

RESEARCH PAPER
**INSECTICIDE HANDLING IN COCOA PRODUCTION IN
FOUR REGIONS IN GHANA**

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ABSTRACT

*Management of insect pests of cocoa (*Theobroma cacao* L.) using insecticides began in 1950 and has since gone through various programmes with concomitant challenges and successes. Presently Imidacloprid (Confidor®), Bifenthrin (Akatemaster®) and Thiamethoxam (Actara®) are recommended by Ghana Cocoa Board (COCOBOD) for the management of insect pests. A survey was conducted in the Ashanti, Eastern, Volta and Western Regions of Ghana using questionnaires and farm visits of 147 cocoa farmers' fields to gather information on the characteristics of the farmers and insecticide handling and use by respondents. The survey showed that males dominated cocoa farming (72.7%) and most of them aged between 50 and 60 years. About 44% have had basic education whilst 37.5% of them belonged to farmer based organizations. About 52.8% of the farmers own motorized mistblower but 47.2% of the farmers use knapsack in the absence of a mistblower. About 44.8% do their own spray application whereas 55.2% hire labour. About 60.9% of the population across the regions read the label on the insecticides before application. A few (31.6 %) of the respondents put on the full personal protective costume during insecticide application and 21.9% do not use any protection. There was a positive correlation between farmers' membership of farmer-based organisation and the costume-wearing farmers in the Ashanti, Eastern and Volta Regions and it was significant in the Ashanti region. It is recommended that training and monitoring programmes be organized for farmers on the need to handle pesticides properly for personal and environmental safety and consumer benefit.*

Keywords: *Insecticides, pest management, cocoa farmers, safety*

INTRODUCTION

Cocoa, *Theobroma cacao* L. is an important cash crop and contributes to about 28% of Ghana's foreign exchange earnings and 63% of agricultural exports (Anim-Kwapong and Frim-

pong, 2006). Cocoa mirids commonly called capsids have been recognised as serious pests since 1908 (Dungeon, 1910) due to their devastating effect on cocoa production. Mirid control has for more than a century been based on

chemical application but the adoption rate by cocoa farmers has been very low due to cost and other institutional constraints (Padi *et al.*, 2001). To address the issues of poor pests and diseases control by farmers, the Government of Ghana in 2001 introduced a nation-wide Cocoa Diseases and Pests Control Programme (CODAPEP) (commonly referred to as mass spraying) with the view to increasing cocoa output (Dormon *et al.*, 2007) and creating jobs in rural communities. Spraying of the insecticide is calendar-based and done four times a year from the period of August to December, leaving out November for harvesting and to ensure that the treatment coincides with the main period of mirid population increase, which is between August and November (Adu-Acheampong *et al.*, 2007). Satisfactory mirid control is achieved with insecticide application. Pesticides misuse and mishandling is known to occur among farmers in Ghana. Consequences of pesticide abuse and misuse, improper application and failure to adopt full research recommendations (Dormon *et al.*, 2007) include resistance of insect pest populations to insecticides, pest resurgence and pesticide residues in food and feed. This study was therefore undertaken to gather information on insecticide handling and use by cocoa farmers in the Ashanti, Eastern, Volta and Western Regions of Ghana with the view to using the information gathered from the study as a guide to suggest remedial measures against the worsening appearance of the negative effects of the insecticides used by the farmers.

MATERIALS AND METHODS

The study was undertaken in 2012 and involved questionnaire administration and farm visits. In all, 147 cocoa farmers comprising 36 from Ashanti, 30 from Eastern, 31 from Volta and 50 from Western Regions of Ghana were covered. Respondents were selected at random in each town visited using coded numbers which were picked by the respondents through balloting. Thus, respondents who picked coded numbers from the balloting were selected for the study. The questionnaire was structured mostly with

closed-ended questions and a few open ended ones and administered using one-on-one interviews. The closed-ended questions enabled the exact information being sought to be collected for quantitative analysis, whilst the open ended ones gave the respondents more room to clarify certain responses provided. Data taken on the characteristics of respondents included gender, marital status, number of dependents, educational level and number of years in farming. Other data were size of cocoa farm, farm ownership, output of farmer, membership of farmer-based organization, source of farm inputs, production constraints, types of insecticides used, frequency of insecticide application, use of personal protective equipment, re-entry period of pesticides and knowledge of expiry date of pesticides.

