FINAL RESEARCH REPORT

Assessment on the Gender Dynamics of Highly Hazardous Pesticides (HHPs) within Cocoa Production Landscape in Ghana

REPORT AUTHORS:

Yaw Osei-Owusu

Raymond Owusu-Achiaw

Submitted to:

INKOTA netzwerk

From:

CONSERVATION ALLIANCE

13 Afari Djan Street, Haatso-ECOMOG, Accra

Tel:+233 302 966 999/+233244277795

info@conservealliance.org/yosei-owusu@conservealliance.org

www.conservealliance.org

DISCLAIMER

ACKNOWLEDGEMENT

This report will not have been possible without the funding support from the Federal Ministry for Economic Cooperation and Development, Germany.

Federal Ministry for Economic Cooperation and Development

Additional gratitude goes to INKOTA-netzwerk for the technical and logistical support in making this report a reality. The completion of this report will be impossible without the assistance and participation of the devoted time of the farmers in this research, their contributions are profoundly appreciated.

LIST OF ABBREVIATIONS

CA	Conservation Alliance International
CCA	Cocoa Conservation Association
CCAFS	Climate Change Agriculture and Food Security
COCOBOD	Ghana Cocoa Board
CODAPEC	National Cocoa Diseases and Pests Control
CRIG	Cocoa Research Institute of Ghana
DDT	Dichlorodiphenyltrichloroethane
DTF	District Task Force
EPA	Environmental Protection Agency
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GHS	Global Harmonized System
HHPs	Highly Hazardous Pesticides
ICI	International Cocoa Initiative
LTF	Local Task Force
OP	Organophosphorus
PAN	Pesticide Action Network
PPEs	Personal Protective equipment
SPSS	Social Statistical Package for Social Science
WHO	World Health Organization

DEFINITIONS

Hazard - Is an inherent property of a substance, agent or situation having the potential to cause undesirable consequences (e.g. properties that can cause adverse effects or damage to health, the environment or property).

Pest – Is any insect, a rodent, bird, fish, mollusc nematode, fungus, weed, microorganism, virus or any other kind of plant or animal life that is injurious to human or animal health, crops, stored produce, processed foods, wood, cloths, fabrics or any other inanimate objects.

Pesticides - Is any substance used to kill, repel, or control certain forms of plant or animal life that are considered pests.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIX

EXECUTIVE SUMMARY

The cocoa sector is the backbone to the Ghanaian economy and it contributes 3% to the country's GPD. This commodity is cultivated in six regions in Ghana (i.e. Eastern, Ashanti, Brong-Ahafo, Central, Volta and Western region). Over the period the sector is faced with numerous challenges including loss of soil fertility, competition of land for other sectors, pest and disease outbreak. In addressing the incidence of pests and diseases, most cocoa farmers tend to rely primarily on pesticide application. This overdependence on pesticides has resulted in the influx and application of unapproved or highly hazardous pesticides (HHPs). This practice is becoming even pronounced among women cocoa farmers, who in recent times have played significant roles in the cocoa supply chain.

Unfortunately, these women farmers face multiple challenges including inadequate access to approved inputs, land, labour and credit facilities and these are compelling them to patronize HHPs. Based on these challenges faced by women cocoa farmers, Conservation Alliance International (CA) with funds from the Federal Ministry for Economic Cooperation and Development, Germany undertook a preliminary study to assess the gender dynamics in the use of Highly Hazardous Pesticides (HHPs) within cocoa production landscape in Ghana. Specifically, the study assessed the knowledge levels of cocoa farmers on the use of pesticides and determine the driving factors for the use of HHPs among women cocoa farmers. Purposive sampling was used to select 503 cocoa farmers from Cocoa Conservation Association (CCA) membership in both the Western North and Central regions.

Semi-structured questionnaires were used to collect data which were administered by trained enumerators. All data were coded and analyzed using descriptive statistics where Statistical Package for Social Sciences (SPSS) and Microsoft Excel were used. The results revealed that more than 85% of the respondents were above 35 years. Majority of the men cocoa farmers (85%) possess at least a primary school education certificate whilst 15% had no formal education. A little over half (52%) of the women cocoa farmers possess at least primary school education with 48% having no formal education at all. The report concludes that the level of education has a significant impact on the correct use of pesticides and protection against pesticide poisoning. Due to the low level of education of women, they are at higher risk of exposure to dangerous effects of pesticides. The educational disparity confirms why about 65% of the men respondents were able to identify both approved and unapproved pesticides whereas only 5% women respondent knew them. Also due to the tedious nature of pesticide application, over 22% of the women cocoa farmers depend entirely on the spraying gangs in the application of pesticides on their farms. Conversely, only 17% of their men counterparts rely on the spraying gangs, preferring rather to apply the pesticides themselves.

Furthermore, the safety behaviours in pesticide usage were inadequate, particularly in the use of goggles (5%), gloves (10.77%) and mask (31%). The high cost of purchase (51.89%), discomfort (30.50%) and unavailability for purchase (17.54%) were the leading factors influencing the limited use of protective gears. Additionally, women cocoa farmers depend largely on the recommendations from other peer farmers and extension officers with respect to pesticide use. On the other hand, the men cocoa farmers' use of pesticides is based on affordability of input. Cocoa farmers are found using both approved and unapproved pesticides on their farms. Highly Hazardous Pesticides are less expensive than government-approved ones. The lower financial status of women is a key driver that they use HHPs.

Consequently, the study recommends the requisite for provision of safety training programs and adequate extension services to facilitate proper pesticide use and uptake of alternative methods for improved livelihoods and environmental conservation. Trainings on good agricultural practices and the use of pesticides offered by Ghanaian authorities, NGOs or the private sector must be accessible to women. Specific trainings for women must take into account the level of knowledge and education and use appropriate methods for knowledge transfer. To public policy, formulating and implementing targeted interventions aimed at promoting the use of alternative pest control methods that minimize negative health and environmental effects from overuse of pesticides. As poverty is a key reason why farmers are not buying protection gear such as goggles, gloves and masks, it is crucial to close the gap to a living income. An improved economic situation can also prevent farmers from turning to the cheaper high hazard pesticides for cost reasons. In order to reduce the hazardous effects of pesticides on health and the environment, all actors in the cocoa sector are called upon to take measures to close the gap to a living income.

BACKGROUND AND CONTEXT

1.1 Background

A significant percentage of people in the developing countries engage themselves in agriculture, but the yields of their products are low due to pests and diseases that plague their crops. Pests and disease management are one of the major problems farmers in Ghana face due to the impacts of pests and disease infestation which leads to a drop in Ghana's cocoa production. Cocoa production serves as a major source of business for rural folks in Ghana. It is subsequently, basic to recognize and resolve challenges that confront this sector in an encompassing way to move forward efficiency and jobs of cocoa farmers. Over the period, pesticide usages were associated with cocoa farming in the fight of its prevalence to pest and diseases. There is therefore the need to educate the populace on the positive and negative effects of these pesticides usage in respect to their health and the environment.

In this regard, Conservation Alliance (CA) conducted a preliminary study to evaluate cocoa farmers' understanding of COCOBOD's policy on subsidized pesticides, knowledge on the use of pesticides and the driving factors influencing the use of Highly Hazardous Pesticides (HHPs). The focus of this study was to examine the gender dynamics in the use of HHPs. The study was carried out in the Central and Western North regions of Ghana due to their prominence in cocoa production.

1.2 Introduction

The cocoa industry has been the backbone of Ghana's economy for more than six decades now. It employs about 54% workforce labour and it remains the major source of livelihood to many people in the country. According to the Bank of Ghana, the sector accounts for more than 9% of agricultural Gross Domestic Product (GDP) (Gyawu et al., 2015) with a total annual output of about 800,000 metric tons (MT). Therefore, the importance of cocoa in the country's economy cannot be overstated.

Cocoa production takes place in six out of the ten regions of Ghana (previous administrative regions) with the Western region accounting for over 50% of total cocoa production (Ghana Cocoa Board, 2012). In 2018/2019, the national cocoa output was about 812 thousand tonnes, compared with 969 thousand tonnes realized in 2016/2017[1]. Also, the majority of cocoa farmers in Ghana operate farm sizes of between 2 – 5 hectares with less than 10% of the farmers operating on a large scale[2]. The yields obtained from these small farm size are often low at an estimated average of about 0.42 tonnes per hectare (tons/ha). This, however, falls below that of other cocoa-producing countries such as Cote d'Ivoire and Indonesia whose estimated yield are 1.4 tons and 1 ton per hectare respectively (Asamoah & Owusu-Ansah, 2017). This low productivity is due to several factors such as climate change, soil fertility issues, pest and diseases prevalence, quality planting materials, inadequate access to extension services and lack of access to credit facilities. Diseases and pests have been touted as the most prominent cause of low farm output and farm productivity.

The most damaging cocoa pod disease in Ghana is the 'black pod' caused by a fungus called *Phythophtora megakarya* and this has the potential to reduce output by 40–90% (Nkamleu et al.,

---

[1] Published by M. Shahbandeh, Apr 23, 2020

[2] https://cocoainitiative.org/news-media-post/cocoa-farmers-in-ghana-experience-poverty-and-economic-vulnerability/

2007). Pesticides application are the most common and preferred method used in controlling the outbreak of these pests and diseases. Pesticides are globally used in crop production to improve productivity by minimizing pest and diseases infestation. Despite the advantages of using pesticides which includes improving productivity, protection of crop losses and control of vector related diseases, it has its added disadvantages. This includes affecting human health and the environment (both land and water) (Kaur & Garg, 2014). Improper handling and use of pesticides could have adverse effects on human health through contamination of food, groundwater, soil and the air as well as on environmental health and biodiversity (PAN Germany, 2003). These dangers are aggravated if pesticides are applied without strict adherence to control measures.

