



Factors influencing access to agrometeorological information among sorghum farmers: Empirical evidence among sorghum farmers in Busia County, Kenya

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ABSTRACT

An increase in climatic shocks resulting from climate change is indeed affecting agricultural productivity among smallholder farmers. Agrometeorological information plays a significant role in helping smallholder farmers with the necessary information to overcome some of the shocks due to climate changes, thereby improving agricultural productivity and incomes. However, access to agrometeorological information among smallholder farmers has been a challenge despite the available agrometeorological information on various platforms and yet this is essential in managing climate change. This study aimed to understand the factors influencing access to agrometeorological information among sorghum farmers in Busia county, Kenya. Primary data collected from 423 smallholder sorghum farmers were used. Using a structured questionnaire and a well-trained team of research assistants, data were collected using a multistage sampling technique. Data were analysed using a binary logistic model in STATA 16 software. The findings revealed that 90% of the smallholder farmers had been exposed to climatic shocks such as droughts and erratic rainfall. The econometric model showed that farmers' location, age, farming experience, radio ownership, access to internet services and credit facilities influenced access to agrometeorological information. The study recommends that improving infrastructure such as roads, electricity, and telecommunication networks is necessary for improving access to agrometeorological information. Moreover, relaying reliable information by agrometeorological advisors is vital in strengthening farmers' trust, which is essential in accessing agrometeorological information.

Keywords: Agrometeorological information, Binary logistic model, Busia County, Climate change, Kenya, Sorghum farmers

RÉSUMÉ

Une augmentation des chocs climatiques résultant du changement climatique affecte en effet la productivité agricole des petits exploitants agricoles. L'information agrométéorologique joue un rôle significatif en aidant les petits agriculteurs avec les informations nécessaires pour surmonter certains de ces chocs dus aux changements climatiques, améliorant ainsi la productivité agricole et les revenus. Cependant, l'accès à l'information agrométéorologique parmi les petits exploitants reste un défi malgré la disponibilité de l'information agrométéorologique sur diverses plateformes, et pourtant cela est essentiel dans la gestion du changement climatique. Cette étude visait à comprendre les facteurs influençant l'accès à l'information agrométéorologique

chez les agriculteurs de sorgho dans le comté de Busia, au Kenya. Des données primaires collectées auprès de 423 petits agriculteurs de sorgho ont été utilisées. À l'aide d'un questionnaire structuré et d'une équipe bien formée d'assistants de recherche, les données ont été collectées en utilisant une technique d'échantillonnage à plusieurs degrés. Les données ont été analysées à l'aide d'un modèle logistique binaire dans le logiciel STATA 16. Les résultats ont révélé que 90 % des petits exploitants avaient été exposés à des chocs climatiques tels que des sécheresses et des précipitations erratiques. Le modèle économétrique a montré que la localisation des agriculteurs, l'âge, l'expérience agricole, la possession d'une radio, l'accès aux services Internet et aux facilités de crédit influençaient l'accès à l'information agrométéorologique. L'étude recommande d'améliorer les infrastructures telles que les routes, l'électricité et les réseaux de télécommunication pour améliorer l'accès à l'information agrométéorologique. En outre, la transmission d'informations fiables par les conseillers agro-météorologiques est vitale pour renforcer la confiance des agriculteurs, ce qui est essentiel pour accéder à l'information agrométéorologique.

Mots-clés: Information agrométéorologique, modèle logistique binaire, comté de Busia, changement climatique, Kenya, agriculteurs de sorgho.

INTRODUCTION

Agriculture plays a significant role in Kenya, especially among the smallholder farmers in rural areas. The sector is a source of livelihood for the many rural poor and contributes significantly to the country's gross domestic product (GDP) (Kogo *et al.*, 2021). Nevertheless, most smallholder farmers rely on the rainfed crop production systems characterized by low productivity, climate risks – prolonged droughts and erratic rainfall, and low input use. Moreover, an increased population, high food demand, high poverty levels, and inadequate policies impact farmers' adaptation and coping capacities. Agrometeorological information that forms part of weather and climate services is vital in supporting agriculture in sub-Saharan Africa (SSA), facing climate change and variability (Tarchiani *et al.*, 2021). Proper dissemination and access to agrometeorological information will improve the farmers' resilience and coping capabilities and eventually improve their livelihoods. Furthermore, agrometeorological information can help guide adaptation practices towards climate change effects, farm management, and decision-making to improve farm

productivity.

