

FARMERS' COMPLIANCE WITH THE USE OF APPROVED COCOA PESTICIDES IN COCOA PRODUCING STATES OF NIGERIA

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ABSTRACT

The survey evaluates the awareness and level of compliance in the use of approved cocoa pesticides by local farmers in selected cocoa producing states of Nigeria. Thirty farmers were randomly selected in Kwara, Ogun and Osun States. More than 70 percent of the farmers were aware of banned cocoa pesticides. The source of cocoa pesticides used by the farmers includes agrochemicals retailers, Cocoa traders, Cocoa Association of Nigeria (CAN), and Agricultural Development Programme (ADP). Ridomil plus (29.2 percent) was mostly known as banned cocoa pesticide by farmers in Ogun State while Gammalin 20 and Basudin were mostly known to the farmers in Osun and Kwara States. About 50 percent of farmers in Ogun, 8.0 percent in Osun and 8.3 percent in Kwara indicated that they were still using some of the banned chemicals due to their effectiveness in the control of pest and diseases and inexpensive. There should be adequate registration of all approved cocoa pesticides by concerned agency as well as enlightenment by extension agents to the cocoa farmers and the sellers and suppliers of the agrochemicals in each of the cocoa producing states of Nigeria. Banned agrochemicals should not be allowed into the country, monitoring group working in conjunction with Federal Environmental Protection Agency (FEPA) are to work out modality for the removal of banned chemicals in the market.

Keywords: Cocoa pesticides, pesticide registration, radio and television, Cocoa Research Institute of Nigeria (CRIN)

INTRODUCTION

It has been reported (www.blog.worldcocoafoundadtion) that approximately 30 to 40 percent of all potential cocoa production is lost to diseases and pests. In localities with exceptional disease and/or pest infestation, losses can exceed 80 percent. In dollar terms, annual losses total approximately \$2 billion. While these losses have an impact throughout the supply chain, it is the cocoa farmer that feels the most immediate and direct impact on family income. Depending on tree variety and region, cocoa farmers can face a variety of fungal diseases and insect pests that attack the leaves, stems, trunks, or pods of their cocoa trees. Farmers therefore resolved at using pesticide at controlling pests and diseases attacks on their plantations to reduce loss.

According to Bateman (2010), the term "pesticide" can be defined simply as any substance which is used to control a pest at any stage in crop production, storage or transport. It is now generally agreed that the term "pest" applies to any organisms that harm crops, be they insects, diseases, weeds, among others. In the past there has been some confusion with the term

“pesticide” - which has at times been applied specifically to insect control agents - and weed-killers (herbicides) that have been managed separately as an agronomy issue. Pesticides therefore include herbicides, insecticides, rodenticides, fungicides, molluscides, nematocides, avicides, repellents and attractants used in agriculture, public health, horticulture, food storage or a chemical substance used for a similar purpose (NAFDAC, 1996). Application of pesticides is the most widely adopted method of cocoa insect pest and disease control because of their quick and effective action (Asogwa and Dongo, 2009). It has been estimated that about 125,000 - 130,000 metric tons of pesticides are applied every year in Nigeria. In 1991, cocoa pesticides accounted for about 31 percent of the total agro-chemical market of which fungicides accounted for 65 percent and insecticides 35 percent (Ikemefuna, 1998).

Heavy metal contamination of the environment caused by parent materials in soils or anthropogenic activities, including fertilization, application of pesticides and traffic, among others has been a worldwide concern to both the governmental and regulatory bodies that are anxious to prevent further environmental deterioration (Li *et al.*, 2004; Vidal *et al.*, 2004). Pesticide use is associated with risk and can be hazardous if not handled properly. Cocoa farmers using pesticides containing Aldrin, Gamma BHC, Cuprous oxide, Copper sulphate, Paraquat dichloride etc. face constant exposure to these pesticides (Fajewonyomi, 1995). According to Takagi *et al.* (1997), risks associated with pesticide use can be divided into two:

- i. Risk associated with human beings: i.e., toxicity categorized as acute toxicity, chronic toxicity, carcinogenicity, teratogenicity and biological concentration. Human exposure to pesticides is an important health and social issue as it usually results in serious health problems such as epilepsy, stroke, respiratory disorders, cancer, leukamia, brain and liver tumours, convulsions etc. Death has been known to occur in some places as a result of exposures to these pesticides.
- ii. Risk associated with the environment: This manifests in the disturbance of the ecosystem, principally in the form of pollution of river water, groundwater, drinking water, soil and air, reduction of fish and wildlife populations, destruction of natural vegetation, among others (Pitmentel *et al.*, 1980).

The high incidence of phytophthora pod rot and mirids resulting from high rainfall and relative humidity in cocoa producing areas of Nigeria has forced farmers to apply fungicides and other pesticides on cocoa (Ogunlade and Agbeniyi, 2011). The anti-mirid campaign, which followed the recommendation of Lindane in 1957, resulted in remarkable increase in cocoa production from an average of 103,000 tons per annum in 1961 - 67 periods to 212,000 tons per annum in 1961 - 65 periods (Gerard, 1967). The European Union (EU) Legislation on Maximum Residue Levels (MRL) allowed on cocoa beans and products, some of the cocoa pesticides have undergone screening and the previously recommended pesticides were banned (ICCO, 2008). For active substances for which no MRL is included in the Regulation, a default MRL of 0.01mg/kg will apply (ICCO, 2008). This new regulation, which came into effect September 1, 2008, has left very few pesticides for use on cocoa both on farm and post farm activities in Nigeria. From that date onwards, all cocoa beans entering the European Union must conform to the provisions of EU Regulation. Cocoa Producing Member countries were therefore advised to take all necessary steps to ensure that consignments of cocoa beans being imported into the European Union with effect from 1 September 2008 conform to the provisions.