After the previous failed attempts to address the problem of pest and disease in the 1960s and 1970s, the Government of Ghana introduced another program in 2001 through the Ghana Cocoa Board (COCOBOD) known as the Cocoa Diseases and Pest Control Program (CODAPEC). The reasons for the failure of the past initiatives were due to the open discrimination against farmers by the spraying personnel, gross inefficiency, apparent diversion and misappropriation by officials (Anang et al., 2013). There are some few setbacks recorded in this CODAPEC program though it appears to be better managed than the past initiatives. A committee made up of the District Task Force (DTF) and the Local Task Force (LTF) have been set in place to support the management of the program at the district and local levels. Despite the efforts to enhance the efficiency of service delivery under the CODAPEC, it is plagued by a myriad of challenges. These include inefficiency on the part of spraying gangs, insufficient education on pesticide application, logistical problems etc. (Gyimah, 2019). As a result, cocoa farmers are found using both Cocoa Research Institute of Ghana (CRIG) approved and unapproved pesticides on their farms (Denkyirah et al., 2016).

Furthermore, in the cocoa sector, women are involved in a wide range of production activities spanning from seed sowing to the conveyance of cocoa beans from the farm to the drying spot. Women not only contribute to the labour force but own cocoa farms as well. According to the African Development Bank (2015), 25% of cocoa farmers in Ghana and Cote d'Ivoire are women and they contribute about 68% of the labour force in the industry.

In carrying out these functions, women face multiple barriers, among these barriers is a growing perception that cocoa farming is not "a woman thing". This, however, limits their aspirations and opportunities in the sector especially access to land. Also societies in Africa, often expect women to take care of their family and perform all kinds of household chores from tender age to their old age, thereby limiting them from acquiring new skills or engage in any farm-related activities (Danso-Abbeam et al., 2020). Therefore, they have limited access to membership of cooperatives, farm resources, credit facilities and technical training in modern technologies, resulting in low productivity and income inequality between themselves and their male counterparts (Murugani et al., 2014; Kilic et al., 2015; Sharaunga & Mudhara, 2016; Mangheni et al., 2019).

Hence, bridging the gap in women access to productive and financial resources has become a critical strategy for increasing productivity and reducing poverty in the agricultural industry including the cocoa sector. Also, concerns have been raised to develop policies that address gender inequalities at the grass-root level to increase yields on women's farm by 2-4%. In view of this, CA sought to assess the gender dynamics in the use of Highly Hazardous Pesticides (HHPs) and also ascertain how women benefited from the CODAPEC program.

1.3 Objectives

The main goal of the study was to gain a better understanding of the gender dynamics of the use of highly hazardous pesticides (HHPs) within cocoa production landscape.

The specific objectives of this study were to:

i. Assess the knowledge levels of cocoa farmers on the use of HHPs.
ii. Determine the driving factors for the use of HHPs among women cocoa farmers.

PESTICIDE USE IN COCOA PRODUCTION LANDSCAPE

2.1 Pest and Disease in the Cocoa

Pests and disease constitute one of the major factors affecting the cocoa sector in Ghana. Some of the cocoa diseases include cocoa necrosis virus, cocoa mottle virus, swollen shoot virus and black pod rot (Phy*tophthora* pod rot) (Olunloyo, n.d.; (Hughes & Ollennu, 1994). The black pod rot is one of the deadly diseases that cause the most damages to cocoa in the country. It is a fungal disease which appears as brown necrotic lesions on the pod's surface and as rotting of the beans. According to Afrane & Ntiamoah, (2011), it is estimated that about 30% of annual cocoa production is lost to this disease, especially during the high rainfall. The major insects that destroy the cocoa trees are mealy bugs and capsids/mirids. The mealybugs are the insects that are responsible for spreading the cocoa swollen shoot virus whiles the capsids/mirids feeds on the sap of the cocoa trees thereby damaging the plant material. The swollen shoot virus transmitted by mealybug is the major cause of the significant reduction of cocoa production in the country (Anang et al., 2013).

Other pests found in the cocoa sector are the parasitic plants and epiphytes. The mistletoe is one of the parasitic plant found on cocoa trees across West Africa. Examples of the epiphytic plants are *Bulbophyllum sp., Chasmanthera dependens* and *Cyrtorchis hamerta* (Dormon et al, 2004). Table 1 shows the various pest and disease affecting cocoa production in Ghana and their symptoms.

Table 1 Diseases of Cocoa in Ghana

Disease	Type of Infection (Causal agent)	Symptoms
Black pod	Fungus (*Phytophthora spp.)*	Pod rots, go brownish-black. Beans destroyed in immature pods. This could result in die-back.
Brown root rot	Fungus (*Fomes noxius)*	Leaves fall prematurely and die-back of twigs occurs. Fungus fruit bodies on root and dead trunks
Cocoa necrosis	Virus (Cocoa necrosis virus)	Leaves show bands of transparent lesions often with perforated centres.
Collar crack	Fungus (*Armillaria mellea*)	Longitudinal cracking of trunk from the ground level to about 1.2m upwards fills with cream-coloured mycelium.
Cushion gall	Fungus (*Calonectria rigidiuscula*)	Excessive production of buds at the nodes.
Vascular Streak Die-back	Fungus (*Oncobasidium theobroma*)	Leaves turn yellow and fall prematurely. Smaller branches wither starting from the tips.
Mealy pod	Fungus (*Trachysphaera fructigena*)	Pods turn brown, becomes encrusted with white to pinkish mealy growth of the fungus.
Mistletoe	Flowering Plant (*Tapinanthus bangwensis*)	Parasitic flowering plant on host branches. Part of branch withers.

Pod rot	Fungus (*Botryodiphlodia theobromae*)	Appears as brown necrotic areas with concentric rings of black spots. Pods are later covered with black sooty powder.
Red rust	Alga (*Cephaleuros mycoidea*)	Reddish patches on leaves and twigs; leaves are shed prematurely.
Swollen shoot	Virus (Cocoa swollen shoot virus)	Swelling of chupons and twigs; leaves develop yellow patterns, get crinkled and malformed.
White Root	Fungus (*Fomes lignosus*)	Premature defoliation, death of twigs, pods are small.
White thread Blight	Fungus (*Marasmius scandens*)	Leaves are covered and killed in a network of white mycelial threads.

Source (Offei et al., 2008)

2.2 Pesticides

Pesticides are natural or synthetic chemicals that are employed in various agricultural practices to control pests, weeds, and diseases in plants. A natural pesticide is the type made by other organisms mostly for their defence ore are derived from a natural source such as plant extracts whereas a synthetic pesticide is a type produced from chemical alteration. The term pesticides cover a wide range of compounds which include insecticides, fungicides, herbicides, rodenticides, nematicides, plant growth regulators etc. (Aktar et al., 2009).

In Africa, pesticide usage has become a necessity in agriculture production in maintaining its ease of addressing pest and disease incidence and promoting high production levels. Weak regulatory mechanisms have resulted in the increased import of banned pesticides and the lack of awareness of the adverse impacts has shielded it from being prohibited by farmers. From a crop production point of view, pesticides are beneficial but the extensive use of it can pose serious consequences on the environment and humans because of their bio-magnification and persistent nature.

2.3 Effects of Pesticides

Pesticides have numerous beneficial effects in today's agriculture. These include crop protection, preservation of food and prevention of vector-borne diseases. Without pesticides, farmers' crops could be totally devastated by these pests, diseases and weeds (Ofosu, 2014). Pesticides are often considered a quick, easy and inexpensive solution for controlling weeds, pest and diseases in the agricultural and urban landscapes. Notwithstanding all the advantages of pesticides, its negative impact far outweighs the positive impacts. This negative impact poses a significant risk to the environment and non-target organisms ranging from beneficial soil microorganisms to insects, plants, fish and birds (Aktar et al., 2009).

According to the World Health Organization (WHO), about 20% of pesticides used in the world is concentrated in developing countries, which pose a great danger to human health and the environment (Hurtig et al., 2003). Families residing in agricultural areas were recorded to have elevated traces of pesticides in their bodies. These are greater in homes located closer to farms

(McCauley et al., 2001; Quandt et al., 2004). A survey carried out by the Northern Presbyterian Agricultural Services in Upper East region of Ghana found that more than a quarter had suffered from directly inhaling chemicals and one fifth from spillage of chemicals on their body (Northern Presbyterian Agricultural Services, 2012). Studies on the analysis of pesticide contamination on farmers in Ghana found the presence of organochlorine pesticide residues including dichlorodiphenyltrichloroethane (DDT) in the breast milk and blood of vegetable farmers (Ntow, 2008).

Furthermore, the exposure to pesticides are reported to have long term effects on thyroid function, cause low sperm count in men, birth defects, increase in testicular cancer, reproductive and immune malfunction/problems, endocrine disruptions, dermatitis, behavioural changes, cancers, immunotoxicity, neurobehavioral and developmental disorders (PAN International, 2007). Organophosphate pesticides have gained popularity worldwide in preference to organochlorines, which are persistent and more damaging to the environment. According to Northern Presbyterian Agricultural Services (2012), pesticides poisoning are often associated with well-known acute health problems which include dizziness, headaches and skin burning. The impacts of pesticides on the environment through contamination of the soil, water and the ecosystem is well documented. In addition to killing insects or weeds, pesticides can be toxic to a host of other organisms including birds, fish, beneficial insects and non target plants.

