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Asian Journal of Agricultural Extension, Economics & Sociology

39(3): 99-113, 2021; Article no.AJAEES.66649
ISSN: 2320-7027

Status and Factors Influencing Access of Extension and Advisory Services on Forage Production in Kenya

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Authors' contributions

The six authors carried out the work. They designed the study, performed the statistical analysis and wrote the manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2021/v39i330550
Editor(s):
(1) Dr. Tulus T.H. Tambunan, Professor,m University of Trisakti, Indonesia.
(2) Dr. Zhao Chen, University of Maryland, USA.
(3) Ian McFarlane, University of Reading, UK.
Reviewers:
(1) Poonam Choudhary, College of Veterinary and Animal Science, India.
(2) Eduardo Figueiredo, UFSCAR, Brazil.
Complete Peer review History: http://www.sdiarticle4.com/review-history/66649

Original Research Article

Received 07 February 2021
Accepted 14 April 2021
Published 26 April 2021

ABSTRACT

This study assessed the status and factors influencing access of extension and advisory services (EAS) for forage production among smallholder dairy farmers in Kenya. Using a multistage stratified random sampling, data were collected from 316 and 313 farmers in Kangundo sub-County and Kirinyaga Counties of Kenya, respectively. The intensity of dairy farming formed the basis of selection of the study areas. The data were analysed using descriptive statistics and binary logistic regression model. Results indicated that, overall the proportion of farmers who accessed EAS on forage production in Kirinyaga (26.4%) was double that of Kangundo (13.6%). Government was the main provider of EAS on forage production and accounted for between 73 to 90% of services in Kangundo and 54 to 81% in Kirinyaga. The main channels for accessing EAS in both sites were trainings (29 - 31%) and field days (22 - 30%). Overall, majority of farmers (71 - 73%) were satisfied with the information and services they received on forage production. The empirical estimates of

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logistic regression revealed that the probability of access to EAS increased with access to credit, membership to farmer groups and importance of livestock on household's food security. We recommend that the governments use innovative extension approaches and strengthen formation of farmer groups/organizations in order to improve access of EAS by smallholder dairy farmers for enhanced forage production.

Keywords: Binary logistic regression; dairy farmers; extension channels; EAS satisfaction.

1. INTRODUCTION

"Extension" is defined as all the different activities that provide the information and advisory services that are needed and demanded by farmers and other actors in agrifood systems and rural development [1]. Extension and advisory services (EAS) play an important role in agricultural development through delivery of knowledge, technologies and innovations [2]. The EAS are critical in the transformation of subsistence farming to commercial agriculture and promotion of household food security. Past studies have reported that, limited coverage of extension services [3], cultural beliefs and lack of financial and technical capacity [4] across rural regions are some of the factors that contribute to poor adoption of agricultural practices.

Kenya's Strategy to Revitalize Agriculture (SRA) [5] has emphasized the importance of EAS in enhancing skills and knowledge for improved agricultural productivity. However, the declining effectiveness of the public extension service is one of the factors impeding agricultural growth in Kenya [6]. SRA has suggested reform of the extension system to create linkages between research, extension and farmers that are more effective. Extension is thus one among the six SRA first-tracked areas requiring urgent fix. In World Food Summit of 2002, the Food and Agriculture Organization (FAO) of the United Nations highlighted the importance of agricultural extension and recommended governments to develop a new and expanded policy in favour of agricultural extension and communication in order to catalyze development and advancement of food security in rural areas [7].

Extension services generally aim at transferring specific knowledge to farmers, such as the transfer of new technology, management practices or building up of capacities [8]. Farmers with a clear understanding of extension services are more likely to bring about the successful use of the extension system, which will effectively address their needs. An effective extension system should identify farmer needs and problems and determine the best solutions [9]. The provision of these services take a wide range of forms including training, demonstrations, field days, specific topics for groups of farmers and agricultural communication using information and communication technologies. However, if farmers will not face the correct incentives, adoption of new technology or management practice will occur thus resulting in production levels that are not socially optimal [10].

In Kenya, Extension services are mainly provided by the public sector (central and local governments, parastatals, research and training institutions) [11]. Other service providers include private and civil society (companies, NGOs, faith-based organizations, cooperatives and community-based organizations). However, a previous study covering 16 districts in Kenya found that, private extension provision was generally skewed towards well-endowed regions and high-value crops [6]. Agricultural EAS in Kenya date back to the early 1900s. They have been undergoing continuous changes in delivery approaches and methodologies in technology dissemination [2]. Among the notable achievements attributed to some of these approaches was success in the dissemination of hybrid maize technology in the late 1960s and early 1970s [12]. However, dissemination of forage technologies and practices has not been successful as that of food and cash crops. This has resulted to low adoption of forage technologies and practices despite the development of improved technologies by research institutions. Since not much literature has been documented on the factors that influence farmers' access to extension services, this paper seeks to assess the status of EAS on forage production and factors that influence their access among smallholder dairy farmers in Kenya. The findings of the study will guide the county governments to re-design methods of EAS that will improve adoption of forage

technologies thereby increasing livestock productivity in the study area.