Many banned, severely restricted or unregistered pesticides are still in many developing countries despite their having been listed as hazardous by the World Health Organisation (WHO) (Tijani, 2006). Fajewonyomi (1995) stated that many of the pesticides are still widely promoted and applied especially in developing countries where weak controls and dangerous work conditions make their impact even more devastating. Papworth and Paharia (1978) stated that since pesticides by their very nature are toxic and can be hazardous to users if not handled properly, their regulation through registration is of great value to developing countries. It is not the increasing use of pesticides that warrants regulation through suitable legislations but the tendency, through ignorance, for overuse, misuse or abuse of pesticides (Tijani, 2006). Snelson (1978) stated that registration' as used in this context implies the acceptance by a statutory authority of extensive document proof submitted in support of all claims for efficacy and safety made for the proposed product. Registration enables authorities to exercise control on use levels claims, labeling, packaging and advertising and thus to ensure that the interest of end users are well protected. After discovering that application of pesticides causes severe contamination of vegetables with residues in Vietnam, Nguyem *et al.* (1998) suggested that instruction sessions should be organized by the local authorities to show farmers how to correctly apply pesticides on their vegetable fields, set up demonstration field using insecticides correctly, distribute leaflets on accurate and safe use of insecticides on vegetables to all vegetable growers, run broadcast from the city broadcasting outfit to educate farmers about safe and accurate application of pesticides to protect their own health and that of consumers. Wetterson (1988) reported that a number of governments and companies within the agrochemical industry provide little, if any, health and safety information on pesticides beyond a label, which reaches pesticide users in the field. In some countries, the labels may be in a language not understood by the users who may not be literate.

From the foregoing, there is still poor public information on the dangers to both people and the environment on usage of banned pesticides. Nevertheless cocoa, like other tropical crops, is often ravaged by insects, diseases and other pests that must be controlled effectively as well as safely. Pesticides can provide useful control solutions, but must be approved for use on the basis of Good Agricultural Practices (GAP) and appropriate application. Unfortunately some farmers are yet to comply with the usage of approved cocoa pesticides while others still use the banned pesticides on their farms. The survey therefore evaluates the awareness and level of compliance of the use of the approved cocoa pesticides by the local farmers in selected cocoa producing states of Nigeria with the view to make adequate recommendation.

METHODOLOGY

The study was conducted in three out of the 14 cocoa producing States of Nigeria. The States include Kwara, Ogun and Osun base on National Cocoa Development Committee (NCDC) (NCDC, 2008) classification of marginal, medium and high cocoa producing states respectively of the country. The tool used for data collection was a set of structured questionnaire. The questionnaire was designed to collect information on demographic information of the farmers, application and sources of cocoa pesticides to the farmers, sources of information on banned cocoa pesticides, compliance of farmers on usage of the banned cocoa pesticides, effectiveness of banned chemicals and alternative means of controlling pest and diseases, and perception (in percentage) of farmers on banned chemicals.

Three Local Government Areas (LGAs) were selected in each of the State. Selection of the LGAs was based on the top three LGAs with respect to total hectares under cocoa production according to the outcome of Nigeria Cocoa Production Survey of 2007. Table 1 presents information on each of the selected LGA in each of the state with respect to their land area under cocoa production as well as their cocoa production for the years 2004 – 2005. Ten cocoa farmers were randomly selected in each of the LGAs (thirty for each of the state and ninety farmers in all) for questionnaire administration. Response rate to the questionnaire in Osun State was 83.3 percent (25 farmers) while in Ogun and Kwara States were 80.0 percent (24 farmers) each.

Table 1: Land area under cocoa production in selected top three Local Government Areas in Kwara, Ogun and Osun States, Nigeria

State	LGAs	Cocoa land area (ha)	Percentage of total cocoa land area	2004 – 2005 State production (Tonnes)	Percentage of total State production
Kwara	Oke Ero	923	25.79	464.3	25.80
	Isin	810	22.64	407.4	22.64
	Irepodun	803	22.44	403.9	22.44
Ogun	Ijebu East	22431	27.95	11282.8	27.95
	Ijebu North	18631	23.22	9371.39	23.22
	Obafemi Owode	10383	12.94	5222.65	12.94
Osun	Ife South	15939	15.03	8017.3	15.03
	Aiyedade	13924	13.13	7003.8	13.13
	Oriade	9337	8.80	4696.5	8.80

Source: NCDC, 2008

RESULTS AND DISCUSSION

Farmer’s demographic information

The mean age of the sampled farmers ranged between 54 and 60 years (Table 2). As presented in Table 2, many of the farmers were male for the three states, and more than 60 percent did not undergo formal education. About 50 percent of the farmers in Ogun State and more than 84 percent in both Osun and Kwara State were married. About 62 percent of the farmers in Ogun State did not declare the number of wife they have. Meanwhile, 20 percent, 64 percent and 50 percent of farmers in Ogun, Osun and Kwara States respectively informed that they have one wife. About 45 percent of farmers in each of Ogun and Kwara States and 36 percent in Osun State has five and above children (Table 3). Primary and secondary occupation of many of the respondents was farming. Farm size of about 62 percent, 54 percent and 44 percent of the sampled farmers in Kwara, Ogun and Osun States respectively was between 1 and 5 ha, although a considerable number of them also had between 6 and 10 ha while none had farm size above 20ha (Table 4).