2.4 Classification of Pesticides

Generally, pesticide categorization is very important because it describes the severity of pesticides on the environment and humans. Pesticides are classified based on the various criteria such as its toxicity (hazardous effects), mode of action (physiological disruption at its target site), pest organism they kill, pesticide function, chemical composition, their effectiveness, formulations and sources of origin (Akashe et al., 2018). These pesticides differ in their physical, chemical and identical properties from one class to other.

The toxicity of pesticides depends on two main factors; dose and time. The *dose* is defined as the amount of substance involved whereas *time* is how often the exposure to the substance occurs. This gives rise to the two different types of toxicity – acute and chronic toxicity (Pesticide Management Division, 2018). The UN Environmental Programme, (2019) describes Highly Hazardous Pesticides (HHPs) as pesticides that are acknowledged to present particularly high levels of acute or chronic hazards to health or the environment according to internationally accepted classification systems by World Health Organization (WHO) or the Global Harmonized System (GHS). In other words, pesticides that appear to cause severe or irreversible harm to health or the environment under conditions of use in a country may be considered as Highly Hazardous.

The PAN International HHP list serves as a list of pesticides to be progressively banned. The PAN HHP list at its present time is based only on classifications by recognized authorities such as the European Union and US Environmental Protection Agency (EPA). This list contains active ingredients of HHPs act as biocidal pesticides whose intentions are to destroy, deter, render harmless, prevent the action of, or otherwise exert a controlling effect on any harmful organism. Biocidal pesticides are also used to manage vegetative growth with the exception of those used as disinfectants, or internal human or veterinary medicines. They also includes pesticides used in agriculture, forestry, fisheries, vector control, plant growth regulators, fumigants and those incorporated into materials and other products (PAN, 2019). The hazard criteria groups structured by PAN are based on their acute toxicity, long-term (chronic) health effects, environmental hazard criteria and international regulations (global pesticide-related conventions). In some years to come, PAN (2019) wants to classify pesticides based on recorded cases of pesticides active ingredient and formulation showing a high incidence of severe or irreversible adverse effects on human or environment with strong and accessible data to support claims. On a further note pesticide that appears to cause severe or irreversible harm to health or the environment under conditions of use in a country may be considered to be and treated as highly hazardous. PAN recommended classification of Pesticides by Hazard is shown in Table 2.

Table 2 PAN Classification of Pesticides

PAN Classification	Examples
Acute toxicity	Demeton-S-methyl, Dicrotophos, Difenacoum, Abamectin, Carbosulfan
Long term effects	Mancozeb, Boric acid, Captafol, Chlordane, Dinoterb
Environmental toxicity	Benzoate, Chlorpyrifos-ethyl, Imidacloprid, Cypermethrin, beta, Esfenvalerate
Conventions	Endosulfan

Source; (PAN 2019)

The common risk associated with pesticide usage is the resistance of pests which leads to the destruction of crops despite appropriate application. An example is the resistance to pyrethroids and organophosphate as seen in aphids (*Aphis gossypii* Glover), whiles whitefly (*Bemisia tabaci* Gennadius) has been reported to develop resistance against pyrethroids, organophosphates and neonicotinoids (Houndete et al., 2010; Carletto et al., 2010). This means that continued dependency on pesticides for pest control is not feasible in the long term.

2.5 Attempts by Governments in Increasing Cocoa Production

Over the years, several programs have been implemented by various governments in Ghana to address pest and disease incidence and other factors causing low productivity in the cocoa sector. The current interventions by the government to address pest and disease infestation and thus increase production levels are the Cocoa Diseases and Pest Control (CODAPEC) program. This initiative focuses on the provision of free inputs especially pesticides to cocoa farmers (Dormon, 2006).

The CODAPEC programme targets the mass spraying of all cocoa farms (six cocoa-producing regions) in the country as a way of reducing pests and diseases such as mirids and black pod incidence at no cost. This was aimed at increasing cocoa production in the country and also an opportunity to train cocoa farmers and technical personnel in the scientific methods of pests and disease control (Adjinah & Opoku, 2010). Synthetic insecticides and fungicides are the types of pesticides used under the CODAPEC program in the fight against capsids and blackpod diseases respectively (Dormon, 2006). Table 3 shows the various synthetic pesticides approved by the Cocoa Research Institute of Ghana (CRIG), the active ingredient it contains and their method of application under the CODAPEC program.

Table 3 Pesticides Used Under the CODAPEC Program

Pesticide used	Active ingredient	Method of application	Frequency
Fungicides			
Ridomil 72 plus WP	12% metalaxyl, 60% Cuprous oxide	Knapsack Sprayer	3 times during each cocoa season
Nordox 75 WP	86% Cuprous oxide, 14% inert		
Funguran OH WP	Cuprous hydroxide		
Champion WP	77% cupric hydroxide		
Kocide 101 WP	Cupric hydroxide		
Fungikill WP	Cupric hydroxide + Metalaxyl		
Metalm 72 Plus WP	Cuprous oxide + metalaxyl		
Insecticides			
Akatemaster	Bifenthrin***	Knapsack Sprayer	Twice during each cocoa season
Actara	Thiamethoxam***		
Cocostar 210 EC	Bifenthrin*** + Pirimiphos methyl***		
Confidor 200SL	Imidacloprid***		
Carbamult	Promecarb		

HHPs on PAN, UK List ***

However, this government initiative is currently facing a number of challenges. A study by (Anang et al., 2013) revealed that most cocoa farmers are worried that the program could no longer cater for all their farms due to shortage of chemicals. They also argued that the spraying exercise takes place later than the due date and often set aside the recommended regime. Nevertheless, the success of the program has been hailed by the international community and stakeholders in the agricultural sector with calls for replication of the program in other sectors of the Ghanaian economy (Arko, 2020).

Poverty is one of the key reasons why an envisioned sustainable cocoa sector is failing. The same poverty has resulted in cocoa farmers especially women farmers not able to purchase protection gear and might have turned to cheaper pesticides, but more hazardous pesticides. Therefore, the introduction of the Living Income Differential (LID) put forward by the governments of the Ivory Coast and Ghana to support farmers' wages in 2020-2021 cocoa season and beyond is meant to alleviate poverty among cocoa farmers. A "living income" for smallholder farmers specifically in the cocoa sector is defined as the "net annual income required for a household in a particular place to afford a decent standard of living for all members of that household."[3] According to

[3] https://www.uncommoncacao.com/blog/2020/10/20/the-lid-in-ghana-and-cote-divoire

Fairtrade International, a living income commitment by chocolate-consuming countries would complement the Ivorian government's efforts to stabilize the price of cocoa for farmers[4].

The Ivorian Conseil du Café Cacao (CCC) and the Ghana Cocoa Board (COCOBOD)- the governmental agencies responsible for cocoa trade and regulation in the respective countries will charge an extra fee of USD 400 per ton of cocoa on top of the Freight on Board (FOB) price. This additional fee charged from international cocoa and chocolate companies is called a living income differential (LID)[5]. In October 2020, the LID allowed both countries to increase the guaranteed producer price; in Ghana by about 28%. It is announced that if the FOB price reaches at least USD2600/MT , the LID will be paid into a stabilization fund set up by both countries to address future fluctuations in the threshold price (USD2600/MT). The introduction of the LID and a floor price on FOB by US 2600/MT, the governments aim to pay a producer price of at least 70% of USD2600/MT. A living income is one of the tools to alleviate poverty, which is a precondition for farmers to implement sustainable agricultural practices, invest in their farms and thus can be also used to address those root causes for inadequate use of approved environmentally-friendly pesticides.

2.6 Gender Perspective of Pesticides Use in Africa

Women and men farmers play different roles in agricultural production and they often possess different levels of knowledge about pest and disease management practices. Despite these gender differences, research and training on pest and disease management often target farmers as a whole neglecting the specific needs of women and men (Kawarazuka et al., 2020). Such oversight is particularly important since providing appropriate support to women and men farmers helps to reduce farmers' exposure to pesticides, improve environmental quality and increase the adoption of appropriate crop protection technologies and practices (Christie et al., 2015).

A study by Okonya et al. (2019) shows that men apply the chemicals in the field usually without any personal protective equipment, while women fetch the water to be used for mixing the pesticides, and also wash the clothes worn during the pesticide application. However, women are often not invited to participate in training about the safe use and handling of pesticides. As a result, women are exposed to the negative effects of pesticides because they frequently do not know about the toxicity levels of the different chemicals being used and their impacts on health as well as the environment. If women were more aware of the hazards, they could influence their husbands to adopt safe practices during pesticide application. Therefore, both women and men should be given training about the safe use and handling of pesticides and other agrochemicals so that both can avoid pesticide poisoning and contribute to effective crop management.

[4] https://www.confectioneryproduction.com/news/34536/fairtrade-urges-eu-to-back-living-incomes-in-west-african-cocoa-supply-chains/

[5] https://www.voicenetwork.eu/wp-content/uploads/2019/09/190905-VOICE-Position-on-West-African-Cocoa-Floor-Price.pdf

METHODOLOGY

3.1 Introduction

This section presents the methods and procedures adopted in the study. This includes information on the study area, data collection and data analysis method.

