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# Non-Compliance with Agrochemical Safety Guides and Associated Health Risks among Cocoa Farmers in the Ashanti Region of Ghana

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**ABSTRACT**

Although several occupational health hazards are associated with farming, cocoa farmers could be exposed to more health hazards through use of agrochemicals. The objective of this study was to analyze the effect of non-compliance with agrochemical safety guides on health risks of farmers. The data were collected from 246 farmers with structured questionnaires using multi-stage sampling procedures. The data were analyzed with descriptive statistics and Probit regression model. The results showed that 24.80% was ≥60 years and 33.33% had no formal education. Majority of the farmers (93.09%) were using liquid insecticide, 56.10% used liquid fungicides and 52.44% used herbicides. Also, 60.16% had increased their use of insecticides over the past three years and awareness of safety guides was reported by 88.21% for insecticides, 73.98% for fertilizers and 65.04% for fungicides. Also, 74.39% followed manufacturers' instructions on insecticides usage. Precautionary measures that farmers were taking include not inhaling the chemical (84.15%) and keeping out of reach of children (82.93%). Ownership of agrochemical safety kits was very low with 51.22%, 33.74% and 32.11% having boots, hand gloves and water resistant overall, respectively. Among the health problems suffered after handling agrochemicals are skin irritation (37.80%), eye irritation (33.33%) and headache (32.93%). The Probit regression showed statistical significant ($p<0.05$) impact of contact and precautionary indices variables with probability of reported health problems in almost all the models, while number of safety kits reduced reported skin infections. It was recommended that more awareness should be created on health hazards associated with agrochemical usage, the need for farmers to use safety kits, and proper education for reducing farmers' contacts with agrochemicals.

**Keywords:** Agrochemicals, safety kits, health risks, cocoa farmers, Ashanti region, Ghana

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## INTRODUCTION

Globally, agriculture is widely reckoned among the jobs with tremendous occupational health hazards [International Labour Organization (ILO), 2000]. Occupational hazards that farmers daily face are not only enormous (International Labour Office, 2000), but can be very severe and fatal. Specifically, globally, agriculture ranks as the second most hazardous occupation after mining (Tettey *et al*, 2009). ILO (2000) estimated that although global work related accidents amount to 250 million annually, there are 170,000 fatal accidents among agricultural workers out of the 335,000 such workplace accidents worldwide. Specifically, cocoa farmers *inter alia* face health risks by using sharp farm tools, working under hot sun, stormy and heavy rainfall, climbing trees to harvest farm produce or cutting mistletoes, carrying heavy loads on their backs or heads over a long and sometimes slippery distance, walking along lonely forests inhabited by dangerous wild animals and being bitten by poisonous snakes or insects. In addition, cocoa farmers could be victims of occupational health hazards by mandatory use of pesticides. Therefore, exposure to pesticides is another form of occupational health risk with hazardous consequences resulting from food and water poisoning, and sometimes death.

The crusade for organic agriculture emphasizes drastic reduction in the use of pesticides as a way of stimulating agricultural production processes that minimize health risks of

farmers and enhance safety of produced farm products. This notion portends a staggering zero tolerance to residuals of pesticides in farm products. It is also a way of ensuring that human health is not adversely affected by food consumed as a result of using pesticides. However, due to persistent problem of pests and diseases, use of pesticides for crop and livestock production remains a globally acceptable practice. It should be emphasized that the use of pesticides by cocoa farmers cannot be compromised because cocoa agriculture exhibits significant vulnerability to pests and diseases through its extreme sensitivity to some farm management practices (such as pruning, weeding and spraying) and changes in some weather parameters. Beginning from the nursery where cocoa seedlings are raised, up to the point of fruiting of young cocoa trees, several pests and diseases are contended with by cocoa farmers (AAR, undated). Also, maturing cocoa pods are susceptible to attacks from various pests and diseases (Schmitz and Shapiro, 2015), among which black pod disease is notable.

