

Access and Types of Agricultural Technologies through Radio among Maize Farmers in Kano State, Nigeria

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Abstract

This study investigates maize farmers' access to agricultural information through radio and the types of agricultural technologies learned and applied in Kano State, Nigeria. Guided by the Diffusion of Innovation (DOI) and Uses and Gratifications (U&G) theories, a descriptive survey design was employed to collect data from 300 maize farmers selected through a multistage sampling procedure across three major maize-producing Local Government Areas. Data were gathered using a structured questionnaire and analysed using descriptive statistics. Results show that radio is highly accessible, with 81.7% of farmers owning radios and (70%) listening daily. Most respondents (73.3%) understood agricultural messages particularly those delivered in Hausa and 57% rated their access to agricultural information as high or very high. Farmers learned a range of technologies from radio, including improved maize varieties, fertilizer application, soil fertility management, pest control, and irrigation practices. The findings confirm radio as a practical and trusted extension tool that fulfils farmers' information needs and facilitates innovation diffusion. The study recommends strengthening radio-based extension, increasing interactivity, and addressing barriers to technology adoption.

Keywords: Access, Agricultural, Farmers, Maize, Technologies

Introduction

Radio remains one of the most effective tools for information dissemination in rural Africa (Antwi-Boateng, Musa & Andani, 2023). Many rural communities face infrastructural challenges that restrict access to modern communication channels such as the internet, making radio a practical alternative because it is affordable, portable, and widely accessible. Consequently, many smallholder farmers rely on radio for agricultural information (Nyirenda & Kausar, 2019). In northern Nigeria, literacy levels vary widely across communities, and digital divides persist due to limited access to digital technologies. Radio therefore provides a culturally appropriate and easily accessible platform for delivering agricultural knowledge, innovations, and extension advice (UNESCO, 2024).

The relevance of radio in agricultural extension lies in its ability to bypass physical barriers, deliver timely information, and reach large farming populations simultaneously (Adedoyin, Tologbonse & Akinyemi, 2020). Through farmer-focused broadcasts, radio provides essential knowledge on crop production, pest and disease management, fertilizer

application, and market trends. Evidence shows that educational radio programming increases farmers' awareness of improved technologies and enhances productivity outcomes (Cardenas & Vasquez, 2018). Community-based and interactive formats further strengthen engagement by tailoring content to local contexts and encouraging farmers' participation (Manyozo, 2017). Agricultural technologies including improved seed varieties, fertilizer management practices, irrigation systems, pest management strategies, and post-harvest innovations remain central to productivity improvement. The Food and Agriculture Organization (FAO, 2021) emphasizes that effective use of such technologies depends on both access to information and the capacity to apply it. Barriers such as weak radio signals, language limitations, and low awareness can hinder farmers' benefits from agricultural broadcasts (Mtega & Msungu, 2021). Even where information is available, adoption may still be constrained by financial limitations, cultural norms, or perceived risks (Doss & Morris, 2018).

In Kano State one of Nigeria's major maize-producing regions radio continues to play a crucial role in agricultural extension. The state includes 13 local government areas in Kano North, where maize farming is a major livelihood activity. Limited access to formal extension services makes radio an important medium for disseminating innovations that enhance productivity and income. Prior research indicates that timely agricultural information strongly influences farmers' decision-making, production efficiency, and livelihood outcomes (Salau *et al.*, 2019; Stifel & Minten, 2021). Despite the prominence of radio, there is limited empirical evidence on the extent to which farmers in Kano State access agricultural information through radio or the types of technologies they learn and apply. This study therefore examines maize farmers' access to agricultural information from radio and identifies the technologies they acquire and utilize. The findings aim to strengthen the design and delivery of radio-based extension services and enhance adoption of improved agricultural technologies.