2. MATERIALS AND METHODS

2.1 Study Area

Two sites, eastern midlands and central highlands of Kenya were selected for the study. In the eastern midlands, the study was conducted in Kangundo sub-County within the Upper Midlands (UM) 2, 3 & 4 and, Lower Midlands (LM) 3 and 4 agro-ecological zones (AEZ). In the central highlands, the study focused in Kirinyaga County in Lower Highlands (LH) 1, UM 1, 2, 3 & 4 and, LM 3 and 4 AEZ (Fig. 1). Jaetzold et al. [13] describe the agro-ecological zones in details.

Kangundo sub-County lies between latitude 1.07° and 1.43° South and longitude 37.09° and 37.43° East. Altitude ranges from 800 to 1800 m above sea level (asl). Rainfall is bimodal with long rains occurring from March to May and the short rains from October to December. The mean annual rainfall range from 700 to 1050 mm and mean temperature from 14 to 29°C. Major soil types are Luvisols, Acrisols and Ferralsols [14]. The main agricultural enterprises include maize, beans, dairy farming, coffee and vegetables. Due to its proximity to Nairobi, dairy farming has become popular in the area. Napier grass (*Pennisetum purpureum*) and Rhodes grass (*Chloris gayana*) are the most commonly grown forages.

Kirinyaga County lies between latitude 0.17° and 0.78° South, and between longitude 37.14° and 37.49° East. It rises from about 1000 m asl in the south to 5,199 m asl at the top of Mt. Kenya in the north. Rainfall pattern is similar to Kangundo but the mean annual rainfall is higher and range from 800 to 2200 mm while the mean temperature range from 14 to 27°C. The major soil type is Humic Nitosols [15] and main agricultural enterprises include maize, beans, dairy, tea, coffee, rice and horticultural crops. Dairy cattle production is one of the most important agricultural activities practiced by the smallholder farmers, who own between 0.40 and 1.21 ha of land [16]. Napier grass is the most commonly grown forage while a few farmers also grow Rhodes grass.

2.2 Sampling and Data Collection

The sample farmers were selected through multistage stratified sampling. In the first stage, two regions, eastern midlands and central highlands were selected. In these regions, farmers practice mixed-crop livestock farming with significant dairy cattle farming. In the second stage, two administrative areas, Kangundo sub-County and Kirinyaga County were selected based on their contrast in production system. In Kagundo, the study was conducted in Upper Midlands (UM) 2, 3, 4, and Lower Midlands (LM) 3 and 4 while in Kirinyaga County it was in Lower Highlands (LH) 1, UM 1, 2, 3, 4, LM 3 and 4. (Table 1). In the third stage, a systematic random sampling using probability proportional to sample size as applied by Beshir et al. [17] was used to select farmers with dairy cattle using a list compiled by agricultural extension officers for each AEZ. This resulted to a sample size of 316 and 313 farmers in Kangundo sub-County and Kirinyaga County, respectively (Table 1).

The household survey was carried out in January and February 2018. Individual farmers were interviewed using a structured questionnaire that had been pre-tested. At the beginning of each interview the respondent was explained on the objective of the survey as well as the confidentiality of handling the data.The data collected included socioeconomic and demographic characteristics, EAS providers, access to information on forage production and level of satisfaction.

2.3 Data Analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 20 [18]. Descriptive statistics (means, standard deviation and frequencies) and inferential statistics (Chi-square and t-tests) were generated for socio-demographic characteristics and EAS accessed on forage production and management practices of the sampled households. A binary logistic regression model was used to determine factors that influenced access to EAS on forage production by applying model of Makhoha et al [19]. The logistic model is specified as follows:

$$Ln\left(\frac{P_i}{1-P_i}\right) = X_t b + e_i$$

Where, X_t is the index reflecting the combined effect of independent *X* variables that prevent or promote access to EAS on forage production. The index level can be specified as:

$$X_t = \beta_o + \beta_1 + \cdots + \beta_n + e_i,$$

Where X_1, X_2,….. X_n are the independent variables and e the error term.

