Socio-Economic Factors Influencing Quantity of Insecticide Use in Cowpea Production in Nigeria

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ABSTRACT

Cowpea is one of the most important staple foods for humans around the world. It is an edible cash crop which is very nutritious and commercially viable with significant possibility of contributing to the national food security. Kano and Ogun states, Nigeria, were used as case study in determining the socio-economic factors influencing the quantity of insecticide usage among cowpea farmers in Nigeria. A multistage sampling procedure was used. Data were analyzed using descriptive statistics and ordinary least square regression (OLS).

The results revealed that average age of cowpea farmers in the study areas was 46 years. They were predominantly illiterates or had elementary/Islamic school education. The result further showed that the important socio-economic factors affecting insecticide used in cowpea production in Kano state were price of insecticide and educational level of farmers. While in Ogun state, price of insecticide and cowpea variety were the significant factors affecting insecticide use in cowpea production. In general, however, price of insecticide, fertilizer price, cowpea price and educational level of farmers are the significant factors affecting cowpea production. It is therefore recommended that while government keep encouraging learnt young people into farm business, an appropriate policy on the removal of duties on imported agrochemicals by government would assist as a short-term measure while strengthening the local industries involved in insecticide manufacturing through the provision of incentives to operate at reduced cost of production would bring a permanent succor to the cowpea farmers in Nigeria.

(Keywords: cowpea, factors, influence, insecticide, production, socio-economic factors, agriculture management)

INTRODUCTION

Cowpea (*Vigna unguiculata*) is an annual herbaceous legume from the genus Vigna. It is as called by other names in different locations such as black-eye pea, southern pea, yard-long pea, marble beans, black eye beans, and china beans (Agricultural Research Council, 2018).

Cowpea is one of the most ancient human staple foods and has perhaps been used as a crop since Neolithic times. It has been domesticated in Africa from its wild ancestral sub species and is the most essential grain legume in many nations of the world (Izge, et al., 2009, Takim and Uddin, 2010, Petr, et al., 2014 Nedumaran, et al., 2015). The production of cowpea is regarded as an important part of the traditional cropping practices in the entire Africa continent (Isubikalu, et al., 2000, Nedumaran, et al., 2015). Cowpea is an edible cash crop – both nutritious and commercially viable – with considerable potential to contribute to national food security (Loredana, 2017) and it is generally grown as an intercrop with maize and this practice is usually preferred by farmers because of its role in maintaining soil fertility through nitrogen-fixation as well as helping in the control of soil erosion (Asiwe, 2009, Mahamadou, 2014, Appiah, et al., 2015). This crop is also very important to farmers as its nutritive value serves as fodder for livestock (Dzemo, et al., 2010, International Livestock Research Institute, 2013, Amole and Ayantunde, 2016).

Insecticide spray offers the most effective control of insect pests where resistant varieties are not available (Hakeem, et al., 2012). The use of insecticide in crop production has been seen as precautionary and curative measures against pre-harvest and post-harvest losses. The relevance of this application varies from one crop to another and the agro-climatic factors operating in the area of production.

The causes of low yields in cowpea production include insect pests, diseases, parasitic weeds, drought, and low soil fertility; however, insect pests constitute the major constraint (Karungi, et al., 2000) and the crop is highly prone to attacks from a spectrum of pest species (Isubikalu, et al., 2000). Cowpea production is therefore considered too risky an enterprise by many growers because of the numerous pest problems associated with it (Egho, 2010; Isubikalu, et al., 2000).

A series of extension activities had been promoted in the past on the need for farmers to use insecticides in cowpea production in Nigeria (Dugje, et al., 2009). Few of many advantages of pesticide use in cowpea production includes the improvement of plant vigor and healthy growth, increase in plant yields and ultimately increase in crop productivity (Omolehin, et al., 2011). From the literature, there has been a series of works done on the economics of insecticide usage and yield performance of cowpea as influenced by insecticide use (Agwu, 2004, Omolehin, et al., 2011, Hakeem, et al., 2012, Lorenana, 2017, Ndiso, et al., 2017) but only a limited work could be found on the socio-economic factors influencing the use of insecticides among cowpea farmers and hence, the need for this study. Therefore, this study is aimed at capturing the following specific objectives:

a. Determining the socio-economic characteristics of the respondents,

b. Determining the insecticide use patterns among cowpea farmers,

c. Assessing the socio-economic factors affecting cowpea output in the study areas,

d. Determining socio-economic factors influencing insecticide use by the respondents.

MATERIALS AND METHODS

Data Collection and Sampling Techniques

Kano and Ogun States were purposely chosen for this study. The choice of these locations was informed by the fact that Kano State is one of the major high-producing areas for cowpea in Nigeria and it is noted for productive and intensive sole cropping of cowpea (Finelib, 2017). Ogun State is one of the locations where cowpea production is recently gaining prominence under a predominantly multiple cropping system. Also, the choice of Kano state as intensive cultivator of cowpea from the northern region of Nigeria and Ogun state as less intensive cultivator of cowpea from the Southern Nigeria is to take care of any variation that might be brought about by management practices involved in cowpea production as well as the socio-economic variations among cowpea farmers from both regions of the country.

