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Factors Influencing Organic Manure Adoption among Tomatoes Farming Household in Epe Local Government Area of Lagos State

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Abstract

Organic manure adoption is a critical aspect of sustainable agriculture, particularly in arable crops production. Therefore, the study was conducted to investigate the factors influencing the adoption of organic manure among tomatoes farming households in Epe local government area of Lagos state, Nigeria. The study sampled a total of 120 farmers using a two-stage sampling technique. Data were analyzed using descriptive statistics and logistic regression model. The mean age of the farmers was 54±7.07 years and majority had a mean household size of 5±0.99 The mean years of education among the respondents was 13±2.07 years while the mean farming experience was 10±1.81 years. The study found that 39% of respondents adopted organic manure, primarily composted animal manure, with frequent application reported by 38% of the farmers. Logistic regression results revealed that education level of the spouse (p≤0.05), extension contacts (p≤0.01) and home to farm distance (p≤0.05)) were significant determinants of organic manure adoption among tomatoes farming households in the study area. The findings underscored the importance of ongoing education and extension training programme in totmato farming in the study area. The study recommends that farmers' education and training should be prioritized by concerned stakeholders.

Keywords: Organic manure, tomato, adoption, logistic regression.

Introduction: Agriculture growth is impossible to fulfill the rising food demands of the rising population without technological solutions to increase yields (Khonje *et al.*, 2015). Projections have shown that population will continue to grow at a rate faster that the rate at food production is growing, and this will continue to generate supply fall in food production except an urgent technology that will maximize crop production through the adoption of fertility enhancing production practice (Freeman *et al*., 2016). In addition, farmers will continue to experience declining per capita food availability due to declining soil fertility, which is a major biophysical cause of this ugly condition in agricultural production (Mugwe *et al.*, 2009). In addressing the declining soil fertility, farmers generally adopt the use of inorganic fertilizer (Ambaw, 2019). However, Ambaw (2019) stressed that the adoption of inorganic fertilizer is influenced by several factors, major of which are high cost of fertilizer and low access to inorganic fertilizer. The high cost of inorganic fertilizer contributes to the high cost of production which in turn results in high cost of food items (Oyetunde-Usman *et al*., 2021).

In order to ensure soil quality, health and fertility, while minimizing the cost of crop production that could be caused by the high cost of fertilizer, farmers source alternative soil fertility enhancing technology called organic manure through composts, manures, cover crops, green waste, etc. Company and Gradziel (2017), revealed that organic manure is source of nutrients for crops while also enhancing soil quality and health. Bhatt *et al.* (2019) revealed that organic manure offers a potential means of reducing the negative environmental consequences of excessively applying chemical fertilizer. Organic manure is a suitable substitute for inorganic or chemical fertilizer in terms of its eco-friendliness (Janmohammadi *et al.,* 2014; Ogungbaro and Olaiya, 2024). Organic manure utilization is suitable substitute for boosting crop production because it supports a variety of beneficial soil microbial communities and are ecologically friendly (Bulluck *et al.*, 2002; Wilkinson, 2005; Islam *et al.*, 2017; Mehdizadeh *et al.*, 2013; Janmohammadi *et al.*, 2014).

Despite the positive impact of organic manure in crop production, to,atoe , inclusive, its adoption is low (Musafiri *et al.,* 2022, (Muluneh *et al.*, 2022*;* Musafiri *et al.,* 2022; Sapbamrer and Thammachai, 2021; Serebrennikov *et al.,* 2020). Sapbamrer and Thammachai (2021) revealed that the low adoption of organic manure is influenced by psycho-behavioral and psychosocial factors, such as a positive

outlook and moral obligations, as well as supporting factor like training. While Sapbamrer and Thammachai (2021) investigated psycho-behavioral and psychosocial factors as correlates of organic manure adoption, this study will investigate the influence of farmers and farm characteristics as correlates of organic manure adoption in the study area.

