Choice Options to meet Household Food Security in the Cattle Corridor of Uganda

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ABSTRACT

This study identified the major options adopted by households in the rangelands of Uganda to meet their food needs, the factors that affect their choices and barriers to making use of various choices. A cross-sectional survey using semi-structured questionnaires was administered among 180 pastoral households in selected rangeland area of Uganda. The options identified include restocking animals, changing planting dates, soil conservation, harnessing new technologies, planting trees and buying food stuffs. Analysis of results from the multinomial logistic model indicated that age, level of education, size of household, years in current location, farm income, non-farm income, livestock ownership, access to extension services and climate and weather information were key determinants of farmers' choice of options to realize household food security. The major perceived barriers to choice options were lack of information on alternative options, poor technologies, climate variability, inadequate land, high food prices and low income. The analysis of choice of options to meet household food security suggests a number of different policy options such as strengthening production facilitation options available to pastoral communities including among others access to affordable credit, investing in yield-increasing technologies, introduction of livestock species that are better suited to drier conditions, raising awareness on climate related variations, creating opportunities for off-farm employment, encouraging pastoralists to grow more crops, and investing in irrigation.

1. INTRODUCTION

Africa's rangeland areas, particularly those in sub-Saharan Africa with the exception of South Africa, are synonymous with food insecurity (Beyene and Muche, 2010; Kratli et al., 2013; Warner and Afifi, 2014; Afifi et al., 2014). The food security challenge in the rangelands of Africa has a wide diversity and multiple dimensions; that are complex as predisposing conditions and escalators of the phenomenon (Bohle et al., 1994; Jacobs, 2009). The variability, complexity and interrelated causes of household food security and local responses to this growing crisis require an analysis that is detailed and in position to unravel choices and options available at household level (Abafita and Kim, 2014).

Adaptation is one of the policy options for reducing the negative impact of food insecurity (Deressa et al., 2008). Adaptation refers to adjustment in natural or human systems in response to actual or expected food shortages or their effects, which moderates harm or exploits beneficial opportunities (Ssewanyana and Kasirye, 2010). Common adaptation option at household level include use of new crop varieties and livestock species that are suited to drier conditions, irrigation, crop diversification, adoption of mixed crop and livestock farming systems and changing planting dates (Kurukulasuriya and Mendelsohn, 2006; Nhemachena and Hassan, 2007). The above adaptation options are often affected by a range of factors such as gender of household head, age, level of education, marital status, number of relatives, size of household, occupation, years in current location, farm income, non-farm income, livestock ownership, farm size, extension services, information about weather and climate variations, access to credit, land size and precipitation (Deressa et al., 2009; Beyene and Muche, 2010). The adaptation options available to a household in the rangeland areas also help to cushion the households from intermittent food insecurity (Beaumier and Ford, 2010).

The majority of Ugandans (86%) remain dependent on agriculture as their mainstay (UBOS, 2008; Egeru et al., 2015). The livestock sector accounts for 17% of the agricultural GDP in the country whose most production (90%) of livestock and livestock products comes from the cattle corridor – a semi-arid region of Uganda (UBOS, 2008; Kratli, 2010). The reliance of communities, in the cattle corridor of Uganda, on livestock is historical and has been indicated as a good food security insurance; a viable adaptation option (Inangolet et al., 2008; Kratli, 2010; Kratli et al., 2013; Mugerwa et al., 2014). Despite its high contribution to

the overall economy, the agriculture sector and livestock sector, in particular, are challenged by many factors, such as drought and flood – often causing famine, poor agriculture extension services, low quality of seed and livestock varieties, and lack of information on climate change related impacts ultimately affecting the adaptation and mitigation measures (Ssewanyana and Kasirye, 2010). Knowledge of the possible adaptation options and factors affecting choices of pastoralists to meet their household food needs is important, if food insecurity is to be diminished in the rangelands of Uganda (Nalule, 2010).

