

ANALYSIS OF AGROCHEMICAL USAGE AMONG RICE FARMERS IN EBONYI STATE, NIGERIA

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ABSTRACT

The study was designed to analyze agrochemicals usage among rice farmers in Ebonyi state, Nigeria. Specifically, the study seeks to: (i) describe the socioeconomic characteristics of the respondents in the study area; (ii) ascertain the perception of rice farmers on the use of agrochemicals in the study area; (iii) identify the types of agrochemicals available in the area and their frequency of use; (iv) estimate the costs and returns in the usage of agrochemicals for rice production in the study area; (v) and as well, determine the constraints limiting the use of agrochemicals among rice farmers in the study area. Data were collected using questionnaire. The data collected were subjected to statistical analysis using both descriptive and inferential statistics. The result revealed that 78.7% of the farmers were married with an average household size of 6-8 persons. They have a general perception that agrochemicals are Hazardous to human health (3.1) not readily available (2.7), costly and unaffordable (2.6) cause environmental hazard (3.0) and help to increase yield (3.3). The result on the types of Agrochemical usage depicted that 80% of the rice farmers used fertilizer, 56.7% use herbicides, and 33.3% use pesticides. Gross margin analysis result showed that using agrochemicals in rice production was a viable and lucrative business having a gross margin of ₦618, 800, net farm income of ₦567, 435 and benefit cost ratio of 3.44. Multiple regression analysis carried out indicated R² of 0.904 implying 90% variation in the regressand was explained by the combined influences of the regressors. It was recommended that government should develop good mechanisms for enforcing the regulations for the overall management and uses of agrochemical adopting FAO guidelines with adequate educational and training intervention. Government and non-governmental organization should ensure timely release of farm inputs to farmers' cooperative so that they can use them at the peak of the planting season.

Keywords: Agrochemicals, rice, rice production, cost and return, economics, perception.

1. INTRODUCTION

Modern agriculture relies on extensive use of agrochemicals which evoke a wide view of responses from different audiences. For farmers, agrochemicals are necessary part of their system for profitable production of high quality goods. For many environmentalists, they are hazardous substances which can damage wildlife and pollute soil and water. They are looked upon as a vehicle for improved crop production technology, though it is a costly input. Balanced use, optimum doses, correct method and right time of application of agrochemicals ensures increased crop production and also poses a risk to the entire ecological system if abused and misused (Kaila & Gupta, 2004). Agrochemicals is any substance used to help manage an agricultural ecosystem in farming area .They includes broad range of chemicals such as pesticides, insecticides, fertilizers, hormones, herbicides,

fungicides, and other growth chemicals. They were introduced to protect crops from pests and enhance crop yields. Globally, agro-chemicals (agricultural chemicals) are used for improving soil fertility and productivity (Nwaobiala, 2010).

The old civilization used organic manure (cow dung and poultry dropping) as a means of providing nutrients to the crops for a long period with consistent yield (Albert, 1989). According to Alex (2007), the use of agrochemicals is dangerous to the health of both the soil and humans. Agrochemicals on other hand, is expensive, and unaffordable to many small-scale farmers. Many of them are toxic and agrochemicals in bulk storage may pose a significant environmental and/or health risks particularly in the event of accidental spills (Andrew, 2007). In many countries, the use of agrochemicals is highly regulated and government permits for

purchase and use of approved agrochemicals. Significant penalties can result from misuse including improper storage resulting in the spillage of the product. On-farm, proper storage facilities and labeling, emergency clean up equipment and procedure for handling, application and disposal are often subject to mandatory standards and regulation and the regulations are carried out through registration process (Andrew, 2008).

Currently, there is low production of local rice due to insufficient supply of the factors of production (land, capital, labour and human resources). These have propelled the Nigeria government and private sectors into action to remedy the situation by giving farmers incentives to enhance rice production, which is one of the major staple crops in the country. Recently, Nigeria's dependence on oil sector have started declining thereby giving room for the country to go back to its original source of income leading both the state and federal governments to embark on aggressive agricultural production by allocation of land to farmers, civil servants and cooperative societies, disbursement of loans to farmers with low or no interest rate, distribution of farm inputs such as seedlings, agrochemicals of all types and cultivation of different types of crops especially rice (Nwaobiala, 2010).

According to Toth and Buhler (2009), about 36% of yield losses are due to weeds and pest occurrences in our farms. This derives from unavailability and inaccessibility of the appropriate and adequate chemicals at required time to farmers for weed control. According to Solomon, Giesy and Jones (2008), the use of agrochemical has gone a long way in reducing the risk of low yield, post-harvest losses and has generally contributed to increasing agricultural productivity.