Table 2: Age of the sampled farmers for the selected states

States	Minimum	Maximum	Mean	Std. Deviation
Ogun State	28.00	89.00	54.4583	19.54922
Osun State	30.00	90.00	57.8400	13.92444
Kwara State	41.00	91.00	60.6667	14.89869

Table 3: Demographic information of the sampled farmers for the selected states

Description	Ogun State		Osun State		Kwara State	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Gender						
- Male	18	75.0	20	80.0	20	83.3
- Female	6	25.0	5	20.0	4	16.7
Sub total	24	100	25	100	24	100
Education						
- Not educated	17	70.8	22	88.0	15	62.5
- Primary	1	4.2	0	0	6	25.0
- Secondary	3	12.5	3	12.0	0	0
- Tertiary	3	12.5	0	0	3	12.5
Sub total	24	100	25	100	24	100
Marital Status						
- Married	12	50.0	21	84.0	22	91.7
- Single	5	20.8	1	4.0	0	0
- Divorce	3	12.5	1	4.0	0	0
- Widower	1	4.2	1	4.0	2	8.3
- Widow	3	12.5	1	4.0	0	0
Sub total	24	100	25	100	24	100
Number of wife						
- No response	15	62.5	6	24.0	3	12.5
- One wife	5	20.8	16	64.0	12	50.0
- Two wives	1	4.2	2	8.0	4	16.7
- Three wives	2	8.3	1	4.0	3	12.5
- Four wives	1	4.2	0	0	2	8.3
Sub total	24	100	25	100	24	100
Number of children						
- No response	5	20.8	3	12.0	1	4.2
- One	1	4.2	1	4.0	1	4.2
- Two	4	16.7	2	8.0	1	4.2
- Three	1	4.2	5	20.0	5	20.8
- Four	2	8.3	5	20.0	5	20.8
- Five and above	11	45.8	9	36.0	11	45.8
Sub total	24	100	25	100	24	100

Table 4: Occupation and farm size of the respondents

Description	Ogun State		Osun State		Kwara State	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
- Farming	17	70.8	18	72.0	19	79.2
- Civil servant	0	0	4	16.0	3	12.5
- Student	7	29.5	1	4.0	0	0
- Artisans	0	0	2	8.0	2	8.3
- Others	0	0	0	0	0	0
Sub total	24	100	25	100	24	100
Secondary Occupation						
- Farming	19	79.2	16	64.0	13	54.2
- Civil servant	2	8.3	4	16.0	4	16.7
- Student	0	0	3	12.0	0	0
- Artisans	3	12.5	2	8.0	7	29.2
- Others	0	0	0	0	0	0
Sub total	24	100	25	100	24	100
Farm Size						
1- 5 ha	13	54.2	11	44.0	15	62.5
6 - 10 ha	10	41.7	9	36.0	6	25.0
11 - 15 ha	1	4.2	3	12.0	3	12.5
16 – 20 ha	0	0	2	8.0	0	0
21 and above	0	0	0	0	0	0
Sub total	24	100	25	100	24	100

As presented in Table 5, all the sampled farmers in the 3 States applied chemicals on their cocoa farms. Also, more than 70 percent of all the farmers were aware of banned cocoa pesticides. The source of cocoa pesticides used by 75.0 percent of farmers in Ogun State was the agrochemicals retailers. Source of cocoa pesticides for 41.7 percent of the farmers in Kwara State was Cocoa traders while both Cocoa Association of Nigeria (CAN) and Agricultural Development Programme (ADP) each contributed 40.0 percent as source of cocoa pesticides to farmers in Osun State. All the farmers in the three states were aware of the approved and banned cocoa chemicals. Dursban ranked topmost (45.8 percent) of all the approved cocoa pesticide used by farmers in Ogun State while Ridomil Gold ranked on top for both Osun State (32.0 percent) and Kwara State (41.7 percent). Table 6 presents the list of currently approved chemicals for cocoa farms in Nigeria.

Banned cocoa pesticides and Sources of information to the farmers

Majority of the farmers in Ogun (50.0 percent) and Kwara (41.7 percent) States indicated that they obtained their information on banned cocoa pesticides through television and radio while 44.0 percent of farmers in Osun state indicated Cocoa Research Institute of Nigeria (CRIN) as their major source of information on banned cocoa pesticides. Ridomil plus (29.2 percent) followed by Basudin (20.8 percent) were the two mostly known banned cocoa pesticides to farmers in Ogun State. For the farmers in Osun and Kwara States, Gammalin 20 and Basudin

were mostly known to the farmers as banned cocoa pesticides. When asked on which of the banned chemicals that are still in use in the study area, although majority of the farmers indicated that they are not using the banned pesticides, yet some of the farmers mentioned that farmers still use the three well known (Basudin, Ridomil Plus and Gammalin 20) banned pesticides on their farms (Table 7).

