Utilization Pattern of Pesticides by Nigerian Farm Households

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ABSTRACT

A study on pesticide utilization and training needs for Nigerian farm households was conducted in Akwa Ibom State. Two hundred and seventy two randomly selected farmers from a population of 14,640 took part in the study. Questionnaire was used to collect data from the respondents. Descriptive and inferential statistics were used to analyze the data. The study reveals that the level of adherence to correct utilization of pesticides is significantly dependent on its determinant socioeconomic characteristics, knowledge level, information communication source and constraints. Besides, 34.2% and 32.8% respondents often and always respectively purchase pesticides from AKADEP, which is an authentic source. The study further reveals that some banned pesticides are still found in circulation and used by farmers. Training of farmers on pesticide use is necessary especially in handling of pesticides by respondents during and after utilization.

Key words: *Pesticide; Utilization; Training;*

Pesticides are substances or mixtures of substances intended to repel or combat pests that attack plants and animals. According to *Anyim (2003)* pesticides are regarded as a basic tool in pest management because they provide a dependable, rapid and effective means of controlling most of the pests when used judiciously. Pesticides by their nature are harmful to man and environment. This is noted by *Ibitayo (2007)* that pesticides are however, poisonous by design and poisonings result from unsafe use of these chemicals. Consequently, pesticides may be the most prevalent and serious occupational hazards faced by farmers and agricultural workers in the Nigeria.

Pesticides were introduced into the Nigerian farming systems because pests and diseases damage had been identified on a world wide basis to be a major constraint to increased crop and animal production with an estimated loss of 30% and 33% or more in many crops and animals production respectively on annual basis. In crops like cowpea (*Vigna unguiculata* L. Walp) and second season maize (*Zea mays* L.), it was literally possible to obtain no yield if the crops were not protected from pests and diseases, National Agricultural Extension and Research Liaison Services (*Naerls, 1995*). Moreover, as observed by Y*oudeowei (1989)*, pest damage in storage places is estimated to range from 5 to 70 per cent.

However, at the 7th International Cocoa Research Conference the Nigerian delegates reiterated the main problem confronting cocoa protection in Nigeria as very low yield due to pests and diseases, which are capable of destroying more than half of the production (*Anonymous, 1979*). As the loss to cocoa farmers became imperative, *Lodeman (1988)* then observed the prominence in the use of technology in the application of pesticides to effectively control pests and diseases with various types of knapsack sprayers. This move was necessary to reduce produce and financial losses to provide food and income at a sustainable level. However, pesticide use is associated with risk and can be hazardous if not handled properly. It was disclosed by *Fajewonyomi (1995)* that cocoa farmers using pesticides containing Aldrin, Gamma BHC, Copper sulphate, Paraquate dichloride and related agro chemicals face constant exposure to these pesticides.

But human exposure to pesticides is an important

health and social issue as it usually results in serious health problems and even death. For instance, "official sources in Benin recorded that at least 37 people died over the 1991–2000 cropping season due to pesticide poisoning. The source was the hazardous insecticide, Endosulfan, introduced because of cotton pest resistant to pyrethroid pesticides", (International Projects, Pesticide Action Network, 2000). The harmfulness of pesticides, *Yudeman and Nygaard (1998)* disclosed that there is a high probability that pesticide use and pesticide induced side effects will grow more rapidly in the developing countries as a whole than in the developed ones. This is because of weak regulations bearing the importation and use of dangerous chemicals and the inactivity or absence of government and non-government environmental control agencies.

Nigeria in general and Akwa Ibom State in particular are not isolated from the global effects of pesticides due to inadequate education and regulations on the proper use and storage of fresh foods by most rural farmers and food retailers. More than 6,00,000 farming households in Akwa Ibom State have been exposed to various problems due to poor handling and use of pesticides and being exposed to hazards from pesticides stored in farm homes according to *Udoh (1998)*. The rural communities may be the most vulnerable to the harmful effects of pesticides since more than 75 per cent of farming activities are carried out in the rural areas. Many of these rural farmers do not have proper education on the correct quantity of pesticides to be applied to crops and the right period of application. The left over pesticides are carelessly handled not considering the harmfulness to their lives and those living around them. This could not be unconnected with weak regulations and guidelines for implementation by relevant authorities in the country. For these reasons, it is observed by *Okopido (2002)* that pesticide misuse and abuse are likely to be rampant due to inadequate education on the guidelines and controls on safe use and disposal of containers, and limited awareness about the lethal toxicity of these chemicals.

