WILLINGNESS TO PAY FOR ORGANIC FERTILIZER BY RESOURCE POOR VEGETABLE FARMERS IN THE HUMID TROPIC

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ABSTRACT

The study was conducted in Itu Local Government Area of Akwa Ibom State, Nigeria between July, 2014 and December, 2014 to assess resource poor vegetable farmers' willingness to pay for a premium of organic fertilizer. With the aid of questionnaire, primary data were obtained from 60 vegetable farmers using multi-stage sampling procedure. Data were subjected to analysis using the univariate probit regression model. Results of analysis showed that whereas age of the farmer was significant ($P<0.01$) and positively related to willingness of farmers to pay for organic fertilizers; education, farm size, farm income were significant ($P<0.01$) and positively related to willingness of farmers to pay for organic fertilizer. Findings further revealed that marital status was positively significant ($P<0.05$). Increasing farm holdings and improvement in educational opportunities are policy decisions aimed at enhancing the willingness of resource poor vegetable farmers to pay for organic fertilizer as an alternative soil ameliorant.

Keywords: Univariate probit regression, chemical fertilizers, soil ameliorant, farm holdings, farm size

1. INTRODUCTION

Rapid urbanization in low and middle income countries has posed major challenges to rural-urban planning and food security as well as waste management and environmental degradation [1, 2]. Food production in Africa suffers from numerous constraints, including diminishing usable land due to the dwindling water resources, climate variability, unimproved planting materials, poor marketing and distribution system and above all, high cost of agricultural inputs, particularly fertilizer [3, 2]. Higher rate of soil fertility decline and consistently lower crop yields therefore necessitate increased use of inorganic fertilizer in Africa [4] and [5]. But the high cost of inorganic fertilizer reported by [6] has prevented the resource poor small scale farmers (predominantly those within the low income class) from utilizing the required levels of fertilizer to boost crop production. It is therefore needful to source for a cost effective alternative soil ameliorant capable of increasing agricultural productivity as well as providing protection and restoration of the ecosystem. Reduction in use of chemical fertilizer through the adoption agricultural production methods will help achieve these goals. Hass [7] posited that achieving optimal agro ecosystem which are socially, ecologically and economical sustainable are the aims of organic production system. According to Dipleolu et al [8], organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health including biodiversity, biological cycles and soil biological activity. It avoids the use of synthetic pesticides, herbicides, chemical fertilizers, growth hormones, antibiotics or gene manipulation. Organic farmers use a range of techniques that help sustain ecosystems and reduce pollution and

rather increases both agricultural yield and disease resistance through powerful laws of nature [9]. Major source of extensive environmental damage has been linked to the use of chemical fertilizer. According to Lumpkin [10], food safety is a major concern as many of today's vegetable farmers inappropriately use toxic pesticides at pre and post-harvest stages and this threatens the health of the farmer and consumer as well as contaminating the environment. In Niger delta region, organic agriculture had existed by default because of the unavailability, high cost and sparse use of chemical inputs like fertilizer by farmers. But the sustainability of an agribusiness venture requires that the willingness to pay for a product by its target consumers be ensured. Willingness to pay (WTP) for a commodity is the amount of money a person would be willing to pay for a higher level of environmental or commodity quality; According to Golan and Kucker [11], WTP is a measure of the resources individual are willing and able to give for a reduction in the probability of encountering a hazard that comprises their health. Spencer [12] opined that a theoretical correct measure of the value individuals attach to improvements in food safety is their 'WTP' for safer food. Thus, therefore, is the largest amount that an individual is willing to pay for a specific improvement in food safety. The notion of willingness to pay could be defined as the sum of money representing the difference between consumer surplus before and after adding or improving a food product attribute [13]. But Anderson et al [14] emphasized the need to evaluate whether or not the product will be accepted by the market before committing financial resources to it. Aside from this, the form which consumers want the product is of great market significance. Since transforming these inputs into usable organic soil augmenting materials requires huge financial resources, it becomes imperative it to investigate the perception and amount of money farmers will be willing to pay for this higher level of environmentally friendly product. This study therefore seeks to assess vegetable farmers perception and willingness to pay for organic fertilizer in Itu, Akwa Ibom State of Nigeria.

