



ANALYSIS OF THE ADOPTION OF ORGANIC LIQUID FERTILIZER AMONG DRY SEASON RICE FARMERS IN TARABA STATE, NIGERIA

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ABSTRACT

This study examined the adoption of organic liquid fertilizer among dry season rice farmers in Taraba State, Nigeria. A multi-stage sampling technique was used to select 193 respondents for the study. Data were collected using a structured questionnaire and were analysed using descriptive and inferential statistics. The results revealed that the majority (72.5% and 63.7%) were male and married. About 31.6% fell within the age bracket of 31–40 years, while 50.3% had household sizes of 6–10 persons. Furthermore, 46.1% had 11–20 years of farming experience, and 36.8% cultivated 1–2 hectares of farmland. The findings also showed that the majority (74.1% and 58%) were aware of organic fertilizer and had adopted it on their farms, while 41.1% had 1–3 years of experience using organic liquid fertilizer. Most respondents agreed that organic liquid fertilizer was environmentally friendly (4.26), improved soil fertility (4.32), increased yield (4.18), enhanced crop quality (4.09), and reduced the cost of production (3.76). The study also identified the high cost of organic liquid fertilizer (3.21), limited product availability (3.15), lack of awareness (3.08), and inadequate extension services (2.97) as the major constraints to adoption. The study concluded that despite the challenges faced by farmers, organic liquid fertilizer was gaining wider acceptance. It recommended that the government should improve farmers' access to credit, strengthen extension services, and increase awareness to enhance and sustain the adoption of organic liquid fertilizer in agricultural production.

Keywords: Adoption, Organic, Liquid, Fertilizer, Rice, Farming.

INTRODUCTION

Agriculture remains a critical sector in Nigeria's economy, contributing significantly to food security, employment generation, and rural livelihoods, particularly in northern regions such as Taraba State where rice farming constitutes a major dry season activity supported by irrigation and favorable agro-ecological conditions. Despite these agronomic advantages, the rate of adoption of organic liquid fertilizers among smallholder farmers in developing countries, including Nigeria, remains relatively low due to a combination of socio-economic, institutional, and technological factors (Ojo *et al.*, 2021). Farmers in Taraba State frequently operate with insufficient information regarding the benefits, application techniques, and long-term impacts of organic liquid fertilizers on rice productivity. This lack of awareness often results in low utilization and reluctance to adopt the technology. According to Ibrahim *et al.* (2024), inadequate access to extension services, training, and institutional support significantly affects farmers' adoption decisions. The broad objectives of the study was to examine the analysis of the adoption of organic liquid fertilizer among dry season rice farmers in Taraba State, the specific objectives are to: describe the socioeconomic characteristics of dry season rice farmers in the study area; examine the level of liquid fertilizer adoption among dry season rice farmers in the study area; assess the impact of liquid fertilizer on dry season rice farmers output in the study area; determine the socioeconomic factors influencing the adoption of liquid fertilizer in the study area; and Find out the constraints to liquid fertilizer adoption in the study area.

METHODOLOGY

The Study Area

The study was conducted in three (3) Local Government Areas (LGAs) of Taraba State, namely; Karim Lamido, Gassol and Wukari which is located between latitude 6°30'N and 9°30'N and longitude



9°00'E and 11°00'E. The state had a population of 2,300,736 according to the 2006 national census, and with an annual growth rate of 3.5%, the population was projected to reach approximately 3,962,560 in 2016 and about 5,588,000 by 2026 (National Population Commission, 2006; National Bureau of Statistics, 2022). Taraba State covers a total land area of about 59,365.2 square kilometers and is administratively divided into three agricultural zones Taraba North, Taraba Central, and Taraba South which are predominantly known for rice production (Taraba State Ministry of Agriculture, 2020). The state lies within the tropical climatic zone and is characterized by diverse agro-ecological conditions, with vegetation ranging from lowland rainforest in the southern part to savannah grassland in the northern region (Food and Agriculture Organization, 2023). The major economic activities in the state include crop farming and livestock production, which serve as the primary livelihood sources for the majority of the population (National Bureau of Statistics, 2022).

