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ASSESSMENT OF FARMERS' PERCEPTION OF FERTILIZER APPLICATION PRACTICES AND CROP YIELD VARIABILITY IN JALINGO AND WUKARI LOCAL GOVERNMENT AREAS, TARABA STATE, NIGERIA

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Abstract
This study assessed farmers' perceptions of fertilizer application practices and crop yield variability in Jalingo and Wukari Local Government Areas (LGAs), Taraba State. A multistage sampling procedure was used to select 200 respondents from six wards: Majidadi, Wurosembe and Barade in Jalingo LGA, and Kente, Rafin Kada and Bantaje in Wukari LGA. Primary data were collected using a structured questionnaire. Data were analysed using frequency, percentage, ranking and multiple regression analysis. The findings indicated that farmers generally had positive perceptions of appropriate fertilizer application practices. Application of fertilizer according to crop nutrient requirements ranked first (97.5%), followed by application at recommended rates (96.5%). Pest and disease infestation was ranked first (69.5%) among factors influencing crop yield variability, followed by rainfall variation (95.0%) and inadequate fertilizer application (94.0%). The regression results indicated that education, farming experience, fertilizer availability, access to extension services and access to fertilizer information significantly influenced farmers' perceptions, while fertilizer cost had a negative influence. The study concludes that improved access to affordable fertilizers, extension services and relevant agricultural information could promote appropriate fertilizer application and contribute to more stable crop yields. The findings provide useful information for agricultural extension planning and interventions aimed at improving crop productivity in Taraba State.
Keywords: *Assessment, Fertilizer application, crop yield variability, farmers' perceptions*

1.0 Introduction

Agriculture remains an important sector of the Nigerian economy, providing food, employment and income, particularly for smallholder farmers. However, low soil fertility, inadequate access to agricultural inputs, limited extension services and other socioeconomic constraints continue to restrict crop productivity. Continuous cultivation, nutrient removal, erosion and inadequate nutrient replenishment can further reduce soil fertility and crop yield potential (Aliyu *et al.,* 2020; Khalid *et al.,* 2024).

Fertilizer application is an important strategy for improving soil fertility and crop productivity. Its effectiveness depends on the appropriate fertilizer type, rate, timing and method of application. Differences in soil fertility across locations mean that uniform fertilizer recommendations may not adequately meet farmers' needs (Aliyu *et al.,* 2020). Evidence from Northern Nigeria shows that site-specific nutrient management can improve fertilizer practices, maize yield, farm revenue and nutrient-use efficiency (Maertens *et al.,* 2023). Similarly, Ojeniyi *et al*. (2024) reported that optimised split fertilizer application increased maize yield and nutrient-use

efficiency in Nigeria's Middle Belt. Farmers' fertilizer application practices are influenced by socioeconomic and institutional factors, including education, farm size, access to information, cooperative membership, input availability and financial resources (Khalid *et al.,* 2024). Farmers' perceptions of soil fertility and fertilizer effectiveness are also important. Akinbode *et al.* (2024) found that farmers in the Southwestern Nigeria commonly relied on personal knowledge and observable field characteristics to assess soil fertility, with limited use of soil testing and digital soil information systems. Similarly, fertilizer prices, household income and access to credit can influence farmers' ability to apply fertilizer at recommended rates (NAERLS *et al.,* 2025).

Crop yield variability may result from differences in soil fertility, rainfall, temperature, crop varieties, pests and diseases, planting practices and fertilizer management. These factors can influence the availability of nutrients, crop growth and the ability of crops to achieve their yield potential. In particular, inadequate or poorly timed fertilizer application may result in nutrient deficiencies and reduced yields, while excessive or inappropriate application can lead to nutrient losses and low nutrient-use efficiency. Appropriate nutrient management can therefore improve crop growth, yield performance and farm productivity, although fertilizer alone cannot eliminate all sources of yield variability. Site-specific nutrient recommendations and improved fertilizer management have consequently been identified as important approaches to improving crop productivity, nutrient-use efficiency and farm returns among smallholder farmers (Maertens *et al.,* 2023; Ojeniyi *et al.,* 2024).

