Effect of Dissemination of Agricultural Information through Radio on Crop Output

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ABSTRACT

The study examined the effects of dissemination of agricultural information through radio on crop output in northern Adamawa Agricultural Zone I. Specifically, effects of disseminating agricultural information through radio on crop output, effects of disseminating information via different radio channels and constraints faced from obtaining information via radio were examined. Data for this study was obtained majorly from primary source which were collected with the aid of structured questionnaire administered to the respondents in the study area via the use of Kobo Collect installed on mobile devices. Purposive and simple random sampling techniques were used as analytical tools for this study. The target population for this study were all the food crop farmers in the five LGAs in the Zone. Two hundred and forty (240) food crop farmers were served as sample size for the study. The content validity method was used to ascertain the strength of the research instrument. On the other hand, the test- re-test method was used to check the reliability of the instrument. Descriptive statistics and inferential statistics were used as analytical tools. The study was anchored on the communication and diffusion of innovation theory by Rogers, 1962 and Rogers and Everest in 1971. The study revealed that agricultural knowledge gained through radio programs, particularly in the context of herbicides/pesticides application if the main effect of dissemination of agricultural information through radio on crop output. Radio stations, such as BBC Hausa, have a significant positive influence on crop output when tuned in by farmers. However, other radio stations, including FM Poly Mubi, NAS FM Mubi, Voice of America (VOA), and Radio France, had no statistically significant impacts on crop production. Critical role of timing, consistency, program diversity, and accessibility in ensuring the efficacy of radio-based knowledge dissemination were the major challenges faced by farmers regarding radio programs. The study recommended that policymakers and agricultural program developers should consider these results when designing information campaigns to support local farmers in improving crop production outputs.

Keywords: Dissemination, Agricultural, Information, Radio and Crop Output

INTRODUCTION

Mass media tools are vital in communication; they have been instrumental in informing the masses about developments taking place in the world, influenced changes, aided democratization at their home fronts and revolutionized humanity. Traditional mass media channels that include radio, television and newspapers continue to be relevant particularly in most of Africa where new technology has been slow in taking root. New developments in technology have not obliterated traditional forms of mass media (Grace, 2014).

Radio remains the most cost effective means of building awareness, and supporting the adoption of new farming practices by small scale farmers for sustainable development and sustainability in agriculture. Although radio is the most popular mass medium, agricultural programming is executed with little participation from the farmers and extension agents (Nabusoba, 2014). Availability of low cost receiving sets operated with electricity or battery have helped radio to penetrate messages deep into the rural community. Radio is appropriate for creating general awareness and bringing desirable changes in the attitude of listeners. Radio plays a significant role for illiterate farmers in gathering information on various kinds of agricultural activities so as to update their knowledge and skills. In developing countries, radio had made its place for backing up agricultural sector extension activities. The rationale for using radio in extension and advisory services came from an understanding that radio is an excellent, cost-effective means of sharing knowledge, building awareness, facilitating informed decision-making and supporting the adoption of new practices by small scale farmers (Chapota, *et al.,* 2014). The potency of modern electronic technology can be exploited for infotainment of farming communities (Guenthner and Swan, 2011).

Various channels are used to disseminate agricultural knowledge to farmers; the most traditional but still most used among farmers in developing countries, the face to face communication which is the most traditional channel in the history of mankind (Msoffe and Ngulube 2016). With this channel of communication communicators may employ different modes (facial expressions, gestures, intonation, words and body language) to convey a single message (Lewandowski *et al.,* 2011). It also enhances immediate feedback because the communicating parties are in the same physical location (Min, 2007). However, the channel is known for its shortcoming of distorting messages as they are passed from one person to another (Velentzas and Broni 2014).

Radio is one of the greatest inventions of science which revolutionized communications among all sectors of human lives including agriculture (Jannat, 2018). Radio is the most effective communication medium which becomes evident during disasters and at the inaccessible locations like sea, hilly areas and other remote areas. In Asian countries large number of poor farmers uses radio to get agricultural information (Baig and Aldosari, 2013). Radio and television, the most wonderful inventions of science are regarded as the best means of communications. These two powerful media transform communications in a different way for transferring effective agricultural information and technologies. They help the farmers disseminate modern technological information to a wider range of audience which help them to increase their agricultural production too. In the field of agricultural information dissemination, radio and television are useful intermediate for farmers to make their appropriate technologies easy access and learn how to effectively utilize them in their farming systems and practices. Here Das (2016) wants to call radio and television the most important media for diffusing the technical, systematic and scientific information to the farming society.

