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Full Length Research Paper

Assessment of smallholder adoption of quality protein maize in Kenya: The case of Kirinyaga County

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Low adoption of modern agricultural innovations amongst farmers in Kenya has been identified as the main reason for low agricultural productivity in the country. This paper examines the socioeconomic factors that influence the uptake of quality protein maize among smallholder farmers in Kirinyaga County of Kenya. Random sampling technique was used to select respondents for the survey and primary data collected using structured questionnaires involved 100 farmers. The data was analyzed using SPSS software. The results from the multiple regression indicates socio economic characteristics in Kirinyaga such as land ownership, family size and income contributes significantly to adoption of quality protein maize. Agriculture was found to be the main source of income with (98%). Lack of seed and the challenges of climate change were major constraints affecting agricultural production in the study areas. Results showed that adoption of agricultural innovations depends on farmers socioeconomic characteristics. Policy maker should therefore take advantage of these factors that influence adoption of quality protein maize positively and formulate policies.

Keywords: Agriculture, adoption, multiple régression, quality protein maize, innovations, smallholder.

INTRODUCTION

In Kenya, the agricultural sector is the mainstay of the economy and a major driver of community livelihoods (GoK, 2009). The success in Kenya's agriculture lies in improvement of agricultural technologies and their subsequent diffusion to the farmers IFPRI (2002). It is classified as a priority sector by the Government of Kenya because of its significant contribution towards the national economy, food security, poverty reduction, and overall enhancement of rural livelihoods. In reference to Khan, (1999), growth in the sector has been linked to development in a powerful impact on poverty because it helps majority of poor people compared with development sectors of the economy. The agricultural sector also provides the basis for development of other socio-economic sectors including trade, industry, livestock, and horticulture among others (GoK, 2002).

Empirical studies in Nigeria on agricultural technology adoption suggest that factors such as socio-economic characteristics of farmers, cash resources and information from extension and other media influence

adoption rate of new agricultural technology among farmers (Ayinde *et al.*, 2010; Idrisa *et al.*, 2012). For instance, Ayinde *et al.* (2010) found that education level of farmers; farming experience; farm size; access to extension agents and access to credit have significant and positive influence on adoption.

According to findings of research carried out by Mamudu *et al.* (2012), the factors that influence the adoption of modern agricultural production technologies are broadly categorised into economic factors, social factors and institutional factors. Economic factors include farm size, cost of technology or modernization, expected benefits from adoption of the technology, and off-farm activities. The social factors that influence probability of adoption of modern agricultural production technologies by farm households include age, level of education and gender. All these social factors are found to significantly influence the decisions of farm households to adopt modern agricultural production technologies. Institutional factors including access to information and extension

services were found to significantly influence farm households' probability of adopting modern agricultural production Mamudu *et al.* (2012).

Studies by Nsabimana and Masabo (2005) found that lack of formal and non-formal education could be considered as the main factor for the non-adoption of innovations. They also concluded that factors which promote adoption of agricultural technologies include sensitization on advantages of the technology, literacy, age, technical information and exposure to technology. Omosa (2000) also asserts that success or failure of the use of communication channels heavily depends on socioeconomic factors such as the literacy level (education level) and wealth status as well as other factors including political environment.

Provision of agricultural information to farmers does not guarantee adoption. This is because a host of social, economic, and psychological factors influence the rate of agricultural information use (Surry, 1997; Akande, 1999). Among the factors Rogers (1995) identified, is the social system into which the information is delivered to farmers. The socioeconomic consequences of an innovation for the community as a whole have not always been considered. "Agricultural research stations often develop their recommendations about the innovations with only a vague perception of those farmers for whom the recommendations are intended. What is needed is preventive about innovations and the conditions of farmers" (Roling *et al* 1976).

The gap between available agricultural information on improved practices and its use exists. It is important to assess perceived needs of the potential adopters of innovations through, the diffusion process which can perhaps contribute to narrowing the socio economic gap. Onu, (1991) noted that using agricultural information studies, is usual to investigate social characteristics of farmers to understand their relative influence in the farmers' information use behaviors. This capacity is dependent on certain socio-economic variables. There is need therefore, to question whether a technological innovation is appropriate as such if it favors some farmers.

The main objective of this study therefore, was to assess the socio economic factors influencing farmers' decision to adopt Quality Protein Maize (QPM) Kirinyaga County. To achieve this objective, it was hypothesized that "farmer's socio-economic conditions do not influence adoption of quality protein maize". This hypothesis was tested using the regression analysis. The next section focuses on the methodological aspects employed in this study.