3.2 Study Area

The study was conducted in Western North and Central Regions of Ghana, which are part of the cocoa growing regions in Ghana. These regions were purposively selected due to their dominance in cocoa production in the area. The Western North region comprises of four (4) cocoa districts, i.e. Enchi, Sefwi Wiawso, Juaboso and Bia whiles the Central region comprises of three (3) cocoa districts, i.e. Assin North & South, Twifo-Hemang-Lower Denkyira and Upper Denkyira.

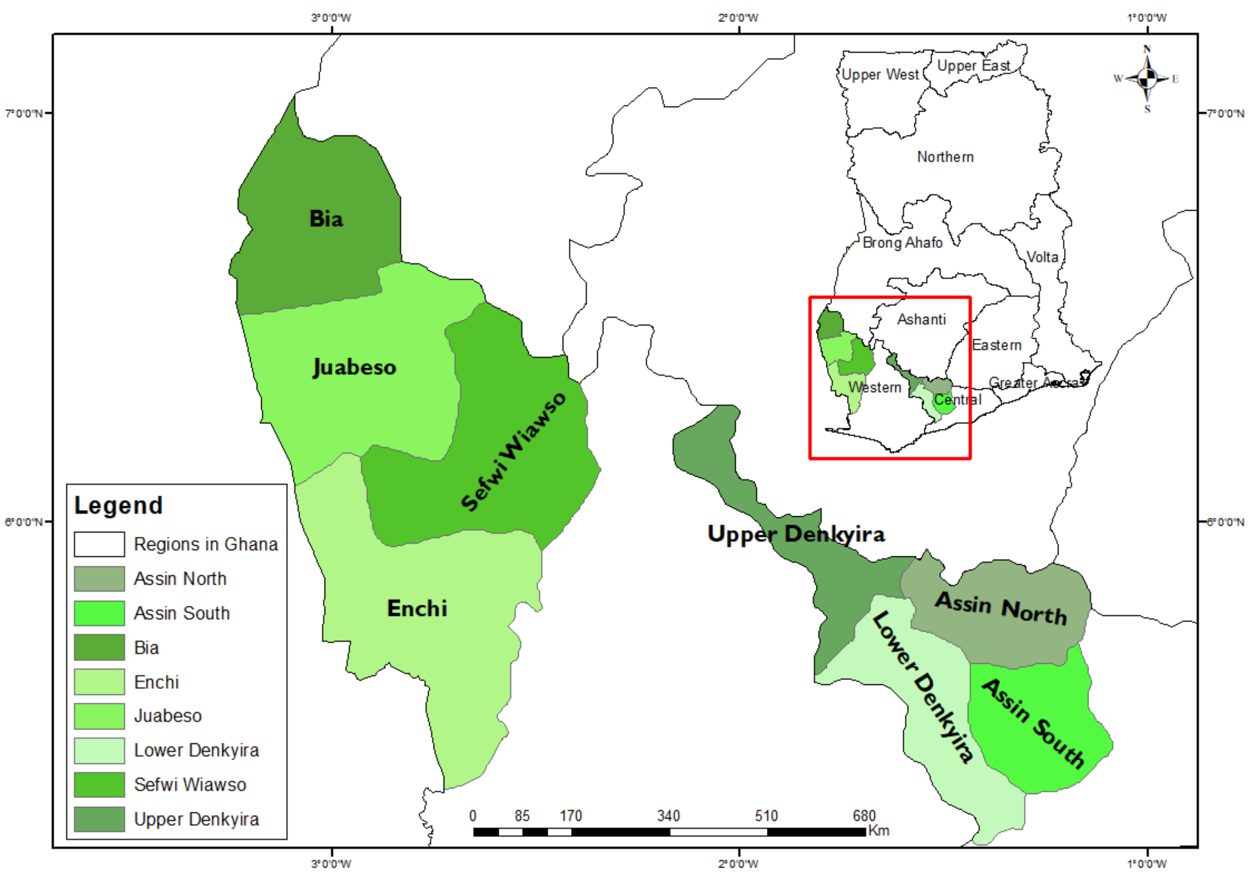

Figure 1 Study Area Map

3.3 Sampling Method

Purposive sampling technique was adopted in selecting members of the Cocoa Conservation Association (CCA). CCA is a cocoa farmers' group dotted within the cocoa districts in the Western North and Central regions of Ghana. In both regions, the total cocoa farmer size is about 1,500 (900 members in the Western North and 600 members in the Central region). Based on the total population (1,500) of registered membership of the group, 70% of whom are men and 30% women, over 500 respondents were carefully sampled. The total sample size used in this study was 503, i.e. 269 from Western North and 234 from the Central region based on the respective population size using Krejcie & Morgan, 1970 Table. The sample size used is shown in details in Table 4.

Table 4 Sample size used based on Krejcie & Morgan, 1970 Table

Total Members of CCA farmer group	Cocoa Regions	
	Western North	Central
Men (70%)	630	420
Women (30%)	270	180
Total Sample Size	**269**	**234**
Men (70%)	188	164
Women (30%)	81	70

Source: CA, 2020

The sample sizes from Table 4 were further divided to get a uniform representation from the respective cocoa districts. In effect, a total of 47 men and 20 women cocoa farmers were selected from each cocoa districts in the Western North region, whereas a total of 55 men and 23 women cocoa farmers were selected from each cocoa districts in the Central region. A simple random technique was adopted in selecting these cocoa farmers from their respective districts.

3.4 Data Collection

In this study, both primary and secondary data source were used. The primary data comprises of questionnaire administration (Figure 2) and Focus Group Discussions (FGDs) (Figure 3) whiles the secondary source of data were obtained from published articles, journals, books etc. The semi-structured questionnaire administered helped addressed the objectives of the study. These questionnaires were administered in the various districts in September 2020 whereas the FGDs were carried out in October 2020.

Also, most of the questions were the close ended type though few were open ended type of questions. The open-ended questions solicited free responses from the respondents (cocoa farmers), and the closed-ended questions allowed respondents to choose one response out of 5 options. The questionnaire consists of both categorical and scale-type question items. Likert-scale question type helped the researchers in gathering and measuring the perceptions of the respondents.

3.5 Data Analysis

The questionnaires were pre-tested using a selected group of respondents outside the target population to ensure reliability and validity of the questions and the responses. All data were coded and analysis was carried out using Statistical Package for Social Sciences (SPSS) and Microsoft Excel. The data obtained reflected the views, opinions and attitude of the respondents and further enhanced the reliability, validity, credibility, and accuracy of the result.

The data obtained are represented in tables for simplicity of the analysis. The analysis was done using descriptive analysis where issues of similarity and dissimilarities of responses were compared. The descriptive statistical tools helped to have a good quantitative comparative analysis of the responses.

Figure 2 Focus Group Discussion

Figure 3 Questionnaire Administration

3.5 Data Analysis

Quantitative and qualitative information was collected using a structured questionnaire. The data collected were analyzed using SPSS 20, Excel, Tableau and Minitab. Results were presented in tables and charts. The respondents were given the opportunity to rank the factors that influence them most in selecting a hazardous pesticide. Responses were ranked on a scale from 1 to 5, where 5 was the highest influence and 1 the least influence.

RESULTS AND DISCUSSION

4.1 Introduction

This section consists of presenting and discussions of the results of the study in an attempt to address the specific objectives of the study. The major areas this section discusses are the demographic characteristics of the cocoa farmers the knowledge levels of cocoa farmers on the use of HHPs and the driving factors on the use of HHPs among women cocoa farmers.

4.2 Demographic Characteristics of Respondents

The demographic characteristics of this study focused on the age, the level of education of the respondent and years of experience in cocoa cultivation.

Table 5 Demographic Characteristics of the respondents

Characteristics of Cocoa Farmers			
Variable		**Frequency**	**Percentage (%)**
Gender	Men	352.00	69.98
	Women	151.00	30.02
Age (years)	20 – 34	75.45	15.00
	35 - 49	217.80	43.30
	50 and above	209.75	41.70
Level of education (Men)	No formal education	75.45	15.00
	Primary education	35.21	7.00
	Middle School /JHS	221.32	44.00
	Secondary education	120.72	24.00
	Tertiary education	50.30	10.00
Level of education (Women)	No formal education	241.44	48.00
	Primary education	45.27	9.00
	Middle School/JHS	140.84	28.00
	Secondary education	55.33	11.00
	Tertiary education	20.12	4.00
Marital status	Single	50.30	10.00
	Married	331.98	66.00
	Divorced	70.42	14.00
	Widowed	50.30	10.00
Family size	Less than 5	101.51	20.18
	Between 5 - 10	228.41	45.41
	Above 10	173.08	34.41
Level of experience in cocoa cultivation (Men)	Between 5 – 10 years	165.99	33.00
	Less than 5 years	25.15	5.00
	More than 10 years	316.89	63.00
Level of experience in cocoa cultivation (Women)	Between 5 – 10 years	311.86	62.00
	Less than 5 years	35.21	7.00
	More than 10 years	150	30.00

Source: CA, 2020

From the analysis, (Table 5), about 70% of respondents were men, (69.98%) and their women counterparts constituted about 30%. This is consistent with the national figures. Generally, cocoa production in Ghana is considered to be men dominated activity even though women play key roles in the post-harvest practices and other farm management activities such as crop care, fermentation and drying of the beans.

The aging population of the respondent as shown in the age profile indicates that almost 42% of the respondents were 50 years and above. Unless more young people are attracted to the industry, the future of the sector could be compromised.