Dissemination of agricultural knowledge in developing countries needs the consideration of channel and associated factors which may influence the delivery of the message. For example, rural areas in most of the

developing countries have poor and impassable roads mainly during the rainy season (Berg *et al.,* 2018) when agricultural activities are at their climax. This limits the dissemination agricultural knowledge packaged in print media. Likewise, most rural areas in developing countries do not have access to ICT networks and computers (Yagos *et al.,* 2017).

Research Gap

Despite the great potential of radio and television stations to knowledge dissemination and the accessibility of information, studies conducted indicate that the level of usage of radio and television sets as sources of agricultural knowledge among farmers is still low (Mubofu and Elia, 2017). Moreover, studies (Msoffe and Ngulube 2016; Ronald *et al*., 2014) indicate that there is a problem of inadequate access to agricultural knowledge among farmers. Empirical studies measuring the effect of dissemination of agricultural information through radio on crop output is also lacking, furthermore, this problem is consolidated by the rapid decline in service and service delivery in most of our government owned institutions (ratio of public extension agents to farmers is 1:3000). However, there are various other channels and platforms of communication to farmers such as mass media (television, newspapers, magazines) and social media (face book, twitter, blogs, watts app etc) but most of these media channels have no wider coverage because majority of Nigerian rural areas lack electricity, communication facilities and networks coupled with the fact that most of the farmers are aged and may hardly read or write, in addition, some of the rural farmers may not have the resources to acquire android phones especially in Mubi Agricultural Zone. In order to fill this gap, this study was undertaken to assess the effect of dissemination of agricultural information through radio on crop output of the farmers. The objectives for the study includes: To determine the effects of disseminating agricultural information through radio on crop output, to examine the effects of disseminating information via different radio channels and to identify the constraints faced from obtaining information via radio in the study area. Furthermore, research questions asked were: 1. What are the effects of disseminating agricultural information through radio on crop output? 2. What are the effects of disseminating information via different radio channels and 3. What are the challenges/constraints faced in obtaining information via radio in the study area.

Theoretical Framework

Diffusion of innovation theory

This theory is also known as the communication theory; it seeks to explain how, why and at what rate new ideas and technologies spread through cultures. Rogers and Shoemaker (1971) thought of the communication process in terms of the S-M-C-R-E Model. According to them a source(S) sends a message (M) via certain Channels(C) to the receiving individuals(R), which causes come effects (E) i.e. changing the existing behaviour pattern of the receiver.

Innovation diffusion according to Rogers (1962) is the process by which a new idea is communicated through certain channels over time among the members of a social system. He explained that there are four major elements that influence the spread of a new idea: innovation, communication channels, time and the social system itself. Rogers (1962) emphasized that the innovation must be widely adopted for it to be self-sustained. Hornor (1998) opined that adoption and diffusion are similar but entirely different, adoption according to her is an individual process involving the stages a person undergoes from hearing about a technology and finally accepting it. The diffusion process however, signifies a group phenomenon suggesting how a technology spreads among several individuals or a group of persons over time (Rogers, 1976; 1997).

Robinson (2009) further explained that the qualities that make an innovation to spread include: relative advantage, compatibility with existing values/practices, simplicity and ease of use, triability and observable results. Based on this, we can conclude that

MATERIALS AND METHODS

The Study Area

This study was carried out in Northern Adamawa Agricultural (Zone I with headquarter in Mubi) of Adamawa State which comprises of five Local Government Areas (LGAs): Madagali, Michika, Mubi North, Mubi South and Maiha. It lies between latitude 9^{o} 00' N to 11^{o} 00' N and longitude 13°00 'E to 14°00'E of the green which meridian with a total land mass of 506.4Km^2 and a population size of 682,026 people (Census 2006). Mubi Zone is bounded with Borno state in the north, by Hong and Song LGA in the west and by the republic of Cameroon in the east. (Adebayo and Tukur 2020). The Mubi zone experiences a tropical climate influenced by the Inter Tropical Convergence Zone and relief. Rainfall starts in April and peaks in July/August, with high intensity (Ray, 2007). Soil, composed of weathered rock materials, organic matter, moisture content, and dissolved minerals, is crucial for plant growth and varies in texture, structure, color, mineral content, and moisture holding capacity (Adebayo and Tukur 2020).

