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Full Length Research Paper

Contribution of sweetpotato (*Ipomoea batatas*) to household food security among farmers in Kilosa District, Tanzania

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The study was conducted to assess the contribution of sweetpotato to food security among farming households in Kilosa District in Eastern Tanzania. Structured questionnaires were used to collect data from 120 randomly selected households. Descriptive statistics were employed to analyze socio-economic characteristics of the selected households whereas logistic regression was used to test variables that determined household food security in the study area. Results showed that the size of farm devoted to sweetpotato cultivation contributed positively and significantly to household food security. Household heads' age, gender, years of schooling and off-farm income were also significantly impacting household food security. This study, therefore, recommended emphasis on favourable land policies to sweetpotato growers, enhancing accessibility of improved sweetpotato technologies, training programmes on good agricultural practices and creation of income generation opportunities in order to improve household food security in Kilosa District.

Key words: Households, sweetpotato, food security, determinants, logistic regression.

INTRODUCTION

Agriculture is the mainstay of the economies of many Sub-Saharan African countries and it supports the livelihood of approximately 85% of the undernourished population (Shah et al., 2008). In Tanzania, the sector accounts for 23.7% of the Gross Domestic Product and employs majority of the rural population which is generally characterized by smallholders (URT, 2009; 2012a; 2012b). Hence, the performance of agriculture in terms of productivity and total output has a significant effect on household income and food security of the rural poor. However, climate change is considered to affect agriculture thereby threatening food security particularly in many of the poor, agriculture-based communities (Shah et al., 2008). This calls for attention to promote production of crops such as sweetpotato which can provide adaptation to climate change.

Sweetpotato (*Ipomoea batatas*) is the third most important tuber crop in the world and food stapple in the Eastern African region (Kyamanywa *et al.,* 2011). This crop is grown in almost all agro-ecological zones of Tanzania (Kapinga et al., 1995) and, being a staple, it is basically grown to meet household food requirements. However, in many parts of Eastern Tanzania, the crop also occupies a prominent position in generating income for households (Masumba et al., 2004). This implies that sweetpotato has important role in reducing poverty and food insecurity which have become common phenomena in most developing countries particularly in the Sub-Saharan

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According to Aidoo et al., (2013), food security and insecurity are terms used to describe whether or not households have access to sufficient quality and quantity of food. Other researchers like Bickel et al., (2000); and Smith and Subandoro, (2007) defined food security as a situation that exists when all people at all times have physical, social and access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Similarly, Temu and Msuya (2004) described it as the guarantee of the physical availability of and economical accessibility to sufficient food (produced with bioenvironmental and sustainable social methods) in terms of quantity (amount, distribution, calories) and quality (safe, nutritious, balanced), while cultural admittance for all people at all times means having healthy and active lives to preserve human places and degrees.

The elements of food security include food availability, food accessibility, utilization and stability of food access (Bonnad, 1999). Food availability refers to the physical existence of food, be it from own production or on the markets and is achieved when a sufficient amount of food is constantly available for all members of society (Aidoo et al., 2013 and Henri-Ukoha et al., 2013). In this regard, rural food production plays important role in ensuring household food security. On the other hand, food accessibility is attained when households or individuals have adequate resources that enable them to obtain appropriate foods for a nutritious diet (USAID, 1992 and Riely et al., 1995) whereas food utilization encompasses decisions on food demand and allocation within the household.

In Tanzania, food insecurity is most prominent in rural areas. However, researchers have been working to come up with crop varieties that would contribute to food security. For instance, most of the research works on sweetpotato in Tanzania have generally concentrated on addressing constraints to production and productivity. These efforts have resulted in the release of many improved varieties with high genetic potential and farmer preferred qualities. Some of these varieties (Mataya, Chahwa and Kiyegea) are orange fleshed and are rich in vitamin A which is important particularly for the health of children and expectant mothers. Despite all these success, the use of improved sweetpotato varieties have not received due weight because of insufficient evidence on the impact of sweetpotato to food security. This study, therefore, sought to fill this gap by empirically determining the contribution of sweetpotato production to household food security in the study area.

METHODOLOGY

Study location, sampling strategy, survey instrument and implementation

The study was conducted in Kilosa District which is in Eastern part of Tanzania. The survey design was based on two-stage sampling procedure. First, the villages to be included in the sample were selected (Figure 1). The sampling frame involved a list of sweetpotato growing villages in the district. In addition, in each village, ten sweetpotato growing households were randomly selected and the household heads were interviewed. The questionnaire was used to study individual sweetpotato farmers at a household level.

