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ASSESSMENT OF FARMER'S USAGE OF PESTICIDES ON COCOA FARMS AT SEFWI WIAWSO DISTRICT IN THE WESTERN REGION OF GHANA

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ABSTRACT: *Cocoa is the most important agricultural export crop in Ghana, and the country has an enviable reputation of producing high quality cocoa. Pests of cocoa are mostly controlled by the application of conventional insecticides. The study investigated farmers use of pesticides on cocoa farms. The objectives of the study were to find out farmers' knowledge on pesticide usage, pesticide use pattern and practices along the cocoa production chain. Descriptive survey design was used for the study. The study involved cocoa farmers. Purposive sampling technique was used to select respondents. Questionnaire was used to collect data for the study. Data were analyzed using descriptive statistics. The findings of the study revealed that farmers had knowledge on pesticide usage. It was found out that some of them failed to use the recommended pesticide rate. Based on the findings it is therefore, recommended that Ghana Cocoa Board should organize training on the use of pesticides for the cocoa farmers every year to enable the farmers familiarize themselves with the pesticide's usage. It is again recommended that Ghana Cocoa Board should restore CODAPEC programme to regulate the use of pesticides by farmers. This is to ensure that the pesticide residue levels in the country's cocoa beans are within the permissible levels*.

KEYWORDS: cocoa, knowledge, pesticides, maximum residue levels, permissible levels

INTRODUCTION

Ghana's cocoa has always enjoyed an unparalleled reputation for quality in international markets and it regularly exceeds international guidelines due to its effective farm management practices and quality control system (Sibun, 2008). Issues about maximum residue levels (MRLs) supported by various legislations in the EU, Japan and the USA have suggested that producers must comply with the codes of practice to minimize the threat of contamination of food from pesticides (Bateman, 2010). In September 2008, an European Union Legislation on MRLs of pesticides (Regulation 149/2008/EEC) came into effect (QCCL Annual Report, 2008). The regulation set maximum levels on the amount of pesticides permitted on imported foods including cocoa beans. In the U.S.A, the Environmental Protection Agency (EPA) established the Food Quality Protection Act of 1996 which regulates the amount of pesticide residues permitted on food for consumption (QCCL Annual Report, 2008). The EPA also required that all approved pesticides should clearly

be labeled with instructions for proper use, handling, storage and disposal.

Previously, the average cocoa farmer had limited contact with the product market and made little use of insecticides in the control of pest and diseases which constituted a major production constraint. Consequently, the Cocoa Disease and Pest Control Programme (CODAPEC) popularly known as Mass Spraying, introduced in 2009, sought to resolve the problem of pest and disease control for the small holder farmers (Abankwah *et al*., 2010).

In 2010, the use of organochlorine insecticide was permitted to be very effective in controlling pests according to International Cocoa Organization (I.C.O). Confidor, Cocostar, Akate Master, Cabamult, and Atara are currently endorsed to be used by the farmers (Oppong & Attuah, 2016). The increasing world population cannot be sustained without the use of pesticides in food production. Their usage therefore benefits not only farmers but also consumers. Pesticides are used to reduce food losses not only during production, but also during the post-harvest storage stage (Moy & Wessel, 2000). The general pest control strategy is an intervention to destroy the pests feasting on the crops, but at the same time not to damage the produce so much as to render them unhealthy or unprofitable. Good agricultural practices require good timing and proper application of the pesticides. Also, in order to maintain the activities of friendly insects, the area of application of insect should be clearly delineated (Offei et al., 2000). Consumer awareness on food safety and environmental concerns has raised major issues on chemical pest control in cocoa. The study aim is therefore, to examine farmers' knowledge, pesticide use pattern and practices along the cocoa production chain at Sefwi Wiawso District in the Western Region of Ghana.

Problem Statement

In recent times, the indiscriminate use of pesticides, both approved and banned, in cocoa production has had adverse effect on the cocoa trading internationally due mainly to the residues found in the beans with a concomitant effect on human health (Adu-Acheampong *et al.,* 2010). The major source of revenue for the establishment of socio-economic infrastructure in the country is cocoa (Fosu-Mensah *et al.,* 2016). The cocoa industry employs about 60 % of the national agricultural labour force and contributes not less than 70% of yearly household income (Appiah, 2004; Anim-Kwapong & Frimpong, 2004; Afrane & Ntiamoah, 2011). This will have an adverse effect on the economy as many farmers as well as licensed buying companies will be deprived of their source of income.

