Full Length Research Paper

Assessment of Organic Fertilizer usage by vegetable farmers in Ondo State South West, Nigeria

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The study analysed the assessment of organic fertilizer usage by vegetable farmers in Ondo State South West, Nigeria. Primary data were collected from one hundred randomly selected vegetable farmers through a multistage sampling procedure in the study area. Data were analysed using descriptive statistics, budgetary analysis and probit regression analysis. Findings of the study revealed that larger percentage (77.0%) of the vegetable farmers fall between age (31-50) years with mean age 43. About 59% of the respondents were female with majority (79.0%) having access to credit. Majority (63.0%) of the respondents suffer from high pest infestation. The budgetary analysis revealed that vegetable production has a high return on investment. The probit analysis showed that gender, age and farm size decreased farmer’s adoption of organic fertilizer while marital status, education and farming experience increased adoption of organic fertilizer in the study area. The study recommended that farmers should keep reasonable farm size that can easily be managed in order to improve adoption of organic fertilizer and they should be encouraged by government to participate in adult education and training that will improve their skill in the use of organic fertilizer in order to increase the productivity of vegetable production.

Key words: Organic, fertilizer, farm size, budgetary analysis.

INTRODUCTION

The cultivation of vegetable serves as a means of livelihood for thousands of household both in the rural and urban communities. Most vegetables farmers in the rural community grow vegetable for commercial purpose in order to generate income while some in the urban centre cultivate vegetable for the purpose of nutritional and medicinal value. This view is supported by Ayethan et al. (1995); Baral et al. (2011) and Alegbejo (2013) who observed that vegetable has been reported to possess both nutritional and pharmacological properties. The vegetables generally cultivated in Africa, most especially the tropics includes: Amaranthus (Amaranthus), Celosia (Celosia), Cucumis (Cucumis), Hibiscus (Hibiscus), Talinum (Talinum fruticosum) Corchorus (Corchorus olitorius), Onion (Allium cepa), Tomato (Solanum lycopersicum), Okro (Abelmoschus esculentus),
Pepper (*Capsicum annuum* Group), Carrot (*Daucus carota* subsp. *Sativus*), Melon (*Cucumis melo*), Jute (*Corchorus capsularis*)

Amaranthus, Celosia, Cucumis, Hibiscus, Talinum, Solanum and Corchorus with onion, tomato, okra, pepper, carrot, melon, and Jute (Tindall, 1983; Ibeawuchi et al., 2015). Though the cultivation of vegetables supports rural and urban population in terms of sustenance and income generation, its cultivation still presents some challenges which however can be reduced with the use of organic fertilizers (Aderinoye-Abdulwahab and Salami, 2017). The application of organic and inorganic fertilizer to the soil is a good agricultural practice that improves the fertility of the soil and plant quality (Mofunanya et al., 2015). Both fertilizers supply plants with the nutrients needed for optimum performance, ensuring soil amendments that guarantee the minimum percentages of Nitrogen, Phosphorus and Potash (Aderinoye-Abdulwahab and Salami, 2017). It advantages also include; increasing crop yield, improving soil texture, quality of the land and faster growth of crops (EPA, 2013). Organic fertilizers have been used for centuries whereas chemically synthesized inorganic fertilizers were only widely developed during the industrial revolution. Inorganic fertilizer has significantly supported global population growth, it has been estimated that almost half the people on the earth are currently fed as a result of artificial nitrogen fertilizer use (Erisman et al., 2008).

Despite this advantage, the use of organic fertilizer is being advocated for because of its soil conservation property and its eco-friendliness over the inorganic fertilizer. It is a sustainable farming system that produces healthy crops and livestock without damaging the environment. It avoids the use of artificial chemical fertilizers and pesticides. It is mainly the cheapest sources adopted by vegetable farmers to supply nutrients for their vegetables to enhance growth and yield (Verena et al., 2012; Fawzy et al., 2016). It is on these bases that, this study tends to assess organic fertilizer usage by vegetable farmers in Ondo State, Nigeria. The specific objectives are to:

(i) describe the socio-economics characteristics of vegetable farmers in the study area
(ii) determine the profitability of vegetable farming in the study area
(iii) determine the factors influencing adoption of organic fertilizer usage in vegetable production in the study area.

