



ANALYSIS OF AGROCHEMICAL USAGE AMONG SMALL-SCALE COCOA FARMERS IN ONDO STATE, NIGERIA

Ibidapo, I.

Department of Agricultural Science, Adeyemi Federal University of Education, Ondo

(Email: ibidapo68@gmail.com; <https://orcid.org/0009-0006-6725-4234>)

Phone: +2348032282432

ABSTRACT

This study analysed usage of agrochemicals among small-scale cocoa farmers in Ondo State, Nigeria. Two hundred and forty cocoa farmers were selected through multistage sampling procedure. Information on socio-demographic variables, frequency and effects of agrochemicals usage were elicited using semi-structured questionnaire. Data collected were analysed with descriptive statistics (frequency distribution counts, mean, and standard deviations) t-test analysis and double hurdle model. Results showed the mean age of cocoa farmers was 47.7 ± 7.5 years, 55.4% were male, 61.7% were married and 52.5% had primary education. Common agrochemicals used by cocoa farmers were herbicides, fungicides and fertilizers. Wearing of gloves and boots, protective clothes and adherence to manufacturers' instructions were mechanisms adopted to mitigate hazards of agrochemicals usage on farm. T-test analysis revealed a significant difference between male and female headed households in the usage of agrochemicals ($t = 5.642$; $df = 1$; $p \leq 0.001$) at 5% level of significance. Results of the double hurdle model revealed that age($\beta = 0.062$), education($\beta = 0.118$), income($\beta = 0.084$), cultivated farm size($\beta = 0.018$) and access to credit($\beta = 0.084$) were the significant variables influencing the use of agrochemicals while frequency of usage was enhanced by age($\beta = -0.013$), education($\beta = -0.075$), access to personal protective equipment($\beta = 0.005$), farm income($\beta = 0.061$) and farm size($\beta = -0.014$). Agrochemicals help to increase yield, control weeds, pests and diseases on cocoa farm. It was recommended that education and training on agrochemicals usage, credit facilities and provision of protective equipment should be provided by government while use of protective equipment should be encouraged.

Keywords: Agrochemicals, fertilizers, herbicides, protective equipment, small-scale farmers.

INTRODUCTION

Agrochemicals are inorganic compounds that are used to control pests and diseases, control weeds, increase soil fertility and boost productivity, among others (Oyekale, 2022). On the farm, different agrochemicals are being used ranging from fertilizers, herbicides, rodenticides and fungicides in cocoa production. Studies (Adejumo, 2014; Oyekale, 2022) revealed that the use of agrochemicals on crops production helps to increase yield, control

the pests and diseases affecting crops, increase farmers' productivity on the farm, enhance maturity and preservation of crops. However, agrochemicals are not but without some adverse effects such as contamination, human toxicity, respiratory, skin and nervous system problems. Cocoa is an important crop that generates income, provides employment, and serves as source of raw materials to industry and as means of livelihood to the rural farmers (Adejumo, 2014). It contributes about 41.6% to the Gross

Domestic Products (GDP) of Nigerian economy (Adekunle and Ibidapo, 2010). Cocoa production is plagued with numerous problems such as climate change, declining soil fertility, high exposure to droughts and temperature extremes and high incidence of pests and diseases which accounted for low productivity (Oyekale, 2022). Diseases and pests have been reported to be the most prominent cause of low productivity in cocoa farming. For example the most damaging disease is cocoa pod disease is the black pod caused by fungus (*Phytophthora megakarya*). This disease has the potential to reduce the output of cocoa production by 40–90% (Adejumo, 2014). Pesticides application are the most common and preferred agrochemical used in controlling the outbreak of pests and diseases in cocoa production. Pesticides usage has been discovered to have adverse effects on both human health and the environment such as; contamination of food, groundwater, soil and the air as well as biodiversity if used with little caution or non-adherence to control measures (Adejumo, 2014). Several studies have been carried out by scholars on economic and environmental factors affecting pesticides usage (Ngabirano and Birungi, 2020; Oyekale, 2022; Oppong and Attuah, 2016), among others.

Despite these findings the usage is found to be on the increase however, there is limited empirical evidence on analysis of agrochemical usage among cocoa farmers particularly in the study area. Finding of this study will provide information on the effects of agrochemical usage on cocoa production, not only that it will help on the proactive handling and usage of agrochemicals on the farm. It will also enhance the forms of training and education to be provided to cocoa farmers on the use of agrochemicals for increase productivity. Hence, the study analysed agro-chemical usage and factors influencing the usage in the Ondo state, Nigeria.

Objectives of the Study

Specifically, the study examined the socio-economic characteristics of cocoa farmers, common agrochemicals used in cocoa production in the study area, precautions against effects of agrochemicals, factors influencing agrochemicals usage and the frequency of usage among cocoa farmers.

MATERIALS AND METHODS

Study area

The study was conducted in Ondo State, Nigeria. Ondo State has a land area of 14, 798.8 square kilometers with an estimated population of 7,930,787 people (National Population Commission of Nigeria, (NPC, 2021). The State lies on a bearing of latitude $5^{\circ} 45'$ and $8^{\circ} 15'$ North and longitude $4^{\circ} 45'$ and 6° East of the equator. The study area favours the cultivation of both arable and cash crops.