The issue is particularly relevant to farmers in Jalingo and Wukari Local Government Areas (LGAs) of Taraba State, where crop production is an important livelihood activity. Farmers in these areas may differ in their access to fertilizers, extension services, credit, markets and technical information, which may influence their fertilizer application practices and perceptions of crop yield. However, limited location-specific evidence exists on farmers' perceptions of fertilizer application practices and crop yield variability in the two LGAs.

2.0 Objectives of the Study

The broad objective of the study was to assess farmers' perceptions of fertilizer application practices and crop yield variability in Jalingo and Wukari LGAs, Taraba State.

The study specifically seeks to:

i. describe the socio-economic characteristics of crop farmers in Jalingo and Wukari LGAs;
ii. ascertain farmers' perceptions of fertilizer application practices in the study areas;
iii. identify and rank the factors influencing crop yield variability as perceived by farmers in Jalingo and Wukari LGAs; and
iv. determine socio-economic factors influencing farmers' perceptions of fertilizer application practices and crop yield variability in the study areas.

3.0 Methodology

The study was conducted in Jalingo and Wukari Local Government Areas (LGAs) of Taraba State, Nigeria. Both LGAs fall within the Southern Guinea Savannah agro-ecological zone and experience distinct wet and dry seasons, making them suitable for rain-fed crop production. The Southern Guinea Savannah is an important agricultural zone for maize and other food crops, with climatic and soil conditions influencing crop productivity and management practices (Babalola *et al.,* 2025). Jalingo LGA is located approximately between latitudes 9°10′ and 9°25′ N and longitudes 11°05′ and 11°20′ E, while Wukari LGA lies approximately between 7°50′ and 8°15′ N latitude and 9°40′ and 10°05′ E longitude. Wukari has distinct wet and dry seasons, and variations in rainfall and temperature have been reported to influence maize production and yield in the area (Angye *et al.,* 2024).

The soils of the two LGAs vary in their physical and chemical properties and support the production of crops such as maize, rice, sorghum, soybean and other legumes. Recent research in

Jalingo has documented variations in soil profile characteristics, classification and fertility-related properties under different landscape positions (Gisilanbe *et al.,* 2020). Similarly, Abdulkadir *et al.* (2024) reported differences in the hydro-physical properties of soils from selected farmlands in Wukari LGA, indicating variations in soil conditions that are relevant to sustainable crop production. Soil degradation and differences in organic matter and other soil properties have also been identified across different topographic positions in Wukari (Gani & Awwal, 2025).

Agriculture is a major economic activity in both LGAs, with smallholder farmers producing crops under varying soil, climatic and socioeconomic conditions. Farmers' fertilizer and soil management practices may differ according to access to inputs, financial capacity, experience, extension services and local production conditions. Studies in Taraba State have demonstrated the importance of soil fertility management, climate conditions and improved agronomic practices for sustainable crop production (Abdulkadir *et al.,* 2024; Angye *et al.,* 2024). Jalingo and Wukari LGAs were therefore selected for the study because of their importance in crop production and their representation of farming systems within the Southern Guinea Savannah agro-ecological zone. The differences in soil characteristics, climatic conditions and farming practices between the two locations provide an appropriate setting for assessing farmers' perceptions of fertilizer application practices and crop yield variability.

The study adopted a multistage sampling procedure. In the first stage, two Local Government Areas (LGAs), namely Jalingo and Wukari, were purposively selected from Taraba State because of their importance in crop production and the relevance of fertilizer application practices to crop productivity. In the second stage, six wards were purposively selected from the two LGAs. In Wukari LGA, the selected wards were Kente, Rafin Kada and Bantaje, while in Jalingo LGA, the selected wards were Majidadi, Wurosembe and Barade. In the third stage, crop-farming communities within the selected wards were identified, and a sampling frame of eligible crop farmers was developed. In the fourth stage, respondents were selected proportionately according to the number of eligible farmers in each selected ward, after which simple random sampling was used to select individual farmers. The procedure ensured that farmers in all the selected wards were adequately represented in the study. Only farmers who had experience with crop production and fertilizer application practices were eligible to participate in the study.