Some attempts have been made to study and characterize food security in Uganda with varied focus such as on persons living with HIV/AIDS (Bukusuba et al., 2007), famine determinants (Okori et al., 2010), urban food security alternative strategy (Maxwell, 1995), plant diseases and food security (Strange and Scott, 2005) and measurement of food insecurity (Maxwell, 1996) among others. Limited attempts and analysis have been undertaken in pastoral and agro-pastoral communities with focus on characterizing food insecurity, diet diversity as indicators of food insecurity (Mayanja et al., 2015) and role of adequate food at households (O'Keefe, 2010). However, none of these studies have attempted to examine the choice options that pastoralists have and use to meet household food security despite such a perspective being important in taking strategic decisions particularly choice of interventions aimed at alleviating belligerent food insecurity in the rangeland areas of Uganda. Therefore, this study sought to determine the choice options that households in the rangelands of Uganda use to meet their household food needs, the factors that affect their choices and barriers to making use of various choices at their disposal.

2. METHODOLOGY

2.1 Description of the study area

This study was conducted in Nakaseke district that lies in the cattle corridor of Uganda. The district receives on average 1300 mm of rainfall per annum. However, the distribution and occurrence patterns are sporadic and poor. Maximum temperature experienced is in the range of 27.5 ˚C - 30˚C and minimum temperature in the range of 15 ˚C - 17.5˚C annually. Minimum temperature in the district has however been rising faster than the maximum temperature thereby increasing the overall average temperature (Nimusiima et al., 2013). The district has a widespread coverage of savannah grasslands with occasional occurrence and patches of woodlands. Soils in the district are generally red sandy loams that support subsistence farming. The communities in the district rear livestock (cattle, goats and sheep) and for the majority, livestock and livestock product sales form a major source of household income.

2.2 Data collection

Data were collected through a cross-sectional household survey using a semi-structured questionnaire administered to 180 respondents that were randomly selected based on Roscoe, (1975) approach. A semi-structured questionnaire was administered by way of guided interviews to selected respondents at household level. This was deemed necessary because, guided interviews provide opportunity to break-ground; establish trust and iteration of responses when dealing with respondents with low levels of formal education (Phellas et al., 2011; Abafita and Kim, 2014). Participatory food security assessment was also embedded in the cross-sectional survey to particularly detail the different food options and choices available to the households in the area. A household in this study was defined based on the Uganda National Bureau of Statistics operational definition as; a group of people living and eating together (UBOS, 2003).

2.3 Factors influencing choice of options to meet household food security

A Multi-Nomial Logit (MNL) model was used to undertake the analysis of factors influencing choice options to meet household food security. This approach has previously been used to determine crop (Kurukulasuriya and Mendelsohn, 2006) and livestock (Seo and Mendelsohn, 2008) choices as alternatives to meet household food security. The advantage of the MNL is that it permits the analysis of decisions across more than two choice categories, allowing the determination of choice probabilities for different categories. Moreover, output result estimates from the MNL model are easy to interpret (Koch, 2007) because it allows correlation between the factors that an individual assigns to the various alternatives.

In this case, in the MNL model, y denotes a random variable taking on the values {1, 2...J} for J, a positive integer, and x denotes a set of conditioning variables. As such, y denotes options or categories and x contains factors that include household attributes such as age, education, income levels, and so forth. The question is how, ceteris paribus, changes in the elements of x affect the response probabilities P (y= j / x), j =1, 2,..J. Since the probabilities must sum to unity, P (y= j / x) is determined once the probabilities for j = 2,..J are known. Thus,

Let x be a 1× K vector with first element unity. The MNL model will have response probabilities as:

$$P(y=j/x) = \exp(x\beta_1)/\left[1 + \sum_{h=1}^{j} \exp(x\beta_h), j = 1, \ldots j\right] \quad (1)$$

Where: β *is* K 1, j 1.....J. j × =1……..j

Unbiased and consistent parameter estimates of the MNL model in equation (1) required the assumption

of independence of irrelevant alternatives (IIA) to hold. More specifically, the IIA assumption requires that the probability of using a certain choice by a given household needs to be independent from the probability of choosing another alternative method (that is, Pj/Pk is independent of the remaining probabilities). The foundation of the IIA assumption is the independent and homoscedastic disturbance terms of the basic model in equation (1).