Method of Data Collection/Sources of Data

Data for this study was obtained majorly from primary source; the primary data was collected with the aid of structured questionnaire which was administered to the respondents in the study area via the use of Kobo Collect installed on mobile devices. Information was obtained from farmers using the data collection tool (structured questionnaire) installed on mobile device, the information was used for analysis to arrive at the results obtained. This procedure is in line with that of Khan, *et al.*, (2017), Hamisu, *et al.*, (2024) and Madugu, *(*2023).

Sampling Procedure and Sample Size

Purposive and simple random sampling techniques were used for this study. The target population for this study were the food crop farmers in the five LGAs in the Zone. In the first stage, four LGAs were purposely selected due to their relative peace and these are Mubi-North, Mubi-South, Maiha and Michika. In the second stage, two remote districts were purposely selected from each of the LGAs giving a total of 8 districts. In the third stage, two wards were randomly selected from each of the district making a total of 16 wards. In the final stage, two hundred and forty (240) food crop farmers were selected proportionate to farmers sampling frame (population) in each of the selected wards.

Validity and Reliability of the study Instrument

The content validity method was used to ascertain the strength of the research instrument. Five (5%) of the questionnaire was distributed to examiner and various staff of the faculty to ensure that the instrument was sound, reasonable and rational for the research work. On the other hand, the test- re-test method was used to check the reliability of the instrument, here, five (5%) of the instrument was distributed to the same members of the faculty at two weeks interval to ensure that the instrument can measure what it intends to measure.

Method of Data Analysis

Both descriptive and inferential statistics such as percentages (%), frequencies, distribution tables, means,

rank order and multiple regression were used for this study.

DISCUSSIONS

Effect of Dissemination of Agricultural Information through Radio on Crop Output

Table 1 presents a linear regression analysis that aims to investigate the effect of disseminating agricultural information through radio on crop output among farmers in the Mubi Agricultural Zone. The coefficient associated with this variable is positive, indicating that there is a positive relationship between receiving new and innovative information and crop output. In other words, farmers who were exposed to novel agricultural ideas and practices through radio broadcasts tended to have higher crop outputs compared to those who did not receive such information. However, the coefficient is not statistically significant ($p > 0.05$), meaning that this positive relationship observed in the data may not be strong enough to conclude that receiving innovative information had a substantial effect on crop output.

The variable "Knowledge gained about herbicides/pesticides application" in the robust linear regression analysis examines the impact of acquiring knowledge related to herbicides and pesticides application through radio programs on crop output among farmers in the Mubi Agricultural Zone. This variable's coefficient is statistically significant at the 1% level ($p < 0.01$). The positive coefficient indicates a strong and positive relationship between gaining knowledge about herbicides and pesticides application through radio programs and crop output. In simpler terms, farmers who received information and guidance on the effective use of herbicides and pesticides via radio broadcasts significantly increased their crop yields compared to those who did not receive such knowledge. This finding is consistent with prior research, such as the study conducted by Adeyeye *et al.* (2021), which underscores the pivotal role of effective pest and disease management practices in enhancing crop yields. The results of this study affirm that when farmers are equipped with knowledge about the appropriate use of herbicides and pesticides, they are better prepared to protect their crops from pests and diseases, ultimately leading to higher crop output. From a policy perspective, this result underscores the importance of prioritizing agricultural programs on radio that provide guidance and information on herbicides and pesticides application. These programs should be designed to effectively communicate best practices, safety measures, and the proper use of these agricultural inputs. Policymakers and agricultural extension services should recognize the significant positive impact that such information can have on farmers' livelihoods and food security.

The variable "Knowledge gained about seed quality" in the robust linear regression analysis examines the influence of acquiring knowledge related to seed quality through radio programs on crop output among farmers. The coefficient for this variable is positive, with a value of 0.549, but it is not statistically significant ($p > 0.05$). The positive coefficient suggests that there is a positive association between gaining knowledge about seed quality through radio programs and crop output. In other words, farmers who received information and insights regarding seed quality tended to have slightly higher crop yields compared to those who did not receive such knowledge. However, the lack of statistical significance indicates that this relationship is not strong enough to be considered statistically reliable. This result implies that while knowledge about seed quality may have some potential to positively impact crop output, its effect is likely to be weak or influenced by other factors that were not included in the model. Crop output is a complex outcome influenced by various factors, including soil quality, weather conditions, pest management, and farming practices. The insignificance of this variable suggests that the effect of seed quality knowledge, as measured in this study, may not be a primary driver of crop output when considered independently.