Agricultural technologies encompass a wide range of tools, practices, and innovations aimed at improving productivity, efficiency, and sustainability. These include improved seed varieties, fertilizers, pesticides, irrigation systems, mechanized equipment, and information and communication technologies (World Bank, 2020). They also include agronomic approaches such as conservation agriculture, climate-smart practices, precision agriculture, and integrated pest management. Research shows substantial productivity gains when such technologies are adopted. For instance, Akinwale, Salisu, & Adekunle (2023) report significant yield increases with improved maize varieties and proper fertilizer application across West Africa. Nonetheless, adoption in many developing countries remains low due to high input costs, limited credit access, cultural resistance, weak extension systems, and infrastructural constraints (Oladele *et al.*, 2022). These challenges highlight the need for effective strategies including mass media to improve farmers' access to agricultural technologies.

Radio communication has long served as a cornerstone of agricultural extension, especially in regions with limited infrastructure and low literacy. Unlike printed materials or

digital platforms that require literacy or internet connectivity, radio is inexpensive, accessible, and adaptable to local languages, enabling it to reach large and often marginalized populations (Nyirenda & Kausar, 2019). Its capacity for real-time information dissemination makes it valuable for time-sensitive issues such as weather alerts, pest outbreaks, and market price changes (Okello et al., 2021). Community radio further strengthens communication by tailoring content to local farming systems, while interactive formats such as call-in shows, interviews, and farmer testimonials promote engagement and improve knowledge retention (Ogutu et al., 2023).

Empirical studies across Africa consistently show that radio enhances farmers' access to agricultural information and promotes adoption of modern technologies. Ango et al. (2013) found that farm-radio programs in Kaduna State increased awareness of improved practices and influenced adoption. Similarly, Salisu, Danwanka, and Hassan (2024) reported that radio was the most accessible information channel among farmers in Bauchi State, especially for those with limited literacy. Mixed-methods research by Hudson et al. (2017) in Kenya and Uganda showed that interactive radio programs improved understanding and adoption of agricultural technologies. In East Africa, Wilson, Ssemakula, and Kalibwani (2025) found that farmers who consistently listened to agricultural radio programs adopted soil fertility, irrigation, and pest management practices more effectively. A study in Tanzania reported in *Sustainability* (2021) further demonstrated that radio content delivered in indigenous languages enhances comprehension and encourages practical application of technologies. Collectively, these findings highlight radio's effectiveness in disseminating agricultural information and promoting technology utilization insights directly relevant to the present study.

This study is guided by two complementary theoretical frameworks: the Diffusion of Innovation (DOI) Theory and the Uses and Gratifications (U&G) Theory. The DOI Theory (Rogers, 1962/2003) explains how innovations spread and are adopted within a social system. Its key components innovation, communication channels, time, and social system align with this study's focus on how radio exposes maize farmers to agricultural technologies and influences adoption. Rogers' categories of adopters (innovators, early adopters, early majority, late majority, and laggards) and the five perceived attributes of innovations (relative advantage, compatibility, complexity, trialability, and observability) help explain differences in farmers' uptake of technologies learned through radio. The Uses and Gratifications (U&G) Theory (Blumler & Katz, 1974) complements DOI by explaining why audiences choose specific media. It emphasizes that individuals actively select media to satisfy cognitive, affective, personal integrative, social integrative, and tension-release needs. Among maize farmers in Kano State, radio fulfills cognitive needs by providing practical agricultural knowledge, supports personal integrative needs by strengthening confidence and self-efficacy, and promotes social integrative needs by connecting farmers with broader agricultural communities. The U&G framework helps explain why farmers engage with agricultural radio programs and how this engagement influences the utilization of technologies. Together, these theories provide a comprehensive lens for examining farmers'

access to agricultural information through radio and their subsequent use of the technologies disseminated. They underpin the study's objectives and support an in-depth assessment of radio's role in agricultural technology adoption among maize farmers in Kano State.

Statement of the Problem

Maize is a major staple food crop in Nigeria and plays a vital role in food security and rural livelihoods. Although several agricultural technologies have been developed to improve maize production, many farmers still face difficulties in accessing and using these technologies effectively. Radio remains one of the most accessible means of communication for rural communities and has been widely recognized as a potential tool for disseminating agricultural information. However, it is not clear how effectively maize farmers in Kano State access and utilize agricultural technologies that are disseminated through radio programs.

