

Baseline Study of Smallholder Farmers in *Striga* Infested Maize Growing Areas of Eastern Uganda

AFRICAN AGRICULTURAL TECHNOLOGY FOUNDATION
FONDATION AFRICAINE POUR LES TECHNOLOGIES AGRICOLES

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- Field Extension Workers
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Acronyms and abbreviations

AATF	African Agricultural Technology Foundation
BDRs	Birth and Death Registers
BMI	Body Mass Index
CAOs	Chief Administrative Officers
CLA	Composite Liquidity Asset
FEWs	Field Extension Workers
GPS	Global Positioning System
ICIPE	International Centre for Insect Physiology and Ecology
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDRC	International Development Research Centre
IHI	Ill Health Intensity
IITA	International Institute of Tropical Agriculture
IR	Imazypyr Resistant
ITDG	Information Technology, Transnational Democracy and Gender
HIV/AIDS	Human Immuno-deficiency Virus/Acquired Immune Deficiency Syndrome
NAADS	National Agricultural Advisory Services
NGO	Non-Governmental Organisation
OPV	Open Pollinated Variety
PAI	Productive Assets Index
PCA	Principal Components Analysis
SLF	Sustainable Livelihood Framework
SSA	Sub-Saharan Africa
UBS	Uganda Bureau of Statistics
UNICEF	United Nations Children's Fund
WTO	World Trade Organisation
ZHFA	Z-scores on Height For Age
ZWFA	Z-scores on Weight For Age
ZWFH	Z-scores on Weight For Height

Summary

This report presents the results of a livelihood study of smallholder farmers undertaken in *Striga*-infested maize growing areas in four districts of eastern Uganda, namely Tororo, Busia, Budaka and Namutumba. Maize is an important crop in this region but its production has been constrained by a number of constraints of which *Striga* is ranked first. *Striga* is estimated to have infested 62,000 hectares of land in the country, with an economic loss of US$ 8 million a year.

The research applied a Sustainable Livelihood Framework (SLF) to conceptualise the study and analyse the data. A structured sampling strategy was used to select the four districts from which 40 villages mostly affected by *Striga* were randomly selected. Seventy-five (75) households in each district chosen were randomly selected for interviews.

Data was collected using a structured questionnaire that was administered with the help of Field Extension Workers (FEWs) in their respective districts between May and June 2007. Data entry was done in CSpro (**C**ensus and **S**urvey **Pro**cessing system) v2.4 software which minimises errors during data entry. The data was then exported from CSpro into SPSS v11.5 for quality checks. STATA v9.0, LIMDEP v8.0, SPSS v11.5 and EPiInfo v3.3.2 were the softwares used in data analysis. Analyses were done at three levels entailing the generation of secondary variables, descriptive and explorative analyses.

The households were characterised by: being headed by men, large household sizes, a high dependency ratio, few years of formal education, dependency on crop farming, and small land holdings with use rights only. With respect to SLF, livelihood assets include natural, physical, financial, human and social capital. These assets help households to improve their living status by utilising them in given contexts and policy environments within which they strive to make a living.

Land is the primary natural capital, particularly in agricultural production. Results indicate that households in the study areas owned land in small holdings, mostly with use rights, although a few had private titles to their land. Physical capital was mainly analysed through a composite index crafted from physical assets and amenities. Some assets are common among types of households and some are not. Improved housing, consumer durables, transportation, and communication assets are owned by the majority of the rich as opposed to the poor.

Analysis of financial capital showed that cash at home or in pocket was the main source of capital accessed by a large proportion of households. Non working animals like cattle, goats, poultry, sheep and pigs, which contribute to the financial capital base, are common. Cattle contributed more to financial capital compared to other animals. Human

capital in terms of quantity and quality of the population available to the households is required for efficient transformation of other forms of capital. The quantity of human capital, estimated as the number of household members fit to engage in livelihood activities, was better in Namutumba District compared to the other districts. Quality is indicated by the number of years of schooling of the household heads and frequency of access to agricultural extension services.

In relation to these qualitative dimensions of human capital, results have shown that male household heads received more education at primary level than their women counterparts. Farming households in Namutumba District received more extension visits per year (seven) compared to as low as three times a year in other districts. Social capital was explored through group networking among sample households in the society. Social networks play an important role in a society by providing informal security among households who subscribe to them with social goals like development and financial safety nets.

Based on the farmland allocated to respective crops, maize, millet and sweet potato were the major crops widely grown in the study area. The tendency of most of the households was to use seed bought from the market for improved varieties and home saved seed when they grew local maize varieties. This indicates the ability and willingness of farmers to adopt novel technologies once they are made available in the market place. Adoption of improved maize gave more yield and better returns to land than local varieties even under severe infestation of *Striga*. Micro-level factors that characterised the decision to allocate more than 50% of farmland to improved maize were wealth status, number of extension visits and overall maize production.

Despite its importance to the livelihood of the majority of people in eastern Uganda, maize production is being threatened by *Striga* among other production constraints. *Striga* is the most limiting factor in maize production as cited by over three quarters of households that ranked it the top most constraint, followed by stalkborer and land shortage. Households have been employing traditional control methods to mitigate the effect of *Striga* which is rated more severe in Budaka, Busia and Namutumba districts than in Tororo District. Among them are uprooting, intercropping, shifting to *Striga* free plots, manuring and burning. The level of awareness of modern *Striga* control technologies is still very low, hence a recommendation urging wider exposure for mass uptake is made.

Livelihood strategies engaged in by households are diverse but crop production was the most common among households. Some engaged in livestock production, wage work, and direct exploitation of natural resources. Non farm activities, although engaged in by a few households, generated more income than farm activities. This underscores the rationale of market participation in rural income generation.

According to respondent farmers, food insecurity was caused by factors like *Striga*, illness, land shortage, drought and low production. Households experienced varied shocks during the last five years which have left majority of them worse off. Drivers that underlay food deficit shocks and famine were cited to be *Striga* infestation and drought. Whereas shocks like human illness and loss of animals due to deaths were attributed to the incidence of human and animal diseases. In response to these shocks households spent cash savings, engaged in casual labour for food or cash, sold animals to obtain cash and shifted to *Striga* free land in case of *Striga* infestation.

Anthropometric measures such as Body Mass Index (BMI) for mothers and Z-scores for children under five years of age were used to explain the nutrition related livelihood outcomes of the household members. BMIs show that the majority of mothers are of normal weight with respect to their heights while Z-scores show that most children are normal although instances of stunting were observed. Households in Budaka District experienced more intense morbidity compared to households in other districts. Mortality in the region in the year 2006 was low where 12% of households reported deaths of their members. The results indicated an average mortality rate of 0.15 members per household. Malaria was a major cause of the deaths that occurred in all the districts with the exception of Budaka where HIV/AIDS was the major cause of death.

Micro level determinants of poverty that were significant were: total land owned, Productive Assets Index (PAI), ratio of formally educated females, number of extension visits, number of household members belonging to group associations, and accessibility (easiness to raise and spend) of conditional liquidity through formal and informal credit. These factors, if accessed in the right numbers, can significantly improve the long run wealth of the households.

Chapter 1

Introduction

Background information

Parasitic weeds, such as witchweed, *Striga* spp, threaten the lives of over 100 million people in Africa and infest 40% of arable land in the Savannah region causing an annual loss of US$ 7 to 13 million. It is estimated that another 40% of arable land may become infested in the next ten years. In Uganda, it is estimated that 62,000ha of farmland is infested with *Striga* (AATF, 2006) causing an economic loss of US $ 8 million a year. Witchweed is also the cause of yield losses that range between 10% and 100% (Kim, 1991; Baguma and Bigirwa, 1996). Among the 23 species of *Striga* identified in Africa, *Striga hermonthica* is indisputably the most important. It parasitises the grass family of crops such as maize, sorghum, millet, rice and sugarcane and is, therefore, one of the most severe constraints to cereal production in Sub-Saharan Africa (SSA). Dogget (1975), estimated a 20–95% yield loss of sorghum and finger millet due to *Striga* in East Africa.

Maize is widely grown all over Uganda, with the climate favouring two crops annually in some of the major production regions. There is also a possibility of having three crops annually in some regions through irrigation. Maize is gaining importance not only as a major food security crop alongside bananas, cassava and sweet potatoes, but also as a source of cash income for small-scale farmers in Uganda (UBS, 2000).

The eastern region of Uganda is a lowland where cereals like maize, millet, sorghum and rice are grown by almost every household. However, the crops are attacked by *Striga*. The frequency and severity of attack by *Striga* is greater in soils that are sandy, low in fertility, and with low to moderate water holding capacity (Weber et al, 1995). The recommended control measures include hand pulling, manuring, hoe weeding, use of trap and catch crops (Khan et al, 2002), intercropping, crop rotation (Carsky et al, 1994), fertilisers, seed treatments (Kanampiu et al, 2002), chemical stimulants, and development of tolerant lines. However, most of these known strategies have proved ineffective and have limited impact on the control of witchweed for small–scale farmers in Uganda.

Most farmers in eastern Uganda use traditional control methods (uprooting and hand hoeing). From observation, most farmers plant without fertiliser due to the high cost of acquiring it. Controlling *Striga* through cultural practices alone is difficult due to the high reproductive potential of the parasites (Odhiambo and Woomer, 2005), and the below ground damage inflicted on crops where the *Striga* roots enter the host, feeding on nutrients and moisture, and releasing toxins into the plant causing twisted, discoloured and stunted growth (Ejeta and Butler, 1993).

A new *Striga* control technology, Imazypyr Resistant (IR) maize is being developed for massive deployment in the severely *Striga* infested areas through the sponsorship of the African Agricultural Technology Foundation (AATF) in collaboration with the private seed industry and Africa 2000 Network. Before the launching, AATF contracted the International Institute of Tropical Agriculture (IITA) to conduct a baseline survey to establish benchmarks to assess the livelihood situation in *Striga* infested areas in eastern Uganda. This report presents the findings of the baseline study carried out in June and July 2007.

Conceptual framework

The Sustainable Livelihood Framework (SLF) was adopted from the project proposal (Figure 1). The framework indicates that every household is endowed with livelihood assets in the form of physical, human, financial, natural and social assets. These assets affect the kind of livelihood strategies a household engages in to provide and sustain a reasonable living standard for its members. These livelihood strategies are expected to result in increased income, reduced vulnerability and sustainable use of natural resources. *Striga* is the most important constraint to maize production which is key to one of the livelihood strategies households engage in crop farming. Several interventions can be introduced by relevant authorities to enable households to reduce their vulnerability to shocks, food deficit, low yields and poor nutrition.

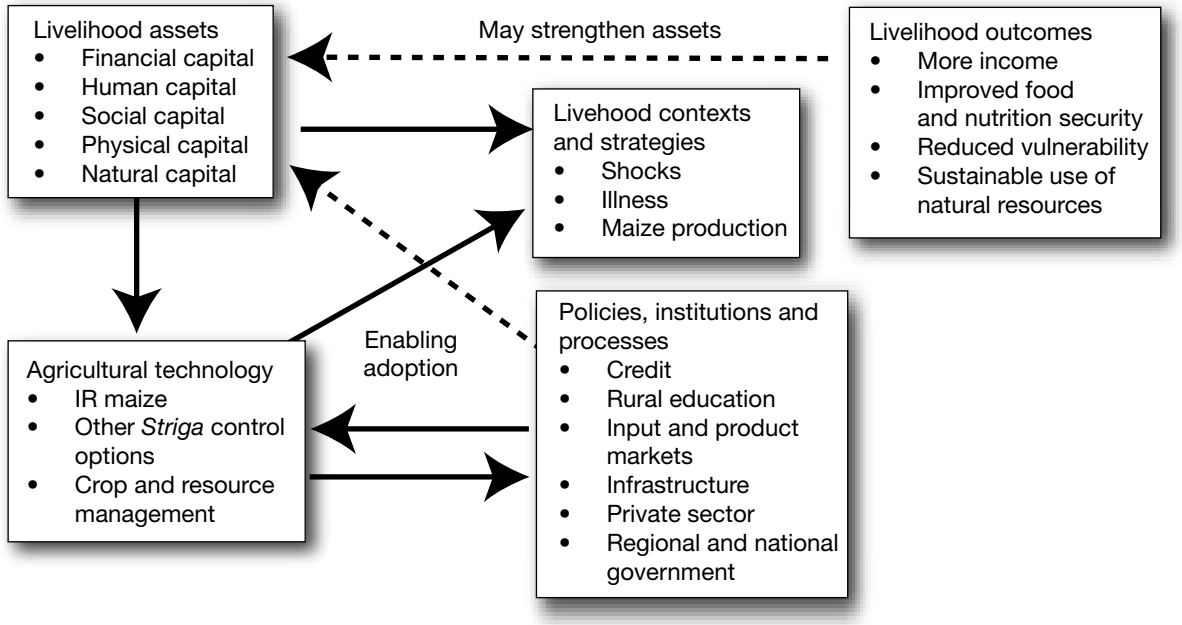

Figure 1: Schematic diagram of the conceptual framework

For adoption of IR technology, for example, to take place, the household must have the necessary livelihood assets. A technology may not be adopted if the household is vulnerable to illness or poor nutrition, for instance, as these may lead to depletion of livelihood assets which will affect the livelihood status of the households.

This study seeks to use this framework to show how the relationships between components contained in it are used to establish benchmark indicators for livelihood analysis so as to reach effective recommendations.

Methodology

Study area

Several secondary sources of literature were reviewed and it was established that Iganga, Mayuge, Jinja, Kapchorwa, Mbale, Kuni, Sironko, Bugiri, Busia, Tororo, Budaka, Namutumba and Soroti districts are major maize producers and that *Striga* was a problem. A trip was made to each district and, in consultation with the Ministry of Agriculture of Uganda, some districts were dropped after realising that *Striga* was not significantly important. The selection of four districts, Busia, Namutumba, Budaka and Tororo, was guided by the fact that AATF in collaboration with a local Non-Governmental Organisations (NGO), Africa 2000 Network, was planning to deploy IR technology in them. This baseline study was implemented in these four districts during the months of June and July 2007. Budaka was part of Pallisa District before it became a new district in July 2005; as a result, the GIS files used in mapping (Figure 2) merged the two.

Tororo District is administratively split into two counties, 15 sub-counties, 69 parishes and 630 villages. Tororo District has a sub-humid climate with aerographic, bimodal rainfall with peaks during the months of May and October. The rainfall lies between 1,130mm and 1,720mm with a temperature between 16.2° Celsius and 28.7° Celsius. It has plinthosols (Ferruginous tropical soils). The district has a total population of 381,259 people (80,331 households) and a population density of 313 people/km^2 according to results of the 2002 census (Tororo Census report, 2007).

Busia District covers a total area of 743km^2 with a total population of 225,008 people (47,886 households) and a population density of 303 people/km^2. The district is made up of one county (Samia-Bugwe), 10 sub-counties, 58 parishes and 534 villages. The district is dominated by undulating plain topography with an altitude of about 1,128m above mean sea level. It receives an annual rainfall of 1,514mm varying from about 1,080mm in the northern parts of the district to about 1,940mm towards Lake Victoria. The rainfall pattern is bimodal, with the first rainy season extending from March to May and a second season extending from August to November. The mean annual maximum temperature is 28.7° Celsius and the mean annual minimum temperature is 16.2° Celsius (Busia Census report, 2007).

