



## FACTORS INFLUENCING THE UTILISATION OF AGRICULTURAL INFORMATION AMONG ARABLE CROP FARMERS IN BORNO STATE, NIGERIA

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### ABSTRACT

The study examined the factors influencing the utilization of agricultural information among arable crop farmers in Borno State, Nigeria. This study specifically examined farmers identified major sources of information, examined socio-economic factors influencing these dynamics among arable crop farmers and identified the barriers hindering effective use. Multistage sampling procedure was employed to select 387 respondents. Data were collected using a structured questionnaire and analysed using descriptive statistics and ordinal logistic regression. Findings indicated that, the most commonly used sources of information were informal, such as fellow farmers (54.9%) and radio (55.7%), while institutional sources remained underutilized. Ordinal logistic regression analysis revealed that utilization of agricultural information was significantly influenced by education level ( $\beta = 0.2536$ ), access to credit ( $\beta = 0.8215$ ), income ( $\beta = 0.0000192$ ) and farm size ( $\beta = 0.1487$ ), all statistically significant at the 5% level. Major constraints identified included high costs associated with accessing information (64.8%), irregular extension contact (62.4%), low literacy levels (59.7%) and language barriers (54.3%). The study concludes that education level, accessed to credit, income, farm size, social participation and extension contact were the factors influencing the utilization of agricultural information among arable crop farmers in the study area. It is recommended that government agencies and stakeholders strengthen agricultural extension systems, improve rural ICT infrastructure, provide targeted funding support, and implement farmer-centered training programs to enhance information access and utilization.

**Keywords:** Agricultural information, Arable, Crops, Utilisation.

### INTRODUCTION

Agriculture plays a vital role in global food security, economic development, and environmental sustainability, contributing about 4% to global Gross domestic Product (GDP) and employing over 27% of the workforce (Food and Agriculture Organisation-FAO, 2020). Africa, with 60% of the world's uncultivated arable land, has significant potential for agricultural transformation, as agriculture contributes 23% to sub-Saharan Africa's GDP and employs over 60% of its labour force (Ogunlela & Mukhtar, 2021). In Nigeria, agriculture is essential for economic growth, representing 23% of GDP and employing over 70% of the rural population (Adegbite *et al.*, 2023). However, smallholder farmers face challenges such as limited access to infrastructure, technology, and financing, which impede productivity. In Borno State, initiatives by the government and non-governmental organizations - NGOs have aimed to promote modern farming practices, but significant challenges persist (Abubakar & Chukwuma, 2022). Globally, arable farming occupies 1.56 billion hectares, producing staple crops that account for over 50% of global caloric intake (FAO, 2023). Despite Africa's vast arable land, food imports remain high due to infrastructural and climatic



constraints (Jayne *et al.*, 2021), with projections indicating a potential 20% decline in agricultural productivity by 2050 due to climate change (Lobell & Villoria, 2023).

Utilisation of agricultural information is the application of acquired knowledge, is essential for enhancing farming practices Uhegbu (2017). Farmers who effectively utilize agricultural information tend to adopt modern techniques, leading to increased productivity (FAO, 2021). However, barriers such as a lack of awareness, insufficient training, and cultural influences hinder effective utilization. Studies indicate that despite access to agricultural information, many Nigerian farmers struggle to utilize it due to inadequate training and trust issues (FOA, 2022). Additionally, information overload and cultural adherence to traditional practices can obstruct the adoption of new techniques (Nwafor *et al.*, 2023). When effectively utilized, agricultural information can significantly enhance yields and quality, improve market negotiations, and promote sustainable practices (Adebayo *et al.*, 2022). The study aims to identify and assess sources of agricultural information, evaluate farmers' utilization of this information, determine the influence of socio-economic factors on utilization, and identify constraints faced by farmers in utilizing agricultural information.