Temperature in Taraba State is generally high throughout the year, reflecting the tropical nature of the region. Average annual temperatures range between 25°C and 35°C, with peak temperatures often recorded during the dry season, particularly between February and April. These temperature conditions favor the growth of a variety of crops such as maize, rice, and sorghum, but may also increase evapotranspiration rates, thereby influencing soil moisture availability and fertilizer efficiency (Nigerian Meteorological Agency [NiMet], 2020; Taraba State Agricultural Development Programme [TSADP], 2020).

Sampling Techniques

A three-stage sampling technique was adopted for the study. In the first stage, three (3) Local Government Areas (LGAs) namely; Karim Lamido, Gassol and Wukari were purposively selected from the three agricultural zones in Taraba State. In the second stage, one ward was selected from each LGA based on agricultural relevance. In the final stage, simple random sampling was used to select respondents from the list of registered farmers in each ward (Kothari, 2004; Taraba State Agricultural Development Programme [TSADP], 2020).

Thus 197 respondents were proportionately selected as presented in the table below.

Table 1: Sampling Frame and Sample Size

Agricultural Zone	LGA	Ward	Sample Frame	Sample Size
Taraba North	Karim Lamido	Karim A	147	74
Taraba Central	Gassol	Gassol	130	66
Taraba South	Wukari	Bantaje	113	57
Total			390	197

Source: Field Survey, 2025

$$n_i = \frac{N_i}{N} \times n$$

Where:

- n_i = Sample size for each ward
- N_i = Population for each ward
- N = total population (390)
- n = total sample size (197)

1. Karima A Ward (Taraba North)

$$n_i = \frac{147}{390} \times 197$$

$$n_i = 0.377 \times 197 = 74.27 = 74$$

2. Gassol Ward (Taraba Central)

$$n_i = \frac{130}{390} \times 197$$

$$n_i = 0.333 \times 197 = 65.60 = 66$$

3. Bantaje Ward (Taraba South)



$$n_i = \frac{113}{390} \times 197$$
$$n_i = 0.290 \times 197 = 57.13 = 57$$

Method of Data Collection

Data was collected through the use of structured questionnaire. The structured questionnaire was meticulously designed to gather relevant data based on the objectives of the study on the adoption of organic liquid fertilizer among dry season rice farmers. The questionnaire was divided into five main sections A (socio-economic characteristics of the respondents) for objective i and B (questions related to the level of liquid fertilizer adoption among dry season rice farmers).for objectives ii and c (question related to impact of liquid fertilizer on dry season rice farmers output).for objective iii and d (question related to the socioeconomic factors influencing the adoption of liquid organic fertilizer).for objective iv and e (question related to constraints to liquid fertilizer adoption in the study area) for objective v. Demographic information included questions on respondents' age, gender, educational background, household size, and farming experience. Understanding these demographic factors is crucial for analyzing the influence of socioeconomic characteristics on the adoption of organic liquid fertilizer.

Method of Data Analysis

Descriptive and inferential statistics was utilized in analyzing the data. Descriptive statistics such as frequency, percentage and mean was used to achieve objectives i, ii, iii and v of the study. Inferential statistics logistic regression model was used to achieve objective iv of the study.

Model Specification

The binary logistic regression model is expressed as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \mu$$

Where:

Y =	Adoption of organic liquid fertilizer (Adopted = 1, Not adopted = 0)
X ₁	Age = (Years)
X ₂	Gender = Male = 1, Female = 0
X ₃	Marital Status = Married = 1, Otherwise = 0
X ₄	Education Level = Educated = 1, Otherwise = 0
X ₅	Household Size = (Number of Persons)
X ₆	Farming Experience = (Years)
X ₇	Membership of Association = Yes = 1, No = 0
X ₈	Extension Contact = Yes = 1, No = 0
X ₉	Farm Size = (Hectares)
X ₁₀	Access to Credit = Yes = 1, No = 0
X ₁₁	Land Acquisition = Inherited = 1, Otherwise = 0
X ₁₂	Labour Type = Family = 1, Otherwise = 0
β ₀ =	Constant (Intercept)
β ₁ – β ₆ =	Regression coefficients
μ (U)	= Error term