Data processing and statistical analysis

The questionnaires were coded by assigning a unique abbreviation to each question. The Statistical Package for Social Sciences (SPSS) software (release 20.0.0, IBM Corporation and its Licensors 1989, 2011) was used for the analysis of the data. The strength of a linear association between two variables was estimated using the Pearson Correlation (r) and significance level was tested at 95%.

RESULTS

Characteristics of respondents

Table 1 summarises the general characteristics of the respondents in the study. The mean age was 60 years; a majority (72.7%) of the respondents were males and a majority (88.9%) were married. Only 24.6% of the respondents had no formal education with the highest level of illiteracy, i.e. 34%, recorded in Western region. Volta region had 3.2% of farmers having tertiary education. A good number of farmers represented by 44.4%, 46.6%, 54.9% and 46% in the Ashanti, Eastern, Volta and Western Regions, respectively had only basic education. Quite a good number of farmers (i.e. 31.4%, 53.3%, 35.5% and 30% in the Ashanti, Eastern, Volta and Western regions, respectively) were members of farmer-based organisations. Examples

Table 1: Characteristics of cocoa farmers in four regions of Ghana

Variable	Mean or %				Mean
	Ashanti	Eastern	Volta	Western	
Age of Farmer (years)	66.0	57.27	49.84	50.58	60.00
Sex (male)	49.58	66.70	96.80	78.00	72.77
Marital status (Married)	88.90	86.70	90.30	90.00	88.98
Illiterates	22.20	13.30	29.00	34.00	24.63
Membership of Farmer-based organisation (Yes)	31.40	53.30	35.50	30.00	37.55

Table 2: Re-entry period of farmers' in four regions of Ghana

Variable	Ashanti (%)	Eastern (%)	Volta (%)	Western (%)	Average (%)
Re-entry period					
1 -24 h	2.8	3.3	0.0	0.0	1.5
24 – 72 h	36.2	0.0	35.5	32.0	25.9
72 – 168 h	11.1	26.7	22.6	28.0	22.1
>168 h	19.4	3.3	3.2	18.0	11.0
Any time	30.5	66.7	38.7	22.0	39.5

of such organisations were Abrabopa, Akuapa Kooko, Akuafu Adamfo, Akuafu boafu, and other locally organised groups.

About 16.7%, 26.7%, 26.7% and 42% of the respondents in the Ashanti, Eastern, Volta and Western regions respectively know about the three COCOBOD approved insecticides for insect pest management on cocoa. Some of the farmers use insecticides not recommended by COCOBOD and do 11 applications of these insecticides to their farms in a year in addition to the two they get from the mass spraying exercise. About 2.8% of the farmers in Ashanti

and 3.3% in Eastern regions have little knowledge about the re-entry period of pesticides (Table 2). Re-entry period of a pesticide is the earliest time at which workers can re-enter agricultural fields safely without personal protective clothing or equipment since last pesticide application (US Environmental Protection Agency, 1996).

Among the farmers that owned spraying machines a little over half (i.e. 52.8%) own motorized mist blower which is the recommended equipment for insecticide application in cocoa farming. A sizeable number (i.e. 47.2%) of the

farmers use knapsack in the absence of a mist-blower (Table 3). Some farmers (i.e. 44.8%) do their own spray application whereas others (i.e. 55.2%) hire labour (Table 4) to spray their farms.

A few (i.e. 31.6%) of the respondents put on the full personal protective costume during insecticide application and 21.9% do not use any protection (Table 5). Full costume is a complete set of Personal Protective Equipment (PPE) required for spraying. This includes a hat, respirator, goggles, gloves, overall and Wellington boot. Partial costume is any of these and no costume is when farmers use their farming gear without an additional PPE. There was a positive correlation between farmers' membership in farmer-based organisation and the costume-wearing farmers in the Ashanti, East-

ern and Volta Regions and it was significant in the Ashanti region (Table 6). About 60.9% of the population across the regions read the label on the insecticides before application (Table 7). This implies that these farmers are likely to be aware of the expiration date of the chemical before use.

Most farmers (59.3%) dispose of the empty chemical containers on the farm after pesticide application (Table 8). There was a positive correlation between farmers' membership in farmer-based organisation and disposal of chemical containers in all the regions with significance recorded in the Ashanti and Volta Regions (Table 9).