Justification

There has been an increased in the use of pesticides to control insects, pests and diseases. Nevertheless, the consistent application and indiscriminate use of these pesticides may cause the residues in the cocoa bean (Fosu-Mensah *et al.,2016*). This may cause the rejection of the produce from Ghana with its associated international sanctions and loss of substantial revenue. There is therefore the need to assess farmers' knowledge and farming practices along the production chain.

Purpose of the study

The purpose of the study was to find out whether cocoa farmers have knowledge on the use of pesticides on cocoa at Sefwi Wiawso District. The study was further designed to determine farming practices of the farmer in the application of pesticide along the cocoa production chain.

Research Questions

1. What knowledge do cocoa farmers have on the use of pesticides at Sefwi Wiawso?
2. What are the farming practices used by the farmers in the application of pesticides along the cocoa production chain?
3. How do the cocoa farmers at Sefwi Wiawso acquire information on the use of pesticides?

METHODOLOGY

The design

Descriptive survey design was used for the study since the researchers wanted to find out farmers opinion on the use of pesticides at Sefwi Wiawso in the Western Region. Mertus (1998) has recommended descriptive survey design for the purposes of generalizing from a sample to a population so as to make inferences from some characteristics of the population. Fraenkel and Wallen (2000) support the use of descriptive design when they said that the design provides meaning picture of events and seeks to explain behaviour on the basis of data gathering. Data gathered by way of descriptive survey represent field conditions and large population are dealt with (Osuala, 1991). However, it is difficult to ensure that questions to be answered are clear and not misleading because descriptive survey results can vary depending on the wording of questions (Fraenkel & Wallen, 2000). Despite this shortcoming, the researchers considered the descriptive survey as useful in gathering data that will facilitate finding out farmers knowledge on the use of pesticides on cocoa.

Population

Sefwi Wiawso was selected as the area for the study. In recent times, one hears of public complaints about a number of farmers not applying suitable pesticides and generally not abiding by the rules of using pesticides particularly with regard to the use of pesticides on cocoa. The Sefwi Wiawso Municipality has a total population of 139, 200 with males and females constituting 50.1 percent, and 49.9 percent of the population respectively. Two-thirds (67.1%) of the population 15 years and older are farmers. The target population for the study comprised all farmers at Sefwi Wiawso District.

Sampling Technique

Purposive sampling technique was used to select the district and cocoa farmers who have worked for at least five years. Kane (1995) posited that purposive sampling does not involve randomly selected samples in that respondents are deliberately chosen because of some qualities that interest the researcher.

Instrument

Questionnaire was the main instrument used to collect data from respondents because data from questionnaire are of limited interference on the part of researchers (Sarantakos, 1998). Questionnaire is mostly used in quantitative research because it is highly standardised and structured. The questionnaire was developed from the literature and it was based on the two issues (knowledge and farm practices in pesticide usage). The items on the questionnaire were mostly multiple scores and therefore, likert-type scale was adopted. Likert-type scale was used because it allows responses to be ranked and provides single scores to a set of items (Sarantakos, 1998).

Data analysis

Data were analyzed using descriptive statistics such as frequencies and percentages with the help of Statistical Package for the Social Sciences (SPSS) version 20.0 for windows and the results were presented in tables and charts.

RESULTS

Research Question 1: What knowledge do cocoa farmers have on the use of pesticides at Sefwi Wiawso district?

Table 1: Pesticides and active ingredient

Characteristics	Frequency		Percentage	
	Yes	No	Yes	No
Application of pesticides	83	1	98.8	1.2
Information of active ingredients	25	59	29.8	70.2

Almost all the farmers (98.8 %) indicated that they had themselves apply these pesticides to control the cocoa pests (Table 1). On the contrary, 1.2 % of the farmers had never used pesticides to control these pests. About 29.8 % of the farmers stated that they know the active ingredients in the pesticides they apply and use whilst majority (70.2 %) of them admitted that they had no knowledge of the active ingredients in the pesticides they have used.

