

**FARMERS' KNOWLEDGE LEVEL OF PRECAUTIONARY MEASURES
AND ASSOCIATED HEALTH PROBLEMS IN THE USE OF
AGRO-CHEMICALS ON COCOA PRODUCTION IN OSUN AND
EDO STATES, NIGERIA.**

S.I. OGUNJIMI¹ & A.J. FARINDE²

¹Corresponding Author: Department of Agricultural Extension and Rural Development, Landmark University, Pmb 1001, Omu-Aran, Kwara State, Nigeria

²Department of Agricultural Extension and Rural Development, Obafemi Awolowo University, Ile-Ife, Nigeria.

ABSTRACT

Comparative analysis of the precautionary measures and operational habits with the associated health problems among 240 farmers in cacao growing communities of Osun and Edo States, Nigeria was carried out. Descriptive and inferential statistics were used to analyze the data. The results showed high risk exposure of cocoa farmers to toxicity and hazards of agrochemicals used on their cocoa farms. The mean knowledge score of precautionary measures in both states was low. More than 50% of the cocoa farmers in the two states were in the habits of eating, drinking and smoking during spraying. About 65% of cocoa farmers in Osun had no extension contact and training on safe handling of chemicals compared to 97.0% of the farmers in Edo state. Majority (60%) of the farmers in the two states claimed that they have health problems with the following symptoms: body itching, cough and difficulty in breathing, which often occurred during and after chemicals usage. It is concluded that cocoa farmers in Osun and Edo States in Nigeria were vulnerable to health hazards associated with the use of chemicals due inadequate knowledge of the precautionary measures and exhibition of culpable operational habits that can be controlled through effective extension education programme.

KEYWORDS: Comparative analysis, operational habits, health problems, Agro-chemicals, cocoa farmers, chemical application and precautionary measures.

INTRODUCTION

Cocoa tree (*Theobroma Cacao*) belong to the Genus *theobroma* and family *sterculeacea*. It is the first major economic tree crop in Southwestern Nigeria since 1957. However, Farinde and Ogunjimi (2006) asserted that the major setback to increased cocoa production since about 35 years ago has been the incidence of diseases and pests, apart from rural-urban migration of able bodied people, neglect of agriculture and natural hazard such as fire outbreak on cocoa plantations. This position confirmed the documentation of Adegbola (1979) that annual losses of the world production due to diseases and pest (especially black and brown pod diseases) were 10 percent and as high as 90 percent in Cameroon and Nigeria. Other diseases of cocoa include cocoa swollen shoot virus (CSSV), cocoa mottle leaf virus and

cocoa yellow mosaic virus. The diseases are caused by insect pests (causative agents) such as Thrips: *Selenothrips rubrocinctus* Sel; Mealybug: *Plannoecoccus citri* Risso; Psyllid: *Messohomotaina tessnii* Aulm; Black Cocoa Mirids: *Distantiella theobroma* Dist; and Brown Cocoa Mirids: *Sahlbergella singularis* Haglund.

The incidence of these diseases and pests and its devastating effects on cocoa farms and farmers' income led to the long history of pesticide usage on their cocoa farms in Nigeria. Some of the insecticides that have been used annually since 1957 in different volumes and at various times till present are: lindane (γ -BHC), endosulfan or thiodan (6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide), diazinon (0,0-diethyl-0-[6-methyl-2-(1-methylethyl)-4-pyrimidinyl]phosphorothioate), propoxur (2-isopropoxyphenyl-N-methyl-carbamate) and dioxacarb {2-(1,3-dioxolan-2-yl)-phenylmethyl-carbamate} (Sosan, Akingbohunge, Ojo, Durosinmi, 2008). All these chemicals play prominent roles in effective control of cocoa diseases and pests, however, they have been found to constitute health hazards to human being, toxic waste to non-target organisms and pollution to the environment due to their active ingredients and inert material. Several studies have documented the adverse health hazards of the pesticides' usage as a series of chronic end-points including prostate cancer (Settimi, Masina, and Axelson., 2003; VanMaele-fabry and Willems 2004); neurotoxic (Kamel and Hoppin, 2004); immunotoxic (Galloway and Handy, 2003); endocrine (Barlow, 2005); developmental effect (Colborn, 2006) and reproductive defect (Yucra et al., 2006). Regoeng (2001) however, described "exposure to pesticides and other agro-chemicals as one of the major occupation injuries in the agricultural sector. This explains why manufacturers of chemicals and Idowu (1996) recommended some precautionary measures when applying agro chemical like putting on protective clothing: boots and rubbers gloves, wearing of apron, not eating, smoking and drinking when using chemicals and covering food and water to avoid contamination. It has been observed and established that farmers in many part of Nigerian did not pay attention to the safety measures in the use of chemicals (Farinde and Ogunjimi, 2007; Alimi, 2004; Alimi and Ayanwale, 2004; Alimi, 1999). Sosan et al. (2010) have confirmed that cocoa farmers in the Southwestern Nigeria are occupationally exposed to the toxic nature of insecticide application for mirid control in their cacao plantations having found insecticide residues (diazinon, lindane, propoxur and endosulfan) in the blood serum and domestic water source of cacao farmers in their respective communities. What then is the Knowledge level of the protective measures against chemical injuries taught to the farmers and what are operational habits with the associated health problems of cacao farmers in Osun and Edo States. Therefore, in this study, we report the comparative analysis of the socio-economic characteristics of cacao farmers, types of chemical used, farmer's knowledge of precautionary measures, operational habits exhibited during agro-chemical usage and occurrence of health related problems among cocoa farmers in Osun and Edo States.