This lack of clarity limits the ability of policymakers, extension agents, and development organizations to design targeted communication strategies that can improve farmers' adoption of modern agricultural practices. The problem is further complicated by factors such as inconsistent radio reception across communities, differences in farmers' literacy levels, and unequal access to radio sets or electricity. These challenges may reduce farmers' ability to receive, understand, and apply radio-based agricultural information.

Therefore, there is a need to examine the extent to which radio serves as an effective channel for reaching maize farmers in Kano State, the barriers they encounter in accessing relevant information, and how these barriers influence their adoption and utilization of agricultural technologies. Understanding these issues is essential for enhancing agricultural productivity and ensuring improved food security in the region. This study, therefore, investigates the access and utilization of agricultural technologies through radio among maize farmers in Kano State, Nigeria.

Objectives of the Study

The main objectives of the study are to determine access and utilization of Agricultural Information and Technologies among maize farmers in Kano state while the specific objectives of the study are to:

1. Determine the extent of access to agricultural information through radio.
2. Determine the types of agricultural technologies that maize farmers learn about through radio broadcasts.

Research Questions

To achieve these objectives, there is need to address the following research questions.

- i. What is the extent of access to Agricultural information through radio among maize farmers in Kano state?
- ii. What are the types of Agricultural technologies maize farmers learnt through radio?

Methodology

This study employed a descriptive survey design, chosen for its effectiveness in systematically collecting quantitative data to describe population characteristics and behaviors, which directly aligned with the objective of measuring farmers' access to and utilization of agricultural radio programs. The study focused on maize farmers in Kano State,

Nigeria, with access to agricultural radio, as this group represents the primary intended audience for such programming. A multistage sampling technique was adopted to select 300 farmers, ensuring both targeted representation and randomization. First, three Local Government Areas (Bichi, Bagwai, and Tsanyawa) were purposively selected due to their high maize production and radio program coverage. Then, three communities were randomly selected from each LGA to improve representativeness, and finally, 25 farmers were systematically sampled from each community to ensure an unbiased selection within communities. Data were collected using a structured questionnaire administered face-to-face by trained, Hausa-speaking assistants; this method was chosen to ensure high response rates and accommodate varying literacy levels. The questionnaire demonstrated good reliability (Cronbach's $\alpha = .81$), and its content validity was confirmed by expert review. The collected data were analyzed using descriptive statistics, including frequencies, percentages, and means, to effectively summarize the demographic profiles and key patterns of access and utilization.

Data presentation and interpretation

Research Question 1: What is the extent of access to Agricultural information through radio among maize farmers in Kano state?

Table 1: Responses of extent to agricultural information

S/N	Statement	A	S	R	N	M	SD	Remark
1	Frequency of listening to radio programs	210	60	20	10	3.57	0.78	High
2	Frequency of listening to agricultural-specific radio programs. (Extension programs, farming advice, weather updates, market prices, etc.)	200	70	10	20	3.50	0.79	High
3	Frequency of understanding agricultural messages broadcast on radio. (Clarity of language, ease of interpretation, relevance)	220	26	54	-	3.55	0.72	High
4	Frequency of accessing useful agricultural information through radio. (Availability, timeliness, relevance of the content received)	71	100	83	46	2.65	1.05	Moderate

Keywords: always (4), sometimes (3), rarely (2) and never (1), mean (m) and standard deviation (SD)

The results in Table 1 provide important insights into the extent to which maize farmers in Kano State access agricultural information through radio. Overall, the mean scores indicate high levels of radio engagement and message comprehension, although access to *useful* agricultural information shows moderate variability. First, the frequency of listening to radio programs recorded a high mean score of 3.57 (SD = 0.78), showing that most farmers listen to radio regularly, with 210 respondents indicating “always.” This demonstrates that radio is a major and consistent source of information in the study area. Similarly, the frequency of listening to agricultural-specific programs also scored high, with a mean of 3.50 (SD = 0.79). This implies that farmers not only listen to general radio content but also actively consume extension-related broadcasts such as farming tips, weather forecasts, and market price updates. The understanding of agricultural messages broadcast on radio also shows a high mean score of 3.55 (SD = 0.72), indicating that the majority of farmers comprehend the information shared. This reflects the clarity, relevance, and language appropriateness of the broadcasts, especially since most agricultural programs in the region are aired in Hausa the widely spoken local language.