Although pesticides can be used to effectively combat pests of crops and livestock for improved yield, improper usage and control may result in unintended consequences. In Akwa Ibom State, information on proper use of pesticides appears relatively scanty among farmers and other pesticides users. The seemingly, dearth of information on pesticide therefore calls for concern. In Nigeria, to attain food sufficiency, the government encourages farmers to use improved seeds, fertilizers and the use of some recommended agro-chemicals or pesticides. "Pesticides as an agricultural input are composed of active ingredient and inert materials which are used in their formulation to control pest and diseases" as observed by *Lawal et. al. (2005)*. *Atu (1990)* noted that most of these pesticides are dangerous, toxic and can cause serious health hazard to human beings.

Against this background, the study examined the socioeconomic characteristics of the farmers, the pesticides used by farmers in Akwa Ibom State of Nigeria, sources and types of the pesticides used by the farmers and level of awareness and adherence to pesticide use by the farmers. This study is of immense benefit to farmers and the general public because they will know the recommended and banned pesticides and the dangerous effects of these pesticides on human health. Farmers will also know the correct methods of pesticides utilization on their farms. The danger of mishandling agro-chemicals at pre and post application on the farms will be evaded. This work will also create more data for other researchers in the area of pesticides and environment oriented studies in Akwa Ibom State in particular and in Nigeria in general.

A null hypothesis was stated that the level of adherence to correct utilization of pesticides by farmers in the study area is not significantly dependent on its determinant socioeconomic characteristics, knowledge level, information communication source, and constraints.

METHODOLOGY

The study was conducted in Akwa Ibom State located in the Southeastern Zone (Latitude 4o33' and 5o35'N and longitude 7o35' and 8o25'E) of Nigeria. The major crops grown in the state are oil palm, cocoa, coconut, cassava, rice, plantain, banana, and vegetables (*Akwa Ibom Ministry of Agriculture, 2005*). The state is divided into six agricultural zones. Three zones were randomly selected to take part in the study. Two hundred and seventy two (272) farmers were randomly selected

from a population of 14,640 to take part in the study. Questionnaire was used to collect data on the respondents' socioeconomic characteristics, knowledge level, information communication source, and constraints on the use of pesticides. The hypothesis was tested using multiple regression and ordinary least square method to estimate the level of adherence to correct pesticide utilization. The implicit form of the model thus:

$$Y = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8)$$

Where:

Y = Adherence to correct use of pesticides
x_1 = Age,
x_2 = Educational qualification,
x_3 = Farming experience,
x_4 = Dependency ratio,
x_5 = Sex,
x_6 = Knowledge level,
x_7 = Information communication source, and
x_8 = Constraints.

To obtain estimates for the parameters in the relationship, four common functional forms of the ordinary least square method (OLS) namely Linear, Exponential, Double-Log and Semi-Log were applied.

RESULTS AND DISCUSSION

Socio-economic characteristics of farmers : This sub-section provides an overview of the personal characteristics of farmers in Akwa Ibom State. Personal characteristics variables considered in the study were age, sex, marital status, educational qualification, monthly income, farming experience, household size and dependency level of households.

Age: Age plays a very significant role in agriculture. The age of the respondents ranged between 20-35 years for 31.6 per cent of them and 51-65 years for 14 per cent while the range of 36-50 years was represented by 54.4 per cent (Table 1). This formed the modal age group of the respondents. Therefore, 86 per cent of the respondents constituted an active work force in the study area. It is expected that this active work force in the agricultural sector will take pain to evaluate pesticide before use in their various farms.

Sex: The data on Table 1 show that 55.9 per cent of the respondents were male while 44.1 were female. This shows that more males are involved in farming and of course they control productive resource and are more likely to go out to source for pesticide.