The parameter estimates of the MNL model thus provided the direction of the effect of the independent variables on the dependent-response variables such as restocking animals, changing planting dates, soil conservation, planting new crop varieties, planting trees and no choice, but estimates did not represent either the actual magnitude of change nor probabilities. Differentiating equation (1) with respect to the explanatory variables provided marginal effects of the explanatory variables given as:

$$\frac{\partial P}{\partial xk} = \mathrm{P}j\ (\beta jk - \sum_{j=1}^{j-1} pj\beta_{jk})$$

The marginal effects or marginal probabilities are functions of the probability itself and measure the expected change in probability of a particular choice being made with respect to a unit change in an independent variable from the mean (Koch, 2007).

In order to determine the drivers of household choice of options to meet their food security, a range of explanatory variables were utilized (Table 1); these included both household demographic characteristics and socio-economic parameters prevalent at household level.

Table 1. Description of the independent variables

Explanatory variables	Mean	Description
Gender of respondent	0.88±0.31	Dummy, takes the value of 1 if male and 0 otherwise
Sex of household head	0.89±0.28	Dummy, takes the value of 1 if male and 0 otherwise
Age	46.5±12.2	Continuous (Number of years)
Education	1.48±0.62	Number of years in school
Marital status	0.95±0.23	Dummy, takes the value of 1 if married and 0 otherwise
Number of relatives in 'got'	3.47±2.03	Continuous
Size of household	6.50±1.16	Continuous (Number of persons in a home)
Occupation	4.01±0.21	Number of occupations possessed
Years in current location	18.97±8.23	Continuous (Number of years spent in the study area)
Farm income	65.8±1.95	Continuous
None farm income	8.40±0.11	Continuous
Livestock ownership	0.64±0.13	Dummy takes the value of 1 if owned and 0 otherwise
Extension services	1.43±0.49	Number of visits received
Information about climate change	1.34±0.31	Number of trainings attended
Access to credit	1.01±0.44	Number of times credit was accessed
Precipitation	0.57±0.11	Dummy takes the value of 1 if adequate and 0 otherwise

3. RESULT AND DISCUSSION

3.1 Options for household food security

3.1.1 Options to improve food supply

Concerning options to improve food supply, households were engaged in the livestock rearing and owned cattle (96.3%). At the same time, some 11.2% of the households were engaged in crop production. The restocking of livestock, particularly cattle, was an important activity undertaken by 28.3% of the respondents to reconstitute their herds so as to maintain milk production and their sales. Some, 13.7%, of the households participated in agroforestry through planting trees particularly fruit trees such as mangoes and citrus. In addition, soil conservation (7.5%), use of different crop varieties (5.1%) and changing planting dates (4.9%) were simultaneously used by respondents to assure improved food supplies at household level. All households (100%) in the area had ever purchased food in the last one month to supplement their household food menu. On average, purchased food accounted for 46.3% of the daily household food menu. A small number (3.7%) of respondents supplemented their livestock production with sale of wage labour. Over 81.5% of the households had at least one relative staying with them and shared on the household food. A marginal number of respondents (3.4%) received advice from agricultural extension agencies such as National Agricultural

Advisory Services (NAADS), District Agriculture Office and Non-Governmental Organizations in the area.

3.1.2 Options to improve food access

The main means by which households accessed food was through household production (76.7%) and purchase (63.3%). These were also the main means by which households accessed many of the production inputs they required. Some of the households have resorted to income support through the sale of charcoal (9.7%) and engagement in petty trade (1.7%). In addition, fewer households (5.5%) stored food items particularly for the dry season.