The finding aligns with the notion that agricultural productivity is influenced by a multitude of interrelated factors. While knowledge about seed quality is undoubtedly important for crop production, its influence

may be overshadowed by other critical factors such as access to improved seeds, soil fertility, and climate conditions. Therefore, the positive coefficient should be interpreted with caution, recognizing that the significance of the variable was not established in this analysis.

The coefficient of "Knowledge gained about fertilizer application" being positive but not statistically significant suggests that while such knowledge may have a potential positive influence on crop output, its effect is likely to be weak or contingent on other unexamined factors. Further research may be needed to delve deeper into the effectiveness of radio programs in delivering fertilizer-related information and to identify potential interactions with other variables. This nuanced understanding can guide more targeted and effective agricultural extension programs.

The variable "Knowledge gained about Timely crop planting" in the robust linear regression analysis examines the impact of acquiring knowledge regarding the timely planting of crops through radio programs on crop output among farmers in the Mubi Agricultural Zone. The coefficient for this variable is positive, with a value of 0.416, but it is not statistically significant ($p > 0.05$). The positive coefficient suggests that there is a positive association between gaining knowledge about timely crop planting through radio programs and crop output. In other words, farmers who received information and guidance on the importance of planting crops at the right time tended to have slightly higher crop yields compared to those who did not receive such knowledge. However, the lack of statistical significance indicates that this relationship is not strong enough to be considered statistically reliable. This result implies that while knowledge about timely crop planting may have some potential to positively impact crop output, its effect is likely to be weak or influenced by other unaccounted factors.

The variable was positive but statistically insignificant coefficient for "Knowledge gained about all of the above" implies that cumulative knowledge about various aspects of crop production, as delivered through radio programs, may have a potential but weak influence on crop output. Further research that considers a wider range of factors and contextual nuances is necessary to develop more effective interventions for enhancing crop productivity among farmers in the Mubi Agricultural Zone.

The variable "General agricultural information gained" in the robust linear regression analysis assesses the impact of receiving general agricultural information through radio programs on crop output among farmers in the Mubi Agricultural Zone. The coefficient for this variable is positive, with a value of 0.046, but it is not statistically significant ($p > 0.05$). The positive coefficient indicates that, on average, receiving general agricultural information through radio programs was associated with a slight increase in crop output. Farmers who gained access to general agricultural knowledge may have benefited from a broader understanding of agricultural practices and trends. However, the lack of statistical significance suggests that this relationship is not strong enough to be considered statistically reliable. This result implies that while general agricultural information is valuable and contributes to farmers' knowledge base, it may not directly translate into a significant increase in crop yields. General agricultural information might serve as a foundation upon which farmers can build their understanding of farming practices, but it may need to be complemented by more specific and targeted information to have a substantial impact on crop output.

The coefficient of cost of production after gaining innovative knowledge is 0.062 which implies that, on average, an increase in production costs after acquiring innovative knowledge is associated with a slight increase in crop output. However, it's crucial to note that the magnitude of this effect is relatively small, given that the coefficient is close to zero. This result suggests that other factors, such as the quality of farming practices, access to resources, and external conditions, may have a more significant impact on crop output than changes in production costs resulting from innovative knowledge.

The coefficient of Revenue after gaining innovative knowledge 1.008*** indicates a statistically significant positive effect ($p < 0.001$) on crop output. In practical terms, this means that when farmers experience

increase in revenue after gaining innovative knowledge from radio programs, there is a substantial and statistically significant improvement in their crop output. This finding is consistent with the idea that farmers who can translate knowledge gained from radio programs into increased revenue are likely to invest more in their farming activities, such as purchasing better seeds, fertilizers, and equipment. This, in turn, leads to higher crop yields.

The variable "Gender" in the robust linear regression analysis assesses the influence of gender on crop output among farmers in the Mubi Agricultural Zone. The coefficient for this variable is -0.023, and its p-value is 0.885. The coefficient of -0.023 indicates that, on average, female farmers in the study tend to have slightly lower crop output compared to male farmers. However, it is important to note that this coefficient is very close to zero, suggesting that any difference in crop output between male and female farmers is minimal. In essence, this result suggests that, in the context of the Mubi Agricultural Zone, gender does not appear to be a significant factor influencing crop output. Both male and female farmers have similar average crop yields, and any variations in output are not statistically linked to gender.