2.0 METHODOLOGY

2.1 Study Area, Sampling and Data Collection Procedure

The study was conducted in Itu Local Government Area of Akwa Ibom State, Nigeria. Itu lies within the humid tropical rain forest zone with annual rainfall of 2000-3000mm. It lies between latitude $4^0$57' and $5^0$10' North of the equator and longitude $7^0$59' and 8^o80' E of the Greenwich meridian. Itu is located in South East of Nigeria and occupies a landmass of approximately 606.10 square kilometers.It has a population of approximately 127,856 people [15]. It is bounded in the North and North East by Odukpani in Cross River State and Arochukwu in Abia State respectively, in the West by Ibiono Ibom and Ikono Local Government Areas; in the South and South East by Uyo and Uruan Local Government Areas respectively. The area is basically agrarian and vegetable production is very prominent among the inhabitants. Itu has 2 distinct seasons viz: the rainy season and short dry season. The predominant occupation of the people are farming and fishing.The types of organic fertilizers commonly used in the study area include poultry droppings, cow dungs, pig waste and goat faeces.

Multistage sampling procedure was employed. First, two (2) out of the five (5) clans in Itu Local Government Area were randomly selected. The second stage sampling involved the selection of 10 villages per clan. The third stage involved the selection of 3 farming households per village to make a total of 60.

Primary data were used for this study and farm level intensive itinerary survey provided the basic cross sectional data from 60 farming households in the study area. Data were collected from farmers for a period of 6 months using questionnaire. Primary data included data from farm income, demographic, socio-economic features of farmers and farm specific variables.