Table 5: Application and sources of cocoa pesticides to the farmers

Description	Ogun State		Osun State		Kwara State	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Chemical application on cocoa farm						
- Yes	24	100.0	25	100.0	24	100.0
- No	0	0	0	0	0	0
Sub total	24	100	25	100	24	100
Awareness on banned cocoa pesticides						
- Yes	17	70.8	20	80.0	19	79.2
- No	7	29.2	5	20.0	5	20.8
Sub total	24	100	25	100	24	100
Source of cocoa pesticides						
- Cocoa Association of Nigeria (CAN)	2	8.3	10	40.0	3	12.5
- Agrochemical retailer	18	75.0	1	4.0	8	33.3
- Cocoa trader	0	0	4	16.0	10	41.7
- Agricultural Development Programme (ADP)	4	16.7	10	40.0	3	12.5
Sub total	24	100	25	100	24	100
Awareness of approved cocoa pesticides						
- Yes	17	70.8	22	88.0	18	75.0
- No	7	29.2	3	12.0	3	12.5
- No response	0	0	0	0	3	12.5
Sub total	24	100	25	100	24	100
Approved chemicals use on farm						
- No response	7	29.2	8	32.0	0	0
- Dursban	11	45.8	0	0	4	16.7
- Funguran	4	16.7	3	12.0	5	20.8
- Touchdown – fort	2	8.3	4	16.0	5	20.8
- Actara	0	0	2	8.0	0	0
- Ridomil Gold	0	0	8	32.0	10	41.7
Sub total	24	100	25	100	24	100

Table 6: List of pesticides currently approved for use on cocoa farms in Nigeria.

S/N	Trade name	Active ingredient	Commercial presentation form	Test pests
Insecticide				
1.	Dursban48EC	Chlorpyrifos	Emulsifiable	Mirid
2.	Actara25 WG	Thiamethoxam	Concentrate	Mirid
3.	Proteus 170 O-TEQ	Deltamethrin 20g/l + Thiocloprid 150g/l	Wettable Granule Oil Dispersion	Mirid
Fungicide				
1.	Funguran ^{-OH}	Copper hydroxide	Wettable powder	Black pod
2.	Champ WG	Copper hydroxide	Wettable powder	Black pod
3.	Ridomil gold 66WP	Cuprous Oxide + metalaxyl-M	Wettable powder	Black pod
4.	Nordox 75WP	Cuprous Oxide	Wettable powder	Black pod
5.	Kocide 101	Cuprous Oxide	Wettable powder	Black pod
Herbicides				
1.	Touch down	Glyphosate	Soluble Concentrate	Weed
2.	Round up	Glyphosate	Soluble Concentrate	Weed

Source: Asogwa and Dongo (2009)

Tables 9, 10 and 11 give details on previously approved cocoa chemicals but that are no more in use (invariably banned from use on cocoa). Some of these pesticides were banned due to their ineffectiveness and the dangers they pose to life and environment. It's been discovered that inappropriate and intensive use of organochlorides and Lindane based insecticides for mirid control in Nigeria resulted to the development of resistance by the mirids, thereby rendering the insecticides ineffective (Entwistle, 1964; Gerard, 1967; Booker, 1969; Youdoweei, 1971; Omole *et al.*, 1977). The development of resistance to these insecticides by the pests according to Idowu (1989) may be attributed to the following reasons:

- i) Inadequate coverage of cocoa trees during blanket spraying, which could be as a result of using poor spray equipment or irrational selection of trees within the plantation.
- ii) Application of sub-lethal dosages of the pesticide. This could be as a result of use of un-recommended pesticide or adulterated/expired pesticides or complete disregard by farmers for CRIN recommendations for pesticide application.

There have been reported cases of toxicity and phytotoxicity resulting in leakages that often poison the user, wastes pesticides, causes environmental pollution and may become phytotoxic where pesticides fall on crops at high doses (Meijden, 1998). There is also evidence of poor pesticide education and misuse in Nigeria, for instance, over-dosage application of pesticides for the purpose of effecting rapid kill of crop pests (Ivbijaro, 1998). Farmers sometimes use pesticides for purposes other than that for which they are manufactured. Some stunning revelations of pesticide misuse have been reported by some scientists (Ivbijaro, 1977; Youdeowei, 1989; Ivbijaro, 1990, 1998) as follows:

- i) Spraying Gammalin 20 on drying cocoa beans or kolanut to prevent insect pest attack in storage.

- ii) Lindane (contain in Gammalin 20) is poured into rivers, lakes and streams to kill fish, which is then sold for human consumption.
- iii) Mixing of fungicides and insecticides together to reduce workload of spraying each differently.
- iv) Inappropriate disposal of expired pesticides and use of pesticide containers for domestic purposes.

There was inverse correlation between banned pesticides known to farmers in Ogun state but direct correlation in Osun and Kwara states. On the contrary, there was direct correlation of source of information on banned pesticides with banned chemicals still in use by the farmers in Ogun state but inverse in Osun and Kwara states (Table 8). It is no doubt that majority of the farmers have not fully adopted the use of approved cocoa pesticides in the selected cocoa producing states of Nigeria. Farmers in Nigeria have poorly adopted much of the technical knowledge on cocoa pest management acquired from scientific research. The major factors responsible for inefficient application of pesticides are financial constraints, poor techniques, inappropriate equipment, improper timing, inadequate understanding and lack of concern for the consequences of careless use of pesticides (Oduwole, 2001). Furthermore, majority of cocoa farmers are often unaware that pesticides should be used in specific dosage in order to be as cost-effective as possible. A means of assuring that at least the concentration of the pesticide in the spraying liquid is correct is the supply of pesticide in sachets containing sufficient dose for each knapsack load, as had been done for some pesticides in Nigeria and other parts of West and Central Africa (Asogwa and Dongo, 2009).