Agrometeorological services were introduced in Kenya in 1974 to assist researchers in selecting appropriate plant and animal breeds for the sustainable food production system in the country (Masesi, 2019). The agrometeorological information and services also targeted the decision and policymakers with prerequisite information for conserving and managing natural resources. Initially, commercial farmers and government institutions such as Kenya Agricultural and Livestock Research Organizations (KARLO) were the main users of this information services. Due to climate change and variability, overcoming communication and technological barriers, access to agrometeorological information is becoming increasingly critical among smallholder farmers (Tarchiani *et al.*, 2021). These information services are essential in overcoming extreme weather events such as droughts and floods, changes in seasons, and outbreaks of pests and diseases. Some of the agrometeorological and information services provided by the Kenya Meteorological Department (KMD) include start and end

of the rainy seasons, amount of rainfall expected, probable planting dates, forecast on weather and crop performance, advisory on the adverse effects of the weather on crops, advisory services on harvest and post-harvest operations (Barrett *et al.*, 2021).

The frequency and severity of extreme events such as droughts and floods have prompted increased demand for agrometeorological information among smallholder farmers (Sivakumar, 2021). Access to this information will help smallholder farmers cope more efficiently with climate variability, improve their resilience, and minimize losses in agricultural production (Oyugi and Tembe, 2016). The Government of Kenya (GoK) and other stakeholders have made significant efforts to collect the agrometeorological information, analysing, archiving and making it accessible for the benefit of the farmers (Ozor and Nyambane, 2018). However, accessing and using the information among the smallholder farmers in Kenya remains a challenge. Some of the challenges include communication barriers, inadequate interaction with the user communities to assess the appropriate dissemination procedure, poverty levels among the users, and lack of knowledge regarding the significance of this information, etc.

Many studies have examined the significance of accessing agrometeorological information among smallholder farmers. For instance, Krell *et al.* (2021) study indicates that mobile phone use among smallholder farmers in central Kenya can help them access information that helps them manage and reduce vulnerabilities to climate change. The study further indicates that access to agrometeorological information is critical to agricultural productivity, mainly reducing uncertainty and risks associated with extreme weather events. Access to reliable and relevant agrometeorological information

among farmers in rural areas enables them to make strategic and tactical decisions in agricultural management. Some of the benefits highlighted include a 40% reduction in production costs and a 41% increase in income (Tarchiani *et al.*, 2021).

Although agrometeorological information is a powerful tool for weather-informed crop management, farmers still face several constraints in accessing and utilizing the information (Bacci *et al.*, 2020; Ahmed and Kiester, 2021; Antwi-Agyei *et al.*, 2021; Ofuoku and Obiazi, 2021). Some of the constraints include factors such as farmers' socioeconomic attributes such as level of formal education, household size, farm size, extension contact and membership in farmers association. Antwi-Agyei *et al.* (2021) intimate that access to climate information is influenced by both household and environmental factors. The findings indicate that climate information should be designed and tailored to meet the needs of smallholder farmers with different socioeconomic backgrounds. Therefore this study was conducted to understand the factors influencing access to agrometeorological information among sorghum farmers in Busia County, Kenya.

MATERIALS AND METHODS

Description of the study area. The study was conducted in Busia County. Busia County lies between latitude 0° and 0° 45 north and longitude 34° 25 East. It covers about 1695 square km (KNBS, 2013). It is located in the western region of Kenya. It borders Siaya to the south-west, Bungoma to the north, Kakamega to the east, Lake Victoria to the south-east and Uganda to the West. The mean temperature in the county is about 21-27 °C (Wanyama, 2018), whereas the annual rainfall is about 750-2000mm. The mean temperatures vary across the county, with areas near Lake Victoria receiving the least

rainfall of about 760-1015mm and Butula and Nambale receiving the highest rainfall of up to 2000mm. The rainfall is bimodal; the long rains usually come between March and May, and the short rains are between August and October. The altitudes vary from 1,140 to 1500 meters above sea level, suitable for crop farming. The major agricultural activities practised in Busia County include crop production (mainly cassava, sorghum, maize, groundnuts, sugar cane and some horticultural crops such as local vegetables and mangoes), livestock and fish farming (Ng'endo *et al.*, 2018). Despite being a high agricultural potential area, the county is documented to be highly affected by climate change.