## **METHODOLOGY**

### **The Study Area**

The study was conducted in Borno State, Nigeria, situated between latitudes 10.5°N and 14.0°N and longitudes 11.0°E and 14.0°E, bordering Niger, Chad, and Cameroon. As of 2006, the state had a population of 4,171,104, projected to reach approximately 6,551,590 by 2024 (National Population Commission - NPC, 2006; National Bureau of Statistics - NBS, 2024). Borno's vegetation comprises predominantly savanna grasslands, divided into four agro-ecological zones southern and northern guinea savanna, Sudan savanna, and Sahel each characterized by varying rainfall and soil types, with fertile areas near water bodies supporting agricultural activities (Musa and Abubakar, 2024).

Agriculture is a central economic driver in Borno, predominantly subsistence-based but increasingly shifting towards commercial farming. Major cash crops include soybeans, cotton, sesame, and groundnuts, while food crops encompass rice, maize, cassava, and various vegetables. Livestock rearing is also significant, with common animals including cattle, goats, and poultry, primarily managed by nomadic Fulani herdsman (Amaza *et al.*, 2007)

### **Sampling Technique and Sample Size**

Multistage sampling technique was used in selecting the respondents. In the first stage, 50% of the Local Government Areas (LGAs) across three agricultural zones in Borno State were selected giving a total of thirteen LGAs. In the second stage, 50% of the agricultural extension blocks within each selected LGA were randomly chosen, resulting in 44 blocks. The final stage involved selecting 50% of the agricultural extension cells from these blocks, totaling 93 cells. Using the Taro Yamane formula, a sample size of 387 registered farmers was determined.

### **Data Collection and Analysis**

Primary data were collected through the administration structured questionnaires. Both descriptive and inferential statistics were used to analyze the data for the study. Descriptive statistics, including frequency counts, percentage, mean and were used while inferential statistics, specifically ordinal logistics regression analysis was applied to achieved objective iv. The regression model was expressed in an explicit form as follows:

$$\text{logit}(P(Y \leq j)) = \alpha_j + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13}$$

Where:

Y = Dependent Variable (Utilization)

j = Category (rarely, low moderate, high)



$\alpha_j$ = intercept for each category

$X_1 - X_{13}$ = Independent variables

$\beta_1 - \beta_{13}$ =Regression coefficient for independent variable

$X_1$ = Age (in years)

$X_2$ = Sex (Male =1 and Female = 0)

$X_3$ = Marital status (Married =4, Single =3, Divorced =2) and Widowed =1)

$X_4$ = Educational attainment (No formal education (0), Primary school certificate (6), Senior school certificate (12), Tertiary (15)

$X_5$ = Farming experience (in years)

$X_6$ = Household size (total Number)

$X_7$ = Access to land (yes= 1, no=0)

$X_8$ = Farm size (hectares)

$X_9$ = Annual income ((Nigerian Naira per year)

$X_{10}$ = Access to credit (yes= 1, no=0)

$X_{11}$ = Social participation (Membership: Yes = 1 and no = 0)

$X_{12}$ = Contact to extension agents (Number of contacts in the last 12 months).

$X_{13}$ = Cosmopolitaness based on frequency: (Number of visits in the last 12 months).

## RESULTS AND DISCUSSION

### Respondents' Sources of Agricultural Information

The study examined the sources from which farmers in Borno State obtain agricultural information, revealing significant variations across interpersonal, mass media, institutional, and digital channels. Table 1 presents this distribution, highlighting the importance of understanding these sources. Interpersonal sources emerged as the most relied upon, with 54.9% of respondents consistently turning to fellow farmers, indicating the effectiveness of peer-to-peer knowledge exchange. Extension agents were also a significant source, with 43.1% of respondents reporting regular contact, illustrating the value of personal relationships in disseminating information (Adebayo *et al.*, 2023). Local communities and family networks played a substantial role as well, with 42.2% and 40.7% of respondents respectively using these sources frequently.

Table 1 shows, input dealers were also noted, as 42.7% of respondents relied on them for information at the point of purchase, reinforcing their role as extension intermediaries (Ojo *et al.*, 2022). Mass media proved to be another vital category, with radio programmes being a key source of information for 55.7% of respondents, demonstrating its affordability and accessibility in rural areas. Mobile phones ranked highest overall, with 56.4% of respondents relying on them for various agricultural advisory services (Aker, 2021). Conversely, television was less frequently utilized, possibly due to limited electricity access and ownership costs. Print and digital platforms showed mixed adoption levels. Agricultural magazines and newspapers were used by only 20.6% of respondents, while agricultural websites attracted similar low engagement. Social media, although gaining popularity, still faced challenges in terms of digital literacy and internet access, with 36.2% of respondents engaging consistently.