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Respondents

Table 2a shows the socio-economic characteristics of the respondents, The result showed that respondents had a mean age of 41 years, with largest proportion (31.6%) of the respondents felt within the 31–40 years age category, followed by 28.0% who were within 41–50 years. This indicates that dry season rice farming in the study area was largely undertaken by relatively mature and economically active farmers. Farmers within these age groups are likely to possess considerable farming experience and decision-making capacity, which may influence their willingness and ability to adopt improved agricultural technologies such as organic liquid fertilizer. According to Oyetunde-Usman *et al.* (2024), farmers' age can influence technology adoption through its effects on farming experience, decision-making and willingness to accept new agricultural innovations.



The findings further revealed that respondents had a mean household size of 8 persons, with the majority (50.3%) having between 6–10 household members. The relatively large household size may provide an important source of family labour for agricultural activities, including land preparation, fertilizer application, weeding and harvesting. However, larger households may also place greater pressure on household resources and farm income because of increased consumption requirements. Manda *et al.* (2021) observed that household size can influence agricultural decisions by affecting both labour availability and the allocation of household resources.

The result indicated that about 46.1% had between 11–20 years of farming experience with the mean farming experience of 16 years. This suggests that a substantial proportion of the farmers had considerable practical knowledge of rice production. Such experience may enhance farmers' ability to understand production problems, assess the usefulness of alternative agricultural inputs and make decisions regarding the adoption of organic liquid fertilizer. Adebayo *et al.* (2023) reported that farming experience can contribute to the adoption of sustainable agricultural practices because experienced farmers may have better knowledge of production conditions and the potential benefits of improved technologies.

The findings also showed that respondents had a mean farm size of 1.62 hectares, with the largest proportion (36.8%) cultivating between 1.1–2.0 hectares, followed by 33.2% cultivating 0.1–1.0 hectares. This indicates that most of the respondents were operating relatively small-scale farms. The predominance of small farm holdings may have implications for farmers' ability to invest in agricultural inputs and technologies, including organic liquid fertilizer. Farm size is an important socioeconomic factor in technology adoption because the scale of operation may influence farmers' expected returns from adopting improved agricultural practices. Tanimonure *et al.* (2024) emphasized that farm size can influence the adoption of organic fertilizer practices among farmers in Nigeria.

Table 2: Distribution of Respondents According to Quantitative Socio-economic Characteristics (n = 193)

Socio-economic Characteristics	Frequency	Percentage	Mean
Age			
21–30	33	17.1	41
31–40	61	31.6	
41–50	54	28.0	
51 and above	45	23.3	
Household Size			
1–5	48	24.9	8
6–10	97	50.3	
11–15	34	17.6	
16 and above	14	7.3	
Farming Experience			
1–10	52	26.9	16
11–20	89	46.1	
21–30	36	18.7	
31 and above	16	8.3	
Farm Size			
0.1–1.0	64	33.2	1.62
1.1–2.0	71	36.8	
2.1–3.0	38	19.7	
3.1 and above	20	10.4	

Source: Field Survey (2026)



Level of Awareness and Adoption of Organic Liquid Fertilizer among Dry Season Rice Farmers

The result in Table 3 shows that a majority (74.1%) of the respondents were aware of organic liquid fertilizer, while 25.9% were not aware. This indicates a relatively high level of awareness among farmers in the study area. This finding agrees with Abdullahi *et al.* (2023), who reported that awareness is a key driver of adoption of agricultural innovations in Nigeria.

In terms of usage, 58.0% of the respondents indicated that they use organic liquid fertilizer, while 42.0% do not. This suggests a moderate level of adoption among dry season rice farmers. The gap between awareness and actual usage implies that although many farmers are aware of the technology, not all have adopted it. This observation supports the findings of Adekunle *et al.* (2020), who noted that awareness does not necessarily translate into adoption due to constraints such as cost, accessibility, and lack of technical knowledge.