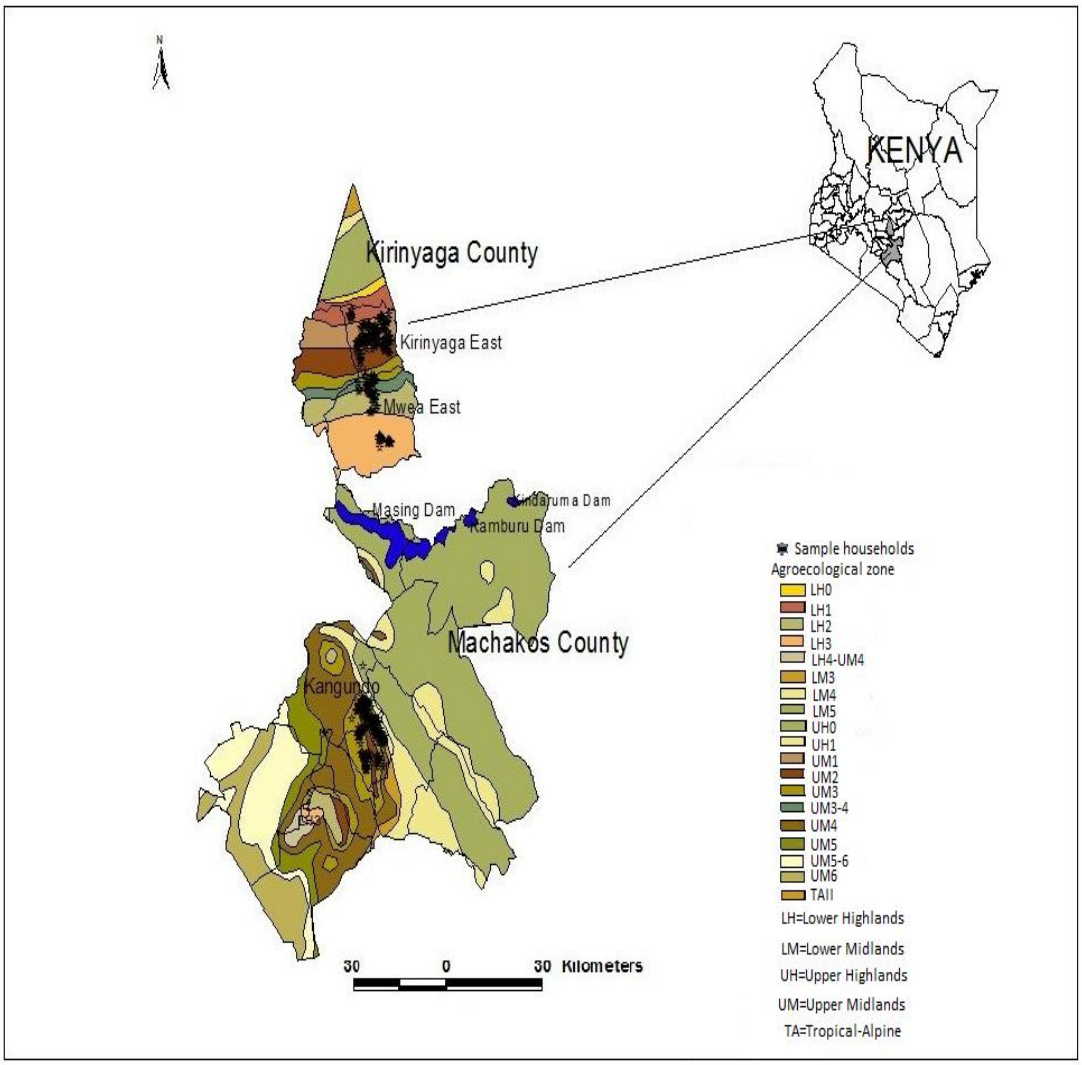

Fig. 1. Map of the study area

The dependent variable is the natural logarithm of the probability of accessing EAS on forage production (P) divided by the probability of not accessing (1-*P*). The model was estimated using the maximum likelihood method of the SPSS software, version 20 [18]. In this analysis access to EAS was the dependent variable while gender, age, off-farm income, education, distance to source of EAS, membership to agricultural groups, land size, importance of livestock to household food security and access to credit were the independent variables (Table 2). The importance of livestock to household food security was ranked on a scale of 1 to 10, where 1 was least important and 10 the most important The independent variables in the model were hypothesized to influence access to EAS on forage production either positively (+), negatively (-) or both positively and negatively (+/-).