Table 2: Pesticide acquisition by cocoa farmers

Characteristics	Frequency	Percentage
Certified agrochemicals sellers	77	91.7
Open market	4	4.8
Roadside sellers	2	2.4
Others	1	1.2

With regard to the purchase of pesticides, majority of the farmers indicated that they acquire their pesticides from certified agrochemical sellers. Minority of them acquire pesticides from road side

sellers and uncertified agrochemical sellers.

Table 3: Pesticide application strategy

Characteristics	Frequency	Percentage
One kind of pesticide	76	90.5
Two kinds of pesticides	8	9.5

Majority of the farmers indicated that they used only one pesticide at a time to spray against the pest and diseases on their cocoa farms. However, less than 10% of the farmers used a combination of two pesticides to spray pest and diseases.

Research Question 2: What are the farming practices used by the farmers in the application of pesticides along the cocoa production chain?

Table 4: Instruments used for the measurement of required quantity of pesticides

Measuring device	Frequency	Percentage
Lid of pesticide container	61	72.6
Lid of spraying equipment	22	26.2
Pesticide measuring cup	1	1.2

Majority of the farmers (72.6 %) used the lid of the pesticide container to measure the quantity of pesticides required for spraying (Table 4). An appreciable proportion of farmers (26.2 %) used the lid of the spraying equipment whilst only 1.2 % of the farmers used the pesticide measuring cups recommended for use by the manufacturers.

Table 5: Quantity of insecticides used per tank by farmers

Insecticide	Recommended rate/11L Knapsack by CRIG	Percentage of farmers		
		% Below	% Recommended rate	% Above
Confodor(*Imidacloprid)*	30	3	91	6
Akate Master(*Bifenthrin)*	100	3	72	25
Actara(*Thiomethoxam)*	17	2	93	5

About 25% of the respondents used more than the recommended rate of Akati Master, 6% of farmer used over doses of Confidor and 5% used over dose of Actara.

Table 6: Quantity of Fungicides used per tank by farmers

Fungicides	Recommended rate/11L Knapsack by CRIG (g)	Parentage of farmers.		
		% Below	% Recommended rate	% Above
Ridomil Gold (Cuprous Oxide and Mefonoxam)	50	3	96	1
Funguran-OH (Cupric Hydroxide)	100	8	89	3
Metalm 75 WP	50	0	0	0
Fungikill 50 WP	75	2	97	1
Kocide 2000(Cupric Hydroxide)	100	0	0	0
Nordox 75 WG(Cuprous Oxide)	75	4	91	5
Champion(Cupric Hydroxide)	100	0	98	2

With regard to fungicides used by farmers in the district, none of the farmers indicated that they used Kocide 2000 and Metalm 75 WP even though they are approved by CRIG (Cocoa Research Institute of Ghana) to be used on cocoa. For all the fungicides, few farmers used dosages above the recommended rates.

Table 7: Sprayer types used by cocoa farmers

Sprayer Type	Frequency	Percentage
Motorized/motor blow	83	98.8
Knapsack sprayer	1	1.2

On spraying equipment, majority of the farmers (98.8 %) reported that they used the motorized sprayer for spraying their crops whilst 1.2 % of the farmers used the knapsack sprayer.

Pesticides selection by farmers

More than half (53.6 %) of the farmers indicated that effective control was their reason for selecting a particular type of pesticide although 29.8 % of the farmers reported that the availability of the pesticides as the main consideration factor for choosing a pesticide (Figure 1). The remaining 15.5 % of the farmers indicated improving the yield of cocoa as the reason for selecting a particular pesticide. Only 1.2 % of the farmers indicated the price as their reason for choosing a particular type of pesticide.

