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Analysis of Pesticide Use in Cocoa Production in Obafemi Owode Local Government Area of Ogun State, Nigeria.

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Abstract
The study focused on the economic analysis of pesticide use by cocoa farmers in Obafemi Owode Local Government Area of Ogun state. Specifically, the study determines pesticide use level by cocoa farmers; the relationship between cocoa output and level inputs used and problems faced by the farmers with the use of pesticides were also determined. Data collected were analyzed using descriptive statistics to examine the socioeconomic factors affecting pesticide use. Multiple regression analysis technique was adopted for determining the relationship between dependent and independent variable. Primary data were collected from fifty (50) cocoa farmers with the aid of well structured questionnaire as interview guide. The study revealed that cocoa production was more popular among illiterate farmers who constituted 40 percent of the respondents and majority of them were males with an average age of 61 years. The cocoa farmers had average of 14 people per household with an average farming experience of 47.5years. Majority (98.0%) of the farmers interviewed were married while about (2.0%) were single and they belonged to farmers' cooperatives. The average land area for cocoa production was 7.18 hectares. The study further found out the factors affecting pesticides use in cocoa production include: farming experience ($\alpha_{0.05}$), cost of pesticides ($\alpha_{0.01}$) and income of the farmer ($\alpha_{0.1}$).The value of the coefficient of multiple determination (R^2) for the quantity of pesticide use was 0.761. The problems associated with pesticides use in cocoa-based production system in the study were found to be high cost of pesticide, adulteration of pesticides and non-availability of the pesticide at designated buying centres at the right time. This study concluded that pesticide use in cocoa production is a major productivity enhancing resource, although farmers used it below the recommended rate. The study therefore recommended among others, that it is necessary to sensitize cocoa farmers on the use of pesticide at a recommended rate and that there is need to make it available at subsidized rate with a view to enhancing their productivity.
Keywords: Pesticides use, cocoa production, socio-economic factors and Regression analysis.

1. Introduction

Cocoa (Theobroma cacao) is one of the earliest cash crops cultivated in Nigeria. It is believed to have originated in the hot, humid region near the source of the River Amazon in South Africa (Mossu, 1992). It was introduced to Nigeria and other countries in West Africa during the 19th century. Prior to the discovery and exploitation of crude oil, cocoa was one of the major foreign exchange earners for Nigeria. It became an important export crop in Nigeria and other countries such as Ghana, Ivory Coast, Cameroon, Togo, etc. and attained its peak between 1954 and 1969. This was when it became the second largest and major source of foreign exchange earner for Nigerian government. Cocoa unquestionably has played a dominant role in the pace of economic development in the Western Region during its peak, providing employment opportunities for more than 1 million Nigerians (Hokona, 1994).

Cocoa is a tropical lowland crop. It grows best where the annual rainfall is at least 1140mm and where the mean temperature falls below 17^0C. It requires shade to reduce moisture evaporation especially on the early stages of its establishment in the field. It also requires a deep, fertile and well aerated loamy soil which must be loose and friable. The cocoa plant when mature reaches a height of 7.5 to 10.5m (Adegbola, 1979). Cocoa is grown mostly in Southern States such as Ondo, Oyo, Ogun and Osun. Apart from the role which crude oil is playing in Nigeria economy, cocoa production also contributes to the economy. It is of good advantage to the farmers, industry and government because it serves as a source of income to the farmers, as well as foreign exchange to the government. It is used to manufacture products like beverages, cream, sweet, etc. It also constitutes raw materials of important industries and by-product of those industries (e.g. husk, fat extracted from husk) are used to feed animals, manufacture fertilizers, etc. (CRIN, 2000).

However, decline in cocoa production was affected by so many factors some of which include effect of pest and diseases, high cost of inputs (fertilizers, pesticides, seeds, etc.), shortage of labour and so on. The effect of pest and diseases was the major factor which led to loss in economic productive value of cocoa. The solution to this effect of pest and diseases called for the use of pesticides by the farmers. In view of the negative role that pest and diseases play in cocoa production, their control has been of utmost importance among agriculturists.