3.1.3 General options

Some households are currently harnessing applied technology to improve food production. For example, over 79.3% of the households carried out cross breeding, 38.5% used improved disease control methods such as vaccination against foot and mouth disease, 19.7% carried out water harvesting, 8.1% carried out crop rotation, 7.2% used improved seeds, 5.7% used improved fertilizers, 4.4% carried out mixed farming and 2.3% used new implements such as hiring tractors from the district to cultivate land. However the households were not engaged in processing and packaging.

The study results indicate that relationship between options made and household food security is changing in important but somewhat different ways. Majority of the households in the study area were unable to rely solely on what they produced on their land. They also relied on other food security choices such as restocking of animals, planting trees, soil conservation, use of different crop varieties and changing planting dates, though some made no choice. This finding is consistent with other literature from Uganda and elsewhere that indicates that households in the cattle corridor of Uganda make diverse options in meeting food security (Mengistu and Haji, 2015; Deressa et al., 2008; Deressa et al., 2009; Anley et al., 2007) and are typically net buyers of food (Sethuraman et al., 2014). The same studies also found out that the main barriers to option are choices; lack of information which points to lack of extension services which this study identified, lack of money which was equally reflected in low access to credit services in the cattle corridors of Uganda, shortage of labour and poor potential of irrigation which is similar to inadequate water sources that was advanced by the households in the Ugandan cattle corridor.

Concerning options to improve food supply, households were engaged in the livestock rearing and owned cattle (96.3%). Livestock rearing is perceived by most pastoralists to improve food supply because they can sell the animals and purchase other food items of their choice. Thus, in the midst of the food insecurity threat, the pastoralists decide to cling onto their flocks to deliver them from the challenge. Similar observations were made by Birch and Grahn, (2007) where the researchers found out that the sale of milk and livestock were the most critical options that pastoralists had in order to deal with food insecurity challenges. On the other hand Hassan and Nhemachena, (2008) noted a growing cultivation in the pastoral areas which never used to be the case in the past. This could be a step towards supplementing the animal products.

The identified technologies in the rangelands especially those aimed at boosting food production such as crop rotation, soil conservation/fertilizer application and use of improved seeds further reflect the growing trend of crop production. However, this is still on a very small scale, given the results obtained during the study. Nalule, (2010) also noted that pastoralists in Karamoja region, Northern Uganda had started breaking the tradition to depending on livestock products alone due to increased incidents of food insecurity and were, in the recent times, engaged in growing of some crops though on a small scale and the practice was projected to increase.

3.2 Factors influencing choice of options for household food security

The results from the MNL model showed that level of education and extension services positively influenced restocking of animals to meet household food needs. Household size and limited access to credit negatively influenced restocking of livestock to meet food needs. Age had a negative influence on the choice of options where the older the household head the more likely that household were to make no choice. Occupation, number of years in current location, farm income and none farm income significantly influenced ($p<0.05$) no choice to meet household food needs.

The results also show that the households whose heads had received more education engaged in soil conservation ($p<0.05$) as compared to those with lesser education level. In addition, a marginal increase in age and income of the household head increased their engagement in soil conservation to meet household food needs. The probability of planting new crop varieties to meet household food needs was high among household heads that had higher education, aged, and stayed in the current location for long as well as those who were exposed to agricultural extension services.

Tree planting as an option was positively influenced by more factors than the rest of the options. Woodlots are perceived as long term investments that will be relied on in future, in case livestock productivity goes down the trees will supplement livestock. In addition some households perceive tree planting to boost rainfall formation in the near future in case the current

drought challenges persist. The increased rainfall is expected to support pasture and water supply as well as crop cultivation. An increase in years in current location increased the chances of a household choosing to plant trees. Further still, level of education, age of household head, farm income, none farm income, livestock ownership, extension services and information about climate change also positively influenced ($p<0.05$) the household's decision to plant trees on the farm. The MNL model further revealed that change of planting dates is also positively influenced by gender of the respondent, information on weather and climate, extension services, farm and non-farm income, years spent in current location and age of household head.