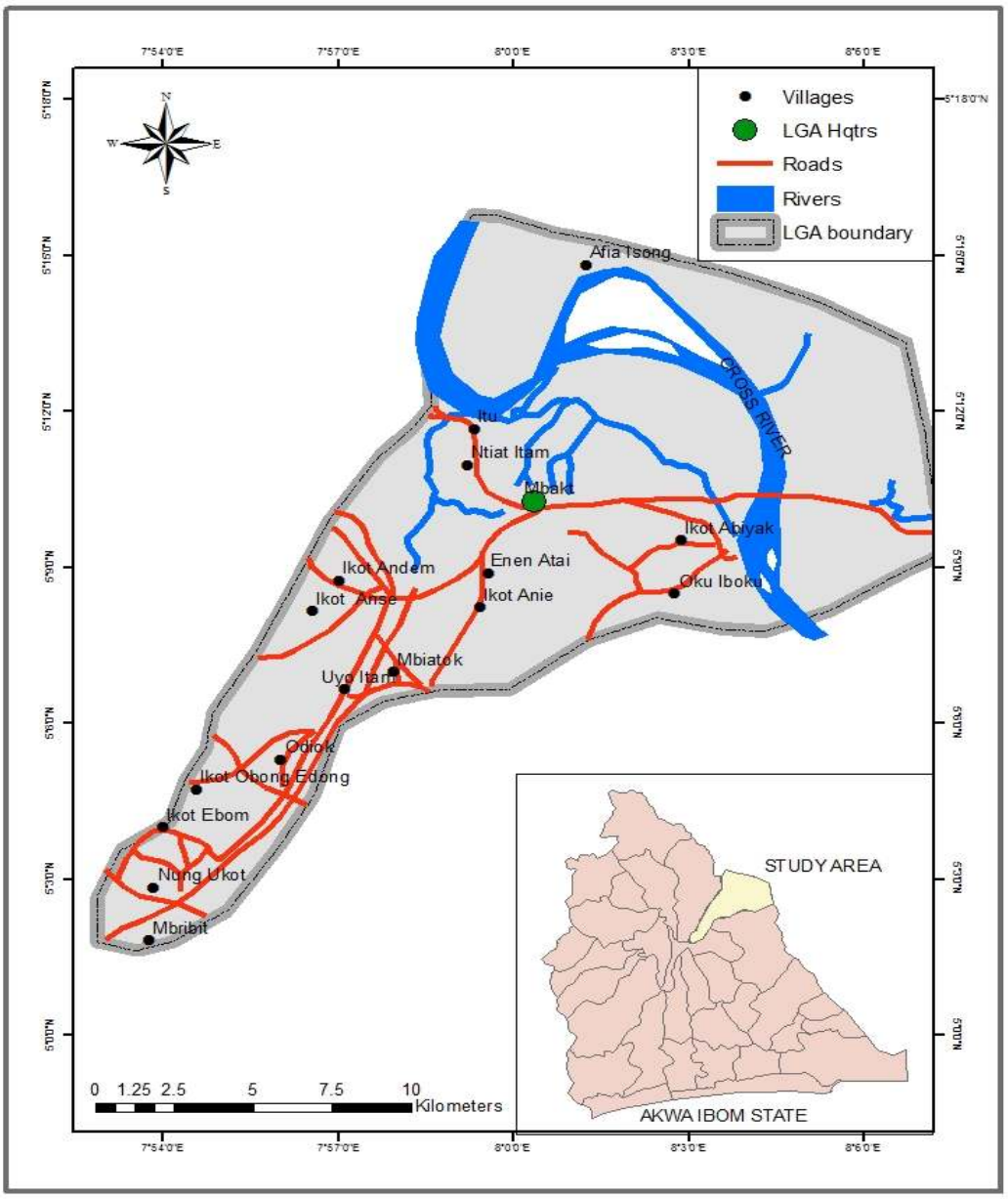


Fig.1 MAP OF ITU SHOWING THE STUDY LOCATION

Table 1: Description of variables used in the analysis of the willingness to pay a premium for organic fertilizer.

Variables	Description
Dependent WTP	Willingness to pay for organic fertilizer (1=yes, 0=no)
Independent	
Sex	Gender of the farmer (1=Male, 0= Female)
Age	Age of the farmer in years
Education	Number of years of formal education
Marital status	Marital status of the farmer (1= married, 0= if otherwise.
Farm size	Farm Size in hectares
Technical assistance	Contact with extension personnel (1=yes, 0=no)
Farm income	Income from farm in Naira

2.2 Theoretical Model

A univariate PROBIT regression model was used to identify key factors most likely to affect the willingness of vegetable farmers to pay for organic fertilizer and corresponding price premiums. This model has found several applications in the literature [15, 16, 17, 18] probit model is mathematically represented as:

$$\phi(\beta\, xi) = \int_{-\infty}^{\beta\, xi} \sqrt{\frac{1}{2\pi}}\, \exp\left[\frac{t^2}{2}\right] dt \quad - \quad - \quad - \quad - \quad (1)$$

Where ϕ (β xi) is normally distributed and represents the probability that the ith individual will pay for a given product, β is a vector of unknown coefficients; X_i is a vector of characteristics of the ith individual; t is a random variable distributed as a standard normal deviate; exp is the exponential function. The probability of paying for a new product is the area under the standard normal distribution curve lying between - ∞ and β Xi. The larger the value of βX_i, the more likely an individual is willing to pay for a new product.

2.3 Empirical Specification: The univariate PROBIT model is used to identity key factors likely to affect farmers willingness to buy a new organic fertilizer. Identification of key factors reported by farmers to affect their decision to buy a new organic fertilizer would be useful for product development, promotion and commercialization.