Majority of the men cocoa farmers (85%) had obtained at least primary school education whiles 15% had no formal education. For the women cocoa farmers, majority (52%) had obtained at least primary school education whiles 48% had no formal education. From the ratio, men cocoa farmers possess minimum to adequate education as compared to women cocoa farmers. This can be attributed to the household roles women are assigned to even at the younger age, hence hindering them from going to school. Ability to read and write could help men, cocoa farmers, to adopt new technologies in cocoa production and decide on the type and dosage of pesticide to apply on farms. Based on the differences in the number of people with some educational background, it stands to reason that men cocoa farmers stand a good chance of applying recommended pesticides on their farms compared to women cocoa farmers.

Cocoa cultivation is a hands-on training exercise. Until recent times, farmers were responsible for training their men-children in the cultivation of the commodity. The study revealed that the number of years in cultivation have a tendency to influence the decisions and practices of farmers. From the responses, 63% of the men cocoa farmers had more than 10 years experienced in cocoa cultivation whereas 30% of the women respondents had more than 10 years' experience in cocoa cultivation. It is expected that the higher the number of years in cocoa cultivation, the better decisions on pesticides should be and the better the skill acquired to develop new sustainable ways of cultivation.

4.2.1 Source of Labour in Pesticide Application

The cocoa sector is recorded to be labour intensive and requires a large number of human labour. These are obtained either from families, hired labour, spraying gangs etc. The family labour in this context includes husband, wife, father, mother, uncles, aunties etc. excluding children below 18 years, whiles the spraying gangs are those trained from CODAPEC. From the survey (Figure 4), 43% of the men respondents carried out the pesticide application with support from spraying gangs whiles 17% of them relied on spraying gangs only and 15% applied it themselves. The application of the pesticides by the farmers themselves could result in compromises in respect of adherence to the spraying protocols including the use of PPEs, the application of the recommended pesticides and the use of the right dosage. For the women respondents, the majority (30%) are also supported by the spraying gangs to apply the pesticides, whereas 22% relied on spraying gangs only. The other sources of labour used are either family labour, hired labour or by themselves. The study also revealed that when the input allocation falls short of the farmers' number of farms, the farmer purchase pesticides from the open market for application. That could be the source of the HHPs and the health hazards.

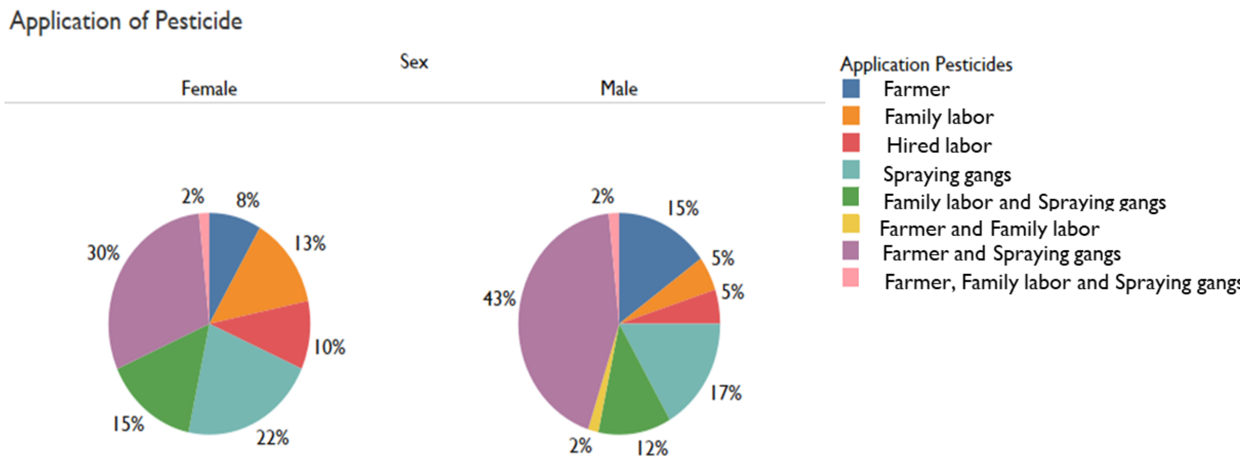

Figure 4 Major source of labour for pesticide application

4.3 Knowledge Levels of Cocoa Farmers on the Use of HHPS

The farmers level of knowledge on the use of HHPs including exposure routes, type of PPEs used by cocoa farmers, safety measures observed after application, effects on human health and environment, disposal of empty pesticide containers, and the awareness of the approved and unapproved HHPs were analyzed.

4.3.1 Type of Personal Protective Equipment used by Cocoa Farmers

Different protective gears worn by cocoa farmers were identified during this study and the results are presented in Table 6. The protective gears used with the highest percentage are boots (97.50%), followed by long-sleeved shirt/jacket (83%), hat (73%) and overalls (71%).

Table 6 Protective Gears used by Cocoa Farmers

Type of protective gear	Percentage	
	Yes	No
Mask	31.00	69.50
Goggles	5.00	95.00
Hat	73.00	27.00
Gloves	10.77	89.23
Long-sleeved shirt/Jacket	83.00	17.00
Boots	97.50	2.50
Overalls	71.00	29.00

The least protective gears used are googles (5%), gloves (10.77%) and mask (31%). These PPEs are considered uncomfortable to use and unavailability when needed. Other reasons attributed to the failure/low usage of these protective clothing by the respondents (cocoa farmers) and these are presented in Table 7.

Table 7 Reasons for not Wearing PPEs during Pesticide Handling and Application

Reasons	Percentage (%)
Costly	51.89
Uncomfortable	30.50
Scarcity	17.54

The leading reasons for not using some of these PPEs such as mask, googles were mainly attributed to unaffordability (51.89%) followed by it being uncomfortable to wear particularly during high temperatures (30.50%) and unavailability (17.54%). These, however, confirm the results obtained in a related study on pesticide use in developing countries (Damalas & Koutroubas, 2017; Bhandari et al., 2018) on. The studies states that farmers hardly use goggles, gloves and mask during pesticide application.

4.3.2 Safety Measures Observed After Pesticide Application

The safety measures practised by the respondent are presented in Table 8. From the table, it shows that majority of the respondents, both men and women (30%) wash their hands after pesticides application before eating whiles 27% and 26% for both men and women respectively bath after pesticide application. These indicate that the respondents (cocoa farmers) are aware of the health risk of pesticides. This, however, is in accordance with the studies by Muilerman (2013), who stated that only 1.4% of cocoa farmers in Ghana fail to wash their hands after pesticide application before eating. Also, 23% of both respondents wash their PPEs together with other clothing. This implies that the spillage of pesticides on these PPEs could be transferred to other clothes, thereby making it unsafe to wear and thus posing a significant risk to their health.

Exposure to pesticides could be through contact with the skin, eyes or through inhalation or ingestion. From the analysis, 20% of the men respondents were exposed to pesticides through some of these routes. This could be as a result of not wearing the required PPEs during pesticide handling and application. Majority of the women cocoa farmers confirmed cases of pesticide poisoning among some cocoa farmers in their communities. Some of them accepted the suggestions that the application protocols were not strictly adhered to but compromised.

Table 8 Safety Measures Observed after Pesticide Application

Variable		Frequency	Percentage (%)
Safety measures of pesticide application (Men)	Wash hands after applying pesticides before eating	150.90	30.00
	Bath after applying pesticides	135.81	27.00
	PPEs washed separately from other clothes	115.69	23.00
	Exposure to pesticides	100.60	20.00
Safety measures of pesticide application (Women)	Wash hands after applying pesticides before eating	150.90	30.00
	Bath after applying pesticides	130.78	26.00
	PPEs washed separately from other clothes	115.69	25.00
	Exposure to pesticides	105.63	19.00

4.3.3 Perceived effects of Pesticides on Human and the Environment

From the analysis (Table 9), most of the respondents (65%) agree or strongly agree that the use of pesticides has an effect on their health and the environment, whereas 11% strongly disagree. About 45% of the respondent experienced itchy skin and eye irritation followed by headache and itchy skin (15%), eye irritation (13%) and difficulty in breathing after pesticide application. Also, 10% experienced dizziness and headache and 7% experience difficulty in breathing. Sometimes the farmers may not be able to link the pesticide effect to the feeling of discomfort among the sprayers and may conclude that the pesticides have no effect on human health and the environment. The immediate effect on the environment may even take some time before it becomes visible.

Table 9 Perceived effects of Pesticides

Variable		Frequency	Percentage (%)
Perceived health effects experienced after pesticide application	Difficulty in breathing	35.21	7.00
	Dizziness	50.30	10.00
	Eye irritation	65.39	13.00
	Headache	50.30	10.00
	Headache and itchy skin	75.45	15.00
	Itchy skin and eye irritation	226.35	45.00

Pesticides have effect on health and the environment	Strongly agree	196.17	39.00
	Agree	130.78	26.00
	Disagree	120.72	24.00
	Strongly disagree	55.33	11.00

4.3.3 Disposal of Empty Pesticides Containers

Some of the ways in which the respondent disposes of their empty containers are presented in Table 10. However, many of these containers were discarded in unsafe ways. This includes leaving them on the farm (75%), burn them (59%), bury them in the soil (45%), throw in pit latrine (28%) and reuse after washing (18%). These ways of used-pesticide container's disposal could have negative effects on the environment i.e. Burying empty containers, for instance, could contaminate the groundwater and burning them indiscriminately can cause emission of greenhouse gases which could affect the ozone causing climate change. Also reusing after washing could pose a risk of ill-health to humans since there could be traces of these chemicals in the containers when used.