The results from the MNL regression revealed a range of factors that influence household choice of options for food security. For example an increase in education further increases the probability of a household adopting restocking as an option for food security. While studies by Deressa et al., (2009) and Sethuraman et al., (2014) have shown that in pastoral areas, as people acquire education, they tend to exit preference in livestock production. However, researchers (Seo and Mendelsohn, 2008; Susanne, 2009) argue that a better education provides openness among people to adopt better livestock production options including better restocking technologies on their farms in order to boost income and food production. This appears to be the case in the study area because higher education was closely associated with more livestock, and livestock in good body conditions. In addition, respondents that had higher education status also indicated that they had received information and advice from the National Agricultural Advisory Services (NAADS) as well had a higher frequency of veterinary officer visit to their farms. Other studies (Wang et al., 2014; Bryan et al., 2013) have similarly established that higher education increases a farmer's participation in good agricultural practices and improves household food security.

Conversely, a large member size of households negatively influenced a household's choice of restocking as an option for food security. This, albeit, is a unique occurrence in a pastoral community because pastoral households are known to have large family sizes so as to facilitate labour intensive livestock production. In the study area, however, a modified form of pastoral livestock production was observed; households had fenced off their farms allowing them to utilize fewer workers to tend to their animals. This could explain the 1.8% decrease in livestock restocking with a unit increase in household members. Further, this result seems to contend with earlier arguments raised in relation to large household sizes particularly its impact on reducing investable income (Doss and McPeak, 2005; Mayanja et al., 2015). In this study, it rather augments the findings of Rufino et al., (2013) in Kenya where fencing of grazing lands had freed more household labour and the introduction of conservancies had helped reduce the number of herders required by a pastoral household (Jones and Thornton, 2009).

Access to credit also had a negative influence on restocking of animals. Obtaining credit is associated with high interest rates that make restocking expensive. Pastoralists do not know how to manage borrowed funds (Jacobs, 2009) and end up accumulating a lot of interest. Besides, the loans are given out with high interest rates (USAID, 2010) which makes it unviable to obtain them for restocking. As a result, those who obtain the loans to restock their farms end up making losses which explains the negative influence of credit shown by the results of this study.

A slight increase in farm and non-farm income increased the household's ability to purchase food which left them not bothered to make any decisions to plant trees as a future fall back strategy for income in case of poor livestock returns, restock animals or change crop varieties. Mengistu and Haji, (2015) also observed that although the majority of the households perceive at least one change in climatic attributes, some of them do not respond by making choice of options to respond accordingly. Household heads think that the kind of work they do (that is pastoralism) can sustain their household food needs and are not bothered to make any other choices to increase food production and availability (Birch and Grahn, 2007; Turyahabwe et al., 2013). Some household heads were of the view that because they have been in the area for long, they were convinced that they knew the characteristics of their surroundings and thought that the strategies they had were adequate enough and required no new ones to meet their household needs. Nalule, (2010) also noted that some pastoralists in the Karamoja region of Uganda were reluctant to adopt new options of food production to address their food security challenges.

A slight increase in farm income increases the ability of the households to buy more fertilizers to apply in their small gardens to improve soil productivity. When the main source of income is farming, households tend to invest in smoothening options such as soil conservation (Deressa et al., 2009; Feleke et al., 2005). Also as pastoralists grow older, they appreciate the importance of conserving soil so as to have more grass growing on the farm to minimize their movements in search of pasture (Fasil, 2007; Turyahabwe et al., 2013). Indication of food insecurity is significantly lower among households with older and better educated household heads because the ability to access assets needed to secure livelihoods increase with seniority, as also noted by Turyahabwe et al., (2013). Education makes it easier for households to comprehend negative externalities and be able to work

toward generating cash for buying food. Persons whose education levels are high, easily understand and appreciate the importance of adopting soil conservation technologies such as rotational grazing and restricting the cattle from reaching some parts of their farm to allow the soil to regain its productivity (Katungi, 2007).