Busia is one of the top producers of sorghum in Kenya, where it is produced in smallholder farms measuring 1-2 acres (0.4-0.8 ha) throughout the county. Sorghum is high yielding and drought tolerant, and can also grow in cold semi-arid regions, moist mid-altitude areas, has high brewing quality and is resistant to smut disease. The area under production in Busia County increased by 71%, to 13,109 ha, between 2012 and 2014 (Githinji *et al.*, 2020). This dramatic increase was driven by the demand generated by the East African Breweries Limited (EABL), located in Kisumu, in a program launched in 2012 to procure all of its sorghum requirements within the country. The county has sub counties namely: Teso North, Teso South, Butula, Nambale, Matayos, Samia and Budalangi. The main sorghum production areas include Teso South, Teso North, Matayos and Samia (Nyongesa *et al.*, 2017). Hence, the study was carried out in Teso South, Teso North, Matayos and Samia sub-counties.

Sampling procedure and method of data collection. The study used a multistage sampling technique. First, Busia County was selected purposively because of its

vulnerability to climate variability and being a sorghum-growing region. Secondly, four sub-counties, Teso South, Teso North, Matayos and Samia, were selected from the seven sub-counties because they are the main sorghum production areas in the County (Busia County Integrated Plan, 2018-2022). Finally, sorghum farming households were selected using a systematic sampling procedure in each sub-county. Households were then selected from a list of farmers generated during a pre-visit where all sorghum farmers were prequalified against the criteria of land size and period of sorghum farming.

The exact population of smallholder sorghum farmers was unknown; therefore, to determine the desired sample size, the formula specified by Cochran (2007) was used as shown in equation 1:

$$n = \frac{pqz^2}{\epsilon^2} \dots \dots \dots 1$$

where; n = sample size; z = confidence level (=0.05); p = proportion of the population containing the major interest; while q=1-p; and = allowable error. Since the proportion of the population is not known, p = 0.5, q = 1- 0.5 = 0.5, Z = 1.96 and (allowable error) = 0.05 because the study allows a 95% confidence level.

$$n = \frac{0.5 \times 0.5 \times 1.96^2}{0.05^2} = 384 \dots \dots \dots 2$$

The sample size in equation 2 was adjusted upwards by 10%; therefore, the total sample size was 423 sorghum farming households. A higher sample size ensured that the minimum required sample size was retained even after dropping uncooperative respondents or any “inconsistent” responses in the collected data at the data cleaning stage. The sample size distribution per sub-county was done proportionately to the population size using the list of farmers from the sub-county agricultural offices (Table 1).

Table 1. Sampling size distribution per Sub-County

Sub-county	Number of farming households	Proportionate distribution formula	Sample size
Teso North	17,182	$17,182 * 423/81,350$	90
Teso South	26,895	$26,895 * 423/81,350$	140
Matayos	16,539	$16,539 * 423/81,350$	85
Samia	20,734	$20,734 * 423/81,350$	108
Total	81,350	Total	423

Source: Busia County agricultural offices

Table 2. Definition of working variables

Variables	Measurement	Expected sign
Dependent variables		
Access to agrometeorological information	1 for access agrometeorological information, 0 otherwise	
Independent variables		
Sub-County (Teso South)	1 for Teso South, 0 otherwise	±
Household size	Number	±
Years of farming experience	Years	±
Group membership	1 for yes, 0 otherwise	±
Frequency of extension visits	Number	±
Access to credit facilities	1 for yes, 0 otherwise	±
Distance to the market for crop produce	Kilmetres	±
Gender of the key decision-maker	1 for male, 0 otherwise	±
Age of the key decision-maker	Years	±
Education level	Years	±
Major income of the key decision-maker	Kenya Shillings	±
Proportion of land under farming	Acres	±
Proportion of income allocated to farming	Kenya Shillings	±
Topography/terrain of the farm	1 for Flat, 0 otherwise	±
Radio ownership	1 for yes, 0 otherwise	±
TV ownership	1 for yes, 0 otherwise	±
Access to internet services	1 for yes, 0 otherwise	±
Mobile phone ownership	1 for yes, 0 otherwise	±