DISCUSSION

It is evident from the results that males domi-

Table 3: Ownership of insecticide application equipment in four regions of Ghana

Variable	Ashanti (%)	Eastern (%)	Volta (%)	Western (%)	Average (%)
Ownership of insecticide application equipment (Motorised mist blower)					
Yes					
No	16.7	73.3	61.3	60.0	52.8
	83.3	26.7	38.7	40.0	47.2

Table 4: Pesticide application by farmers in four regions of Ghana

Variable	Ashanti (%)	Eastern (%)	Volta (%)	Western (%)	Average (%)
Pesticide application by farmers					
Self	27.8	33.3	74.2	44.0	44.8
Hired labour	72.2	66.7	25.8	56.0	55.2

Table 5: Dress code of farmers during chemical spraying application in four regions of Ghana

Variable	Ashanti (%)	Eastern (%)	Volta (%)	Western (%)	Average (%)
Dress code during chemical spraying application					
Full costume	40.0	25.0	20.7	40.5	31.6
Partial costume	36.7	75.0	41.4	33.3	46.6
No costume	23.3	0.0	37.9	26.2	21.9

Table 6: Correlation between membership in farmer-based organisation and farmers dress during spraying

Independent Variable	Dependent Variable	Pearson Correlation (r)			
		Ashanti	Eastern	Volta	Western
Are you part of a farmer organization	If yes, then how do you dress when spraying	0.553*	0.323	0.362	-0.078

*significant at $p < 0.01$

Table 7: The response of farmers in four regions of Ghana on their knowledge of expiration date of pesticides

Variable	Ashanti (%)	Eastern (%)	Volta (%)	Western (%)	Average (%)
Farmers response on their knowledge of expiration date of pesticides					
Yes	54.3	53.3	73.3	62.5	60.9
No	45.7	46.7	26.7	37.5	39.1

nate cocoa farming. This can be attributed to the fact that cocoa farming is labour intensive. It was observed that cocoa farmers in the study areas were comparatively old. In recent times, the youth are not interested in agriculture because it is not lucrative and appealing enough.

The government’s introduction of the Youth in Agriculture Programme (YIAP) was aimed at responding to that and also facilitating sustainability in agriculture production (MoFA, 2011). The farmers have been in cocoa production for years and this has helped them gain experience

Table 8: Disposal of chemical containers after chemical by farmers in four regions of Ghana

Variable	Ashanti (%)	Eastern (%)	Volta (%)	Western (%)	Average (%)
Disposal of chemical containers					
Throw away on farm	61.1	40.0	58.0	78.0	59.3
Bury in ground on farm	13.9	30.0	25.8	4.0	18.4
Burn	13.9	23.3	6.5	10.0	13.4
Carry it away	11.1	6.7	0.0	8.0	6.5
Dispose at refuse damp	0.0	0.0	9.7	0.0	2.4

Table 9 : Correlation between how farmers discard empty chemical containers and their membership in farmer-based organization

Independent variable	Dependent Variable	Pearson Correlation (r)			
		Ashanti	Eastern	Volta	Western
Are you part of a farmer organisation	how do you discard empty chemical containers	0.439*	0.254	0.597*	0.044

* significant at $p < 0.05$

in the practices that work well. Formal education makes farmers more open and willing to adopt new ideas and cocoa production methods. Generally, most of the farmers in the study areas may be considered semi-literates and may be operating on the assumption that one does not need formal education to do farming. This confirms a report from MoFA (2011) that Ghanaians negatively perceive farming to be for the uneducated and unskilled people. The well-educated families usually look elsewhere for other jobs. The few that go into farming consider the profession as a hobby and perhaps go into it a few years to retirement.

Farmer-based organisations are formal collective action groups of farmers with an aim of achieving common interest (Hellin *et al.*, 2007). They serve as means by which farmers get education on proper agricultural practices as well as learn new methods in farming. Some of

the farmers who were members of identifiable groups indicated that it has been helpful in terms of education, market access, loans and materials needed for managing their farms. One farmer confirmed that a year after joining one of these organisations, his yield drastically increased from 16 bags to 36 bags from one hectare and has since been increasing. Despite the enormous benefits of being a member of an organisation, a major challenge is cost. Stockbridge *et al.* (2003) observed that farmer organizations incur transaction costs which, if too high, may put financial burden on its members, with the effect of discouraging other farmers from joining. Farmers should be encouraged to join these organisations because being a member enhances a farmer's tendency of learning new things and these farmers are also easily identified in the society. Farmers also are involved in healthy competition and strive to do their best to improve on their productivity.