Budaka District was carved out of Pallisa District in 2005 and appears in the map available as part of its mother district (Figure 2). It has a total area of 367km^2. It has a total population of 136,475 people (26,655 households) and a population density of 372 people/km^2. It is made up of one (1) county and seven (7) sub-counties which are

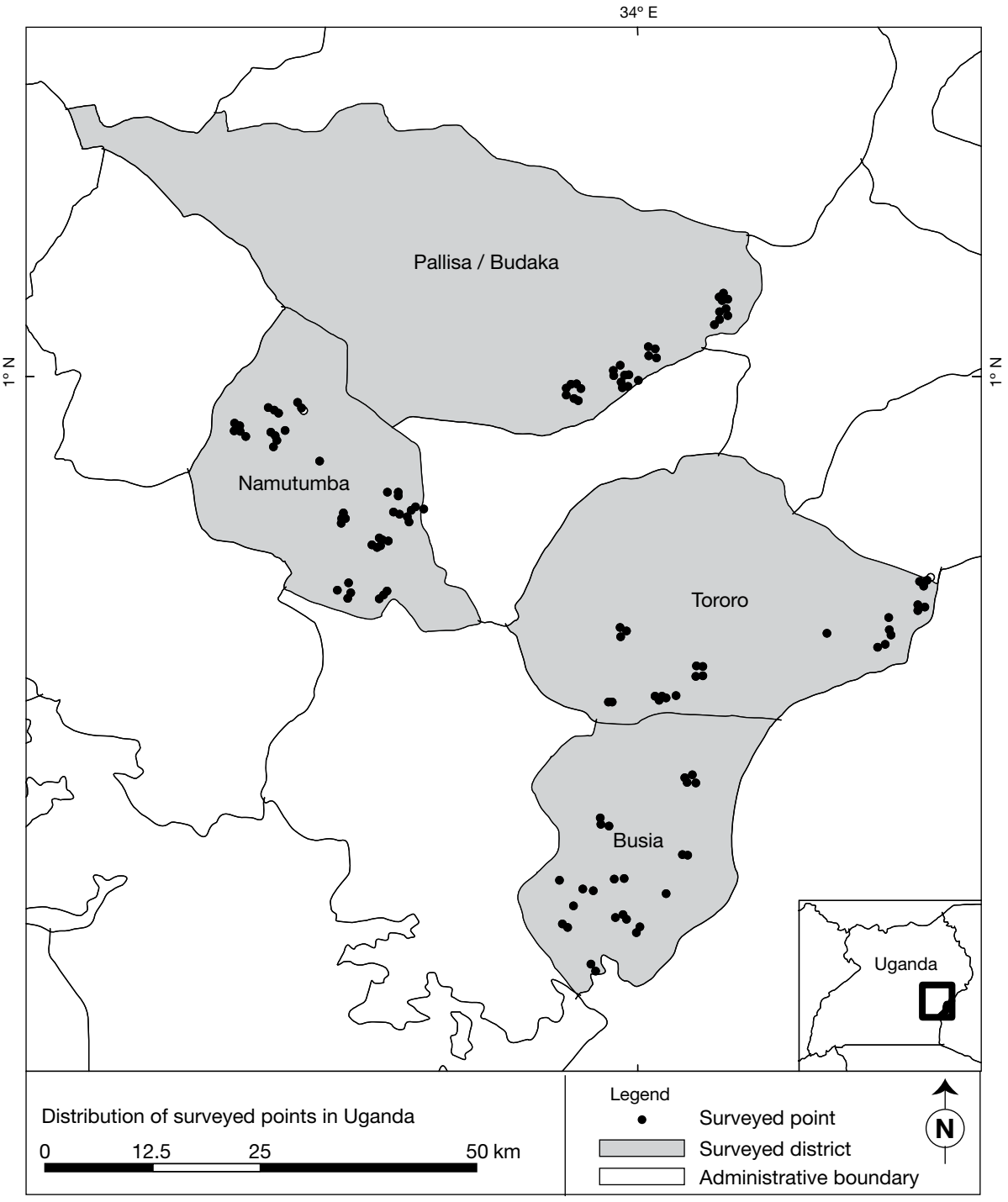

Figure 2: GIS map showing sampled villages and districts in eastern Uganda

further sub–divided into 35 parishes. The climate is characterised by two rainy seasons in March–June and August–November; and average temperatures of 17° Celsius. The relief is generally flat and low with shallow seasonal wetlands. The average altitude is 1,145m with the lowest at 900m and highest at 1,200m (Budaka Census report, 2007). Namutumba District was established in 2005 and was previously part of Iganga District having a total area of 801,87km^2. It has 1 county, 6 sub-counties, 36 parishes and 233 villages. The district has a total population of 167,691 people (33,714 households) and a population density of 208 persons/km^2. The rainfall pattern is bimodal in nature, and

averages 1,250mm. The topography rises from lowlands of 1,167m to hilly surroundings of 1,249m (Namutumba Census Report, 2007).

Sampling strategy and sample size

The importance of maize and the severity of *Striga* in maize production were two factors which guided the sampling strategy for this baseline study. Discussions held prior to the beginning of the survey with the district staff of the Production and Marketing Department of the Ministry of Agriculture of Uganda in each district helped to strategically select counties and sub-counties where maize and *Striga* were important. During a three day methodology workshop held in May 2007, a list was developed with the help of local extension staff of the villages most hit by *Striga* in the selected sub-counties. All the villages in each district were put together and ten were randomly sampled using STATA (*sample %*). The list of households in each village was extracted from the Birth and Death Registers (BDRs) kept at the sub-county on the villages. However, BDRs were not available in five villages (two villages in Busia and three villages in Namutumba). The extension workers developed the list in collaboration with the respective village heads referred to as Local Chairmen I in Uganda. Ten households (with two to three reserve households) in each village were randomly selected, and seven to eight households per village were interviewed depending on how large a particular village was. Ultimately, the overall sample comprised 300 households across all four districts (Annex A).

Data collection

Data was collected using a structured questionnaire (Annex B) that was administered with the assistance of trained extension workers. These extension workers were trained in a three day methodology workshop that addressed the themes of the survey, Global Positioning System (GPS), recording and anthropometric data collection techniques. An extension worker in charge of a sub-county in the Ministry of Agriculture's Production and Marketing department was assigned to administer the questionnaire to households in that sub-county as it was thought that this would enhance the quality of data. Themes included in the questionnaire were related to household characteristics; productive resources endowment; productivity, costs, labour and marketing; *Striga* extent, severity and control techniques; vulnerability, capital assets and livelihood aspects. In addition to the survey questionnaire, each extension worker received a UNICEF weighing scale and a meter with which to take anthropometric measurements of children under five years of age as well as their mothers or female guardians. They were also trained on GPS handset use to record geo-referenced coordinates, and area determination, during the workshop. The District Agricultural Officer for each district was assigned a supervisory role of front line extension workers involved in actual data collection. The IITA country research supervisor undertook the second quality check right in the field before the questionnaires were accepted.

Data analysis

Analysis of household characteristics

Descriptive statistics and tabulation were used to summarise household characteristics such as gender of household head, household size, dependency ratio and years of schooling of the household head. The dependency ratio was calculated by dividing the total number of able bodied members by the number of dependents (children below 15 years, the elderly and the permanently sick).

Household size was adjusted by composition and economies of scale. The concept behind this adjustment is that it costs less to feed four children than four adults (composition effects) and doubling the size of the family does not imply doubling the amount of expenditure necessary to maintain living standards (scale effects). Richards et al (2003) suggested the following equivalent units used to adjust the sample households (Table 1).

a) Adjustment of household size by composition

Based on equivalent units presented in Table 1, the household size is adjusted to address composition effects as expressed in Equation 1

$$H_i = \alpha_1 N_1 + \alpha_2 N_2 + \alpha_3 N_3 + ... + \alpha_n N_n \qquad \textbf{(1)}$$

Where:

H_i = gender and age weighted of the i^{th} household in the sample

$\alpha_{1 \ldots} \alpha_n$ = the relative weight given to individuals with respect to age and gender

$N_{1 \ldots} N_n$ = the size of components of households with similar sex and age range

b) Adjustment of household size by gender and age weight

The household size was then further adjusted to scale economies as expressed in Equation 2.

$$HE_i = (H_i)^{\psi} \qquad \textbf{(2)}$$

Where:

HE_i = the household size of the i^{th} household in the sample adjusted to both composition and scale effect

H_i = the gender and age weighted of the i^{th} household in the sample

ψ = scale economies within the household.

Table 1: Adult equivalent scales for adjusting aggregate household size

Age category (years)	Sex based adult equivalent scales		Household size	Economies of scale
	Male	Female		
0 to 2	0.40	0.40	0 to 2	1.000
3 to 4	0.48	0.48	2 to 3	0.946
5 to 6	0.56	0.56	3 to 4	0.897
7 to 8	0.64	0.64	4 to 5	0.851
9 to 10	0.76	0.76	5 to 6	0.807
11 to 12	0.80	0.88	6 to 7	0.778
13 to 14	1.00	1.00	7 to 8	0.757
15 to 18	1.20	1.00	8 to 9	0.741
19 to 59	1.00	0.88	9 to 10	0.729
60+	0.88	0.72	10+	0.719

Analysis of livelihood capital

(a) Natural capital

Natural capital includes all the biophysical components which include land quantity and quality. Land is a natural asset that man can only own for the sake of producing some vital goods and services needed to improve their livelihood. Land ownership is estimated using descriptive statistics of the number of hectares a household has under various regimes of land tenure (private ownership, customary tenure land with use rights only, borrowed, gifted, rented in or out, and share cropped land). Land use shows the proportion of land allocated to the various crop types; (annuals, perennials, mixed cropping, fallow and grazing.)

(b) Physical capital

Physical capital comprises productive assets, amenities and consumer durables. Productive assets are those used in the production process, which lead to the attainment of livelihood outcomes, while amenities and consumer durables indicate the living standard and wealth status. Core analyses of physical capital included derivation indices for productive assets and wealth.

The productive assets considered in this case are working livestock (oxen), machinery, tools and equipment. The Productive Assets Index (PAI) was developed by combining the number and condition of the productive assets and can be expressed mathematically as shown in Equation 3.

$$PAI_i = \sum_{j=1}^{m} n_j W_j \qquad \textbf{(3)}$$

Where:

PAI_i = the Productive Assets Index of the i^{th} household (i = 1 … 300)

n_{ij} = the number of productive asset j^{th} in the i^{th} household

$j \ldots m$ = a portfolio of productive assets

W_{ij} = the working status of the j^{th} productive asset of the i^{th} household.

The working status of any productive asset had been coded as ordered variables 1 = working improperly, 2 = working moderately, and 3 = working properly. This means that the larger the PAI the better off the household. The resulting PAI can then be divided by the adjusted household size for comparison purposes.

Amenities and utility assets were used to construct the wealth index that indicated long run wealth status. These assets were grouped as furniture and; consumer durables (watch, iron box, sofa bed and mattress), transportation (bicycle, motorbike and car), communication (radio, television, cell phone and landline), water and energy (source of drinking water and energy for cooking and lighting), and housing (toilet, building materials and possession of more than one house). The wealth index was estimated using the statistical procedure of Principal Components Analysis (PCA), which is closely related to factor analysis. This procedure was used to determine the factor loadings that attached weights to the amenities and assets. The first principal component is the linear index of variables with the largest amount of information common to all of the variables (Filmer and Pritchett, 2001). The result of Principal Component Analysis is the physical wealth index for each household based on the formula described in Equation 4.

$$PWI_j = \sum_{i=1}^{n} f_i (a_j - a_i) / s_i \qquad \textbf{(4)}$$

Where:

f_1 = factor scoring for the first asset as determined by the procedure

a_{ji} = the j^{th} household's value for the first asset

a_i and s_i = the mean and standard deviation of the first asset variable over all households.

The factor loadings of the components were summed to account for at least 50% of the explained variance. The summed factor loadings formed the scoring factor used in Equation 4 above. Furthermore, graphical analysis was used to depict the differential possession of amenities and assets between the relatively poor and rich households. In creating the poverty groups, the wealth index variable was sorted in descending order defining increasing poverty depth. Three groups were created from the top entailing 20%, 40% and 40% of the rich, middle and poorest strata, respectively. Possession of amenities and assets was mapped for the two contrast groups of rich and poor households.

(c) Human capital

The quality of education of the household head and its members indicates the quality of the human capital. Other elements of human capital include the dependency ratio, number of extension visits per household per year, and number of years of education of the household members. Illness (Ill Health Intensity indices) and nutrition (Body Mass Index and Z-scores) are factors that can affect human capital directly or indirectly.

The health status of household members affects the quantity and quality of the labour force available to a household. The index was constructed with the incorporation of ten diseases: Malaria or fever, dysentery or diarrhoea, respiratory diseases, measles, typhoid, tuberculosis, under nutrition, HIV/AIDS, injurious accident and lifetime disease or disorder. For each disease, a disease intensity index was calculated using Equation 5.

$$IHI_j = \sum_{k=1}^{m}\left[\sum_{i=1}^{n}\left(\frac{d_j}{N_j}\right)\bullet\theta\right] \qquad (5)$$

Where:

IHI_j = Ill Health Index of the j^{th} household from diseases $k^{th} = 1 \ldots m$
d_{ij} = number of days the i^{th} member of the j^{th} household suffered from disease k^{th}
N_j = unadjusted size of the j^{th} household
$1 \ldots n$ = members of household j^{th} who suffered from disease k^{th}
$k \ldots m$ = portfolio of diseases that afflicted the j^{th} household
θ = annualisation factor = 1/365

IHI increases in magnitude with increasing intensity of suffering from diseases by members during a reference period. Therefore IHI explains the level of ill health or morbidity in the household.

(d) Financial capital

Different households can access different sources of capital depending on the kind of other assets which the household has. The forms of financial capital in this study are cash at home or in pocket, cash at bank, formal and informal credit, jewellery, remittances, and transfers in kind from relatives and friends. These were analysed using frequencies and cross tabulation to show the proportion of households accessing a given source of capital. The value of non working animals was also computed to reflect financial endowment of the households using descriptive statistics.

The Composite Liquidity Asset (CLA) index combines the access to the various sources of financial capital and the ordinal ranks of their magnitude and easiness to raise or access and spend. The easiness to access, assesses the ability of the household to acquire that source of capital while easiness to spend addresses the aspect of households' ability to liquidate it in case a financial obligation arises. The sources of financial capital can

be classified into three groups: current assets (cash at bank, cash in hand, claim on good debtors and jewels), conditional credit (formal and informal credit), and social transfers (cash remittances from relatives and friends, and in kind transfers).

The CLA index is constructed from the respondent's ranking of the sources of financial capital which he or she could access in relation to its magnitude, and how it ranks in terms of its easiness to raise and spend. These ordinal rankings were reordered to reflect cardinal weights in the index as 1 = not easy, 2 = moderate, and 3 = very easy to raise. These ranks together with ranks for the magnitude of money value accessible from a range of sources were averaged to get a precise rank (r_{ij}). CLA can be mathematically expressed as in Equation 6.

$$CLA_{ij} = \sum I_j \left(\frac{R_i}{r_j} \right) \qquad \textbf{(6)}$$

Where:

CLA_{ij} = the liquidity asset index of household i = 1 … n and financial capital source j = 1 … m

I_{ij} = an indicator variable equal to 1 if the household *i* accessed a source of capital and 0 for otherwise

r_{ij} = the average cardinal rank given to source *j* among sources accessed by house hold *i* computed by averaging the ranks across easiness to raise and spend at tributes

R_i = the number of sources of finance ranked.

The CLA index increases with the number of financial capital sources which a household had access to and the easiness of its being raised and spent. Descriptive statistics were then used to analyse these variables.