Research Methodology: Study Area: Epe Local Government Area (LGA) is located in Lagos State, Nigeria, situated in the southwestern part of the country. It lies within the coordinates of 6°35'N latitude and 3°58'E longitude. The area is known for its diverse topography, characterized by a mix of coastal plains, mangrove swamps, and tropical rainforest vegetation. Agriculture forms the backbone of the economy in Epe LGA, with a focus on both subsistence and commercial farming activities. The fertile soils, coupled with favorable climatic conditions, support the cultivation of various crops, including cassava, plantain, cocoa yam, vegetables, and tomatoes. Tomato farming, in particular, has gained prominence in recent years due to its economic viability and high demand in local markets and urban centers like Lagos City. Tomato farming is a significant agricultural enterprise in Epe LGA, with numerous households engaging in its cultivation across the region. The process of tomato farming typically involves land preparation, seedling cultivation, transplanting, irrigation, pest control, and harvesting. Farmers in Epe LGA employ both traditional and modern farming techniques, depending on factors such as land availability, resources, and expertise.

Sampling Procedure and Data: A two stage sampling procedure was used to select respondents for the study. The first stage involved the purposive selection of 6 communities from Epe LGA, where tomato is widely cultivated. The selected communities are Araga, Araromi, Agbowa, Erodo, Ejinrin and Poka, respectively. In the second stage, 20 respondents were selected from each chosen communities using simple random sampling techniques without replacement, to obtain a total sample size of 120 respondents. The data were collected using a self-designed structured questionnaire with the aid of an interview schedule.

Method of data analysis: Data collected for the study were analysed with the aid of simple percentage, frequency count, standard deviation and logistic regression model. The Statistical Package for Social Science (SPSS) Version 24 and Stata version 12 were the analytical software used to analyse data for the study.

Model specification: The logistic regression model is an analytical model used to predict the relationship between two sets of variable – dependent/response variable, which has two only two possibilities (dummy) and independent/ explanatory variables (Hosmer and Lemeshow, 2000). The relationship between a response variable, measured as a binary or categorically and explanatory variables cannot be described using the conventional ordinary linear regression models using the Ordinary Least Square (OLS) method (Rusliyadi *et al*., 2023). When the OLS is employed to analyse data of such a scenario above, the estimate is said to be biased and hence violate Gauss-Markov estimation assumption (Kutner *et al*., 2004; Rusliyadi *et al*., 2023). According to Haridanti *et al*. (2018). Logistic regression model is a regression model used to analyse the relationship between an outcome or dependent and a set of predictor variables, where the outcome variable is binary, dummy or dichotomous. Such a dichotomous qualitative variable is assigned a value of 1, to indicate the occurrence of an event and a value of 0, to indicate the non-occurrence of an event. The structure of the logistic regression model is formulated as follows:

$$Logit(P) = Log\left[{}^{P}/_{(1-P)}\right] \quad \text{Eq. 1.}$$

The term within the parenthesis is the odds of an event occurring or otherwise. In case of this study, it is the odds of a tomato farming household adopting organic manure.

$$P_i/(1-P_i) = exp(\beta_0 + \beta_1 X_1) \quad \text{Eq. 2.}$$

$$P - P_i = 1/\left(1 + esp(\beta_0 + \beta_1\beta_1)\right) \quad \text{Eq.3.}$$

$$P_i = P_i + f_i = exp\,(\beta_0 + \beta_1 X_1)/1 + exp(\beta_0 + \beta_1 X_x) + f_i \quad \text{Eq.4.}$$

The squared differences between the observed and expected values of Y (the residuals) would be minimized by the coefficients found by the regression process. As the outcome variable of the logistic regression is binary, Y needs to be transformed so that the regression process can be used (Rusliyadi *et al*., 2023).

The transformed logistic regression model gives the following:

$$ln\left(\frac{p}{1-p}\right) - \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 \ldots\ldots \beta_x X_n \quad \text{Eq. 5.}$$

Where

ρ = probability of event occurring (a tomato farming household adopting organic manure)

$\frac{p}{1-p}$ = Odds ratio

OR

$$\ln(Odd)\ ln\frac{\hat{Y}}{1-\hat{Y}} = a + bX \quad \text{Eq. 6.}$$

Where

$\hat{Y}$ = the predicted probability of the event (adoption of organic manure),

1- $\hat{Y}$ = the predicted probability of non-adoption

X = the predictor variables.