Kano State, in its present configuration, was created in 1992. It is located in the Sudan savannah zone with a uni-modal rainfall pattern of between 90-110mm per year. The vegetation is mainly woodland type which makes it favorable for high production of cowpea, other legumes, cereals and vegetables. It has forty-six (46) Local Government Areas which spread across a land area of 20,400 km^2. Ogun State was created in 1976. It is one of the southwestern states of Nigeria and it is characterized by bimodal rainfall, which provides a favorable ecology for both early and as well as late season cropping (which particularly favors the production of cowpea especially in the derived savannah zone). It has a total of twenty (20) Local Government Areas (LGAs) on a land area of 16, 409.26 square kilometers. The Ogun State Agricultural Development Programme (OGADEP) has divided the State into four zones (Abeokuta, Ijebu-Ode, Ikenne and Ilaro) on the basis of geographical spread and administrative convenience.

Two zones were selected from each of the two states selected for this study. In Kano, the two zones selected through random sampling technique were Zone 2 (Danbatta) and Zone 3 (Gaya). Two blocks were as well selected through simple random sampling from each zone. Danbatta and Bichi blocks from Danbatta; Albasu and Wudil blocks from Gaya zone. From each block, a total of 25 respondents were selected through the simple random sampling

procedure using the list of cowpea farmers compiled by the Village Extension Agents as the sample frame. This gave a total of fifty respondents per block and one hundred for Kano State. In Ogun state, the zones selected were Ilaro and Abeokuta zones. Two blocks were selected from each zone through simple random sampling technique (using the list of blocks available at OGADEP as sample frame). Ilugun and Opeji Blocks were selected from Abeokuta zones while Sawonjo and Imeko blocks from Ilaro zone. From each block, a total of 25 respondents were selected through the simple random sampling procedure using the list of cowpea farmers compiled by the Village Extension Agents (VEAs) as the sample frame. This gave a total of 50 respondents per block and a total of one hundred (100) respondents also in Ogun state.

The overall sample size used for the study was two hundred (200) respondents. However, only 97 questionnaires could be used for meaningful analysis from those administered in Ogun state. Hence, an overall of 197 questionnaires were analyzed.

Analytical Techniques

Descriptive Statistics (such as frequency and percentage tables) were used to describe the socio-economic characteristics of respondent cowpea farmers, insecticide use pattern among cowpea producers in the states. The socio-economic factors affecting the quantity of insecticide used in cowpea production was analyzed using Ordinary Least Square regression (OLS). OLS regression estimate has also gained prominence over the years in the determination of causal relationship between two outcomes (Olayemi, 1998). In this respect, it has become a handy tool to determine the socio-economic factors affecting insecticide use by cowpea farmers in the study areas.

The model is specified in the implicit form as follows:

$$Pu = f(Pp, Fp, Co, Cp, Hc, Fe, Va, Edu, U) \quad \textbf{(Equation 1)}$$

In explicit form, the equation is denoted as:

$$Pu = (\beta 0 + \beta 1Pp + \beta 2Fp + \beta 3Co + \beta 4Cp + \beta 5Hc + \beta 6Fe + \beta 7Va + \beta 8Edu + U) \quad \textbf{(Equation 2)}$$

Where:

Pu = Insecticide used (gramme a.i. per ha.)

Pp = Price of insecticide (N/gm ai/ha)

Fp = Fertilizer price (N/kg)

Co = Cowpea output (kg)

Cp = Cowpea price (N/kg)

Hc = Area grown to cowpea (Ha)

Fe = Farming Experience (Years)

Va = Variety of cowpea grown (Dummy: Local 1, Improved 0)

Edu = Education (Number of years spent in school)

The a priori expectation of the parameter estimates is $\beta 1 < 0$, $\beta 3 > 0$, $\beta 4 > 0$, $\beta 5 > 0$.

While $\beta 2$, $\beta 6$, $\beta 7$ and $\beta 8$ can either be > or < 0.

That is, the null and the alternative hypotheses are:

Ho: $\beta i = 0$ (Where i = 1…….8)

Hi: $\beta i > 0$ (Where i = 1…….8)

RESULTS AND DISCUSSION

Description of the Socio-Economic Characteristics of Cowpea Farmers and their Farming Activities

Farmers' socioeconomic characteristics have an intrinsic role to play in the way farmers take farm decisions and go about their farm activities. The knowledge of such characteristics helps one to understand the behavior of farmers as well as provide a clue towards explaining their disposition to technological interventions that could improve farm productivity. Some of the important socioeconomic variables are described as follows:

Table 1: Distribution of Sampled Cowpea Farmers according to their Age.