Land ownership has an influence on the decision to plant trees. Tree planting as a choice of option is a perennial activity and cannot be engaged into if the land tenure is not secure. The trees that were often planted by households included eucalyptus trees, pine trees and some fruit trees such as mangoes, avocado and oranges. Household size and access to credit had a negative influence on tree planting. A marginal increase in household size increased the probability of lacking adequate capital to invest in purchasing tree seedlings. Access to credit services, though good, creates unprecedented expenditure and cannot be easily repaid from the proceeds of selling trees since the trees take longer to mature than any credit facility can wait (Deressa et al., 2009). The choice of planting trees, among those who had stayed for long in the location, points to the fact that the more the years one stayed on the land, the more secure their land tenure became eventually (Knowler and Bradshaw, 2008; Hassan and Nhemachena, 2008).

Access to weather and climate related information such as the changing drought and precipitation patterns also had an effect on planting dates. For example knowing that the rains will delay may result in postponement of the planting dates to avoid sun-burn on the crops. Availability of extension services also resulted in provision of information about the favorable planting dates by the extension workers to households (Birch and Grahn, 2007). Such information influences the decisions about the planting dates to avoid losses and failure to meet household food needs (Deressa et al., 2009).

Farm and non-farm income had a strong bearing on planting dates. Nhemachena and Hassan, (2007) noted that households decide to plant based on their ability to meet planting expenses such as purchase of seeds, land clearing expenses, labour, weeding, and pest and disease management costs. The longer a household head had stayed in the area also influenced their planting dates. This is often the case because such household heads master the weather and climatic patterns and can easily forecast and adjust the planting dates accordingly (Knowler and Bradshaw, 2007).

In addition to the above, the age of the household head also influenced the decisions to change the planting dates as older household heads could easily change to any date they deemed convenient in order to meet their household food needs. The older the household head was, the more likely he/she was to forecast good planting dates and adjust accordingly. Related observations were made by (Deressa et al., 2008; Turyahebwa et al., 2013) who stressed that increasing the age of the household head by one year increases the probability of perceiving a change in weather and climate related changes by 0.4%, whereas increasing farm income by one unit increases perception by 0.13%. Likewise, factors that are believed to create awareness of weather and climate variability, such as access to such information, access to farmer-to-farmer extension, and number of relatives, increase the likelihood of choice of options.

A marginal increase in farm income increased the chances of engaging in tree planting at household level. Availability of income means that households have the ability to purchase seedlings (Nhemachena and Hassan, 2007) and sponsor the tree planting activities such as land clearance, pitting, transplanting and the associated after care activities such as replacing the weathered trees, weeding, pest control, and pruning. Ownership of livestock means that households can sell some of the animals to engage in tree planting since tree planting is costly and requires substantive income to cater for workers' wages (Kurukulasuriya, 2008). Access to extension services is associated with awareness creation and encouraging households to engage in agro-forestry (Mengistu and Haji, 2015). This is aimed at conserving the available vegetation cover, providing extra sources of income other than pastoralism and replacing the trees lost to deforestation especially through charcoal burning (Mwangi, 2007).

Information on weather and climate also influenced households to plant trees in order to deal with the effects such as delayed rainfall and prolonged droughts that reduce the pasture and water for their animals (Nimusiima et al., 2013), as this is their strongest source of food (Turyahabwe et al., 2013). This is reflected in the fact that older persons appreciate that climate has indeed unfavorably changed and are often willing to engage in activities that can reduce its impacts (Seo and Mendelsohn, 2008). The higher the level of education, the higher the probability of engaging in tree planting; this means that educated household heads easily appreciate the importance of tree planting as compared to less educated household heads (Deressa et al., 2008).