The implementation of the survey involved collaboration with local researchers and extension personnel in the study area. The protocol adopted by the survey team was to make courtesy call to the village authorities (Village Executive Officer and/or Chairperson). As part of introduction of the activity to different village executives, the team highlighted the objective of the project, explained about the survey and got approval to proceed. The village authority also provided the team with the list of sweetpotato growing households from which selection of a sample of respondents was made. The interviewers then visited the households and administered the questionnaire.

Analytical model

Determinants of food security

Logistic regression was estimated to examine whether sweetpotato production was among the determinants of food security in the study area. This was proxied by the size of land allocated to the production of sweetpotato. In this study, the household was considered food secure if it had access to the basic food requirements; and could afford at least three meals a day throughout the past 12 months. Based on these criteria, households were disaggregated into food secure and food insecure households. The decision was based on a binary outcome of whether the household was food secure or not. Food secure household was assigned the value of “1”; and “0” if otherwise. Since the response probability is assumed to be a linear function of the explanatory variables (Maddala, 1983; Wooldridge, 2003), the logit model could be represented as:

$$P_i = F(Z_i) = \frac{1}{1 + e^{-(\alpha + \Sigma \beta i Xi)}} \quad \text{..... (1)}$$

Where; P_i = the probability that the household is food secure given X_i

X_i = a vector of dependent variable

α and β = Parameters of the regression

e = the base of natural logarithm

In order to simplify the interpretation of the coefficients, the model could be represented in terms of odds ratio. According to Aidoo et al., (2013), the odds ratio represents the ratio of the probability that a household would be food secure (P_i) to the probability of a household not being food secure (1-P_i). Mathematically;

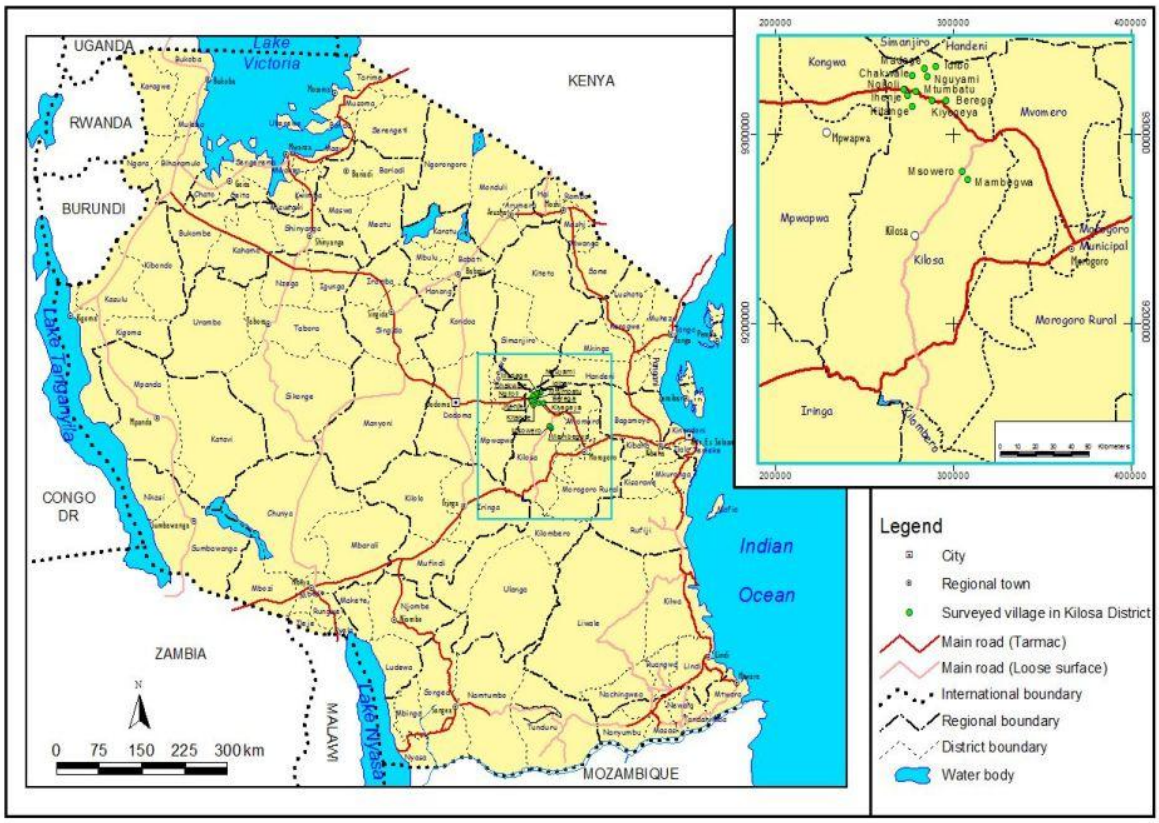

Figure 1. Map of Tanzania showing survey villages.