This study used a semi-structured questionnaire to collect primary data from smallholder sorghum farmers. A pilot study was conducted to test the validity of the questionnaire. According to Connelly (2008), existing literature proposes that a pilot study sample should be 10% of the sample estimated for the main study. Hence, 42 smallholder sorghum farmers were selected for the pilot study to estimate the validity of the instrument and the time taken to complete one questionnaire. Trained enumerators experienced in agricultural and household data collection administered the questionnaires, containing open and close-ended questions. The study used a digitized questionnaire using the open data kit (ODK) application and administered through face-to-face interviews with the decision-maker in the household. Data collected included farm and farmer characteristics, institutional, production, climate and market-related factors (Table 2). The primary data were then entered into STATA software (Version 16) for analysis.

Method of data analysis. Descriptive statistics such as percentages, frequency, mean and standard deviation were used. Access to agrometeorological information by smallholder sorghum farmers in Busia County is a discrete choice form. Specifically, one (1) denotes smallholder sorghum farmers who accessed agrometeorological information, and zero (0) denotes otherwise. The common models used for estimating such parameters include the linear probability model (LPM), Logit and Probit models (Maddala and Rao, 2005). The LPM, though the simplest, is deficient because the probability does not always lie between zero and one (Gujarati and Zain, 1988). This leaves the choice between logit and Probit, which are widely used in

practice. According to Johnston and DiNardo (1997), the difference between the logit and Probit models is rarely large to discriminate between them because both seem to produce a similar result. Eventually, estimates from both models produce similar results and using one or the other is a matter of habit or choice. Therefore, the binary Logit model will be used for this objective since the logit model is easier to interpret. The binary Logit model guarantees that the estimated probabilities lie in the 0–1 range and that it is nonlinearly related to the explanatory variables (Gujarati and Porter, 1995). The binary logit model has been widely adopted since the 1960s because it has analytical advantages in dealing with discrete binary outcomes (Long and Mustillo, 2021). The general form of a binary logit model is as follows (Greene and Hensher, 2010):

$$P_i(Y_i = 1) = \frac{e^{Z_i}}{1 + e^{Z_i}} \dots \dots \dots 3$$

Where P_i is the probability that the i th household accessed agrometeorological information, β is a vector of parameters, and Z_i is the linear function of the independent variables (socioeconomic, institutional and climate-related factors). The linear function can be expressed as follows

$$Z_i = \beta_0 + \beta_1 \sum_{i=1}^n X_i + U_i \dots \dots \dots 4$$

Where β_0 is the constant term, β_i is coefficients of the independent variables, X_i independent variables, and U_i is the error term. The β_i indicates how the log-odds for those who accessed agrometeorological information change as the independent variables change. The odd to be used can be defined as the ratio of the probability that a household accessing agrometeorological information P_i to the probability that he/she is not (1- P_i).

$$ME = \frac{\partial \Lambda(X'\beta)}{\partial X} = \Lambda(X'\beta)[1 - \Lambda(X'\beta)]\beta \dots \dots \dots 5$$

Where; X is the matrix of the independent variables in the logit model (socioeconomic, institutional and climate-related factors) and β is a matrix of parameters in the logit model.

In correspondence with previous studies on access to agrometeorological information conducted by Kirui *et al.* (2012), Oyekale (2012, 2015), and Wekesa (2017) the socioeconomic, institutional and climate-related factors influencing access to agrometeorological information are indicated below.

$$Access = \beta_0 + \beta_1 age + \beta_3 educ + \beta_4 gender + \beta_5 occup + \beta_6 hhsiz + \beta_7 exp + \beta_8 income + \beta_9 landsiz + \beta_{10} farmsiz + \beta_{11} mktdst + \beta_{12} credit + \beta_{13} extensio + \beta_{14} training + \beta_{15} group + \beta_{16} insuranc + \beta_{17} radio + \beta_{18} tv + \beta_{19} phone + \beta_{20} internet + \beta_{20} TesoN + \beta_{21} Samia + \beta_{22} Matayos.....6$$

RESULTS AND DISCUSSION
Socioeconomic and institutional characteristics of the respondents.