The contribution of cocoa to the economy cannot be over-emphasized. One of the major problems facing cocoa production in Nigeria is pests and diseases outbreak and these include black pod disease, capsids and swollen shoot disease. The effect of pests and diseases reduced crop yield, losses in the value of foreign exchange, reduction in farmer's income and also reduction in government revenue, etc.

Unfortunately, Nigeria's annual cocoa production started declining steadily since 1970/1971 harvest season up till today. Nigerian fell from its comfortable position as the 2nd largest producer to the 4th position among the league of world cocoa producers. One of the reasons adduced for the deplorable state of production included amongst others, loss in economic productive value of coca tree planted early in the century due to overage, disease infection and also high cost of input such as pesticides and fertilizers and the reduction cocoa price in the international market.

1.1 Economic Importance of Cocoa Production

Cocoa is many things to most people. To the farmers, it is an important tropical perennial tree crop which generates his income for the up keep of his family and himself (Mossu, 1992). To the government, cocoa is a cash crop whose export provides much needed foreign exchange for financing capital projects. Cocoa has become a major foreign exchange earner for different West African countries growing it, like Nigeria, Ghana, etc. It has contributed considerable amounts to the capital savings of different countries and this money is being used to finance many capital development project. In Nigeria, between 1959 and 1968, an average of 78 million per annum was realized from cocoa sales in form of foreign exchange earnings (FAO, 1969). Also in 1969, cocoa earned N106 million or nearly 40% of N258 million obtained from all agricultural exports. These figures indicate the importance of cocoa to the Nigerian economy (FAO, 1971).

To the cocoa manufacturers or industry, it is a raw material that is use to produce many products. Cocoa beans is used in production of chocolate, sweet, cocoa drink, cocoa biscuit, cocoa wine and spirits, etc. (Ojeh, 1971). In recent years, the Cocoa Research Institutes of Nigeria (CRIN) has sponsored research into the manufacture of wine and spirits using both powdered and cocoa beans to which sugar and water are added (Soyele, 1971). In Western States of Nigeria, home economics section of the Ministry of Agriculture and Natural Resources was trying to popularized various drinks and food items made from local cocoa (Ministry of Agriculture, 1985). In Nigeria, locally produced food items from cocoa are cocoa bead, cocoa drink, cocoa cake, cocoa flakes, cocoa popcorn (guguru), etc. In addition, Adeyemi (1992), popularized the use of cocoa juice for wine making, jam and jelly making.

However, by products of this industry such as husks, fat extracted from husks and germs can be used to feed cattle, manufacture fertilizers, soap, pharmaceutical products, ceiling boards, shoe polish, etc (CRIN, 1998). It has also been found that cheap feed for pig can be produced using dried cocoa pod husk to replace 25% of maize in the feed composition (CRIN, 2000).

Cocoa is also of importance to consumers. To the consumers it is a food taken for pleasure, but with high nutritional value, making it a supplement to a balanced diet (Ojeh, 1979; CRIN, 2000). Cocoa is a complete food high in energy value due to its high level of minerals and vitamins which are important for growth (Mossu, 1992).

Cocoa is also of importance to researchers whose primary concern is to ensure its continued existence with better performance; it is a fascinating tree crop with numerous challenges for each category of specialists (Adegbola, 1998; Mossu, 1992).

The role of pesticides in cocoa production in Nigeria has in the past been assessed in terms of their contribution to the output and quality of cocoa. According to FAO/UN report (1972), the control of diseases and pests of cocoa in the cocoa belt of Western Nigeria, is said to have increased cocoa output by about 40 to 50 percent in recent years.

It has been suggested in the past that control of pests and diseases should be initiated when the pest population is low enough to cause damages whose naira value is equal to the cost of control. Youdewei (1971) argues that the treatment of pests when population are already high is unreasonable, because considerable damage would have been done by the time control measure are undertaken.