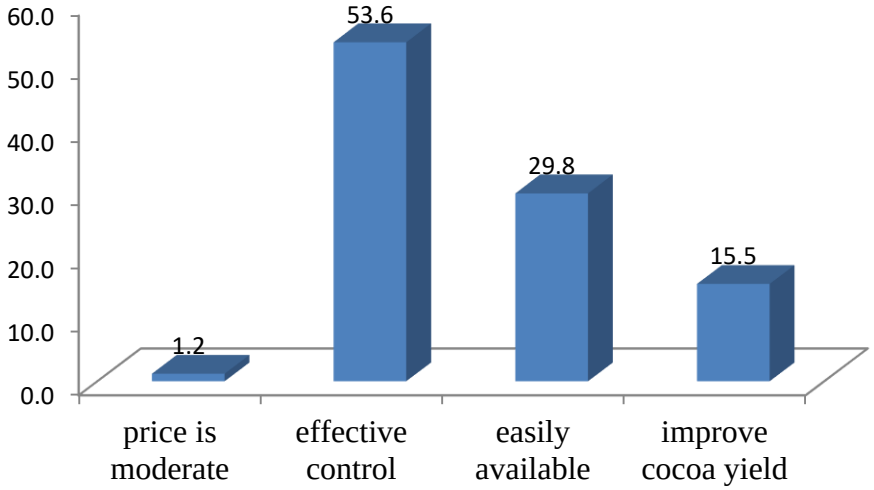

Figure 1: Reasons for selecting a particular type of pesticide

Pesticide's effectiveness on the cocoa pests

Majority of farmers indicated that the pesticides they used were very effective whiles about 14% said they were moderately effective with a few (2 %) of the farmers stating that the pesticides were not effective (Figure 2).

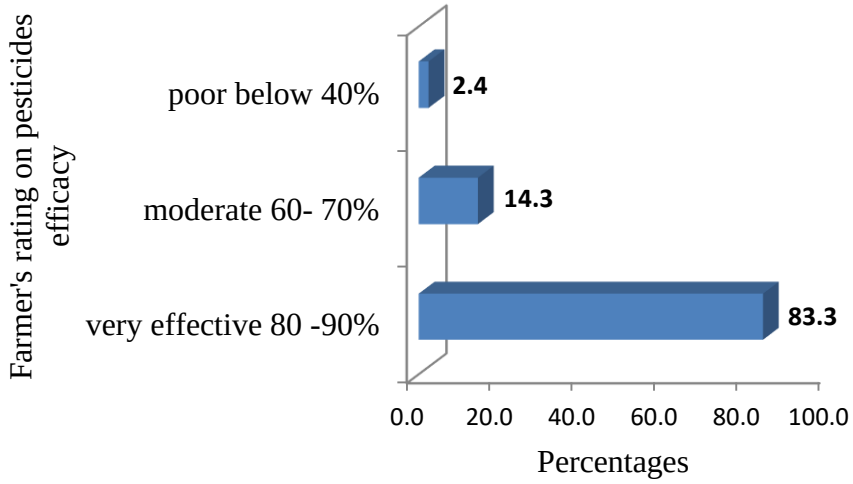

Figure 2: Effectiveness of pesticides used by farmers

Pesticide pre-harvest interval

In terms of pre-harvest waiting period of the pesticides, only a small number of farmers (2.4 %) waited for more than 4 weeks. Majority of the farmers (63.1 %) waited for an average of 2 weeks (range of 1- 3 weeks) whiles about 29 % waited for 3 to 4 weeks. On the other hand, about 6 % of the farmers do not wait for even 1 week after spraying to start harvesting (Figure 3).