It is worthy of note that there exists a demand-supply gap due to increase consumption rate of rice. Despite the place of rice in contributing to the food supply in Nigeria, its production is still put at 3.2 million tonnes (Babafada, 2003; Ohaka *et al.*, 2013). This has shown to be far below the national requirement as over 600 million dollars' worth of rice is imported annually into the country (Raufu, 2014). Some of the challenges of rice production in Nigeria include: high input cost, inadequate access to credit, high cost of imported equipment, high cost of agrochemicals. In Nigeria, out of 4.6 million hectares available for rice production, only 1.7 million hectares are put to rice cultivation, despite that, its production is labour intensive (Nwaobiala, 2010).

Weed, birds, rodents and pests are the major constraints to rice production in many parts of the world and therefore, success in this venture mostly depends on effective weed control and management. The application of Agrochemicals for the control of wide variety of insectivorous, herbaceous pests and

green leaves, has contributed enormously to the success of agricultural advancement globally, but with some noticeable pollution effects on ecosystem and human health (Afolabi, Omotayo & Olesegun, 2013). Most farmers in developing world are not aware of the environmental impacts of using agrochemicals on their farms, animals and plant (Kamel, 2000). Specifically, the study seeks to: describe the socioeconomic characteristics of the respondents in the study area; ascertain the perception of rice farmers on the use of agrochemicals in the study area; identify the types of agrochemicals available in the area and their frequency of use; estimate the costs and returns in the usage of agrochemicals for rice production in the study area; and as well, determine the constraints limiting the use of agrochemicals among rice farmers in the study area.

2.0 METHODOLOGY

2.1 Study Area

The study area is Ebonyi State; an inland South – Eastern State of Nigeria created on 1st October 1996. Its capital and largest city is Abakaliki. It lies between Latitudes 5° 40'N and 6° 45'N of the Equator and Longitude 7° 30'N and 8° 28'E of the Greenwich Meridian. The State is bounded to the South-East by Cross River, to the North East by Benue, to the West by Enugu and on the South West by Abia State (Ebonyi State Ministry of land and survey, 1997). Ebonyi State has a population of 2,175,501 (National Population Commission, NPC, 2006) and a land mass of about 5,935km² most of which are fertile and arable. The state is blessed with an abundance of flood plains and a good number of perennial and seasonal rivers and other natural resources such as zinc, limestone, etc. The topography is level land with scattered hills, valleys and rocky settings fit for tourism (Nwambe, 2004).

2.2 Sampling and Data Collection

Multistage sampling technique was employed in the selection of respondents. The first stage involved a random selection of six (6) local government areas out of the thirteen (13) local government areas in the state. In the second stage, five (5) communities were randomly selected from each of the selected local government making a total of thirty (30) communities. Finally, five (5) farmers were randomly selected from each of the sampled communities making it a total of one hundred and fifty (150) farmers who supplied information used for the study. Data were collected from primary sources only using a set of structured and pre-tested questionnaires.

2.3 Methods of Data Analysis

Objectives (i), (ii), (iii) and (vi) were analyzed using descriptive statistics such as tables, percentages and frequencies. Objectives (iv) was analyzed using the

budgetary technique-gross margin analysis. Finally, Objective (v) was addressed using multiple regression analysis.

2.4 Model Specifications

2.4.1 Gross Margin

The budgetary technique was used to determine the profitability of rice production systems in the study area. Gross margin analysis is one of the budgetary techniques and it basically measures the difference between total returns and total variable costs. The Gross margin analysis that was adopted in this research is in accordance with Nwaobiala (2010).

$$GM = \sum P_i Q_i - \sum P_j X_j \quad (1)$$

where: GM = Gross Margin;

P_i	=	Unit price of output;
Q_i	=	Quantity of each output;
P_j	=	Unit price of each input;
X_j	=	Quantity of each input

NR = GM – TFC, where NR= net revenue GM= gross margin and TFC= total fixed cost.

2.4.2 The OLS Multiple Regression Model

The OLS multiple regression model was used to determine the effects of socio-economic characteristics of the rice farmers on the frequency of agrochemicals use.

The OLS multiple regression model is implicitly and explicitly stated as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, \dots, X_{10}) \text{ (implicit form)} \quad (2)$$

$$Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + \dots + b_n X_n + e_t \text{ (explicit form)}$$

Where

Y = frequency of agrochemicals use (Number of application times in a planting season)

X_1 = Gender (dummy variable: Male=1, Female=0)

X_2 = Age (years)

X_3 = Marital status ((dummy variable: married=1, otherwise, 0)

X_4 = Household Size (number of persons)

X_5 = Educational level (years)

X_6 = Farming Experience (years)

X_7 = Farm size (hectares)

X_8 = Membership of Cooperative Society (dummy variable: Member=1, Non-member=0)

X_9 = Extension contact (dummy variable: yes=1, no=0)

X_{10} = Annual income (₦)

b_1 - b_{10} = Regression coefficients

e_t = Stochastic error term.