The study relied entirely on primary data. Data were collected from crop farmers in the selected wards of Jalingo and Wukari LGAs using a structured questionnaire developed in accordance with the objectives and research questions of the study. The questionnaire was divided into sections covering the socio-demographic characteristics of respondents, fertilizer application practices, factors influencing crop yield variability, and farmers' perceptions of the effects of fertilizer application on crop yield. The perception items were measured using a four-point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD), assigned scores of 4, 3, 2 and 1, respectively. The questionnaires were administered directly to the selected farmers with the assistance of trained research assistants/enumerators. The completed questionnaires were collected, checked for completeness and consistency, and subsequently coded for statistical analysis. The data generated from the questionnaires were analysed using frequency, percentage, ranking and appropriate inferential statistical techniques in line with the objectives of the study.

Data collected for the study were coded and analysed using descriptive and inferential statistical techniques. Frequencies, percentages and ranking were used to analyse Objectives I, II and III. The ranking was based on the percentage of respondents who agreed with each statement, with the highest percentage assigned Rank 1. Multiple regression analysis was used to analyse Objective IV by determining the factors influencing farmers' perceptions of fertilizer application practices and crop yield variability.

The multiple regression models are explicitly expressed as:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + e \quad \ldots\ldots\ldots (1)$$

Where:
Y = Farmers' perception of fertilizer application practices and crop yield variability
β_0 = Constant/intercept
β_1–β_{10} = Estimated regression coefficients
X_1–X_{10} = Explanatory variables
e = Error term

The explanatory variables are defined as follows:
X_1 = Age (years)
X_2 = Sex (Male = 1, Female = 0)
X_3 = Marital Status (Married = 1, Not married = 0)
X_4 = Educational Status (years of formal education)
X_5 = Household Size (number of household members)
X_6 = Farm Size (hectares)
X_7 = Farming Experience (years of farming experience)
X_8 = Fertilizer Cost (amount spent on fertilizer in Nigerian Naira)
X_9 = Access to Extension Services (No access = 0, Access = 1)
X_{10} = Access to Agricultural Credit (No access = 0, Access = 1)

The regression analysis was used to determine the direction and magnitude of the effects of the explanatory variables on farmers' perceptions. The coefficient of determination (R^2) was used to determine the proportion of variation in the dependent variable explained by the independent variables. The statistical significance of the estimated coefficients was tested at 5% and 1% probability levels.

4.0 Results and Discussion

4.1 Socio-Demographic Characteristics of Respondents

Table 1 shows the socio-demographic characteristics of the 200 respondents. The respondents were equally distributed between Jalingo and Wukari LGAs, with 100 (50.0%) from each LGA, providing balanced representation of the two study areas. The respondents were predominantly male (71.0%), while females constituted 29.0%. This agrees with Sani *et al.* (2025), who reported that about 69% of farmers surveyed nationally were male and 31% female. The predominance of males may reflect differences in access to farmland and involvement in crop production. In terms of age, the largest group was 36–45 years (30.5%), followed by 26–35 years (27.0%). Thus, more than half (57.5%) of the respondents were between 26 and 45 years, indicating that most were within the economically active age group. This is important because age may influence farmers' decision-making, farming activities and adoption of improved agricultural practices. Sani *et al.* (2025) similarly reported a national mean farmer age of 47 years.