Based on the above stated objectives, the following hypotheses were formulated and tested at $P \leq 0.05$.

- i. There is no significant relationship between farmer's knowledge of precautionary measures and operational habits in the use of chemicals.

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- ii. There is no significant relationship between the health related problems of cocoa farmers and knowledge of precautionary measures .
- iii. There is no significant difference in the types of chemicals used, knowledge of precautionary measures; operational habits; health hazards and demographic socio-economic characteristics among cocoa farmers in Osun and Edo States.

MATERIALS AND METHODS

The study area

The study was purposively conducted in Osun and Edo states. Osun State is made up of thirty Local Government Areas (LGAs). It is situated in the south western part of Nigeria. It lies between longitude $21^{\circ} 65''$ and $6^{\circ} 75''$ East of Greenwich meridian and Latitudes $6^{\circ} 59''$ and 9° North. It is bounded in the East and West respectively by Ondo and Oyo State. While Kwara and Ogun States are its boundaries in the North and South respectively. Whereas, Edo State composed of eighteen LGAs. It is located between 6° and 8° North of the equator and bounded by longitude $6^{\circ} 8''$ and $6^{\circ} 58''$. It is bounded in the west by Ondo State, in the North by Kogi State and in the South and East by Delta State respectively. Osun State has landed area of 925,100 hectares or 9,251 square kilometers with population of 3,423,535, while Edo State has landed area of 1,780,200 hectares or 17,802 square kilometers with population of 3,218,332 (Federal Office of Statistics, 1998; NPC, 2006). The predominant population of Osun State is Yoruba but Edo State is made of different ethnic groups such as Ishan, Edo and Yoruba. Osun vegetation comprises of Rainforest zone, derived Savannah and Savannah while Edo State vegetation is mainly Rainforest. Two LGAs each per State were selected been major cocoa producing area in each State. Ife East and Ife South LGAs were selected in Osun, while Ovia North East and Ovia South West LGAs were selected in Edo state. Six villages were randomly selected from each of these LGAs. Twenty cocoa farmers were selected from the checklist of cocoa farmers under the extension coverage in each selected villages using simple random sampling technique. A total of two hundred and forty cocoa farmers in the two states were interviewed using structured, pretested and validated interview schedule. Data were elicited on the types of chemicals, knowledge of precautionary measures, operational habits, health related problems and socio-economic characteristics. The interviewed was conducted between May and September 2010. The variables investigated were operationalised using number or integer of units of the variable such as operational habit, knowledge of precautionary measures etc. (Farinde and Ogunjinmi 2006). Descriptive and inferential statistics were used to analyse the data.