The empirical model for willingness to pay for a new organic fertilizer is specified as;
$= Yi^* P(Y_i = i) = \beta X_i + \varepsilon i$ - - - - - (2)

Were Y_i is the "willingness to pay" (WTP) for a new organic fertilizer, Y_i^*, the estimated value of Y_i, ($Y_i^*=i$) if $Yi>0$, and εi is the error term which follows a normal distribution (mean $\mu=0$, variance $r=1$).p is the probability function. β is the vector of parameters to be estimated. X_i is the matrix of explanatory variables that affects the ith farmer's decision to be willing to pay for a new organic fertilizer.

The dependent variable Y_i or WTP takes a value of 1 for farmers who are willing to pay for a new organic fertilizer and 0 otherwise.

2.4 Test for collinearity among explanatory variables used in the model

Multi-collinearity is among prominent econometric problems of cross sectional data. This property of econometric was tested among explanatory variables to ensure the consistency and unbiasness of the probit model estimates. The variance inflation factor (VIF) was used. For VIF, the minimum possible value is 1.0; while value greater than 10 indicates a probably collinearity problem. VIF was estimated using the formula stated below:

$VIF_j = 1/\{1 - R^2_j\}$ …….. (3)

Where R^2_j is the multiple correlation coefficient between variable j and the other specified explanatory variables.

3. RESULTS AND DISCUSSION

3.1 Descriptive analysis

Figure 2 shows the distribution of Vegetable farmers by sex. Most of the farmer (77 percent) were women whereas only 33 percent were men. This result dominates vegetable production. Several empirical studies by [19, 20] in Lusaka; [21] in Dar es salaam, [22] in Kampala.
[23, 24, 25 and 26] in Nigeria agreed that women dominated all part of agricultural production system.

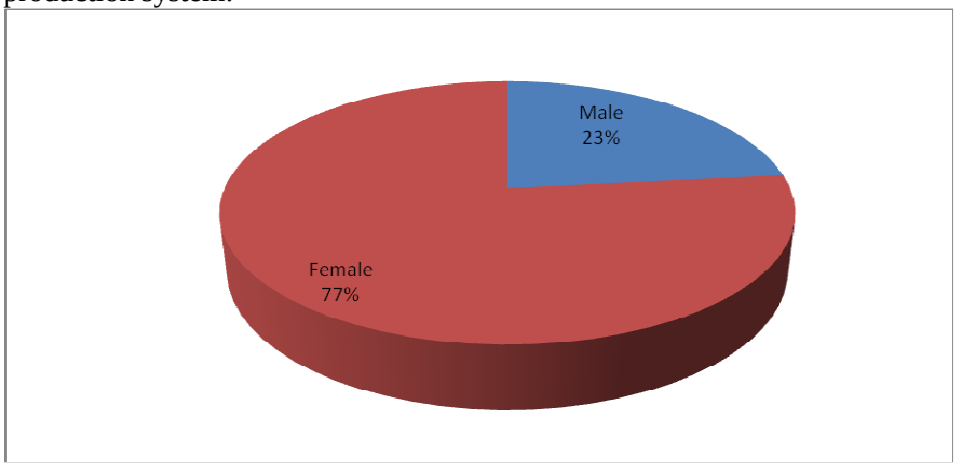
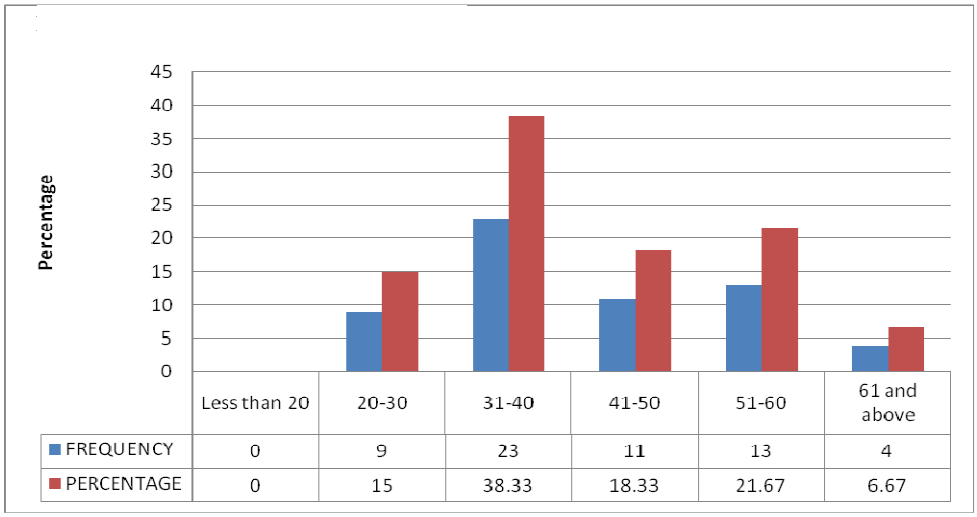