The distribution of respondents by their socioeconomic and institutional characteristics revealed that 63% of the respondents were female (Table 3). The result implies that women carried out most farming activities compared to males. The average number of years for the respondents was 48 years. This indicates that sorghum farmers in the study area were fairly old, although they are within the active years to carry out agricultural activities. This finding corroborates previous studies in Western Kenya by Wetende *et al.* (2018) and Musafiri *et al.* (2022), who found that the sampled households were still in the active age bracket. The study further revealed that the average years of schooling was nine

years, implying that most respondents had at least a primary school education level. These findings agreed with Evans *et al.* (2021), who reported an average of schooling of 9.98 years in a study conducted in Tigania West Meru, Kenya. This result implies that farmers are knowledgeable enough and understand the significance of accessing agrometeorological information. The respondents had at least two decades (21 years) of farming experience, corroborating the findings of Evans *et al.* (2021). This elucidates that majority of the sorghum farmers were aware of climate change and variability and its effects.

Further, the results imply that the sorghum farmers had adequate skills and knowledge to utilise agrometeorological information. Most of the respondents (90%) had been exposed to climate change shocks such as droughts, floods and erratic rainfall. This affirms the statement of Mogaka *et al.* (2021) that most farmers in SSA have been affected by climate change. It was also revealed that the majority (79%) of the respondent owned a mobile phone. The fact that most of the farmers in the study area owned mobile phones reflects that farmers understand how important these devices are in accessing agrometeorological information. The findings agree with those of Krell *et al.* (2021), who reported that 98% of the respondents in central Kenya owned mobile phones. The study further revealed that mobile phones have transformative potential to furnish farmers in the rural setting with important agrometeorological information. Access to internet facilities was relatively low as only 43% of the sorghum farmers used them. This result reveals that very few farmers use internet services to access agrometeorological information. This can be attributed to the cost of connectivity and poor internet infrastructure in rural areas. Further, most farmers do not know

how to use internet services to access agrometeorological information, given their age and education level. Radio ownership among the respondents was 59%. The findings corroborate with Keinembabazi (2022) who indicated that most farmers (56%) owned radios since most agrometeorological information was disseminated through radio stations. Respondents who owned television were about 40%. The result implies that very few farmers can access agrometeorological information through television. This result can be attributed to the cost of owning one and the lack of access to electricity that is important in operating a television.

The study identified important factors of access to agrometeorological information among farmers using a binary logistic model to provide policy information on which critical determinants to target. The binary logistic model odds ratio and their significance level are provided in Table 4. The econometric model results show Samia and Matayos sub-counties, farming experience, access to credit facilities, age of the decision-maker, owning a radio, access to internet services, and trust of agrometeorological information have significant relationships with access to agrometeorological information in Busia County.

Binary logistic regression model results. The marginal effects are given in Table

Table 3. Description of variables and descriptive statistics

Variable description and their measurements		Mean
Continuous variables		
Age	Age of the decision-maker a in years	48.07
Distance	Distance from home to the market (in km b)	2.53
Education	Years of education of the respondent	8.25
Farming Experience	Respondent's farming experience in years	21.36
Extension visits	Frequency of extension visits in a year	1.90
Household size	Number of household members	6.56
Farming land	Proportion of land under farming (Acres)	0.68
Categorical variables		
Internet services	% of respondents who access internet services	43.26
Trust of agrometeorological information	% of respondents trusting agrometeorological information services	37.83
Exposure to climate shocks	% of respondents exposed to climate shocks	90.31
Gender	% of male decision-makers	37.12
Income	% of respondents with farming as the main income activity	91.02
Group membership	% of respondents who are members of farmers group	71.39
Mobilephone	% of respondents who own mobile phone	78.96
Radio	% of respondents who own radio	58.63
Television	% of respondents who own television	40.43
Teso North	% of respondents in Teso South	21.28
Matayos	% of respondents in Matayos	20.09
Samia	% of respondents in Samia	25.53

^a Decision-maker is the household member responsible for making farming decisions.

^b km = distance in kilometers

4 and measure the average (percentage point) change in the probability of access to agrometeorological information among sorghum farmers when the explanatory variable of interest changes by one unit (for continuous variables) or switches from (0 to 1) for categorical variables. Furthermore, a robust standard error method is employed in the analysis for the four sub-counties. The logistic model of Busia County shows that being in Samia decreases the probability of farmers access to agrometeorological information by around 11%, while being in Matayos increases the probability by 8%. The study concludes that the marginal effects of some of the explanatory variables vary significantly.