Age (Yrs)	Kano		Ogun		All		
	Frequency	%	Frequency	%	Frequency	%	Cumulative Percentage
< 20	0	0	1	1.03	1	0.5	0.5
20 – 30	16	16.0	5	5.16	21	10.7	11.2
31 – 40	31	31.0	23	23.71	54	27.4	38.6
41 – 50	32	32.0	33	34.02	66	33.5	72.1
51 – 60	12	12.0	24	24.74	36	18.3	90.4
> 60	8	8.0	11	11.34	19	9.6	100.0
Total	**100**	**100.0**	**97**	**100.0**	**197**	**100**	
Average	44.13		48.05				45.81 ≃ 46 years

Source: Field Survey

Age Distribution of the Respondents

Age is an important determinant of farm activities. Farmers in the working age group are likely to commit more energy into farm production, which is especially subsistent in nature; this will have attendant impact on productivity.

Table 1 indicates the age distribution of respondents for the two states considered in this study. The Table shows that majority (33.5%) of the cowpea farmers sampled are within the age range of 41 and 50 years. This is closely followed by those in the age range of 31 to 40 years. The age range of cowpea farmers shows a normal distribution around the mean age of 44 years for Kano state cowpea farmers and 48 years for those in Ogun state. On the overall, the mean age of cowpea farmers in the study area is 46 years. These indicate that most cowpea farmers in Nigeria are in the active age group. The implication of this is that given adequate incentives and an environment that is conducive, cowpea farmers have the potentials for improved productivity and enhancement of income for the farm family.

Description of the Educational Level of Respondents, their Sources of Farm Credit and Membership of Cooperative Society

Positive responses to new farm technologies and adoption of improved farm technologies have been known to be greatly influenced by the level of education. Adequate education enlightens the farmer and can make him a better manager of resources used on the farm towards improved farm productivity.

Table 2 highlights the fact that majority of the cowpea farmers in Kano state (41%), Ogun state (42.2%) had primary education. For both locations, (41.6%) had only primary education while only 16.8% attained secondary school education. The result is in agreement with Adeola et al. (2011) that stated that majority of cowpea farmers in Kaduna state do not have beyond Arabic and primary school education. A negligible percentage (9.6%) of the cowpea farmers had tertiary education. Some (8.6%) of the cowpea farmers, mainly from the northern part of the country had Arabic education, which, in scope and method, is similar to primary school education. Approximately 23 percent of the respondents in all had no formal education whatsoever. This scenario largely shows that the cowpea farmers were poorly educated.

This may have significant effect on cowpea farming activities in terms of farming methods and technologies adopted. Most of the farmers (60.4%) belonged to farmers' cooperatives. Ogun state accounted for the largest contributor to the number of cowpea farmers who were members of cooperatives, with 75% of the cowpea farmers being members of agricultural cooperatives. This could afford them the opportunity of group benefits in terms of procurement of agrochemical and disposal of farm output at a better price.

In terms of credit facility, most of the cowpea farmers made use of the informal sources of credit for their cowpea production process. Credit sourced through personal savings accounted for the most predominant form of credit source across board.

Table 2: Distribution of Respondent Cowpea Farmers according to their Educational Level, Membership of Cooperative Societies, and Sources of Credit.

Education Level	Kano		Ogun		All		
	Frequency	%	Frequency	%	Frequency	%	Cumulative Percentage
			Education				
No formal education	18	18.0	27	27.84	45	22.8	22.8
Adult education	0	0	1	1.03	1	0.5	23.4
Primary education	41	41.0	41	42.27	82	41.6	65.0
Arabic education	17	17.0	0	0	17	8.6	73.6
Secondary education	11	11.0	22	22.68	33	16.8	90.4
NCE/OND	9	9.0	4	4.12	13	6.6	97.0
HND/BSc.	4	4.0	2	2.06	6	3.0	100.0
Total	**100**	**100.0**	**97**	**100.0**	**197**		
			Membership of Cooperative Societies				
Yes	46	46.0	73	75.26	119	60.4	60.4
No	54	54.0	24	24.74	78	39.6	100.0
Total	**100**	**100.0**	**97**	**100.0**	**197**	**100.0**	
			Credit Sources				
Bank loan	5	5.0	3	3.09	8	4.1	4.1
"Esusu"	4	4.0	23	23.71	27	13.7	17.8
Personal saving	88	88.0	55	56.70	143	72.6	90.4
Friends and relations	3	3.0	16	16.50	19	9.6	100.0
Total	**100**	**100.0**	**97**	**100.0**	**197**	**100.0**	

Source: Field Survey

Credit obtained from Esusu was the next important source of credit for cowpea farmers in Ogun state, while those in Kano state made use of bank loan as the immediate alternative credit source. Other sources of funds were from friends and relations ((9.6%) as well as Esusu (13.7%). Negligible percentage (4.1%) of the farmers financed their farm business with bank loan. Generally, this funding situation may not permit the farmers access to the required financial capital needed for their farm activities.