**METHODOLOGY**

The study was conducted in Akure South Local Government Area of Ondo State, South West Nigeria (Figure 1). Data for the research work was from primary source. The primary data was collected via the administration of structured questionnaire to cassava producing farmers in the study area. A multistage sampling technique was employed in the selection of respondents. The first stage involved the selection of five villages/farming communities in the selected Local Government Areas (LGAs) using simple random sampling. The second stage involved a purposive selection of twenty-two households who are vegetable farmers in each of the farming communities, making a total of two hundred respondents. Only 100 questionnaires were properly administered and returned. Data collected were analysed using descriptive statistics such as frequency distribution, percentages, budgetary and Probit regression analysis. Budgetary analysis was used to determine the profitability of vegetable farmers in the study area (Olukosi et al., 2006; Abdullahi, 2012). The relationship is expressed as:

\[
NFI = GI - TVC - IFC
\]

Where: \(NFI = \) Net farm income
\(GI = \) Gross income (Total revenue)
\(TVC = \) Total variable cost
\(IFC = \) Total fixed cost

Test of difference of mean was used to determine the significant difference between the profits of vegetable farmers who have access to organic fertilizers and those without access to organic fertilizer.

\[
T = \frac{X_1 - X_2}{S^2_1/n_1 + S^2_2/n_2}
\]

Source: Shukla (2017).

Where: \(X_1 = \) profit of vegetable farmers with access to organic fertilizer
\(X_2 = \) profit of vegetable farmers without access to organic fertilizer
\(S^2_1 = \) sample variance of vegetable farmers with access to organic fertilizer
\(S^2_2 = \) sample variance of vegetable farmers without access to organic fertilizer
\(n_1 = \) number of vegetable farmers with access to organic fertilizer
\(n_2 = \) number of vegetable farmers without access to organic fertilizer

**Probit regression model**

Probit Regression model in SHAZAM software was used to analyse factors influencing adoption of organic fertilizer usage by vegetable farmers in the study area. The model is implicitly stated as shown below (Nagler, 2002; Sebopetji and Belete, 2009):

\[
Y_i = \beta_0 Z_{i} + \varepsilon_i
\]

Where:
\(Y_i = \) 1 if farmers access organic fertilizer and 0 if there is no access)
\(Z_i = \) Exogenous variables (Z1-Z6)
\(Z_1 = \) Gender Age \(Z_2 = \) Age (years)
\(Z_3 = \) Marital Status
\(Z_4 = \) Education (Number of Years)
\(Z_5 = \) Experience (years)
\(Z_6 = \) Farm size (ha)
\(\beta_i = \) Parameters to be estimated
\(\varepsilon_i = \) Error terms.
RESULTS AND DISCUSSION

Personal characteristic of respondents

Table 1, presents the descriptive analysis of socio-economics characteristics of vegetable farmers in the study area. Larger percentage (77.0%) of the vegetable farmers fall between age (31-50) years with mean age 42.62. The mean age shows that majority of the sampled farmers are young and agile, which is an asset to adoption of organic farming innovation in the study area. This result agrees with the finding of Adeola and Adetunbi (2015) which shown that most farmers in South-Western Nigeria are still in their active age which falls between ages 31-40 years. About 59.0% of the respondents were female with majority (85.0%) married. The reason while female respondents dominated the total population sample for the study was that, vegetable production is considered as a farming activity left alone mostly for housewives in the rural communities. Similar result was reported by Aderinoye-Abdulwahab and Salami (2017) that female farmers dominated vegetable production in Asa Local government area of Kwara State, Nigeria. About (50.0%) of the vegetable farmers were predominantly educated to the tune of secondary school. The implication is that, most of the farmers with no formal or primary education that constitute about (49.0%) of the total respondents will not be able to efficiently adopt new agricultural innovation and technology in organic vegetable farming (Table 1).