Table 2. Regression marginal effects of factors influencing choice of options to meet household food security

Explanatory variables	Restocking animals	Planting new crop varieties	Soil conservation	Changing planting dates	Planting trees	No choice
Intercept	006(0.013)	0.090*(0.927)	0.315(0.962)	1.462(0.000)	0.040(0.001)	0.010(0.000)
Gender of respondent	0.514(1.318)	5.742(0.969)	1.662(0.982)	0.001*(0.697)	1.810(0.672)	-0.070(-0.460)
Sex of household head	0.589(1.363)	7.300(0.967)	4.493(0.988)	1.431(0.744)	1.855(0.809)	1.403(0.403)
Age	0.714(0.016)	0.027(0.580)	0.045(0.917)	0.014(0.428**)	0.022(0.265)	-0.016(0.014)
Level of education	0.008*(0.003)	0.001(0.013)	0.029(0.010)	0.273 (0.322)	0.349(0.006)	0.267(0.003)
Marital status	0.222(0.766)	1.208(0.569)	4.522(0.761)	0.747(0.631)	1.080(0.870)	0.740(0.822)
Number of relatives	0.304(0.135)	0.205(0.444)	0.399(0.586)	0.115*(0.823)	0.156(0.667)	0.118(0.460)
Size of household	0.006*(-0.015)	0.232(0.461)	0.370(0.382)	0.130(0.320)	-0.023(-0.006)	0.132(0.336)
Occupation	0.700(-)	0.000(-)	0.070	0.000	0.000(-)	0.000(-)
Years in current location	-0.386(0.029)	0.048(0.328)	0.078(0.877)	0.026(0.766)	0.036(0.236)	0.027(0.042)
Farm income	0.252**(0.000)	0.000(0.386)	0.000(0.876)	0.000(0.148)	0.000(0.015)	0.000(0.086)
Non-farm income	0.956*(0.001)	0.000(0.112*)	0.000(0.815)	0.000(0.449)	0.003(0.760)	0.000(0.055)
Livestock ownership	0.247 (0.410)	-0.653(0.963)	-1.057(-0.603)	0.368(0.635)	0.000(0.005)	0.362(-0.177)
Extension services	0.010*(0.397)	0.002(0.008)	1.041(0.172)	0.007(0.004)	0.040(0.009)	0.358(0.990)
Information about weather/climate	0.300(0.379)	0.615(0.713)	0.949(0.343)	0.006(0.021)	0.024(0.014)	0.336(0.335)
Access to credit	-0.006(0.374)	0.582(-0.006)	-0.925(-0.461)	0.339(0.066*)	0.019(0.064)	0.335(0.491)
Precipitation	0.390(0.396)	0.701(0.286)	1.185*(0.298)	0.038(0.007)	0.491(0.198*)	0.349(0.597)
Base category	No adaptation					
Number of observations	180					
LR Chi- Square	537.24					
Log likelihood	-804.53					
Pseudo R-Square	0.34					

*Notes: **, *= significant at 0.01 and 0.1 probability level, respectively.*

Gender of the household head influences decision making (Mwangi, 2007). From the results, most decisions about choice adoptions were made by males. Male headed households were more likely to make quick decisions to change planting dates in order to avoid losing the seeds to drought as compared to female headed households (Susanne, 2009; Turyahabwe et al., 2013). This was because males can easily influence the household members. However, the risk of male based decision making is that they may not adequately consult their family members which could result in wrong decisions. Male-headed households are often considered to be more likely to get information about new technologies and take on risk than female-headed households (Deressa et al., 2009).

4. CONCLUSIONS

Households met their food needs by using different options including, among others, restocking of animals, planting fruit trees, soil and water conservation, use of different crop varieties, changing planting dates, sale of wage labour, sale of charcoal, harnessing new technologies such as cross breeding and used improved disease control methods such as vaccination against foot and mouth disease. The Multi-nominal Logit (MNL) model was used to reveal the drivers of household choice of options for food security. These included factors such as level of education, size of household, years in current location, farm and non-farm income, livestock ownership, extension services, and information about climate change. In this regard, there is need to pursue a range of interventions that seek to improve food supply and improve food access among pastoralists. These options include continuous awareness raising on rainfall and temperature variations, increasing access to low interest rate credit, investing in high yield technologies, creating opportunities for off-farm employment, encouraging pastoralists to grow more crops, introduction of livestock species that are better suited to drier conditions, and investing in irrigation.

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