Many of the farmers in the three selected states indicated that the main reason they stopped usage of the banned cocoa pesticides was due to its health implication (Table 7). Although, majority of the farmers indicated that they were no more using the banned chemicals on their farms, yet about 50 percent in Ogun, 8.0 percent in Osun and 8.3 percent in Kwara indicated that they were still using some of the banned chemicals due to their effectiveness in the control of pest and diseases. Few of the farmers also indicated that they were still using some of the chemicals because they were cheap. Most of the farmers in Ogun (91.7 percent), Osun (52.0 percent) and Kwara (58.3 percent) therefore advised on prevention of circulation of the banned cocoa pesticides was total removal of the chemicals out of the market and from the reach of the sellers.

Table 7: Sources of information to the farmers on banned cocoa pesticides

Variables	Ogun State		Osun State		Kwara State	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Source of information on banned cocoa pesticides						
- FFH	3	12.5	1	4.0	2	8.3
- CRIN	6	25.0	11	44.0	2	8.3
- ADP	0	0	2	8.0	3	12.5
- Farmers' group	3	12.5	0	0	2	8.3
- Radio or Television	12	50.0	6	24.0	10	41.7
- No response	0	0	5	20	5	20.8
Sub total	24	100	25	100	24	100
Banned cocoa pesticides that you know						
- Basudin	5	20.8	8	32.0	6	25.0
- Unden	2	8.3	0	0	2	8.3
- Glyphosate	1	4.2	0	0	2	8.3
- Gramazone	0	0	0	0	0	0
- Gammalin 20	9	37.5	12	48.0	5	20.8
- Copper sulphate	0	0	0	0	0	0
- Rindomil Plus	7	29.2	1	4.0	4	16.7
- No response	0	0	4	16.0	5	20.8
Sub total	24	100	25	100	24	100
Banned pesticides still in use by farmers						
- None	7	29.2	17	68.0	18	75.0
- Basudin	3	12.5	0	0	5	20.8
- Unden	2	8.3	0	0	0	0
- Rindomil Plus	3	12.5	2	8.0	0	0
- Gammaline 20	8	33.3	2	8.0	0	0
- All of the above	1	4.2	0	0	1	4.2
- No response	0	0	4	16.0	0	0
Sub total	24	100	25	100	24	100
Reason for stopping use of banned pesticides						
- No response	6	25.0	0	0	4	16.7
- Health hazard	14	58.3	18	72.0	11	45.8
- Too expensive	1	4.2	3	12.0	8	33.3
- Not available	3	12.5	4	16.0	1	4.2
Sub total	24	100	25	100	24	100
Reason for using banned cocoa pesticides						
- No response	10	41.7	22	88.0	20	83.3
- Cheap	2	8.3	1	4.0	2	8.3
- Very effective	12	50.0	2	8.0	2	8.3

Sub total	24	100	25	100	24	100
Advise on circulation and use of banned chemicals on cocoa						
- Total removal of the chemicals out of market	22	91.7	13	52.0	14	58.3
- Completely stop use of it	1	4.2	4	16.0	3	12.5
- Create more awareness health implications	1	4.2	5	20.0	7	29.2
- No response	0	0	3	12.0	0	0
Sub total	24	100	25	100	24	100

Table 8: Correlation results on banned pesticides and sources of information to farmers on the banned chemicals

States		Source of information on banned pesticides
Ogun State	Banned pesticide known to farmers	-0.209 (0.326)
	Banned chemicals still in use	0.340 (0.104)
Osun State	Banned pesticide known to farmers	0.279 (0.176)
	Banned chemicals still in use	-0.033 (0.874)
Kwara State	Banned pesticide known to farmers	0.457 (0.25)
	Banned chemicals still in use	- 0.437 (0.33)

Values in brackets are levels of significance

Table 9: List of insecticides previously approved for use on cocoa farms in Nigeria.

Trade name	Active ingredient	Chem. class	Commercial presentation form	Percent Active ingredient	Mixture ratio	Test insects
Agrothion	Fenitrothion	Organo-phosphate	Emulsifiable concentrate (EC)	20	12.5 ml/L	Termite
Basudin	Diazinon	Organo-phosphate	Emulsifiable concentrate (EC)	60	4.2 ml/L	Mirid
Durbin	Chlorpyrifos	Organo-phosphate	Emulsifiable concentrate (EC)	48	5.2 ml/L	Mirid
Elocron	Dioxacard	Carbamate	Wettable Powder (WP)	50	3.9 ml/L	Mirid
Mipcin	Isoprocarb	Carbamate	Wettable Powder (WP)	75	15.1 ml/L	Mirid
Unden	Propoxurr	Carbamate	Emulsifiable concentrate (EC)	20	12.5 ml/L	Mirid
Thiodan	Endosulfan	Cyclic Sulphuric group	Emulsifiable concentrate (EC)	35	7.2 ml/L	Mirid
Decis-Dan/Cracker 282 E.C.	Endosulfan and Deltamethrin	Pyrethroid	Emulsifiable concentrate (EC)	280 (2.0g)		Mirid

Table 10: List of fungicides previously approved for use on cocoa farms in Nigeria

Trade name	Active ingredient	Dosage	Rate/ha
Caocobre-Sandoz	Copper oxide	13.5 g/10 L H ₂ O	3.36 kg/ha
Ridomil Plus 72 WP	Metalaxyl + Copper	33 g/10 L H ₂ O	3.24 kg/ha
Brestan	Tin Triphenyl acetate	13.5 g/10 L H ₂ O	2.33 kg/ha
Kocide 101	Copper hydroxide	40 g/10 L H ₂ O	2.5 kg/ha
Bordeaux mixture	Copper sulphate + Lime	40 g/10 L H ₂ O	3.8 kg/ha
Perenox	Copper Oxide	40 g/10 L H ₂ O	3.4 kg/ha
Procida BBS	Copper sulphate + 5H ₂ O	40 g/10 L H ₂ O	3.8 kg/ha
Orthodifolatan	4-Cyclohexane Dicarboxymide	45 g/10 L H ₂ O	1.9 kg/ha

Table 11: List of herbicides previously approved for use on cocoa farms in Nigeria.