Empirical results for factors influencing access to agrometeorological information.

In Samia sub-county, the logistic model revealed that farmers in Samia have negative and significant relationships with access to agrometeorological information in Busia county at a 1% probability level. As indicated in Table 4, the mean marginal effects switch from Teso North to Samia sub-counties the probability of sorghum farmer's access to agrometeorological information decreased by 11%. Thus, the farmer's location influences the access to agrometeorological information. The plausible explanation to this finding is attributed to the sub-county's proximity to basic infrastructure such roads – which makes it easily accessible by the extension service provides and basic information and communication infrastructure (ICT), particularly internet service and electricity (Gbangou *et al.*, 2020). Moreover, the sub-county has well connectivity to electricity and telecommunication networks, which make the farmers to have easy access to agrometeorological information compared to those in Teso North which is interior.

For Matayos sub-county, the logistic model revealed that the farmers have positive and significant relationships with access to agrometeorological information at a 10% probability level. As indicated in Table 4, the mean marginal effects switch from Teso North to Samia sub-counties where the probability of sorghum farmer's access to agrometeorological information decreased by 8%. Thus, the farmer's location influences the access to agrometeorological information.

Access to credit facilities. Access to credit facilities had the expected positive and significant effects on the probability of access to agrometeorological information due to mainly access to finances. The logistic results reveal that access to credit facilities positively influenced access to agrometeorological information and was statistically significant at 5% in Busia County. Access to credit facilities switch from non-access to where credit facility access would increase the probability of access to agrometeorological information by 9% in Busia county. Antwi-Agyei *et al.* (2021) study corroborate our findings that access to credit facilities increases a male farmer's probability of accessing climate information.

Age of the decision-maker. The age of the farmers plays a vital role in the access to agrometeorological information as previously reported by Antwi-Agyei *et al.* (2021). The study reveals that age influences sorghum farmers negatively and significant at a 10% probability level in Busia county. It implies that a one-year age increase, decreases the likelihood of accessing agrometeorological information by 0.3% in Busia County. Younger farmers are therefore more likely to access information than old. This finding is consistent with a study conducted in Ghana by Antwi-Agyei *et al.* (2021) and in Kenya by Muema *et al.* (2018), suggesting

that older farmers are less likely to seek agrometeorological information because of the vast climate knowledge they have gathered for many years.

Furthermore, older farmers have indigenous climate monitoring and risk spreading skills hence have less demand for accessing climate information services (Muema *et al.*, 2018). Older farmers allude to confidence in knowing the weather patterns and do not see the need to seek agrometeorological information. For instance, in the study by Nesheim *et al.* (2017), a farmer argued that with 40 years in farming, they are already well conversant with the agricultural calendar and do not require more information.

Radio Ownership. As per the expectation, owning a radio influenced the sorghum farmer's access to agrometeorological information positively and significant at 1% in Busia county. It implies that sorghum farmers who own radios have a higher likelihood (14.6%) of having access to agrometeorological information than those who do not own one. Most of the information is disseminated through radio stations (Keinembabazi, 2022). Therefore, most farmers who own radios are likely to receive more information than those who do not own one. The finding also conformed with Onyango *et al.* (2021) who indicated that radios are readily available and relatively easy to operate. Rural and community radios that use vernacular languages are preferred communication approaches that many smallholder farmers embrace. In addition, real-time meteorological information is highly perishable (Tuheirwe-Mukasa *et al.*, 2019), therefore, rapid dissemination through radio broadcast is a most efficient way of disseminating information.

Access to internet services. The world is opening up quickly, and internet services are becoming available in the village. Internet penetration has increased from 29.5% in 2014 to 39.5% in 2015 (Tuheirwe-Mukasa *et al.*, 2019). The study reveals that access to internet services positively and significantly influenced sorghum farmers' access to agrometeorological information by 1%. The logistic model results indicate that farmers who accessed internet service have a higher probability of accessing agrometeorological information at 14% compared to those who do not access it. Today, through the internet and social media, farmers can easily interact and access information about weather and climate and get informed on how to manage their farming enterprises (Rathore, 2020).