3. RESULTS AND DISCUSSION

3.1 Demographic and Socioeconomic Characteristics of Sample Farmers

Table 3 shows demographic and socioeconomic characteristics of the sampled households. In both regions, majority of the households were male headed (76% in Kangundo and 82% in Kirinyaga) though there were no significant differences ($p > 0.05$) between the two sites. A high proportion of household heads (>97%) had formal education and therefore able to understand the benefits associated with EAS on forage production. A significantly higher ($\chi^2 = 11.69$, $p = 0.003$) proportion of households in Kirinyaga (81%) were engaged in farming than in Kangundo (70%). However, there were significant differences ($p < 0.05$) in major

Table 1. Distribution of sample farmers by agro-ecological zone

Site	Agro-ecological zone	Number of dairy farmers[a]	Number of households sampled		
			Number of males	Number of females	Total
Kangudo sub-county	Upper Midlands 2	214	8	4	12
	Upper Midlands 3	1775	83	23	106
	Upper Midlands 4	221	76	18	94
	Lower Midlands 3	1520	65	26	91
	Lower Midlands 4	1576	12	1	13
Kirinyaga county	Lower Highlands 1	255	11	5	16
	Upper Midlands 1	2794	142	29	171
	Upper Midlands 2	540	27	7	34
	Upper Midlands 3	224	9	4	13
	Upper Midlands 4	340	18	3	21
	Lower Midlands 3	400	19	6	25
	Lower Midlands 4	547	27	6	33
Total		10406	497	132	629

Sources: [a]Extension officer, Ministry of Agriculture, livestock and Fisheries

Table 2. Description of dependent and independent variables used in the logistic model

Variable	Description	Variable type	Expected sign
Dependent variable			
Access to EAS	Farmers access to EAS. (1=Yes, 0=No)		
Independent variables			
Gender	Gender of household head (Male/Female). Gender was hypothesized to influence or not to influence access of EAS.	Categorical	+/-
Age	Age of education head. Age can have a positive or negative effect on access to EAS on forage production.	Continuous	+/-
Off-farm income	Household head with monthly off-farm income. (1=Yes, 0=No). Household head with extra income expected to have positive influence in access to EAS compared with those without.	Categorical	+
Education	Education level of household head, (0= No formal education 1=Received formal education). Educated farmers have a higher probability to sources and access for information on farming practices	Categorical	+

Variable	Description	Variable type	Expected sign
Distance	Distance to source of extension and advisory services. Distance to source of EAS can encourage or discourage a farmer in accessing information on new practices.	Continuous	+/-
Group membership	Membership to farmers group (1=Yes, 0=No) Membership to group is expected to expose a farmer to EAS on farming practices.	Discrete	+
Land size	Size of the land owned. Land size was positively associated with access to EAS on forage production.	Continuous	+
Importance of livestock	Importance of livestock on food security (1=least important, 10=most important) Farmers who attach high value to livestock are more likely to source for EAS on how to improve productivity	Continuous	+
Access to credit	Access to credit (1=Yes, 0=No) Access to credit is expected to stimulate access to EAS on forage production	Categorical	+

Table 3. Demographic and socioeconomic characteristics of sampled farmers in study sites

		Kangundo (n=316)		Kirinyaga (n=313)			
Characteristic		**(%)**		**(%)**		**χ^2**	**p**
Sex of household head	Female	24.14		17.8		3.76	0.053
	Male	75.9		82.2			
Education level of household head	None	2.5		3.2		4.98	0.173
	Primary	27.2		34.8			
	Secondary	48.7		41.2			
	Tertiary	20.6		20.1			
Major occupation of household head	Farming	69.9		81.4		11.69	0.003
	Employed	15.7		8.7			
	Self- employed/business	14.4		9.9			
		Mean	**SD**	**Mean**	**SD**	**t**	**p**
Age of household head (Years)		58.06	13.07	53.45	13.35	4.38	0.000
Number of years spent in school by household head (No.)		10.70	3.81	10.32	3.75	1.25	0.212
Household head monthly farm income (Ksh.)		12932	12292	18759	16466	-4.96	0.000
Household head monthly off-farm income (Ksh.)		11078	11133	10513	13226	-1.17	0.243
Farm size (Ha)		1.36	1.78	1.10	1.12	2.16	0.031
†Importance of livestock farming for food security of household		6.84	1.81	7.01	1.77	-1.16	0.247
†Importance of crop farming for food security of household		6.79	1.78	7.27	1.64	-3.52	0.000
†Importance of off-farm income for food security of household		5.08	2.74	4.43	2.62	3.04	0.002