Different pesticides have been used in cocoa production with varying result. For effective control of weeds, black pod diseases, capsids and cocoa swollen shoot diseases, the following pesticides have been confirmed and

reported to be effective.
Weed growth decreased with increase in the herbicide rates. Folar 525 (Adeyemi, 1999) and Gramoxone (Adenikinju, 1988; Adeyemi, 1984) were reported to be effective for weed control. Asulox 40, Actril DS and Gramoxones which are all herbicides, have been reported to be effective in the control of weeds such as Tridax procumbens, Sida acuta and Chromolena odoratum, which are the most common weeds in a typical cocoa plantation (Adeyemi, 1984; CRIN, 2000). For black pod disease, three copper-based fungicides including Perenox (Cuprous oxide), BBS Procida (stabilized Bordeaux mixture) and Normal mixture (Lime and Copper sulphate 10:10:10) have been reported to be effective against black pod disease of cocoa (Lass and Egbe, 1972; Adegbola, 1998).
Furthermore, Gammalin 20 has been found effective against cocoa swollen shoot diseases (Adomako, 1992) and also chemicals such as Azodrin and Bidrin (CRIN, 2000). Insecticides such as Cocostar 210EC (Acetellic + Bifenthrin), Thiodan 35EC, Desiedan EC2 + 280, Basudin 600EC (Diazinon) were the insecticides recommended by Cocoa Research Institute of Nigeria (CRIN) for control of cocoa capsids and other important insect, pests of cocoa in Nigeria (Idowu, 1997). Lindane was evaluated under laboratory condition and it was found to be effective against cocoa capsids (Ojo and Idowu, 1984).
Pesticides are required in agricultural production mainly for crop protection but pesticides are extremely hazardous to the health of workers, general public and environment (International Labour Organization, 1991). However, Paolletic et al. (1989) reported that agricultural practices have adopted more and more, the use of chemical (fertilizers and pesticides) to produce crops since the 1940s. Amatobi (1994), however, pointed out that health hazards resulting from the use of pesticides; such as high mammalian toxicity, persistence in the soil and pollution of the environment of some pesticides were identified as early as late 1970s. According to the estimate from World Health Organization (WHO) in 1973, 50% of poisoning cases, 75% of fatal poisonings and about 500,000 people in the world are accidentally poisoned annually by insecticides. The spate of pesticides use in Nigeria is increasing and it has been estimated that Nigeria consumes about 1.3 million tones of pesticides per annum (FMARO, 2000). According to estimates the utilization rate of pesticides is about 30%, the remaining 70% of the pesticides is retained in the soil or drained with rain into the rivers and lakes (UNEP, 2002). By implication, the retained pesticides in the soil accumulate over years and may be translocated by arable crops which may be cultivated on the contaminated land. Consumption of such crop may have negative health effect on people.
Adesiyan (1992) reported that, pesticides expose human being to toxicity especially as a result of misuse of pesticides. Farmers or workers who apply the pesticide are faced with potential health hazards. Amatobi (1995) also pointed out that health hazards resulting from use of pesticides is mammalian toxicity.
Dung and Dung (1999) reported that the risk from pesticides exposure to farmers health increase with application because of fatal toxicity of chemical pesticides. Most of the farmers do not also have access to sprayer and protective clothing, and they engage in the use of un-orthodox method of mixing chemicals through the use of bare fingers to mix and their tongues to determine pesticide concentration (Bull, 1982). Other pre-disposing factors include the fact that peasant farmers who are mostly illiterates in Nigeria cannot read the instruction for pesticide application in terms of application rate and frequency of spraying and preventive techniques to adopt when spraying. Other effects of pesticide toxicity can either be chronic (in which case the effect of some non lethal dose is felt over a long time), which can lead to cancer, brain, liver or kidney damage or acute (in which the immediate effect of exposure to a single dose of the pesticide is felt), which leads to nausea, nervous symptoms and eventual death.