The variable "Log (age)" in the robust linear regression analysis examines the relationship between the age of farmers and their crop output in the Mubi Agricultural Zone. The coefficient for this variable is -0.250, and the associated p-value is 0.517. The coefficient of -0.250 suggests that, on average, older farmers tend to have slightly lower crop output compared to younger farmers. However, it's important to note that the magnitude of this coefficient is relatively small, indicating that the impact of age on crop output is minimal. The p-value of 0.517 is notably higher than conventional significance levels (e.g., 0.05 or 0.1). This high p-value implies that the variable "Log(age)" is not statistically significant, meaning that the age of farmers does not have a substantial and statistically verifiable influence on their crop output in this context.

The variable "Log (farm size)" attempts to examine whether the size of a farmer's landholding, as represented by the logarithmically transformed farm size, has a significant impact on crop output. The coefficient of 0.093 suggests that, on average, there is a positive relationship between farm size and crop output. In other words, as farm size increases, there is a slight increase in crop output. However, it's important to note that the magnitude of this effect is relatively modest, given that the coefficient is close to zero. The p-value associated with this coefficient is 0.498, which is substantially higher than conventional levels of statistical significance (e.g., 0.05). This high p-value implies that the variable "Log(farm size)" is not statistically significant in explaining variations in crop output. Therefore, in this specific context, farm size does not appear to have a substantial and statistically verifiable influence on crop output.

The negative coefficient of -0.031 on the variable "Years of Education" suggests that, on average, higher levels of education are associated with a slight decrease in crop output. However, like other coefficients, the magnitude of this effect is relatively small. The p-value of 0.086 is higher than the conventional 0.05 significance level but falls within the 0.1 significance level. This suggests that there may be a weak statistical relationship between education and crop output, but it is not highly significant. The negative coefficient might indicate that farmers with more education may be engaged in non-agricultural activities or may have different priorities, which could affect their crop production.

The variable "Log (Household size)" explores the influence of household size on crop output. The coefficient of 0.035 indicates that, on average, a larger household size is associated with a slight increase in crop output. However, similar to other coefficients, the effect size is small. The p-value of 0.357 is higher than the conventional significance level of 0.05, indicating that the variable "Log (Household size)" is not statistically significant. This suggests that household size may not be a critical determinant of crop output in this context. The F-test ($F = 6.777$, $Prob > F = 0.000$) indicates that the overall model is statistically significant and the R-squared value of 0.410 indicates that the model explains approximately 41% of the variation in crop output which is statistically significant (F-statistic = 6.777). While this suggests that there may be other unaccounted-for factors influencing crop yields which requires further research to explore

additional factors, in a typical cross sectional data analysis, the 41 percent R-squared is a great sign of a good model. However, policy implications should be drawn from individual coefficient interpretations rather than relying solely on the overall model's significance.

Effect of Information Dissemination via Radio Channels Tuned by Farmers on Crop Output in Mubi Agricultural Zone

The results presented in Table 2 shed light on the relationship between farmers' tuning preferences for specific radio stations and their crop output in the context of the Mubi Agricultural Zone I. The robust linear regression analysis presented in Table 2 investigates the effect of information dissemination via various radio stations tuned in by farmers on crop output within the Mubi Agricultural Zone. This analysis explores how specific radio stations influence crop output and also considers control variables such as financial factors, demographics, and educational background.

The variable "FM Poly Mubi" in the regression analysis has a coefficient of -0.286 and a p-value of 0.302. This variable represents the effect of farmers tuning in to FM Poly Mubi, a specific radio station, on their crop output within the Mubi Agricultural Zone. The negative coefficient of -0.286 indicates that, on average, farmers who tuned in to FM Poly Mubi had slightly lower crop output than those who did not. However, it's crucial to note that this negative coefficient is not statistically significant ($p > 0.05$). This lack of statistical significance implies that the observed negative relationship between tuning in to FM Poly Mubi and crop output may not be robust and could be due to chance or influenced by other unaccounted-for factors. In practical terms, this means that there is no strong evidence to suggest that FM Poly Mubi had a significant impact, either positive or negative, on the crop production of the surveyed farmers in the Mubi Agricultural Zone. Therefore, while the negative coefficient may raise questions about the radio station's influence, the absence of statistical significance implies that this finding should be interpreted with caution. Other factors not considered in this analysis could be influencing crop output among farmers who tuned in to FM Poly Mubi. Further research or a more extensive dataset may be needed to better understand the relationship between this radio station and crop production in the area.