(e) Social capital

This is shown by the subscription of household members to social associations like women groups and community development. Social capital seeks to establish the proportion of households belonging to each type of association and how these influence their livelihood.

Livelihood contexts and strategies

A livelihood context examines land allocated to various crops by households by estimating the mean land per crop in every district in hectares. Crop (maize) productivity estimates the yield in metric tonnes per hectare of maize and per type of cropping system: local maize monocrop, improved (OPV and hybrid) maize monocrop, local maize intercropped and improved maize intercropped.

Livelihood strategy income was derived from summation of annual incomes from the various livelihood strategies (farm and non farm activities) which households were

engaged in as shown in Equation 7. Per capita income for each household was then calculated by dividing the total livelihood strategy income by adjusted household size.

$$I_i = \sum_{j=1}^{n} E_{ji} / HS_i \quad \textbf{(7)}$$

Where:

I_i = annual income per capita of the i^{th} household from various livelihood enterprises

E_{ji} = income from the j^{th} livelihood enterprises (crop production, livestock, business, formal employment, wage work, technical and artisan works, natural resources, traditional medicine and resource rent) of the i^{th} household

HS_i = adjusted household size of the i^{th} household.

Livelihood outcomes

Anthropometric measurements are useful for assessing the livelihoods of a group of people. The Body Mass Index (BMI) measures the nutritional status based on the height and weight of the individual. It is used to compare and determine the health effects of body weight on human beings. A BMI score of between 22 and 24 is considered normal. Below the lower limit, the individual is underweight; and above the upper limit, the individual is overweight or obese.

$$BMI_i = W_i / (H_i)^2 \quad \textbf{(8)}$$

Where:

BMI_i = the body mass index of the i^{th} mother or female guardian

W_i = weight of the i^{th} mother or female guardian

H_i = the height of the i^{th} mother or female guardian.

The most common indicators used for assessing the nutritional status of children are Z-scores. The Z-score is the difference between the value (weight) of a child and the median value (weight) of the healthy reference population of children of the same age or height, divided by the standard deviation of the reference population as shown in Equation 9.

$$Z_i = (V_i - M)/S \quad \textbf{(9)}$$

Where:

Z_i = the Z-score (SD score) value of the i^{th} child

V_i = the weight of the i^{th} child

M = median weight of the reference population

S = the standard deviation of the reference population.

The Z-scores on weight for height (wasting) or ZWFH, weight for age (underweight) or ZWFA, and height for age (stunting) or ZHFA were made for children aged five years and below in all districts. The Z values used in the classification of children

were as follows: Z>-1.00 is normal; -1.00>Z<-2.00 is mild malnutrition; -2.00>Z<-3.00 is moderate malnutrition; and Z< -3.00 is severe malnutrition.

Analysis of determinants of poverty

A logistic model was used to estimate the probability of a household being poor which takes a value of *1* if a household is poor, and *0* if otherwise (Kennedy, 1998). The households were classified into three categories using the Filmer and Pritchett approach of 20% top most (rich), 40% middle and 40% bottom (poor) using the wealth indices sorted in descending order. The rich and middle (60%) took the value of 0 while the poor (40%) took the value of 1 as shown in Equations 10–12.

$$P_i^* = \mathbf{X_i}\beta + \varepsilon_i \quad \textbf{(10)}$$

$$p_i = 1 \quad \text{if} \quad P_i^* \geq 0 \quad \textbf{(11)}$$

$$p_i = 0 \quad \text{if} \quad P_i^* < 0 \quad \textbf{(12)}$$

Where β and ε_i represent the vector of parameters and unmodelled influences, respectively. We consider P_i^*, a response variable and define a dummy variable p_i which takes the value of 1 if the household is poor and 0 if otherwise. The arguments of the right hand side (X_i) include natural assets, physical, financial, social, human capital characteristics, and demographic characteristics of households. Natural asset variables are landholding (in acres) and whether Striga has infested the land or not, physical asset is given by the Physical Assets Index which aggregates the value of productive assets and total livestock units, while the financial aspect is indicated by accessibility to conditional financial assets (informal and formal credit) and cash remittances from relatives or friends. Social capital is indicated by the number of household members in group affiliations. Human capital characteristics include the dependency ratio, number of extension visits, number of years of formal education of household head, gender of the household head, whether the household head works off-farm, formally educated adult female ratio and the Ill Health Index.

Outline of the report

This report consists of six chapters. Chapter one is the introduction which gives the background information, conceptual framework and methodology. The methodology describes the study area, sampling procedure, sample size and data analysis techniques used for the study. Chapter two gives information on the characteristics of the households and livelihood capital which they own. Chapter three explains the livelihood contexts and strategies employed by households in allocating resources among alternative activities they are engaged in. Chapter four shows the analysis of the livelihood outcomes and Chapter five shows the micro-level determinants of livelihood outcomes. Chapter six gives the conclusions and recommendations of the study.

Chapter 2

Characteristics of households and livelihood capitals

Characteristics of sampled households

This study shows that the majority of households in the study area were headed by men (Table 2). The adjusted[1] household size of 4.8 was almost equal to the national average of 4.7 people per household according to the 2002 population and housing census. Results also indicated that Budaka District had the highest number of people per household with an average of 5.1 people while Namutumba had the lowest of 4.4 people. The dependency ratio for Busia is the highest compared to that of other districts. This indicates that households tended to have more dependants relative to able bodied members, a common feature of poor countries in SSA. The average age of the household heads in the study area was 44.5 years which is considerably young. The results indicated that household heads in Tororo District were slightly older than those in other districts. Household heads in Namutumba District registered the lowest average age of 41.8 years. This suggests that there is rural – urban migration among the relatively younger people who are also the most economically active.

Table 2: Characteristics of sampled households

Characteristics	All	Tororo	Busia	Budaka	Namutumba
N	300	75	75	75	75
Male headed households	84.7	88.0	74.7	82.7	93.3
Average household size	4.8	4.8	4.7	5.1	4.4
Average age of household heads	44.5	48.1	42.9	45.0	41.8
Attended school for household heads (%)	72.0	85.3	78.0	74.7	80.0
Dependency ratio	1.6	1.6	1.8	1.4	1.5
Average years of schooling for household heads	5.6	5.7	6.4	5.0	5.3
Major occupation (crop production) of household heads (%)	74.7	78.7	73.3	66.7	80.0

N = Number of respondents

About 70% of household heads had attended school. Busia District had the highest proportion of household heads having attended school followed by Tororo, then Namutumba and lastly Budaka District. However, average years of schooling for household heads was 5.6 years which means that the majority barely completed

1 Adjusted to composition and economies of scale using adult equivalents as stipulated in the methodology section.

primary education, attainable in seven years. Most household heads were engaged in crop production as their main occupation. The level of diversifcation away from crop production was highest among households in Budaka and Busia compared to Namutumba and Tororo districts. Busia District borders Kenya a situation which favours cross border trading and commercialisation.

Livelihood capitals

Natural capital

The natural capital entails resources provided by nature such as land. Land is an essential factor of production which households accessed through different tenure arrangements. Some of the forms of land acquisition include private titled land, land with use rights, renting, land received as a gift, or even borrowing. From the study it can be observed that the majority of the households have land that has use rights (Table 3). This is also common among the rural families that inherit land which had use rights. Private titling of land, which is increasingly encouraged by land reforms in many SSA countries, is still uncommon among rural smallholders. Namutumba and Tororo districts had relatively larger average land holdings compared to Busia and Budaka. Less popular land access arrangements across districts included sharecropping, borrowing, gifting and renting.

Table 3: Average land access by tenure arrangement

Tenure arrangements	All		Tororo		Busia		Budaka		Namutumba	
	N	ha	N	ha	N	ha	N	ha	N	ha
Total land ownership	300	1.6	75	1.9	75	1.4	75	1.3	75	1.9
Private titled land	31	1.7	5	2.0	6	1.8	4	1.7	16	1.6
Land with use rights only	261	1.4	71	1.5	67	1.3	72	1.2	51	1.7
Rented in land	49	0.6	17	0.9	7	0.5	8	0.4	17	0.6
Sharecropped land	11	0.6	1	0.2	1	0.6		–	9	0.6
Borrowed land	10	0.5	5	0.5	1	0.1		–	4	0.5
Gifted land	8	1.7	4	0.8		–		–	4	2.6
Rented out land	7	1.2	3	1.1		–	1	3.2	3	0.5

N = Number of respondents

In terms of land use, the largest proportion of land was allocated to annual crops followed by fallow then grazing. Across districts more than 60% of the total farmland was allocated to annual crops with the exception of Busia District (Table 4). In Busia District, more than 40% of the total farmland was under fallow. This situation would have resulted from the influence of cross border participation in off farm activities which compete with farming mainly for labour.

Table 4: Land utilisation (percentage of total farmland)

Types of use	N	All	N	Tororo	N	Busia	N	Budaka	N	Namutumba
Total land ownership (ha)	300	1.6	75	1.9	75	1.4	75	1.3	75	1.9
Annual crops (%)	292	64.2	75	64.9	73	47.8	71	84.6	73	61.3
Perennial crops (%)	32	2.3	7	2.0	7	1.6	3	2.5	15	2.9
Mixed crops (%)	17	2.6	5	0.7	1	0.4	8	8.9	3	1.7
Grazing (%)	54	9.2	21	8.2	12	8.8	10	7.9	11	11.4
Fallow (%)	127	21.7	30	20.9	62	43.0	14	5.0	21	19.4

N = Number of respondents (Pls check shouldn't the columns be N and %)

Physical capital

Households in Tororo and Namutumba districts were better off in terms of stocks of productive assets compared to those in the remaining two districts (Table 5). Households endowed with adequate and more productive tools would more easily transform agricultural resources into livelihood outcomes. As indicated by the average wealth index, households in Busia District appeared to be better off compared to households in other districts. Long run deprivation in improved amenities and possession of utility assets was widespread in Budaka and Tororo districts.

Table 5: Descriptive statistics of productive assets and wealth indices

Locality/index	Descriptive statistics				
	N	Mean	Std Dev	Minimum	Maximum
Productive Assets Index					
All	300	10.4	6.9	1.0	49.0
Tororo	75	11.8	8.1	2.0	49.0
Busia	75	9.3	5.4	1.0	27.0
Budaka	75	9.8	6.3	1.0	32.0
Namutumba	75	10.6	7.2	2.0	31.0
Wealth index					
All	300	-0.001	4.83	-11.79	14.45
Tororo	75	-0.5	5.6	-11.8	9.2
Busia	75	1.7	3.6	-6.2	10.2
Budaka	75	-1.7	4.8	-11.5	11.4
Namutumba	75	0.5	4.5	-7.6	14.5

Scatter plots (Figure 3) have been used to compare the rich and poor regarding binary possession of assets and amenities. The rich tended to have more assets and improved amenities compared to the poor. With respect to communication assets, the majority of

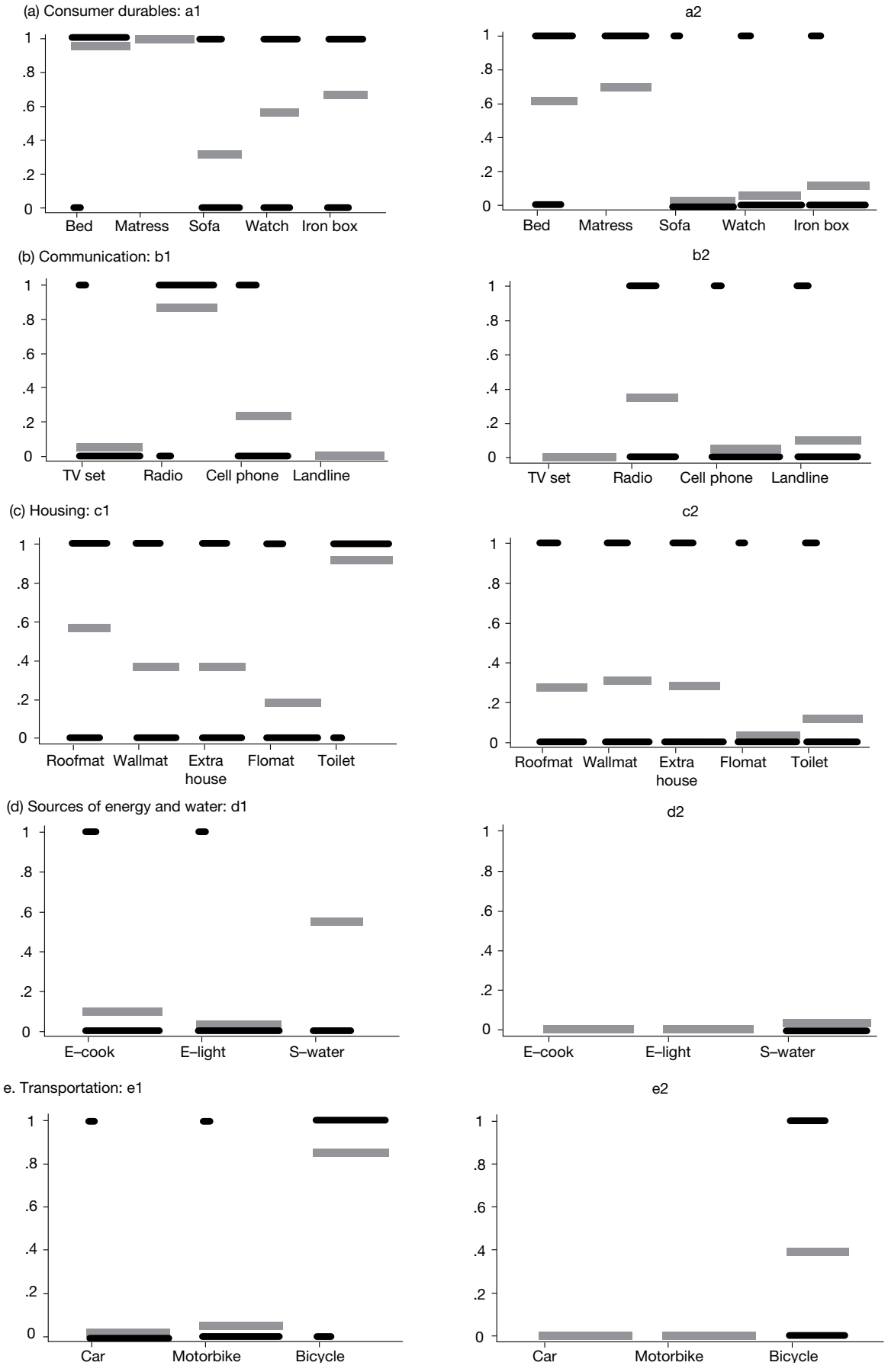

Figure 3: Housing and assets owned by the rich (left graphs, 1s) and the poor (right graphs, 2s)

poor households did not own television sets compared to the rich, but to some extent the poor owned radios and mobile phones. The rich are assumed to have accumulated wealth over time and can easily acquire consumer durables. The rich households had better housing compared to the poor. Both the poor and the rich had an extra house used for sleeping. The majority of the rich had improved toilets compared to the poor. Most poor households used primitive sources of energy and drinking water compared to rich households. In terms of transportation assets, there was no big difference between the poor and the rich but only that more of the rich owned bicycles than the poor. A few of the rich households owned motorbikes and cars while none among the poor did.