Table 3: Distribution of Respondents According to Awareness and Adoption of Organic Liquid Fertilizer (n = 193)

Variable	Frequency	Percentage
Awareness of Organic Liquid Fertilizer		
Yes	143	74.1
No	50	25.9
Adoption of Organic Liquid Fertilizer		
Users	112	58.0
Non-users	81	42.0

Source: Field survey, (2026)

Frequency of Use of Organic Liquid Fertilizer

Table 4 reveals that among the users of organic liquid fertilizer, 42.0% use it rarely, 35.7% use it occasionally, while only 22.3% use it consistently. This indicates that most farmers are still at the partial adoption stage, with relatively few fully adopting the technology. This finding is consistent with Musa *et al.* (2021), who observed that many farmers remain at the trial stage of adoption due to uncertainties about the effectiveness of new technologies. The low proportion of consistent users may be attributed to factors such as high cost, limited availability, and inadequate technical knowledge. According to Ibrahim and Lawal (2022), farmers are more likely to adopt and consistently use innovations when they perceive clear economic benefits and have access to adequate support services.

Table 4: Distribution of Respondents According to Frequency of Use of Organic Liquid Fertilizer (n = 112)

Frequency of Use	Frequency	Percentage
Rarely	47	42.0
Occasionally	40	35.7
Always	25	22.3

Source: Field survey, (2026)

Sources of Information on Organic Liquid Fertilizer

The result in Table 5 indicates that extension agents are the primary source of information for 35.2% of the respondents, followed by fellow farmers (28.0%). This highlights the importance of extension services and peer networks in disseminating agricultural innovations. This finding corroborates Olagunju *et al.* (2022), who emphasized the role of extension agents in promoting adoption of improved agricultural technologies. The role of fellow farmers also suggests the importance of social learning and farmer-to-farmer interaction in the diffusion of innovations. Media and NGOs contribute



to awareness but to a lesser extent, indicating a need to strengthen these channels for wider dissemination.

Table 5: Distribution of Respondents According to Sources of Information on Organic Liquid Fertilizer (n = 193)

Source of Information	Frequency	Percentage
Extension agents	68	35.2
Fellow farmers	54	28.0
Media	31	16.1
NGOs	21	10.9
Others	19	9.8

Source: Field survey (2026)

Years of Use of Organic Liquid Fertilizer

Table 6 shows that about 41.1% of the respondents have been using organic liquid fertilizer for 1–3 years, while 25.9% have used it for less than one year. Only 12.5% have used it for more than six years. This suggests that the adoption of organic liquid fertilizer is relatively recent in the study area. The dominance of short-term users indicates that many farmers are still in the early stages of adoption. This finding aligns with Ojo *et al.* (2024), who reported that newly introduced agricultural technologies often experience gradual adoption over time as farmers gain confidence in their effectiveness.

The findings reveal that although awareness of organic liquid fertilizer is relatively high, the level of adoption remains moderate, with most farmers still at the partial adoption stage. Factors such as limited consistent usage and relatively short duration of adoption suggest that efforts should be intensified to promote sustained use through improved extension services, training, and access to inputs.

Table 6: Distribution of Respondents According to Years of Use of Organic Liquid Fertilizer (n = 112)

Years of Use	Frequency	Percentage
Less than 1 year	29	25.9
1–3 years	46	41.1
4–6 years	23	20.5
Above 6 years	14	12.5

Source: Field survey (2026)

Impact of Organic Liquid Fertilizer on Output of Dry Season Rice Farmers

The results presented in Table 7 indicate that respondents generally agreed that organic liquid fertilizer has a positive impact on rice production. The mean score of 4.18 for increased rice yield suggests that farmers perceive the fertilizer as effective in boosting productivity. This finding is consistent with Adebayo *et al.* (2021), who reported that organic fertilizers significantly improve crop yield through enhanced nutrient availability.

The highest mean score of 4.32 was recorded for improvement in soil fertility, indicating that farmers strongly perceive organic liquid fertilizer as beneficial to soil health. This aligns with the findings of Nwankwo *et al.* (2023), who emphasized that organic fertilizers improve soil structure, increase organic matter content, and enhance microbial activity, all of which contribute to sustainable agricultural production. Similarly, the mean score of 4.26 for environmental friendliness indicates that farmers recognize the ecological benefits of organic liquid fertilizer. This supports the assertion by Ibrahim *et al.* (2022) that organic fertilizers are environmentally sustainable and reduce the negative impacts associated with chemical fertilizer use, such as soil degradation and water pollution.