$$\frac{P_i}{1-P_i} = e^{zi} \quad \text{..... (2)}$$

When natural logarithm is applied, the equation becomes;

$$Ln\left(\frac{P_i}{1-P_i}\right) = Z_i = \alpha + \beta_1 X_1 + \beta_2 X_1 + \cdots \beta_k X_k$$

..... (3)

If the error term, ε_i is considered the equation takes the form;

$$Z_i = \alpha + \Sigma_{i=0}^{k} \beta_i X_i + \varepsilon_i \quad \text{..... (4)}$$

The present study used the following explanatory variables in the model:

X_1 = Age of household head in years
X_2 = Gender of household head (Male = 1, Female = 0)
X_3 = Marital status of household head (Married = 1, Otherwise = 0)
X_4 = Family size
X_5 = Years of schooling
X_6 = Sweetpotato farm size in acres
X_7 = Off-farm income activity (If yes = 1, otherwise = 0)
X_8 = Livestock (cattle, goat or sheep) ownership (Yes = 1, No = 0)

Maximum Likelihood Approach was used to estimate the parameters of the specified logistic regression.

Results and Discussion

Socio-economic characteristics of the household heads

Table 1 presents descriptive statistics for the heads of households who are the main farmers. Majority of sampled households (70%) were male headed. The age of the respondents fell between 36 and 50 years pointing out that most of the household heads were labour active. Over 80% of the heads of households were married suggesting the presence of many stable families which could concentrate on economic activities in the survey area. The proportions of divorced, single and widowed

Table 1. Household socio-economic characteristics.

Socio-economic characteristics	Frequency	Percent
Gender		
Male	70	58.3
Female	50	41.7
Age		
< 20	3	2.5
21-35	37	30.8
36-50	54	45.0
51-65	22	18.3
>65	4	3.3
Marital status		
Married	97	80.8
Single	7	5.8
Widowed	5	4.2
Divorced	11	9.2
Family size		
1-3	11	9.2
4-6	65	54.2
7-9	33	27.5
10-12	9	7.5
13 and above	2	1.7
Education level		
None	20	16.7
Primary	96	80.0
O' Level	4	3.3
Off-farm income		
Yes	55	45.8
No	65	54.2
Food security status		
Food secure	59	49.2
Food insecure	61	50.8

were 9%, 6% and 4%, respectively. Most (90%) of the surveyed households consisted of more than four members. Likewise, the majority (80%) of household heads had primary education; and less than half (40%) of the respondents were engaged in off-farm activities for income generation.

Crop Enterprises and Their Relative Importance

The summary of data on acreage allocation between different crops grown is presented in Figure 2. Apart from sweetpotato, other crops grown by farmers in the study area include maize, sunflower, beans, cowpeas, pigeon peas, paddy, cassava, groundnuts, sesame and vegetables. Sweetpotato ranked third in terms of land allocation after maize and sunflower indicating that it was among the priority crops in the district. The average sweetpotato farm size across the district was 1.8 acres with 0.25 and 4 acres as minimum and maximum, respectively. This implies that majority of sweetpotato farmers