This confirms the result of studies by Afari-Sefa et al. (2015) which revealed that, majority of cocoa farmers in Ghana leave the empty pesticide containers on their farms after use. The study results further showed that some of the cocoa farmers store seeds and other food items such as salt, palm oil and other stuff like kerosene in these empty pesticide containers. Ntow (2001), also noted that, this act could potentially pose a great risk to aquatic life if they pollute any nearby water bodies, and further endanger the life of communities which depend on the water bodies for domestic use.

Table 10 Methods of Discarding Empty Pesticide Containers

Disposal methods/practices	Percentage	
	Yes	No
Leave them on farm	75.00	25.00
Bury them in the soil	45.00	55.00
Burn them	59.00	41.00
Reuse after washing it	18.00	82.00
Throw into pit latrine	28.00	72.00

4.3.4 Awareness of Cocoa Farmers on Approved & Unapproved Pesticides

About 60% and 58% of the men and women respondents respectively were aware that some pesticides are unapproved and restricted for use by COCOBOD (Table 11). About 65% of the men respondents were able to identify some of these pesticides whereas only 5% women respondent knew them. This could be attributed to the several factors faced by women such as less participation during sensitization exercises, inability to read and their lack of involvement during group meetings. Also, 65.98% of the men respondents and 54% of the women respondent knew that, the toxic nature of these unapproved pesticides largely account for the reasons for restricting their use. Unless COCOBOD and NGOs intensify their public education and public awareness campaigns on the risk associated with the use of unapproved pesticides, the cocoa sector could suffer dire consequences in the future.

Table 11 Awareness of Approved and Unapproved Pesticides

Variable		Frequency	Percentage
Men			
Do you know some pesticides are unapproved and restricted for use?	Yes	301.80	60.00
	No	211.26	42.00
Do you know the pesticides that are unapproved for use?	Yes	326.95	65.00
	No	176.05	35.00
Do you know the reasons for restricting these pesticides?	Highly toxic	331.88	65.98
	Ineffective	62.21	12.37
	Don't know	109.00	21.65
Women			
Do you know some pesticides are unapproved and restricted for use?	Yes	291.74	58.00
	No	201.20	40.00
Do you know the pesticides that are unapproved for use?	Yes	25.15	5.00
	No	477.85	95.00
Do you know the reasons for restricting these pesticides?	Highly toxic	271.62	54.00
	Ineffective	181.08	36.00
	Don't know	50.30	10.00

4.4 Factors Influencing the Use of HHPs

The factors influencing the use of HHPs among cocoa farmers in CCA were analyzed and the results is as shown in Figure 5. These were ranked based on the scale 1-5, where 1 is the least influencing factor and 5 is the highest). Affordability and recommendation were the major factors influencing the use of HHPs among the respondents (cocoa farmers). For the women respondents, recommendation (3.8) was the highest rank obtained followed by affordability (3.5). That is, they relied on recommendations from families, friends, extension officers and pesticide dealers. This can be partly explained based on the rate of illiteracy among the women respondents as seen in Table 5 (under demographics), therefore they cannot read and understand to select the right pesticides. Affordability was the second option based on the lower financial status of these women, therefore they tend to rely on less expensive pesticides. The HHPs were found to be less expensive than the government-approved ones.

For the men respondents', affordability was the highest influencing factor (3.7) as compared to women whose influencing factor was based on recommendation. Also, the availability of pesticides was ranked as the third influencing factor (2.8) of pesticide use by both respondents (men & women). Studies by Idris et al. (2013) & Denkyirah et al. (2016) explained that, pesticides used by cocoa farmers are often influenced by the cost of pesticides and not necessarily its availability.

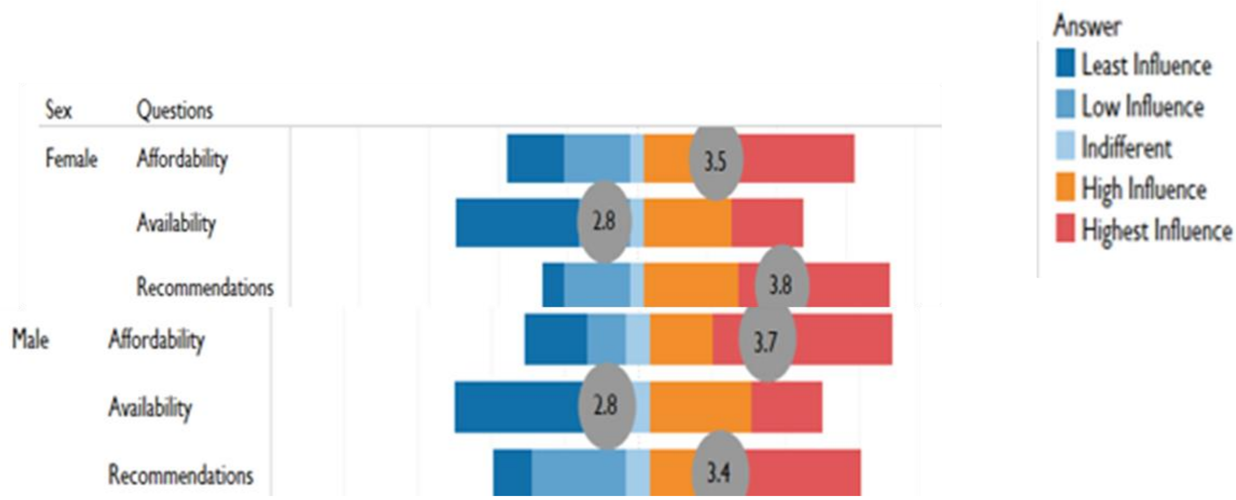

Figure 5 Factors Influencing the Use of HHPs

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The study sought to understand the gender dynamics of the use of Highly Hazardous Pesticides (HHPs) in the two focused areas (Central and Western North regions) within the cocoa production in Ghana. The following conclusions are;

i. The aging population of the respondent as shown in the age profile indicates that, 85% of the respondents were 35 years and above. The study shows that most of the men respondent (85%) had primary education whereas 15% had no formal education. 52% of the women respondents on the other hand had primary education with 48% having no education. Activities in the cocoa sector are tedious in nature, hence requires a large number of human labor. From the analysis, the men respondents had more than 10 years' experience in cocoa cultivation as compared to a few women who had more than 10 years' experience. Low education, less participation during sensitization exercises, inability to read and lack of involvement during group meetings can be considered as main factors, why woman are more exposed to the risks of HHPs than men and why they do not implement good pesticide management standards.

ii. The safety behaviors in pesticide use were limited particularly in the use of personal protective equipment such as mask, gloves, and goggles. Factors such as the high cost of purchase and discomfort were associated with lack of/limited use of protective gears. Majority of the respondent strongly agreed that the use of pesticides has an effect on their health and the environment. Also, the empty pesticide containers were discarded haphazardly. A greater portion of the respondents leave the empty containers on their farms' whiles other burns, bury them, throw them in pit latrine and reuse after washing. This haphazard nature of disposal could have a tremendous effect on the health and environment. Furthermore, 60% of men respondents and 58% of women respondents were aware that some pesticides were unapproved by COCOBOD. However, only 5% of the women respondent knew these unapproved pesticides as compared to the men respondent 65%. The toxic nature of these unapproved pesticides was widely known by 65.98% men respondent and 54% women respondent.

iii. Moreover, as men cocoa farmers relied on affordability as the main factor influencing their use of pesticides, this was also a key driver for woman. Still, woman highly relied on recommendations from friends, family and extension officers, which shows the limitation to make their own well-informed decisions on the use of pesticides. Therefore, the low level of knowledge of women cocoa farmers on the unapproved pesticides could be an indication of inadequate sensitization which could not be overcome through CODAPEC programs.

5.2 Recommendation

From the study, it was revealed that women are at a higher risk of pesticide application and have access to inadequate farm inputs. Therefore, the following recommendations are made to help boost a sustainable cocoa sector. This includes;

i. There should be more sensitization on the dangers of pesticide misuse on human health and environment should be carried out through farmer groups, pesticide dealers and partnership with other relevant stakeholders to facilitate change in behavior, attitude, and practices and promote safety behaviors in pesticide use. Trainings on good agricultural practices and the use of pesticides offered by Ghanaian authorities, NGOs or the private sector must be accessible to women. Specific trainings for women must take into account the level of knowledge and education and use appropriate methods for knowledge transfer.

ii. Cocoa farmers especially women should be encouraged to join farmer groups and other social networks to facilitate the exchange of new ideas, information, increase their bargaining power, access vital farm inputs, protective gears, access lucrative markets, credit, and other relevant services at a lower cost.

iii. CODAPEC and other private extension service providers, should upgrade the skills of their personnel to enhance their effectiveness and implementation of a farmer to farmer extension provision services. This will encourage the promotion of safe pesticide use and use of alternative crop protection methods to avert pesticide misuse behavior at the farm fields. Furthermore, there should be a provision of participatory training programs on safe pesticide use and alternative crop protection methods (for instance through farm demonstrations and farmer field schools). This should be gender-sensitive and age-inclusive to facilitate mass to access to accurate and reliable information to all relevant stakeholders in the cocoa value chain (i.e. from chemical input suppliers to producers and traders).

iv. The health and environmental impacts of the use of HHPs in the cocoa sector should receive greater attention from stakeholders in the cocoa sector. There is the need for promotion and implementation of new efficient integrated pest management approaches and other alternative methods by public policymakers and other development partners tailored towards the needs of the cocoa farmers. This can be achieved through relevant government and non-governmental information dissemination channels in order to reduce unapproved pesticide use to a bare minimum.

v. As poverty is a key reason why farmers are not buying protection gear such as googles, gloves and masks, it is crucial to close the gap to a living income. An improved economic situation can also prevent farmers from turning to the cheaper high hazard pesticides for cost reasons. In order to reduce the hazardous effects of pesticides on health and the environment, all actors in the cocoa sector are called upon to take measures to close the living income gap.