Fig. 2: Sex of Vegetable farmers

The age of vegetable farmers reveal a varied picture but with a dominance of most young people in farming. Figure 3 shows that about 78.33 percent of the vegetable farmers were aged 31-60 years. Result implies that most farmers were within active and productive population.



Mean age = 42.25 years.

Fig. 3: Age of Vegetable farmers

Figure 4 shows the marital status of the vegetable farmers. Result reveal that most (55 percent) of the farmers were married, while 28.33 percent were single. Only 3.33 percent were divorced.

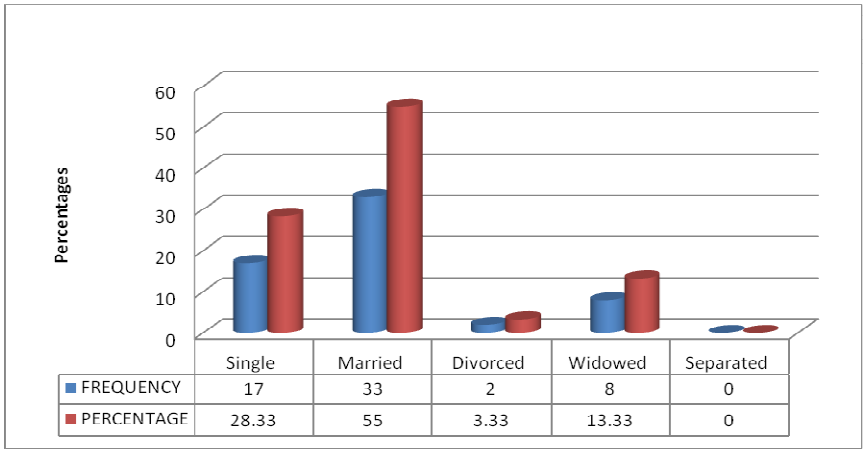
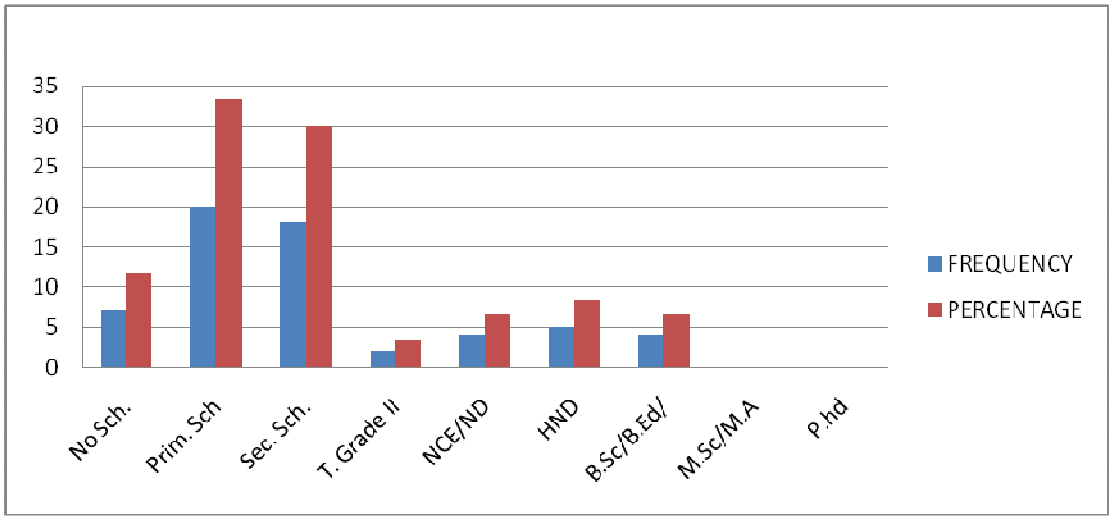