Trust in agrometeorological information. As per the expectation, the study reveals that trust in agrometeorological information influenced the sorghum farmer's access to it positively and significant at a 1% probability level. The result implies that sorghum farmers who trusted the agrometeorological information had a higher probability (36%) of accessing it than those who did not trust it. Trusting agro-climate information, especially on the certainty of weather forecasts provided by the agro-met service providers, is important when accessing information (Nesheim *et al.*, 2017). Farmers are generally looking for accurate information. Amegnaglo *et al.* (2017) found that the mean accuracy level of climate forecasts was about 77%, implying that eight of the ten forecasts were correct as per the service provider. Thus, farmers who are more confident with the agrometeorological information are motivated to access it than those who are not confident.

Table 4. Logistic regression model results

Variables	Odds Ratio	Std. Err.	z-Value	p> z	Marginal effects
Teso North	0.750	0.358	-0.60	0.547	-0.026
Samia	0.271***	0.129	-2.73	0.006	-0.111***
Matayos	2.455*	1.140	1.93	0.053	0.088*
Household size	1.009	0.071	0.13	0.899	0.001
Farming experience (years)	1.043**	0.020	2.15	0.032	0.004**
Group membership	0.867	0.370	-0.33	0.739	-0.013
Frequency of extension visits	1.155	0.102	1.64	0.102	0.013
Access to credit facilities	2.736**	1.091	2.52	0.012	0.090**
Distance to the market (crop produce)	1.043	0.113	0.39	0.698	0.004
Gender of the decision-maker	0.952	0.380	-0.12	0.901	-0.044
Age of the decision maker	0.968*	0.018	-1.78	0.075	-0.003*
Education level	1.032	0.049	0.66	0.510	0.003
Major income of the decision maker	0.763	0.932	-0.53	0.599	-0.024
Proportion of land under farming (Acres)	0.991	0.966	-0.01	0.992	-0.001
Radio ownership	5.166***	3.170	2.68	0.007	0.147***
TV ownership	0.718	0.340	-0.70	0.485	-0.030
Access to internet services	4.820***	2.090	3.63	0.000	0.140***
Mobile phone ownership	0.489	0.259	-1.35	0.177	-0.063**
Exposure to climate shocks	0.633	0.324	-0.89	0.371	-0.041
Trust in agrometeorological information	56.820***	23.321	9.84	0.000	0.361***
Log likelihood ratio					-124.26
Chi-square					0.0000
Wald chi2 (20)					146.51
Number of observations					423

*P < 0.1, **P < 0.05, ***P < .001

Source: Own survey, 2021

CONCLUSIONS

RECOMMENDATIONS

This study employed the logistic regression model to study the factors influencing access to agrometeorological information among smallholder farmers in Busia County, Kenya. The findings revealed that institutional and socioeconomic factors influence access to agrometeorological information. Location of the smallholder farmers, age of the information user, possession of communication tools such as radio and access to internet services influenced

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access to agrometeorological information among the sorghum farmers. Climate variability and change have also led to changes in weather patterns. Farmers are experiencing prolonged seasons of drought and rainfall and delayed onset of rains that have exacerbated climate shocks. Therefore, relaying reliable agrometeorological information by agro-met advisors enhances farmers' trust, leading to increased access to information.

The study concludes that these factors

should be considered to enhance access to agrometeorological information. The location of the smallholder farmers is important due to access to key infrastructure used to relay the information, such as electricity, roads, and telecommunications. Since age negatively correlates with access to agrometeorological information, concerted effort is required for older farmers who rely on indigenous knowledge or farming experience. Climate change has disorganized the stable weather patterns that farmers relied on; hence accessing agrometeorological information is vital to both the young and old farmers. Communicating trusted information regarding the weather is also crucial since it motivates smallholder farmers to search and access agrometeorological information.

The study recommends a raft of policies that seeks to improve access to agrometeorological information especially improving the infrastructure such as roads, access to electricity and telecommunication network to ensure that smallholder farmers are able to access the agrometeorological information wherever they are located. Agrometeorological information should be well-tailored to suit both the young and old farmers. Agro-met advisors such as Kenya Meteorologic Divison should give the correct information so that farmers trust it. Unreliable information can result in farmers incurring losses, which discourages farmers from accessing the information in the future.

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STATEMENT OF NO-CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this paper.

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