Table 1. Socioeconomic characteristics distribution of respondents and dependency ratio

SE Characteristics	No	%
Age (years)		
20 – 35	86	31.6
36 – 50	148	54.4
51 – 65	38	14.0
Sex		
Male	152	55.9
Female	120	44.1
Marital status		
Single	75	27.6
Married	129	47.4
Widowed	68	25.0
Educational qualification		
No formal education	47	17.3
Primary	27	9.9
Secondary	115	42.3
Tertiary	83	30.5
Monthly income (*Naira*)		
N5,000 – N30,000	159	58.5
31,000 – 60,000	87	32.0
61,000 – 90,000	19	7.0
N91,000 – N120,000	7	2.5
Farming experience (years)		
0 – 10	88	32.3
11 – 20	130	47.8
21 – 30	44	16.2
31 – 40	10	3.70
Household size (hhs)		
0 – 4	77	28.3
5 – 9	111	40.8
10 – 14	67	24.6
15 – 19	17	6.3
Dependency ratio		
0.000 – 0.339	160	58.8
0.034 – 0.669	79	29.0
0.670 – 1.000	33	12.1

Source: Field data, 2009

Martial status: Table 1 indicates that 47.4 per cent of the respondents were married, 27.6 per cent were single and while 25 per cent were widows. The highest percentage of respondents of 47.4 per cent was married and was engaged in farming activities.

Educational qualification: The level of education is an important factor in the use of modern agricultural technologists. Data in Table 1 show that 42.3 per cent of the respondents had secondary school education, 30.5 per cent had tertiary institution education, 9.9 per cent

had primary school education while 17.3 per cent had no formal education. The combination of the percentages for secondary and tertiary education gave a total of 72.8 per cent and indication that many farmers in Akwa Ibom State can relatively read and write. This invariably means that they can read pesticides instructions for application.

Monthly Income: The level of income of a farmer may determine his spending. Farmers with high level of income may likely purchase large quantity of farm inputs. Similarly, according to *Pinstrup – Anderson (1985)* the ability of an individual to obtain needed food depends on income and purchasing power. From Table 1 it is indicated that 58.5 per cent of the respondents earned between N5,000 – N30,000; 32.0 per cent of them earned between N31,000 – N60,000, 7.0 per cent earned between N61,000 – N90,000 while 2.5 per cent earned between N91,000 to N120,000 per month. The highest percentage of 58.5 per cent of the respondents earning between N5,000 – N30,000 is an evidence that farmers monthly income in the state is poor coupled with the fact that many of them are married with children. This income class can have restrictions in the purchase of pesticides in case of pests attack on crops and livestock in their farms.

Farming experience **:** According to *Udoh et al (2009),* it is imperative that farmers acquire enough experience to enable them succeed in their farming business because experience has shown that the longer we stay in an occupation the higher the skills derived. Experience therefore helps one to adjust to adverse farming conditions and to adopt modern farming technologies. The farming experience of 80.1 per cent of the respondents is from 10 – 20 years showing that many farmers were relatively experienced in farming. Their one to two decades of experience have made significant contribution to agricultural sector in terms of food production. But due to poor income as reflected in the Table 1 the farmers might not meet the challenges especially in the sustainable application of pesticides to combat pests in their farms.

Household size: Farm households are characterized by high number of members or rather with a high dependency ratio (*Udoh, 1999*). Similarly, the household size of the respondents with regards to pesticide utilization is also noted with a high dependency ratio. For instance, only 28.3 per cent of the respondents had less than four members per household, while the modal group of 40.8 per cent had between 5 to 9 members per household, 24.6 per cent had 10 – 14 and 6.3 per cent had 15 – 19 members per household (Table 1). It is certain that a large household size offers free and cheap labour for farm activities.

Dependency ratio: This is used to know how many young people (under 16) and older people (over 64) depend on people of working age. The higher the dependency ratio in a country, the more people who are not in working age and the fewer those who are working and paying taxes. From the analysis, a dependency ratio range of 0.000-0.339 is represented by 58.8 per cent, a range of 0.0340 – 0.669 is represented by 29.0 per cent and a range of 0.670 – 1.000 is represented by 12 per cent of the respondents. The explanation is that high and fairly high dependency ratios of 58.8 per cent and 29 per cent respectively is an indication that people have few active farm workers and feed more people who are not assisting in farm work activities. This situation could result in less labour if only 12 per cent are the active workforce of the total respondents and therefore may negatively affect pesticide utilization by the respondents.