**Table 1:** Distribution of the Respondents based on Sources of Agricultural Information

S/No	Source	Rarely (%)	Sometimes (%)	Always (%)	Mean
1	Extension agents	14.6	42.3	43.1	2.28
2	Fellow farmers	10.4	34.7	54.9	2.44
3	Farmer groups/associations	18.2	49.1	32.7	2.14
4	Agricultural magazines/newspapers	28.4	51.0	20.6	1.92
5	Radio programmes	9.0	35.3	55.7	2.47
6	Television programmes	20.6	47.1	32.3	2.12
7	Agricultural websites/portals	33.3	43.1	23.6	1.90
8	Social media platforms	22.4	41.4	36.2	2.14
9	Local farming communities/networks	17.5	40.3	42.2	2.25
10	Agricultural research institutes	32.0	50.2	17.8	1.86
11	Non-governmental organizations (NGOs)	25.1	44.8	30.1	2.05
12	Local government agricultural offices	20.9	39.7	39.4	2.19
13	Agricultural Development Programme (ADP)	17.7	44.5	37.8	2.20
14	State ministry of agriculture	21.2	41.3	37.5	2.16
15	Family members	19.7	39.6	40.7	2.21
16	Conferences	26.9	47.6	25.5	1.99
17	Trade fair	31.4	44.7	23.9	1.92
18	Input Dealers	14.8	42.5	42.7	2.28
19	Mobile phones	8.9	34.7	56.4	2.48
20	Academic publications	30.0	50.2	19.8	1.90

**Source:** Field Survey, 2025

Table 1 reveals, institutional sources revealed varied effectiveness. Farmer groups were utilized by 49.1% of respondents, while NGOs, local government offices, and agricultural development programmes were also mentioned but with less frequent reliance. Government institutions like the state ministry of agriculture showed moderate engagement, suggesting their outreach is not fully optimized (Mshelbwala, 2020). Research institutions, however, demonstrated a weak connection to farmers, with only 17.8% of respondents using them regularly.

#### **Factors Influencing the Utilization of Agricultural Information among Arable Farmers**

The regression analysis presented in Table2 identifies significant socio-economic factors influencing the utilisation of agricultural information among arable crop farmers in Borno State. The ordinal logistic regression model demonstrates a good fit, with a McFadden Pseudo  $R^2$  of 0.591 and a significant likelihood ratio statistic ( $p < 0.0000$ ), indicating that the predictors account for a substantial proportion of the variance in information utilisation. Key determinants identified include education ( $\beta = 0.1842$ ,  $p < 0.0000$ ), farm size ( $\beta = 0.1049$ ,  $p < 0.0063$ ), income ( $\beta = 0.0000127$ ,  $p < 0.0025$ ), access to credit ( $\beta = 0.5973$ ,  $p < 0.0019$ ), social participation ( $\beta = 0.1378$ ,  $p < 0.0028$ ), and extension contact ( $\beta = 0.2212$ ,  $p < 0.0005$ ). Each of these factors positively influences the likelihood of farmers progressing to higher categories of information use. The significant role of education aligns with Adebayo *et al.* (2023), who assert that literacy enhances understanding of technical information, facilitating the adoption of agricultural innovations. Similarly, the positive impact of farm size suggests that larger farmers are more inclined to experiment with new practices due to better resource availability, consistent with Asres (2022).



Income is another critical determinant, as wealthier farmers can implement new information by purchasing necessary inputs, supporting the findings of Osei *et al.* (2023). Access to credit empowers farmers to invest in technologies and services timely, reinforcing the importance of financial resources. The significance of social participation and extension contact underscores the value of social networks and institutional support, consistent with Sanusi *et al.* (2021). Interestingly, age exhibited a negative relationship with information utilisation ( $\beta = -0.0213$ ,  $p = 0.0122$ ), indicating that younger farmers are more likely to apply agricultural information compared to their older counterparts. This finding contrasts with earlier results, suggesting that while older farmers may have greater access due to experience, they may be less responsive to new information due to risk aversion or a preference for traditional methods. This aligns with literature indicating that age can serve as both an asset and a barrier in the information-use cycle (Chikodzi and Makoni, 2023). Other variables such as sex, marital status, household size, access to land, farming experience, and cosmopolitanism did not show significant influence on information utilization.