The enhancement of crop quality recorded a mean score of 4.09, suggesting that farmers observe improvements in the physical and market quality of rice produced using organic liquid



fertilizer. This finding agrees with Ojo *et al.* (2024), who reported that organic inputs contribute to better grain quality and increased market value. Although respondents agreed that organic liquid fertilizer reduces the cost of production ($\bar{x}= 3.76$), this variable recorded the lowest mean among the listed impacts. This suggests that while farmers acknowledge some cost benefits, these may not be immediately significant. The relatively lower mean could be attributed to the initial cost of acquisition or limited availability, as noted by Adekunle *et al.* (2020).

The findings indicate that organic liquid fertilizer has a significant positive impact on rice production in the study area. The high mean scores across all variables suggest strong farmer perception of its benefits, particularly in improving soil fertility, enhancing environmental sustainability, and increasing crop yield. These results imply that promoting the use of organic liquid fertilizer could contribute to sustainable agricultural development and improved food security. However, for these benefits to be fully realized, challenges related to accessibility, cost, and technical knowledge must be addressed through effective extension services and policy support.

Table 7: Distribution of Respondents according to Perceived Impact of Organic Liquid Fertilizer on Output (n = 193)

Variable	Mean	S.D	Decision
Increases rice yield	4.18	0.87	Agree
Improves soil fertility	4.32	0.81	Agree
Enhances crop quality	4.09	0.92	Agree
Reduces cost of production	3.76	0.95	Agree
Environmentally friendly	4.26	0.84	Agree

Source: Field survey, (2026)

Decision Rule: Mean ≥ 3.0 = Agree; Mean < 3.0 = Disagree

Factors Influencing the Adoption of Organic Liquid Fertilizer

Table 8 showed the result of the logistic regression analysis on socio-economic factors influencing the adoption of organic liquid fertilizer among dry season rice farmers. The result of the logistic regression analysis reveals that age ($P<0.05$) educational level ($P<0.01$).Extension services ($P<0.01$), farm size ($P<0.01$) and access to credit ($P< 0.05$) were significant factors influencing the adoption of organic liquid fertilizer in the study area. The coefficient of age was found to be negative and significant indicating that younger household were more likely to adopt organic liquid fertilizer application than older farmers in the study area.The coefficient of education was also positive and significant indicating that educated farmers were more likely to adopt organic liquid fertilizer than non-educated farmers.

The coefficient of extension contact was positive and significant indicating that farmers with greater extension contact were more likely to adopt organic liquid fertilizer. Ojo *et al.* (2024) similarly emphasized the role of extension services in promoting agricultural technology adoption.

The coefficient of farm size was positive and significant indicating that farmers with larger farm sizes were more likely to adopt the technology. Access to credit was also positive and significant, indicating that access to credit increased the likelihood of adoption of organic liquid fertilizer. This agrees with Abdullahi *et al.* (2023).

The model recorded a -2 Log Likelihood of 168.742, while the Cox and Snell R^2 was 0.287 and Nagelkerke R^2 was 0.391. This indicates that the model explained approximately 39.1% of the variation in adoption.



Table 8: Factors Influencing Adoption of Organic Liquid Fertilizer Among Dry Season Rice Farmers