Distribution of respondents by farm characteristics

Most (39.0%) of the respondents had between (4-6) years of experience with mean household size of 5 persons per household. This implies that more family labour will be readily available on the farm to support vegetable production. Oyedele et al. (2018) reported similar result that, the larger the household size the more
Table 1. Showing the socio-economics characteristics of respondents.

| Description            | Frequency | Percentage |
|------------------------|-----------|------------|
| Age group (Years)      | Mean age 42.62 |
| ≤30                    | 7         | 7.0        |
| 31 – 50                | 77        | 77.0       |
| ≥50                    | 16        | 16.0       |
| Gender                 |           |            |
| Male                   | 41        | 41.0       |
| Female                 | 59        | 59.0       |
| Marital status         |           |            |
| Married                | 85        | 85.0       |
| Single                 | 11        | 11.0       |
| Divorce                | 4         | 4.0        |
| Education              |           |            |
| No formal Education    | 23        | 23.0       |
| Primary Education      | 26        | 26.0       |
| Secondary Education    | 50        | 50.0       |
| Tertiary education     | 1         | 1.0        |

Source: Field Survey (2018).

the available labour supply on the farm. Most (69.0%) of the vegetable farmers cultivated between 2-3 ha of farm land with mean farm size of 2.30. This indicated that most of the respondents in the study area operated small scale vegetable farming. Ibrahim et al. (2019) reported similar finding that majority of the maize-based crop farmers in Niger State cultivated as low as 1.88 ha.

Majority (63.0%) of the farmers surveyed for the study reported high occurrences of pest infestation in vegetable production while (37.0%) of the respondents reported that organic fertilizer was not readily available for their usage. The Table also revealed that most (48.0%) of the respondents had an income of between 21,000 and 30,000. A larger percentage (79.0%) of the farmers had access to credit facilities while only (21%) does not access credit during the 2018 production season (Table 2). A hypothesis was tested on the relationship between the income of vegetable farmers who applied organic fertilizer and the income of vegetable farmers who do not apply organic fertilizer in the study area. The result as shown in Table 3 revealed that there is a significant difference between the income of the two set of farmers. Therefore, the null hypothesis is rejected. This showed that vegetable farmers that apply organic fertilizer realized more income compare to their counterpart who do not use organic fertilizer in vegetable production in terms of return on investment.

Budgetary analysis

The result of the budgetary analysis shows the cost and return analysis for an average vegetable farmer in the study area. The result is shown in the Table 4. The table revealed that vegetable production is a profitable venture. This was measured by the rate of returned on investment and the net farm income. Returned on investment was approximately 1.67 while net farm income was greater than the cost of production. This is in agreement with the findings of Yisa et al. (2018), who reported that maize/sorghum enterprise was a profitable business on the bases of its gross ratio of 0.44 and an operating ratio of 0.40 in Niger State of Nigeria.

Table 5 present the results of the estimated Probit model. The McFadden R² and the likelihood ratio value indicated a goodness of fit for the equation. The probit regression analysis result showed that adoption and use of organic fertilizer depend on the following variables; Gender, Age, Marital Status, Education, Farming Experience and Farm size. The coefficient of gender of vegetable farmers was negatively correlated with adoption and use of organic fertilizer and was statistically significant at P<0.01 alpha level, suggesting that female farmers dominate the use of organic fertilizer in the study area. The coefficients of farmers age and farm size were negative and statistically significant at P<0.10 alpha level respectively. This shows that increase in farmers age decreases the adoption and use of organic fertilizer while the larger the farm size that a vegetable farmer cultivated the less the probability of farmer’s adoption and use of organic fertilizer. The coefficient of the variable of marital status was positively correlated with farmer’s adoption of organic fertilizer. Coefficients of education and farming
Table 2. Showing the distribution of respondents by farm characteristics.

| Description     | Frequency | Percentage |
|-----------------|-----------|------------|
| Experience      |           |            |
| 1 - 3           | 30        | 30.0       |
| 4 - 6           | 39        | 39.0       |
| 6               | 31        | 31.0       |
| Household Size  | Mean household size 4.45 |
| 1 - 2           | 7         | 7.0        |
| 3 - 4           | 43        | 43.0       |
| 5 - 6           | 47        | 47.0       |
| >6              | 3         | 3.0        |
| Farm Size       | Mean farm size 2.30 |
| ≤1              | 21        | 21.0       |
| 2 - 3           | 69        | 69.0       |
| ≥4              | 10        | 10.0       |
| Constraints to use of organic fertilizer |
| High occurrences of Pest | 63 | 63.0 |
| Scarcity of Organic Fertilizer | 37 | 37.0 |
| INCOME          |           |            |
| 21,000-30,000   | 69        | 69.0       |
| 31,000-40,000   | 26        | 26.0       |
| >41,000         | 5         | 5.0        |
| Access to Credit|           |            |
| YES             | 71        | 71.0       |
| No              | 29        | 29.0       |

Source: Field Survey (2018).