The variable "NAS FM Mubi" in the regression analysis has a coefficient of 0.082 and a p-value of 0.762. This variable represents the impact of farmers tuning in to NAS FM Mubi, a specific radio station, on their crop output within the Mubi Agricultural Zone. The positive coefficient of 0.082 indicates that, on average, farmers who tuned in to NAS FM Mubi had a slightly higher crop output compared to those who did not. However, it is essential to emphasize that this positive coefficient is not statistically significant ($p > 0.05$). This lack of statistical significance implies that there is no strong evidence to support the notion that NAS FM Mubi had a significant positive impact on the crop production of the surveyed farmers. In practical terms, this result suggests that tuning in to NAS FM Mubi did not have a statistically verifiable effect on farmers' crop output in the Mubi Agricultural Zone. While the positive direction of the coefficient might imply a potential positive influence, the absence of statistical significance indicates that this effect may not be robust and could be due to random chance or influenced by unaccounted-for factors. Overall, these findings suggest that NAS FM Mubi did not play a statistically significant role in influencing farmers' crop production in the area. Further research or a more comprehensive dataset may be necessary to explore any potential impacts that were not captured in this analysis.

The variable "VOA Hausa" in the regression analysis has a coefficient of 0.037 and a p-value of 0.929. This variable represents the impact of farmers tuning in to VOA Hausa, a well-known radio station, on their crop output within the Mubi Agricultural Zone. The positive coefficient of 0.037 suggests that, on average, farmers who tuned in to BBC Hausa had a slightly higher crop output compared to those who did not. However, it is crucial to note that this positive coefficient is not statistically significant ($p > 0.05$). This lack of statistical significance implies that there is no strong evidence to support the idea that BBC Hausa had a significant positive impact on the crop production of the surveyed farmers. VOA Hausa is recognized for its

credible and informative broadcasts, particularly in rural areas. Nevertheless, based on the results of this study, tuning in to VOA Hausa did not have a statistically verifiable effect on farmers' crop output in the Mubi Agricultural Zone. This outcome suggests that other factors or sources of information may have played more substantial roles in influencing crop production decisions among farmers in this region. Therefore, while VOA Hausa is a reputable source of information, the findings of this study indicate that its influence on crop production, at least within the scope of this research, may not be statistically significant. Further investigation and a broader perspective may be needed to uncover any potential impacts that were not captured in this analysis.

The variable "BBC Hausa" in the regression analysis exhibits a notably strong and statistically significant positive effect on crop output. BBC Hausa had a coefficient of 0.837, and the p-value associated with this coefficient is less than 0.001, signifying a highly significant impact. This result underscores the substantial influence of tuning in to Voice of America on farmers' crop production within the Mubi Agricultural Zone I. Farmers who actively listened to BBC Hausa experienced a substantial increase in their crop yields. This finding is consistent with the notion that radio programs that are both credible and informative can play a pivotal role in enhancing agricultural practices and, consequently, crop production. The significance of BBC Hausa in this context suggests that it serves as a valuable source of information and knowledge for farmers in the region. BBC Hausa broadcasts may provide farmers with insights, advice, and updates on best practices, crop management, and relevant agricultural innovations. This, in turn, can lead to improved decision-making, enhanced farming techniques, and ultimately higher crop yields. This finding aligns with previous research emphasizing the pivotal role of informative radio programs in enhancing agricultural knowledge and practices (Adeyeye *et al.*, 2021).

The variable "Radio France" in the regression analysis exhibits a positive coefficient, but it is not statistically significant ($p > 0.05$). This implies that tuning in to Radio France did not have a significant impact on crop output among the surveyed farmers within the Mubi Agricultural Zone. The lack of statistical significance suggests that Radio France's broadcasts did not play a substantiated role in influencing farmers' crop production. While the positive coefficient indicates a potential positive relationship, the absence of statistical significance implies that this relationship may be weak or influenced by other unaccounted factors. This result implies that Radio France's programs, as received by the surveyed farmers, may not have effectively contributed to enhancing crop yields. It is possible that the content, timing, or relevance of Radio France's agricultural information broadcasts did not resonate with the specific needs or circumstances of the local farming community. Further research or a closer examination of Radio France's programming may be necessary to determine why its impact on crop output was not statistically significant.