†Importance was rated on a score of 1 to 10 with 1 denoting least important and 10 most important

occupation of household head, age, monthly farm income, farm size, importance of crop farming and off-farm income between the sites. The mean age of household head was significantly ($p < 0.001$) higher in Kangundo (58 years) than in Kirinyaga (53 years). Household heads' monthly farm income in Kirinyaga (Ksh. 18,759) was one and half times more than in Kangundo (Ksh. 12,932). The higher monthly farm income in Kirinyaga was due to sale of a range of cash crops such as coffee, tea and rice whereas in Kangundo, only a small proportion of farmers have coffee. The average farm size (1.36 ha) was higher in Kangundo than in Kirinyaga (1.10 ha). A previous study in Kangundo by Njarui et al. [20] reported an average farm size of 2.12 ha. The decrease in farm sizes is due to land fragmentation attributed to increasing population [4]. The contribution of off-farm income to household's food security was rated significantly ($p = 0000$) higher (5.08) in Kangundo than in Kirinyaga (4.43). This can be explained by the fact that, agriculture in Kangundo is less productive than in Kirinyaga due to lower rainfall and frequent drought and as a result, the major source of meeting the household food security is through employment and business. This is reflected well in the results on major occupation of the household head where a relatively higher proportion of household heads in Kangundo were either employed or engaged in business (30%) compared to 19% in Kirinyaga.

3.2 Access to EAS on Forage Production

Table 4 shows the type of EAS accessed by farmers in Kangundo and Kirinyaga on different practices related to forages production namely land preparation, forage selection, forage management, feed conservation, feeding management, climate early warming, agricultural credit and agricultural insurance. The overall mean proportion of farmers who accessed EAS on forage production in Kirinyaga (26.4%) was almost double that of Kangundo (13.6%).

Due to favourable climate in Kirinyaga, dairy farming is more commercialized than in Kangundo, thus farmers have higher demand of EAS from government. The difference on access to EAS was statistically significant ($p < 0.05$) for all type of practices except for agricultural insurance ($p > 0.05$). Low level of access of EAS in both sites was attributed to few number of extension officers in the region and dwindling of government budgetary provision for extension services [21]. For example, in Kangundo sub-county, there is only one livestock officer for over 3000 smallholder dairy farmers.

Government was the main provider of EAS on forage production and accounted for between 73 to 90% of services in Kangundo and 54 to 81% in Kirinyaga (Table 5). This is consistent with the findings of a study in other areas of Kenya, where between 40 and 70% of farmers reported that, government extension was the main source of information [22]. This is primarily because government has trained EAS providers to educate farmers to improve farming skills practices including forage production.

Fig. 2 shows the frequency of accessing EAS on forage production from extension service providers in Kangundo and Kirinyaga. Generally, the frequency of access to EAS services was low with highest frequency being twice per year. However, farmers in Kangundo accessed EAS on feeding management and feed conservation

Table 4. Proportion of farmers with access to extension services on forage production and other agricultural advisory services in the study sites

	Kangundo (*n*=316)	Kirinyaga (*n*=313)		
EAS accessed	**%**	**%**	**t**	**P**
Land preparation	15.2	26.5	12.24	0.000
Forage selection	16.8	32.6	21.18	0.000
Forage management	14.6	36.1	38.65	0.000
Feed conservation	13.0	30.4	28.02	0.000
Feeding management	13.3	33.2	35.06	0.000
Climate early warning	13.0	21.1	7.33	0.007
Agricultural credit	12.0	18.6	5.22	0.022
Agricultural insurance	11.4	12.5	0.17	0.680
Mean	13.6	26.4		

more frequently than in Kirinyaga. The frequency of access of EAS on forage selection, management and agricultural credit was very low in both areas. Previous studies by Ochienno [23], Ernest et al. [24] and Melusi et al. [25] reported that, the frequency of extension visits significantly increased the likelihood of farmers adopting new technologies.

Farmers relied on multiple channels to access the EAS on forage production (Fig. 3). Training and field days were the most widely used channels and accounted for 29 - 31% and 22 - 30% of services, respectively. Previous studies Adolwa et al. [26], Kingiri and Nderitu [27] reported field days as one of the most common extension channels. The other channels such as media, mobile phones, farmers' field schools and farmer-to-farmers reached less than 10% of the farmers. Generally, trainings and field days are regularly conduced in both regions compared to workshops or field schools while there are very few mobile service providers on agriculture. Very few farmers participate in participatory research on technology validation.