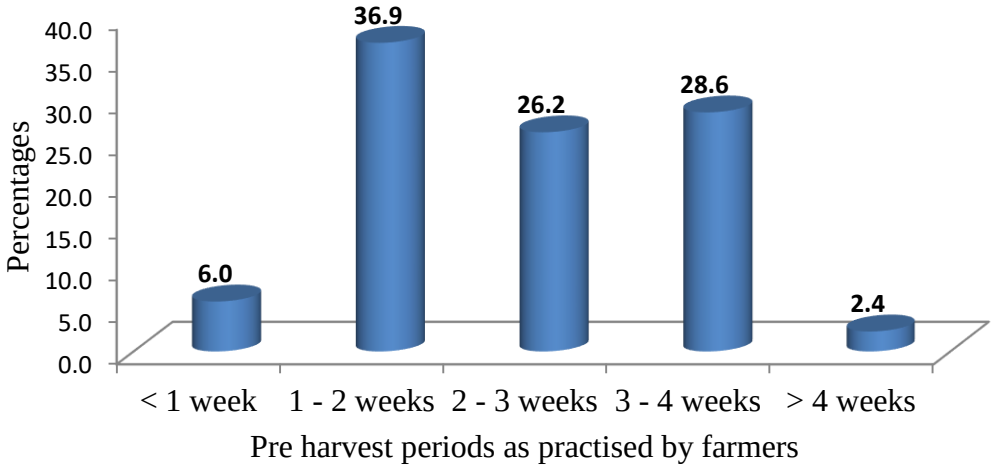

Figure 3: Pesticide pre-harvest intervals experienced by farmers

Research Question 3: How do the cocoa farmers at Sefwi Wiawso acquire information on the use of pesticides?

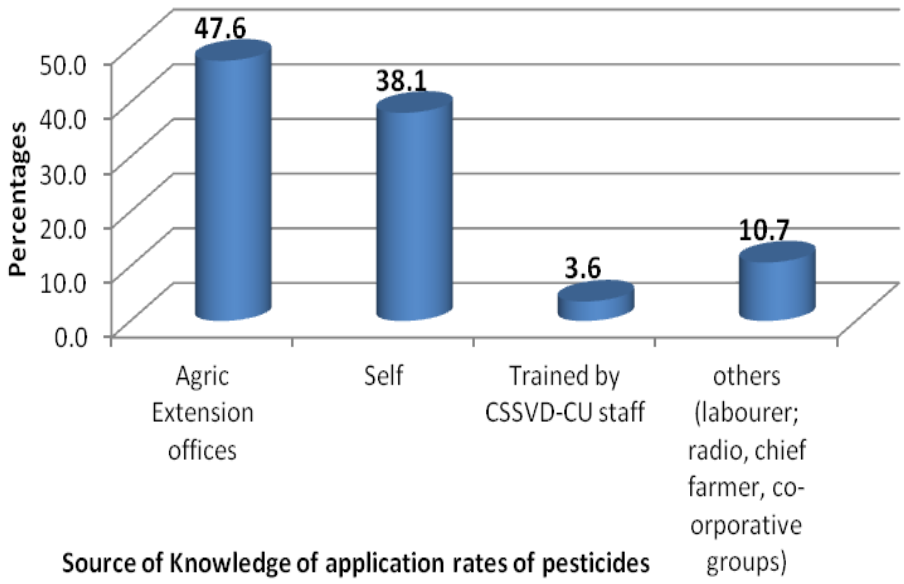

Figure 4: Sources of knowledge in pesticide application

About 47.6 % of the farmers acquired the knowledge of measuring the rate of pesticides from extension officers, 38.1 % did self-learning and 10.7% depended on information from labourers, media (radio), the chief farmers and through co-operative societies. Only 3.6 % of the farmers

acquired the knowledge through training by Cocoa Swollen Shoot Virus Disease and Control Unit (CSSVD – CU) staff.

Table 8: Sources of information about pesticide residue awareness

Characteristics	Frequency	Percentage
Awareness of pesticide residues		
Yes	72	85.7
No	12	14.3
Source of information		
Extension officer	8	9.7
Media (radio, TV, etc.)	74	87.5
Others (farmers, peers, etc)	2	2.8

About 85.7 % of the farmers responded that they knew that pesticide residue had become a food safety issue whilst 14.3 % of the farmers reported that they were not aware. For the farmers who were aware, 87.5% of them stated that they learnt it from the media such as, the radio and television.

DISCUSSION

Farmer's knowledge in pesticides application and practices

For farmers knowledge on pesticide usage, majority of farmers have knowledge in pesticides application. The usage of chemicals by majority of the farmers to control pests on their farms is an indication that farmers used pesticides intensively in the controlling of pests on their cocoa farms. This is in agreement with Bateman (2008) who reported that pesticide application in Ghana is more concentrated in cocoa, oil palm, cereals, vegetables and the fruits sectors. Since cocoa farming is their main vocation and as such have acquired knowledge and skills in all aspect of farming.