Table 3. T-text of difference of mean between vegetable farmers who applied organic fertilizer and those who do not apply organic fertilizer.

| Profit                      | Mean    | Standard deviation | N  | t-value | Decision |
|-----------------------------|---------|--------------------|----|---------|----------|
| Used organic fertilizer     | 28857.99| 75475.89           | 71 | 4.297   | Reject H₀|
| Do not use organic fertilizer| 15293.10| 23995.192         | 29 |         |          |

experience were positive and statistically significant at P<0.05 alpha level respectively, suggesting that farmer’s education and farming experience increased adoption of organic fertilizer in the study area.

Conclusion

The study analysed the assessment of organic fertilizer usage by vegetable farmers in Ondo State South West, Nigeria. Based on the findings, the research concluded that vegetable production is a profitable venture as revealed by the profitability analysis, though farmers reported to have faced the challenges of pest infestation due to organic fertilizer usage as well as scarcity in the availability of organic fertilizer. The probit regression analysis showed that gender, age and farm size decreased farmer’s adoption of organic fertilizer while marital status, education and farming experience increased adoption of organic fertilizer in the study area. The study recommended that:

1. Farmers should keep reasonable farm size that they can be able to manage in other to improve adoption of
Table 4. Cost structure analysis.

| Item            | Value (Naira) | Percentage |
|-----------------|--------------|------------|
| **Variable cost** |              |            |
| Weeding         | 148400       | 4.528021   |
| Land clearing   | 121000       | 3.691985   |
| Planting        | 254450       | 7.763847   |
| Organic application | 234400   | 7.152076   |
| Planting material | 1140920 | 34.81206   |
| **Total variable cost** | 1899170 | 57.94799   |
| **Fixed cost**   |              |            |
| Cost of Cutlass | 233550       | 7.126141   |
| Cost of Hoe     | 481500       | 14.69166   |
| Cost of Bucket  | 120750       | 3.684357   |
| Rain Booth      | 365000       | 11.13698   |
| Watering Cane   | 177400       | 5.412877   |
| **Total depreciated fixed cost** | 1378200 | 42.05201   |
| Total cost      | 3277370      |            |
| Total revenue   | 3332000      |            |
| Gross margin    | 1432830      |            |
| Net farm income | 54630        |            |
| **RORI = (NFI/TC)100** | 1.666885 |            |

Source: Field Survey (2018).

Table 5. Probit regression estimates of factors affecting adoption of organic fertilizer.

| Explanatory variable | Estimated parameter coefficient | T - value |
|----------------------|--------------------------------|-----------|
| Gender               | -1.9561***                     | -4.0102   |
| Age                  | -0.0696*                       | -1.7114   |
| Marital status       | 1.5618*                        | 1.8493    |
| Education            | 0.0980**                       | 2.5807    |
| Farming experience   | 0.1375**                       | 2.0408    |
| Farm size            | -0.3606*                       | -1.9104   |
| Constant             | 0.8541                         | 0.6154    |
| McFadden R. Square   | 0.31654                        |           |
| Log- likelihood ratio text | 38.1211 |           |
| % of right prediction| 0.86000                        |           |

Source: Field Survey (2018).

(2) Holding training courses for farmers of all ages to improve their skills to take advantage of modern agricultural technology to increase the productivity and national wealth of the great Nigeria.

(3) Using the media to spread agricultural culture within the morning and evening programs to duplicate the benefits of organic farming and its positive effects on the individual, the environment, and society.