3.3 Farmers' Satisfaction on Access to Extension and Advisory Services

Table 6 shows farmers' level of satisfaction in accessing EAS on forage production. Overall, a high proportion of farmers, 71% and 73% in Kangundo and Kirinyaga, respectively were satisfied with the EAS they accessed while 6% and 5% were dissatisfied and 5% and 4% were neutral. However, slightly over 20% of farmers in Kangundo reported dissatisfaction in accessing information on climate early warning, agricultural credit and insurance. The mean proportion of farmers who were satisfied with access to the EAS in the two sites (71-73.2%) was higher than in North West Ethiopia (55%) [28], implying that the extension programme in Kenya was perhaps more focused.

3.4 Factors Affecting Access of EAS on Forages Production

Out of the 629 respondent interviewed only 214 households had access to EAS on forage production, representing 34% (Table 7). There were significant differences (p=0.000) between households with access to EAS and those without access for agricultural credit and membership to agricultural groups. Households with access to EAS had higher monthly on-farm income and gave higher importance to livestock than those without access.

The logistic model accounted for 69% of the total variation in access to EAS on forage production in the study area. The chi-square statistic (χ^2=97.87) was highly significant (p<0.000), indicating that, the parameters included in the model were significantly different from zero for access to EAS on forage production. The Hosmer & Lemeshow test of the goodness of fit suggested the model was a good fit to the data as p=0.222 (>.05) while Nagelkerke's R^2 (0.202) showed that the model explained 20% of the variation in access to EAS on forage production.

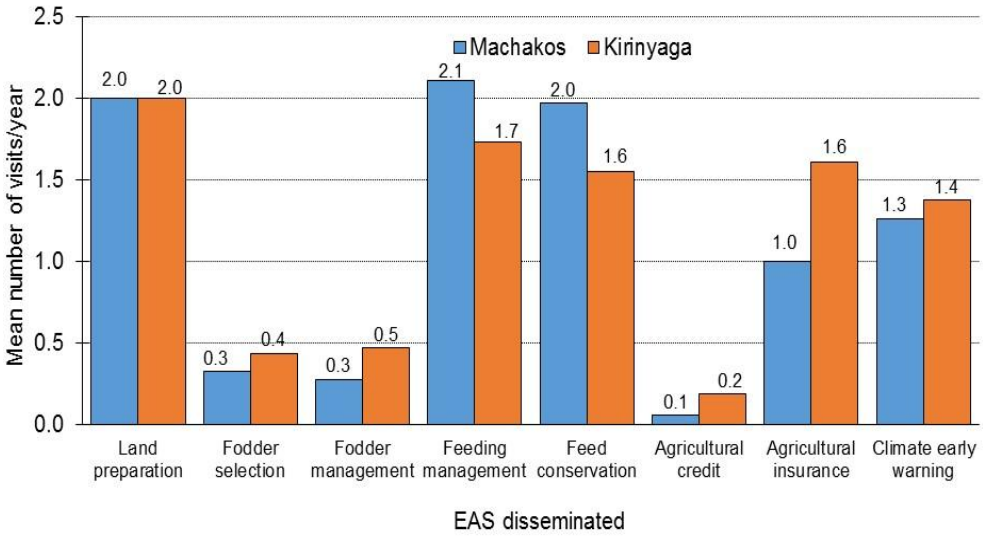

Fig. 2. Mean number of visits by extension agents per year

Table 5. Main sources of EAS on farming practices related to forage production in the study sites

		Kangundo (*n*=316)	Kirinyaga (*n*=313)		
Type of EAS	**Source**	**% of farmers**	**% of farmers**	**χ^2**	**P**
Land preparation	Research Institute	18.8	6.4	19.38	0.007
	Government extension	77.1	59.0		
	Cooperative society	0.0	7.7		
	Private company	0.0	5.1		
	Private practitioner	0.0	3.8		
	NGO	2.1	1.36		
	Other farmers	2.1	15.4		
	Community based organization	0.0	1.3		
Forage selection	Research Institute	26.9	13.7	10.87	0.093
	Government extension	65.4	60.0		
	Other government institutions	0.0	0.0		
	Cooperative society	0.0	2.1		
	Private company	0.0	3.2		
	Private practitioner	0.0	2.1		
	NGO	3.8	4.2		
	Other farmers	3.8	14.7		
Forage management	Agro-vet dealer	2.3	0.9	14.43	0.071
	Research Institute	18.2	9.4		
	Government extension	72.7	53.8		
	Cooperative society	2.3	7.5		
	Private company	0.0	3.8		
	Private practitioner	0.0	3.8		
	NGO	2.3	4.7		
	Other farmers	2.3	15.1		
	Faith based organization	0.0	0.9		
Feed conservation	Research Institute	20.0	8.0	15.36	0.018
	Government extension	77.5	59.8		
	Cooperative society	0.0	4.6		
	Private company	0.0	4.6		
	Private practitioner	0.0	1.1		
	NGO	0.0	5.7		