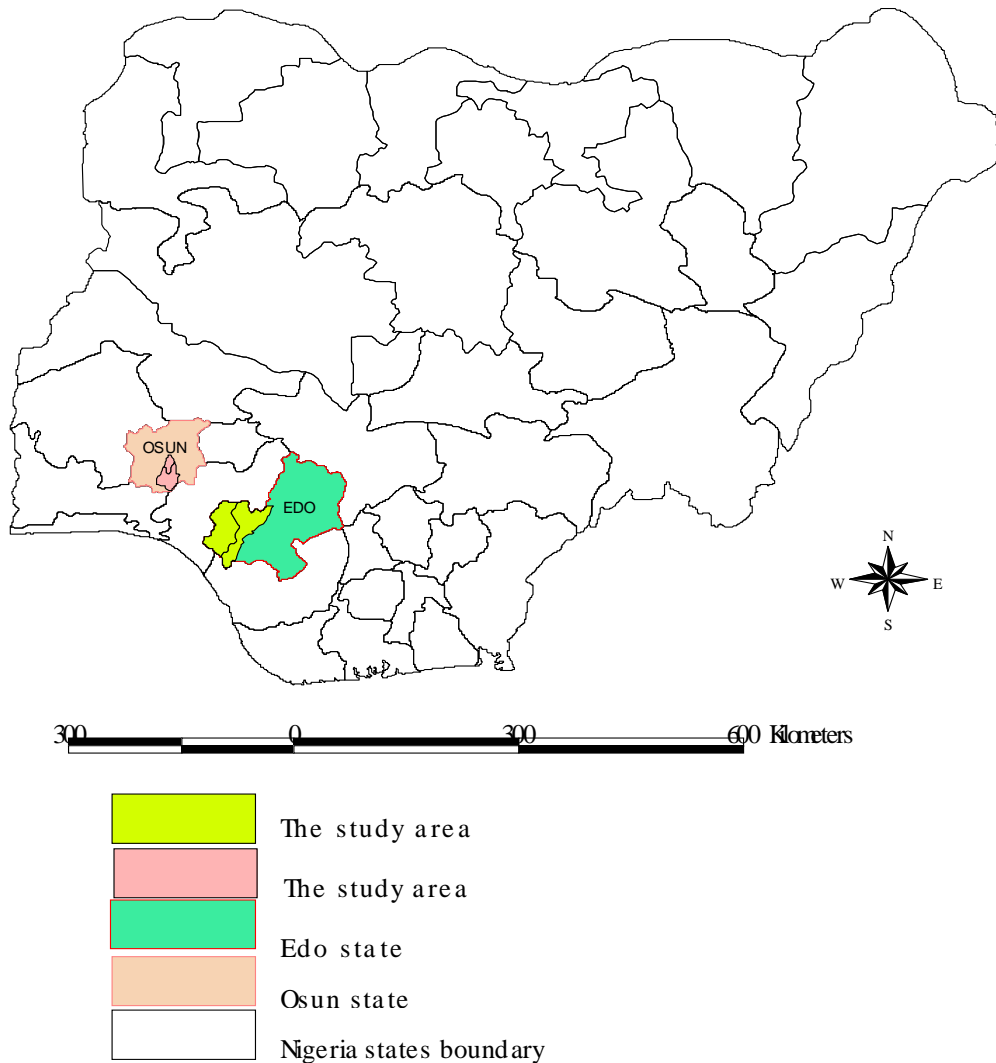


Fig 1: The map of Nigeria showing Osun and Edo States study areas

RESULTS AND DISCUSSION

Type of agro-chemicals used by cocoa farmers

Data in Table 1 show that majority of cocoa farmers in Osun State (98%) used copper sulphate, 95% used benzene hexachloride (gammalin 20), 73.3% used diazinon (basudin), 55% used cuprous oxide (perenox) and 46.7% used lindane (kokotine). In Edo state, majority of cocoa farmers used recommended chemical like copper sulphate (87.5%) gammalin 20 (86.7%); basudin 600EC (76.7%) and ridomil (61.2%).

Moreover majority of the respondents in Osun and Edo States indicated that chemicals like perenox, copper sulphate and ridomil are not hazardous in nature. While chemicals like gammalin 20 and

basudin were claimed to be moderately hazardous in Edo State. Only gammalin 20 was claimed to be moderately hazardous in Osun while Basudin 60 EC was highly hazardous. The findings are contrary to the WHO (1992) classification of chemicals based on level of toxicity, which stipulates that chemicals like Aldrin (Aldrex 40) and diazinon (basudin 600EC) were classified as highly hazardous while chemicals like benzene hexachloride (gammalin 20), Kokotone, Bordeaux mixtures (copper sulphate) cuprous oxide (perenox) and cerbendazin (ridomil) are moderately hazardous. The implication of the above findings was that the majority of cocoa farmers in the two states were using hazardous chemicals, with little or no attention to the safety measures, which may have adverse effect on their health. These findings agreed with Sosan and Akingbohunge (2009), Alimi (1999) and Fajewonyomi (1995) that cocoa farmers used agro-chemicals, which are toxic in nature but with little attention to the precautionary measures.