METHODOLOGY

The study was carried out between 2014 and 2015 to assess the smallholder adoption of quality protein maize in Kirinyaga County. Six sub locations were purposively selected in the county, namely Kanjuu, Githumbu, Mirichi,

Table 1: Proportionate stratified random sampling

Strata	A	B	C	D	E
Population size	60	30	40	45	35
Sampling proportion	48	48	48	48	48
Final sample size	29	14	19	21	17

Maita-Rui, Gariambu and Merisi. The quality protein maize was given by the Catholic Diocese of Murang'a through the Kenya Agricultural Livestock and Research Organization. From the Catholic of Murang'a a list of five groups of farmers who participated in the production of quality protein maize was provided. This formed the sampling frame from which 100 farmers were selected. Cochran's (1977) formula was adopted to determine the sample size of 100 farmers for interview using a sampling proportion of 48% (Table 1).

To elicit the required information, a structured questionnaire was administered with the help of trained enumerators. The questionnaire was pre-tested and revised accordingly prior to the actual survey. The researchers followed the enumerators randomly to ensure data consistency. Data collected included land ownership, income, family size, education, age, gender, and farm size to assess various socio-economic characteristics of the farmers.

Statistical Package for Social Sciences (IBM SPSS21) was used for data analysis. Covariance analysis was done to establish the degree of relationship between variables. Variables that had significant correlation were regressed on adoption of quality protein maize to obtain relationships governing the rate of uptake of quality protein maize. The form of the multiple regression equation used in this analysis is given in equation 1.

$$Y = A + \beta_1 X^1 + \beta_2 X^2 + \beta_3 X^3 + \beta_4 X^4 \dots + \beta_9 X^9 + \mu \text{ -----(1)}$$

Where Y= Adoption of QPM

A= the intercept (constant)

$\beta_1 \dots \beta_{12}$ = regression coefficients of regressed variables $X^1 \dots X^9$

$X^1 \dots X^{12}$ = variables under study where X^1 = Age, X^2 = education, X^3 = Income, X^4 = Gender, X^5 , X^6 = Farm size, X^7 = Distance, X^8 = Extension Visits and X^9 = Marital status.

μ = Error term which was assumed to be evenly distributed across the study population

RESULTS AND DISCUSSION

Results indicate that different socio economic factors determine the adoption of quality protein maize in the study region. The populations studied were the households involved in quality protein maize in the rural areas of Kirinyaga County. Key socio economic characteristics of the sample have been presented in table 2.

The family sizes table 2 varied greatly, but majority (55%) were between 4 and 7 household members, 1-3 members (20.2%), 8-11 (20.2%) and >15 (1%). Majority

Table 2: Distribution of respondents by demographic characteristics

Variables	Distribution of Respondents by Demographic Characteristics (%)	
Gender	Male	51.5%
	Female	48.5%
Age	18-30	3.00%
	31-40	24.20%
	41-50	20.20%
	>50	50.52%
Education	No schooling	5.1%
	Primary 1-8	43.9%
	Secondary 8-12	38.8%
	Tertiary 12-15	8.2%
	University 12-20 years	4.1%
Family size	1-3	20.2%
	4-7	54.5%
	8-11	20.2%
	12-15	4.0%
	>15	1.0%
Land Ownership	Free hold	91.8%
	Leasehold/Rented	1.0%
	Communal	2.0%
	Borrowed	5.1%
Annual Income (Kshs)	0-5000	3.10%
	5001-10000	9.20%
	10001-15000	9.20%
	15001-20000	7.10%
	20001-25000	16.30%
	25001-30000	6.10%
	30001-35000	4.10%
	35001-40000	1.00%
	40001-45000	4.10%
	45001-50000	6.10%
>50000	33.70%	
Farm size (Acres)	<5	81.8%
	5-10	18.2%

of the farmers (91.8%) held their own land as opposed to those who had leased (1%), communal (2%) or borrowed land (5.1%). Most households (33.7%) received an annual income of > Ksh.50,000 with the lowest income earners (3.1%) and (9.2%) of the respondents earning less than Ksh. 10,000 per annum. There was a fairly balanced distribution of education levels with (43.9%) of the respondents having completed primary school and a subsequent (38.8%) having attained a secondary education with more respondents having attained higher education with (8.2%) in tertiary and (4.1%) having gone through university. The respondents age with the

majority being above 50 years of age. There is a smaller number of farming respondents below the age of 30 perhaps indicative of a shift from Agricultural based livelihoods towards other alternatives. The majority of farmers (81.8%) held less than 5 acres of land, no farmer held more than 10 acres of land, a fact attributable to land fragmentation and increased population density.