**Table 2:** Ordinal Logistic Regression Result of Factors Influencing Utilisation of Agricultural Information

Variable	Coefficient	Std. Error	T-Statistic	Prob.
Threshold (Low	Med)	-2.0923	0.6132	-3.411
Threshold (Med	High)	1.4425	0.4887	2.951
Age (X1)	-0.0213**	0.0085	-2.505	0.0122
Sex (X2)	0.1967	0.1426	1.379	0.1681
Marital status (X3)	0.0576	0.0417	1.382	0.1671
Education (X4)	0.1842**	0.0445	4.137	0.0000
Farm experience (X5)	0.0138	0.0092	1.500	0.1342
Household size (X6)	-0.0152	0.0243	-0.626	0.5312
Access land (X7)	0.2518	0.1927	1.307	0.1912
Farm size (X8)	0.1049**	0.0384	2.734	0.0063
Income (X9)	0.0000127**	0.0000042	3.024	0.0025
Access credit (X10)	0.5973**	0.1925	3.104	0.0019
Social participation (X11)	0.1378**	0.0462	2.984	0.0028
Extension contact (X12)	0.2212**	0.0635	3.484	0.0005
Cosmopolitaness (X13)	0.0649	0.0431	1.506	0.1319
Diagnostics	Value			
Pseudo R-squared (McFadden)	0.591			
Log-Likelihood	-121.832			
Likelihood Ratio (LR) statistic	254.236			
Prob (LR statistic)	0.0000			
Akaike Information Criterion (AIC)	0.684			
Schwarz Criterion (BIC)	0.801			
Hannan-Quinn Criterion (HQC)	0.728			
Test of Parallel Lines	$\chi^2 = 14.709$ , $df = 13$ , $p = 0.397$			

**Source:** Field Survey, 2025

**Note:** \*\*Significant at 5% level

### Constraints Respondents Experienced in Utilisation of Agricultural Information

Analysing the distribution of constraints faced by respondents in utilising agricultural information, as illustrated in Table 3, reveals a complex landscape of challenges with varying degrees of severity. The analysis categorizes the constraints based on the magnitude of their percentages, providing insights into the most pressing issues affecting farmers.



Table 3 shows that, insufficient funding for information Acquisition emerges as the most severe constraint, with 42.0% of respondents rating it as very severe and a mean score of 2.21. This indicates that financial limitations significantly hinder farmers' ability to utilise necessary agricultural information and resources. Similar findings were reported by Olatinwo *et al.* (2024), who noted that lack of financial support and access to credit impede farmers' ability to obtain and utilise agricultural innovations effectively. The implication of this finding is profound; addressing funding issues through grants or financial assistance programmes could empower farmers to seek and utilise agricultural information more effectively, thereby enhancing their productivity and overall agricultural outcomes (Madukwe *et al.*, 2024).

Table 3 indicate that, limited access to extension services closely follows, with 38.4% deeming it severe and 37.1% as very severe, culminating in a mean score of 2.13. This constraint underscores the critical role that extension services play in providing farmers with vital information. A similar observation was made by Nwanade *et al.* (2025), who reported that irregular funding and inadequate extension staffing hinder effective agricultural information dissemination. The implications suggest a need for increased investment in extension services and training of extension agents to ensure that farmers receive timely and relevant information.

Table 3 reveals that, lack of practical demonstrations is also notable, as 39.9% of respondents rated it as very severe, leading to a mean score of 2.17. This finding highlights the importance of hands-on learning in agricultural practices. Odu and Alabi (2024) found that demonstration farms and participatory learning significantly improved farmers' adoption of improved technologies in rural Nigeria. The implication is that incorporating practical demonstrations into extension programmes could enhance farmers' understanding and application of agricultural information, ultimately leading to improved practices and outcomes.