However, the table reveals a noticeable decline in the frequency of accessing useful agricultural information, which recorded a moderate mean score of 2.65 (SD = 1.05). This suggests that although farmers listen regularly and understand the content, they may not always receive timely, relevant, or comprehensive agricultural information. The relatively high standard deviation (1.05) indicates wide variability in farmers’ experiences, possibly due to inconsistent programming, differences in station listenership, signal quality, or variation in content relevance. Overall, the table demonstrates that maize farmers in Kano State have high access to radio and agricultural broadcasts, **strong comprehension of messages, but only moderate access to consistently useful agricultural information**, indicating room for improvement in the tailoring, frequency, and depth of radio-based agricultural programs.

Research Question 2: What are the types of Agricultural technologies maize farmers learnt through radio?

Table 2: Frequencies and percentages on types of agricultural technologies learned (multiple options)

Characteristics	Category	Frequency	Percentage
Technologies learned from radio	Improved maize seed varieties	220	(19.3%)
	Fertilizer application	210	(18.5%)
	Pest control	190	(16.7%)
	Post-harvest handling	123	(10.8%)
	Irrigation practices	155	(13.6%)
	Soil fertility management	200	(17.6%)
	Others	40	(3.5%)
	Total	1138	100

Table 2 presents the types of agricultural technologies that respondents learned through radio programs, based on multiple-response options. The results indicate that radio serves as an important source of diverse agricultural information. Improved maize seed varieties were the most frequently learned technology (19.3%), showing that seed improvement messages are widely disseminated and potentially central to radio extension programming. Fertilizer application (18.5%) and soil fertility management (17.6%) were also highly reported, suggesting that radio messages strongly emphasize crop nutrition and soil improvement practices. Pest control accounted for (16.7%) of responses, reflecting moderate awareness of pest management techniques among listeners. Irrigation practices contributed (13.6%) of total responses, which may indicate targeted messaging in areas where water management is important. Post-harvest handling had 10.8%, showing that although post-harvest losses are a concern for farmers, fewer radio programs may focus on these subjects. Other unspecified technologies made up only (3.5%) suggesting that most agricultural information shared aligns well with farmers' major production needs. Overall, the results demonstrate that radio is particularly influential in promoting improved seed varieties, fertilizer use, and soil fertility management.

Discussion of Findings

Extent of access to agricultural information through radio among maize farmers in Kano State

The finding offers a detailed and meaningful understanding of farmers' engagement with radio as an information source. The findings reveal a high level of radio access and usage, reflected in strong listenership frequencies and consistently high comprehension of agricultural messages. These patterns indicate that radio remains a primary and reliable medium for disseminating agricultural information in the study area. However, despite this strong engagement, access to consistently useful agricultural information is only moderate, with considerable variation across respondents. This discrepancy suggests a gap between farmers' exposure to radio content and the actual utility of the agricultural information provided. The variability may be linked to inconsistencies in program quality, limited depth of content, irregular scheduling, or differences in reception and preferred stations. Thus, while radio is widely used and easily understood, the effectiveness of the agricultural content delivered is not uniform, highlighting the need for improved programming coherence and relevance. These findings align with existing scholarship across Sub-Saharan Africa, where radio has been shown to play a central role in bridging agricultural information gaps in contexts with limited digital infrastructure and insufficient extension personnel (Nyirenda & Kausar, 2019; Salisu, Danwanka & Hassan, 2024). The high comprehension levels further support evidence that agricultural radio programs broadcast in culturally appropriate and linguistically accessible formats enhance message clarity and promote innovation uptake (Mtega & Msungu, 2021; Sustainability, 2021).