Information sources of pesticides available to farmers: In this sub-section, the study examined the sources of pesticides, pattern of awareness and utilization by farmers, knowledge pattern on banned pesticides but sill in circulation and degree of use through the sources by farmers in the study area. Farmers have a wide variety of sources of information for farming business. The choice of information sources depend largely on the level of training and exposure of the farmers. As observed by *Robinson et.al. (2007),* trained farmers use multiple sources to get information about pest management, whereas untrained farmers rely almost exclusively on pesticide dealers and their own experience.

Information sources on pesticide utilization: The frequency of usage of the available sources was computed and the results shown in on Table 2 based on the following components of I, II and III.

Component 1: Source of purchase of pesticide for use in the farm: The results on component 1 show that 34.2 per cent indicated that they often buy pesticides

from AKADEP while 32.8 per cent always buy from AKADEP. With regards to component 1b, 32.0 per cent of the respondents buy less pesticide from the open market and 25.4 per cent often buy from open market. Component 1c, indicates the patronage of agro-chemical shop by 34.4 per cent and 18.4 per cent of the respondents who obtain and mostly use agro-chemical shop respectively as their sources of pesticides in their farms. In component 1d, few respondents considered friends and neighbours as a source of pesticides to farmers. The highest number of respondents, 55.1 per cent indicated that they never considered the source followed by 16.2 per cent who got information in pesticides from friends and neighbours. It is considered that some of these people are not well acquainted with pesticide rules and regulations that could be beneficial to those who act as a source. Based on the results shown on component 1, it can be deduced that many farmers patronized AKADEP as a major source of pesticides for their farms. This could be due to easy access through extension agents.

Component II: Extent of reliance on the sources of correct use of pesticides: The level of reliability on one's self/family members, friends/family members and chemical applicators/technicians by farmers to ensure proper pesticides usage were assessed as shown on Table 2 component II. The result in component IIa shows that 32.4 per cent mostly rely on self / family members, followed by 27.2 per cent that often rely on one's self/family members respectively. Similarly, 28.7 per cent often rely on chemical applicators/technicians. This implies that the farmers have more confidence in those who have basic knowledge on pesticides than those who have not. They are ready to get instructions from the chemical applicators/technicians that are highly reliable to ensure proper pesticide usage.

Component III: Sources of information on correct use of pesticides: From the result in component IIIa, the highest respondents of 65.6 per cent always got information on correct use of pesticides from labels and instruction manual. Component IIIb shows that 28.3 per cent of the respondents mostly access information from handbills/flyers. Component IIIc indicates that 25.7 per cent never read newspapers/magazines/ catalogues for information on correct use of pesticides. In component IIId, the data reveal that the respondents got less information from agricultural seminars due to unawareness of such seminars or inability to pay for the cost of the seminars. In the analysis in component IIIe, 40.1 per cent of the respondents often got information from discussion with colleagues/friends. According to *Robinson et.al. (2007*), Focus Group Discussions (FGD) revealed that the large numbers of information sources both formal and informal are available from which farmers can obtain advice on pests and pest management.

In component IIIf, 27.9 per cent of the respondents often got information from radio / television. The result in component IIIg shows that 23.2 per cent of the farmers often got information from agro-chemical offices/shops while in component IIIh 25.0 per cent of the respondents often got information from chemical applicators. This means that, most of the farmers are educated and depend on labels and instruction manual as a good source of information on correct use of pesticides.