Regarding the control variables, log (Revenue after gaining innovative knowledge) (Coefficient: 0.986***, p-value: 0.000) shows a highly significant and positive effect on crop output, suggesting that increased revenue resulting from innovative knowledge significantly boosts crop yields. Also, log (Cost of production after gaining innovative knowledge) (Coefficient: 0.002, p-value: 0.988) is not statistically significant, implying that the cost of production, after gaining innovative knowledge, did not have a significant effect on crop output. Additionally, demographic variables such as gender, age, farm size, years of education, and household size, as well as the constant term, are considered in the analysis. Notably, household size (Log (Household size)) demonstrates a statistically significant and positive effect (Coefficient: 1.004**, p-value: 0.014), suggesting that larger household sizes are associated with increased crop output.

Challenges and Constraints faced with Radio Programs

Table 3 revealed that most prominent challenge highlighted by the respondents is the "Wrong time for airing the programme," with a substantial frequency of 238 instances and a corresponding percentage of 51.52%. This finding echoes the importance of timing in reaching target audiences effectively. Similar to the findings

of Ndaghu and Taru (2012), the timing of agricultural programs becomes crucial to ensure that the intended recipients are available and engaged during broadcast periods. "Frequent change of time/date for programmes" emerges as the second most reported challenge, accounting for 113 instances or 24.46%. This data aligns with the need for consistency and predictability in programming schedules. The fluctuation in airing times and dates might hinder farmers' ability to regularly tune in to radio programs, compromising the accessibility of crucial agricultural information. This finding resonates with prior studies emphasizing the significance of regularity and stability in broadcasting schedules (Khan *et al.,* 2017).

"Very few agricultural programs in radio" is identified as the third most significant challenge, garnering 96 instances or 20.77%. This finding reinforces the idea that a diversified and comprehensive range of agricultural programs is essential to cater to the diverse needs and interests of the farming community. The scarcity of agricultural content on the radio may limit farmers' exposure to the latest advancements and best practices. This echoes the observations of Chapman *et al.* (2003), stressing the importance of addressing information gaps to ensure a holistic agricultural knowledge transfer process.

Respondents also identified issues such as "Disturbance from people who want to listen," "Lack of ownership of radio," and "No agricultural programs on crop production in the radio station" as less frequently reported challenges, reinforcing the broader theme of accessibility and relevancy. These constraints highlight the need for creating an environment conducive to uninterrupted and meaningful engagement with radio programs. The identification of these challenges underscores the multifaceted nature of barriers in information delivery (Ndaghu and Taru, 2012). Moreover, it is notable that the constraints such as "Poor/lack of power supply," "Lack of money to own radio set," "High cost of radio set," and "Constant stealing of radio sets" emerged with minimal frequencies. While these factors are less frequently reported, they point to structural and economic challenges that might inhibit consistent access to radio programs. This highlights the significance of infrastructural support and affordability, as emphasized by Sabiiti *et al.* (2019) in the context of fostering effective agricultural communication.

RESULTS

Table 1: Robust linear regression result of the effect of dissemination of information via radio on crop output of farmers in Mubi agricultural zone

Log of output (kg of produce)	**Coefficient**	**St.Err.**	**t-value**	**p-value**
Received new & innovative information	0.113	0.213	0.530	0.598
Knowledge gained about herbicides/pesticides application	1.046***	0.397	2.630	0.009
Knowledge gained about seed quality	0.549	0.610	0.900	0.370
Knowledge gained about fertilizer application	0.387	0.382	1.010	0.312
Knowledge gained about timely crop planting	0.416	0.336	1.240	0.217
Knowledge gained about other agronomic practices	0.357	0.278	1.290	0.200
Knowledge gained about all of the above	0.265	0.441	0.600	0.549
General agricultural information gained	0.046	0.054	0.850	0.397
Control Variables				
Log(Cost of production after gaining innovative knowledge)	0.062	0.114	0.540	0.588
Log(Revenue after gaining innovative knowledge)	1.008***	0.221	4.550	0.000
Gender	-0.023	0.162	-0.140	0.885
Log(age)	-0.250	0.385	-0.650	0.517
Log(farm size)	0.093	0.137	0.680	0.498
Years of Education	-0.031*	0.018	-1.720	0.086

Log(Household size)	0.035	0.038	0.920	0.357
Constant	-6.313**	2.695	-2.340	0.020

Mean dependent var	8.371	SD dependent var	1.876
R-squared	0.410	Number of obs	240
F-test	6.777	Prob > F	0.001
Akaike crit. (AIC)	887.367	Bayesian crit. (BIC)	943.057

Source: Field Survey, 2023. Note: Stata 15 was used for the estimation and *** *p<.01*, ** *p<.05*, * *p<.1* indicate significance at 1%, 5% and 10% levels respectively. The dependent variable is the log of output in kg of crop produced after gaining innovative information from radio programs.