Human capital

Every household is endowed with human capital whose quality and quantity shapes its livelihood strategies. The overall average number of years of schooling for the household heads was less than the seven years taken for completing primary education (Table 6). More men received formal education compared to their female counterparts which is a common trend in rural SSA where more boys are enrolled in school compared to girls. Furthermore, women form a larger part of the farm labour force among the rural farmers who rely on family labour. The level of education determines the cognitive capacity which, in turn, dictates how a farmer uses information and existing livelihood opportunities such as novel technologies in pursuit of a sustainable livelihood. The average number of extension visits by public and private institutions, and local NGOs at three per year is very low. Compared to other districts, households in Namutumba District were visited most frequently by extension officers. Ill health was more intense in Budaka and less pronounced in Tororo compared to other districts. The ill health situation is one of the vulnerabilities that affect the quality and quantity of human capital available. Where diseases are more prevalent, the amount of labour available to farming reduces considerably. Furthermore, ill health is an impoverishing driver as sometimes assets may be liquidated or used up to treat the sick.

Table 6: Descriptive statistics of human capital attributes

Attributes	All	Tororo	Busia	Budaka	Namutumba
Years of schooling of household head	5.6	5.7	6.4	5.0	5.3
Dependency ratio	1.6	1.6	1.8	1.4	1.5
Formally educated male ratio	0.4	0.4	0.4	0.4	0.4
Formally educated female ratio	0.3	0.3	0.4	0.3	0.3
Number of extension visits per year	3.0	2.4	0.9	1.7	7.2
Ill Health Index	0.021	0.011	0.018	0.036	0.019

Financial capital

Cash at home or pocket is the only source of capital that was accessed by majority of the households in all districts (Table 7). Less than 8% of the households across districts had any savings at a bank. This can be explained by the fact that majority of households depend on agriculture whose incomes are seasonal and unstable. Over 25% of the households in Busia District had claims on good debtors who are very likely to pay them back while households in other districts had limited access to the same liquidity source. The influence of cross border trade activities in Busia District, might be the encouraging factor in money lending practices. About 34% of the households in Namutumba had access to formal credit but Budaka and Tororo districts had lower access at 1.3%. This high percentage in Namutumba is due to the fact that most households (>75%) belong to savings and credit, safety net and women groups. Informal credit can be accessed by more than 25% of respondents in Busia and Tororo districts. About 20% of the households in Tororo and Namutumba districts received cash remittances from relatives or friends who work off farm. Up to 21% of the households in Namutumba district received in kind remittances from relatives or friends while none in Budaka District had access to the same financial resource.

Table 7: Sources of financial capital (%)

Financial sources	All	Tororo	Busia	Budaka	Namutumba
N	300	75	75	75	75
Cash savings at bank	5.7	8.0	2.7	4.0	5.3
Cash savings at home/pocket	75.7	48.0	74.7	90.7	89.3
Claim on debtors	12.0	8.0	26.7	1.3	12.0
Jewellery	0.3	–	–	–	1.3
Formal credit	11.7	1.3	9.3	1.3	34.7
Informal credit	19.3	26.7	34.7	8.0	8.0
Cash remittances from relatives/friends	19.0	22.7	18.7	6.7	26.7
In kind remittances from relatives/friends	8.7	6.7	5.3	–	21.3

N = Number of respondents

Most households in every district kept poultry followed by goats and then cattle which were a major contributor of animal related financial capital (Table 8). Piggery enterprises were also an important source of income to some households especially in Tororo and Busia districts.

Table 8: Mean value of non working livestock

Livestock	All		Tororo		Busia		Budaka		Namutumba	
	N	US$	N	US$	N	US$	N	US$	N	US$
Cattle	126	409.1	32	330.9	24	566.7	34	329.1	36	449.0
Goats	157	55.0	48	61.6	35	74.2	33	40.1	41	42.8
Sheep	19	33.5	6	20.0	3	56.1	5	29.4	5	40.2
Pigs	54	58.8	23	40.2	13	23.1	10	135.1	8	74.7
Poultry	239	20.3	67	21.0	68	18.1	50	22.4	54	20.3
Rabbits	2	6.5	–	–	–	–	1	11.1	1	1.8
Pigeons	10	5.9	4	7.8	1	1.8	2	4.4	3	5.6
Pets	2	11.4	1	12.0	–	–	1	10.8	–	–

N = Number of valid respondents; US$ 1 = Ushs 1,665 (2007 rates)

Social capital

Social groups are important and play a unique role in any given society. Results in Table 9 indicate that more than 30% of the households had membership of community development and women groups. The results also indicate that the majority (>59%) of households in Tororo, Busia and Budaka districts had membership of community development and women groups. In Namutumba, the majority belonged to women groups and informal insurance groups as safety nets against livelihood shocks. Budaka and Namutumba districts had most of their households (24% and 18%, respectively) subscribing to credit and savings associations.

Table 9: Memberships to social associations (% of households)

Type of association	All	Tororo	Busia	Budaka	Namutumba
N	157	36	41	42	38
Community development	32.9	61.1	26.2	36.6	10.5
Cooperative association	0.6	–	–	–	2.6
Religious group	7.6	8.3	19.0	–	2.6
Credit and savings group	13.3	8.3	2.4	24.4	18.4
Informal insurance (safety net)	12.7	–	19.0	4.9	26.3
Women group	31.6	22.2	33.3	34.1	34.2
AIDS group	1.3	–	–	–	5.3

N = Number of valid respondents with multiple responses

Chapter 3

Livelihood contexts and strategies

Land allocation

Maize, millet, cassava and sweet potato were the major crops grown by many households. Maize was allocated more land compared to other crops in all districts. This shows how maize has become an important crop among the households. Majority of the farmers planted local varieties. Cassava was another important crop grown by about 50% of the sampled households (Table 10). Cassava helps families reduce food insecurity by providing food when other sources are out of stock. Millet was also grown by a notable number of households in Tororo and Budaka districts who allocalted an average of 0.4ha and 0.3ha, respectively. In these districts, millet is used to make local beer and is also exported to Kenya through middlemen. Sweet potato was also important to about 27% of the households in all districts who allocated 0.2ha for the crop.

Table 10: Land allocations among crops

Crops	All		Tororo		Busia		Budaka		Namutumba	
	N	ha	N	ha	N	ha	N	ha	N	ha
Local maize (monocrop)	141	0.4	31	0.4	50	0.4	26	0.3	34	0.2
Improved maize (monocrop)	52	0.6	17	0.7	4	0.5	12	0.3	19	0.3
Local maize (intercropped)	89	0.4	20	0.4	18	0.3	29	0.3	22	0.2
Improved maize (intercropped)	26	0.5	8	0.4	6	0.5	8	0.7	4	0.2
Beans	31	0.2	8	0.2	3	0.2	9	0.1	11	0.1
Sorghum	67	0.3	12	0.2	5	0.2	48	0.3	2	0.1
Millet	106	0.3	38	0.4	8	0.2	37	0.3	23	0.1
Soya bean	8	0.2	1	0.1	2	0.2	1	0.2	4	0.1
Groundnuts	66	0.3	19	0.3	7	0.2	20	0.3	20	0.2
Cowpea	5	0.2	–	–	–	–	4	0.2	1	0.1
Sunflower	1	0.4	–	–	–	–	–	–	1	0.2
Cassava	137	0.4	48	0.5	39	0.4	17	0.3	33	0.2
Irish potatoes	1	0.4	1	0.4	–	–	–	–	–	–
Sweet potatoes	80	0.2	15	0.2	3	0.2	19	0.1	43	0.1
Vegetables	8	0.2	7	0.2	–	–	1	0.1	–	–
Banana	19	0.4	6	0.5	3	0.1	3	0.9	7	0.1
Coffee	10	0.3	1	0.1	–	–	1	0.4	8	0.1
Tobacco	3	0.3	3	0.3	–	–	–	–	–	–
Rice	16	0.2	3	0.2	–	–	10	0.2	3	0.1

N = Number of valid responses

Seed procurement, yield and profitability of maize enterprise

Maize seed procurement

Figure 4 shows that most of the households when planting improved maize tended to source seed from the market instead of recycling. On the contrary, the majority of farmers used home-saved seed when they planted local maize. Improved maize varieties such as OPVs can be recycled for some time before losing their genetic vigour. As a result, farmers are advised to use new seed every season if they want to reap the productivity advantage associated with improved varieties. In Busia District, none of the sampled households recycled improved seed during the reference season. As Busia District borders Kenya which dominates the seed sub-sector trade in East Africa, farmers would have good access to improved seed markets. It can be said that smallholder farmers are able and willing to invest in improved maize technology once it is made available in convenient market places.

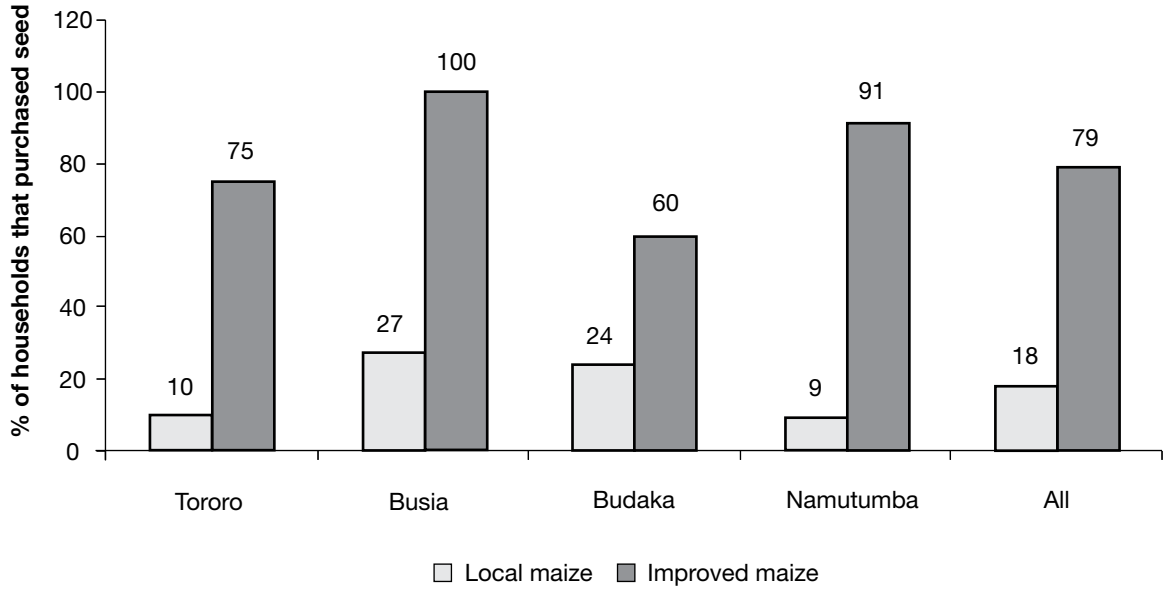

Figure 4: Procurement of maize seed from the market by district

Maize yields with levels of *Striga* infestation

Generally, the maize yield trend shown in Figure 5 suggests that the expected outcome of improved maize being superior to local maize especially under severe *Striga* infestation. Unexpectedly, in Tororo and Busia districts, the productivity potential of improved maize over local maize with no *Striga* infestation did not occur. This means that once *Striga* is not a stumbling block, other factors that undermine a poorly adapted improved variety might come into effect. For example the full potential of an improved variety could be realised when fertiliser is also used at the recommended rates. In a nutshell, the use of improved maize varieties can appreciably offset the detriment occasioned by *Striga* on crop productivity.

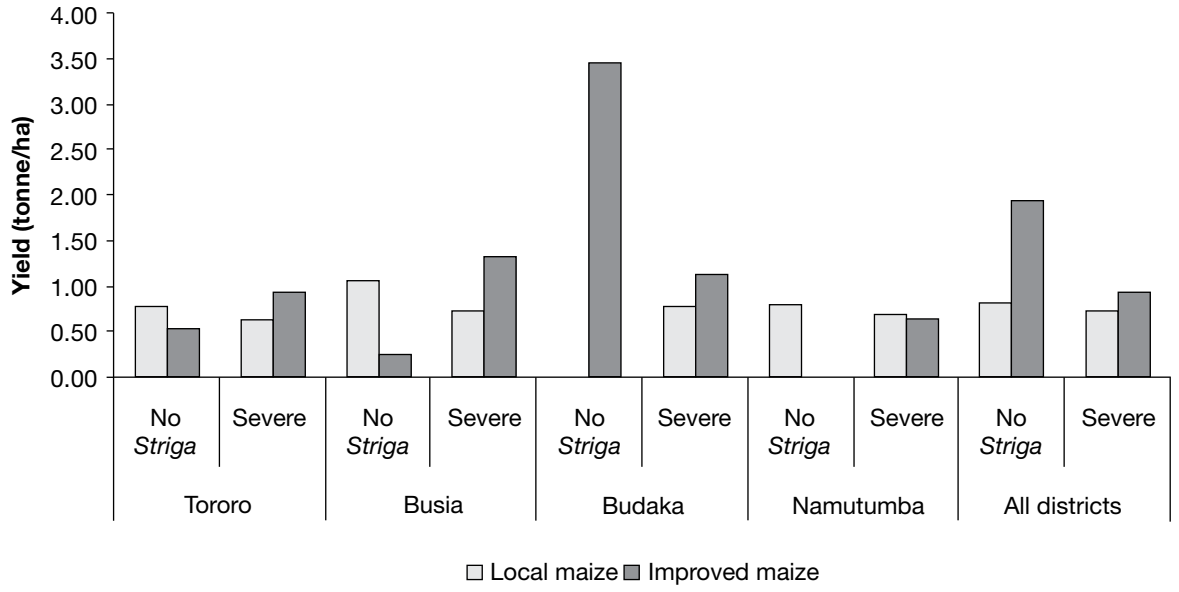

Figure 5: Yield of maize with different levels of Striga *infestation by district*

Maize returns to land

Profitability in terms of financial returns to critical factors like land is pivotal for the growth and sustainability of the maize enterprise. Figure 6 shows that returns to land with and without *Striga* infestation followed the same trend as that of yield in Figure 5. This implies that maize related input and output markets were transparent to all farmers in respective districts. In other words, farmers experienced much similar maize input and output prices giving similar cost and revenue structures. As in the case of yield, adoption of improved maize has the potential for increasing income from maize, thereby contributing to poverty reduction.

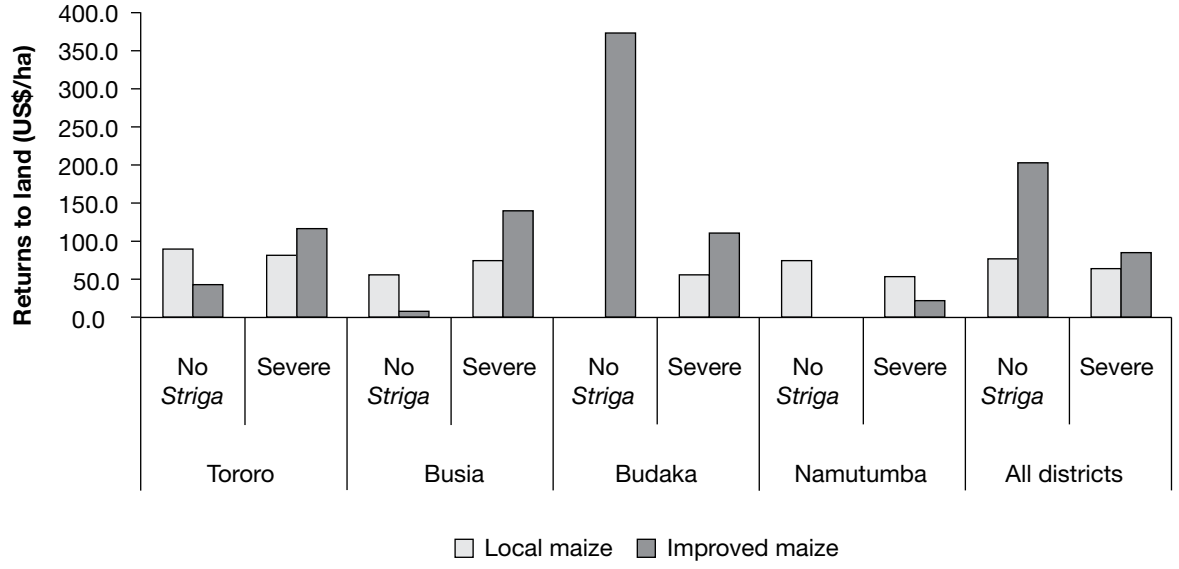

Figure 6: Returns to land from maize with different levels of Striga *infestation by district*

Determinants of land allocated to improved maize varieties

Understanding the extent of adoption of novel technologies like an improved maize variety and factors underlying it are critical in research for development. A binary choice regression model was estimated with households that allocated more than 50% of farmed land to improved maize was assigned a value of '1' and '0' otherwise. The chance of the household allocating more than 50% of its farmed land to improved maize increased with the wealth index, number of extension visits and overall maize production. In this regard, wealthier households adopted improved maize varieties more widely compared to poorer households (Table 11). The more extension visits a household gets, the more likely it is to adopt or allocate more land to a given enterprise which is being introduced. Households that allocated more land to improved maize realised more from overall maize production.