3. RESULTS AND DISCUSSION.

3.1 Socio-Economic Characteristics of Respondents

The result presented in Table 1 showed that males dominated among farmers that used agrochemicals in

rice production in Ebonyi State accounting for 61.3% of the respondents, while the remaining 38.7% were females. This finding is in consonance with that of Chukwu and Umeh (2015). It was found that 6.7% were within the age range of 21-30 years, 40% were within 31-40years, 29.3% and 14.7% were within the age range of 41-50 and 51-60 years respectively while 9.3% were above 60 years. This shows that most of them were in their active economic years, hence had active participation in the farming activities. This will go a long way to enhance productivity since agriculture is a labour -intensive activity. According to Adewumi and Omotosho (2002), productivity and output of the farmer is expected to be affected by his age, as younger and more energetic farmers tend to have increased overall output from their farming enterprise as opposed to their aged counterpart who makes minimal input.

Moreover, the result also showed that greater proportions (78.7%) of the respondents were married while 21.3% were single. This implies that married people were more involved in rice production than those who are single. This could be attributed to the fact that married men and women had greater household responsibilities and seek various ways to feed their families. This is in agreement with the findings of Nwosu, Onyeneke and Okoli (2013) who revealed that majority of adult population of any society consists of married people. Also, majority (53.3%) of the respondents had the highest household size of between 6-8 persons while minority (6.7%) had below 3 persons. The household size of most of the respondents was high due to polygamous nature of most farmers since members of the farm household contribute largely to family labour supply. Although, this report contradicts the findings of Okwuosa (1997) who reported that household size of farmers in Nigeria ranged between 11-15 persons.

Furthermore, a good number (40%) of the rice farmers had primary education while a few (13.3%) had tertiary education. From this result, it can be deduced categorically that majority of the rice farmers in the study area were relatively literate. In view of these findings, it is expected that based on their educational level, their level to adoption of innovation will be relatively high compared to illiterate farmers who are always conservative, skeptical to innovation and risk averse as opined by Obasi *et al* (2016), Adesina & Baidu (1995). Moreso, 34.7% of the rice farmers had farming experience of 16-20 years, 20% had from 21 years and above, 15.3% had between 11-15years, 12% had 5-10years while 10% had below 5 years experience in farming. Therefore, majority of the farmers were highly experienced and knowledgeable in rice production, and hence are expected to increase their yield as a result of much experience in farming. This findings is in agreement with findings of Nwachukwu and

Onyenweaku (2009) who reported that experience of farmers increase farmers output.

Result gathered on farm size shows that majority (40%) of the respondents had farm size range of 0.5-1.5 hectares of land, the least farm size in the area they cultivate rice was between 3.8 hectares and above which accounted for 5.3%. The implication of this result is that rice is being cultivated on a small plot of land. This may be as a result of problem land tenure system prevalent in Nigeria. These findings concur with the result obtained by Ogunbible and Olukosi (1991) and Nwaiwu (2007) that majority of farmers in West Africa are small holder farmers with farm size less than 6 hectares. The result also shows that majority (65.3%) of the farmers were members of cooperative while minority (34.7%) of them were not members of cooperative society. The higher participation to the cooperative may be as a result of the farmers' literate level which helps them to form cooperative to enhance easy accessibility of farm input from both governmental and non-governmental organization. However, these findings are in sharp contrast to that of Shettima, Ibrahim, Mohammed and Zongoma (2016) which attributed farmers in ability to join cooperative to the fact that there is no

much enlighten on the importance/benefits derived from being a member of farmers group.

It was also seen that majority of the farmers (53.3%) had extension contact while (46.7%) had no extension contact. This clearly indicated that extension agent in the study area are working but has not been effectively reached the farmers to introduce innovation which could enhance their agricultural productivity in the study area. This may be as the result of poor rural road network within the study area and other factors. This result is in line with the findings of Adesina & Baidu (1995) who opined that extension agent is one of the means to achieve high productivity in agricultural production. Rice farmers in Ebonyi State uses different sources of labour in rice production but majority (69.3%) used hired labour, minority (13.3%) used communal labour while 17.3% used family labour. This result indicates that labour is mainly hired in the study area. The result of the analysis on annual income of rice farmers showed that majority (62.67%) were those who earned between ₦ 100,001 - ₦ 200,000 while the least (3.33%) were those who earned above ₦ 300,001 and above annually. This implies that the rice farmers had minimal income possibly as a result of their engagement in small scale rice production.