Table 2: Robust linear regression result of the effect of information dissemination via radio tuned by farmers on crop output in Mubi agricultural zone

Log of output (in kg of produce)	**Coefficient**	**St.Err.**	**t-value**	**p-value**
FM Poly Mubi	-0.286	0.276	-1.030	0.302
NAS FM Mubi	0.082	0.270	0.300	0.762
BBC Hausa	0.837***	0.181	4.630	0.000
Voice of America	0.037	0.419	0.090	0.929
Radio France	0.121	0.229	0.530	0.599
Control Variables				
Log(Revenue after gaining innovative knowledge)	0.986***	0.219	4.510	0.000
Log(Cost of production after gaining innovative knowledge)	0.002	0.108	0.020	0.988
Gender	-0.143	0.188	-0.760	0.448
Log(age)	-0.054	0.393	-0.140	0.891
Log(farm size)	0.165	0.133	1.240	0.216
Years of Education	-0.031*	0.017	-1.820	0.070
Log(Household size)	1.004**	0.406	2.470	0.014
Constant	-6.84**	3.174	-2.150	0.032

Mean dependent var	8.371	SD dependent var	1.876
R-squared	0.377	Number of obs	240
F-test	6.189	Prob > F	0.000
Akaike crit. (AIC)	894.281	Bayesian crit. (BIC)	939.529

Source: Field Survey, 2023. Note: Stata 15 was used for the estimation and *** *p<.01*, ** *p<.05*, * *p<.1* indicate significance at 1%, 5% and 10% levels respectively.

Table 3: Challenges and constraints faced by farmers regarding radio programs in Mubi agricultural Zone

Challenges and Constraints	**Frequency**	**Percentage**	**Ranking**
Wrong time for airing the program	238	51.52	1st
Frequent change of time/date for program	113	24.46	2nd
Very few agricultural programs in radio	96	20.77	3rd
Disturbance from people who want to listen	11	2.38	4th
Lack of ownership of radio	2	0.43	5th

No program on crop production in the radio station	1	0.22	6th
Inadequate power supply	1	0.22	6th
lack of money to own radio set	0	0.00	8th
High cost of radio set	0	0.00	8th
Constant stealing of radio sets	0	0.00	8th
Owning radio sets attracts kidnappers	0	0.00	8th
Total	462*	100	

Source: Field Survey, 2023. Note: 462* denotes multiple responses.

CONCLUSION

The study conclude that agricultural knowledge gained through radio programs, particularly in the context of herbicides/pesticides application is the main effect of dissemination of agricultural information through radio on crop output. Radio stations, such as BBC Hausa, have a significant positive influence on crop output when tuned in by farmers. However, other radio stations, including FM Poly Mubi, NAS FM Mubi, Voice of America (VOA), and Radio France, did not exhibit statistically significant impacts on crop production. Critical role of timing, consistency, program diversity, and accessibility in ensuring the efficacy of radio-based knowledge dissemination were the major challenges faced by farmers regarding radio programs.

RECOMMENDATIONS

Based on the finding of the study the following recommendations are made;

Policymakers and agricultural program developers should consider these results when designing information campaigns to support local farmers in improving crop production.

There is a need to diversify agricultural content on local radio stations. Currently, very few agricultural programs are available. To address this gap, broadcasters should collaborate with agricultural experts and extension services to develop a diverse range of programs covering various aspects of crop production, pest management, and modern farming techniques. This diversification will provide farmers with a broader spectrum of knowledge to enhance their practices.

Policymakers and radio broadcasters must consider strategic scheduling, program consistency, and expanding agricultural content. Initiatives to promote radio ownership and community awareness can also contribute to overcoming these hurdles.

Also, the study also uncovers various challenges and constraints that impede the effectiveness of these programs. Issues like incorrect program timing, inconsistent scheduling, and a shortage of agricultural content on radio stations hinder farmers' ability to access and utilize vital information. Moreover, disturbances from other listeners and barriers like radio ownership and affordability pose additional obstacles.

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