1.2 Statement of the Problem

The contribution of cocoa to the economy cannot be over-emphasized. One of the major problems facing cocoa production in Nigeria is pests and diseases outbreak and these include black pod disease, capsids and swollen shoot disease. The effect of pests and diseases reduced crop yield, losses in the value of foreign exchange, reduction in farmer's income and also reduction in government revenue, etc.
Unfortunately, Nigeria's annual cocoa production started declining steadily since 1970/1971 harvest season up till today. Nigerian fell from its comfortable position as the 2nd largest producer to the 4th position among the league of world cocoa producers. One of the reasons adduced for the deplorable state of production included amongst others, loss in economic productive value of coca tree planted early in the century due to overage, disease infection and also high cost of input such as pesticides and fertilizers and the reduction of cocoa price in the international market.
However, the broad objective of the study is to carry out the analysis of pesticides use in cocoa production in the study area. The specific objectives are to: describe the socio-economic characteristics of cocoa farmers in the

study area, identify the types of pesticide used by the respondents, and the level of use, estimate the relevant factors influencing pesticides use in cocoa production and explain the effect of pesticide use on cocoa output and make recommendations based on the findings.

1.3 Justification

Pesticides have been found to be the major control of pests and diseases of cocoa to increase its productivity and reduce effects of pests and diseases. Since cocoa constitutes raw materials of important industries and by-products of these industries such as husks, fat extracted from husks and germ can be used to feed cattle, manufacture fertilizer, soap, cream, sweet, etc, there is need to prevent cocoa from pests and diseases. Cocoa apart from being a source of revenue to farmers and government, it has some nutritional values. It is the main ingredients in beverages and chocolates which have a high energy value, rich in vitamins and is a source of mineral salts.

The study therefore, is justified to provide information on pesticide use in cocoa production. Information obtained from this study would assist policy formulation in the area of pesticides use in full agric production and establishment of a worthwhile framework that will facilitate effective and efficient use of pesticides among cocoa farmers in Nigeria.

2. Methodology

2.1 Area of Study

Ogun State in general is a relatively homogenous socio-cultural region inhabited predominantly by Yorubas. The study was conducted in Obafemi-Owode Local Government Area, located on longitude 3.4095^0 and latitude 6.8801^0, Ogun State, Nigeria. The headquarters is Owode which was created in 1976; it has a geographical area of about 104,787.07ha of Agric land, which is about 6.3% of the land covered by Ogun State.

Obafemi-Owode Local Government is bounded in the North by Odeda and Oyo State, in the South by Ifo and Sagamu Local Government, in the West by Ewekoro and Abeokuta South Local Government, and in the East by Remo North, Ikenne and Sagamu Local Government. The Local Government is located in the tropical forest zone with two distinct seasons, the wet and dry seasons.

The Local Government is made up of about 1,204 towns and villages. It is politically divided into 12 wards viz; Mokoloki, Oba, Ofada, Egbeda, Owode, Kajola, Ajura, Obafemi, Moloko Asipa, Ajebo, Onidundu and Alapako Oni. The Local Government is endowed with vast fertile land suitable for the cultivation of rice, kolanut, cocoa, maize, sugarcane and a variety of vegetables.

Both primary and secondary data were used for the study. The primary data were obtained through administration of well structured questionnaire among cocoa farmers in Obafemi-Owode Local Government Area. The questionnaires were used to collect qualitative and quantitative data from 50 randomly selected farmers. Data collection was done by personal interview of the respondents to determine their output level, usage of pesticides as well as socio-economic factors influencing usage. The secondary source of data collection included journals, articles, texts, bulletin, institute report, past project work, etc.

2.2 Sampling Technique

A multi-stage sampling technique was used in selecting cocoa producers in the study area. The target population for the study was cocoa farmers in Obafemi-Owode Local Government. The list of cocoa producing areas in the Local Government was collected from the Cocoa Development Unit (CDU) of the state. Five villages were selected randomly from the list of villages in the Local Government Area. Based on this, in each village, 10 farmers were again randomly chosen making a total of 50 farmers in all (table 1).

2.3 Techniques of data analysis

2.3.1 Descriptive statistics

Frequency tables and percentages were used to describe the socio-economic characteristics of the respondents. These includes: age, gender, marital status, educational qualification, religion, cocoa variety, household size, farm size, farming experience and others.

2.3.2 Multiple Regression Analysis

This is a technique for determining the relationship between dependent and independent variable. It was used to determine the relationship between cocoa output and other input. The multiple regression analysis is used in this study because it will help to analyze quantitatively the pertinent factors affecting the pesticide use by the

cocoa farmers.