Gender and Marital Status of Respondents

Table 3 shows that all the farmers in Kano state were males while they were 96.2% in Ogun State. Generally, 98.5 percent of the cowpea farmers interviewed are males while females are 1.5%percent. Nearly all (98% and 93.8%) were married in both Kano and Ogun states respectively while for general classification, 96% of the cowpea farmers were married.

Majority of the farm family (84% for Kano, 89.79% for Ogun and 86.8% for all) had household size ranging from 5 to above 12 people in the household. The average household size was 12 people for Kano state and 9 people for Ogun State while it was 10 people in all.

Insecticide Use Pattern in Cowpea Production

Insecticide use in cowpea production is a sine qua non to increased cowpea yield because almost all the stages of cowpea production cycle are affected by one pest or the other. Table 4 shows that over 90 percent of the cowpea farmers used insecticide on their cowpea plots in both locations. However, majority (42.6%) of the farmers used less than 1 liter of insecticide on their farm, while 31.5 percent of the farmers used between 1 and 2 liters of insecticide. Cowpea farmers who used between 3 and 4 liters of insecticide per season were 10.2% of the respondents while those who applied upward of 4 liters were 9.6%. The average quantity of insecticide used per season was 2.1 liters. This is an indication that cowpea farmers applied less than the minimum recommended application rate.

Table 3: Distribution of Cowpea Farmers according to their Gender, Marital Status, and Household Size.

Parameters	Kano		Ogun		All		
	Frequency	%	Frequency	%	Frequency	%	Cumulative Percentage
a) Gender							
Female	0	0	3	3.09	3	1.5	1.5
Male	100	100.0	94	96.91	194	98.5	100.0
Total	**100**	**100.0**	**97**	**100.0**	**197**	**100.0**	
b) Marital status							
Married	98	98.0	91	93.81	189	96.0	96.0
Single	2	2.0	6	6.19	8	4.0	100.0
Total	**100**	**100.0**	**97**	**100.0**	**197**	**100**	
c) Household size							
< 2 persons	4	4.00	4	4.12	8	4.1	4.1
2 – 4 persons	12	12.00	6	6.19	18	9.1	13.2
5 – 8 persons	21	21.00	44	45.36	65	33.0	46.2
9–12 persons	24	24.00	27	27.84	51	25.9	72.1
>12 persons	39		16	16.49	55	27.9	100.0
Total	**100**	**100.0**	**97**	**100.0**	**197**	**100**	
Average household size (Persons)	11.58 ≃ 12persons		8.97 ≃ 9 persons		10.20 ≃ 10 persons		

Source: Field Survey

Further observation of insecticide use at the state level revealed an interesting pattern. In Ogun state, majority of the cowpea farmers (41.24%) applied insecticides in the range of 1 to 2 liters relative to those in Kano state where majority (49%) used insecticide in the range of 0.1 liter to 1 liter, but Kano cowpea farmers accounted for those who used insecticide above 4.1 liters.

Further reflection is shown by the fact that the average quantity of insecticide used per farmer in Ogun state (3 liters), which was higher than what obtained in Kano state. But in terms of application rate, Kano state applied for an average of 3 times relative to Ogun State farmers who applied insecticides for an average of 2 times during the production season. In general, the frequency of insecticide application ranged from 1 to 5 times. However, majority (44.2%) of the respondents applied insecticide two times while 38.6 percent applied insecticide three times.

Negligible percentages (6.6% and 2.5%) applied insecticide four and five times, respectively. The average number of insecticide application of two times in a year falls short of the recommended

number of application (which is 5 times according to Singh and Rachie, 1985). This is likely to reduce the optimal yield of cowpea attainable per hectare. A point to note however is the fact that most of the cowpea farmers (71.07%) knew and agreed that insecticide use can significantly increase cowpea production when applied. Therefore, it is not unlikely that there are other factors influencing the use of insecticide.

The use of knapsack sprayer to apply insecticide was more popular among the cowpea farmers. Approximately 85 percent of the cowpea farmers used knapsack sprayers while a negligible percentage (0.5%) applied insecticide using boom sprayer. The reason adduced for this was the small average farm size while boom sprayer was used to spray insecticide on large farm holdings. The use of boom sprayer was observed only in Kano state where larger areas of land were cultivated to cowpea.

Socioeconomic Factors affecting Cowpea Production in the Study Area

This was done to establish whether cowpea farmers have other reasons for going into cowpea production (using cowpea output as a proxy), apart from the assumed profit maximization motive. Cowpea gross output (₦) was regressed on amount spent on insecticide (₦), fertilizer price (₦), cowpea price (₦), area grown to cowpea (ha), farming experience in cowpea production (years), cowpea variety (dummy), education level (number of years spent in school) as well as income need (Dummy) and family need (Dummy).

Table 4: Distribution of Respondents According to their Insecticide use Pattern.