S/N	Trade name	Active ingredient	Type of herbicide	Rate of active ingredient	Mixture ratio
1	Asulam +Loxynl 2 – 40	Methyl sulfamily carbamate	Carbamate (selection) post emergence systemic herbicide	3.4 + 0.5 kg/ha	3.0 L/ha
2	Glyphosate	N- (Phosphono methyl) glycine	Broad spectrum postemergence Herbicide	1.92 kg/ha	-
3	Paraquat	1.1 Dimethyl 1- 4.4 bipyridinium (cation) dichloride	Non- selective contact action Herbicide	0.56 kg/ha	3.0 L/ha

Farmers' responses on banned and approved cocoa pesticides

Responses of the farmers to questions meant to evaluate their perception on the approved and banned cocoa pesticides are presented in Table 12. Majority of the farmers in Ogun (58.3 percent), Osun (40.0 percent) and about 29.2 percent in Kwara strongly agree that government should not ban cocoa pesticides. On the perception that ban of some previously approved cocoa pesticides is a political move to close some chemical manufacturing industries, apart from 40.0 percent of the farmers in Osun State that strongly agree with the statement, other farmers in Ogun and Kwara States has diverse perceptions. Majority of the farmers strongly agree (52.4 percent in Ogun and 32.4 percent in Osun) and agree (50.0 percent in Kwara) that some of the banned pesticides are cheaper therefore government should lift ban on them. Many of the farmers in the three States strongly agree (68.0 percent in Osun, 54.2 percent in Kwara and 41.7 in Ogun) that regular training should be organized on banned cocoa pesticides. Majority of the farmers strongly agree with 64.0 percent and 37.5 percent respectively in Osun and Kwara States, and agree with 45.8 percent in Ogun State to awareness creation on radio and/or

television on the recently banned cocoa pesticides. On the use of projector to enlighten farmers and chemical dealers on the recent banned cocoa pesticides in remote areas, more than half of all the farmers in the three States (70.8 percent in Kwara, 58.3 percent in Ogun and 56.0 percent in Osun) strongly agree with the suggestion.

It was revealed that majority of the farmers strongly disagree (33.3 percent) in Kwara and disagree with 36.0 percent and 33.3 percent respectively in Osun and Ogun States respectively that government should provide subsidies on approved cocoa pesticide. In the same vein, majority of the farmers strongly disagree (37.5 percent) in Kwara and 33.3 percent and 32.0 percent in Ogun and Osun States that banned cocoa pesticide is not a means of discouraging cocoa production. Inferences from the perceptions of the farmers on banned cocoa pesticides revealed that majority of the farmers still have interest in the use of the banned chemicals and one of the reasons was that the banned chemicals are cheaper compared to approved pesticides and that the pesticides are not harmful. Also, farmers think that banning of some pesticides is a political move to close some chemical manufacturing industries. Most importantly, majority of the farmers support the idea of awareness creation on radio and/or television on the recently banned cocoa pesticides. They also accept awareness creation in remote areas through the use of outreach programme in the form of film show and use of projector. Many of the farmers disagree on government subsidy for approved cocoa pesticides because they believe they will not benefit from the assistance. The corrupt nature of the government officials discourages some of the farmers to support and lose interest in government subsidy. For instance, government subsidy on fertilizer did not get to the farmers and they have to buy the product through open market which is invariably defeating the financial support.

Due to the global emphasis on appropriate use of pesticides in food and agricultural produce, many of the cocoa producing countries have embarked on campaign and enlightenment programme for the local farmers to embrace modern cocoa farming practices so as to produce more quality cocoa beans. National Agency for Food and Drug Administration and Control (NAFDAC) has warned cocoa farmers in Nigeria to desist from spraying their trees with chemicals that have been banned by the agency (NBF, 2010). The agency informed that World Health Organisation had estimated at least three million cases of acute poisoning and 20, 000 deaths occurred annually all over the World due to foods exposed to pesticides. Availability of unapproved, unregistered and fake agro-chemicals in agricultural production in the markets therefore posed additional health risks. In addition, applying wrong pesticides did not only reduce the lifespan of the trees but also expose consumers of the products to health risk. Ghana has gone a step further in a bid to assist farmers in promoting effective use of pesticides and fighting cocoa pest and diseases by embarking on massive spraying of the cocoa farms and recommending appropriate pesticides (GNA, 2011). Other cocoa producing countries should endorse this form of programme so as to prevent improper handling of chemicals by farmers.