For the probability of adoption, the model can be specified as follows, following Rusliyadi *et al*., (2023):

$$p = \frac{exp(\beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \cdots \ldots\ldots\ldots \beta nXn)}{exp(1 + \exp(\beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \cdots \ldots\ldots \beta 7X7 + \beta 8X8 + \beta 9X9)} \quad 0 < p < p < 1$$

Where:

Y represents the probability of adoption
X1 – Xn represents the independent variables
β_0 represents the intercept, representing the constant term
β_1 - β_n, represent the coefficient of independent variables

Result and discussion: Summary characteristics of Tomato farmer in Epe local government

Table 1 reveals the descriptive result of the socioeconomic characteristics of Tomato farming households in Epe local government area. The mean of sex of respondents was 0.72±0.12. This implied that 72 percent of the respondents were male while just 28 percent of them were female. This implied that tomato farming in the study area was dominated by male farmers. The mean age of the household heads in the study was 54.35±7.05 years. This showed that the tomato farming household heads in the area were in their active ages. The mean levels education of household head and the spouse in years was 14±2.07 and 12.00±3.13 years, respectively. These implied that the household heads and their spouses were educated. This levels of education is capable of influencing their choice of farm practices. The mean household size of the respondents was 5±0.991. This implied that the respondents had minimum of five people living under their roofs that could serve as family labour. The mean farming experience was 9.97±1.81 years, which implied that the respondents are well experience in tomato farming which in turn showed knowledge of tomato farming. The mean home to farm distance was 4.9±1.3 km, mean home to market distance was 4.3±2.3 km while the mean market to farm distance was 3.779±1.679 km, respectively. This implied that the respondents traveled distanced between home, market and farm. The mean farm size in the study area was 2.350±0.834 acres. This implied that the tomato farmers in the area were very small scaled farmers considering the mean size of farm. The mean of land ownership among the tomato farmers was 0.21±0.20. This implied that just 21 percent of the respondents owned the land on which they operate. The mean access to credit in the study area was 0.59±0.41 while the mean extension contacts was 0.58±0.51. This implied that 59 percent of the respondents had access to credit, which was mainly from informal sources while 58 percent of them had access to extension contacts. This high proportion of respondents who had access to extension contacts was as a result of the Lagos State intervention programme on tomato production in the study area.

Organic manure use typology: The organic manure adoption typology is presented in Figure 1. According to figure, 39 percent adopted organic manure in tomato farming in the study area. The low adoption rate of organic manure could be traced to the bulkiness associated with organic manure.

Logistic regression analysis on the adoption of organic manure among tomato farmers: Logistic regression

analysis of factors influencing adoption of organic manure among tomato farmers are presented in Table 2. According to the results in the table, the Log-likelihood function of the model was 68.733 while the chi-square value of the model was 84.36. The entire model was significant at 1 percent alpha level. These diagnostic parameters showed that the model is fit to discuss factors influencing adoption of organic manure in the study area. The results in the table showed that education of spouse ($p \leq 0.05$), access to credit ($p \leq 0.0s$), farm size ($p \leq 0.10$), extension contacts (≤ 0.01) and home-farm-distance were significant determinants of organic manure adoption in the study area. The education of spouse, access to credit, farm size and extension contacts were positive determinants of organic manure adoption while home-farm-distance is a negative determinants of organic manure adoption in the study area. A rise in the education of the spouse would raise adoption probability by 11.6 percent while a rise in the amount of credit access would raise probability of adoption by 3.2 percent. The results also showed that a rise in the size of farm owned by a respondents by 0.4 percent while a rise in the contacts a farmer had with extension personnel, the rise the probability of adopting organic manure. However, a rise in the home-farm distance by a unit would decrease the probability of adopting organic manure. This could be traced to the bulkiness features of most agricultural inputs and output.