Table 1: Socio-Economic Characteristics of Respondents

Socioeconomic variable	Frequency (150)	Percentage	Mean
Gender			
Male	92	61.3	
Female	58	38.7	
Age(years)			
21-30	10	6.7	
31-40	60	40.0	49
41-50	44	29.3	
51-60	22	14.7	
61 and above	14	9.3	
Marital status			
Married	118	78.7	
Single	32	21.3	
Household size			
1-5	40	26.7	8
6-10	80	53.3	
11-15	20	13.3	
16 and above	10	6.7	
Educational level			
No formal education	30	20.0	
Primary education	60	40.0	
Secondary education	40	26.7	
Tertiary education	20	13.3	
Farming experience			
1- 5	15	10.0	15
6-10	18	12.0	
11-15	23	15.3	
16-20	52	34.7	
21 and above	42	28.0	
Farm size (ha)			
0.5-1.5	80	53.3	1.8

1.6-2.6	34	22.7
2.7-3.7	28	18.7
3.8 and above	8	5.3
Membership of farmers cooperative Society		
Yes	98	65.3
No	52	34.7
Extension contact		
Yes	80	53.3
No	70	46.7
Source of labour		
Family	26	17.3
Hired	104	69.3
Communal	20	13.3
Annual income (₦)		
Below 100,000	32	21.3
101,000 – 200,000	94	62.7
2010,001 – 300,000	19	12.7
301,000 and above	05	3.3
Total	150	100

Source: field survey, 2019.

3.2 Perception of Rice Farmers on the use of Agrochemicals

The result presented in Table 2, showed the mean score analysis of perception of rice farmers on the use of agrochemicals in the study area. From the result, it can be seen that item below 2.5 were rejected and considered as weak factor on the perception of the rice farmers on the use of agrochemicals, whereas those items that attained a mean score of 2.5 and above were chosen to be a strong factor on the perception of the rice farmers on the use of agrochemicals. Based on this, items that attained a mean score and above were: Hazardous to

human health (3.1) not readily available (2.7), costly and unaffordable (2.6) cause environmental hazard (3.0) and help to increase yield (3.3). This however, implies that these factors mostly influence the decision making approaches of farmers in the choice of the type, quality and concentration of the agrochemicals used in combating rice pest and weed. On the other hand, items that did not attain a mean score of 2.5 are weak factor on the perception of farmers on the use of agrochemical; an indication that they have little or no influence on their choice of agrochemicals used on the field.

Table 2: Mean score Analysis of Perception of Rice Farmers on the use of Agrochemicals.

S/N	Items	Means score (\bar{x})	Decision
i.	Hazardous to human health	3.1	Accepted
ii.	Not readily available	2.7	Accepted
iii.	Costly and unaffordable	2.6	Accepted
iv.	Hazardous to soil microbes	1.7	Rejected
v.	Destroy the soil	2.2	Rejected
vi.	Cause decay	1.8	Rejected
vii.	Reduce the rice yield	1.4	Rejected
viii.	Cause soil compaction	2.0	Rejected
ix.	Increase soil Ph	2.3	Rejected
x.	Cause environmental hazards	3.0	Accepted
xi.	Attract pests	2.4	Rejected
xii.	Help o increase yield	3.3	Accepted

Source: field survey, 2019

3.3 Types of agrochemicals used in the study area

The result in Figure 1 depicted that 80% of the rice farmers used fertilizer, 56.7% use herbicides, and 33.3% use pesticides while 30% use insecticides in the management of their field pest and weed control in the study area. The result equally showed that none of the respondents used fungicides in pest

management, indicating that that there is little or no infestation of fungal diseases in the study area. The level of availability of fertilizers in agrochemical input stores is higher than that of other agrochemicals which were not frequently used. From these observations, one can see that there exists an agreement with the findings of this research and

Chukwu and Umeh (2015) who reported that majority of farmers use chemical fertilizer in

agricultural production especially in rice production in Ebonyi State.