The model is implicitly expressed as:

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6 U)$

Y = Pesticide use (₦)

X_1 = Farm size (ha)

X_2 = Income of farmer (₦)

X_3 = Educational background/Level (Number of years used in school.)

X_4 = Farming experience (Yrs)

X_5 = Cost of labour used (₦ /ha)

X_6 = Cost of pesticide (₦)

U = Error term

From the regression analysis, a number of tests were carried out, and the tests include: The R^2 test, the t-test, and the F-test. The R^2 is called the coefficient of multiple determinations and it shows the percentage of the total variation of the dependent variable explained by the regression plane i.e. by the independent variables. The higher the R^2, the better the goodness of fit and the value lies between 0 and 1.

The following functional forms were explicitly estimated:

Linear: $Y = \phi_0 + \phi_1 X_1 + \phi_2 X_2 + \ldots + \phi_6 X_6 + u$

Semi log: $Y = \log \phi_0 + \phi_1 \log X_1 + \phi_2 \log X_2 + \ldots + \phi_6 \log X_6 + u$

Double log: $\log Y = \log \phi_0 + \phi_1 \log X_1 + \phi_2 \log X_2 + \ldots + \phi_6 \log X_6 + u$

The best of the 3 functional forms was selected based on: Economic criterion in terms of a priori expectation of signs of coefficient. Statistical criterion in terms of values of coefficient of multiple determination (R^2), and t-test statistics.

2.4 Apriori expectation.

The coefficient of farm size (ϕ_1) is expected to be positive ($\phi_1 > 0$). That is the larger the farm size, the more the pesticide to be used by farmers.

The coefficient of income of the farmer (ϕ_2) is expected to be positive ($\phi_2 > 0$) because it influences the farmers management and maintenance capacity which has direct relationship with pesticide use.

The coefficient of educational background (ϕ_3) is expected to be positive ($\phi_3 > 0$) because the more educated the farmer is, the more enlightened the farmer is towards pesticide use. This has a direct relationship with pesticide use.

The coefficient of farming experience (ϕ_4) is expected to be positive, the more the farming experience, the higher will be the rate of pesticide use, farming experience has a direct relationship with pesticide use.

4. Results and Discussion

4.1 Socio-economic characteristics of respondent in the study area

The analysis shows that about 14% of the farmers interviewed for the study were less than 50 years of age. About 24% were between the age bracket of 51-60 years. 58% were between 61 and 70 years, 4% were between 71 years and above (Table 2). The average age of cocoa farmers was 61.4 years. The implication of this is that cocoa production seems to be attractive to people in their active age group, therefore provision of adequate incentives would boost cocoa production Ceteris paribus.

Distribution of farmers by gender shows that 98.0% were males while the remaining 2% were females. It means therefore that cocoa production enjoys more patronage among the males in the study area.

Distribution of farmers according to marital status shows that majority (98.0%) of the farmers interviewed were married while about (2.0%) were single.

Distribution of Farmers according to household size shows that majority (48%) of the farmers interviewed have between 11 and 15 people in their houses. The average household size of respondents was 14 people. This has implication on cocoa production because most of the farmers used both family and hired labour in their farm operations. The former form of labour would therefore be benefited from the farming household as a cheaper alternative.

Education status of the farmers indicates that larger percentage of the farmers (58%) has primary education, 32.0% attended secondary school, and 8.0% have no formal education while 2.0% have tertiary institution. This implies that most farmers were not well educated. This is likely to have effect on their management of resources and adoption of innovation in cocoa production.

Distribution of Farmers according to Years of Experience in Cocoa Production shows that 82% of the farmers

interviewed had more than 40 years of experience. The average years of experience in cocoa production was (48 years.). This indicates that farmers would have adequate technical knowhow which may positively influence pesticide use in cocoa production. Also, distribution of farmers according to farm size shows that majority (42.0%) of the farmers interviewed have farm size that was between 3 and 5 hectares while 8.0% cultivated between 6 and 8ha, 14.0% cultivated between 9 and 11ha, 4.0% cultivated between 12 and 14ha and 16.0% had less than 3 hectares of farm sizes. The average farm size of 7.18 hectares indicates that cocoa farmers were relatively medium scale produces.