Fig. 4: Marital Status of Vegetable farmer.

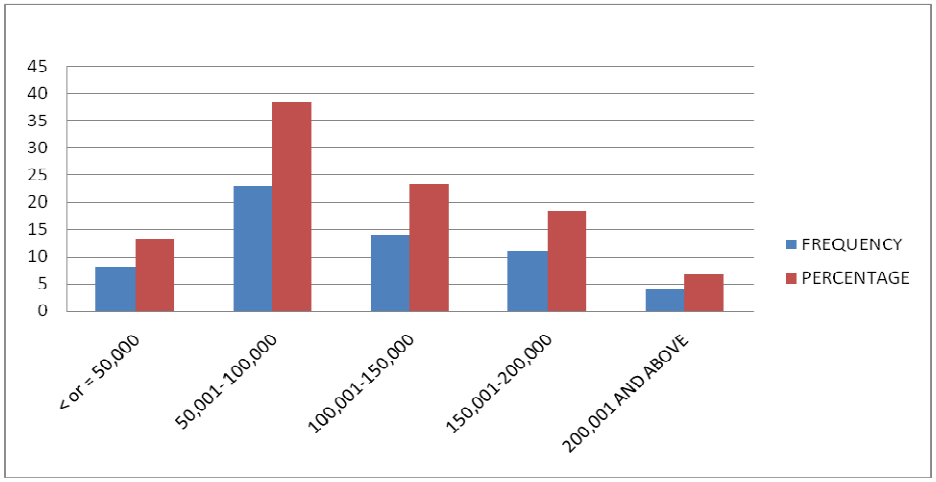
The educational background of the vegetable farmer is shown in figure 5. The result revealed that most farmers (66 percent) had primary and post-primary education. This is a indication that since most farmer were literate, there was high receptivity to new methods of farming.



Mean: 9.3 years

Fig. 5: Educational Background of Farmers

Figure 6 shows the income distribution of vegetable farmers. About 38.33 percent of farmers earned between ₦50,000 and ₦100,000, 23.33 percent earned between ₦100,000 - ₦150,000, 18.33 percent earned between ₦150,001- ₦200,000 whereas only 6.67 percent earned more than N200,000 per season. The income earned by vegetable farmer shows a varied picture.



Average income is ₦121,700.