Most respondents (68.5%) were married. Educational attainment was relatively high, as 89.0% had some form of formal education, with 39.5% having secondary education and 25.5% tertiary education. Education may enhance farmers' ability to understand extension information and adopt improved technologies. Ayanwale *et al.* (2025) similarly identified education as an important factor influencing organic fertilizer adoption among Nigerian farming households. Regarding farming experience, the largest proportion (33.5%) had 11–20 years of experience, indicating that many respondents had considerable practical knowledge of crop production. Farm-size distribution shows that 84.0% cultivated five hectares or less, confirming that the respondents were predominantly smallholder farmers. This is consistent with Sani *et al.* (2025), who reported an average Nigerian farm holding of approximately 1.5 ha.

Table 1: Socio-demographic characteristics of respondents (n=200)

Variables	Categories	Frequency	Percentage (%)
LGA	Jalingo	100	50.0
	Wukari	100	50.0
Sex	Male	142	71.0
	Female	58	29.0
Age	18–25 years	28	14.0
	26–35 years	54	27.0
	36–45 years	61	30.5
	46–55 years	37	18.5
	56 years and above	20	10.0
Marital status	Single	38	19.0
	Married	137	68.5
	Divorced/Separated	9	4.5
	Widowed	16	8.0
Educational level	Non formal education	22	11.0
	Primary education	48	24.0
	Secondary education	79	39.5
	Tertiary education	51	25.5
Farming experience	Less than 5 years	25	12.5
	5–10 years	51	25.5
	11–20 years	67	33.5
	21–30 years	39	19.5
	Above 30 years	18	9.0
Farm size	Less than 1 ha	31	15.5
	1–2 ha	76	38.0
	3–5 ha	61	30.5
	6–10 ha	22	11.0
	Above 10 ha	10	5.0

Source: *Field Survey (2026).*

4.2 Farmers' Perceptions of Fertilizer Application Practices

Farmers generally had positive perceptions of fertilizer application practices (Table 2). The highest proportion, 195 respondents (97.5%), agreed that fertilizer should be applied according to crop nutrient requirements, followed by 193 (96.5%) who agreed that recommended fertilizer rates improve crop yield. Also, 191 (95.5%) indicated that inadequate fertilizer application can result in poor yield. This suggests good awareness of appropriate fertilizer management, consistent with Maertens *et al.* (2023), who reported that site-specific nutrient recommendations improved fertilizer management and maize productivity among Nigerian farmers. Furthermore, 95.0% agreed that fertilizer type affects yield, while 93.5% recognised the importance of soil fertility in determining fertilizer rates. Also, 92.5% identified application timing as important, and 92.0% agreed that extension services improve fertilizer practices. These findings support Aliyu *et al.* (2020) and Akinbode *et al.* (2024), who emphasised site-specific soil fertility management and farmers' access to appropriate information.

The lowest responses were recorded for excessive fertilizer negatively affecting crop performance (85.0%) and farmers generally following recommended practices (71.5%). The latter suggests a possible gap between farmers' knowledge and actual practice, potentially due to fertilizer cost, availability and limited extension support. Ojeniyi *et al*. (2024) and Khalid *et al.* (2024) similarly identified fertilizer-management practices and socioeconomic factors as important influences on nutrient-use efficiency and adoption. Overall, farmers in Jalingo and Wukari

demonstrated favourable perceptions of fertilizer application, particularly regarding appropriate rates, nutrient requirements and effects on yield. However, the relatively low proportion reporting adherence to recommendations indicates the need for improved extension services, fertilizer accessibility and site-specific recommendations.

Table 2: Farmers' perceptions of fertilizer application practices (n=200)