Distribution of Farmers according to varieties of Cocoa shows that 78.0% of farmers planted hybrid while 4% and 18.0% planted Amazon and Amelonado respectively. This is due to increased accessibility of farmers to enlightenment programmes to boost agricultural production, because most of the farmers who planted hybrid varieties got this knowledge from their participation in agricultural programmes by the Ogun State Agricultural Development Programme (OGADEP).

From the analysis, it was observed that most of the cocoa farmers make use of fungicides, since majority of them are affected by black pod disease which is a very common disease in their farms caused by Phytophthora palmivora. The predominant type of fungicides used in this respect were Bordeaux mixture, Basudin and Ridomil plus.

Table 3 shows the distribution of problems faced by cocoa farmers. The ranking revealed cost of pesticide as the highest problem encountered by the cocoa farmers. The aeronautical price of the pesticides makes it almost impossible for these cocoa farmers to purchase and applied to their farms and this financial shortcoming led to infestation of pest and diseases which resulted in low productivity and less profit margin.

Another identifiable problem faced by the cocoa farmers that has the least ranking was the cost of spraying equipment according to the ranking. This includes knapsack sprayer, boom sprayer e.t.c. Others problems includes equipment availability, pesticides availability and adulteration of pesticides.

4.2 Relationship between Pesticide use and inputs

Regression analysis was used to determine estimate the influence of the relevant factors affecting pesticide use in cocoa production as indicated in table 4. This is with a view to revealing those parameters that are of significance to pesticide use in cocoa production the study area. Three functional forms were used to estimate the pesticide use function. These include the linear, semi –log and double log forms. The results are presented in table 4

The three functional forms tried were examined in terms of the significance of each production functions as indicated "F" value, the magnitude of the coefficient of determination (R^2) and the appropriateness of the signs of the regression coefficient to the

appropriate expectation. Using the above criteria, the double logarithmic function was chosen as the lead equation based on the statistical criteria such as R^2, number of significant regression coefficient and value of the F –ratio. The a priori expectation including the magnitude and signs of the coefficient were also used in selecting the equation of best fit. The double log equation is significant at 1%, 5% and 10% probability level respectively.

The values in parenthesis represent the t-test. The relationship between pesticide use and the explanatory variables in presented is equation below.

The value of the coefficient of determination (R^2) for the pesticide use was 0.761. This implies that 76.1% of the variation in pesticide use was explained by explanatory variables such as income, farming experience, cost of labour used and cost of application of pesticide.

This also means that 23.9% of the variation in the use of pesticide in cocoa production was accounted for by other variables not included in the regression model. The F –test indicates the overall equation is statistically significant at $P<0.01$. The coefficient X_2 for income of farmer, X_4 for the farming experience of farmers and X_6 for cost of pesticide, had correct signs and consistent with the a priori expectation. Coefficient X_2 and X_5 are statistically significant at 10%, while X_4 was significant at 5%.

The study showed that income of the farmers was positively related to the level pesticide use. This result shows that one naira increase in the income level of the farmers will cause the pesticide use to rise by 0.335 units. This is an indication that income is a critical factor to be reckoned within the estimation of pesticide use by farmers. This is consistent with the findings of Dung and Dung (1999) in his study on estimating pesticide productivity and cost of pesticide.

Similarly a proportional increase in the farming experiences of farmers by one unit will increase the pesticide use by 0.260 units. This is in accordance with the a priori expectation. The equation above shows the effects of the explanatory variables on the dependent variable, pesticide use out of all the seven explanatory variables captured in this study, X_2 (income of the farmer), X_4 (farming experience) and X_5 (cost of labour) were found significant at 10%, 5%, 1% respectively. This implies that these variable exerted significant influence on pesticide use in the

study area. X_2 (income of farmers ₦) being significant at 10% level showed a positive relationship with the pesticide use in cocoa production, which was in conformity with the a priori expectation. It implies that for every additional increase in the income of farmers by ₦1, the level of pesticide use in cocoa increases by 0.084 Naira. X_4 (farming experience) being significant at 5 percent showed a positive relationship with the level of pesticide use in cocoa production, which also conform to the a priori expectation. For every additional year of experience in farming, 0.107units increases the pesticide use in cocoa production. X_6 (cost of pesticide) being significant at 1 percent level, showed a positive relationship with the pesticide use in cocoa production with respect to the farm size.The higher the cost of pesticide the lower will be the pesticide used.