Table 12: Perception (in percentage) of farmers on banned chemicals in Ogun Osun and Kwara State, Nigeria

S/N	Questions	Ogun state					Osun State					Kwara State				
		SA	A	UD	D	SD	SA	A	UD	D	SD	SA	A	UD	D	SD
1	Government should not ban any pesticide on cocoa	58.3	12.5	16.7	8.3	4.2	40.0	20.0	16.0	12.0	12.0	29.2	4.2	16.7	29.2	20.8
2	Ban of some previously approved cocoa pesticides is a political move to close some chemical manufacturing industries	12.5	12.5	20.8	25.0	29.2	40.0	20.0	16.0	20.0	4.0	16.7	12.5	29.2	20.8	20.8
3	Some of the banned pesticides are cheaper therefore government should lift ban on them	54.2	16.7	8.3	16.7	4.2	32.0	24.0	16.0	16.0	12.0	16.7	50.0	20.8	8.3	4.2
4	Regular training should be organized on banned cocoa pesticides	41.7	37.5	4.2	8.3	8.3	68.0	24.0	8.0	0	0	54.2	29.2	16.7	0	0
5	There should be awareness creation on radio and/or television on the recently banned cocoa pesticides	25.0	45.8	12.5	8.3	8.3	64.0	12.0	12.0	4.0	8.0	37.5	33.3	20.8	4.2	4.2
6	In remote area, projector should be used to enlightened farmers and chemical dealers on the recent banned cocoa pesticides	58.3	41.7	0	0	0	56.0	36.0	8.0	0	0	70.8	16.7	4.2	4.2	4.2
7	Government should provide subsidies on approved cocoa pesticides.	12.5	8.3	12.5	33.3	33.3	8.0	4.0	24.0	36.0	28.0	8.3	0	33.3	25.0	33.3
8	Recently banned cocoa pesticide is a means of discouraging cocoa production	8.3	4.2	12.5	33.3	41.7	24.0	16.0	4.0	32.0	24.0	4.2	8.3	12.5	37.5	37.5

Safety issues in pesticide application

Safety aspects of chemicals are by far the greatest concerns for the general public and thus regulators, but pesticides can be important tools for farmers and cannot simply be wished away. Essentially the three measures that can be taken at the farmer - operator level to mitigate pesticides residual problems include application of the right substance (s), in the right way, and at the right time (Bateman, 2010). Consumers do not always appreciate the high levels of disease and insect pressure that occur in tropical countries, and solving pest control problems for growers remains a crucial issue. The major over-arching issues with pesticide use in cocoa production as identified by Bateman (2009) include:

- i) Safety aspects including real and potential risks to growers and consumers;
- ii) Cost - effectiveness: perhaps of greatest interest to many farmers.
- iii) Technical problems with pesticide applications: including development of resistance by pests (resulting in loss of effectiveness) and resurgence where insecticides can actually make minor pest problems worse.
- iv) Other sustainability concerns including general impact on the environment (*e.g.* the build-up of copper in the soil after long-term use for disease control).

CONCLUSION AND RECOMMENDATIONS

Level of compliance of local farmers to the use of banned cocoa pesticides in the selected cocoa producing states of Nigeria is still low. Source of cocoa pesticides used by includes agrochemicals retailers, Cocoa traders, Cocoa Association of Nigeria (CAN), and Agricultural Development Programme (ADP). The major sources of information on cocoa pesticides to the farmers are through television and radio, and Cocoa Research Institute of Nigeria (CRIN). Some of the banned cocoa pesticides still in use by some of the farmers include Basudin, Ridomil Plus and Gammalin 20. Although farmers agree with the health implications for the use of the banned pesticides yet they were still using some of the chemicals due to their perceived effectiveness in the control of pest and diseases, and cheapness.

A pertinent issue with pesticides in the country is inadequate information and appropriate registration of the agrochemicals. Bateman (2010) informed that before finishing the description on pesticide labels, it is important to stress the need for rigorous registration and label approval processes for permitted products. National pesticide guides that focus on locally recommended plant protection products are increasingly being published and are an important source of information on trade names, recommended application rates for different crop uses, *etc.* Where they are not available (or difficult for farmers to obtain), provision of such guidance in a user-friendly form, is an important role for Government and NGO extension agencies.

Base on the findings of this study, following recommendations are made:

- There is need for proper registration of all approved cocoa pesticides by the appropriate agricultural government agency in the country and farmers should be informed adequately about this.
- There should be adequate enlightenment by extension agents on the approved cocoa chemicals to the cocoa farmers as well as the sellers and suppliers of the agrochemicals in each of the cocoa producing states of Nigeria. For wide dissemination of this information,

there is need for proper use advertisement, programmes and jingles on radio and television, and extension agents from Cocoa Research Institute of Nigeria (CRIN).

- There should be collaborations among agrochemicals retailers, Cocoa traders, Cocoa Association of Nigeria (CAN), Agricultural Development Programme (ADP), National Agency for Foods and Drugs Administration and Control (NAFDAC), and Cocoa Research Institute of Nigeria (CRIN) in awareness creation on implications of use of banned cocoa pesticides and prevention of their circulation and/or use by farmers.
- Random checking of the chemicals in stock for sale to the public should be conducted so as to prevent circulation of banned agrochemicals – especially cocoa pesticides.
- With the issue of health and environmental concern on the use of agrochemicals coupled with the high cost of purchase to farmers, environmentally sound alternatives to agrochemicals should be supported and Integrated Pest Management strategies should be promoted.
- Banned agrochemicals should not be allowed into the country, monitoring group working in conjunction with Federal Environmental Protection Agency (FEPA) are to work out modality for the removal of banned chemicals in the market.