Pattern of pesticides awareness and utilization by farmers: Farmers use variety of pesticides in their farms depending on the types of crops to fight pests for bountiful harvest. Table 3 below shows farmers pattern of pesticide awareness and utilization. It is observed that 81.2 per cent in the "I don't know" column for Risane shows that most farmers from the study area are not aware of this pesticide and do not use it in their farms. Simply because it is a herbicide mainly for destruction of weeds in rice farm. Other herbicides are Primextra 78.6 per cent, Primegram 75.0 per cent, Galex 73.9 per cent and Glamozone 64.7 per cent with the response of don't know because the farmers do not know their usefulness. Insecticide like Karate with the response of 57.8 per cent, Decis 12 EC with 64.3 per cent and Furandan 3G with 50.0 per cent are known to respondents as indicated in the "Yes" column. This is probably because of their usefulness in their farms. For instance, these insecticides are used in killing of insects that attack crops such as vegetables, maize and cowpea in the farms. This suggests that many farmers from the study area are growers of these crops, therefore make good use of the insecticides. However, the respondents should not loose sight of the consequences of these insecticides to human health, food eco-system and the environment. There is therefore concern over the

Table 2. Response analysis on the sources of pesticides to farmers in their farms (N = 272)

S.No.	Components	Never	Less	Often	More	Most	Always
1.	Source of purchase of pesticides for use in the farm						
a	AKADEP	77	4.4	34.2	6.6	14.3	32.8
b	Open market	14.3	32.0	25.4	4.4	7.0	11.4
c.	Agro/chemical shops	0.4	17.6	32.4	18.0	18.4	13.2
d	Friends/Neighbours	55.1	16.2	15.8	9.6	1.1	2.2
II	Extent of reliance on the sources of correct use of pesticides						
a	One's self/family members	3.3	4.7	27.2	8.8	32.4	13.6
b	Friends/family members	35.2	23.5	20.2	13.6	4.4	0.0
c	Chemical application/ Technicians	4.8	14.7	28.7	9.2	15.1	27.6
III	Sources of Information on correct use of pesticides						
a	From labels and instruction manuals	9.0	1.1	2.6	10.7	11.0	67.6
b	Handbills/flyers	27.6	16.5	6.3	4.0	28.3	17.3
c	Newspaper/Magazines/catalogues	25.7	5.5	14.0	25.4	17.6	11.8
d	Seminars	30.1	136.8	14.0	5.1	3.7	10.3
e	Discussion with colleagues/friends	1.5	9.9	40.1	26.1	11.4	11.0
f	Radio/Television	8.8	23.2	27.9	23.2	12.0	4.0
g	Agro-chemical offices/shops	16.2	8.8	23.2	22.4	14.7	14.7
h	Chemical applicators	20.2	12.9	25.0	22.8	8.5	10.7

Source: Field Survey 2009

potentials with insidious effects of pesticides operating through the food chain (*Mills and Semlitsch, 2004*). Therefore, ecological consequences of insecticide use are of major concern. However, other aspects of modern agriculture often have a greater environmental impact consequently insecticides have lethal or sub-lethal impact on non-target organisms (*Devine and Furlong, 2007*). According to *Blaustein and Kiesecker (2002); Davidson et. al. (2001); Sparling et. al. (2001)* global declines in amphibian populations are strongly associated with agro-chemical use.

Table 3. Pattern of pesticide awareness and utilization by farmers(N = 272)

Types of pesticides	Don't know	No	Yes
Risane	81.2	15.1	3.7
Primextra	78.6	19.9	1.5
Primegram	75.0	16.9	8.1
Galex	73.9	15.8	10.3
Glamozone	64.7	15.8	3.7
Karate	30.9	17.3	51.8
Decis	24.3	11.4	64.3
Furandan 3a	32.4	17.6	50.0
Copper-sulphate	39.3	11.4	49.3
Benlate	87.5	12.1	0.4

Source: Field Survey 2009

In Table 3, fungicide such as copper sulphate is used by 49.3 per cent of the respondents as reflected in the yes column. This means that the respondents embraced the fungicide because some of the respondents are animal production farmers. Copper sulphate is used as animal feed dietary supplement. For Benlate, 87.5 per cent of the respondents said they did not know as shown in the column. Again, this means that the respondents are unaware of Benlate existence and do not use it in their farms because it is relatively unimportant for their farms.