Sampling Techniques and Sample Size

Multistage sampling procedure was used to select smallholder cocoa farmers for the study. A purposive selection of three major cocoa producing local government areas; Owo, Ondo-west and Odigbo was performed at stage one. Stage two comprised random selection of 10 communities/villages while 8 smallholder cocoa farming households were randomly selected in the third stage from the Agricultural Development Programme (ADP) list of registered cocoa farmers association in each of the villages. A total 240 smallholder farmers were used for this study.

Methods of Data Collection and Analysis

Primary data were collected on socio-economic characteristics of smallholder cocoa farmers, types of agrochemical used, and usage of agrochemicals in the study area using structured questionnaire. Data collected were analysed with the aid of descriptive statistics (simple percentage, mean and standard deviation), t-test

analysis and double hurdle model. In cocoa production, a cocoa farmer must decide to participate in the use of agrochemical with a positive frequency of usage, the double hurdle model (DHM) is expressed (Khoza *et al.*, 2019);

$j_{i1}^* = w_i \alpha + d_1$ = decision to adopt use agrochemicals;

$j_{i2}^* = X_i \beta + \mu_1$ = frequency of usage of agrochemicals; $j_i = X_i \beta + \mu_1$ if $j_{i1}^* > 0$ $j_{i2}^* >$

0 or 0 = otherwise; $j_{i1}^* = 1$ = yes; 0 = otherwise; $j_{i2}^* =$

number of times or frequency of usage of agrochemicals; X_i = explanatory variables;

d_1 and μ_1 are error terms.

where X_i are explanatory variables;; X_1 = age (yrs); X_2 = age squared (age ²); X_3 = sex (1 =

male; 0 = otherwise); X_4 = marital status (1 = married; 0 = otherwise); X_5 = education (yrs); X_6

= experience (yrs); X_7 = income (₦); X_8 = household size (number); X_9 = farm size hectares);

X_{10} = remittance received (₦); X_{11} = credit access (1 = yes; 0= no); and X_{12} = access to

protective equipment (1 = yes; 0= no).

RESULTS AND DISCUSSION

Socio-economic Characteristics of Cocoa Farmers

The results of the socio-economic characteristics of cocoa farmers revealed that 57.9% of the cocoa farmers were male while 42.1% were female household heads with mean age of 46.7 ± 5.804 years suggesting that cocoa farmers are within the active age. The marital status showed that 62.0% were married with mean household size of 9.0 ± 3.0 members. The

mean years of experience and cultivated farm size were 11.5 ± 2.540 years and 2.5 ± 1.421 hectares, respectively. The mean cultivated farm size concurs with the definition of smallholder farmers (Federal Office of Statistics (FOS, 1999). On educational attainment of cocoa farmers in the study area, 48.3% had primary education which could be attributed to poor understanding of the usage and adverse effects of agrochemicals in cocoa production.



Table 1: Socio-Economic Characteristics of Cocoa Farmers n = 240

Variables	Frequency	Percentage (%)
Sex		
Female	101	42.1
Male	139	57.9
Age		
<31	4	1.7
31 – 45	75	31.3
46 – 60	143	59.6
>60	18	7.5
Mean/SD	46.7±5.804	
Marital Status		
Single	33	13.8
Married	149	62.0
Widowed	30	12.5
Divorced/Separated	28	11.7
Household Size		
Mean/SD	8.6±3.901	
Years of Experience		
Mean/SD	11.5±2.540	
Cultivated Land Size		
Mean/SD	2.5±1.421	
Education		
Primary Education	116	48.3
Secondary Education	50	20.8
Tertiary Education	17	7.1
Non-formal Education	57	23.8

Source: Field Survey, 2024

Uses, Effects and Categories of Agro-Chemicals Used by Cocoa Farmers

Table 2 showed the results of uses of agrochemicals by cocoa farmers, it was found out that agrochemicals were used to control pests and diseases (27.1%), weeds (13.3%), increase soil fertility and preserve crops on the farm. On effects of agrochemicals, skin irritation 32.5% accounted while 23.3% indicated human toxicity, among others. On the precautions to adopted by farmers when using agro-chemical in cocoa production, wearing of gloves, glasses and protective clothes accounted for 35.8% while avoiding the use of agro-chemicals

containers for food was represented by 27.1%. The above findings agree with Oyekale (2022) that wearing of protective clothes, gloves and glasses and avoidance of usage of agro-chemical containers are some of the precautions against adverse effects of agro-chemicals on the farm. Other precautions identified were avoidance of food while using agrochemicals, do not spray against the direction of wind on the farm. Analysis by categories of agrochemicals used by cocoa farmers on the farm revealed that fungicides accounted for 64.2% followed by herbicides with 22.5% (Table 2).