		Kangundo (*n*=316)	Kirinyaga (*n*=313)		
Type of EAS	**Source**	**% of farmers**	**% of farmers**	**χ^2**	**P**
	Other farmers	2.5	16.1		
Feeding management	Research Institute	2.6	6.3	14.49	0.070
	Government extension	89.7	56.8		
	Cooperative society	2.6	5.3		
	Private company	0.0	5.3		
	Private practitioner	0.0	5.3		
	NGO	0.0	5.3		
	Other farmers	5.1	13.7		
	Community based organization	0.0	1.1		
	Faith based organization	0.0	1.1		
Climate early warning	Research Institute	4.9	4.8	2.23	0.693
	Government extension	87.8	81.0		
	Cooperative society	7.3	9.5		
	Private company	0.0	3.2		
	Private practitioner	0.0	1.6		

Table 6. Farmers' satisfaction level in accessing EAS on forage production

Type of EAS	**Level of satisfaction (% of farmers)**					
	Dissatisfied		**Neutral**		**Satisfied**	
	Kangundo	**Kirinyaga**	**Kangundo**	**Kirinyaga**	**Kangundo**	**Kirinyaga**
Land preparation	4.2	2.4	2.1	0.0	93.6	97.6
Forage selection	5.7	7.9	9.6	5.0	84.6	87.2
Forage management	4.3	10.7	4.3	2.7	91.3	86.6
Feed conservation	7.5	3.2	5.0	5.3	87.5	93.5
Feeding management	12.2	9.7	4.9	4.9	82.9	85.4
Climate early warning	22.5	6.0	2.5	1.5	75.0	92.5
Agricultural credit	29.8	13.8	8.1	6.9	62.2	79.3
Agricultural insurance	33.3	12.8	6.1	7.7	60.6	79.5
Mean	5.8	4.6	5.3	4.3	71.0	73.2

Table 7. Socioeconomic characteristics of households with and without access to EAS on forage production

Characteristic		With access to EAS (*n*=214)	Without access to EAS (*n*=415)		
		%	%	χ^2	p
Gender of household head	Female	29.5	70.5	1.492	0.222
	Male	35.2	64.8		
Education level of household head	None	36.8	63.2	0.069	0.792
	Educated	33.9	66.1		
Access to credit	Yes	44.4	28.2	16.952	0.000
	No	55.6	71.8		
Membership to agricultural group(s)	Yes	47.2	16.8	63.368	0.000
	No	52.8	83.2		
		Mean	**Mean**	**t**	**p**
Age of household head (years)		55.0 ± (13.3)	56.2 ± (13.5)	1.053	0.293
Distance to source of EAS (km)		4.20 ± (4.1)	4.90 ± (6.2)	0.949	0.344
Monthly on-farm income (Ksh.)		20919 ± (17724)	15217 ± (18766)	-3.657	0.000
Monthly off-farm income (Ksh.)		10316 ± (18853)	12000 ± (50979)	-0.467	0.641
Land size (Ha)		1.22 ± (1.26)	1.23 ± (1.61)	0.131	0.896
Importance of livestock on food security (No.) †		7.3 ± (1.5)	6.7 ± (1.9)	-3.934	0.000

Note: The number in parenthesis is the standard deviation

†Importance was rated on a score of 1 to 10 with 1 denoting least important and 10 most important