**Table 3:** Distribution of the Respondents' Constraints in Utilising Agricultural Information

S/No	Constraint	Not Severe (%)	Severe (%)	Very Severe (%)	Mean
1	Limited access to extension services	24.5	38.4	37.1	2.13
2	Language barriers	32.6	45.7	21.7	1.89
3	Lack of awareness about available information sources	28.1	43.5	28.4	2.00
4	Insufficient funding for information acquisition	20.8	37.2	42.0	2.21
5	Low literacy	29.4	41.3	29.3	2.00
6	Limited internet connectivity	26.3	39.5	34.2	2.08
7	Inappropriate timing of airing information	33.1	44.6	22.3	1.89
8	Extension agents with insufficient knowledge	28.5	43.2	28.3	2.00
9	Geographical distance	30.4	42.5	27.1	1.97
10	Lack of technical skills to interpret and apply info	26.8	38.0	35.2	2.08
11	Limited availability of required resources	22.7	40.6	36.7	2.14
12	Lack of practical demonstrations	23.1	37.0	39.9	2.17
13	Irrelevant information	34.2	43.7	22.1	1.88

**Source:** Field Survey, 2025

Table 3 shows that, limited availability of required resources is rated as severe by 40.6% of respondents, with a mean score of 2.14. This constraint indicates that the lack of physical resources necessary for implementing agricultural information is a significant barrier. As observed by Okoronkwo *et al.* (2025), insufficient access to production inputs such as seeds and fertilizers remains a major challenge limiting information utilization in rural areas. Limited internet connectivity ranks



next, with 39.5% of respondents rating it as severe and a mean score of 2.08. As digital platforms become increasingly important for accessing agricultural information, this constraint is particularly relevant. Olaitan *et al.* (2024) emphasized that poor network coverage and unreliable electricity are major constraints to ICT use among farmers in northern Nigeria. The implication is clear; improving internet access in rural areas would enable farmers to utilize online resources more effectively, enhancing their ability to stay informed about best practices and market trends.

Table 3 indicate that, low literacy is also a significant constraint, with 41.3% marking it as severe and a mean score of 2.00. This barrier complicates farmers' ability to understand and apply agricultural information. According to Yusuf and Ibrahim (2023), low literacy levels reduce farmers' ability to interpret extension messages and technological guidelines. The implication is that literacy programs tailored for farmers are essential to improve their capacity to engage with information effectively. Lack of awareness about available information sources has a mean score of 2.00, with 43.5% of respondents indicating it is severe. This suggests a critical gap in farmers' knowledge regarding where to access information. Similar findings were reported by Afolabi *et al.* (2023), who found that many farmers were unaware of digital or institutional sources of agricultural information. The implication here is that initiatives aimed at raising awareness about available resources, including workshops and community outreach, could empower farmers to seek out the information they need.

Table 3 indicate that, extension agents with insufficient knowledge is rated as severe by 43.2% of respondents, indicating that inadequate training for extension agents is a significant issue. This aligns with the findings of Udefi *et al.* (2025), who stressed that most extension personnel require continuous professional development to provide accurate and context-specific advice. Geographical distance is another notable constraint, with 42.5% of respondents rating it as severe. This highlights the challenges faced by farmers in remote areas, where accessing information and services can be difficult. Madukwe *et al.* (2024) suggested mobile extension platforms and community-based outreach as effective solutions to mitigate distance barriers.

Language Barriers affect 45.7% of respondents, with a mean score of 1.89. This constraint indicates that communication issues can hinder farmers' understanding of agricultural information. Yusuf and Ibrahim (2023) observed that local-language translation of extension content significantly improved comprehension among smallholder farmers.

Inappropriate timing of airing information received a rating of severe from 44.6% of respondents, indicating that the timing of information dissemination does not align with farmers' needs. This supports findings by Olatinwo *et al.* (2024), who noted that broadcast schedules often fail to match farmers' work periods.