Table 11: Determinants of land allocation to improved maize

Determinants	Average	SD	Expected sign	β
Physical wealth index	-0.3	2.0	+	0.223**
Number of extension visits per year	3.0	6.6	+	0.046*
Overall liquidity in US$	228.4	548.6	+	-0.001
Overall income per capita	86.2	160.3	+	0.002
Household head working off farm			+	0.833
Household from different social status			–	-0.078
Overall maize production	301.0	420.2	+	0.003**
Constant				-2.081***
Goodness of fit measures				
-2log likelihood				274.21
% of correct prediction				80.8

***, ** and * significant at 1%, 5% and 10%, respectively

Production and post–harvest constraints

A range of factors constrained production and storage of farm produce. These factors include *Striga*, stalk borer, storage pests, and land shortage among others (Table 12). *Striga* was seen as a major constraint to maize production in all the districts and was widely felt in Busia District (100%). Stalk borer, low soil fertility and storage pests were other production and post–harvest constraints cited by respondents. In Budaka District, farmers were constrained by almost all constraints except water logging and vermin. Low and erratic rainfall, water logging, inadequate input supply and vermin were less prominent in Namutumba District compared to other districts.

Table 12: Production and post–harvest constraints (% of households)

Constraints	All	Tororo	Busia	Budaka	Namutumba
N	300	75	75	75	75
Striga	95.0	85.3	100.0	97.3	97.3
Stalkborer	65.0	57.3	54.7	53.3	94.7
Storage pests	69.0	54.7	61.3	85.3	74.7
Low and erratic rainfall	36.2	20.0	46.7	68.0	9.6
Water logging	14.8	25.3	25.3	5.3	2.7
Low soil fertility	62.0	44.0	58.7	77.3	68.0
Inadequate input supply	44.3	40.0	38.7	76.0	21.9
Land shortage	53.8	42.7	40.0	64.9	68.0
Vermin	28.9	13.3	54.3	25.0	–

N = Number of respondents

Low productivity and post–harvest losses of food grains like maize are behind food insecurity of many farming households in SSA. Table 13 shows that between half and three quarters (61-93%) of households ranked *Striga* as a critical constraint to maize production. After *Striga* followed land shortage, inadequate input supply, low soil fertility and stalk borer in that rank order. Therefore, *Striga* ranks as the most limiting factor to maize production in eastern Uganda.

Table 13: Maize production and post–harvest constraints

Constraints	All	Tororo	Busia	Budaka	Namutumba
N	300	75	75	75	75
Striga (%)	75.7	61.3	77.3	93.3	70.7
Stalkborer (%)	6.7	1.3	13.3	1.3	10.7
Storage pests (%)	1.3	1.3	1.3	1.3	1.3
Low and erratic rainfall (%)	0.3	–	1.3	–	–
Water logging (%)	0.7	2.7	–	–	–
Low soil fertility (%)	4.0	4.0	5.3	2.7	4.0
Inadequate input supply (%)	3.3	1.3	1.3	1.3	6.7
Land shortage (%)	6.7	14.7	5.3	–	6.7
Vermin (%)	0.3	–	1.3	–	–

N = Number of respondents

Most of the households reported severe *Striga* infestation levels in the study area. In Tororo District, *Striga* infestation was mild in most of the cereal based farms (53%)

although severe (42%) in some farms (Table 14). In the other districts infestation levels were perceived as severe. The severity was high in Budaka District due to the fact that it started being a problem much earlier compared to other districts (see Figure 7), and that as a result the *Striga* seed bank would have grown substantially.

Table 14: Severity of *Striga* infestation (%)

Level of infestation	All	Tororo	Busia	Budaka	Namutumba
N	297	74	75	74	74
No infestation	4.0	5.4	1.3	4.1	5.4
Mild infestation	36.4	52.7	34.7	24.3	33.8
Severe infestation	59.6	41.9	64.0	71.6	60.8

N = Number of valid households

Time when *Striga* became a problem

On average over 94% of the households in the region perceived that *Striga* became a problem from 1976. *Striga* was perceived to be a problem in Budaka District by more than 70% of the households between 1976 and 2000 compared to less than 44% who perceived it to be so in other districts in the same period (Figure 7). The finding that a high percentage of farmers perceive *Striga* to be a problem over time is confirmed by the severity, which indicates that over 74% of the households reported severe infestation in Budaka.

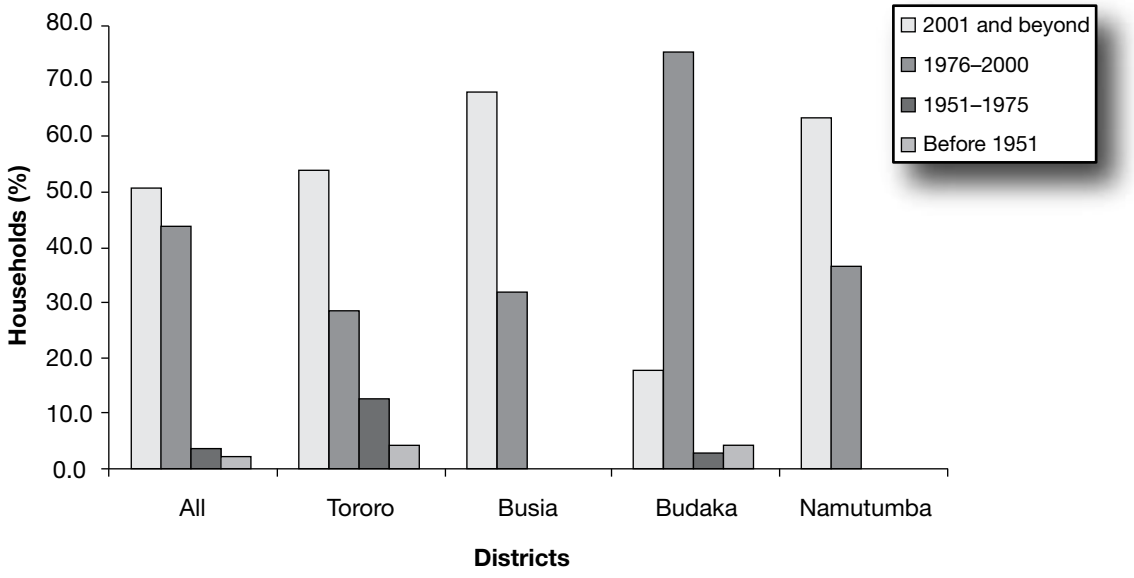

Figure 7: Periods when Striga *perceived important by farmers in sampled districts*

Traditional *Striga* control methods

Traditional *Striga* control methods that households in the region use include uprooting, manuring, intercropping, burning and shifting cultivation. Households rarely use one *Striga* control measure, rather they use several of them in combination. Over 70% of the households employed uprooting (in combination with other control measures such as shifting cultivation, burning, intercropping and manuring) as their main *Striga* control measure (Figure 8). Intercropping was the second *Striga* control measure used by 15% of the respondents. Shifting to *Striga* free plots was the third in order of prominence probably due to land scarcity coupled with severe *Striga* infestation.

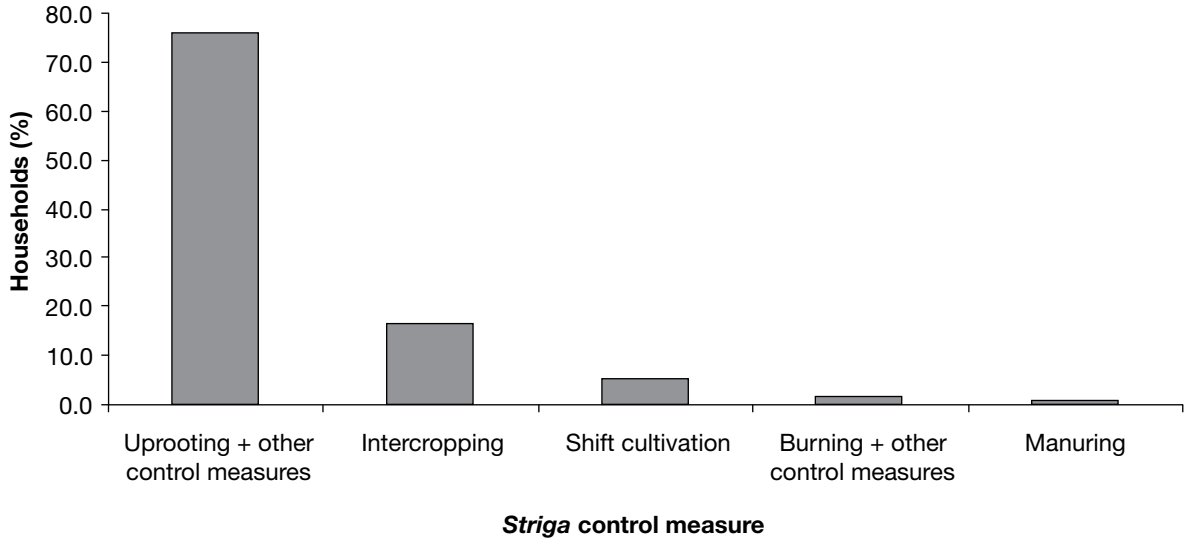

Figure 8: Traditional methods of Striga *control*

Awareness and use status of modern *Striga* control technologies

A few of the households in the region were aware of modern methods of controlling *Striga.* Use of kraal manure and fertiliser were known to at least a few households in all the districts. More households in Tororo District were aware of the use of manure (16%) and inorganic fertiliser (8%) to control *Striga* (Table 15) because a few households in Tororo have livestock which is a source of manure. Use of *Striga* resistant maize grown with and without legumes was known to very few households in all districts except for Busia District where no one had such knowledge. Push–pull technology was known to a few households in all districts except Namutumba. This is because the International Centre for Insect Physiology and Ecology (ICIPE) in collaboration with the Africa 2000 Network is promoting the use of this technology to control *Striga* and stalk borer in eastern Uganda.

Awareness and use of modern *Striga* control technologies is still low in all districts. The low awareness levels can be attributed to unavailability of information on the modern technologies. Thus more awareness campaigns are still needed given that *Striga* is a major constraint to cereal production among most of the households in the study area.

Table 15: Awareness of modern *Striga* control technologies (% of households)

Technology	All	Tororo	Busia	Budaka	Namutumba
N	300	75	75	75	75
Farmyard manure	5.3	16.0	2.7	2.7	2.7
Inorganic fertiliser	3.0	8.0	1.3	2.7	2.7
Striga resistant maize with legumes	0.3	–	–	1.3	1.3
Striga resistant maize without legumes	1.3	1.3	–	–	4.0
Intercropping legumes followed by cassava/desmodium	1.0	4.0	–	–	–
Push–pull (maize/desmodium stripping)	0.7	1.3	1.3	1.3	–

N = Number of respondents

About half or more of the households who were aware of the modern *Striga* control technologies were using them except for inorganic fertiliser. Half of the households were using farmyard manure and others had either abandoned or never adopted it (Table 16). Very few farmers (only five) were using *Striga* resistant maize without interplanting with a legume but none had ever used *Striga* resistant maize with legumes due to inaccessibility of the seed. The seed is still in the hands of the NGOs and farmers are just being introduced to it through trials. About 0.3% of the respondents in the study area used inorganic fertiliser at planting. This is probably because the cost of fertiliser is prohibitive to most smallholder farmers. Some households might have abandoned using push–pull technology perhaps because they do not own animals who can use the fodder produced from *Desmodium* and Napier grass or because there is no reliable market for the same fodder.

Table 16 : Current use of modern *Striga* control technologies (% of households)

Technology	N	Currently using	Abandoned	Never adopted
Farmyard manure	16	50.0	12.5	37.5
Inorganic fertiliser	9	11.1	22.2	66.7
Striga resistant maize with legumes	1	–	–	–
Striga resistant maize without legumes	4	50.0	–	–
Intercropping legumes followed by cassava/desmodium	3	66.7	–	33.3
Push–pull (maize–desmodium stripping)	2	50.0	50.0	–

N = Number of valid entries

Sources of information on modern *Striga* control technologies

Very few households reported getting information on modern *Striga* control technologies. The main sources of information on modern *Striga* control technologies for most of the households were the extension agents and farmers in the village followed by farmers in neighbouring villages (Table 17). Local NGOs appeared to be promising avenues for promoting new technologies. In this respect the NGOs empower extension staff and farmers with agricultural information.

Table 17: Sources of information on modern *Striga* control technologies (% of N)

Technology	N	Farmers in the village	Farmers in another village	Mass media	Local NGOs	Extension agents	Research institute
Farmyard manure	15	46.7	20.0	6.7	–	26.7	–
Inorganic fertiliser	9	22.2	11.1	22.2	–	44.4	–
Striga resistant maize with legumes	1	–	–	–	100.0	–	–
Striga resistant maize without legumes	4	25.0	–	–	50.0	–	25.0
Intercropping legumes followed by cassava/ desmodium	3	33.3	–	–	–	66.7	–
Push–pull (maize desmodium stripping)	2	–	–	–	50.0	50.0	–

N = Number of households on which the analysis is based

Reasons for non adoption of modern *Striga* control technologies

The households which were aware of modern *Striga* control technologies and who responded to this question gave a number of reasons for their non adoption. Cash constraint to buy inputs associated with technologies was the most important reason for non adoption (Figure 9) followed by gathering information about the technology and some felt it was too risky to adopt. Risk aversion which slows adoption could be reduced by providing more information about novel technologies. Although most households can access cash at home or pocket it may not be sufficient to buy inputs which have been mentioned as being in inadequate supply. Analyses have also shown that not many households are aware of these technologies so there is a need to address potential constraints to their uptake before publicising them. One way would be to provide credit and agricultural extension services.