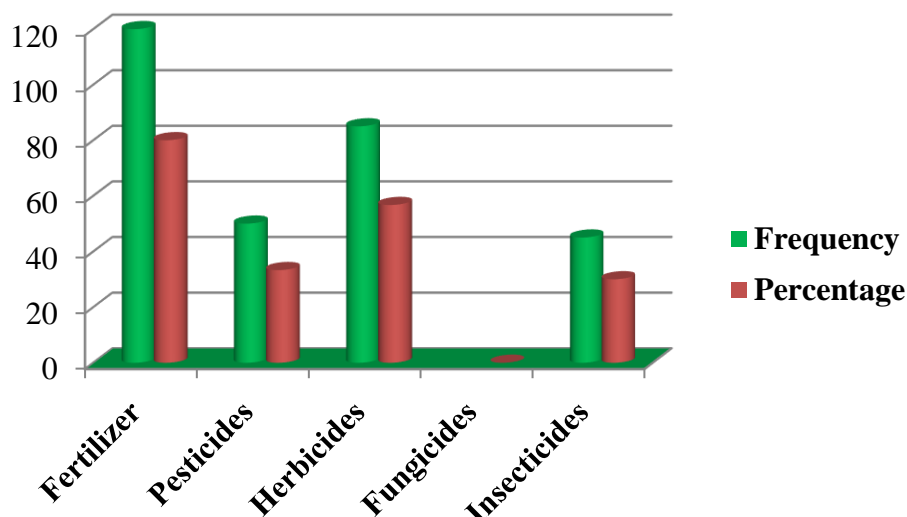


Figure 1: Distribution of Respondents According to the Type of Agrochemicals Used in the Study Area (computed from data of field survey, 2019 (Multiple responses obtained *))

3.4 Frequency of Agrochemicals Use in the Study Area

It was also seen in Table 3 that 84% and 83.3% of the farmers applied fertilizers and herbicides respectively once or twice in a planting season while only 60% applied insecticides, whereas a negligible number of the farmers (1.33%, 16.7% and 5.3%) admitted to have applied chemical fertilizer, herbicides and pesticides three to four times

respectively within a year. Others who never adopted the use of agrochemicals are mainly the subsistence/peasant ones who only produce for domestic consumption. This practice has always been met with poor yield owing to soil degradation, weed suppression and pest infestation on the field. This clearly showed that chemical fertilizers are the most commonly used agrochemicals employed by rice farmers in Ebonyi State to boost their crop yield.

Table 3: Distribution of rice farmers according to the frequency of agrochemicals use in the study area

	Agrochemicals (number of times in a season)	Frequency	percentage	Mean (\bar{x})
A	Fertilizer (inorganic)			
	1-2	126	84	
	3-4	22	14.7	
	5 and above	2	1.3	2
B	Herbicides			
	1-2	125	83.3	
	3-4	25	16.7	
	5 and above	-	-	2
C	Insecticides			
	1-2	82	54.7	
	3-4	8	5.3	1
	5 and above	-	-	

Source: field survey, 2019

3.5 Cost and Return Analysis of rice produced using agrochemicals

Conversely, from Table 4, the result of the cost and return analysis of rice production revealed that a total gross margin of ₦ 618,800 (Six hundred and eighteen thousand, eight hundred naira) only was made in the production of rice in a hectare using agrochemicals. Further analysis was carried out to

determine the benefit cost ratio and result gotten showed that to every ₦ 1 invested/spent in rice production in the state, ₦ 3.44 could be realized as incomes. This implies that rice production enterprise is a viable and lucrative venture which concurs with the findings of Chukwu and Umeh (2015). This also conforms to the finding of Nwakpu (2014) who

reported that fertilizer application in rice production increases output and so makes it more profitable.

A high gross margin is an indication that the farmers are selling their produce at high profit level. Hence, the farmers are expected to have sufficient fund to pay for operating expenses such as wages, utilities and rent while having high turnover in the study area. This finding is in consonance with Ekpe and Alimba (2013), where they reported that rice production in Ebonyi State has positive gross margin because total revenue is far higher than total variable cost. The profitability of rice enterprises and of course farmers income is expected to increase significantly when more land is allocated to the production of rice. Moreover, the findings revealed that total variable

cost (₦ 181,200) which comprised total cost of input (₦ 91,700) and total cost of labour (₦ 89,500) accounted for the largest proportion of resources used in rice production per production cycle. These costs include seeds, selective and non-selective herbicides, insecticides, urea, NPK, nursery preparation, transplanting, fertilizer application, herbicide application, harvesting, bagging among others. This clearly indicates that large amount of resources is invested on input requirements. This findings is corroborated with the assertions of Ereinstein, Lançon, Osiname, & Kebbeh. (2004); Duvvuru and Motkuri (2013) that 'Rice production is labour intensive and relies on a significant usage of paid labour' in most cases.