Knowledge pattern on banned pesticides: It is obvious that not all pesticides are recommended for use by farmers because some are banned by law or legislation of a nation. In Nigeria, there are similar pesticides prohibited by law from usage for farming activities. The data in Table 4 show the knowledge pattern of respondents on banned pesticides but still in circulation. In the "I don't know" column apart from DDT with 40.4 per cent of the respondents, the rest have more than 50.00 per cent meaning, the respondents do not know that these pesticides are banned from circulation by government or still in use by farmers. The "No" column has less than 30.0 per cent respondents, an indication that they are still doubting the ban. As a result, farmers can still make use of them in their farms if they

have access to these pesticides. Similarly, the "Yes" column, apart from DDT that has as high as 45.3 per cent, other pesticides have less than 30.0%; This suggests that the respondents agreed that they have knowledge of these banned pesticides from circulation by the government but still in use by some farmers.

Table 4. Knowledge pattern on banned pesticides still in circulation (N = 272)

Types of pesticides	Don't know	No	Yes
DDT (Dichloro-Diphenyl Trichloto-ethane)	40.4	54.7	45.3
Aldrin	52.9	71.7	28.3
Chlodene	72.8	99.3	0.7
Lindane	52.2	76.8	23.2
Dieldrin	68.4	93.8	6.2
Parathion	68.4	88.3	11.7
Ethylene oxide	79.4	100.0	0.0
Heptachlor	77.9	100.0	0.0
Endrin	72.1	93.34	6.6
Mirex	80.5	99.6	0.4

Source: Field Survey 2009

However, as knowledgeable as some respondents are on banned pesticides, in circulation it is unbelievable that more than 45.0 per cent are aware of the banned pesticides but are still having access to them not minding its impact on man and environment. The use of broad spectrum insecticides viz. DDT, Gamma BHC and Dieldrin during campaign against the tsetse fly in the Southern African Savanna as observed by *Divine and Furlong (2007)* have had pronounced effects on non-targeted organisms like birds, reptiles, small mammals, fish and insects. The circulation of these pesticides though banned from circulation may be attributed to inappropriate government mechanisms to enforce, laws on banned pesticides from circulation. Because of weak monitoring programme on the use of pesticides, consumers of the products have little or no fear of being caught by the law. Therefore, there is no way of checking that government pesticides legislation is being obeyed. This is illustrated well by DDT.

Level of adherence to pesticide utilization: It is expected that farmers must adhere to instructions from pesticide experts during utilization in the farms and other usage because of its hazardous effects. This sub-section therefore assesses the respondents' level of adherence to pesticides instructions and advice from experts.

The level of adherence to correct utilization of pesticides was considered as dependent variable and the independent variables age X_1, educational qualification X_2, farming experience X_3, dependency ratio X_4, sex X_5, knowledge level X_6, information communication source X_7 , and constraints, X_8 were estimated through multiple regression analysis carried out using four functional forms that utilized Ordinary Least Square (OLS). These were: Linear, Exponential, Double – Log and Semi Log equations. The equation variables: age, educational qualification, farming experience, dependency ratio, sex, knowledge level, information communication source and constraints and the results are presented in Table 5.

From the results in Table 5, linear equation was chosen as the lead equation. The choice of the equation is based on the Coefficients of determination R^2 and F-statistics, which were relatively high. The number of significant variables was high, the a *priori* expectation of the signs and magnitude on variables. The R of 0.31 shows that 31 per cent of the independent variables explain the total variation in the dependent variable.The F-statistics = 14.59, this shows that the model is acceptable at 5% confidence level. The result shows that eight of the estimated Coefficients show significance at 5 per cent level. The Coefficients of age X_1, educational qualification X_2,dependency ratio X_4, information communication source X_7, and constraints X_8 were significant at 5 per cent level but positively signed while farming experience X_3, sex X_5 and knowledge level X_6 were also significant at 5 per cent level but negatively signed.

This is because adherence to correct pesticide utilization requires maturity considering the hazardous effects which cannot be managed by age group below 10 years. The level of educational qualification is necessary as the farmers will be able to read and understand the instructions as contained in the pesticide manuals. Dependency ratio is positively significant because the higher the number of household size the greater the level of pesticide utilization. However, this may be constrained because of less labour with regards to active workforce. Information communication source and constraints are also positive because if information is not got from the right source, it will negatively affect the level of adherence to correct utilization of pesticides.