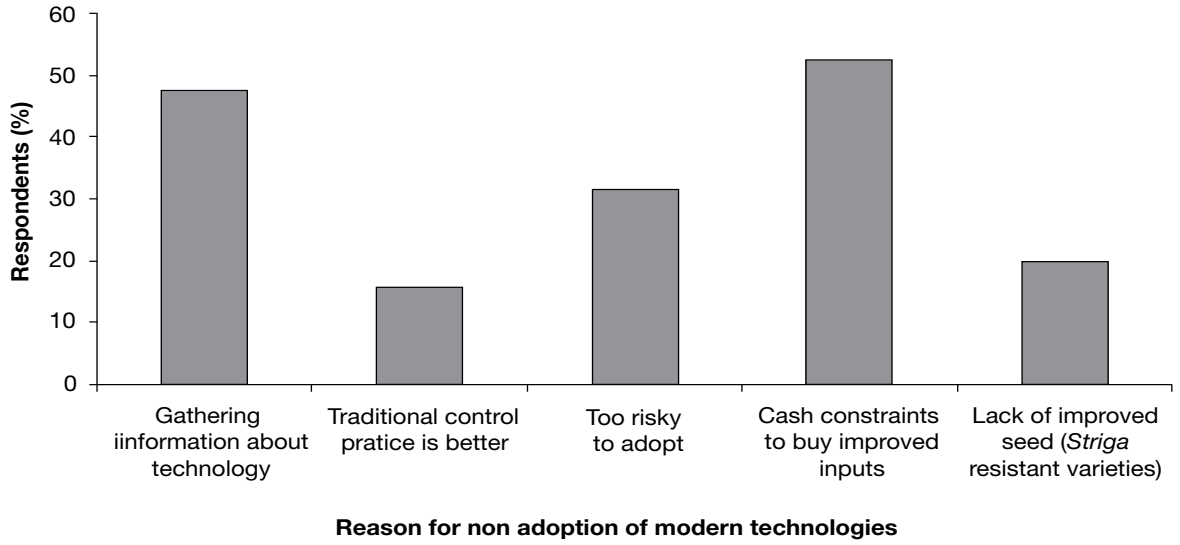

Figure 9: Reasons for non adoption of various Striga *control technologies*

Livelihood income strategies

A livelihood income strategy can be defined as an activity or a set of activities in which a household engages to make a living. These income activities are often linked to market participation. Households engage in diverse income activities so as to earn a reasonable standard of living and, at the same time spread risk. Crop production was the main livelihood strategy of majority of the households in three districts (Table 18). Livestock keeping was the second most important economic activity on average and only more so in Tororo District. Wage work was also important to households in Tororo (13%) and Budaka (15%). In Busia District, natural resource use was second to crop production where 16% of the households were involved in direct exploitation of natural resources, mainly charcoal making. Busia town and other small towns provide markets for charcoal as a main source of energy for cooking. Fishing was also another natural resource activity in Busia District because of its proximity to Lake Victoria.

Livelihood income from market participation

Livelihood strategy incomes are income estimates per person per year obtained from farm and non farm enterprises. Namutumba District had the highest total per capita income while Busia District had the lowest (Table 19). Such low per capita income, as found in Busia, can be attributed to the prevailing high dependency ratio and large household size. Over 90% of the households earned far less than a dollar per day from market participation. The per capita per day per household income for Namutumba was slightly better than those of other districts. These figures cannot be used as poverty indicators because they just give a picture of the proportion of cash income households who had access to markets can earn, leaving out the value of non-marketed products. This indicates that there is a need for households to increase marketed outputs and to engage in more profitable enterprises so as to realise greater returns per day which, in turn, would improve their income status.

Table 18: Involvement of households in livelihood income strategies (%)

Activity	All	Tororo	Busia	Budaka	Namutumba
N	300	75	75	75	75
Crop production	66.3	72.0	60.0	40.0	93.3
Livestock keeping	11.0	24.0	5.3	10.7	4.0
Business	10.0	8.0	14.7	9.3	8.0
Professional employment	4.7	5.3	4.0	4.0	5.3
Wage work	9.0	13.3	4.0	14.7	4.0
Technician	2.3	6.7	1.3	1.3	–
Artisan/handcraft	5.3	5.3	1.3	13.3	1.3
Natural resources	7.3	2.7	16.0	8.0	2.7
Traditional medicine	1.0	–	–	1.3	2.7
Resource rent	1.0	2.7	1.3	–	–

N = Number of respondents

Table 19: Livelihood strategy income

Per capita and proportion	All	Tororo	Busia	Budaka	Namutumba
N	300	75	75	75	75
Farm income per capita (US$)	31.05	31.45	19.20	17.71	55.84
Non farm income per capita (US$)	55.10	59.49	31.03	74.51	55.36
Total per capita income (US$)	86.15	90.93	50.23	92.22	111.21
Per capita per day per household income (US$)	0.236	0.249	0.138	0.253	0.305
Proportion of households with per capita income less than US$ 1 per day	93.7	93.3	94.7	94.7	88.0

N = Number of respondents
Exchange rate was US$ 1 = Ushs 1,665 (2007 rates)

Chapter 4

Livelihood outcomes

Food security

Respondents cited potential causes which they perceived as underlying food insecurity in their households. This gives a first impression of the multifaceted phenomenon of food security. *Striga* was ranked first as the main source of food shortages by the majority in all districts. The *Striga* problem was especially high in Busia and Namutumba. Other factors ranked first included illness in which Tororo had the highest (15%) and land shortage in all districts except Namutumba (Table 20). Drought and low production also contributed to food insecurity in the region.

Table 20: Causes of food insecurity

Causes	All	Tororo	Busia	Budaka	Namutumba
N	300	75	75	75	75
Striga	54.3	20.0	66.7	58.7	72.0
Land shortage	11.3	17.3	9.3	18.7	-
Illness	8.7	14.7	5.3	2.7	12.0
Drought	3.0	1.3	4.0	5.3	1.3
Low production	3.0	4.0	–	8.0	–
Pests and diseases	2.7	–	8.0	–	2.7
Flooding	2.0	6.7	–	1.3	–
Low soil fertility	2.0	–	2.7	2.7	2.7
Lack of labour	1.3	4.0	1.3	–	–
Lack of capital	1.0	2.7	–	1.3	–
Low income	1.0	–	1.3	–	2.7

N = Number of respondents

Shocks

Shocks experienced by households

Some households suffered more than one type of shock in five years preceding the survey. Food deficit was a shock experienced by more than 40% of the households in all the districts but those in Namutumba were hit most as reported by 77% of the sampled households (Table 21). Illness was also experienced in all districts and might have caused deaths of more than 10% of important household members in all the

districts. Loss of animals was reported at low levels in all districts except for Tororo (17%). Famine which might have resulted from drought, hit Budaka more than other districts and forced households to depend on relief food.

Table 21: Percentage of respondents who experienced shocks in the past five years

Type of shock	All	Tororo	Busia	Budaka	Namutumba
N	300	75	75	75	75
Food deficit	58.7	44.0	58.7	54.7	77.3
Famine	10.7	8.0	8.0	17.3	9.3
Loss of property	2.7	1.3	1.3	5.3	2.7
Illness	20.3	20.0	29.3	8.0	24.0
Death of an important member	17.3	18.7	14.7	22.7	13.3
Loss of animals	9.3	17.3	4.0	6.7	9.3

N = Number of respondents

Major causes of shocks

The results shown in Table 22 indicate that *Striga* infestation, human disease, drought and livestock diseases were the major causes of shocks. Households in Tororo District reported human disease as the main cause as it might have caused the death of important family members which either reduced labour or caused psychological stress. *Striga* was the second shock which could have caused food deficits. In Busia, Budaka and Namutumba, *Striga* infestation was cited as the main cause of the shocks followed by human illness. Households in Budaka District reported drought as one of the causes of the shocks associated with low crop production leading to famine.

Table 22: Causes of shocks

Causes of shock	All	Tororo	Busia	Budaka	Namutumba
N	300	75	75	75	75
Striga infestation	46.7	16.0	45.3	53.3	72.0
Drought	10.3	12.0	6.7	17.3	5.3
Floods	1.7	2.7	1.3	–	2.7
Theft	2.0	1.3	1.3	5.3	–
Human diseases	25.3	30.7	37.3	17.3	16.0
Crop pests/diseases	2.3	1.3	4.0	–	4.0
Livestock diseases	5.3	14.7	1.3	5.3	–
Strong wind	0.3	1.3	–	–	–
Lack of inputs	0.3	1.3	–	–	–
Land shortage	1.3	2.7	2.7	–	–
Car accident	0.3	–	–	1.3	–

N = Number of respondents

Effects of the shocks

Economic shocks affected households in many ways and left them more vulnerable. Shocks led to low crop production followed by loss of income in all districts. Shocks also resulted in depletion of assets in Tororo District and reduced labour availability in Busia and Budaka districts (Table 23). The effects of shocks might be far reaching, for example prolonged or frequent illness of household members reduces the amount and quality of human labour available for agriculture. This, in turn, might result in low agricultural production which can lead to the food and income poverty which manifested itself among the sampled households.

Table 23: Effects of the shocks

Effects	All	Tororo	Busia	Budaka	Namutumba
N	300	75	75	75	75
Low production	64.0	42.7	57.3	66.7	89.3
Reduced labour availability	7.3	6.7	9.3	10.7	2.7
Low use of inputs	1.3	–	2.7	1.3	1.3
Health disorders	5.7	8.0	8.0	6.7	-
Loss of source of income	13.0	14.7	21.3	9.3	6.7
Depletion of assets	4.7	12.0	1.3	5.3	-

N = Number of respondents

Responses to shocks

Responses to shocks varied from one district to another. Spending of cash savings, casual labour for cash or food, and sale of animals for cash and shifting to *Striga* free land were common responses to shocks in the region. Households in Tororo District engaged in casual labour for cash or food and sold animals for cash to manage shocks. Since *Striga* infestation was the major shock in Busia District, a notable proportion of households (38%) responded by shifting to *Striga* free plots as well as spending cash savings. In Budaka District, sale of animals for cash and reliance on relief food helped to ease the effect of shocks caused by *Striga* and drought. In Namutumba District where *Striga* and illness were the main shocks, the households had to shift to *Striga* free plots and sell animals for cash to treat the sick members (Table 24).

Trends in livelihood situation

Livelihood situations for most of the respondents worsened compared to five years before the survey in all districts. Most of the households in Namutumba District (84%) felt that their livelihoods had worsened by the time of the survey compared to five years earlier (Figure 10). Budaka District had the highest percentage (27%) of households that cited their livelihood as having improved while 21% of households in Tororo reported

their livelihood situation to have stagnated. Households cited a number of reasons for the trends which they were experiencing. In Tororo District, low yields, low incomes, loss of animals, illness and large family size were mentioned by most households to be the impoverishing factors. In Busia District, *Striga*, illness and low income were the main reasons for the worsening livelihood situation as cited by 74% of the households. In Budaka District, low yields were mentioned together with lack of capital and food deficits as underlying the worsening livelihood situation. In Namutumba District low yields were mentioned by about 32% of the households, followed by poverty, *Striga* and illness as drawback factors on livelihood levels.

Table 24: Responses to shocks (%)

Response	All	Tororo	Busia	Budaka	Namutumba
N	288	63	75	75	75
Adopt *Striga* control measure	1.1	2.4	1.3	1.5	0.0
Shift to *Striga* free plots	17.2	2.4	37.5	7.7	22.8
Abandon maize	3.2	4.9	0.0	9.2	1.0
Sale of animal	16.4	20.7	5.0	21.5	21.8
Received relief food	6.9	1.2	1.3	16.9	10.9
Remittance	5.5	1.2	7.5	7.7	6.9
Sale of crop stock	6.0	7.3	8.8	3.1	5.9
Sale of durable assets	4.6	4.9	0.0	15.4	2.0
Spent cash savings	14.7	17.1	20.0	15.4	10.9
Casual labour for cash or food	24.4	37.8	18.8	1.5	17.8

N = Number of valid respondents

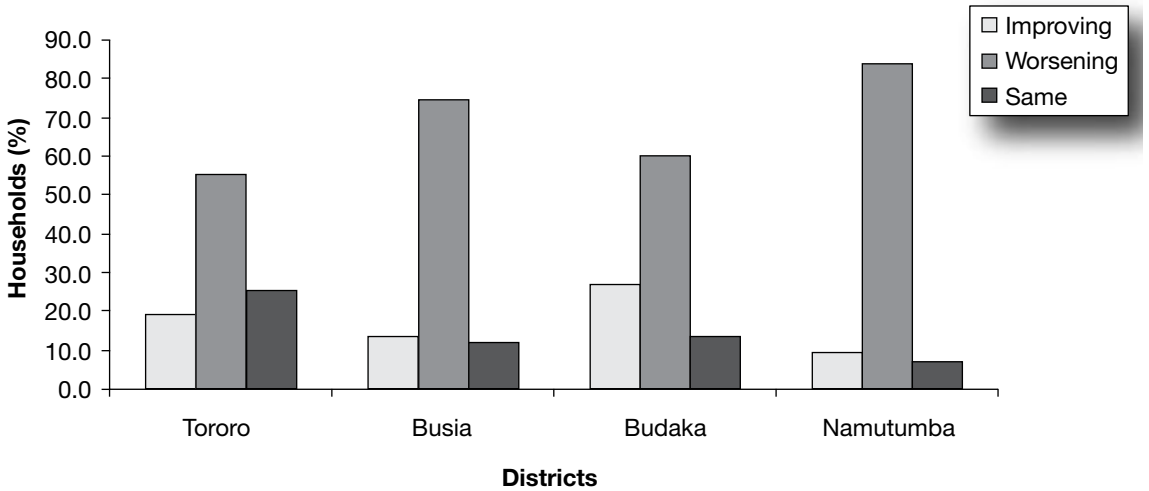

Figure 10: Livelihood situation trends (situation between now and five years ago)
N = 75 Number of households in each district

Anthropometric measures

Anthropometrics of children

The Z-scores are used to measure the nutritional status of children below the age of five years. The Z-scores in Table 25 are averages obtained from the Z-scores of children who were five years and below in each household. The Z-scores on weight for height and same weight for age fall under the normal standard, but height for age results fall under mild malnutrition and moderate malnutrition. Differences are found between districts in the weight for age where households in Tororo and Busia districts reported mild malnutrition indicating that some children were underweight but in the remaining districts children recorded normal weights relative to their ages. A high incidence of child stunting was found in Busia and Namutumba districts compared to the other two districts. The trends observed here can be attributed to illness and chronic food deficits associated with the low food production experienced by households.

Table 25: Anthropometric indices in children

Z-scores	All	Tororo	Busia	Budaka	Namutumba
Weight for height	0.33 (194)	0.04 (47)	-0.19 (54)	0.14 (44)	1.33 (49)
Weight for age	-0.91 (206)	-1.01 (49)	-1.59 (55)	-0.45 (51)	-0.52 (51)
Height for age	-2.17 (197)	-1.86 (48)	-2.36 (54)	-1.86 (46)	-2.56 (49)

Note: Figures in brackets indicate number of valid entries analysed

Weight for height and weight for age indicated that a higher percentage of the children in all districts are of normal nutritional status (Table 26). A few cases of severe malnutrition were observed in all districts but more in Namutumba and Busia districts which can be attributed to illness and food insecurity.

Body Mass Index for mothers

A higher percentage of mothers fell in the underweight category in Tororo and Busia districts while the majority in Budaka and Namutumba districts were either normal or overweight (Table 27). The high underweight percentages in Busia can be attributed to food insecurity and high dependency ratio while in Tororo a high incidence of malaria might explain it.