Table 4: Cost and Return Analysis of rice produced using agrochemicals per hectare

s/n	Items	Unit	Quantity	Unit price (₦)	Total cost (₦)
1.	Revenue	₦	4mt	200,000	800,000
2.	Total Revenue				800,000
3	Variable cost				
3a.	Cost of inputs				
i.	Seeds	Kg	50	350	17,500
ii.	Non-selective herbicides	Litre	4	1,800	7,200
iii.	Selective herbicides	Litre	2	3,500	7,000
iv..	Insecticides	Litre	2	2,500	5,000
V	NPK	50kg	4	8,000	32,000
vi.	Urea	bags 50kg	2	9,000	18,000
vii.	Pesticides	bags 50kg	2	2,500	5,000
	Total cost of input				91,700
3b	Cost of labour				
viii.	Nursery preparation	Md	3	1,500	4,500
ix.	Land preparation	Md	20	2,000	40,000
x.	Transplanting	Md	10	1,000	10,000
xi.	Fertilizer application	Md	4	1,000	4,000
xii.	pesticide application	Md	2	1,000	2,000
Xiii	Herbicides application	Md	2	1,000	2,000
xiv.	Bird scaring	Md	2	1,000	2,000
xv.	Harvesting	Md	6	1,000	2,000
xvi.	Threshing/winnowing	Md	4	1,000	4,000
xvii.	Drying	Md	2	1,000	4,000
xviii.	Bagging	Md	4	1,000	4,000
xix	Miscellaneous				10,000
	Total cost of labour				89,500
4.	Total variable cost(TVC) (3a+3b)				181,200
5.	Fixed cost (depreciated value of farm cost except land)				
Xxi	Land	Ha	1	40,000	40,000
xxii.	Knapsack sprayer	₦	2	2,250	4,500
Xxiii	Hoe	₦	3	340	1,020
xxiv.	Matchete	₦	3	230	690
xxvi.	Wheelbarrow	₦	1	2,875	2,875
xxvii.	Sickle	₦	3	60	180
xxviii.	Bag	-	70	30	2,100
	Total fixed cost (TFC)				51,365

6	Total cost (4+5)	232,565
7	Gross margin (2-4)	618,800
8	Net farm income (2-6)	567,435
9	Benefit cost ratio (2/4)	3.44

Source: computed from field survey data, 2019.

3.6 Test of Hypothesis

Multiple regression analysis carried out as shown in Table 5, shows high coefficient of multiple determination (R^2) of 90% and an F-ratio of 94.32 which was significant at 1% level. The coefficient of gender (X_1), age (X_2), marital status (X_3), educational level (X_5), farm size (X_7), extension contact (X_9) and annual income (X_{10}) were statistically significant, while the coefficient of household size (X_4), farming

experience (X_6) and membership of cooperative (X_8) were statistically insignificant. Furthermore, since t -cal for gender, age, marital status, extension contact and educational level $> t$ -tab, the null hypothesis was rejected and alternative accepted and this implies that the socio-economic characteristics of the rice farmers have a significant influence on the frequency of agrochemicals used by those variables in the study area.

Table 5: Decision table for test of hypothesis

Socio economic characteristics	T-cal	T-tab(critical)	Decision
Gender	-4.51	2.57	Rejected
Age	20.70	2.57	Rejected
Marital status	-3.60	2.57	Rejected
Household Size	0.08	0.67	Accepted
Educational level	1.77	1.28	Rejected
Farming Experience	-0.27	0.67	Accepted
Farm size	-1.93	1.96	Accepted
Member of cooperative society	0.62	0.67	Accepted
Extension contract	2.71	2.57	Rejected
Annual income	-1.63	1.96	Accepted

Source: computed from field survey data, 2019.

From Table 6, it can be seen that the farmers face a lot of challenges in the effective utilization of agrochemicals in rice farming in the study area. The constraints that score 3.0 and above were chosen to be a strong constraints to effective utilization of the agrochemical while any item that score below 3 is seen as not a strong constraints to use of agrochemicals. However, the constraints that score 3.0 and above includes the following: High cost of agrochemicals (3.0), Hazardous to man (3.1), Not readily available (3.2), lack of technical know-how (3.1), inadequate access to credit (3.3), low farm income (3.2), poor access to trained agrochemical experts (3.1), High cost of transportation (3.4) and inconsistency in availability of agrochemicals (3.3). This finding is in accordance with Robertson and Swinton (2005) who are of the opinion that high cost of transportation, inadequate access to credit problem of land tenure among others are limiting factors to agrochemical use in agriculture. The findings equally concur to that of Tekwa et al; (2010) who reported that the major constraints to effective use of

agrochemical includes lack of technical know-how, low farm income, and poor policy implementation. This is because when government policies are not favourable in line with subsidization of agrochemical, the use of agrochemical becomes limited.

On the other hand, the constraints that were below the mean point were identified to include: not readily accessible (2.4), late access to credit (2.8), high cost of agrochemical application (2.7), unpredictable weather (2.7), high interest rate on credit (2.9) and poor access to extension agent. Kamel (2000) reported that poor use of agrochemicals in agricultural production could be attributed to some factors which include poor farm income, hazardous in nature and inconsistency in agrochemical availability. Also Andrew (2008) observed that the use of these agrochemicals though on one side accounts for increased yield, on the other hand, the products are of less natural content and contain some heavy chemicals.