FARMERS PERCEPTION OF PRECAUTIONARY MEASURES AND OPERATIONAL HABITS

Data in Table 2 show perception of precautionary measures and operational habits among cocoa farmers in Osun and Edo States. The mean perception scores were ranked in descending order of hazard/injury to farmers' health. In Osun State, the operational habit of eating during the spraying of chemical was ranked first as being injurious to health (mean = 2.81), followed by washing and cleaning of spraying equipments after use (mean = 2.77) perceived as necessary and good. Other includes drinking during spraying as injurious to health (mean = 2.70) and spraying should not be directed towards direction of air (mean = 2.65) to prevent chemical contact with body. They were similarly followed by wearing protective clothing during spraying of chemicals to prevent body exposure to chemical (mean = 2.38), not taking produce from the farm within 24 hours after spraying of chemicals to prevent eating contaminated food (mean 2.37); washing of contaminated clothes immediately after spraying is necessary (mean =2.29), burying or burning of empty chemical containers after use (mean = 2.08) and burying of any food contaminated during spraying of chemical (mean = 1.58) respectively to avoid taken poison.

In Edo state, eating during spraying of chemicals is injurious to health (mean = 2.55) was similarly ranked first but, drinking during spraying of chemicals is injurious to health (mean = 2.54) came next. This was followed by smoking during spraying of chemical as injurious to health (mean = 2.47), washing and cleaning of spraying equipments is necessary after spraying, (mean = 2.31), bath immediately after spraying chemical is necessary (mean = 2.19). Wearing of protective clothing during spraying to prevent body exposure to chemicals (mean = 2.06) was perceived good and necessary, and spraying should not be directed towards the direction of air (mean = 1.87), not good to enter the farm within 24 hours after spraying of chemical to prevent eating contaminated food (mean = 1.66), burying or burning of empty containers after spraying is necessary (mean = 1.65) and burying of food contaminated during spraying of chemicals (mean = 1.63) respectively.

In general, the results show that cocoa farmers in Osun state had a better perception of all except one of the various precautionary measures whose means was less than 2.0 to be observed in order to avoid pesticide contamination and exposure hazards. Hence the mean perception scores ranged from 2.08-2.81. Whereas perception in Edo state was low, hence means range from 1.63 to 2.55 for all the precautionary measures. With five of the precautionary measures having mean scores less than 2.00 in Edo state compared to only one in Osun State.

OPERATIONAL HABITS

Data in Table 3 reveal usual habits of the cocoa farmers on display when applying agro-chemicals on their farms. In Osun State majority of the respondents (84.2%) indicated not wearing protective clothing's like glove, glasses and boots. Similarly 81.3% indicated not wearing protective clothing. This report was in line with Alimi (1999) that smaller percentage of farmers actually wears protective apparel when using chemicals. Majority of cocoa farmers in Osun (61.7%) and Edo (68.3%) states were in habit of eating during spraying of chemicals, and 75.0% and 75.8% of cocoa farmers in Osun and Edo States respectively, were drinking during application of chemicals. Similarly 51.7% and 59.7 were smoking during spraying of chemical in Osun and Edo States respectively. This is inline with Sosan and Akingbongbe (2009) that majority of cocoa farmers in southwestern were in habit of drinking and eating during the spaying of agro-chemical which usually exposed them to health related problems

Furthermore majority of the respondents in Osun State (59.2%) and 60.0% in Edo state claimed taking their bath immediately after spraying of chemical. In Osun (88.3%) and Edo (79.2%) states claimed not washing their contaminated clothes after spraying of chemicals. The findings indicated that majority of cocoa farmers in both states do not wash their contaminated clothes immediately after spraying. This may constitute health problems to them because of the fact that contaminated apparels are in direct contact with body hence can cause body irritation.

On storage of chemical and disposal of empty containers, the results reveals that farmers in Osun State (54.0%) stored their chemicals in living room and together with food stuff, where as cocoa farmers in Edo state (68.3%) stored their chemicals in the living room and together with food items. Moreover 60.8% cocoa farmers in Osun state washed and re used empty containers; while 71.7% of cocoa farmers in Edo state washed and re-used empty containers. This report was in line with Alimi (1999) that 92% stored pesticides inside their house even in the bedroom in Katsina state. This practice exposes farmers to food poisoning, which may have effect on their health. Majority of farmers in Osun State (56.7% and 65.8%) were involved in other habits such as mixing of chemicals with their bare hand and removal of blockage with mouth respectively where as 60.8% and 62.8% does so in Edo state.

