq 0.05$) and the use of indigenous methods. The results agree with the findings of [16,13] who asserted that farmers' age, sex, marital status, farm size, yield and income have significant relationship with their use of indigenous knowledge. This could be because most of the older farmers are not willing to take risks while farmers with large farms are not ready to depend solely on the use of Indigenous knowledge for control of Cocoa Pest and diseases.

3.7.2 Hypothesis 2

The result in Table 5 reveals a non-significant relationship between extension visits and farmers' use of indigenous methods in controlling cocoa pests and diseases. This implies that farmers will continue to use indigenous control methods regardless of whether they are being visited by extension agents or not. This is because extension services are not available to disseminate information on innovations for cocoa pests and disease control to the farmers. The result confirms [11,7] findings that most farmers got their information on indigenous control methods from their parents and grandparents and not from the agricultural extension agents.

Table 2. Respondents' indigenous methods of controlling cocoa diseases

Diseases	Frequency	Percentage (%)
Frosty pod rot		
Harvesting affected pods immediately	83	69.2
Thinning the canopy	20	16.7
Weeding	10	8.3
Avoiding heavy shade	7	5.8
Witches broom		
Cutting affected trees	63	52.5
Removal of infected plant material	30	25.0
Cleaning of the plantation	27	22.5
Ceratocytosis wilt		
Uprooting affected trees	49	60.5
Removal of infected plant material	41	34.1
Burning of affected plant material	30	25.0
Vascular streak die back		
Pruning of affected branches	89	74.1
Protection of seedling	14	15.2
Burning of removed plant material	13	14.1
Harvesting affected pods immediately	4	4.3
Black pod		
Regular harvesting	83	69.2
Removal of infected pods	20	16.7
Regular removal of mistletoe	10	8.3
Avoiding heavy shade	3	2.5
Weeding	5	1.7
Cocoa swollen shoot virus		
Uprooting and burning affected trees	82	68.3
Harvesting affected pods immediately	16	13.3
Avoiding trees that act as hosts	14	11.7
Use of shade trees	4	3.3
Use of oil palm and citrus to prevent mealy buq	4	3.3

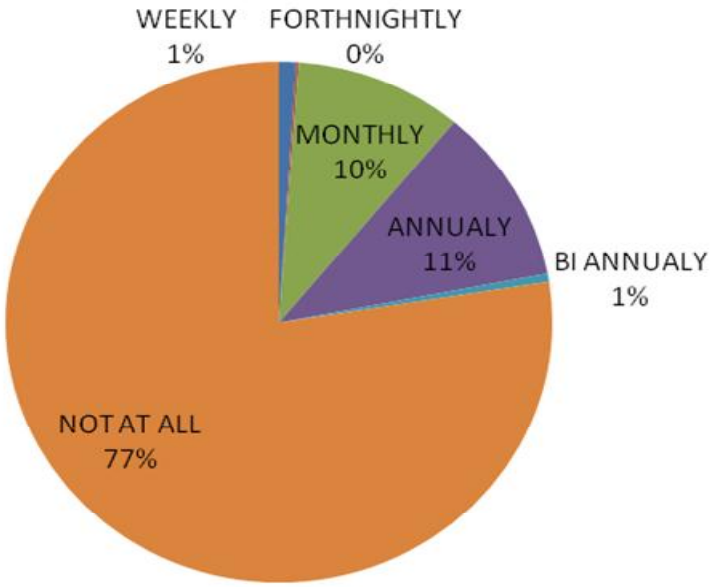

Fig. 4. Frequency of extension agents' visit

Table 3. Respondents' perceived effects of extension activities on their output

S/N	Statement	SA	A	U	D	SD	Mean
1	Extension agents' visit has improved your use of Indigenous Methods in controlling cocoa pests and diseases	8.3(10)	9.3(11)	0.7(2)	30.0(36)	51.7(62)	1.91
2	Extension agents disseminate information on indigenous methods for cocoa pests and diseases control	7.5(9)	9.9(12)	-	40.0(48)	42.5(51)	1.98
3	Extension agent information on indigenous knowledge has increased my farm output	11.6(14)	-	5.0(6)	39.2(47)	44.2(53)	1.92
4	Extension agents' visit has not improved your cocoa output	39(47)	26.8(32)	-	16.7(20)	17.5(21)	3.50
5	Extension activities discourage the use of indigenous methods	5.0(6)	5.0(6)	9.2(11)	35.0(42)	45.8(55)	1.88
6	Extension agents information on indigenous knowledge has increased my level of income	5.8(7)	3.3(4)	3.3(4)	37.5(45)	50.0(60)	1.77
7	Extension agent information on indigenous knowledge has increased my farm sanitary practices	6.7(8)	5.0(6)	2.5(3)	34.2(41)	51.7(62)	1.80
8	Extension agents do not know much about indigenous methods	2.5(3)	4.2(5)	10.8(13)	30.8(37)	50.8(61)	1.75

Table 4a. Relationship between respondents' personal characteristics and the use of indigenous knowledge

Socio-economic versus use of IK method	Chi-square calculated value X^2	Df	P-value	Decision
Sex	4.253	1	0.039	Significant
Educational status	2.773	1	0.096	Not significant
Marital status	29.244	4	0.000	Significant
Religion	19.160	2	0.000	Significant
Membership of social group	0.202	1	0.653	Not significant

Table 4b. Relationship between respondents' socio-economic characteristics and the use of indigenous knowledge

Socio-economic versus use of IK method	r- value	P-value	Decision
Age	0.175	0.010	Significant
Income	0.276	0.000	Significant
Yield	0.128	0.160	Significant
Farm size	0.828	0.000	Significant
Farming experience	0.221	0.001	Significant

Table 5. Relationship between extension activities and respondents' use of indigenous methods of controlling cocoa pests and diseases

	r- value	P-value	Decision
Extension agents' activities and use of indigenous control methods	0.340	0.716	NS

N.S= Not Significant

4. CONCLUSION AND RECOMMENDATIONS

The study has established that farmers in the study area were aware of indigenous methods of controlling cocoa pests and diseases and a majority of them utilized indigenous methods in controlling pests and diseases in their cocoa farms as they regard it as simple to use, affordable, cost effective, sustainable and compatible with their culture. However the extension activities are at very low ebb without imparting much to the farmers in the area of Indigenous knowledge. There is the need for well funded and effective extension system to help the farmers it can also be concluded from the study that the farmers used indigenous methods in combination with scientific methods in controlling cocoa pest and diseases.

There is the need for extensive empirical documentation of indigenous practices of controlling cocoa pests and diseases out by scientists, experts, Non-Governmental Organizations and relevant organizations to enhance utilization by future farmers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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