Table 5. Result of multiple regression analysis

Functional forms	Constant Terms	Age X_1	Educational qualification X_2	Farming experience X_3	Dependency ratio X_4	Sex level X_5	Knowledge X_6	Inf. commu.source X_7	Constraints X_8
Linear	16.855	0.224**	0.264**	-0.2960**	0.108**	0.026**	-0.039**	0.437**	0.009**
t-value	7.562	3.153	3.941	-4.333	1.969	-0.469	-0.679	7.069	0.150
Std error	2.232	0.031	0.055	0.039	0.928	0.492	0.115	0.033	0.037
Exponential	2.888	0.227**	0.285	-0.309	0.097	-0.038	-0.033	0.419	0.033
t-value	34.894	3.193	4.234	-4.514	1.760	0.684	-0.571	6.751	0.586
Std error	0.083	0.001	0.002	03.001	0.034	0.018	0.004	0.001	0.001
Double log	1.954	0.199	0.286	-0.218	0.076	-0.031	0.026	0.367	0.018
t-value	7.537	2.717**	4.101	-3.130	1.329	0.552	0.438	5.752	0.311
Std error	0.259	0.047	0.020	0.021	0.036	0.019	0.066	0.045	0.052
Semi log	-7.473	0.198	0.268	-0.205	0.087	-0.020	-0.031	0.387	-0.008
t-value	-1.071	2.728	3.850	-2.962	1.531	0.357	0.537	6.088	0.141
Std error	6.979	1.261	0.528	0.553	0.961	0.500	1.781	1.202	1.401

Source: Computed from field data, 2009 *** Significant at 5%*

Summary of the models

Linear	Exponential	Double-log	Secondary
**	**	**	**
F-ratio -14.591	F-ratio -14.252	F-ratio -12.522	F-ratio -12.999
R^1-0.554	R^1-0.550	R^1-525	R^1-0.523
R^2-0.307	R^2-0.302	R^2-0.276	R^2-0.283
SE-3.70741	SE-3.70741	SE-0.14007	SE-3.77118

Again, constraints such as low capital, adherence to correct utilization of pesticide where the farmers' capital is low, is difficult to purchase the recommended pesticides for crops and therefore affecting the level of adherence. Nevertheless, farming experience, sex and knowledge level have negative significant relationship on the level of adherence to correct utilization of pesticides because it is not the number of years a farmer has in farming activities that could ensure adherence to correct utilization of pesticides but ability to understand the rules and regulations of the pesticide utilization as contained in the pesticides hand bills and manuals. In addition, there is no gender difference in the level of adherence to correct utilization of pesticide as male and female can handle the work perfectly. Again it is not until a farmer is more knowledgeable in farming business that could guarantee a high level of adherence to correct utilization of pesticide, after all, a farmer with little knowledge in the business can do the same job provided he understands the rudiments of pesticides utilization.

CONCLUSION

From the socio-economic characteristics, it can be concluded that majority of the farmers are in middle age group, males out numbered females and married men and women constitute the bulk of farmers in the study area. Many of them have basic educational qualification from primary to tertiary and few without formal education. The monthly income of majority of the farmers are low which has posed a serious problem in acquiring the recommended pesticide to combat pests in their farms. The farmers have a wide range of sources they can obtain information on pesticides that could be beneficial to them during pre and post pesticide application. A majority of the farmers are unaware of the recommended pesticide and still patronize the banned ones. During pesticide application, some farmers conform to rules and regulations guiding the exercise while some do not adhere, due to lack of knowledge and above all there is a need to train the farmers in different areas of pesticide administration, since most of them cannot do it due to some constraints.

Based on the findings of this research, the following recommendations are made:

1. Information on banned pesticides must be made available to farmers through publicity.
2. Government through respective agencies for strict compliance must ensure that banned pesticides are completely out of reach by farmers and other users in the society, since there is evidence that some are still in circulation.

3. Government should subsidize the cost of recommended pesticides due to low income of the majority of the farmers coupled with large household size and high dependency ratio that could not allow them to save enough money for it.
4. Farmers should be given intensive training on pesticide application as many of them lack knowledge on the recommended pesticide.

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