Health related problems to the use of Agro-chemicals

Data in table 4 show that majority of the cocoa farmers in Osun State (64.2%) and 50.0% of cocoa farmers in Edo State were aware that chemicals are dangerous to health. In view of this, farmers were expected to be careful on how to handle agro-chemicals but in reality it was not so. In Osun State

(40.0%) and Edo State (54.2%) of cocoa farmers indicated that they have experienced one health problem or the other.

Those that claimed health related problem when using chemicals in Osun State mentioned problems like tearing and redness of eye (52.5%), cough (39.2%), difficulty in breathing (23.3%), excessive sweating (22.5%), headache (20%) and yellowing of skin (5.8%). The Edo State health related problem mentioned include tearing and redness of eye (66.7%), body itching (59.2%), lack of muscle coordination (59.2%), yellowing of skin (39.2%), cough (29.2%) and difficult, in breathing (26.7). The findings indicated that cocoa farmers in Osun and Edo states suffered almost all and the same type of health problems except yellowing of skin, which was more common in Edo states (39.2%) than in Osun states (5.8%). This might be due to exposure of the body and high rate of using hand to mix chemicals in Edo state. It could also be deduced from these findings that 59.6% of the farmers have one ailment/illness or the other, which might be as a result of improper use of chemicals. The result was in line with Sosan and Akingbohunbe (2009), Sosan, Akingbohunbe and Durosinmi (2010) and Regoeng (2001) claimed that major disease occurring in agricultural works are infectious disorders, such as respiratory infections, dermatosis, allergies, cancer, illness arising from repetitive work.

SOCIO-ECONOMICS CHARACTERISTICS

Data in Table 5 show that (54.2%) of the respondents in Osun State were between the ages of 41 and 60 years. Similarly in Edo state, (52.5%) were between 41 and 60 years. The implication of these findings was that cocoa farmers in the two states were fairly old people, which must be replaced with young and able-bodied people who can withstand the back-bending and standing nature of cocoa farm operation like spraying of chemicals. Majority of the farmers in Osun (97.5) and Edo State (96.7%) were males. The findings were expected because of the involvement of women in other activities like planting of arable crops, processing and trading. It may also be attributed to the tenure system where female right to land ownership is limited. In Osun State, (43.0%) had no formal education while in Edo State (53.3%) had no formal education. Moreover, majority of cocoa farmers in Osun (55.8%) and Edo (63.3%) States indicated that they could not read the instruction on the chemical label. The low level of education may have adverse effect on farmer's operational habits and health hazards in relation to chemical usage especially in Edo State.

Majority of the cocoa farmers in Osun State (93.4%) cultivated land between 1 and 10-hectares. Similarly in Edo state, majority (80.0%) had between 1 and 10 hectares. This implies that cocoa farmers in Osun and Edo States were smallholder farmers. The implication drawn was based on the criteria set by Olayide and Ogunfeditimi (1980) that all farmers who operate on land less than 10 hectares are small-scale farmers. Most of the cocoa farmers in Osun State (65.8%) and (67.5%) in Edo State, employed between 1 and 4 family labour. In addition, majority of the farmers in Osun State (55.0%) and Edo State (56.6%) employed between 1 and 4 hired labour. Most of the labourers would have been exposed to

chemical poison substance and other activities that brought them in contact with pesticide. The cumulative effect of this exposure might result in health problems. These findings also corroborated previous findings by National research council of Nigeria (1993), where it drawn conclusion that early in life exposure to pesticide led to greater risk of cancer, neurodevelopment; impairment and immunedysfunctions.

Data in Table 5 also show that 56.7% of the respondents in Osun State realized between ₦1,000 and ₦50,000 on their farms annually while 31.7% have income between ₦51,000 and ₦100,000. Whereas in Edo State majority of cocoa farmers 55.0% had income between ₦51, 000 and ₦100,000. The findings reveal that cocoa farmers have more income which might be due to increase in price of cocoa in international market especially in Edo State with average income of ₦85, 833. It would be expected that farmers with high income should be able to afford necessary protective materials needed when using chemicals. However, from observations it was contrary. Farmers used the money realized on social prestige. Detailed analysis showed that majority of cocoa farmers in Osun State (50.5%) got information about pests and disease problems, chemical usage and precautionary measures to follow when using chemicals from other farmers. Others include extension agents (34%), sales agents (25.0%) and cocoa merchants (18.3%). In Edo State, 75.5% cocoa farmers got their information from other farmers. Other sources include cocoa merchants (28.0%), sales agents (24.0%) and extension agents (3.3%).