Therefore, cocoa agriculture requires significant use of pesticides (Ogunjimi and Farinde, 2012). However, the type and quantity of pesticides that are being used by cocoa farmers are often motivated by several factors. These include frequency and intensity of pest and disease outbreak, difficulties in weed control and perhaps the level of farmers' income. Addressing losses of potential cocoa outputs due to pest infestation and disease outbreak is a major decision for agricultural policy makers in cocoa producing countries. This is very critical because estimates revealed that between 30 to 40 percent of potential cocoa outputs could be lost through pest invasion and outbreak of diseases (International Cocoa Organization, 2015). Pesticides therefore constitute veritable means of reducing the impact of pests and diseases on cocoa production (Moy and Wessel, 2000; Opoku *et al*, 2007; Adjinah and Opoku, 2010).

In Ghana, where cocoa remains one the major foreign exchange earners and a viable source of livelihood for many rural dwellers, compromising fundamental requisites for cocoa productivity is tantamount to undermining the country's major area of comparative advantage. Therefore, Ghanaian government has demonstrated significant supports in enhancing more success stories in the development and productivity of cocoa industry as a way of reducing rural poverty and increasing national incomes. These initiatives *inter alia* include provision of agrochemicals to farmers in order to reduce yield losses through pest invasion and disease outbreaks and promotion of timely cocoa spraying through the mass cocoa spraying programme.

It should however be noted that pesticides usage constitutes significant health risk to cocoa farmers. There are different channels through which cocoa farmers can get contaminated by the pesticides they are using. These include unconscious inhaling, direct contamination of food and water, contacts during spraying and improper disposal of the containers. In Nigeria, Sosan *et al* (2010) found residues of some pesticides that cocoa farmers were using for control of mirid in their blood serum and water for domestic uses in some cocoa growing communities. When the levels of pesticides in the body system exceed certain thresholds, studies have indicated adverse health hazards such prostate cancer (Settimi *et al*, 2003; VanMaele-Fabry and Willems, 2004), neurotoxic (Kamel and Hoppin, 2004), immunotoxic (Galloway and Handy, 2003), endocrine problems (Barlow, 2005), developmental effect (Colborn, 2006) and reproductive defects.

The toxicity property of agrochemicals is what enhances their ability to control crop pests and diseases (Lorenz, 2009). Adherence to safety guideline is meant to reduce contacts with agrochemicals which would lead to reduction in post application health problems. Some instant health challenges associated with contacts with pesticides are eye irritations and infections, skin irritations and infection, headache, nasal discharge and breathing difficulties. Specifically, National Institute for Occupational Safety and Health (2011) submitted that in the United States, agrochemicals' contacts with skins result in several skin disorders which are among the occupational health hazards frequently reported with more than $1 billion estimated cost implications to the United States economy. Lorenz (2009) also noted that inflammation of the skin may result from contacts with agrichemicals, while eye irritations which may result in permanent damages to the retinal cells, coughing and wheezing may be reported by others. The objective of this paper is therefore to determine the effects of pesticide safety guides' compliance on post-application health complaints by cocoa farmers in the Ashanti region of Ghana.

## MATERIALS AND METHODS

### *Study Area*

This study was conducted in the Ashanti region of Ghana. Ghana Statistical Service (2013) noted that with a population of 4.78 million, the region accounted for 19.4% - which is the highest contribution from any region – of Ghana's population in 2010. It was also emphasized that agriculture is the highest economic activity, engaging 30.5% of the labour force, while despite exhibiting some form of tribal diversity, the Akan including Asante accounts for 74.3 of the population. The region comprises of 37 districts, of which Ahafo Ano North which is located in the north western part of Ashanti region was selected for this study due to its high concentration of cocoa farmers. Ahafo Ano North comprises of 593.7 $Km^2$ land area and it is located between latitude 60 47'N and 70 02'N and longitude 20 26'W and 20 04'W. The district had a population of 94,285 in 2010 with 81.2% and 74.0% living in rural areas and engaging in agriculture, respectively (Ghana Statistical Service, 2014).