Variable	B	S.E.	Wald	df	p-value (Sig.)	t-value
Constant	-1.562	0.421	13.780	1	0.000***	-3.710
Age (X ₁)	-0.215	0.098	4.816	1	0.028**	-2.194
Gender (X ₂)	0.134	0.087	2.370	1	0.124NS	1.540
Marital Status (X ₃)	0.072	0.065	1.215	1	0.271NS	1.108
Education (X ₄)	0.374	0.112	11.164	1	0.002***	3.339
Household Size (X ₅)	0.058	0.041	1.996	1	0.158NS	1.415
Farming Experience (X ₆)	0.066	0.052	1.614	1	0.204NS	1.269
Membership (X ₇)	0.091	0.078	1.363	1	0.243NS	1.167
Extension Contact (X ₈)	0.428	0.119	12.934	1	0.001***	3.597
Farm Size (X ₉)	0.291	0.105	7.676	1	0.006***	2.771
Access to Credit (X ₁₀)	0.187	0.094	3.980	1	0.046**	1.989
Land Acquisition (X ₁₁)	0.063	0.071	0.795	1	0.372NS	0.887
Labour Type (X ₁₂)	0.049	0.068	0.524	1	0.469NS	0.721
-2 Log Likelihood	168.742					
Cox & Snell R ²	0.287					
Nagelkerke R ²	0.391					

Source: Field Survey, 2026.

Note: *** Significant at 1% level ($p < 0.01$); ** Significant at 5% level ($p < 0.05$); NS = Not significant.

Constraints to the Adoption of Organic Liquid Fertilizer

The results in Table 9 indicate that the high cost of organic liquid fertilizer ($\bar{x} = 3.21$) is one of the most critical constraints faced by farmers. This suggests that many farmers are unable to afford the input, thereby limiting its adoption. This finding is consistent with Abdullahi *et al.* (2023), who identified financial limitations as a major barrier to technology adoption among smallholder farmers. Limited availability of the product ($\bar{x} = 3.15$) also emerged as a major constraint. This implies that even when farmers are willing to adopt the technology, access remains a challenge due to poor distribution networks or limited supply in rural areas.

Lack of awareness and information ($\bar{x} = 3.08$) was another significant constraint, indicating that many farmers are not adequately informed about the benefits and proper usage of organic liquid fertilizer. This highlights the need for improved extension services and farmer education programs.

Inadequate extension services ($\bar{x} = 2.97$) further reinforces the role of institutional support in adoption. Farmers who do not receive adequate guidance from extension agents are less likely to adopt new technologies. This finding aligns with Ojo *et al.* (2024), who emphasized that extension services are critical for disseminating agricultural innovations.

Difficulty in application techniques ($\bar{x} = 2.85$) suggests that some farmers find the use of organic liquid fertilizer technically challenging. This may be due to lack of training or complexity in application methods. Lack of access to credit ($\bar{x} = 2.89$) also poses a serious challenge, as farmers require financial resources to purchase inputs. This supports earlier findings in the regression analysis where access to credit significantly influenced adoption.

Uncertainty about the effectiveness of organic liquid fertilizer ($\bar{x} = 2.74$) indicates that some farmers are skeptical about its performance compared to conventional fertilizers. This lack of confidence may hinder adoption unless supported by demonstration trials and evidence-based extension campaigns.

However, cultural resistance to new practices ($\bar{x} = 2.31$) was not considered a serious constraint. This suggests that farmers in the study area are generally open to innovation, provided that economic and institutional barriers are addressed. The findings reveal that economic, informational, and



institutional constraints are the major barriers to adoption, rather than cultural factors. Addressing these issues will significantly improve the uptake of organic liquid fertilizer among farmers.

Table 9: Distribution of Respondents on Constraints to the Adoption of Organic Liquid Fertilizer (n = 193)

Constraints	Mean Score	S.D	Decision
High cost of organic liquid fertilizer	3.21	0.84	Serious
Lack of awareness/information	3.08	0.91	Serious
Inadequate extension services	2.97	0.88	Serious
Difficulty in application techniques	2.85	0.79	Serious
Limited availability of the product	3.15	0.86	Serious
Lack of access to credit	2.89	0.90	Serious
Uncertainty about effectiveness	2.74	0.83	Serious
Cultural resistance to new practices	2.31	0.77	Not Serious

Source: Field Survey, 2026.

Decision Rule: Mean $\geq$ 2.50 = Serious Constraint

CONCLUSION AND RECOMMENDATIONS

The study concluded that despite the challenges faced by farmers, organic liquid fertilizer was gaining wider acceptance. It recommended that the government should improve farmers' access to credit, strengthen extension services, and increase awareness to enhance and sustain the adoption of organic liquid fertilizer in agricultural production.

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