Fig. 6: Income from vegetable production

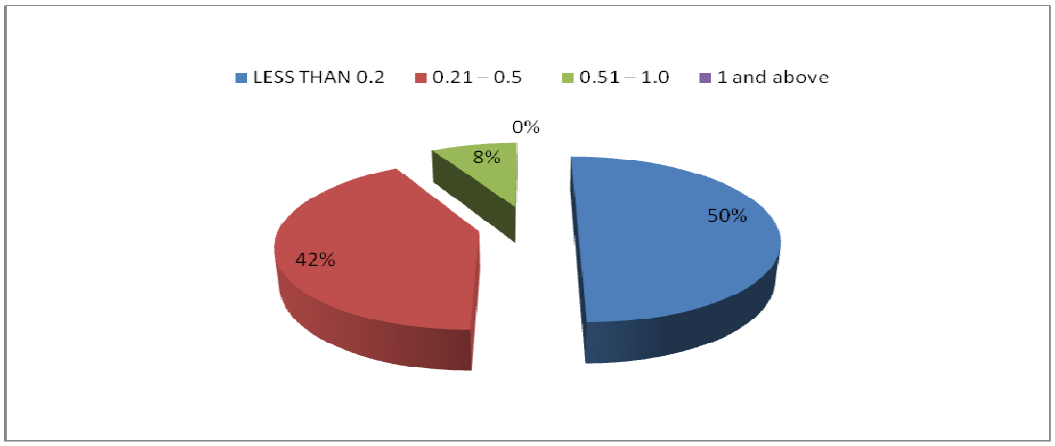
Table 2 revealed that majority (65 percent of farmers had between 1-10 years experience, 31.67 percent had 11-20 years experience in farming while only 3.33 percent had between 21-30 years of experience in vegetable farming.

Table 2: Farming experience of vegetable producers

FARMING EXPERIENCE (IN YEARS)	FREQUENCY	PERCENTAGE (%)
1-10	39	65
11-20	19	31.67
21-30	2	3.33
TOTAL	**60**	**100**

Mean = 9.8 years

The Farm size of farmers is revealed in figure 7. Result indicates that 50 percent of the farmers owned less than 0.2 hectare of farmland whereas 8 percent had plot sizes ranging from 0.5 to 1 hectare.



Mean value = 0.24ha

Fig. 7: Farm size of vegetable farmers

Table 3 revealed that 60 percent of the farmers affirmed that high cost of chemical fertilizer is the reason for their choice of organic fertilizer. This was followed by 65 percent of the farmers who agreed that timely availability of organic fertilizer is their reason for choosing organic fertilizer. Furthermore, 61.67 percent agreed that ease of application of organic fertilizer is the reason behind their choice of organic fertilizer but 38.33% went on the contrary. About 36.67% claimed that non availability of chemical fertilizer is the reason for their choice of organic fertilizer. About 31.67% of the respondents agreed that smallness of cultivable land is the reason behind their choice of organic fertilizer. Majority of the farmers (about 68.33%) said that rapid action of organic fertilizer is the factor responsible for their choice of organic fertilizer. Finally, about 63.33% of the respondents claimed that soil pollution by chemical fertilizer is their reason for choosing organic fertilizer although 36.67% of the respondents did not support this claim.

Table 3: Reasons for Vegetable Farmers Choice of Organic Fertilizers.

Factors responsible for farmer's choice of organic fertilizer	Yes	No
High cost of chemical fertilizer	36(60.00%)	24(40.00%)
Timely availability of organic fertilizer	39(65.00%)	21(35.00%)
Ease of application	37(61.67%)	23(38.33%)
Non availability of chemical fertilizer	22(36.67%)	38(63.33%)
Small ness of cultivable land	19(31.67%)	41(68.33%)
Rapid action of organic fertilizer	41(68.33%)	19(31.67%)
Soil pollution by chemical fertilizer	38(63.33%)	22(36.67%)

Figures in bracket represent percentages, while others are frequencies.

3.2 Test Results for Multicollinearity Among Specified Explanatory Variables

Table 4. Presents the VIF test result for multi collinearity among explanatory variables used in the probit regression model. The result revealed that there was no significant multi collinearity among the specified explanatory and dependent variables in the model. The result implies that, the probit model estimates has minimum variances, consistent and probably unbiased.

Table 4. The Variance Inflation Factor (VIF) test result for multicollinearity of variables used in the analysis.