The analysis reveals that other farmers were major source of information. Other sources such as cocoa merchants and chemical sales agents would have been much more concerned with making money from their sales rather than training of farmers on proper handling of chemicals. Findings on extension agents' contact with cocoa farmers show that in Osun State, (65%) had no contact with extension agents to discuss chemicals usage and precautionary measures to follow when using chemicals. In Edo State (96.6%) of the cocoa farmers had no extension contact. From the findings it can be deduced that there was relatively low extension contact in the two states but there were high level of extensions contact among cocoa farmers in Osun State than Edo State. The implication of this finding is that farmers in Edo State were not exposed to knowledge of precautionary measures through extension personnel because majority of them 97.0% had no contact with extension agents. This was supported by Williams *et al* (1984) that in Nigeria there are many farmers that are not reached by extension agents and are therefore not exposed to new technology in agriculture.

TESTING OF HYPOTHESIS

Data in Table 6 show the correlation coefficient, which establish that at $P < 0.05$ level of significant, there exist a positive and significant relationship between farmers knowledge of precautionary measures ($r = 0.604$) and operational habits. This implies that farmers who are

knowledgeable about precautionary measures to follow when using chemical were exhibiting good/positive operational habits when using chemicals. Alimi (1999) obtained similar result that awareness of precautionary have relationship with practice.

Furthermore the result shows positive and significant relationship between level of education ($r=0.398$), extension contact ($r=0.298$), sources of information ($r= 0.218$) and operational habits. The health related problems ($r=0.120$) have positive but non-significant relationship with knowledge of precautionary measures. This indicated that the health related problems had by farmers during chemical application had no relationship with knowledge of precautionary measures. This was in line with Regoeng (2001) reports that there are limited reliable data on the extent of pesticide related illness both in industrialized and developing countries due to difficulties in the accurate reports of cases.

The results of hypothesis testing using ANOVA revealed that there was significant difference between knowledge of precautionary measures to be followed when using chemicals among cocoa farmers in Osun and Edo States ($F=9.04$). Furthermore there were significant differences between some socioeconomic characteristics such as farm size ($F=8.36$), labour size ($F=79.44$) annual income ($F=10.40$), and extension contact ($F=37.2$) of cocoa farmers in Osun and Edo States. Whereas there were no significant differences between the types of chemicals used ($F=5.76$). Operational habits ($F=2.00$) and health hazards ($F=5.24$) among cocoa farmers in Osun and Edo States. Moreover, there were no significant differences between some socio-economic characteristics such as age ($F=0.07$), level of education ($F=2.87$), and sources of information ($F=1.70$) among cocoa farmers in Osun and Edo States.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Evidence from the study has shown that cocoa farmers in Osun and Edo States were exposed to the same types of recommended chemicals like copper sulphate; gammalin 20, basudin, kokotine and aldrex 40. But the use of perenox was higher in Osun State while ridomil was more used in Edo State. Cocoa farmers in Osun State are more knowledgeable about precautionary measures to be taken in order to avoid chemical contamination and exposure hazards than Edo State cocoa farmers. Despite the fact that cocoa farmers in Osun State are more knowledgeable about precautionary measures to be taken than Edo State cocoa farmers, most of the farmers in the two states were involved in negative habit which often resulted in farmers been exposed to chemical harmful effects. Majority in the two states were in the habits of eating; drinking; smoking and spraying towards the direction of air. The farmers' health related problems includes redness and tearing of eye, body itching, cough, body pains and headache. The major sources of information on precautionary measures in the two states were other farmers. The effects of extension agents were more felt in Osun State than in Edo State.

RECOMMENDATIONS

Based on the major conclusions, the following recommendations for improving the knowledge of cocoa farmers are very important.

- There is need for agricultural development programmes (ADPs), Ministry of Agriculture, Cocoa Development Unit (CDU), commissions, Non- Governmental Organizations and other agencies related to cocoa production to be directly or indirectly involved in the training of farmers on safety handling of recommended chemicals and health hazards involved if carelessly handled. This training should involve use of posters, drama, songs, campaign and increasing frequency of called on the formers by extension agents.
- There is need to re-orientate the extension agents in shift their focus to training of farmers on safety handling of chemicals and long term effect of chemicals of human health.
- There is need for the farmers to be enlightened through introduction of more adult education literacy centers by stakeholders in order to broaden the knowledge of the farmers and to train the farmers to be able to know how to read and write at least in their local language.
- Farmer must be taught on adequate ways of disposing empty containers of pesticides.
- The government should encourage Federal Environmental Protection Agency (FEPA) to intensify its efforts on chemical registration and control with a view to categorizing them according to their safety status. Those chemicals needed to be banned or restricted should be categorized and the level of toxicity should be made known to farmers and other chemical users.