Parameters	Kano		Ogun		All		
	Frequency	%	Frequency	%	Frequency	%	Cumulative Percentage
a) Quantity of insecticide used per season							
0.1 – 1 liter	49	49.0	35	36.08	84	42.6	42.6
1.1 – 2.0 liters	22	22.0	40	41.24	62	31.5	74.1
2.1 – 3.0 liters	13	13.0	7	7.22	20	10.2	84.3
3.1 – 4.0 liters	0	0	0	0	0	0	84.3
4.1 liters above	14	14.0	5	5.15	19	9.6	93.9
Not applicable	2	2.0	10	10.31	12	6.1	100.0
Total	100	100.0	97	100.0	197	100.0	
Mean	1.62 ≃ 2 liters		2.62 ≃ 3 liters		2.12 liters ≃ 2.1 liters		
b) Frequency of insecticide use							
Not applicable	2	2.0	10	10.31	12	6.1	6.1
1 time	4	4.0	0	0	4	2.0	8.1
2 times	42	42.0	45	46.39	87	44.2	52.3
3 times	36	36.0	40	41.24	76	38.6	90.9
4 times	12	12.0	1	1.03	13	6.6	97.5
5 times	4	4.0	1	1.03	5	2.5	100.0
Total	100	100.0	97	100.0	197	100.0	
Average (No of times)	2.56 ≃ 3 times		2.32 ≃ 2 times		2.44 ≃ 2 times		
c) Method of applying insecticide							
Use of knapsack sprayer	89	78.0	78	80.41	167	84.8	84.8
Use of boom sprayer	1	1.0	0	0	1	0.5	85.3
No response	10	11.0	19	19.59	29	14.7	100
Total	100.0	100.0	97	100.0	197	100.0	
Perception of farmers on whether insecticide can increase cowpea yield							
a) Strongly agree	58	58.0	42	43.30	100	50.76	50.76
b) Agree	24	24.0	16	16.50	40	20.31	71.07
c) Undecided	5	5.0	15	15.46	20	10.15	81.22
d) Disagree	10	10.0	20	20.62	30	15.23	96.45
e) Strongly disagree	3	3.0	4	4.12	7	3.55	100.0
Total	100	100.0	97	100.0	197	100	

Source: Field Survey

Table 5: Results of Regression Analysis showing the Socioeconomic Factors affecting Cowpea Output in the Study Areas.

COEFFICIENTS	LINEAR			SEMI-LOG			DOUBLE-LOG		
	Kano	**Ogun**	**All**	**Kano**	**Ogun**	**All**	**Kano**	**Ogun**	**All**
β_0	1508.763***	-49.616	1004***	895.905	-0.846	897.756*	3.568***	-0.685	2.526***
	(2.297)	(-0.094)	(3.478)	(0.980)	(0.400)	(1.825)	(4.192)	(0.495)	(4.283)
β_1	-0.144	-0.025	-0.015	0.145	0.214	0.141*	-0.107	0.051	-0.016
	(-1.274)	(-0.241)	(-0.217)	(1.353)	(2.029)	(1.905)	(-1.000)	(0.493)	(-0.212)
β_2	0.013	-0.076	-0.044	0.027	-0.045	0.033	0.208**	-0.028	0.085
	(0.131)	(-0.709)	(-0.581)	(0.254)	(-0.427)	(0.436)	(1.976)	(-0.269)	(1.133)
β_3	0.130*	0.050	-0.025	-0.078	0.104	-0.087	-0.140	0.135	0.007**
	(1.898)	(0.455)	(-1.324)	(-0.726)	(0.936)	(-1.149)	(-1.314)	(1.229)	(2.199)
β_4	0.172	0.238**	0.088	-0.045	0.153	-0.033	0.190	0.102	0.042
	(1.572)	(2.023)	(1.171)	(-0.423)	(1.389)	(-0.437)	(0.850)	(0.942)	(0.563)
β_5	0.022	0.381***	-0.024***	0.054	-0.084	0.012	-0.154	-0.107	0.142*
	(0.220)	(2.430)	(-3.339)	(0.500)	(-0.792)	(0.157)	(-1.427)	(-1.016)	(1.927)
β_6	0.367***	0.116	-270***	-0.018	-0.023	-0.011	0.102	0.069	0.068
	(3.572)	(1.073)	(-3.552)	(-0.174)	(-0.025)	(-0.145)	(0.973)	(0.636)	(0.935)
β_7	-0.090	-0.003	-0.079	-0.173	0.046	-0.118	0.024	0.133	0.104
	(-0.989)	(-0.032)	(-1.130)	(-1.645)	(0.423)	(-1.624)	(0.229)	(1.250)	(1.440)
β_8	0.124**	-0.003	-0.070	0.866	-0.045	-0.096	-0.056	-0.194	0.154
	(2.272)	(-0.029)	(-0.939)	(0.389)	(0.417)	(-1.285)	(-0.156)	(-1.819)	(0.208)
β_9	0.154	0.015***	0.041	0.004	0.090	0.001	-0.507	-0.009	0.017**
	(0.878)	(2.258)	(0.552)	(0.997)	(0.833)	(0.010)	(-0.257)	(-0.087)	(2.248)
R^2	0.633	0.605	0.496	0.547	0.648	0.508	0.496	0.514	0.662
Adjusted R^2	0.589	0.547	0.468	0.416	0.584	0.465	0.447	0.502	0.576
F-value	22.085**	21.089	21.000*	17.402*	20.034	26.580*	15.588	18.043	31.357**
DW	1.696	1.645	1.513	1.415	1.605	1.524	1.312	1.496	1.621