Majority of the farmers acquire pesticides from certified agrochemicals and this is an indication that they used approved and appropriate pesticides. The knowledge of the farmers on pesticides was reflected in their source of acquisition of pesticides which were the certified agrochemical sellers who had been licensed by the Environmental Protection Authority (EPA) and the Ghana Agricultural Inputs Dealers Association (GAIDA). These agrochemical sellers according to Adu-Acheampong *et al*. (2010) educate farmers in relation to measuring pesticides for use during purchase. Majority of farmers used only one pesticide at a time to spray against pest and diseases on their cocoa farms since they are trained by the licensed chemical sellers. Consequently, COCOBOD in its future interventions to reduce pesticide residues in cocoa production could target the education of agrochemical sellers as agents of change. The farmers, however, had no knowledge of the active ingredients in the pesticides and this confirms the report by Bateman (2010) who reported that farmers usually show less interest in the technicalities associated with the active ingredients in the pesticides.

On the selection of spraying machine, majority reported that they used the motorized sprayer for spraying their crops. This is more effective in targeting the pest during spraying. This confirmed the report by Adjinah and Opoku (2010) that most farmers preferred to spray their own farms and therefore did not patronize the Cocoa Disease and Pest Control (CODAPEC) programme which offered mass spraying of the coca farms. Most of the farmers preferred to purchase some particular pesticides and the reason provided by these farmers was in agreement with the reasons expressed by Moy and Wessel (2000) who indicated that particular pesticides were chosen by farmers due to their ability to reduce food losses and increase profits. The choice of chemical was however guided by their knowledge about the toxicity attributes of the pesticides and further underscored their understanding of pesticide labels and precautionary measures on its use written on the label.

With regard to insecticides usage, farmers did not adhere strictly to application rates recommended by research and gave reasons such as the extent of infection of cocoa trees and the potency of the pesticide for the quantities of pesticides used for spraying. The study revealed that a wide range of pesticides were being used by the farmers including Akate Master (*Bifenthrin*) and Confidor 200SL (*Imidacloprid*). This may increase pesticide residue levels and may exceed Japan and EU maximum residue levels and therefore should be a concern to the cocoa industry. A case of Imidacloprid MRL exceedances in Ghana's cocoa by Japan over years have been documented by Ntiamoah and Afrane (2012).

Pre-harvest interval is the minimum permitted period between a pesticide application and when a crop can be harvested (Bateman, 2015). During the pre-harvest interval stage, pesticides may degrade in the crop, or on its surface. Factors that causes the degradation of the pesticides in the crops are exposure to sun, rain, and warm temperatures. The study further revealed that majority of the farmers (63.1 %) waited for an average of 2 weeks (range of 1- 3 weeks). Pesticides may not degrade because most cocoa farmers harvest their produce within 1-3 weeks after spraying with pesticides. Farmers did not consider the residues of the pesticides and health implication but considered only their income.

Regarding farmers' source of information on pesticides application rates, some farmers (47.6 %) acquired the knowledge and skill of measuring the pesticides rates from extension officers. However, about 38 % of farmers learnt it by themselves. This fact of self-tuition should be a cause for concern since it could be a contributing factor to the detection of pesticide residues higher than recommended levels in cocoa analyzed samples. Majority of the farmers were aware that pesticide residue had become a food safety issue and indicated their source of information to be the media. This suggests that the media could also be used to disseminate relevant information to farmers since majority rely on the media for information. Similar sentiments have also been expressed in other studies (Moy and Wessel, 2000; Hamilton and Crossly, 2004; Yeboah *et al.*, 2004; Bateman, 2010).

CONCLUSION

The study revealed that there is a dearth of information on pesticide use in the cocoa industry in relation to the residue levels in the cocoa beans. Efforts should therefore be made by COCOBOD and other regulatory bodies to ensure that the pesticides residue levels in the country's cocoa beans are within the permissible levels to avoid the rejection of beans from Ghana with its attendant international sanctions and loss of substantial revenue.

RECOMMENDATION

There should be a lot of in-service training organized for the farmers by Ghana cocoa board and also CODAPEC programme should be restored to regulate the used of pesticide by farmers. This is to ensure that the pesticides residue levels in the country's cocoa beans are within the permissible levels to avoid the rejection of beans from Ghana with its associated international sanctions and loss of substantial revenue.

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