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25. Table 1: Distribution of respondents according to the types to chemical used

Type of chemicals used	Osun State		Edo State		Total	
	F	%	F	%	F	%
Cuprous (Perenox)	67	55.8	15	12.5	82	34.2
Bordeaux mixture (cupper sulphate)	117	97.5	105	87.5	222	92.5
Cerbendazin (Ridomil)	19	15.8	74	61.2	93	38.8
Gamma-BCH (Gammalin 20)	114	95.0	104	86.7	218	90.8
Diaziorion (basudin600EC)	88	73.3	92	76.7	180	75.0
Lindane (kokotine)	56	46.7	29	24.2	85	35.4

Multiple responses

Source: Field survey, 2010

Table 2: Ranking of farmers' knowledge of precautionary measures based on mean scores in order of hazard to health.

Precautionary measures	Osun State		Edo State	
	Means Rank		Mean Rank	
Eating during spraying chemical injurious to health	2.81	1 st	2.55	1 st
Washing and cleaning spraying equipment is necessary after spraying chemicals.	2.79	2 nd	2.31	4 th
Drinking during spraying chemicals injurious to health	2.77	3 rd	2.54	2 nd
Smoking during spraying chemical is injurious to health	2.70	4 th	2.47	3 rd
Spraying should not be directed towards directions of air	2.65	5 th	1.87	7 th
Wearing of protective clothes during prevent body exposure to chemical.	2.38	6 th	2.06	6 th
Washing of contaminated clothes immediately after spraying is necessary.	2.37	7 th	2.19	5 th
Bath immediately after spraying of chemical is necessary	2.34	8 th	1.82	8 th
It is not good to enter the farm within 24 hours after spraying chemical to prevent eating contaminated food	2.29	9 th	1.66	9 th
Burying or burning of empty chemical containers after spraying is necessary	2.08	10 th	1.65	10 th
Contaminated food during spraying should be buries	1.28	11 th	1.63	11 th

Source – Field survey, 2010.

Table 3: Distribution of respondents according to operational habits exhibited using chemicals.

Operational habits	Osun State		Edo State		Total	
	F	%	F	%	F	%
Eating during spraying of chemical	74	61.7	82	68.3	156	65.0
Wearing of protective clothing when spraying chemicals	19	15.8	22	18.3	41	17.0
Drinking during spraying of chemicals	90	75.0	91	75.8	181	75.4
Smoking during spraying of chemicals	62	51.7	71	59.2	133	55.4
Bath immediately after spraying of chemicals	49	40.8	72	60.0	121	50.4
Washing of contaminated clothes immediately after spraying	14	11.7	25	20.8	39	16.3
Burying of contaminated food	29	24.2	24	20.0	53	22.1
Storage of chemicals in recommended storage box	5	4.2	32	2.5	8	3.3
Storage of chemical in living room and together with food stuff	65	54.2	96	80.8	184	76.7
Ways of disposing empty container by bury after use	11	9.2	11	9.2	22	9.2
Disposing empty container by throwing after use	20	16.7	18	15.0	38	15.8
Washing empty container and re-use	73	60.8	86	71.7	159	66.3
Selling container to buyer	21	17.5	16	13.3	37	15.4
Mixed chemicals with bare hand	68	56.7	73	60.8	141	58.8
Mixed chemicals by using stick	52	43.3	45	37.5	97	40.4

Multiple responses

Source: Field survey, 2010

Table 4: Ranking of health related problems in order to frequencies of occurrence among farmers

Health related variables	Osun State		Edo State		Total	
	F	%	F	%	F	%
Tearing and redness eyes	63	52.5	80	66.7	143	59.6
Lack of muscle coordination	59	45.8	71	59.2	126	52.5
Body itching	55	45.8	71	59.2	126	52.5
Cough	47	39.3	23	19.2	70	29.2
Difficulty in breathing	28	23.3	32	26.7	60	25.0
Excessive sweating	27	22.5	35	29.2	62	25.8
Headache	24	20.0	30	25.0	54	18.8
Diarrhea	17	14.2	15	12.5	32	13.3
Stomach cramps	9	7.5	16	13.3	25	10.4
Vomiting	7	5.8	6	5.0	13	5.4
Yellow skin	7	5.8	47	39.2	54	22.5