The socioeconomic characteristics of farmers such as family size, land ownership, income played a crucial role in determining the adoption of quality protein maize in Kirinyaga. In this study correlation was used to identify the degree of relationship among factors that positively

Table 3: Pearson's Correlation Model

	Respondents status	Gender	Age	Marital status	Education	Income	Family size	Farmer group	Land ownership	Distance
Respondents status	1									
Gender	.103	1								
Age	-.255**	-.007	1							
Marital status	-.090	-.335**	.046	1						
Education	-.123	.195*	-.027	-.274**	1					
Income	-.080	.073	.133	-.164	.358**	1				
Family size	-.094	.159	.241**	-.228*	.046	.010	1			
Farmer group	-.202*	-.191*	.175*	.000	.004	.112	.153	1		
Land ownership	.182*	-.040	-.365**	.153	-.026	-.154	-.098	-.062	1	
Distance	.229*	-.033	.120	-.012	-.121	.074	.017	.046	-.210*	1

*Significant at 5%; **Significant at 10%

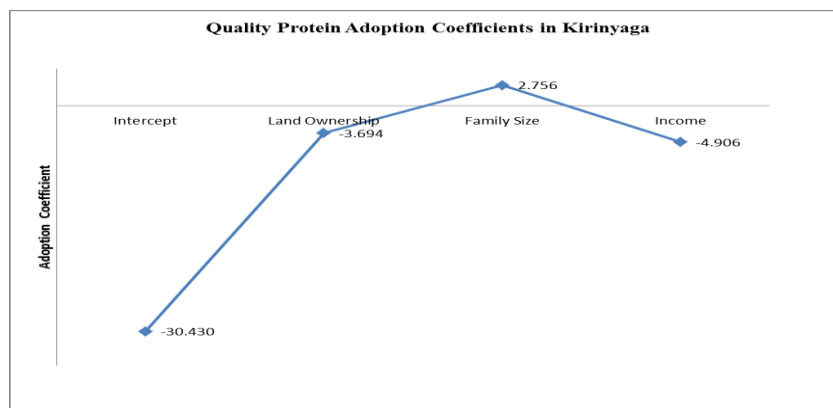


Figure 1: QPM adoption coefficients in Kirinyaga

contribute to adoption of quality protein maize as shown in table 3.

From the above Pearson’s correlations; age, marital status, gender, education, land ownership, farmer groups and distance are strongly correlated to adoption of quality protein maize technologies at 10% and 5% level of significant respectively.

The significant socioeconomic determinants to adoption of quality protein maize in Kirinyaga upon multiple regression on adoption of QPM gave rise to the adoption regression equations given as equation 2

$$Y = -30.430 - 3.694 X^1 + 2.756 X^2 - 4.906 X^3 \quad (r^2 = 0.214) \dots \dots \dots (2)$$

Where Y = Adoption of QPM

X¹ – Land ownership

X² – Family size

X³ – Income

From equation 2 is evident that in Kirinyaga County, adoption of QPM was influenced by factors that include

land ownership, family size and income. Family size is an important factor that contributes positively to adoption of quality protein maize at 0.094 level of significance in Kirinyaga. This means that at (90%) confidence interval (normal distribution), for every (1%) increase in family size, there is a (2.8%) increase in quality protein maize adoption. This suggests that an additional member of the family will result in increase of farm labour and hence increased production.

Land ownership level of significance was 0.041 indicating that at (96%) confidence interval, for every (1%) increase in land ownership there is (3.7%) decrease in quality protein maize adoption. The statistical analysis from the regression indicated that income of the households interviewed in Kirinyaga was statistically significant at 0.08, implying that at (92%) confidence interval (normal distribution) for every (1%) increase in income, there is (4.9%) decrease in adoption of quality protein maize.

This observation is further supported by the results in figure 1.

Therefore, the null hypothesis that socio-economic conditions do not influence adoption of quality protein maize was rejected and alternative one accepted that highlights the critical contributions of, land ownership, income and family size.

CONCLUSION

Each of the socio-economic variables studied should be addressed at levels in which it affects the farmer's decision to adopt Quality protein maize. For example, adult literacy programs could be promoted while at the same time encouraging younger family members of to pursue formal education to at least to secondary level. Secondly, the gender balance in household decision making should be embraced to promote and enhance increase of adoption of agricultural innovation. Family size, land ownership and income are factors that have the probability of influencing the farmers' decisions to adopt quality protein maize technologies in Kirinyaga.

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