S/N	Statement	Frequency	Percentage (%)	Rank
1	Applying fertilizer improves crop growth and development.	188	94.0	5
2	Applying fertilizer at the recommended rate improves crop yield.	193	96.5	2
3	The type of fertilizer used affects crop yield.	190	95.0	4
4	The timing of fertilizer application affects crop performance.	185	92.5	7
5	Proper placement of fertilizer improves its effectiveness.	178	89.0	10
6	Applying too little fertilizer can result in poor crop yield.	191	95.5	3
7	Applying excessive fertilizer can negatively affect crop performance.	170	85.0	14
8	Splitting fertilizer application improves nutrient use by crops.	176	88.0	12
9	Fertilizer should be applied according to crop nutrient requirements.	195	97.5	1
10	Soil fertility should be considered when determining fertilizer rates.	187	93.5	6
11	Farmers generally follow recommended fertilizer practices.	143	71.5	15
12	Farmers' knowledge influences proper fertilizer application.	181	90.5	9
13	Extension services improve fertilizer application practices.	184	92.0	8
14	High fertilizer cost affects recommended fertilizer application.	174	87.0	13
15	Fertilizer availability affects its application by farmers.	177	88.5	11

Source: *Field Survey, 2026.*

4.3 Factors Influencing Crop Yield Variability

From Table 3 result revealed those farmers' perceptions of factors influencing crop yield variability in the study areas. The results indicate that pest and disease infestation was the most frequently identified factor, with 193 respondents (96.5%), ranking first. This was followed by variations in rainfall (95.0%) and inadequate fertilizer application (94.0%), ranking second and third, respectively. These findings suggest that farmers consider both climatic and crop-management factors important causes of differences in crop yield. This agrees with Angye *et al*. (2024), who reported that climate variability significantly influences maize yield in Wukari LGA, Taraba State. Weed infestation (93.5%), differences in soil fertility (92.0%), soil moisture availability (91.0%) and improper fertilizer application (90.5%) were also highly reported. These findings indicate that farmers recognise the importance of soil conditions, moisture and proper

nutrient management in determining crop performance. Aliyu *et al.* (2020) similarly reported substantial spatial differences in soil fertility across Nigeria's maize belt, supporting the importance of site-specific soil and nutrient management.

Other factors identified included changes in weather conditions (90.0%), availability of farm inputs (89.0%), availability of quality seeds (87.5%) and farm management skills (86.0%). High temperature (84.5%), access to extension services (84.0%), poor land preparation (83.0%) and differences in crop varieties (80.5%) received comparatively lower rankings. Nevertheless, the relatively high percentages indicate that farmers perceive crop yield variability as being influenced by multiple interacting factors rather than fertilizer alone. Overall, the findings show that pests and diseases, rainfall variability, inadequate fertilizer application, weeds and soil fertility differences were the major factors perceived by farmers to influence crop yield variability. This highlights the need for integrated crop management involving appropriate fertilizer use, improved pest and weed management, climate-responsive practices and effective extension services.

Table 3: Farmers' perceptions of factors influencing crop yield variability (n=200)

S/N	Factors	Frequency	Percentage (%)	Rank
1	Differences in soil fertility	184	92.0	5
2	Variations in rainfall	190	95.0	2
3	High temperature	169	84.5	12
4	Pest and disease infestation	193	96.5	1
5	Differences in crop varieties	161	80.5	15
6	Poor land preparation	166	83.0	14
7	Inadequate fertilizer application	188	94.0	3
8	Improper fertilizer application	181	90.5	7
9	Availability of quality seeds	175	87.5	10
10	Weed infestation	187	93.5	4
11	Access to extension services	168	84.0	13
12	Availability of farm inputs	178	89.0	9
13	Farm management skills	172	86.0	11
14	Soil moisture availability	182	91.0	6
15	Changes in weather conditions	180	90.0	8

Source: *Field Surveye (2026).*

4.4 Perceived Effects of Fertilizer Application on Crop Yield

Table 4 revealed farmers' perceptions of the effects of fertilizer application on crop yield. The results show that farmers generally perceived fertilizer application as having a positive effect on crop productivity. The highest proportion, 194 respondents (97.0%), agreed that appropriate fertilizer application increases crop yield, ranking first. This was followed by 192 (96.0%) who indicated that recommended fertilizer rates produce better yields, while 191 (95.5%) agreed that farmers who apply fertilizer appropriately generally obtain better yields. These findings demonstrate farmers' strong perception of the importance of proper fertilizer management for improving crop productivity. This agrees with Maertens *et al.* (2023), who found that improved, site-specific fertilizer recommendations increased maize yield and farm revenue among smallholder farmers in Nigeria. Similarly, 95.0% of respondents indicated that fertilizer improves crop growth and vigour, while 94.0% agreed that appropriate fertilizer timing improves yield. Balanced nutrient application (93.0%) and reduction of nutrient-deficiency-related yield losses (92.5%) were also highly rated. These findings support Ojeniyi *et al.* (2024), who reported that appropriate fertilizer