Multiple responses

Source: Field survey, 2010

Table 5: Distribution of respondents according to socio-economic characteristics

Socio-Economic Characteristics	Osun State		Edo State		Total		Osun State	Edo State
	F	%	F	%	F	%	Mean/Std.	Mean/Std
Age								
20 and below	4	3.30	10	8.30	14	11.6		50(12.4)*
21-40	25	20.5	19	15.8	44	18.3	47(12.1)*	
41-60	65	54.2	63	52.5	128	53.4		
61 above	26	21.7	28	23.4	54	22.5		
Sex								
Male	117	97.5	116	96.7	233	97.1		
Female	3	2.50	4	3.3	7	2.9		
Level of Education (Year)								
None	52	43.3	64	53.3	116	48.3	1.8(1.3)*	1.7(1.2)*
1-6	45	37.5	32	26.7	77	32.1		
7-12	17	14.2	20	16.7	37	15.4		
13 and above	6	5.00	4	3.3	10	4.2		
Family labour								
None	17	14.2	13	10.8	40	16.7	6.2(3.4)*	5.8(3.1)*
1-4	79	65.8	82	67.2	161	66.7		
5-8	24	20	27	21.7	50	20.8		
Hired labour								
None	1	0.8	9	7.5	10	4.2		
1-4	67	56.8	104	86.6	171	71.2		2.5(1.4)*
5-8	47	39.2	7	5.8	54	22.5	5.0(2.1)*	
9-12	5	4.2	0	0.0	5	2.1		
Farm size (hectares)								
1-5	86	71.7	54	45.0	140	58.3		6.7(3.9)*
6-10	26	21.6	54	45.0	80	33.3	5.2(3.1)*	
11-15	8	6.6	12	10	20	8.4		
Level of income								
1-50	68	56.7	27	22.5	95	39.6		
51-100	38	31.7	66	55.0	194	43.3		
101-150	6	6.5	18	15.0	24	10.0		85,883
150 and above	8	6.6	9	7.5	17	7.1	61,725 (49,795)*	(52,889)*
Sources of information								
Extension agents	42	34.2	4	3.3	46	19.2		1.3(0.9)*
Other farmers	61	50.8	69	57.5	120	50	1.4(1.2)*	
Sale agents	30	25	29	24.2	59	24.2		
Cocoa merchants	22	18.3	34	28.3	56	23.3		
Extension contact (No)								
None	78	65.0	116	96.7	194	80.8		0.1(0.4)*
1-4	31	25.8	4	3.3	35	14.6	1.2(2.2)*	
5 and above	11	9.2	0	0.0	11	4.6		

Multiple responses

* Standard deviation are in parenthesis.

Source: Field survey, 2010

Table 6: Summary of liner correlation of knowledge of precautionary measures with operational habits, health related problems and socio-economic characteristics.

Variables	Correlation (r)	Coefficient of Determination (r^2)	Decision
Operational habits	0.604*	0.366*	S
Health related problems	0.120	0.914	NS
Age	0.127	0.016	NS
Family size	0.103	0.016	NS
Level of education	0.398*	0.158	S
Labour size	0.119	0.014	NS
Annual income	0.069	0.012	NS
Extension contact	0.298*	0.089	S
Sources of information	0.218*	0.048	S
Farm size	0.114	0.013	NS

$P \leq 0.05$; S = Significant; NS = Not significant

Source: Field survey, 2010

Table 7: Analysis of variance showing the results of difference in type of chemicals, knowledge of precautionary measures, operational habits, occurrence of health related problems and socio-economic characteristics of cocoa farmers in Osun State and Edo State

Variables	Osun state	Edo State	F Calculated	Decision
	Mean	Mean		
Type of chemicals	3.9	3.6	5.76	NS
Knowledge of precautionary measures	2.8	1.9	9.04*	S
Operational habits	3.1	3.4	2.00	NS
Occurrence of health problems	2.0	2.1	5.24	NS
Age	47.0	50.0	0.07	NS
Farm size	5.2	6.7	8.36*	S
Labour size	5.0	2.5	79.44*	S
Level of Education	1.8	1.7	2.87	NS
Annual income	61.725	85;833	10.40*	S
Sources of information	1.4	1.3	1.70	NS
Extension contact	1.2	0.1	37.20*	S

$P \leq 0.05$; S = significant; NS = Not significant

Source: Field survey, 2010