From a theoretical standpoint, the strong engagement observed fits within the Uses and Gratifications (U&G) framework, which posits that audiences actively select media based on the fulfillment of specific needs. In this case, maize farmers rely on radio because it satisfies their cognitive need for agricultural knowledge, supports practical decision-making related to farming operations, and fosters social integrative functions by connecting them to broader agricultural networks. This theoretical alignment reinforces radio's continued relevance as a strategic tool for agricultural extension in rural communities. Overall, the results indicate that while access and comprehension are high, the inconsistency in receiving useful agricultural information underscores the need for enhanced content design, more frequent agricultural programming, and stronger alignment with farmers' immediate production challenges.

Types of agricultural technologies maize farmers learn through radio

The finding provides a nuanced understanding of both the content focus and practical influence of radio-based agricultural information. The findings show that radio broadcasts predominantly emphasize improved maize seed varieties (19.3%), fertilizer application (18.5%), and soil fertility management (17.6%). These three areas represent core yield-enhancing technologies, indicating that radio programming is strategically aligned with productivity improvement, which mirrors the priorities reported in earlier studies by Akinwale, Salisu, and Adekunle (2023) and Ango et al. (2013). The prominence of these topics suggests intentional programming that targets the major constraints affecting maize production in the region. Moderate exposure to pest control (16.7%) and irrigation practices (13.6%) reflects the dissemination of complementary technologies necessary for crop protection and water management. However, the relatively lower emphasis on irrigation may signal structural barriers—such as cost, equipment availability, and infrastructural limitations—which have been documented by Obidike et al. (2022). This suggests that even when information is available, the feasibility of adoption may remain constrained. Post-harvest handling received the least attention (10.8%), despite being a critical stage where significant losses often occur. This underrepresentation indicates a potential gap in radio programming, which may limit farmers' access to knowledge that could minimize post-harvest losses. The small proportion assigned to “other technologies” (3.5%) further reinforces the targeted nature of radio content, showing that broadcasts remain tightly aligned with farmers' immediate production needs, consistent with observations by Wilson, Ssemakula, and Kalibwani (2025). Overall, the findings demonstrate that radio not only disseminates essential agricultural technologies but also influences learning in areas directly tied to productivity and crop management. These learning patterns are consistent with the KnowledgeStage of Rogers' Diffusion of Innovation (DOI) theory, where individuals first gain awareness of innovations through a communication channel. Thus, radio serves as a critical platform for initiating the diffusion process among maize farmers in Kano State, reinforcing its role as an accessible, practical, and trusted extension tool.

Conclusion

The study shows that radio is a highly accessible and effective medium for disseminating agricultural information among maize farmers in Kano State. Farmers frequently listen to programs and demonstrate strong comprehension, particularly when broadcasts are in local languages. Key technologies learned include improved maize seed varieties, fertilizer application, and soil fertility management, while irrigation and post-harvest practices receive less attention. Access to consistently useful information is moderate, indicating variability in program relevance and timeliness. Overall, radio serves as a trusted tool for agricultural extension, supporting awareness and adoption of productivity-enhancing practices, though program content and coverage could be improved for greater impact.

Recommendations

Based the findings the study recommends the following:

- i. strengthen radio-based extension services by increasing the use of local-language broadcasts and scheduling programs during peak listening times.
- ii. Emphasize high-impact agricultural technologies while also promoting less-adopted innovations such as irrigation practices.
- iii. Enhance program interactivity through call-in segments, participatory discussions, and community-level demonstrations to improve farmers' understanding and adoption of technologies.
- iv. Address financial, technical, and infrastructural constraints through complementary interventions that support farmers in applying the technologies learned.
- v. Implement continuous monitoring and evaluation to refine broadcast content and ensure alignment with farmers' evolving needs and production challenges.

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