type, timing and application practices improved maize yield and nutrient-use efficiency in Nigeria's Middle Belt.

The lowest responses were recorded for the perception that proper fertilizer management can reduce yield differences between farms (84.0%) and that organic fertilizer can improve crop yield (85.0%). Nevertheless, the relatively high percentages indicate that farmers generally recognise the contribution of fertilizer to crop performance. Khalid *et al.* (2024) similarly reported that soil-management practices, including the use of soil fertility technologies, are associated with agricultural productivity among Nigerian farming households. Overall, the findings indicate that farmers in Jalingo and Wukari strongly perceive appropriate fertilizer application as beneficial to crop yield, growth, productivity and yield stability. This suggests that promoting recommended fertilizer rates, proper timing and balanced nutrient management through agricultural extension could contribute to improved crop productivity in the study areas.

Table 4: Perceived effects of fertilizer application on crop yield (n=200)

S/N	Statement	Frequency	Percentage (%)	Rank
1	Appropriate fertilizer application increases crop yield.	194	97.0	1
2	Fertilizer application improves crop growth and vigour.	190	95.0	4
3	Fertilizer application improves the number of productive plants.	174	87.0	12
4	Proper fertilizer application improves crop quality.	181	90.5	8
5	Recommended fertilizer rates produce better yields.	192	96.0	2
6	Appropriate timing of fertilizer improves crop yield.	188	94.0	5
7	Balanced nutrient application improves productivity.	186	93.0	6
8	Appropriate fertilizer use helps maintain soil productivity.	179	89.5	10
9	Fertilizer reduces yield losses caused by nutrient deficiency.	185	92.5	7
10	Organic fertilizer can improve crop yield.	170	85.0	14
11	Combining organic and inorganic fertilizers can improve productivity.	176	88.0	11
12	Proper fertilizer management can reduce yield differences between farms.	168	84.0	15
13	Farmers who apply fertilizer appropriately generally obtain better yields.	191	95.5	3
14	Lack of fertilizer application contributes to low crop productivity.	180	90.0	9
15	Proper fertilizer application contributes to more stable crop yields.	173	86.5	13

Source: *Field Survey, 2026.*

4.5 Factors Influencing Farmers' Perceptions of Fertilizer Application Practices

Table 5 showed the factors influencing farmers' perceptions of fertilizer application practices. The model explained 68% of the variation in farmers' perceptions ($R^2 = 0.68$), indicating that the variables included in the model provided a substantial explanation of differences in farmers' perceptions. Most variables had positive and significant coefficients, including sex, age, marital status, household size, education, farm size, farming experience, fertilizer availability, extension services, agricultural credit, farmers' organisation membership, fertilizer information and LGA.

Access to extension services (0.4217), farm size (0.3972) and fertilizer information (0.3395) were among the more influential positive factors, indicating that farmers with better access to technical information and production resources tended to have more favourable perceptions of fertilizer application. This agrees with Abdullahi *et al.* (2023), who found that education, extension access, household resources and other socioeconomic characteristics influenced the adoption of agricultural technologies among farmers in rural Nigeria.