(4) Training farmers in modern methods of controlling agricultural pests using biological materials, as well as propagating and spreading natural enemies to reduce the damage of insect pests and others in effective biological methods and materials against harmful insects and not polluting the environment and safe for human food.

**CONFLICT OF INTERESTS**

The authors have not declared any conflict of interests.

**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. Nigeria Journal of Basic and Apply Science Volume 20(2):146-151.

Aderinoye-Abdulwahab SA, Salami ST (2017). Assessment of organic fertilizer usage by vegetable farmers in Asa Local Government Area of Kwara State, Nigeria. Agrosearch 17(1):101-114.

Adeola RG, Adetunbi SI (2015). Farmers’ perception of sustainable agriculture in South-Western Nigeria: Implications for rural Economy. International Journal of Applied Agricultural and Apicultural Research 11(1-2):86-92.

Alegbejo JO (2013). Nutritional value and utilization of Amaranthus (Amaranthus spp.): A review. Bayero Journal of Pure Applied Science 6(1):136-143.

Ayethan WM, Mu-Musein M, Mayb W (1995). The effects of some medicinal plants on smooth muscle. AB Abstract 1970/79.

Baral M, Datta A, Chakraborty S, Chakraborty P (2011). Pharmacognostic studies on stem and leaves of Amaranthus spinosus Linn. International Journal of Applied Biology and Pharmaceutical Technology 2(1):41-47.

Erisman JW, Sutton MA, Galloway J, Klimont Z, Winiwarter W (2008). How a century of ammonia synthesis changed the world. Natural Geoscience 1(10):636-639.

Fawzy Z, Shaymaa F, Shedeed I, Nagwa M, Hassan K (2016). A Review of Organic Agricultural of Some Vegetables Crops, American Journal of Food Science and Health 2(3):25-31.

Ibeawuchi II, Okoli NA, Alagba RA, Ofor MO, Emma-Onoh CA, Ojeielu J (2015). Fruit and Vegetable crop production in Nigeria: The gains, challenges and the way forward. Journal of Biology, Agriculture and Healthcare 5(2):2224-3208.

Ibrahim FD, Oforomata AO, Jirgi AJ, Adewumi A (2019). Optimum production plan for Maize-Based crop farmers in Niger State, Nigeria. Journal of Tropical Agriculture, Food, Environment and Extension 18(3):35-41.

Mofunanya AAJ, Ebigwai JK, Bello OS, Egbe AO (2015). Comparative Study of the Effects of Organic and Inorganic Fertilizer on Nutritional Composition of Amaranthus spinosus L., Asian Journal of Plant Sciences 14(1):34-39.

Nagler J (2002). Interpreting probit analysis. New York University; available:www.nyu.edu/classes/nagler/quant1/probit1_post.pdf

Olukosi JO, Isitori SU, Ode MO (2006). Introduction to agricultural marketing and prices: principle and application. Abuja, Living book series, GU publications P 115.

Oyedele GT, Wole-Alo FI, Owolabi KE, Okulola JO (2018). Small-scale farmers’ perception on Organic Farming Status in Ondo State, Nigeria. American Journal of Agriculture and Forestry 6(6):186-190. doi: 10.11648/j.ajaf.20180606.15

Shukla S (2017). Significance of difference between means. 10.13140/RG.2.2.21228.97924.

Sebopetji TO, Belete A (2009). An Application of Probit Analysis to Factors Affecting Small-scale Farmers’ Decision to take Credit: A case study of Greater Letaba Local Municipality in South Africa. African Journal Agricultural Research 4(8):718-723.

Tindall HD (1983). Vegetables in the Tropics. Macmillan Press Limited, London pp. 37-45.

US Environmental Protection Agency (EPA) (2013). Organic Fertilizers http://www.epa.gov/agriculture/tfer.html Retrieved 14th September, 2015

Verena S, Navin R, Jonathan AF (2012). Comparing the yields of organic and conventional agriculture. Nature, 2012 DOI: 10.1038/nature11069

Yisa ES, Nmadu JN, Tanko L, Tsado EK (2018). Comparative analysis of the profitability of Maize and Sorghum based cropping enterprises in Niger State, Nigeria. Nigerian Journal of Agricultural Economics 8(1):81-88.