### *Sampling and Ethical Issues*

The data were collected in June 2015 from farm households that were randomly selected from the district. The selection processes followed stratified random sampling with samples selected in proportion to the estimated number of farmers therein. A list of villages to be selected was randomly generated among which 246 farmers were interviewed. The farmers' leaders and/or chiefs in the villages were the linking persons were intimated on the purpose of the data collection exercises, the confidentiality that is to be attached to their responses and the fact that they are free to withdraw their participation at any time of the interview, if they so think that should be done in their best interest. Many of the farmers were interviewed in their local language (Akan-twi) given that majority were not literate and could not understand English in which the questionnaires were presented.

***Estimated Models***

The binary nature of the dependent variable (reported some health problems after spraying agrochemical or not) compels the use of Probit model. The model uses cumulative probability density function and its is of the form

$$\Pr\left(Y = \frac{1}{X}\right) = \Phi X^k \beta \qquad \ldots\ldots\ldots\ldots 1$$

Pr represents probability and Φ is the cumulative distribution function (CDF) of the standard normal distribution. The parameters of the estimated model are denoted as $\beta$. These are estimated by the maximum likelihood estimation (MLE) approach. This model can be assumed to mimic a latent variable model.

Suppose

$$Y^* = X^k \beta + \varepsilon \qquad \ldots\ldots\ldots\ldots 2$$

$\varepsilon \sim N(0,1)$ and when we assume that the latent variable is positve,

$$Y = \begin{matrix} 1 \text{ if } Y^* > 0 \\ 0 \text{ otherwise} \end{matrix} \qquad \ldots\ldots\ldots\ldots 3$$

In this study, the estimated model is specified as

$$Y_i = \pi + \beta_k \sum_{k=1}^{9} X_k + \varepsilon_i \qquad \ldots\ldots\ldots\ldots 4$$

Where $\pi$ is the constant term and $\varepsilon_i$ is the stochastic error term. The included independent variables were number of protective kits, age of farmers, marital status, farming experience, gender of farmers, attainment of formal education, awareness index, precautionary index and contact index. The variable awareness index was computed using principal component analysis (PCA) from awareness of safety measures to be taken when using insecticides, herbicides, fungicides and fertilizers. Also, precautions index was computed with PCA from answers to the questions of whether farmers do not handle with bare hand, do not keep within the reach of children, do not inhale the chemical, do not pour the left over inside river or stream, have a pit dug within the farm where left over of chemicals are poured, ensure no contact of chemicals with food or drink and ensure it is kept under specified temperature. Finally, contact index was computed from question that probed into whether in the course of spraying or handling agrochemicals, farmers inhale it, taste it, drink it, touch it with bare hand, make it enter their eyes and let it touch their skins. The included variables were subjected to multicollinearity test after subjecting to data to linear probability modelling using Ordinary Least Square (OLS) regression in STATA 12 software. The tolerance levels of the variables were computed and the results showed that multicollinearity was not a problem with the lowest tolerance being 73.38%, while the overall variance inflation factor (VIF) was 1.20.

**RESULTS**

**Demographic characteristics**

Table 1 shows the socio-economic characteristics of heads of the farming households. It reveals that about one out of every four farmers was 60 years or more old, while 51.22% were between 40 and 60 years of age. The average age was 50.5 years with standard deviation of 14.17. Majority of the farmers (76.83%) were married, while 12.20% were widows. Farming was the primary occupation of majority of the households, while primary and secondary educational attainments were achieved by 47.56% and 16.67% respectively. Approximately one out of every three farmers from the sample did not have formal education. Also, one out of every five households comprised of 10 to 14 members, while majority of the households have less than 14 members