Similarly, the positive effects of education, farm size, cooperative membership and access to productive resources are consistent with Khalid *et al.* (2024), who reported that education, farm size and membership of farmer organisations were important determinants of access to soil-management technologies in Nigeria. Ehiwario *et al.* (2024) also found significant relationships between education, household characteristics, cooperative membership, extension access and the adoption of improved agricultural technologies among Nigerian farming households. In contrast, fertilizer cost (-0.4628) had a negative and significant coefficient, indicating that higher fertilizer costs were associated with less favourable perceptions of fertilizer application practices. This may reflect farmers' financial constraints and difficulties in applying fertilizer at recommended rates. Recent evidence from Nigerian farmers similarly identifies high technology costs and inadequate credit as important constraints to agricultural technology adoption. Udoh *et al.* (2024) reported that high costs, inadequate extension contact and limited credit access constrained farmers' adoption of improved production technologies. Overall, the findings indicate that farmers' perceptions of fertilizer application practices are shaped by a combination of socioeconomic, institutional and economic factors. In particular, access to extension services, fertilizer information, farm resources and credit can enhance favourable perceptions, whereas high fertilizer costs may discourage them. Strengthening extension delivery, improving access to affordable fertilizer and credit, and expanding farmer organisations could therefore support better fertilizer-management decisions.

Table 5: Factors influencing farmers' perceptions of fertilizer application practices (n=200)

Variables	Coefficient	Std. Err.	T-value
Sex	0.6847	0.2715	2.52**
Age	0.2156	0.0324	6.65***
Marital status	0.3184	0.0712	4.47***
Household size	0.1845	0.0658	2.80**
Years of education	0.0287	0.0063	4.56***
Farm size	0.3972	0.1184	3.35***
Farming experience	0.0315	0.0078	4.04***
Fertilizer cost	-0.4628	0.1543	-3.00***
Fertilizer availability	0.2865	0.0817	3.51***
Access to extension services	0.4217	0.0985	4.28***
Access to agricultural credit	0.2538	0.0914	2.78**
Membership of farmers' organisation	0.1764	0.0587	3.01***
Access to fertilizer information	0.3395	0.1056	3.21***
Wukari LGA	0.1457	0.0624	2.33**
Constant	2.1846	0.4862	4.49***

Variables	Coefficient	Std. Err.	T-value
R^2	0.68		

Note: ** and *** indicate significance at 5% and 1%, respectively.
***Source**: Field Survey (2026).*

4.6 Factors Influencing Perceived Crop Yield Variability

Table 6 displays the factors influencing farmers' perceptions of crop yield variability. The model produced an R^2 of 0.72, indicating that the variables included in the model explained 72% of the variation in farmers' perceptions. The results show that sex, age, marital status, household size, education, farm size and farming experience had positive and statistically significant effects. Similarly, fertilizer application rate (0.4863), rainfall variability (0.5136), pest and disease incidence (0.4275), access to extension services (0.3965), and climate information (0.3528) significantly influenced farmers' perceptions. This suggests that farmers with greater exposure to production and climate information were more likely to recognise the factors contributing to yield differences. Rainfall variability had the largest positive coefficient (0.5136), followed by fertilizer application rate (0.4863) and pest and disease incidence (0.4275). This indicates that farmers considered climatic conditions, fertilizer management and biological stresses as major contributors to crop yield variability. This finding agrees with Angye *et al.* (2024), who reported that climate variability significantly affected maize yield in Wukari LGA, Taraba State.

In addition, access to extension services, climate information and agricultural credit had positive significant effects, indicating the importance of institutional support in farmers' understanding of yield variability. Fertilizer cost (-0.3154) was the only variable with a negative significant coefficient, suggesting that higher fertilizer costs may constrain farmers' ability to manage nutrient-related yield differences. Overall, the findings indicate that farmers perceive crop yield variability as a result of interacting climatic, agronomic, biological, socioeconomic and institutional factors. The relatively high R^2 (0.72) suggests that these factors jointly provide a strong explanation of differences in farmers' perceptions. Strengthening extension services, climate information, access to affordable fertilizer and credit could therefore improve farmers' capacity to manage yield variability.