Morbidity and mortality

Morbidity status

Illness can rob a household of much needed labour through inability and inefficiency at work. Results reveal that 1.3 members from each of the households in the region fell sick during 2006. The percentage of individuals who fell sick was high in Tororo

Table 26: Nutritional status of children

District	Nutritional status	Weight for height	Weight for age	Height for age
Tororo	N	47	49	48
	Normal (%)	85.1	65.3	37.5
	Mild malnutrition (%)	6.4	18.4	31.3
	Moderate malnutrition (%)	–	6.1	16.7
	Severe malnutrition (%)	8.5	10.2	14.6
Busia	N	54	55	54
	Normal (%)	74.1	45.5	24.1
	Mild malnutrition (%)	9.3	25.5	29.6
	Moderate malnutrition (%)	7.4	9.1	20.4
	Severe malnutrition (%)	9.3	20	25.9
District	Nutritional status	Weight for height	Weight for age	Height for age
Budaka	N	44	51	46
	Normal (%)	75.0	66.7	47.8
	Mild malnutrition (%)	9.1	19.6	15.2
	Moderate malnutrition (%)	9.1	2	8.7
	Severe malnutrition (%)	6.8	11.8	28.3
Namutumba	N	49	51	49
	Normal (%)	91.8	74.5	32.7
	Mild malnutrition (%)	4.1	13.7	14.3
	Moderate malnutrition (%)	–	2	14.3
	Severe malnutrition (%)	4.1	9.8	38.8

N = Number of children five years and below
Z-score categories: Normal >-1.00, mild malnutrition -1.00>Z<-2.00, moderate malnutrition -2.00>Z<-3.00 and severe malnutrition >-3.00

Table 27: BMI for mothers

Mean/ proportion	All	Tororo	Busia	Budaka	Namutumba
N	286	70	75	72	69
Average BMI	21.7	21.3	21.1	22.3	22.3
Underweight (%)	50.3	55.7	56.0	43.1	46.4
Normal (%)	32.2	30.0	32.0	33.3	33.3
Overweight (%)	17.5	14.3	12.0	23.6	20.3

N = Number of mothers or female guardians
BMI categories: underweight <22, normal 22>BMI<24, and overweight >24

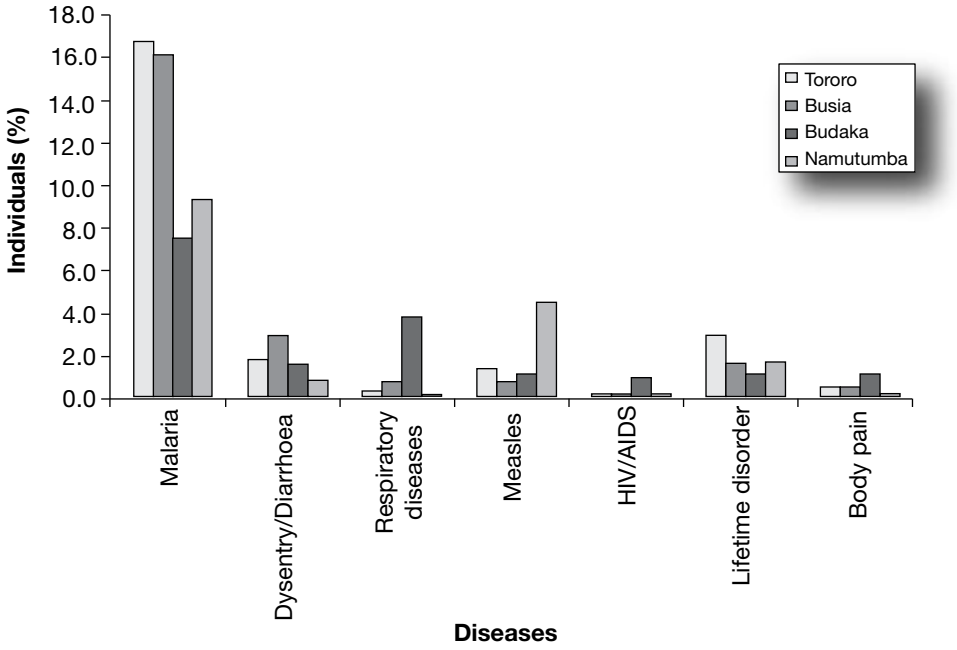

Figure 11: Percentage of individuals who fell sick in the year 2006

(26.5%) followed by Busia (21.8%), Namutumba (17.5%) then Budaka (16.1%). The main cause of sickness in all the districts was malaria or fever. Malaria accounted for about 16% of household members who fell sick in both Tororo and Busia, and less than 10% in Budaka and Namutumba districts (Figure 11).

Mortality rates

Mortality in the region in the year 2006 was low. A total of 36 out of 300 (12%) households in the region reported deaths of their household members. The results indicated an average mortality rate of 0.15 members per household. Budaka reported a higher number of deaths per household of 0.3 while Busia had the lowest of 0.07. Malaria was one of the diseases that caused deaths in all the districts, although Budaka reported HIV/AIDS as the major cause. Busia reported cases of lifetime diseases or disorders while in Tororo malaria accounted for more deaths than other diseases.

Chapter 5

Micro-level determinants of livelihoods

Determinants of poverty

A logistic regression model was used to examine determinants of poverty. Poverty was defined as households being in the bottom 40% stratum of the wealth index sorted in descending order. The results shown in Table 28 indicate that the data fitted the model well with a 69.4% prediction rate. All the variables revealed pre-estimation expected signs. Physical, natural, social, financial and human capital related variables had different effects on the poverty status. These variables can reduce or increase the probability of a household falling into poverty.

Under natural capital, the larger the total land holding held by a household, the lower the chances of that household becoming poor. The Productive Asset Index is a measure of the adequacy and working condition of the productive assets that a household possesses and uses in the production process. The higher the index, the better the farm working tools available to that household. The index influences the livelihood status of a household significantly in that as it increases, there are less chances of that household remaining trapped into poverty. Farming efficiency can be improved as the household has adequate farming tools which are in good working condition.

The proportion of formally educated female adult members over all adults in the household influences the livelihood status of a household positively. Women have been known to play a very important role in a household as they provide labour, management skills and knowledge to farming and running of household affairs. The level of education received by women affects the kind of decisions made in a household such as the way in which factors of production are combined to realise livelihood outcomes such as income. The number of extension visits per year per household correlated in the same direction with the chance of the household being in the poor category. This could be associated with more attention in terms of extension services deliberately targeting poorer compared to relatively richer households.

The number of household members belonging to social groups significantly reduced the likelihood of the household falling into poverty. In addition to strengthening social insurance, group networking can help members to access social and economic support such as labour sharing, information exchange and informal credit which are positive drivers of wellbeing. Conditional liquidity entailing formal and informal credit is important to improved wealth or poverty. For poor households with limited savings, credit is the dependable source of liquidity needed to make productive investments and finance business and farming operations.

Table 28: Logit model estimates of determinants of poverty (y = poor)

Factor	Average	SD	Expected sign	β
Constant				1.661
Natural capital				
Total land owned (ha)	1.6	5.4	(–)	-0.347*
Striga infestation (dummy, Yes = 1))			(+)	1.088
Physical capital				
Productive Assets Index	10.4	6.9	(–)	-0.074***
Overall total livestock units	1.4	2.4	(–)	-0.078
Human capital				
Sex of household head (dummy, Male = 1)			(–/+)	-0.503
Years of schooling for household head	5.6	3.8	(–)	-0.046
Household head working off farm (dummy, Yes = 1)			(–)	-0.269
Formally educated adult female ratio	0.32	0.3	(–)	-1.696***
Number of extension visits per year	3	6.6	(–/+)	0.062**
Dependency ratio	1.6	1.2	(–)	-0.097
Ill Health Index	0.1	1.2	(+)	0.083
Social capital				
Number of members with group affiliation	0.5	0.7	(–)	-0.516**
Financial capital				
Conditional financial assets	0.2	0.4	(–)	-0.810**
Social transfers or cash remittances	0.2	0.5	(+)	0.319
Goodness of fit				
-2 log likelihood				315.03
% of correct prediction				69.4

***, ** and * significant at 1%, 5% and 10%, respectively

Chapter 6

Conclusions and recommendations

This report presents the results from a baseline study carried out in four districts of eastern Uganda; namely Tororo, Busia, Budaka and Namutumba. Maize has become an important crop in the region and its production has been constrained by a number of factors of which *Striga* is ranked first. The main objective of this study was to analyse the current livelihood status and develop livelihood benchmark indicators that could be used to measure future technological changes. Data was collected from 4 districts, 40 villages and 300 households which were selected using multi-stage random sampling technique. Data was analysed from which the results based policy relevant conclusions and recommendations are given below.

The majority of sampled households owned relatively small landholdings of about 1.6ha per household. This suggests a limited scope for attaining economies of scale through planted area increase. In this regard increased crop production to meet food security and generate income viably remains a function of intensification through the use of inputs and improved technologies. In addition to this, productivity undermining constraints such as *Striga* and agricultural droughts need to be addressed.

The relatively rich households were better off in terms of utilities, assets and amenities that determine long run wealth and standard of living. Some of these assets such as those used for transportation and communication are needed to assist participation of farmers in the market economy. Furthermore, living standard aspects of housing, energy, water and sanitation were relatively primitive among the poorest. In this respect, it is recommended that pro-poor interventions need to give attention to upgrading these assets and amenities by specifically targeting the poorest of the poor.

Financial liquidity of most farming households is vested more in own home savings, informal credit and social transfers. Unpopular forms of liquidity among sampled households were savings at a bank and formal credit. Own savings, informal credit and financial remittances are unreliable sources for the liquidity needed to finance productive investments and farm operations. Rural micro-finance through formal savings and micro-credit should be institutionalised in rural settings to improve the liquidity of smallholders.

Formal education of women appeared to be an important factor which contributed positively to long run wealth. The proportion of male household heads by far exceeded that of female household heads. This means that interventions into the formal education sector should continue to encourage enrollment of girls in schools. In some areas, the level of delivery of agricultural extension services in terms of the frequency with which

farmers were contacted by extension agents was not impressive. Therefore, access to agricultural education through extension needs to be further improved particularly in Busia, Budaka and Tororo districts.

Group networking expressed in terms of the intensity of membership of social groups correlated positively with better wellbeing of the household. Advantage has to be taken of existing social groups as vehicles of wealth creation through information and knowledge exchange, and fostering of pro-poor savings and credit systems.

Based on the amount of farmland allocated, maize was the most important crop followed by millet and sweet potato. However, productivity of the maize enterprise is decimated by *Striga* infestation in the study area. Millet which is next in importance to maize is a cereal crop which is also affected by *Striga*. In this regard addressing the *Striga* problem among other critical production constraints is central in areas studied in eastern Uganda.

Farmers demonstrated that they are able and willing to purchase improved maize seed in the market. This finding refutes the widely held hypothesis that smallholders are reluctant to invest in novel technologies available at cost. For increased uptake of promising novel technologies supplied in the markets, farmers have to be given enough information regarding the potential benefits of the technology so that they become ready to commit their limited finance. For example improved access to extension services proved to increase the probability of adopting improved maize varieties at a larger scale, that is allocating more than 50% of farmland to improved maize.

The incidence of child stunting was noticeable in all districts. Stunting, that is a child being too short relative to his or her age, suggests the presence of long term malnutrition. Long term nutritional insecurity requires long term nutrition improvement programmes together with better child care. Improved production of major food crops such as maize should be part of such nutrition programmes. It has been shown that *Striga* has been a long term production constraint to maize and other cereals dominating the food menu of households in the study area. This study recommends more efforts, like IR maize technology, to combat *Striga* and indirectly contribute to improved child nutrition.

Malaria affected most of the households. It contributed to the morbidity and some deaths in the households. The livelihood externalities of malaria at the household level are far reaching. It reduces the availability of family labour and its quality while it depletes financial resources in meeting medication costs. In this regard, addressing malaria should be among the priority medical interventions aimed at improving the livelihood of farmers.

Last but not least, positive micro-level factors that would help in reducing poverty are needed. These include increasing the amount of owned farmland, the availability of productive assets, the proportion of formally educated female members in the house-

hold, the frequency of access to agricultural extension services, the intensity of group networking, and access to conditional liquidity (formal and informal credit).

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Appendices

Annex A: Study sites and sample size

District	County	No. of sub-counties	Selected sub-counties	No. of parishes	Selected parishes	No. of villages with *Striga*	Names of selected villages	No. of house-holds	No. of randomly selected house-holds
Tororo	Tororo	2	Kwapa	4	Kalait	4	Ochoto	177	8
			Mella	5	Amoni	11	Kakuye	72	7
					Mella	11	Kinyil North	60	7
					Koitangiro	12	Adumai	82	7
							Okuret	55	7
	West Budama	3	Nabuyoga	4	Nyamalogo	9	Lwala P'obona A	143	8
			Iyolwa	2	Pabone	7	Nambogo A	96	8
							Akipenet	69	7
					Magola	22	Paloto	123	8
							Magola	125	8
Busia	Samia Bugwe	7	Busitema	6	Sikuda	4	Sikuda	128	8
			Masafu	4	Kubo	2	Kubo West	117	8
					Busikho	4	Busikho East	50	7
			Lumino	3	Lumino	3	Nandwa A	51	7
					Jinja	4	Doma	62	7
			Masaba	2	Masaba	4	Buhayenje	89	8
					Butangasi	6	Sifuyo	84	8
			Lunyo	3	Lunyo	3	Bulondani A	47	7
					Nalwire	4	Bwaliro	41	7
					Busime	3	Burwodo	87	8

Budaka	Budaka	4	Budaka	1	Sapiri	5	Nansekese	200	8
							Bulumbi	136	7
					Chali	3	Chali	156	7
			Kamonkoli	6	Kamonkoli	3	Kamonkoli	232	8
							Bubulanga	199	8
					Jami	3	Bukooli	170	8
			Lyama	3	Lyama	8	Lyama	189	8
							Lukonge A	146	7
							Lukonge B	105	7
			Naboa	1	Naboa	3	Naboa	100	7
Namutumba	Busiki	3	Bulange	7	Nawankofu	4	Nawankofu	142	7
					Buwaga	4	Butogoli	177	8
			Ivukula	6	Nabitula	3	Buliowa	217	8
							Kimenyulo	258	8
					Kisewuzi	6	Mpande	148	7
					Ivukula	7	Kiranga	124	7
			Namutumba	5	Namutumba	3	Itonko	131	7
					Nawansaga	6	Namuseeno	167	7
							Buwoola	375	8
					Nakalo	4	Mawungwe	196	8
Total									300

Annex B: The household questionnaire

Smallholder Livelihoods in the *Striga* Infested Maize Areas of Eastern and Southern Africa: Baseline Study in Uganda

AATF/IITA PROJECT

Part A: Interview and household details

I-A: Interview information

A1 Interviewer name		
A2 Name of respondent		
A3 Name of head of household		
A4 District name		
A5 County		
A6 Sub-county		
A7 Parish name		
A8 Village name		
Gps Readings	Way point number	
	N/S	
	E/W	
	Altitude (Metres)	

A9 Date dd mm yy | |	A10a Time start Hr Min |	A10b AM or PM |	A11a Interview end Hr Min |	A11b AM or PM |

A12 Interpreter 1 = YES 2 = NO	A13 Quality checking by supervisors			
		Date	Signature	Rating
	Quality check 1 District supervisor			
	Quality check 2* District supervisor			
	Quality check 3 AATF/IITA supervisor			
	* If the rating of quality check 1 is poor, the enumerator must correct for the mistake at his/her own cost. Then a Quality check 2 by the same supervisor would be required. Any final form MUST be rated GOOD to pass through.			