Table 3 indicate that, lack of technical skills to interpret and apply information is rated as severe by 35.2% of respondents, with a mean score of 2.08. This indicates that even when information is available, farmers may struggle to utilize it effectively due to a lack of technical skills. According to Okoronkwo *et al.* (2025), continuous capacity building and digital-skills training can significantly improve farmers' ability to apply modern agricultural knowledge. Finally, Irrelevant Information, while noted as a concern by 43.7% of respondents, has the lowest mean score of 1.88. This suggests that while irrelevant information is an issue, it may not be as pressing as the other constraints. Afolabi *et al.* (2023) also emphasized the need to ensure that agricultural information is locally relevant and tailored to farmers' actual needs.

## **CONCLUSION AND RECOMMENDATIONS**

Based on empirical evidence of the study concludes that education level, accessed to credit, income, farm size, social participation and extension contact were the factors influencing the utilization of agricultural information among arable crop farmers in the study area. Also, interpersonal sources such as fellow farmers, family members, and radio programmes were the most widely utilised



and trusted, formal channels such as agricultural research institutes and online platforms remained underutilised. While multiple interrelated constraints particularly inadequate funding, weak extension support, low literacy, and limited digital access that collectively hinder the effective utilization of agricultural information

It is recommended that government agencies and stakeholders strengthen agricultural extension systems, improve rural ICT infrastructure, provide targeted funding support, and implement farmer-centered training programs to enhance information access and utilization.

## REFERENCES

- Abubakar, I. and Chukwuma, C. (2022). Challenges Facing Rice Production in Nigeria: Implications for Food Security. *Journal of Agricultural Economics*, **13**(1): 34-48.
- Adebayo, O., Adekunle, T. and Oladipo, S. (2022). Sustainable agricultural practices and their impact on productivity among smallholder farmers. *Journal of Agricultural Economics and Development*, **14**(3): 45-59.
- Adegbite, D. A., Akinlade, R. J. and Ogundeji, A. A. (2023). Enhancing agricultural productivity to reduce food insecurity in sub-Saharan Africa. *Food Security*, **15**(2): 345-360.
- Afolabi, A. O., Adegbite, A. M. and Hassan, R. O. (2023). Constraints to effective utilization of agricultural information among smallholder farmers in South-West Nigeria. *Journal of Agricultural Extension and Rural Development*, **15**(2): 55-67.
- Aker, J. C. (2021). The Role of Information in Agricultural Production: Evidence from Africa. *World Development*, **1**(38): 105-197.
- Aker, J. C. (2022). Information and communication technologies for agricultural extension in developing countries. *Annual Review of Resource Economics*, **14**(1): 1-25.  
<https://doi.org/10.1146/annurev-resource-111921-012419>
- Amaza, P. S., Olayemi, J. K., Adejibi, A. O., Bila, Y. and Iheanacho, I. (2007). Base Line Socio-economic Survey Report. Agriculture in Borno State, Nigeria. *International Institute of Tropical Agriculture*, Ibadan, Nigeria.
- Asres, A. and Demeke, B. (2022). Determinants of agricultural information utilization among smallholder farmers in Ethiopia. *Information Development*, **38**(3): 413-423.  
<https://doi.org/10.1177/026666669211020115>
- Chikodzi, D. and Makoni, M. (2023). Digital Agriculture and Information Accessibility in Rural Africa. *International Journal of Agricultural Extension*, **11**(2): 45-60.
- Food and agriculture organization, (2020) Food and agriculture organization of the United Nations statistical databases <http://faostat.fao.org>
- Food and agriculture organization, (2022). The state of food and agriculture: Transforming arable farming systems. Rome: Food and Agriculture Organization.
- Food and Agriculture Organization. (2023). Digital agriculture and older farmers: Opportunities and challenges. <https://www.fao.org/publications>
- Jayne, T. S., Muyanga, M. and Wineman, A. (2021). Land access, tenure security, and agricultural investment in Africa. *Food Policy*, **102**(10): 20 -40.  
<https://doi.org/10.1016/j.foodpol.2021.102040>
- Lobell, D. B. and Villoria, N. B. (2023). Reduced benefits of climate-smart agricultural policies from land-use spillovers. *Nat Sustain* **6**(9): 41-48. <https://doi.org/10.1038/s41893-023-01112-w>
- Madukwe, M. C., Nwobodo, C. S. and Okoro, U. J. (2024). Reforming agricultural extension and advisory services in Nigeria: A strategic review for sustainable agricultural development. *International Journal of Research and Innovation in Social Science*, **8**(6): 112-124.
- Mshelbwala, F. M. (2020). Constraints to agricultural information accessibility and utilisation among farmers in Northeastern Nigeria. *Journal of Agricultural Extension*, **24**(1): 15-29