**Table 1:**
Socioeconomic Characteristics of Cocoa farmer

| Socioeconomic group | Freq | % | Socioeconomic group | Freq | % |
|---|---|---|---|---|---|
| *Age of household head* | | | *Household size* | | |
| <30 | 11 | 4.47 | <5 | 32 | 13.01 |
| 30<40 | 48 | 19.51 | 5<10 | 131 | 53.25 |
| 40<50 | 71 | 28.86 | 10<15 | 51 | 20.73 |
| 50<60 | 55 | 22.36 | 15<20 | 19 | 7.72 |
| >=60 | 61 | 24.80 | >=20 | 13 | 5.28 |
| *Marital status* | | | *Education* | | |
| Single | 14 | 5.69 | Primary | 117 | 47.56 |
| Married | 189 | 76.83 | Secondary | 41 | 16.67 |
| Divorced | 13 | 5.28 | Tertiary | 3 | 1.22 |
| Widowed | 30 | 12.20 | None | 85 | 34.55 |
| *Primary Occupation* | | | *Gender* | | |
| Farming | 223 | 90.65 | Male | 150 | 60.98 |
| Artisan | 6 | 2.44 | Female | 96 | 39.02 |
| Trading | 8 | 3.25 | | | |
| Others | 9 | 3.66 | | | |

**Table 2:**
Agrochemical usage and awareness of necessary precautions

| | **Insecticide** | | **Herbicide** | | **Fertilizer** | | **Fungicide** | |
|---|---|---|---|---|---|---|---|---|
| Type of agrochemical | Freq | % | Freq | % | Freq | % | Freq | % |
| Liquid | 229 | 93.09 | 129 | 52.44 | 114 | 46.34 | 138 | 56.10 |
| Solid | 12 | 4.88 | 12 | 4.88 | 86 | 34.96 | 30 | 12.20 |
| Trend in Usage | | | | | | | | |
| Increasing | 148 | 60.16 | 69 | 28.05 | 118 | 47.97 | 69 | 28.05 |
| Decreasing | 28 | 11.38 | 35 | 14.23 | 21 | 8.54 | 34 | 13.82 |
| The Same | 37 | 15.04 | 35 | 14.23 | 39 | 15.85 | 36 | 14.63 |
| Precautions Awareness/ Compliance | | | | | | | | |
| Awareness of safety guides | 217 | 88.21 | 152 | 61.79 | 182 | 73.98 | 160 | 65.04 |
| Manufacturers instruction followed | 183 | 74.39 | 127 | 51.63 | 125 | 50.81 | 127 | 51.63 |

**Table 3:**
Precautions taken by cocoa farmers and ownership of safety kits

| **Groups** | **Freq** | **%** |
|---|---|---|
| Safety precaution | | |
| Do not handle with bare hand | 182 | 73.98 |
| Keep away from children | 204 | 82.93 |
| Do no inhale | 207 | 84.15 |
| Do not pour inside river | 200 | 81.3 |
| Dig pits where leftover should be poured | 174 | 70.73 |
| No contacts with food | 202 | 82.11 |
| Keep in cool environment | 194 | 78.86 |
| Safety kits | | |
| Hand gloves | 83 | 33.74 |
| Safety boot | 126 | 51.22 |
| Water resistant over all | 79 | 32.11 |
| Goggle | 70 | 28.46 |
| Ventilation mask | 82 | 33.33 |

**Type of agrochemicals used and safety compliance**

Table 2 shows the types of agrochemicals being used by the farmers in the study area. It reveals that majority of the farmers (93.09%) were using liquid insecticides. This can be compared to 56.10% that used liquid fungicides and 52.44% that used herbicides. The farmers were asked to indicate the trend of agrochemical usage. The results show that 60.16% indicated increase in the usage of insecticides when compared to three years ago, while 15.04% noted that there was no change. Similarly, 28.05% of the farmers indicated increasing trends in the use of herbicides and fungicide as against 47.97% for fertilizers. Decreasing trends in the use of agrochemicals were reported by 14.23% of the farmers for herbicides, 13.82% for fungicides and 11.38% for insecticides. Awareness of safety guides was reported by 88.21% of the farmers for insecticides, 73.98% for fertilizers and 65.04% for fungicides. However, the results indicated that lesser number of the farmers that were aware of safety guides actually followed manufacturers' instructions. Specifically, 74.39% of the farmers followed manufacturers' instructions in respect of usage of insecticides, as against 51.63% for herbicides and fungicides.