Source: Computed from Field Survey *** = significant at 1% ($\propto_{0.01}$) ** = significant at 5% ($\propto_{0.05}$) * = significant at 10% ($\propto_{0.10}$)

Figures in parenthesis are t-values

This analysis was done at each state level and at aggregate level. The model adopted to explain the socio-economic factors influencing cowpea production in Kano state is the linear model partly because it has the highest values for the R^2 (0.63) and adjusted R^2 (0.59). Moreover, the F value (22.085) is the highest apart from being significant at 5% while the Durbin Watson value is 1.696 as shown in Table 5.

From Table 6, it could be observed that the socio-economic factors influencing the quantity of cowpea produced by cowpea farmers are cowpea price ($\propto_{0.10}$), cowpea variety ($\propto_{0.01}$) and income need ($\propto_{0.10}$). This implies that cowpea farmers in Kano state produce cowpea mostly to meet their income needs while taking into consideration the variety of cowpea as well as the market price of cowpea, which have a bearing on the income level generated from cowpea sales.

The need to generate more income by the farm family producing cowpea in Kano state may have been the reason behind the transportation of cowpea for sale to the southwest part of Nigeria where it would command higher prices.

A different picture is however presented in the case of cowpea farmers in Ogun state. Table 5 shows the models used to determine the socioeconomic factors affecting cowpea production in Ogun state, from which the linear model was chosen as the lead equation. The linear model although has the next best value for the R^2 (0.61) and adjusted R^2 (0.55) and F value (21.089) relative to the semi-log model, it has the highest number of significant variables and the highest Durbin Watson statistics of 1.645. The socioeconomic factors affecting cowpea production as shown in table 6 are area grown to cowpea ($\propto_{0.05}$), farming experience ($\propto_{0.05}$) and family needs of the cowpea farmers ($\propto_{0.05}$). Family needs therefore (apart from the area cultivated to cowpea and farming experience), was a main factor behind the cultivation of cowpea in Ogun state.

Table 6: Socio-Economic Factors affecting Cowpea Output in the Study Areas.

Parameter	Variable Name	Coefficient (Kano)	Coefficient (Ogun)	Coefficient (All)
Amount spent on pesticide (₦)	X_1	-0.144	-0.025	-0.016
		(-1.274)	(-0.241)	(-0.212)
Fertilizer price (₦)	X_2	0.013	-0.076	0.085
		(0.131)	(-0.709)	(1.133)
Cowpea price (₦)	X_3	0.130*	0.050	0.007**
		(1.898)	(0.455)	(2.199)
Area grown to cowpea	X_4	0.172	0.238	0.042
		(1.572)	(2.023)	(0.563)
Farming experience (Yrs.)	X_5	0.022	0.381**	0.142*
		(0.220)	(2.430)	(1.927)
Cowpea variety (Dummy)	X_6	0.367***	0.116	0.068
		(3.572)	(1.073)	(0.935)
Education level (Yrs.)	X_7	-0.090	-0.003	0.104
		(-0.898)	(-0.032)	(1.440)
Income need (Dummy)	X_8	0.124**	-0.003	0.154
		(2.272)	(-0.029)	(0.208)
Family need (Dummy)	X_9	0.017	0.015**	0.017**
		(0.154)	(2.258)	(2.248)
R^2		0.633	0.605	0.662
Adjusted R^2		0.589	0.547	0.576
F value		22.085**	21.089**	31.357**
DW		1.696	1.745	1.621

Source: Field Survey

The general outlook of socioeconomic factors affecting cowpea production in both states is also presented in Table 5. The lead equation adopted is the double-log model which has the highest value for R^2 (0.66) and adjusted R^2 (0.58). Moreover, the F value (31.357) is the highest apart from being significant at 5% while the Durbin Watson value is 1.621.

The significant socio-economic variables affecting cowpea production in the study areas according to Table 6 are cowpea price ($\propto_{0.05}$), farming experience ($\propto_{0.10}$) and family need consideration ($\propto_{0.05}$). The implication of this is that food need of the farm-family was a major consideration in cowpea production. The fact that income need of the farm family is not significant may be an explanation for the non-significance of insecticide as a major resource in cowpea production. On a general note, since farmers' goal is to take care of their satisfying needs, they may be contented with the cowpea output generated on their farm; hence they may downplay the use of insecticide in this regard.