5. Conclusion

Pesticide use in cocoa production has been found to be a necessary requirement to increase yield of cocoa per hectare and cocoa farmers are aware of this. The fact that cocoa farmers are aware of the importance of pesticide use on Cocoa farm, most of them are not using pesticide at the optimal level, which was attributed to the low level of education of the cocoa farmers, the high cost of pesticide and problem of adulteration. If these problems are given due attention, more people will be encouraged to go into cocoa production and there will be increase in cocoa output when pesticides is accessible and affordable. It is therefore safe to conclude that enhancing high cocoa yield cannot be done without the use of pesticides; if however requires the adoption of best practice guideline with respect to quantity of pesticide used. To further stimulate the availability of pesticides to farmers at lower prices, policy on the removal of duties on imported agro-chemicals would assist as a short term measure. Furthermore, strengthening the local industries involved in pesticide manufacturing through the provision of an enabling environment to operate at reduced cost of production could be a long-term solution. The alternative use of Agro-Service Corporations towards the supply of agrochemical to cocoa farmers should take into consideration diversionary strategies employed by operators and the timeliness of agricultural activities, especially as it relates to cocoa that is susceptible to insect pest damage at every stage of development.

References

Adegbola, M.O.K. (1979). Cocoa diseases of West Africa. Paper delivered at the 7th International Cocoa Research Conference, Douala, United Republic of Cameroon, November, 1979.

Adegbola, M.O.K. (1998). "Evaluation of the effectiveness of Cocoa Pesticides" Annual Report of Cocoa Research Institutes of Nigeria (CRIN). Page 22-23.

Adenikinju, S.A. (1998). "Weed control with Gramoxone, Gramuron and Round up in mature cocoa". Annual Report of Cocoa Research Institutes of Nigeria (CRIN), 1998.11pp.

Adeyemi, A.A. (1999). "Weed control in mature cocoa with Folar 525". Annual Report of Cocoa Research Institutes of Nigeria (CRIN), Ibadan. Page 6-7.

Adeyemi, S.A.O. (1992). "Current status of insecticides in controlling cocoa pests in Nigeria". Annual Report of Cocoa Research Institutes of Nigeria, Ibadan.

Amatobi, C.I. (1995): "Insecticides application for economic production of cowpea grains in the Northern Sudan Savannah of Nigeria". International Journal of Pest Management 41(1) 14-18.

Cocoa Research Institutes of Nigeria (CRIN) (2000): Information Booklet, page 10.

CRIN 1998, 1999, 2000: Cocoa Research Institutes of Nigeria, Annual Report, 1998,1999 and 2000.

Dung, N.H. and Dung, I.T. (1999): Economic and Health Consequences of Pesticides use in paddy production in the Mekong Delta, Vietnam. Research Report submitted to the International Development Research Centre (IDRC) Ottawa, Canada.

Food Agricultural Organization (FAO): Cocoa Statistics (1969) Volume 14.

Food Agricultural Organization (FAO): Cocoa Statistics (1971), Volume 16.

FRIN (1990): Forestry Research Institutes of Nigeria, Annual Report, 1990.

Hokana, F. (1994): World Cocoa Bean Production. World Agricultural Production (!994). No. 10, 36-39

Idowu, O.L. (1997): "Evaluation of Cocoa Insecticides". Annual Report of Cocoa Research Institutes of Nigeria (CRIN), Ibadan, 1997, pg. 25-29.

Ministry of Agriculture (1985): Uses of Cocoa-Commercial and Local.

Mossu, G. (1992): Cocoa. Macmillan Press Limited, London and Basingstoke, 103pp.