Table 3 presents the results on the types of precautions that farmers were complying with and ownership of safety kits. The results show impressive compliance necessary precautions with 84.15% of the farmers avoiding inhaling agrochemicals, 82.93%, keeping them away from children and 81.3% not pouring inside rivers or streams. Also, 82.11% would ensure no contact is made between agrochemicals and food, while 73.98 were not holding them with bare hands. The results in table 3 further show that ownership of agrochemical safety kits was very low among the farmers. It reveals that safety boots were owned by 51.22% of the farmers as against 33.74% and 32.11% that owned hand gloves and water resistant overall, respectively. However, goggles for eye protection were owned by 28.46% of the farmers, compared to 33.33% for ventilation mask.

**Reported Health Hazards in Agrochemical Usage and their Correlates**

Table 4 shows the reported health problems that were suffered by farmers after handling agrochemicals. It reveals that skin irritation was suffered by 37.80 percent of the farmers, while 33.33% and 32.93% respectively suffered eye irritations and headache. Only 20.33% and 16.67% reported nasal discharge and coughing, respectively. Table 5 shows the results of Probit regression for predicting probabilities of suffering some health problems after having contacts with agrochemicals. The results reveal that all the models produced good fits for the data with Likelihood Ratio Chi Square statistics being statistically significant ($p<0.01$). This implies that the parameters estimated in each of the models are not jointly equal to zero.

The models estimated for eye irritation shows three of the parameters being statistically significant ($p<0.05$). The results show that being married significantly reduced probability of suffering eye irritations after handling agrochemicals. In addition, as farmers' precautionary index in the use of agrochemicals increased, probability of reporting eye infection after using agrochemical significantly increased.

**Table 4:**
Reported health problems suffered after handling agrochemicals

| | Mean | Std. | [95% | Conf. |
|---|---|---|---|---|
| Eye irritation | 0.3333 | 0.0301 | 0.2740 | 0.3927 |
| Skin irritation | 0.3780 | 0.0310 | 0.3170 | 0.4391 |
| Nasal | 0.2033 | 0.0257 | 0.1526 | 0.2539 |
| headache | 0.3293 | 0.0300 | 0.2701 | 0.3884 |
| coughing | 0.1667 | 0.0238 | 0.1198 | 0.2136 |

Similar result was found for contact index variable which significantly increased probability of reporting eye infection.
In the model for skin irritation, age, precautionary index, contact index and number of safety kits show statistical significance ($p<0.05$). The results imply that probability of reporting skin infection after handling agrochemicals significantly reduced as the age of farmers increased. The results further reveal that precautionary index increased the probability of reporting skin irritations after handling agrochemicals. However, as expected, contact index increased the probability of reporting skin irritation, while the number of safety kits in use reduced it.
Nasal discharge model has the parameters of farmers' age and contact index being statistically significant.($p<0.05$). The results imply that as farmers' age increased, probability of reporting nasal discharge significantly increased. Also, as contact index increased, probability of reporting nasal discharges increased significantly. In the model estimated for reported headache, parameters of farming experience, precautionary index and contact index showed statistical significance ($p<0.05$). The results imply that as farmers' experience increased, probability of experiencing headache after using agrochemicals reduced. However, as precautionary and contact indices increased, the probability of reporting headache increased. In the model estimated for coughing, the parameters of age and contact index showed statistical significance. As age of farmers increased, probability of coughing after using agrochemicals reduced significantly. Also, as the contact index increased, probability of reporting coughing after using agrochemicals increased.

## DISCUSSIONS

The results show that majority of the household heads were ageing as a result of inability to induce many youth into coca production. With less than 5% being less than 30 years and 24.80% being 60 years and above, the prospect of building successful transition in cocoa agriculture in Ghana is very daisy. Ageing of cocoa farmers is a major issue of concern in Ghana and West Africa at large (Roundtable for a Sustainable Cocoa Economy, undated). If educated youths are willing to be involved in cocoa farming, resource productivity can be enhanced through more effective utilization of farm inputs such as agrochemicals and expected minimization of occupational hazards as a result of non-compliance with prescribed safety guides.