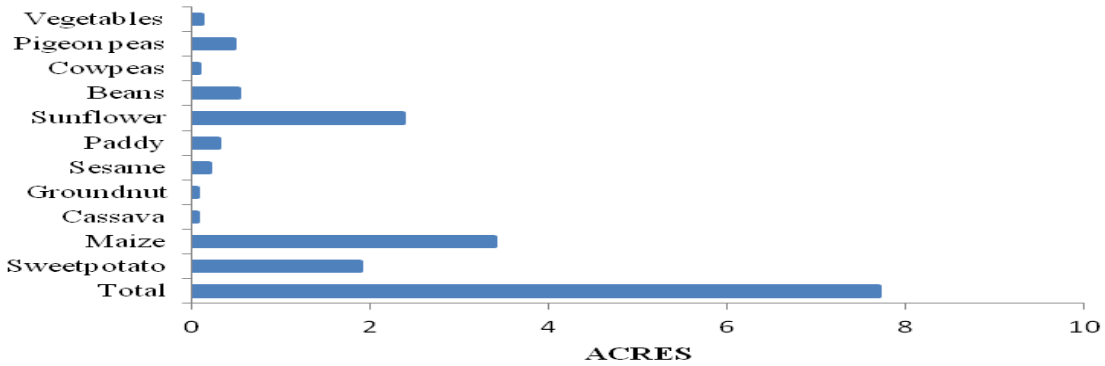

Figure 2. Average acres of land allocated to different crops.

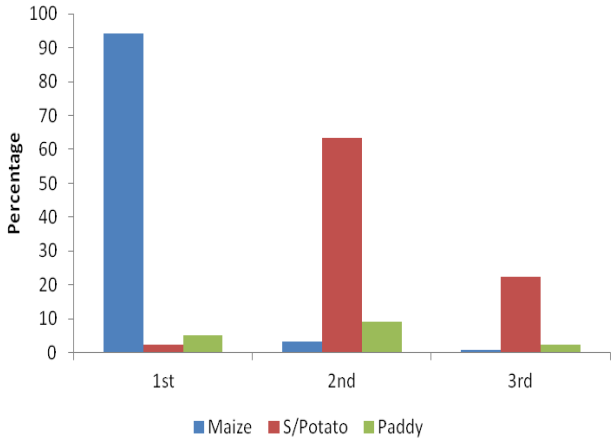

Figure 3. Most important food crops.

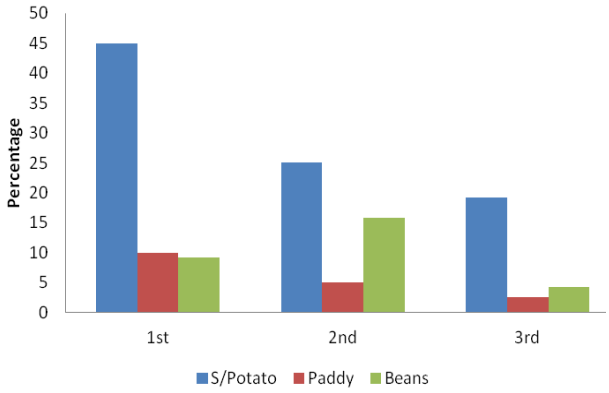

Figure 4. Most important crops for income.

in the study area operate at a small scale.

Important food and income generating crops grown by the households are shown in Figures 3 and 4. Sweetpotato was reported as the second important food crop after maize while in terms of income generation, the crop was ranked the most important. Beans and paddy were also ranked as second and third important income generating crops, respectively after sweetpotato. Other crop commodities which contributed to crop income were sunflower and pigeon peas.

Most important crops for income Following the survey, three main sources of income were identified in the study area which included cropping, livestock-keeping and off-farm activities. Crop income contributed the largest share of the total household income followed by livestock (Figure 5). Out of the total crop income, sweetpotato had the largest proportion (53%) implying that the crop is very important in the livelihood of farmers in Kilosa District. On the other hand, paddy and beans contributed 21% and 15% of the crop income, respectively, whereas sunflower and pigeon pea contributed 6% and 5% in that order (Figure 6).

Determinants of Food Security

Results of logistic regression are depicted in Table 2 below. The Pseudo R^2 as from the maximum likelihood estimates of the model was 45 % implying that the independent variables moderately explain the likelihood of a household being food secure. Explanatory variables that were found to have significant influence on food security included age, gender, years that the household head spent in formal education, size of sweetpotato farm and off-farm activity.

The age was statistically significant at 10% level and the coefficient suggests that household food security increases with the age of the family head. The corresponding odds ratio for age is 1.033 which means food security increases by that much when the household head gets older. This is probably due to the reason that

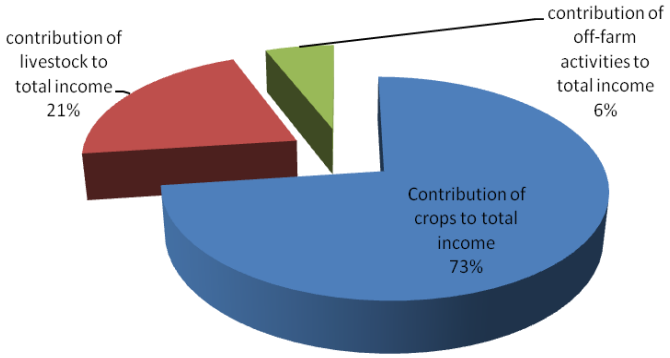

Figure 5. Main sources of income.