Ojeh, O.A. (1979): Uses of Cocoa. Text of a lecture delivered to Cocoa and Tree Crop Development Units Field Staff at the Annual In-Service Training organized by Cocoa Research Institutes of Nigeria (CRIN), 28the September, 1979.

Opeke, L,K. (1990): Tropical Tree Crops. Cocoa diseases and their control, 322pp.

Opeke, L.K. and Gorenz, A.M. (1974): Chemical Control of Black pod diseases. Fungicides. In Gregory, P.H. (ed) Phytophthora disease of cocoa. Longman, London, pg. 235-257.
Paolletic, M.G.; Stinnor, H.R. and Lorenzoni, G.G. (1995): "Introductory note for theProceedings of an International Symposium on Agricultural Ecology and Man. 5-7 April, 1994, Padora, Italy". Agricultural Ecosystem and the Environment 27 (1-4), 1-2.
Soleye, W.A. (1971): Processing of Cocoa for the Markets. Progress in Tree CropResearch in Nigeria, Cocoa Research Institutes of Nigeria (CRIN), Ibadan. Page 7-9.
UNEP (1979): United Nations Environment Programme, Annual Report, 1979.
Warren-George, W. (1975): Pesticides. An Auto-Nutritional Approach. W.H. Freeman and Co., USA. 1-5.
Youdewei, A and Mike, W. (1995): "Pests and Vector management in the tropics". Concepts of Pest Management in Agriculture. Longman Nigeria PLC. Page 26-27.

Table 1: List of villages covered.

Local Government Area	Village covered	No. of Farmers interviewed
Obafemi-Owode	Mokoloki	10
	Alapako Oni	10
	Kajola	10
	Ajura	10
	Owode	10

Table 2: Socio-economic characteristics of respondent in the study area

Socio-economic characteristics	Frequency	Percentages (%)	Mean
Age			61 years
< 50	7	14	
51 – 60	12	24	
61 – 70	29	58	
71 – 80	2	4	
Gender			
Male	49	98	
Female	1	2	
Household Size			14
< 10	18	36	
11 – 15	24	48	
16 – 20	5	10	
> 21	3	6	
Educational Level			
No formal education	4	8	
Primary education	29	58	
Secondary education	16	32	
Tertiary education	1	2	
Years of Experience			47.5
< 40	14	28	
41 – 50	23	56	

51 – 60	10	20	
> 61	3	6	
Farm Size			7.18ha
< 3	8	16	
3 – 5	21	42	
6 – 8	4	8	
9 – 11	7	14	
12 – 14	2	4	
> 15	8	16	
Varieties of Cocoa			
Amelonado	9	18	
Amazon	2	4	
Hybrid	39	78	
Type of Pesticides			
Insecticides	-		
Nematicides	-		
Fungicides	50	100	
Acaricides	-		
Avicides	-		
Herbicides	-		
Rodenticides	-		

Table 3: Distribution of problems faced by cocoa farmers

High Cost of Pesticides	Equipment In-availability	Pesticide In-availability	High Cost of spraying equipment	Adulteration of Pesticide
1**	4	3	5*	2

*Least Ranked

** Highly Ranked

Table 4 Regression result for the quantity pesticide use in cocoa production

Functional form	b_0	b_1	b_2	b_3	b_4	b_5	b_6	R^2	$\bar{R}^2$	F
Linear	-17.063	-.0.028	0.071	-0.090	0.167*	0.026	0.773***	0.761	0.723	20.132***
t-value	(26.490)	(-0.336)	(0.804)	(-1.105)	(1.678)	(0.279)	(8.028)			
Semi log	2.714	37E – 03	77E – 04	-0.146	86E-03	95E-06	04E-05	0.707	0.661	15.313***
t-value	(4.890)	(0.373)	(0.480)	(-1.315)	(0.632)	(1.236)	(6.915)			
Double log	-7.828***	0.002	-0.084*	-0.121	0.107**	0.013	0.080***	0.761	0.723	20.185***
t-value	(-2.463)	(-0.002)	(1.933)	(-1.488)	(3.101)	(1.482)	(8.893)			

* - Coefficient significant at (10%) level

** - Coefficient significant at (5%) level

*** - Coefficient significant at (1%) level