EXPLANATORY VARIABLES	VIF ESTIMATES
Sex	1.199
Age	1.726
Marital status	1.245
Education	1.290
Farm experience	1.735
Farm size	1.862
Contact with extension personnel	1.064
Farm income	1.665

3.3 Probit Model Estimate Results

In this study, farm size in hectares is used as a proxy for wealth. The variable is positively significant ($P<0.05$). This means that, increasing the size of farmland will increase the willingness to pay for a new product. Abara and Singh [27] [28, 29, 30, 31, 32] in their studies empirically reported the positive impact of farm size on the willingness of farmers to adopt a new product. The marginal effect of farm size is 0.447 implying that a unit increment in farm size increases the willingness to pay a premium for a new product by 44.7 percent. This conform with earlier findings by [33, 34].

The variable age could positively or negatively affect the willingness of farmers to pay for a new product. Younger farmer are more likely to adopt agricultural innovations and vice versa. In this study, as revealed in table 4, age has positively signed and significantly impacts on willingness to pay (P<0.10). Age indexes experience and services as evidence for human capital revealing that vegetable farmers with more years of experience acquired accumulated years of observation and experimentation with various agricultural technologies are more likely to adopt and willing (to pay for innovations faster than farmers with less experience in farming. Result is synonymous with earlier studies by [35, 36, 37, 38 and 32] who reported that increased experience in farming may also enhance critical evaluation of the relevance of better production decisions including efficient utilization of productive resources. The marginal effect of age is 0.0137 meaning that a unit increase in age of the farmer will result in 0.0137 rise in the probability or willingness to pay for organic fertilizer.

Education has a coefficient of 0.0356 and significant (P<0.01). This means that vegetable farmers who have acquired some form of education are more likely to adopt and pay for improved farming techniques earlier and faster than the uneducated ones. This result is synonymous with earlier report by [39, 40, 41, 24, 42, 26 and 32]. This finding supports the hypothesis that human capital plays a positive role in the acquisition and evaluation of new ideas [32]. Studies by [43] in Cameroon; [44 and 45] in Ethiopia [46] in Malawi; and [47] in Nigeria also agree with this finding.

The coefficient of farm income is positive and significant (P<0.01). This implies that as the income accruable to farmers increases, the rate of willingness to pay for a new product is likely to increase.

3.4 Determinants of farmers' willingness to pay for organic Fertilizer

Table 5. Probit Estimates of farmers' willingness to pay for organic fertilizer

Variable	Coefficient	Standard error	Z-test	Marginal effect
Constant	-0.0074	1.1973	-0.0061	-
Sex	0.7578	0.5991	1.2649	0.1917
Age	-0.0456	0.0272	-1.6764*	-0.0137
Education	0.0356	0.0093	3.8357***	0.0107
Contact with extension agent	-0.2335	0.4036	-0.5784	-0.0713
Farm size	4.8049	2.0978	2.2904**	0.4472
Years of experience	0.0319	0.0529	0.6023	0.0096
Farm income	1.2981e-06	2.9817e-07	4.3535***	3.9097e-07
Marital status	1.20395	0.5171	2.3283**	0.3668
Diagnostic Analysis				
McFadden R-squared = 0.7089				
Log-likelihood = -28.9957				
Normality test = 5.2730 (0.0716)*				

Note: *, **, *** represent significance at 10%, 5% and 1%

4. Conclusion

The study assessed the perception and willingness of resource poor vegetable farmers to pay for organic fertilizer. Using the univariate probit model, the result of analysis revealed that the most critical determinants of the willingness of farmers to pay for organic fertilizer were age, education, farm size and farm income. The study revealed that vegetable farmers would be more likely and willing to pay for organic fertilizer as they acquire more years of observation and experimentation with various agricultural technologies. Also, farmers whose cultivable areas increase would be more willing to pay for organic fertilizer. Findings also showed that as farmers income rise, the willingness to adopt and pay for organic fertilizer increase. Farmers who acquire formal education would be more likely to adopt and willing to pay for the new product. Policy concerns targeted at improving the educational opportunities and increasing the income of the poor would be a sensible option. The use of organic fertilizer should be encouraged as a useful soil ameliorant in the face of paucity and high cost of chemical fertilizer.

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