REFERENCES

- Asogwa, E. U. and Dongo, L. N., (2009). Problems associated with pesticide usage and application in Nigerian cocoa production: A review. *African Journal of Agricultural Research* 4 (8): 675-683. Available online at <http://www.academicjournals.org/AJAR>
- Asogwa, E.U., and Dongo, L. N., (2009). Problems associated with pesticide usage and application in Nigerian cocoa production: A review. *African Journal of Agricultural Research* Vol. 4 (8), pp. 675-683
- Bateman, R., (2010). Pesticide Use in Cocoa. A Guide for Training Administrative and Research Staff. 2nd Edition. International Cocoa Organization (ICCO), London. 70 pp
- Fajewonyomi, B.A., (1995). Knowledge, attitudes and practices (KAP) of farmers regarding the use of pesticides: A case study of a cocoa farming community in south- western Nigeria. *Ife Journal of Agriculture*, 16 &17: 98-198
- Ghana News Agency (GNA), (2011). Cocoa farmers advised to desist from using fake pesticides. *Agriculture*, Mon, 28 Mar 2011. Available online at: <http://www.modernghana.com/news/322130/1/cocoa-farmers-advised-to-desist-from-using-fake-pe.html>. Accessed 03 June, 2011.
- Ikemefuna, P.N., (1998). Agrochemicals and the environment. NOVARTIS Newsletter. 4: 1: 2.
- International Cocoa Organization (ICCO), (2008). Manual on pesticides use in cocoa. ICCO Press releases of 10 June 2008 by ICCO Executive Director Dr. Jan Vingerhoets. International Cocoa Organization (ICCO), London. Available online at <http://www.icco.org/about/press2.aspx?Id=v3110299>
- Ivbijaro, M.F.A., (1977). Gamma – BHC residues in kolanuts, *Cola nitida* and control of kola nut weevil, *Balanogastriis kolae* (Desbr). *Indian J. of Exp. Biol.* 15 (12): 1236-1238
- Ivbijaro, M.F.A., (1990). Natural Pesticides: Role and Production Potential in Nigeria. National workshop on the pesticide Industry in Nigeria University of Ibadan. Sept. 24 – 27, 1990. 24pp.

- Ivbijaro, M.F.A., (1998). National Programme on agrochemical technology. A keynote address presented at the Centre for Agricultural Technology, University of Agriculture, Makurdi, July, 26-29. 10pp.
- Li, X.D., Lee, S.L., Wong, S.C., Shi, W.Z., Thornton, I., (2004). The study of metal accumulation in urban soils of Hong Kong using GIS based approach. *Environ. Pollut.*, 129: 113-124.
- Meijden G, van der, (1998). Pesticide Application Techniques in West Africa. A study by the Agricultural Engineering Branch of FAO through the FAO Regional Office for Africa. 17pp.
- NAFDAC (National Agency for food and Drug Administration and Control), (1996). Pesticide Registration Regulations. BV303 – B307.
- National Cocoa Development Committee (NCDC), 2008. Cocoa Production Survey (2007). Final report submitted to National Cocoa Development Committee (NCDC) by Cocoa Research Institute of Nigeria (CRIN). 101 pp
- Nigeria Best Forum (NBF), (2010). NAFDAC warns cocoa farmers against use of pesticides. Online News of Nigeria Best Forum by Sunday Aborisade, Akure. Friday, 24 Sep 2010. <http://www.nigerianbestforum.com/generaltopics/?p=70232> . Accessed 03 June, 2011
- Oduwole, O.O., (2001). Sustainable cocoa production in Nigeria: Farmers perception of technology characteristics and socio economic factors
- Ogunlade, M.O. and Agbeniyi, S.O., (2011). Impact of pesticides use on heavy metals pollution in cocoa soils of Cross-River State, Nigeria. *African Journal of Agricultural Research* Vol. 6(16):3725-3728
- Omole, M.M., Youdeowei, A., Adeyemi, A.A., (1977). The present status of cocoa mirid resistance to chlorinated insecticides in Nigeria. Proc. 6th Int. Cacao Res. Conf. Caracas Venezuela. November 1977. pp. 380-383.
- Papworth, D.S. and Paharia, K.D., (1978). Value of pesticides registration regulation to developing countries. *Plant Protection Bulletin*, 26: 101-109
- Pimentel, D. Andow, D, Dyson-Hudson, R.O., Gallahan, D., Jacobson, S., Irish, M., Kroop, S., Moss, A. and Vinzant, B., (1980). Environmental and social cost of pesticide: A preliminary assessment. *Agriculture, Ecosystems and Environment*, 34: 127-140.
- Takagi, K., Kazuhiro, O., Ijeji, M. and Masako, A., (1997). Use, Research and Development of pesticides in relation to sustainable agriculture in Japan. *Japan Agricultural Research Quarterly*, 31: 13-20.
- Tijani, A.A., (2006). Pesticide Use Practices and Safety Issues: The case of cocoa farmers in Ondo State, Nigeria. *J. Hum. Ecol.*, 19(3) 183-190
- Vidal, J., Perez-Sirvent, C., Martinez-Sanchez, M.J., Navarro, M.C., (2004). Origin and behaviour of heavy metals in agricultural calcareous fluvisols in semi arid conditions. *Geoderma*, 121: 257-270, 26: 343-357.
- Youdeowei, A., (1971). Resistance of cocoa capsid to insecticides use in Nigeria. *Cacao Growers Bull.* 16: pp.15-20.
- Youdeowei, A., (1989). Provisional report on pesticide management in Anglophone West Africa. Prepared for FAO Rome.