Table 6: Mean Score Distribution of Constraints to Effective use of Agrochemicals in the Study Area.

s/n	Constraints	Means score (x)	Decision
I	High cost of agrochemicals	3.5	Accepted
Ii	Hazardous to man	3.1	Accepted
Iii	Not readily available	3.2	Accepted
Iv	Not readily accessible	3.4	Rejected
V	Lack of technical know how	3.1	Accepted
Vi	Poor government policy	2.3	Rejected
Vii	Poor policy implementation	3.0	Rejected
Viii	Inadequate access to credit	3.3	Accepted
Ix	Poor access to extension agents	2.9	Rejected
X	Low farm income	3.2	Accepted
Xi	Late access to credit	2.8	Rejected
Xii	High interest rate on credit	2.9	Rejected
Xiii	High cost of agrochemical application	2.7	Rejected
Xiv	Poor access to trained agrochemical experts	3.1	Rejected
Xv	Unpredictable weather	3.4	Accepted
Xvii	Inconsistency in availability of agrochemicals	3.3	Accepted

Source: field survey, 2019.

4 CONCLUSION AND RECOMMENDATIONS

Rice production, a major staple, is an important agricultural enterprise that should be encourage among farmers. Proper usage of agrochemicals enhances rice profitability and as well, reduces its environmental impact on the ecosystem. The promotion of rice production among farmers will increase availability and affordability of the grain, enhance income generation of farmers and improve food security at the household and national level. Agrochemicals were mainly used by male farmers who were still within their productive and youthful age and mostly by those who have attained some level of education. Some farmers perceived agrochemicals as dangerous to humans, costly and unaffordable to some of them, and always not readily available. They also viewed agrochemicals that it helps to increase their yield and the most common agrichemicals used in the area were fertilizer, herbicides, pesticides and insecticides.

Finally, the major constraints that impede agrochemicals used in the study area were identified to include; high cost of agrochemicals, hazardous to man, not readily available, lack of technical know-how, inadequate access to credit, low farm income, poor access to trained agrochemical experts, high cost of transportation and inconsistency in availability of agrochemicals in the study area.

By virtue of the findings of this study, the following recommendations were made: Government should develop good mechanism for enforcing the regulations for the overall management and use of agrochemicals adopting FAO guidelines with adequate educational and training interventions. Farmers should also be encouraged to form cooperative societies which will help them in pooling their resources together thereby acquiring financial assistance from government and financial institutions to make agrochemicals available to them at all time. Governmental and Non-governmental organization

should ensure timely release of farm inputs to farmers' cooperatives to enable them used at the correct planting sessions.

Extension agents should be trained and empowered to educate farmers on correct and effective use of agrochemicals in rice production. It is also imperative that government subsidize the price of farm inputs to make them accessible and affordable to farmers.

REFERENCES

- Abdullahi, A. (2012). Comparative Economic Analysis of Rice Production by Adopter and non- Adopter of improved varieties of rice among farmers in Paikoro LGA of Niger state. *Niger. J. Basic and Appl. Sci.* 20(2). pp, 146-151.
- Adesina, A. A. & Baidu-Forson, J. (1995). Farmers' perceptions and adoption of new agricultural technology: evidence from analysis in Burkina Faso and Guinea, West Africa *Agricultural economics*, 13(1), 1-9.
- Alim & Ayanwale (2004). A Study of occupational safety practices among rural Farmers in Ile-Ife area of Ogun State, Nigeria. An emphasis on relevant training needs. *Journal of Agricultural and Biological Sciences* 2(5): 227-235.
- Alex, G. (2007). Organic abundance report: fatally flawed-commentary. *Renewable Agriculture and food systems* a (Cambridge: University press) 22(4): Pp321-323.
- Andrew, W. (2007). http://disaster.itas.uft.edu/agrochemical_security.htm agrow (538):5 retrieved 5th Dec. 2011.
- Audu, S.I. (2008). Analysis of Cost and Return of Rice Production in Ankpa Local Government Area of Kogi State, Nigeria. *Proceedings of*