REFERENCES

Adjinah, K. O., & Opoku, I. Y. (2010). The National Cocoa Diseases and Pest Control (CODAPEC): *Achievements and Challenges*.

Afari-Sefa, V., Asare-Bediako, E., Kenyon, L., & Micah, J. A. (2015). Pesticide Use Practices and Perceptions of Vegetable Farmers in the CAfari-Sefa, V., Asare-Bediako, E., Kenyon, L., & Micah, J. A. (2015). Pesticide Use Practices and Perceptions of Vegetable Farmers in the Cocoa Belts of the Ashanti and Western Regions o. *Advances in Crop Science and Technology*, *03*(03). https://doi.org/10.4172/2329-8863.1000174

Afful, S. (2015). *Persistent Organochlorine Pollutants in Lake Bosomtwi and Weija Lake and their Potential Toxicological Health Implications.* (Vol. 151).

Afrane, G., & Ntiamoah, A. (2011). Use of Pesticides in the Cocoa Industry and Their Impact on the Environment and the Food Chain. *Pesticides in the Modern World - Risks and Benefits*. https://doi.org/10.5772/17921

Akashe, M. M., Pawade, U. V, & Nikam, A. V. (2018). Classification of Pesticides: a Review. *International Journal of Research in Ayurveda and Pharmacy*, *9*(4), 144–150. https://doi.org/10.7897/2277-4343.094131

Aktar, M. W., Sengupta, D., & Chowdhury, A. (2009). Impact of pesticides use in agriculture: their benefits and hazards. *Interdiscip Toxicol.*, *2*(1), 1–12. https://doi.org/10.2478/v10102-009-0001-7

Anang, B. T., Mensah, F., & Asamoah, A. (2013). Farmers' Assessment of the Government Spraying Program in Ghana. *Journal of Economics and Sustainable Development*, *4*(7).

Antwi-Agyakwa, A. K., Osekre, E. A., Adu-Acheampong, R., & Ninsin, K. D. (2015). Insecticide use practices in cocoa production in four regions in Ghana. *West African Journal of Applied Ecology*, *23*(1), 39–48.

Arko, A. B. (2020). Factors Influencing the Implementation of Agricultural Policy: A Case Study from Ghana's Cocoa Diseases and Pests Control (CODAPEC) Program. *Journal of Public Administration and Governance*, *10*(1), 262. https://doi.org/10.5296/jpag.v10i1.16613

Asamoah, M., & Owusu-Ansah, F. (2017). *LAND TENURE & COCOA PRODUCTION IN GHANA*.

Barrientos, S. (2013). Women in cocoa production: where is the gender equity? *The Guardian*.

Bhandari, G., Atreya, K., Yang, X., Fan, L., & Geissen, V. (2018). Factors Affecting Pesticide Safety Behaviour: The Perception of Farmers and Retailers. *Science of The Total Environment*, *631*, 1560–1571.

Damalas, C. A., & Khan, M. (2017). Farmers\` Training on Pesticide Use is Associated with Elevated Safety Behaviour. *Toxics*, *5*(19), 1–10.

Damalas, Christos A., & Eleftherohorinos, I. G. (2011). Pesticide exposure, safety issues, and risk assessment indicators. *International Journal of Environmental Research and Public Health*, *8*(5), 1402–1419. https://doi.org/10.3390/ijerph8051402

Denkyirah, E. K., Okoffo, E. D., Adu, D. T., Aziz, A. A., Ofori, A., & Denkyirah, E. K. (2016). Modeling Ghanaian cocoa farmers' decision to use pesticide and frequency of application: the case of Brong Ahafo Region. *SpringerPlus*, *5*(1). https://doi.org/10.1186/s40064-016-2779-z

Dormon, E. N. A. (2006). *From a technology focus to innovation development: The management of cocoa pests and diseases in Ghana*.

Gyawu, M. A.-, Brako, S., & Adzimah, E. D. (2015). Assessing The Challenges Facing Cocoa Production In Ghana: A Supply Chain Perspective (A Case Of Selected Licensed Cocoa Buying Companies In Ashanti Region-Ghana). *Journal of Supply Chain Management*, *2*(1).

Gyimah, N. (2019). *IMPACT OF COCOA MASS SPRAYING PROGRAM IN GHANA: THE CASE OF SEFWI WIAWSO MUNICIPALITY IN WESTERN NORTH REGION*. University of Education, Winneba, Ghana.

Hughes, J. D. A., & Ollennu, L. A. A. (1994). Mild Strain Protection of Cocoa in Ghana Against Cocoa Swollen Shoot Virus: A Review. *Plant Pathology*, *43*(3), 442–457. https://doi.org/10.1111/j.1365-3059.1994.tb01578.x

Hurtig, A. K., Sebastián, M. S., Soto, A., Shingre, A., Zambrano, D., & Guerrero, W. (2003). Pesticide use among farmers in the Amazon basin of Ecuador. *Arch Environ Health*, *58*(4), 223–228.

ICI. (2016). *Researching the Impact of Increased Cocoa Production on the Child Labour Risk and Labour Market in Ghana and Côte d'Ivoire.* (M. Vigneri & R. Serra (eds.)).

Idris, A., Rasaki, K., Folake, T., & Hakeem, B. (2013). Analysis of pesticide use in cocoa production in Obawomi Owode local government area of Ogun State, Nigeria. *Journal of Biology, Agriculture and Healthcare*, *3*(6), 1–9.

Kaur, H., & Garg, H. (2014). Pesticides: Environmental Impacts and Management Strategies. *Pesticides - Toxic Aspects*, *February*. https://doi.org/10.5772/57399

Marston, A. (2016). *Women's Rights in the Cocoa Sector: Examples of Emerging Good Practice.* Oxfam Discussion Papers.

McCauley, L. A., M Beltran, J. P., Lasare, M., & Sticker, D. (2001). Environmental Health Perspectives. *The Oregon Migrant Farmworker Community: An Evolving Model for Participatory Research*, *109*(3), 449–455.

Mohammed, S., Lamoree, M., Ansa-Asare, O. D., & de Boer, J. (2019). Review of the analysis of insecticide residues and their levels in different matrices in Ghana. *Ecotoxicology and Environmental Safety*, *171*(September 2018), 361–372. https://doi.org/10.1016/j.ecoenv.2018.12.049

Muilerman, S. (2013). *Occupational Safety and Health on Ghanaian Cocoa Farms*.

Northern Presbyterian Agricultural Services. (2012). *Ghana'S Pesticide Crisis*. *April*.

Ntow, W. J. (2001). Organochlorine pesticides in water, sediment, crops, and human fluids in a farming community in Ghana. *Archives of Environmental Contamination and Toxicology*, *40*(4), 557–563. https://doi.org/10.1007/s002440010210

Ntow, William J. (2008). *The use and fate of pesticides in vegetable-based agroecosystems in Ghana*. Wageningen Univesity.

Offei, S. ., Cornekuis, E. ., & Sakyi-Dawson, O. (2008). *Crop Disease in Ghana and their Management*.

Olunloyo, O. A. (n.d.). *A General Overview of Cocoa Viruses in West Africa. Cocoa Research Institute of Nigeria, Ibadan, Nigeria.*

Oyekale, A. S. (2018). Cocoa farmers' compliance with safety precautions in spraying agrochemicals and use of personal protective equipment (PPE) in Cameroon. *International Journal of Environmental Research and Public Health*, *15*(2). https://doi.org/10.3390/ijerph15020327

PAN. (2007). *June 07, 2007 1*. *May 2004*, 1–8.

Pesticide Management division, N. (2018). *Pesticide classification on use, chemical nature, formulation toxicity and action, etc, Hyderabad*.

Quandt, S. A., Arcury, T. A., Rao, P., Snively, B. M., Camann, D. E., Doran, A. M., Yau, A. Y., Hoppin, J. A., & Jackson, D. S. (2004). Environmental Health Perspective. *Agricultural and Residential Pesticides in Wipe Samples from Farmworker Family Residences in North Carolina and Virginia*, *112*(3), 382–387.

Ruano, P., Delgado, L. L., Picco, S., Villegas, L., Tonelli, F., Merlo, M., Rigau, J., Diaz, D., & Masuelli, M. (2016). We are IntechOpen , the world ' s leading publisher of Open Access books Built by scientists , for scientists TOP 1 %. *Intech*, *tourism*, 13.

Shaoli, D., & Biswajit, D. (2016). Prevalence of Health Hazards Associated with Solid Waste Disposal- A Case Study of Kolkata, India. *Procedia Environmental Sciences*, *35*, 201–208. https://doi.org/10.1016/j.proenv.2016.07.081

UN Environmental Prgromme. (2019). *Highly Hazardous Pesticides (HHPs)*.

APPENDICES

Appendix 1 Sample Questionnaire

CONSERVATION ALLIANCE

Assessments on the gender dynamics of highly hazardous pesticides (HHPs) within cocoa production in Western North and Central region

This questionnaire is carried out by Conservation Alliance International with support from INKOTA NETWORK to assess the levels of knowledge, attitudes and practices of cocoa farmers on the safe use of pesticides, and to ascertain the possible constraints on the health of cocoa farmers. Your privacy is highly assured and any sensitive information provided will not be shared to any third party.