Cocoa farmers are expected to do about four spray applications in a year and are entitled to two spray applications under the CODAPEC exercise (Asare, 2011). Farmers are therefore expected to do the other two applications. Lack of knowledge of the COCOBOD recommended insecticides and the recommendations for application can result in misuse and misapplication of pesticides. Some farmers do more than four insecticide applications in a year, implying that some farmers are applying insecticides over and above the recommendations and this could lead to negative consequences including undesirable chemical residues (data not shown) in harvested cocoa beans as well as pesticide resistance and pest resurgence.

Observance of the entry period of chemicals is an important concept under pesticide handling to avoid contamination and to be safe from pesticide effect. Most farmers are not aware of the re-entry period and therefore visit the farm to carry out agronomic activities such as weeding and pruning and other activities with respect to the other food crops they grow. It is important to educate farmers on the dangers involved in poor handling of insecticides and the strict adherence of the re-entry period to avoid or reduce pesticide toxicity. Pesticides have been one of the most important occupational hazards among farmers in developing countries (Coronado *et al.*, 2004). Therefore it is important that farmers pay particular attention to the handling of these chemicals so as to enjoy maximum benefit and escape their hazardous effects as much as possible.

The motorised mistblower is suitable for aerial spraying over large areas. It produces a high velocity air stream which is discharged through the hose as droplets (Pal and Das Gupta, 1996), whereas a knapsack does not. This makes the mistblower more effective than a knapsack in the application of insecticides for the control of mirids.

Some farmers do spraying without wearing personal protective equipment (PPE). Most farmers complained of the cost of acquiring

these protective clothing. This confirms findings by Ntow *et al.* (2006) that the use of PPE by Ghanaian farmers during mixing, loading and application of pesticides is low mainly because of financial difficulties. Other farmers stated that they feel uncomfortable in the use of these wears in addition to interference with work. Attention must be paid to PPE because it helps protect farmers from pesticide poisoning. It is stated in the Pesticide Control and Management Act of the Laws of Ghana that no person should use pesticides without PPE (Ghana Laws, 2014). But this law has been totally ignored. According to WHO (2004), 1 to 5 million cases of pesticide poisoning occur every year, resulting in 20,000 fatalities among agricultural workers, most of them in developing countries including Ghana. Another estimate is that pesticides misuse cause 14% of all known occupational injuries in agriculture and 10% of all fatal injuries (Oppong-Wereko, 2013).

The fact that most farmers indicate little knowledge about the expiration date of insecticides presupposes that often they do not read the label on the container. Labels on chemical containers contain important information which includes the best way a chemical can be used to attain desirable results, the way to dispose of the container and excess chemical solution. From the results gathered, it can be inferred that literate farmers read the labels whereas illiterate farmers do not read. Some of these farmers might have used expired chemicals without even knowing it. This may explain why some farmers do not remember the names of the chemicals they have used or are using. Farmers must be encouraged to read the labels in order to avoid the use of expired chemicals and this calls for the intensification of education on safe handling and use of pesticides.

Farmers in the study areas mostly dispose of empty chemical containers on the field which may cause adverse effects on soil flora and fauna. Ntow *et al.* (2006) also reported that throwing of containers on the field is the most common practice and method Ghanaian farm-

ers adopt in disposing of empty chemical containers. The Environmental Health Manual (2010) identifies the community rubbish dump as the best place to discard empty pesticide containers after the containers have been triple washed with the appropriate solvent. The Manual again warned against the burning of pesticide containers because they can give off poisonous gases. It is unfortunate that most farmers in Ghana do not attach much importance to the handling and disposal of chemical containers.

CONCLUSION

Males dominate cocoa production in Ghana. Farmers use Ghana COCOBOD recommended pesticides and others sold on the open market. Most farmers do their own spray application with some having their own spraying machines. Very few farmers wear full costume during spray application and very few observe the restricted entry interval of the insecticides. Farmers need more education on pesticide use practices so it behoves on the government, non-governmental agencies and individuals to help train farmers on safe pesticide handling and use.

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