- the 42nd Annual Conference of ASN held at EBSU, Abakaliki October 19-23rd Pp 768.
- Chukwu, V.A & Umeh, G. N (2015). Adoption Differentials and Benefits of Improved Rice Production Technologies among Farmers in Ebonyi State of Nigeria. *Journal of Biology, Agriculture and Healthcare* 5(7), www.iiste.org ISSN 2224-3208 (Paper) ISSN 2225-093X.
- Ebonyi State Agricultural development programme (EBADEP,2005). Annual report.
- Ebonyi State Ministry of lands and survey (1997).Administrative map of Ebonyi.
- Ekpe, I.I. and Alimba, J.O.(2013). Economics of Rice Production in Ebonyi State Nigeria, *International Journal of Agriculture and Veterinary Sciences* ISSN: 2277-209X (Online) An Online International Journal Available at <http://www.cibtech.org/jfav.htm> 2013Vol.3 (2): 77–8. Gupta, M and Kaila, B (2004). *Economics of Agricultural Production and Resources use*. Prentice –hall, New Jersey.
- Johns, R. (2010). Likert items and scales: surveys question bank. Retrieved august10,2016 from <http://www.surveynet.ac.uk/sqb/data/collection/likertsheet.pdf>.
- Kalia, A & Gupta R.P. (2004). Disruption of soil food web by pesticides. *Indian Journal of ecology* 31(2):85-92.
- National Population Commission. (NPC, 2006). *Census Report of Nigeria. Population and Development Review*, 33(1) (Mar., 2007), pp. 206-210 Published by: Population Council Article Stable URL: <http://www.jstor.org/stable/25434601> Assessed 7th May 2013.
- Nwachukwu, I.N & Onyenweaku, C. (2007) *Economic efficiency of Fadama Telferia Production in Imo State, Nigeria: A translog profit function approach*. Munich Personal Repec Archive. MRA Paper No. 13469.
- Nwaiwu, I.U (2007). Comparative Analysis of the use of External and Internal farm inputs for sustainable cassava production in Imo State. An unpublished M.Sc. thesis submitted to the Postgraduate School, Federal University Technology, Owerri, Imo State Nigeria.
- Nwaobiala, C.U. (2010). Economic Analysis of Swamp Rice Production in Ebonyi Southern Agricultural Zone of Ebonyi State, Nigeria. *Journal of Agriculture and Social Research (JASR)* 6 (2): 44-48.
- Nwosu, C.S., Onyeneke, R.Y & Okoli, V.B. (2013). Socio-economic determinations of fluted pumpkin leaf (*Telferia occidentalis*) Production in Ezinihitte Mbaise Local Government Area of Imo state, Nigeria.
- Odoemenem, I. U. & Obinne, C. P. O. (2010). Assessing the factors influencing the utilization of improved cereal crop production technologies by small-scale farmers in Nigeria. *Indian Journal of Science and Technology*, 3(2), 180-183.
- Okorji, E. C. and K.O. Onwuka. (1994). A Comparative Analysis of Costs and Returns of Non-Integrated and Integrated Rice Production Systems in Uzo Uwani Local Government Area of Enugu State, Nigeria. *Agricultural Systems in Africa*, Vol. 4, No. 2.
- Okwuosa, A.C. (1997). Women and Food Security in the context of Economic and rural Development. *Integrated Agricultural Production in Nigeria, Strategies and mechanisms for food security*. Fairchild design and print, Ibadan pp46-48.
- Omotosho, A.O, Muhammad- Lawal A & Yusuf, YK (2014). Economics of small scale rice production in Patigi and Edu Local Government Areas of Kwara State, Nigeria. *Afr. J. Agric. Res.* 5(4).
- Osagie C (2014). Rice Import Ban and Trade Politics. "This day news" Jan 28.
- Raufun, M.O (2014). Costs and Returns Analysis of rice production in Kwara State Nigeria. *Under Sawah technology. Advance in Agriculture and Biology* 1(2). pp. 79-83.
- Shettima B.G., Ibrahim, A., Mohammed, S.T & Zongoma B.A. (2016). Economic Efficiency of Irrigated Vegetable Production in Borno State Nigeria: A Stochastic Frontier Cost Function Approach.
- Solomon, K; Giesy, J, & Jones P. (2008). Probabilistic risk assessment of agrochemicals in the environment. *Crop Protection*.19(8-10):649-5.5
- Toth, S.J.& Buhler W.G (2009). Environmental effects of pesticides, Department of Entomology and Horticultural Science, North Carolina State University.
- West African Rice Development Agency, WARDA(1998). *Focus interspecifics: Africa-Asia Joint Research on Interspecific Hybridization between African and Asia Rice varieties*. Highlights of 1998 Activities, Bouaké.
- Wikipedia (2007). Ebonyi State Population. Retrieved Sept 7th 2016 from <http://en.wikipedia.org>
- Yuguda, U. (2003). "Towards a sustainable rice production in Nigeria, proceedings of a seminar organized by Nigeria Export Promotion Council at Hamadala Hotel, Kaduna. P.10.