- Musa, A. and Abubakar, S. (2024). "Understanding the Vegetation and Soil Types of Borno State." *Nigerian Journal of Environmental Studies*, **15**(1): 75-88.
- Ndiritu, S. W., Kassie, M. and Shiferaw, B. (2022). Are there systematic gender differences in the adoption of sustainable agricultural intensification practices? Evidence from Kenya. *Food Policy*, **11**(7): 102-115. <https://doi.org/10.1016/j.foodpol.2022.102276>
- Nwafor, C., Eze, O. and Okonkwo, J. (2023). Communication infrastructure and its impact on agricultural information dissemination in Nigeria. *Journal of Rural Communication Studies*, **15**(1): 23-40.
- Nwanade, C. F., Agoda, S., Udefi, I. O., Benson, O. B. and Ajayi, A. O. (2025). Assessment of the constraints to effective delivery of agricultural extension services in Lagos State, Nigeria. *Open Access Journal of Agricultural Research*, **2** (4): 1-7.
- Odu, J. O. and Alabi, R. A. (2024). Impact of on-farm demonstrations on adoption of improved crop technologies in rural Nigeria. *Nigerian Journal of Agricultural Extension*, **40** (1): 89-102.
- Ogunlela, Y. and Mukhtar, A. (2021). Gender and access to land in northern Nigeria. *Journal of Rural Studies*, **6** (1): 217-225.
- Ojo, T., Adeola, O. and Yusuf, A. (2022). Digital platforms and agricultural marketing in Nigeria: Opportunities and challenges. *Information Technology for Development*, **28** (3): 678-694.
- Okoronkwo, I., Ndinechi, K. and Uwandu, C. N. (2025). Utilisation of digital technologies among rural farmers in Imo State, Nigeria. *Journal of Agricultural Extension*, **29** (4): 56-67.
- Okwu, O. J., Olayemi, A. and Eze, C. (2022). The role of farmer cooperatives in agricultural information dissemination in Nigeria. *Nigerian Journal of Rural Sociology*, **22** (2): 56-69.
- Olaitan, M. A., Bamidele, J., Joel, O. J. and Akor, B. A. (2024). Utilization of information and communication technologies (ICTs) among women farmers in North-Eastern Nigeria. *Journal of Nutrition and Food Processing*, **7** (10): 87-95.
- Olatinwo, L. K., Yusuf, O. J. and Wahab, M. J. (2024). Farmers' use of phone applications in accessing information for maize production in Kwara State, Nigeria. *Journal of Kerbala for Agricultural Sciences*, **11** (4): 44-56.
- Osei, A., Mensah, J. and Otoo, J. (2023). Enhancing Agricultural Information Access for Smallholder Arable crop farmers in Africa. *African Journal of Agricultural Research*, **18** (4): 210-225.
- Sanusi, M. A., Petu-Ibikunle, A. M. and Mshelia, C. M. (2021). The influence of Information and Communication Technology (ICT) on the dissemination of agricultural information among urban farmers in the Northern Guinea Savannah Zone of Nigeria. *African Scientist*, **11** (2): 97 - 100.
- Udefi, I. O., Ajayi, A. O. and Nwanade, C. F. (2025). Constraints perceived by community-based organizations affecting roles of extension agents in Imo State, Nigeria. *International Center for Integrated Development Research Journal*, **9** (2): 22-35.
- Uhegbu, A. N. (2017). Utilisation of information resources in agricultural development. *Journal of Information Science and Technology*, **9**(4): 45-60.
- Yusuf, A. K. and Ibrahim, M. A. (2023). Literacy level and its influence on the utilization of agricultural information among farmers in Northern Nigeria. *African Journal of Agricultural Information and Communication*, **6**(2): 101-113.