The marital status of cocoa farmers is a reflection of labour intensiveness of cocoa agriculture. In many instances, cocoa farmers depend on family labour for farm clearing, chemical spraying, harvesting and transportation of the beans to the village. This is often reflected in high fertility among farmers which is confirmed with 13.10% having less than five household members while one out of every sampled household had at least ten members. Large family size often results in poverty, especially as the farm ages and productivity declines. This would make procurement of necessary safety guides for agrochemical usage very difficult even though government's programmes on agrochemical distribution is on-still going

**Table 5:**
Probit Regression Results of Factors Influencing Health Complaints Associated with Contacts With Agrochemicals

| | Eye Irritation | | Skin Irritation | | Nasal Discharge | | Headache | | Coughing | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Coef. | Z stat | Coef. | Z stat | Coef. | Z stat | Coef. | Z stat | Coef. | Z stat | Tolerance |
| Age | -0.0021 | -0.30 | -0.0158** | -2.18 | -0.0164** | -2.23 | 0.0024 | 0.35 | -0.0202** | -2.46 | 0.8061 |
| Married | -0.5204** | -2.27 | -0.3569 | -1.52 | -0.2739 | -1.13 | -0.0540 | -0.24 | -0.2668 | -1.03 | 0.8142 |
| Gender | 0.0043 | 0.02 | 0.1927 | 0.92 | 0.2390 | 1.12 | 0.0626 | 0.31 | -0.0391 | -0.17 | 0.8452 |
| Educated | 0.1534 | 0.73 | 0.0473 | 0.22 | -0.1762 | -0.82 | 0.0401 | 0.19 | -0.1439 | -0.61 | 0.8594 |
| Farming Experience | -0.2068 | -0.57 | 0.6074 | 1.53 | 0.3560 | 0.94 | -0.7373** | -2.14 | 0.1139 | 0.31 | 0.9411 |
| Awareness index | -0.0360 | -0.63 | 0.0548 | 0.92 | 0.0213 | 0.35 | 0.0349 | 0.61 | 0.0756 | 1.13 | 0.7798 |
| Precautionary Index | 0.2007*** | 3.68 | 0.2701*** | 4.34 | 0.0947 | 1.94 | 0.0932** | 2.13 | 0.0920 | 1.66 | 0.9325 |
| Contact Index | 0.1820*** | 5.98 | 0.1963*** | 5.50 | 0.0750*** | 2.62 | 0.1576*** | 5.19 | 0.1015*** | 3.40 | 0.8429 |
| No. of safety kits | -0.0618 | -1.19 | -0.1018** | -1.96 | -0.0119 | -0.23 | -0.0241 | -0.47 | -0.0818 | -1.39 | 0.7338 |
| Constant | 0.1553 | 0.27 | 0.1330 | 0.22 | -0.1929 | -0.33 | 0.0936 | 0.17 | 0.2863 | 0.45 | |
| No of observations | 246 | | 246 | | 246 | | 246 | | 246 | | |
| LR Chi Square | 68.42*** | | 82.95*** | | 18.89** | | 53.12*** | | 31.48*** | | |
| Pseudo Rsquare | 0.2185 | | 0.2543 | | 0.0761 | | 0.1704 | | 0.142 | | |
| Log likelihood | -122.37 | | -121.64 | | -114.75 | | -129.31 | | -95.1 | | |
| VIF | | | | | | | | | | | 1.20 |

Cocoa agriculture is confronted with pest and disease management issues which often raise some health concerns for ultimate consumers of cocoa beans due to inability of farmers to avoid the use of agrochemicals (Moy and Wessel, 2000; Opoku et al., 2007; Adjinah and Opoku, 2010). In this study, all the farmers were using agrochemicals either for the control of pests, diseases, weeds or enhancement of soil fertility levels. In line with the submission of Afrane and Ntiamoah (2011), the trends of agrochemical usage are rising for majority of the farmers. More precisely, several issues are at the heart of agrochemical usage on cocoa farms. Notable among these are changes in some environmental parameters which facilitate infestation of some pests and diseases, difficulties in weed and pest control and some resistances to insecticides by some pests. Associated environmental and health risks of farmers rising trends in the use of agrochemical can be properly gauged from the fact that government is engaged in mass cocoa spraying in Ghana.