Socio-Economic Factors Affecting the Quantity of Insecticide Used in Cowpea Production in the Study Areas

The result of this study has shown that insecticide use is a significant factor in cowpea production only in Kano state. The results obtained for Ogun state and all the cowpea farmers in the study areas indicated that cowpea farmers are operating without special emphasis on the use of insecticide at optimal and significant levels. An insight into the socio-economic factors affecting the use of insecticide in cowpea production is therefore necessary in order to provide explanation to this unfolding scenario.

Table 7 shows the results of the regression analysis which explain the socioeconomic factors affecting insecticide use in the study areas. The results in table 8 are obtained from the Semi-log model which had the second highest R^2 (0.685) relative to the Cobb Douglas model (0.683). However, it has more variables significant while only one variable is significant in the Cobb Douglas model.

Table 7: Results of the Regression Analysis showing the Socio-Economic Factors affecting Insecticide use in Cowpea Production in the Study Areas.

COEFFICIENTS	LINEAR			SEMI-LOG			DOUBLE-LOG		
	Kano	**Ogun**	**All**	**Kano**	**Ogun**	**All**	**Kano**	**Ogun**	**All**
β_0	83.316	340.50*	166.30***	33.770	159.74	89.972	0.875	1.147	0.488
	(1.000)	(1.926)	(3.117)	(.218)	(-.223)	(.888)	(1.366)	(.702)	(1.293)
β_1	-0.150	0.256***	0.107	-0.228**	0.181*	-0.196	0.450***	0.079	0.345***
	(-1.284)	(2.666)	(1.498)	(-2.247)	(1.712)	(-2.724)	(4.765)	(0.865)	(5.063)
β_2	0.157	-0.026	0.140*	0.112	-0.035	0.144**	1.050	-0.013	0.040
	(1.491)	(-0.261)	(1.855)	(1.091)	(-0.329)	(1.996)	(0.297)	(-0.117)	(0.591)
β_3	-0.033	-0.106	-0.074	-0.009	-0.038	0.023	-0.102	-0.058	0.073
	(-0.308)	(-1.072)	(-1.015)	(-0.087)	(0.351)	(0.321)	(1.091)	(-0.533)	(1.093)
β_4	0.195*	-0.022	0.063	0.091	0.040	0.026**	-0.036	0.042	0.149**
	(1.736)	(-0.219)	(0.830)	(0.891)	(0.353)	(1.992)	(-0.375)	(0.360)	(2.134)
β_5	0.025	0.064	0.037	0.021	-0.063	0.006	-0.030	-0.004	-0.008
	(0.218)	(0.903)	(0.510)	(0.215)	(-0.563)	(0.087)	(-0.327)	(-0.632)	(-0.122)
β_6	-0.099	-0.063	-0.092	-0.037	-0.084	-0.062	0.084	0.025	0.055
	(-0.973)	(-0.575)	(-1.281)	(-0.368)	(-0.781)	(-0.863)	(0.997)	(0.428)	(0.811)
β_7	-0.064	0.356***	-0.156**	0.078	0.567	0.065	1.020	0.762	0.162
	(-0.574)	(3.585)	(-2.012)	(0.489)	(1.023)	(0.923)	(1.446)	(1.012)	(1.001)
β_8	-0.072	-0.011	-0.073	0.189*	0.011	0.120*	0.131	-0.085	-0.095
	(-0.695)	(-0.421)	(-1.027)	(1.923)	(0.097)	(1.701)	(1.612	(-0.763)	(-1.417)
R^2	0.603	0.61	0.56	0.653	0.600	0.69	0.685	0.587	0.68
Adjusted R^2	0.593	0.581	0.51	0.611	0.563	0.65	0.632	0.511	0.61
F-value	11.817	23.01**	22.07***	21.976**	16.03	37.63***	24.532*	12.042	36.06***
DW	1.873	1.71	1.70	1.939	1.41	1.71	1.807	1.32	1.67

Source: Field Survey

*** = significant at 1% ($\propto_{0.01}$) ** = significant at 5% ($\propto_{0.05}$) * = significant at 10% ($\propto_{0.10}$) Figures in parenthesis are t-value

The adjusted R^2 value of the selected model is 0.61 while the F value (21.976) is significant at $\propto_{0.05}$. The model is also consistent with the a priori expectations with respect to the sign and magnitude of the estimated parameters.

The results show that the socio-economic factors influencing insecticide use in cowpea production in Kano state are price of insecticide ($\propto_{0.05}$) and education level ($\propto_{0.10}$). Furthermore, a negative relationship exists between cowpea output and insecticide used. As price of insecticide decrease the unit of insecticide used increases and vice versa. This indicates that reduction in insecticide price will further increase insecticide use in cowpea production in Kano state. A positive relationship, however, exists between insecticide use and education. This indicates that increase in education level will further assist cowpea farmers in Kano state to know the advantages of using insecticide in cowpea production, which will have an attendant effect in boosting its use in cowpea production process.