Conclusion: Organic manure is one of the greatest alternatives to chemical fertilizers and can improve the quality of vital minerals in the soil, sustainably. This paper investigates the factors influencing the adoption of Organic fertilizer among household of tomato farmers in Epe local government area. The study found that tomato farmers in the study area were in their active ages and operated at a very small scale. Findings of the study further revealed that education of spouse, extension contacts and access to credit were positive determinants of adoption of organic manure in the study area. The study recommends that concerned stakeholders should put in place effort to educate tomato farmers in the area as well as ensuring access to credit and extension contacts.

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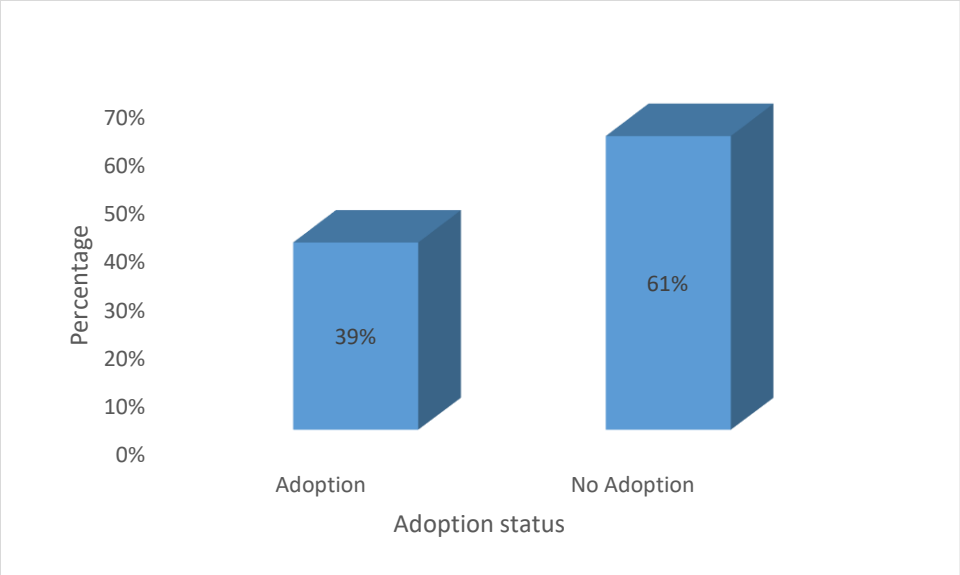

Fig. 1: Adoption typology

Table 1: Summary characteristics of Tomato farming households in Epe local government

Socioeconomic characteristics	Mean	S.D
Sex (dummy: 1 = male, 0 = female)	0.72	0.12
Age (years)	54.35	7.05
Educational level of household head (years)	14.00	2.07
Education level of spouse (years)	12.00	3.13
Household size	5	0.99

Farming experience (years)	9.97	1.81
Home to farm distance (km)	5	1.343
Market to home distance (km)	3.78	1.68
Home to market distance (km)	4.33	2.31
Size of farm land (acre)	2.350	0.834
Land ownership (dummy: owned =1, 0 = otherwise)	0.21	0.20
Access to credit	0.59	0.41
Extension contacts (dummy: yes =1, 0 = otherwise)	0.58	0.40

Source: Field survey, 2024

Table 2: Logistic regression analysis on the adoption of organic manure among tomato farmers

Variable	Coefficient	Stand. Error	Sig.	Marginal Effect
X_1Education of household head	0.097	0.365	0.792	0.002
X_2Education of spouse	0.484**	0.235	0.040	0.116
X_3Landownership	0.382	0.489	0.610	0.001
X_4Access to credit	2.622**	1.123	0.032	0.032
X_5Farm size	0.021*	0.544	0.073	0.004
X_6Extension contacts	0.347***	0.112	0.003	0.093
X_7Farming experience	0.158	0.349	0.651	0.002
X_8Agevof household head	-0.091	0.089	0.308	-0.003
X_9 *Home-farm-distance*	-0.636**	0.316	0.031	-0.044
Constant	6.032	6.822	0.782	
Log-likelihood	68.753			
Chi-square	84.36***			

Source: Data analysis, 2024.

Note: *Significant at 10%, **Significant at 5% & ***Significant at 1% alpha levels

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