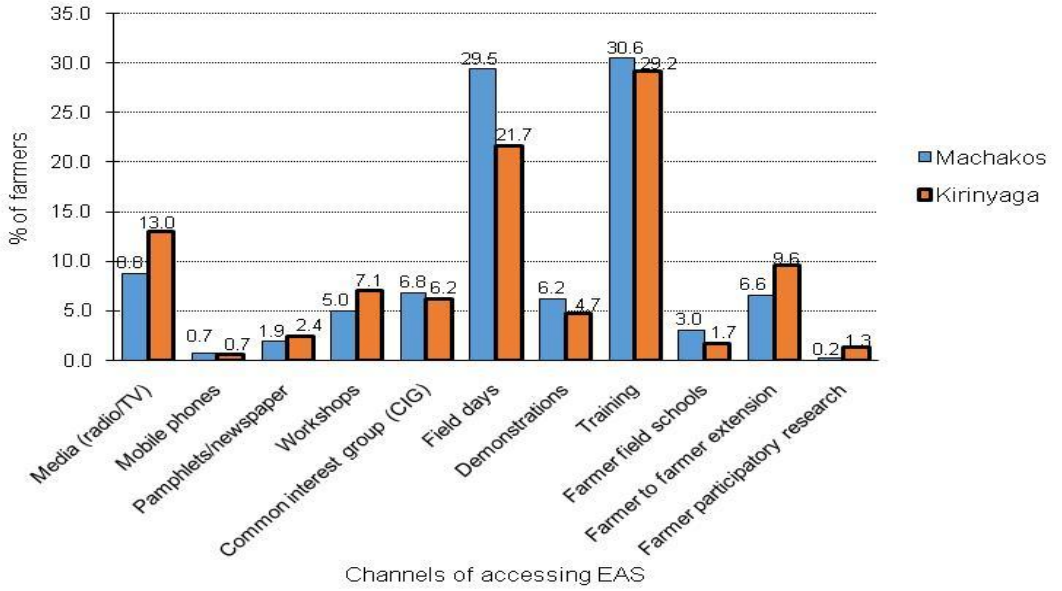

Fig. 3. Channels for accessing EAS on farming practice related to forage production

Table 8. Parameter estimates for factors affecting access to EAS on forage production

Variables	(β)	SE	Wald	Df	Sig.	Exp(β)
Gender of household head	0.163	0.243	0.447	1	0.504	1.176
Age of household head (yr)	-0.009	0.007	1.522	1	0.217	0.991
Education level of household head	0.337	0.380	0.786	1	0.375	1.400
Off-farm income (Ksh.)	0.000	0.000	0.413	1	0.520	1.000
Distance to source of EAS (km)	0.038	0.057	0.449	1	0.503	1.039
Land size (Ha)	-0.009	0.068	0.017	1	0.896	0.991
Access to credit	0.539	0.190	8.066	1	0.005	1.713
Membership to farmer group(s)	1.467	0.203	52.358	1	0.000	4.336
Importance of livestock on food security	0.233	0.057	16.873	1	0.000	1.262
Constant	-02.730	0.811	11.337	1	0.001	0.065

β – coefficient; Wald - Wald chi-square to test the null hypothesis that the constant equals 0; Df- degrees of freedom; Sig- significant; Exp(β – exponentiation of the β coefficient (odds ratio)

Access to credit, membership to farmer groups and the importance of livestock on household's food security were the only factors that significantly influenced access to EAS on forage production. The likelihood of accessing EAS on forage production increased by a factor of 1.71 for farmers who had access to credit and by a factor of 4.34 for farmers who were members of agricultural groups (Table 8). Farmers with access to credit can afford to seek for EAS especially if the service providers are far away. A study by Muigai et al. [29] showed that, farmers with access to credit had a higher likelihood to uptake banana value -addition compared to farmers without access. Membership to farmers groups increases access to information on productivity-enhancing technologies, and serve as a driving force for positive adoption decisions. This agrees with other studies by Makhoha et al [19], Omollo et al. [30] and Ernest et al. [24] who found that, farmers who were members of agricultural organizations had higher probability of adopting crop related technologies and practices. Most of the agricultural extension services in Kenya are delivered through groups due to limited number of extension workers. Similarly, the likelihood of accessing EAS on forage production increased by a factor of 1.26 times for farmers who attached more importance to livestock keeping for household's food security. Farmers were asked to give the importance of livestock keeping for household's food security on a scale of 1 to 10 with 1 denoting least important and 10 most important Farmers who attach high value to livestock are more likely to source for information

and advisory services on how to improve productivity.

4. CONCLUSION AND RECOM-MENDATIONS

The study showed that, access to EAS on forage production in both Kangundo and Kirinyaga was generally low. Similarly, the frequency of visits by service providers to the farmers was low although the level of satisfaction by farmers was quite high for most of the EAS they received. Access to credit, membership to farmer groups and the importance of livestock on household's food security were the factors that significantly influenced access to EAS on forage production.

The study recommends governments to use other innovative EAS approaches and encourage formation of farmer groups/cooperatives in order to improve access of EAS services. A Village Knowledge Centre (an Information Communication Technology digital platform linking farmers through smartphones and social media) established in Kangundo could be replicated in other areas as a conduit for faster and effective information.

ACKNOWLEDGEMENTS

This research work reported in this paper is part of project on, 'Innovations in Technology, Institutional and Extension Approaches towards Sustainable Agriculture and enhanced Food and Nutrition Security in Africa (InnovAfrica)' and funded by the European's Union H2020 research and innovation programme under Grant Agreement No. 727201. The authors thank farmers who provided invaluable information. The views expressed in this study are not necessarily those of EU.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/66649