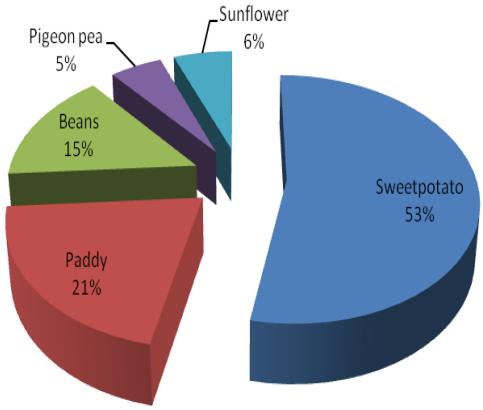

Figure 6. Proportions of crop income

Table 2. Determinants of food security.

Variable	Coefficients	S.E.	p-values	Exp(B)
Constant	-6.256	1.452	0.000	0.002
Age	0.032	0.019	0.095*	1.033
Gender	1.081	0.535	0.043**	2.947
Marital status	0.450	0.725	0.535	1.568
Family size	0.107	0.096	0.263	1.113
Years of schooling	0.164	0.095	0.084*	1.179
Sweetpotato farm size	1.206	0.328	0.000***	3.341
Livestock ownership	-0.392	0.577	0.497	0.676
Off-farm activities	1.207	0.481	0.012**	3.344
Pseudo R^2 = 0.451				
2Log Likelihood = 116.785				
Observations = 120				

*, **, *** denote statistical significance at 10%, 5% and 1% level, respectively.

older people may have acquired more resources which could be pulled together to ensure that food is on the table.

Gender of household head also had a significant relationship with food security at 5% level of significance, which implies that the chances of food security are higher for male headed households. The odds ratio in favour of food security increases by the factor 2.947 when the household is headed by a male. This could be attributed to the fact that in most male headed households there are women (wives) who complement the efforts of men to feed the members of the household. On the other hand, most female headed households have single parents who have to struggle to bear the burden of the family alone due to either being divorced or widowed.

Education level (years of schooling) had positive and significant relationship with the probability of household being food secure. The odds ratio in favour of food security rises by the factor 1.179 as the time spent in formal education increases by one year. The possible explanation for this is that the more one stays in school the more they are likely to be exposed to agricultural inst-

instructions and research guides which may result in increased food and cash crop production and productivity. This is because education is important in creating positive mental attitude towards adoption of modern farming innovation (Benor *et al.,* 1997).

The coefficient of sweetpotato farm size was positive and significant at 1%. This indicated the presence of positive relationship between sweetpotato farm size and household food security. The odds ratio in favour of food security increases by the factor 3.341when the area under sweetpotato cultivation is increased by one acre. The finding is not uncommon because with big farm size the household can produce more sweetpotatoes and hence more food. This is in agreement with the findings of a similar study by Aidoo et al., (2013) in Ghana.

Income from off-farm activities was found to be significant at 5%. Off-farm income generating activities help farming household to earn additional income through participating in petty business and artisanship. Income from these activities act as safety net during periods of food shortage as households could manage to cover the deficit. Also the household can increase its access to food by investing some of this income in crop production. Other independent variables like household size, marital status and livestock ownership did not show significant impact in household food security status in the study area.

CONCLUSION AND RECOMMENDATIONS

Survey results have shown that only 49% of the farming households in Kilosa District were food secure during the study period. As it was expected, sweetpotato farm size was found to contribute positively and significantly to food security in the study area. Also, it was noted that households headed by males had a higher likelihood of being food secure than those headed by females. Other explanatory variables that had positive influence on food security at household level were age, years of schooling and off-farm activities. On the other hand, household size and marital status did not contribute significantly to food security of sweetpotato growing households.

Based on the findings from the study, it is evident that sweetpotato cultivation has a potential of contributing to food security in the study area. This study, therefore, recommended emphasis on favourable land policies for sweetpotato farmers, enhancing accessibility of improved sweetpotato technologies (instituting the system that will make improved planting materials accessible to farmers), training programmes on good agricultural practices and creation of income generation opportunities in order to improve household food security in sweetpotato farming communities.

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