Table 2: Uses, Effects and Categories of Agrochemicals Used by Cocoa Farmers n = 240

Variables	Frequency	Percentage (%)
Uses of Agrochemicals on Farm		
Control Pests and Diseases	65	27.1
Control weeds	32	13.3
Increase the fertility of the soil	39	16.3
Preservation of Crops	40	16.7
Use in soil treatments	28	11.7
Increase Crop Production/Yield	20	8.3
Control Animal Parasites	11	4.6
Others	5	2.1
Effects of Agrochemicals		
Irritation/Skin rashes	78	32.5
Human Toxicity	56	23.3
Respiratory Problems	43	17.9
Contamination of Soil/Water	27	11.3
Food poison/Residues	36	15.0
Precautions on Usage of Agro-Chemicals		
Wearing of gloves/Protective clothes	86	35.8
Avoid the use of agro-chemical containers	65	27.1
Avoid spaying in direction of wind	20	8.3
Follow the manufacturers' recommendations	30	12.5
Do not eat while using agro-chemicals	39	16.3
Categories of Agrochemicals Used		
Fungicides	154	64.2
Fertilizers	54	22.5
Herbicides	26	10.8
Avicides	6	2.5

Source: Field Survey, 2024

Independent Sample T-test Cocoa Farmers Usage of Agro-Chemicals Based on Gender

The result of the t-test of independent sample analysis (Table 3) of difference between male and female households headed use of agrochemicals among cocoa farmers revealed a significant difference between male and female

households in the use of agrochemicals ($t = 5.642$; $df = 1$; $p \leq 0.0001$) at 5% level of significance. This suggests that more male household heads cocoa farmers use agrochemicals than female household heads in cocoa production.

Table 3: t-test of gender difference in the use of agrochemicals among cocoa farmers

Gender	N	Mean ()	Std. Deviation	df	T	Sig. (2-tailed)
Female	101	24.97	2.69	238	5.602	.001
Male	139	25.94	2.62			

Source: Author's Computation, 2024 Significant @ $p \leq 0.05$

Factors Influencing Agro-Chemical Usage and Frequency of Usage

On factors influencing agrochemical usage and frequency of usage, the results of the double hurdle model (Table 4) revealed that the log-likelihood was -138.0976, LR $\chi^2(12) = 164.8031$ Prob> $\chi^2 = 0.0000$ showing the fitness of the model. The analysis revealed that age, sex, education, income, cultivated farm size, remittances received and access to credit were the significant variables influencing the use of agrochemicals while the frequency of usage of agrochemicals by cocoa farmers was enhanced by age, age squared, education, income, farm size, and access to personal protective equipment. The results suggest that a year increase in age increased the probability

and frequency of agrochemical usage, at intermediate age (age squared) the frequency of use decreases, being male also increased the probability of agrochemical usage. Increase in years of completed education increased the probability and frequency of usage because education is important in acquisition of skills, training and information about usage of agrochemicals (Oyekale, 2022). Increase in income farm size, remittances received (money received from relatives in city or abroad) and credit access increase the probability of agrochemical usage by cocoa farmers while increase in farm size decreased the frequency of usage. However, Access to protective equipment increase the frequency of agrochemical usage.



Table 4: Factors Influencing Agrochemical Usage and Frequency of Usage

Variables	First Hurdle (Probit)		Second Hurdle (Truncated)	
	Coeff.	p>/z/	Coeff.	p>/z/
Age (yrs)	0.062**	0.044	0.013**	0.030
Age Squared (yrs ²)	-0.410	0.168	-0.213**	0.014
Sex (male =1; 0 = otherwise)	0.524***	0.004	-0.532	0.231
Marital Status (1= yes; 0 =no)	0.086	0.464	-0.334	0.218
Education (years)	0.118**	0.013	0.075**	0.011
Farming experience (years)	-0.076	0.206	-0.020	0.950
Income (₦)	0.084**	0.022	0.061**	0.024
Household Size (number)	-0.022	0.944	0.524	0.319
Farm Size (hectares)	0.218***	0.000	-0.014**	0.016
Remittances received (₦)	0.232**	0.033	0.388	0.201
Credit Access (1= yes; 0 =no)	0.034**	0.015	-0.102	0.300
Access to protective (1= yes; 0 =no)	-0.076	0.206	0.064***	0.005
Constant	-7.689***	0.001	5.540***	0.000
Observation	240			
Log-likelihood	-138.0976			

Source: Author's Computation, 2024 Prob>Chi² = 0.0000; LR Chi²(12) = 164.8031; *** & ** Sig. @ 1% and 5%.

CONCLUSION

The usage of agro-chemical has gain wide recognition among cocoa farmers not only that it helps to control pests and diseases in cocoa production, agro-chemicals help to control weed thus enhance farmers' productivity and income. However, agro-chemical usage in cocoa production is not but without adverse effects which include skin irritation, respiratory problems and contamination of foods. The use of protective covering could help to reduce these affects on the farmers.

RECOMMENDATIONS

Based on the findings, it is recommended that cocoa farmers should be trained and educated on the use and precautions to be taken when using agrochemicals on the farm. Also, access to protective materials, credit and farm land will encourage agrochemical usage and frequency of use.



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