Table 6: Factors influencing farmers' perception of crop yield variability (n=3200)

Variables	Coefficient	Std. Err.	T-value
Sex	0.5724	0.2286	2.50**
Age	0.1847	0.0289	6.39***
Marital status	0.2915	0.0673	4.33***
Household size	0.1632	0.0587	2.78**
Years of education	0.0314	0.0071	4.42***
Farm size	0.3486	0.1094	3.19***
Farming experience	0.0278	0.0065	4.28***
Fertilizer application rate	0.4863	0.1217	3.99***
Fertilizer cost	-0.3154	0.1046	-3.01***
Fertilizer availability	0.2647	0.0785	3.37***
Access to extension services	0.3965	0.0924	4.29***
Access to agricultural credit	0.2186	0.0837	2.61**
Access to climate information	0.3528	0.0973	3.63***
Pest and disease incidence	0.4275	0.1168	3.66***

Variables	Coefficient	Std. Err.	T-value
Rainfall variability	0.5136	0.1274	4.03***
Constant	1.9468	0.4375	4.45***
R^2	0.72		

Note: ** and *** indicate significance at 5% and 1%, respectively.
***Source**: Field Survey (2026).*

4.7 Relationship between Fertilizer Application Practices and Crop Yield Variability

Table 7 shows a negative and statistically significant relationship between fertilizer application practices and perceived crop yield variability ($r = -0.624$, $p < 0.001$). This indicates that better fertilizer application practices were associated with lower perceived crop yield variability among farmers. The correlation coefficient of −0.624 represents a moderately strong inverse relationship. Thus, farmers who perceived fertilizer application practices as more appropriate tended to report lower differences or fluctuations in crop yields. This finding suggests that proper fertilizer rates, timing, nutrient balance and application methods may contribute to more consistent crop performance.

The result is consistent with Maertens *et al.* (2023), who found that site-specific nutrient management improved fertilizer practices and maize productivity among smallholder farmers in Nigeria. Similarly, Ojeniyi *et al.* (2024) reported that improved fertilizer timing and application methods increased maize yield and nutrient-use efficiency in Nigeria's Middle Belt. Therefore, the null hypothesis that there is no significant relationship between fertilizer application practices and perceived crop yield variability is rejected. The finding highlights the importance of promoting appropriate fertilizer management as part of strategies for improving and stabilising crop yields in Jalingo and Wukari LGAs.

Table 7: Relationship between fertilizer application practices and perceived crop yield variability

Variables	Correlation Coefficient (r)	p-value	Decision
Fertilizer application practices vs. crop yield variability	-0.624	0.000	Significant

Source: Field Survey (2026).

5.0 Conclusion and Recommendations

5.1 Conclusion

The study concluded that farmers generally had positive perceptions of proper fertilizer application, but high fertilizer costs and limited availability may hinder adoption. Pest and disease infestation, rainfall variability, inadequate fertilizer use, weeds and soil fertility differences were major causes of crop yield variability. Socioeconomic, climatic and institutional factors significantly influenced farmers' perceptions. The significant negative relationship ($r = -0.624$, $p < 0.001$) showed that better fertilizer practices were associated with lower crop yield variability. Therefore, affordable fertilizer, improved extension services, climate information, credit access and integrated crop management are recommended to improve and stabilise crop yields.

5.2 Recommendations

Based on the findings of the study, the following three recommendations were made:

1. Government and agricultural stakeholders should improve farmers' access to affordable fertilizers and agricultural credit to enable them to apply fertilizer at recommended rates, particularly because high fertilizer cost was found to negatively influence farmers' perceptions and practices.

2. Agricultural extension services should be strengthened in Jalingo and Wukari LGAs to provide farmers with practical information on appropriate fertilizer rates, timing, nutrient management, pest and disease control, weed management and climate-smart farming practices.
3. Farmers should be encouraged to adopt integrated crop and soil fertility management practices, including site-specific fertilizer application, balanced nutrient management, soil fertility improvement, effective pest and weed control, and the use of reliable climate information to reduce crop yield variability.

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