Questionnaire Number………

Name of Enumerator: ……………………………………… Date of Interview: __/__/____
Name of community: …………………………………………………………………….

1. Bio-data of Cocoa Farmer

a. Name of respondent: …………………………………………………………………...
b. Telephone of respondent: ……………………………………………………………….
c. Sex of respondent: ☐ Men ☐ Women
d. Age of respondent: ☐ Less than 20 years ☐ 21-34 years ☐ 35-49 years ☐ 50 years and above
e. Marital status of respondent: ☐ Single ☐ Married ☐ Divorced ☐ Widow/Widower
f. Family size of respondent: ☐ Less than 5 ☐ Between 5-10 ☐ Above 10
g. Level of Education: ☐ Not been in school ☐ Primary school ☐ Middle School/JHS ☐ SHS ☐ Technical/Vocational ☐ Tertiary ☐ Others (specify) ……………………………………...
h. Respondent's experience in cocoa cultivation: ☐ Less than 5 years ☐ Between 5-10 years ☐ More than 10 years
i. Farm size of respondent: ……………………………………………………………….

2. Knowledge on the application of pesticides

a. Who applies the pesticides on your cocoa farms? (Select those applicable):
☐ Myself ☐ Family labour (*please specify*; *e.g. father, mother, uncle etc.)* ☐ Spraying gangs ☐ Family labour and spraying gangs ☐ Myself and spraying gangs ☐ Others; please specify: ……………………………………………………………………………………………
b. Tick Yes/or No against the Personal Protective Equipment (PPEs) often used during pesticides handling and application
i. Mask ☐ Yes ☐ No
ii. Googles ☐ Yes ☐ No
iii. Hat ☐ Yes ☐ No
iv. Gloves ☐ Yes ☐ No
iv. Long-sleeved shirt/Jacket ☐ Yes ☐ No
v. Overall ☐ Yes ☐ No
vi. Boots ☐ Yes ☐ No

c. What are the reasons for wearing PPEs during pesticide handling and application?

☐ Too expensive to purchase

☐ Uncomfortable

☐ Time-consuming

☐ Unavailable when needed

d. Who provides you with advice regarding the use of pesticides on your farms? (Select all that apply)

☐ Colleague farmers ☐ Agricultural extension officer ☐ Agrochemical shops

☐ Cocoa producing buying companies ☐ Media (Radio/TV)

☐ Others; please specify: ………………………..…………………………………………………

e. Do you follow the prescribed pesticide label instructions?

☐ Yes / ☐ No

f. After spraying farms with pesticides, do you usually wash your hands before eating?

☐ Yes / ☐ No

g. After spraying farms with pesticides, do you usually bathe or shower before continuing with other activities?

☐ Yes / ☐ No

h. Are the clothes/PPEs usually washed separately from your other clothing?

☐ Yes / ☐ No

i. In what way do you dispose of the pesticide waste materials?

☐ Burn them ☐ Bury them ☐ Burn and bury them ☐ Leave them on farm ☐ Others; please specify: …………..……………………………………………………………………………

j. Where do you store your pesticides?

☐ In your bedroom ☐ Storeroom within the house ☐ Storeroom on the farm ☐ Others; please specify: …………………………...………………………………………………………..

k. Do you think that pesticides affect the environment?

☐ Strongly agree

☐ Agree

☐ Disagree

☐ Strongly disagree

3. Effects of pesticides on health

a(i) Do you tend to experience any symptoms after applying pesticides on the farm under normal circumstances?

☐ Yes / ☐ No

ii. If yes, please select symptom(s) you normally experience: ☐headache ☐nausea ☐difficulty in breathing ☐Itchy skin ☐eye irritation ☐vomiting ☐dizziness

b. Have you had any incidents with pesticides that caused you unusually high personal exposure (for example from accidental spillage or failure of personal protective equipment)?

☐ Yes / ☐ No

c. How many incidents like this did you have in the last 5 years?

……………………………………………………………………………………………………

d. Following any of these incidents, did you experience symptoms (such as headaches, nausea, difficulty breathing, etc.) which you thought may have been related to the incident?

☐ Yes / ☐ No

e. What did you do after the incidents?

☐ Did nothing ☐ Took self-medication ☐ Went to the hospital ☐ Others; please specify:

……………………………………………………………………………………………………

f. Were you hospitalized following any of these incidents?

☐ Yes / ☐ No; *if answered yes, answer g, else skip*

g. Please provide us with the name of the hospital

……………………………..………………………………………………………………………

……………………………..………………………………………………………………………

4. Proposed method or methods of application, including the availability of appropriate application and safety equipment

a. What is the method of pesticide application?

☐ Knapsack sprayers ☐ hand-held applicators ☐ motorized sprayers

b. Which of the method yield the best result?

☐ Knapsack sprayers ☐ hand-held applicators ☐ motorized sprayers

c. How often do you apply the pesticides?

☐ Very often ☐ Rarely ☐ Sometimes

5. The basis for selection of pesticide used

a. Do you know some pesticides are banned or restricted for use?

☐ Yes / ☐ No

b. Do you know the pesticides that are banned or unapproved for use?

☐ Yes / ☐ No

c. Do you know the reasons for banning or unapproved these pesticides?

☐ Highly toxic

☐ Not effective

☐ Don't know

d. Are you aware of the COCOBOD approved pesticides?

☐ Yes / ☐ No

d(i). If yes, please list some of these pesticides?

……………………………..…………………………………………………………………………...

……………………………..…………………………………………………………………………...

……………………………..…………………………………………………………………………...

d(ii). Which of these pesticides named above do you use?

……………………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

e. Do you use any of these banned/unapproved pesticides?

☐ Yes / ☐ No

e(i) If yes, list some of them

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

6. The effectiveness of the pesticide used

a. What is the target pest and disease for the proposed pesticides used stated in (section 5)?

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

b (i). On a scale of 1-4, how effective are the non-approved pesticides against the target pest and disease?

☐1 = Very Effective ☐2 = Effective ☐3 = Indifferent ☐4 = Not Effective

b (ii). On a scale of 1-4, how effective are the approved pesticides against the target pest and disease?

☐1 = Very Effective ☐2 = Effective ☐3 = Indifferent ☐4 = Not Effective

c (i). How long does the non-approved pesticide take to be effective?

……………………………………………………………………………………………

c (ii). How long does the approved pesticide take to be effective?

……………………………………………………………………………………………

7. The driving factors influencing the use of HHPs

Please rank the factors that influence your choice of selecting these HHPs using a scale of 1-4, where 1 is the highest influencing factor and 4 is the lowest.

Factors	Scaling (1-4)
Availability	
Affordability	
Recommendation/past experience	
Others; distance to the source of pesticides	

8. Conditions under which the pesticides are used, including climate, flora, fauna, geography, hydrology, and soils.

a. What is the general topography of your farm? (Select those applicable)

☐ Farm fields on slopes in mountainous areas with seasonal rains

☐Farm fields at low elevation frequently near streams, well-drained fields with seasonal rains

b. Are there any wells, water sources, perennial or intermittent streams or rivers, natural or impounded lakes or reservoirs within 200 feet of the application site(s)?

☐ Yes / ☐ No

c. Do the sites favour runoff?

☐ Yes / ☐ No

Appendix 2 Guiding Questions for Focus Group Discussion

1. It has been realized from data processing that men cocoa farmers make high yields than women cocoa farmers. What do men cocoa farmers do differently?

Example;

If men and women cocoa farmers have the same farm size and are taught how to do farming, which of the farms are likely to yield more and why?

2. How effective is the government' CODAPEC programme over a period of time?

If you were to rate the benefits to farmers on a scale 1-5 (1- least and 5 – highest) how will you rate it and why?

Do you think there is a need for changes to be made of the program to make it more effective?

Which aspect of the program will you call for a change or your opinion about the change?

3. How will you rate cocoa extension services in this area on a scale of 1-5. If we want farmers to have access to extension officers, what do you think can be done to help this situation?

After these suggestions have been given by farmers, it was grouped and ranked

Appendix 3 Farmer Groups/Associations Present in the Study Areas

Kakum	Enchi	Sefwi	Juaboso	Bia
Conservation Cocoa Association(CCA)	Conservation Cocoa Association(CCA)	Conservation Cocoa Association(CCA)	Conservation Cocoa Association(CCA)	Conservation Cocoa Association(CCA)
Akwagyaw Cocoa Co-operative	Co-operative Farmers Association	Cocolife Association	Ellubo Farmers Association	Cargill
Olam Cocoa Association	Jensue Peace Farmers Association	CROMA	Kofi Krom Cocoa Farmers Association	Cocolife Association
Adom Cocoa Association	Ohiamp3 Anika	Nyonkapa Cocoa Farmers	Kwabenakrakrom Cocoa Farmers Association	Mondules Cocoa Associaton
Osamkwaa Cocoa Cooperative		Olam Cocoa Association	Mondules Cocoa Associaton	Fonfidi
Nyame Ne Meboafo) Co-operative		Cocoa Abrabopa	Nyinahini	Kankyiabo)d) Association Farmers
Nyame y3 boato-cooperative		Abrabopa Cocoa	PROHOANO Farmers' Association	Kumikrom Adom Association Farmers
Mangoase Cocoa Co-operative		Amajaro Cocoa farmers group	Proso Farmers Association	Adom Farmers Association

		Ashanti Cocoa Association	Tanokrom Farmers' Cooperative Association
		Mondules Cocoa Association	