Majority of the farmers indicated that they were aware of agrochemical safety guides. However, probably due to low educational attainments, some farmers were not complying with manufacturers' instructions as indicated on agrochemical products. The farmers' ownership of safety kit was however very poor. Specifically, beside boots, other kits to protect inhaling and body contacts with agrochemicals were possessed by less than half of the farmers. This emphasizes the fact that knowledge acquired by the farmers on safety in the use of agrochemicals was not properly translated into actions. The results are in line with the findings of Joseph (2012) that cocoa farmers in the district did not concur with some agrochemical safety guides that they were already taught. Therefore, usage of safety kits was considered irrelevant and in doing so some farmers are suffering several health hazards.

The mostly reported health hazards that farmers suffered after handling agrochemicals were skin irritations (Bateman, 2010), eye irritations and headache each of which was reported by at least one out of every three farmers. Others were coughing and nasal discharges. Reactions of individuals to agrochemical contacts vary, depending on some genetical composition. However, impact of agrochemicals when in contact with the body also depends on the concentration. Specifically, This Similar finding had been reported by Joseph (2012) that the farmers were spraying their crops against capsid and in doing so they were not wearing any protective kits. Designated spraying gangs by government are always equipped with those standard safety measures. The major challenge is that with government planning to discontinue free cocoa spraying, the worse may not have been witnessed in terms of health hazards to be suffered by cocoa farmers in Ghana from the use of agrochemicals.

The results of econometric analyses further indicated that contacts with agrochemicals variable was statistically significant for all the health problems that were analyzed. Contacts with eyes are possible if the farmer is not wearing eye goggles during spraying. This may be stimulated by some sudden changes in the wind direction or accidental splashes as the sprays hit leaves or trucks of cocoa trees. However, the parameter of precautionary index was with positive sign, which may depict that farmers that were liable of suffering some health hazards from agrochemicals were the ones taking precautions.

In addition to contact and precautionary indices, skin irritation, coughing and nasal discharge models have age of farmers being statistically significant while in skin irritation model, the number of safety kit possessed by farmers was statistically significant with negative sign. These results point at the fact that aged farmers may have possessed sufficient experience to know how to spray with less body contacts. It may also indicate development of resistance and susceptibility by aged farmers due to many years of exposure. It had been noted that younger people are vulnerable to many health hazards that are associated with use of agrochemicals (Mott *et al*, 1997). In addition, the number of safety kits that farmers wear reduced probability of experience skin irritations after using agrochemical. This is expected because when properly used, safety kits are meant to reduce skin contacts with agrochemicals and the associated health problems

Although agrochemicals are meant to attack pests, diseases and weeds that compete with proper growth and development of crops, their usage, when not regulated could constitute health hazards to farmers. In Ghana, the impact of agrochemicals on cocoa farmers is expected to be minimized because of government interventions in assisting farmers to spray their cocoa pods freely at some certain periods of the year. In some instances, however, farmers have got to supplement government spraying with some personal interventions in order to control weeds, enhance soil fertility and reduce the impacts of some other diseases on cocoa production. The results of data analysis point at high awareness of the precautions to be taken although manufacturers' instructions were not followed by some. Ownership of safety kits was very low and farmers complained of some health problems including eye irritations, skin irritations, coughing, nasal discharges and headache. The findings from this study emphasizes the need for interventions in supplying farmers with safety kits, even if they would have to pay back at certain point in the year. If government could provide them with agrochemicals, such gestures may be extended to interventions to ensure that the chemicals given to cocoa farmers are not death traps for them. Similarly, cocoa farmers should be properly educated on the reasons why they should acquire and wear safety kits when applying agrochemicals. Such training should target younger farmer who were found to be much more susceptible to suffering some health hazards in this study.

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