Ogun State

Table 7 shows the results of the regression analysis which explain the socioeconomic factors affecting insecticide use in the study areas. The results in Table 8 are obtained from the Linear model which had the highest R^2 (0.61). It also has an adjusted R^2 value of 0.581 while the F value (23.01) is significant at μ 0.05. The model is also consistent with the a priori expectations with respect to the sign and magnitude of the estimated parameters.

The model shows that the socio-economic factors influencing insecticide use in cowpea production is insecticide price and variety of cowpea. This implies that price of insecticide is an important factor affecting the use of insecticide for cowpea production in Ogun state. However, a negative relationship exists between insecticide price and the quantity of insecticide used in the state. This means that a decrease in the unit price of insecticide would bring about an increase in the quantity of insecticide used. Cowpea variety on the other hand is a significant factor affecting insecticide use in Ogun state.

Table 8: Socioeconomic Factors affecting Insecticide use in Cowpea Production in the Study Areas.

Variables	Variable Names	Coefficients **Kano state**	Coefficients **Ogun state**	Coefficients **All**
Constant		33.770	340.50*	89.972
		(0.218)	(1.926)	(0.888)
Price of insecticide (₦)	Pp	-0.228**	-0.256***	-0.196***
		(-2.247)	(-2.666)	(-2.724)
Fertilizer price (₦)	Fp	0.112	-0.026	0.144**
		(1.091)	(-0.661)	(1.996)
Cowpea output (Kg)	Co	-0.009	-0.106	0.023
		(-0.087)	(-1.072)	(0.321)
Cowpea price (₦)	Cp	0.091	-0.022	0.026**
		(0.891)	(-0.219)	(1.992)
Area grown to cowpea (Ha)	Hc	0.021	0.064	0.006
		(0.215)	(0.903)	(0.087)
Farming experience (Years)	Fe	-0.037	-0.063	-0.062
		(-0.368)	(-0.575)	(-0.863)
Variety of cowpea grown (Dummy)	Va	0.078	-0.356	0.065
		(0.489)	(-3.585)	(0.923)
Education level (Yrs spent in school)	Edu	0.189*	-0.011	0.120*
		(1.923)	(-0.421)	(1.701)
R^2		0.653	0.61	0.69
Adjusted R^2		0.611	0.60	0.65
F-value		21.976	23.01**	37.63***
		1.939	1.71	1.71

Source: Field Survey

The results in Table 8 are obtained from the Semi-log model which has the highest R^2 (0.69) and an adjusted R^2 value of 0.61 while the F value (37.63) is significant at μ 0.01. The Durbin Watson value for the adopted model is 1.71, which shows positive auto-correlation of the model.

The model shows that the socio-economic factors influencing insecticide use in cowpea production in Kano and Ogun state are the price of insecticide ($\propto_{0.01}$), fertilizer price ($\propto_{0.05}$), cowpea price ($\propto_{0.05}$) and educational level of the respondents ($\propto_{0.10}$). A negative relationship exists between the insecticide used by the cowpea farmers and price of insecticide.

The fact that most of the cowpea farmers operate mixed cropping enterprises may have caused fertilizer price to be significant. It implies that a unit increase in fertilizer price would cause insecticide use to increase by (a less than proportionate change) 0.14%. Furthermore, a higher cowpea price would stimulate the cowpea farmers to produce more cowpea, a situation which might increase the demand for insecticide and a consequent increase in its price. Positive relationship was also found to exist between insecticide use and educational level of cowpea farmers.

CONCLUSION AND RECOMMENDATION

Insecticide use in cowpea production has been found to be a necessary requirement to increase yield of cowpea per hectare, and cowpea farmers were aware of this. Farmers did not however fully apply the recommended dose; this may be due to their low level of education coupled with the high cost of insecticide. This is also tied with the fact that majority of the cowpea farmers embarked on cowpea production in order to meet the farm family needs, a situation which made them engage more in multiple cropping, as a cultural strategy to reduce pest build-up and consequently lower the need for insecticide use on the farm.

This study has shown that it is imperative for governments at every level to create enabling environment for educate young individuals to go into farm business for national development (going beyond farming for family satisfaction). Also, to further stimulate the availability of insecticides to farmers at lower prices, it is therefore recommended that appropriate policy on the removal of duties on imported agrochemicals by government would assist as a short-term measure. Furthermore, strengthening the local industries involved in insecticide manufacturing through the provision of incentives to operate at reduced cost of production, could be a long-term solution. The alternative use of Agro-services corporations towards the supply of agrochemicals to cowpea farmers should take into consideration the diversionary strategies employed by operators and the timeliness of agricultural activities, especially as it relates to cowpea that is susceptible to insect pest damage at every stage of crop development.

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