Part B: Household characteristics

B1. Household socio-demographics as of end of 2006 (December)

ID	Name of household member	Sex 1 = Male 2 = Female	Age (In years, but in months for infants, ie <1 year)	Relationship to the household head 1 = Head 2 = Spouse 3 = Son/ Daughter 4 = Relative 5 = Unrelated	Formal schooling 1 = Attended before 2 = Attending now 3 = Never attended 4 = Too young to attend	Number of years of schooling completed (if attended or is attending school)	Non school training 1 = None 2 = Vocational training 3 = Short term training on best agric practices (non-extension)	Working on the farm 1 = Full time 2 = Part time	Working off farm 1 = Yes 2 = No	Major livelihood occupation
01										
02										
03										
04										
05										
06										
07										
08										
09										
10										
11										
12										

Major occupation: 0 = None, 1 = Crop production, 2 = Livestock keeping, 3 = Business, 4 = Salaried employment, 5 = Wage work, 6 = Technician, 7 = Artisan/ handcraft, 8 = Natural resource (wood, charcoal etc), 9 = Traditional healing/medicine, 10 = Rent income, 11 = Others (Specify)_____

Part C: Productive resource endowment

C-1: Land tenure and use structure

C1.1. Please provide information on land tenure and use (first season 2006)

Land tenure structure	Size (Acres)	Size of land (Acres) under different land uses				
		Annual crops	Perennial crops	Annual/perennial crops	Grazing	Fallow
Private (titled) land						
Land with use rights only						
Rented in land						
Sharecropped land						
Borrowed land						
Gifted land						
Rented out						
Given out						

C-3: Productive assets

C3. Please provide information on the following key productive assets

Asset	Number owned	Working status 1 = Is it or are most of them working properly; 2 = Is it or are most of them working moderately; 3 = Is it or are most of them working improperly	Total value (Current value if liquidated)
Hand hoe			
Machete			
Axe			
Ox plough, weeder, riper, etc			
Ox cart			
Wheelbarrow			
Oxen			
Donkeys			
Horses			
Sprayer			
Watering can			
Irrigation pump			
Tractor			
Pick up, lorry			
Others (Specify)_____			

Part D: Productivity, costs, family labour and marketing

D1. Land allocation, *Striga* infestation and inputs during the first season 2006

Crop system ID	Crop enterprise	Area (Acres)	Extent of *Striga* infestation 1 = Not infested 2 = Mild 3 = Severe	Inter-cropped with	Proportion of maize area (%)	Planting seed type **	Organic fertiliser (FYM)			Inorganic fertiliser			Seeds (For all intercrops if so)				Pesticides (For all intercrops if so)		
							Qty	Unit*	Unit price	Qty	Unit*	Unit price	Crops	Qty	Unit*	Unit price	Qty	Unit*	Unit price
01	Local maize, mono																		
02	Hybrid maize, mono																		
03	Local maize, intercropped																		
04	Hybrid maize, intercropped																		
05	Beans																		
06	Sorghum																		
07	Millet																		
08	Soya bean																		
09	Groundnut																		
10	Cowpea																		
11	Sunflower																		

12	Cassava																		
13	Irish potatoes																		
14	Sweet potatoes																		
15	Vegetables																		
16	Banana																		
17	Tea																		
18	Coffee																		
19	Tobacco																		
20	Sugarcane																		
21	Napier																		
22	Rice																		
23	Others (Specify) ____																		

**Planted seed type codes: 1 = Purchased improved non-*Striga* resistant; 2 = Purchased OPV *Striga* tolerant; 3 = Purchased OPV non-*Striga* tolerant;

4 = Retained OPV *Striga* resistant; 5 = Retained OPV non-*Striga* resistant; 6 = Local variety purchased; 7 = Local variety retained

*Measurement unit codes: 1 = Kilogram, 2 = Litre, 3 = Bag _____ (specify in kgs), 4 = Basin/tin (15kgs); 5 = Others _____ (specify in kgs)

D2. Production costs and labour inputs for the first season 2006

Valid crop system ID (as in D1)	How do you rate the season with regard to rainfall/soil moisture in your farm? 1 = Above average 2 = Normal 3 = Below average	How much did you harvest (In kg please)?			Direct costs and family labour input Family labour: People (AE) X effective days X effective hours AE = Adult Equivalents (1 Adult = A person of 15 and above years of age; A child of 10–14 years of age will be equated to 0.5 of an Adult Equivalent)											
		Crop 1	Crop 2	Crop 3	Land rent if rented in	Land preparation		Planting		Fertiliser/chemical application		Weeding (all)		Harvesting and transporting		Storage (Shelling + storage equipment)	
					Cost	Cost for hired labour	Family labour	Cost for hired labour	Family labour	Cost for hired labour	Family labour	Cost for hired labour	Family labour	Cost for hired labour	Family labour	Cost for hired labour & items	Family labour

D3. Crop marketing aspects for the first season 2006

Valid crop system ID (as in D2	Name of the crop	Quantity in store based on measurement unit of sale	Quantity sold	Month most of the produce was sold (month/yr)	Average unit sale price during a peak month of sale	Marketplace where most of the produce was sold[1]	Who bought most of the produce?[2]	What is the most limiting marketing constraint?[3]	Does this market constraint limit your willingness to adopt productivity enhancing technologies? 1 = Yes 2 = No	Mention any of such technologies you have declined to adopt because of lack of market incentives

Part E. *Striga* extent and severity, and control technologies

E1. What are the most important maize production and post–harvest constraints?

Production constraint	A constraint? Yes = 1 No = 2	If yes, what is the level of severity (Intrinsic ranking) 1 = Highly severe 2 = Severe 3 = Less severe	If yes, what is the level of severity compared relative to other constraints (Comparative ranking, 1st being most severe)	If yes, to *Striga*, which year did it start to be a major constraint in your farm?
Striga				
Stalkborer				
Storage pests (large grain borer, weevils etc)				
Low and erratic rainfall				
Water logging (excessive moisture)				
Low soil fertility				
Inadequate input supply				
Land shortage				
Others (Specify)_____				

E2. What is the extent and severity of the *Striga* problem in your farm plots usually under cereals?

Plots (SN)	Acreage (Acres)	Proportion of land infested by *Striga* (%)			Perceived level of severity (impact on maize production) Codes: 1 = More severe, 2 = Severe, 3 = Less severe, 4 = Not yet a problem			
		Now	Ten years ago	Control measures used (multiple answer possible)*	1st season 2006 (most recent and complete)		Ten years ago	
				1, 2, 3	Severity	Average (kgs)	Severity	Average (kgs)

* Codes for *Striga* control measures: 1 = Uprooting, 2 = Burning, 3 = Manuring, 4 = Shifting to *Striga* free plots, 5 = Others (Specify)_____

E3. Which of the following *Striga* control technologies are you aware of and what is your current use status? If you are currently using a *Striga* control technology, what is the associated per acre maize yield?

Technology ID	*Striga* control technology	Aware of the technology? 1 = Yes 2 = No	If aware, current use status 1 = Currently using 2 = Abandoned 3 = Never adopted 4 = No *Striga* on the farm	When did you know of the existence of this technology?	Since when did you start to use it for the first time? (year)	If you are aware, from who did you receive the information?	If you are practising it who demonstrated it to you?*
01	Use of farm yard manure						
02	Use of inorganic fertiliser						
03	*Striga* resistant maize grown with legumes						
04	*Striga* resistant maize without legumes						
05	Intercropping of legumes followed by cassava/Desmodium (Maize in the 3rd year)						
06	Push-pull (Maize/Desmodium strip cropping)						
07	Others (Specify) _____						
08	Integrated ____; _____; _____; (Use technology IDs)						

*Codes for source of information and technology demonstration: 1 = Farmers in the village; 2 = Farmers in other villages; 3 = Mass media (radio, newspapers); 4 = Extension agents; 5 = Local NGOs; 6 = Research institutes (Specify) _____; 7 = Farmer Community Based Organisations (CBOs); 8 = Others (Specify)_____

E4. If you are aware of any *Striga* control technology but have not adopted any, what is the most important reason for non adoption? (Multiple answers possible)

	Reason for non adoption	Reason status (1 = Yes, 2 = No)	Ranking (1st being the most important reason)
01	Gathering more information about the technology		
02	Traditional control practice is better		
03	Too risky to adopt		
04	Cash constraint to buy seed and other inputs		
05	Lack of improved seed (*Striga* resistant varieties)		
06	Others, for example cultural factors (Specify) _____		

E5. If you are aware of any modern *Striga* control technologies mentioned in E5, how would you rank them relative to your own traditional control practices?

Technology ID	*Striga* control technology	Rank based on				
		Maize yield (Most yield enhancing to the least) 1 = Most yield enhancing 2 = Moderately yield enhancing 3 = Least yield enhancing	Technical simplicity (Simplest to most complex) 1 = Simplest 2 = Simpler 3 = Complex	Labour demand (Least demanding to the most demanding) 1 = Least demanding 2 = Moderately demanding 3 = Most demanding	*Striga* population (Most *Striga* reducing to the least) 1 = Most *Striga* reducing 2 = Moderately *Striga* reducing 3 = Least *Striga* reducing	Soil fertility (Most fertility enhancing to the least) 1 = Most fertility enhancing 2 = Moderately fertility enhancing 3 = Least fertility enhancing
01	Use of farm yard manure					
02	Use of inorganic fertiliser					
03	*Striga* resistant maize grown with legumes					
04	*Striga* resistant maize without legumes					
05	Intercropping of legumes followed by cassava/Desmodium (Maize in the 3rd year)					
06	Push-pull (Maize/Desmodium strip cropping)					
07	Others (Specify) _____					
08	Integrated ____; _____; _____; (Use technology IDs)					

Part F. Vulnerability, capital assets and livelihoods

F: Food security and livelihood aspects

F1. Post–harvest losses first season 2006

Crop (as in D3)	Crops	Date of last harvest (Month-Year)	Amount of this harvest in store now	When store depleted/will be depleted (Month-Year)	Loss in store? 1 = Yes 2 = No	Estimated quantity lost in store	Reasons for loss**
			Quantity (kgs)	Approx date		Quantity (kgs)	

*Crops: 1 = Maize, 2 = Beans, 3 = Sorghum, 4 = Millet, 5 = Soyabean, 6 = Groundnut, 7 = Cowpea, 8 = Sunflower, 9 = Cassava, 10 = Irish potatoes,

11 = Sweet potatoes, 12 = Banana, 13 = Others (Specify) _____

**Reasons for loss: 1 = Rodents, 2 = Insects, 3 = Damp/rot, 4 = Theft, 5 = Others (Specify) _____

F2. What are the major sources of food insecurity in your household (ability to access food through both own production and market procurement)

Source of food insecurity	Rank (1 = Most important, 2, ... n = Least important

F3. What are the nature, effects and responses to shocks, and livelihood situation by the household in the last five years (Take note of the codes)?

Shock[1]	Description of the cause[2]	When happened/ started (date)	Effect of the event/shock[2]	Response to event/shock[4]	How is your livelihood situation now as compared to the past five years? 1 = Improving, 2 = Worsening, 3 = The same	What is the single most important reason for such a livelihood situation

[1]Shocks: 1 = Food deficit, 2 = Famine, 3 = Loss of property, 4 = Illness, 5 = Death of important family member, 6 = Loss of animals

[2]Cause: 1 = *Striga* infestation, 2 = Drought, 3 = Floods, 4 = Theft, 5 = Human disease, 6 = Crop pest/disease, 7 = Livestock disease, 8 = Strong wind, 9 = Others (Specify) _____

[3]Effects: 1 = Low production, 2 = Reduced labour, 3 = Low use of inputs, 4 = Health disorders (malnutrition, susceptibility to diseases), 5 = Loss of source of income, 6 = Depletion of assets, 7 = Any others (Specify)_____

[4]Responses: 1 = Adopt *Striga* control technologies, 2 = Shift to *Striga* free/less infested land, 3 = Abandon maize because of *Striga*, 4 = Sale of animal for cash, 5 = Receive relief help, 6 = Remittances, 7 = Sale of crop stock, 8 = Sale of durable assets (land, durables), 9 = Spend cash savings, 10 = Casual labour for work or cash, 11 = Hhd members migrated, 12 = Others (Specify)_____

F3: Financial capital

F3.1. Please indicate the types of your financial capital and rank them in order of importance.

Financial capital	Do you have access to such a financial capital? 1 = Yes 2 = No	How much in absolute terms can you access/command per month and per year?		Rank your portfolio of financial capital in order of importance in relation to magnitude of value, easiness to access/raise, and easiness to spend		
		Month	Year	Monetary value	Access/raise/command (1 = Very easy, 2 = Moderate, 3 = Not easy)	Easiness to spend (1 = Very easy, 2 = Moderate, 3 = Not easy)
Cash savings at bank						
Cash savings at home/ pocket						
Claim on your good debtors						
Jewellery						
Formal credit	*					
Informal credit	*					
Cash remittances from relatives/friends						
Remittances from relatives/friends (easily transformable into cash)						
Others (Specify) _____						

* The question needs to be addressed as whether the household can get formal/informal credit when needed.

F3.2. Please indicate the type and number of non working livestock the household owns.

Type	Number		Value	
	Young animals	Adult animals	Average price per young animal	Average price per adult animal
Cattle				
Goats				
Sheep				
Pigs				
Poultry (chicken, ducks)				
Rabbits				
Doves				
Donkeys				
Others (Specify)_____				

F4: Physical capital

F4.1. Qualitative typologies of amenities and possession of quasi productive assets

What is the roofing material of the main house? 1 = Mud/cow dung 2 = Leaves/Grass 3 = Timber/wood 4 = Corrugated iron sheets 5 = Cement concrete 6 = Tiles 7 = Asbestos sheets 8 = Others (Specify)_____	What is the wall material of the main house? 1 = Mud/cow dung/raw bricks 2 = Stones 3 = Burnt bricks 4 = Cement blocks 5 = Wood/bamboo 6 = Iron/metal sheets 7 = Others (Specify)_____	How many sleeping rooms does the main house contain? Is there any other dwelling apart from the main house which is used for sleeping? 1 = Yes 2 = No
What is the floor material of the main house? 1 = Earth 2 = Cement 3 = Others (Specify) _____	What kind of toilet is mostly used? 1 = No toilet (Bush) 2 = Pan/bucket 3 = Pit latrine uncovered 4 = Pit latrine covered 5 = Own flush toilet 6 = Shared flush toilet 7 = Others (Specify) _____	What is the main source energy for cooking? 1 = Fuelwood 2 = Charcoal 3 = Kerosene 4 = Gas 5 = Electricity 6 = Crop residues 7 = Animal dung 8 = Others (Specify) _____

What is the main source of energy for lighting? 1 = Kerosene 2 = Gas 3 = Electricity 4 = Generator 5 = Candles 6 = Battery 7 = Firewood 8 = Others (Specify)_____	What is the major source of water for drinking? 1 = Piped in dwelling 2 = Piped outside dwelling 3 = Public tap 4 = Borehole 5 = Protected well/spring, 6 = Unprotected well/spring 7 = Rain water 8 = Vendor/tanker truck 9 = River/lake/stream 10 = Others (Specify)_____	Does the household own any of the following items? 1 = Luxurious car 2 = Motorbike 3 = Television 4 = Bicycle 5 = Radio 6 = Bed 7 = Iron 8 = Mobile phone 9 = Landline 10 = Sofa 11 = Spongy mattress 12 = Wrist watch

F4.2. Accessibility to various services/facilities

Services/facilities	How long does it take (IN MINUTES) from your homestead to a place where you usually get this service or the facility is located? 1 = 0–14 2 = 15–29 3 = 30–44 4 = 45–59 5 = 60+	What kind of transport do you always use to get to this service /facility? 1 = Public transport (car, bus) 2 = Public transport (motorbike, bicycle) 3 = Own transport (car) 4 = Own transport (motorbike) 5 = Own transport (bicycle) 6 = On foot	How many KILOMETRES is it from your homestead to this service/facility?
Source of drinking water			
Offices where to get extension services			
Market place for agricultural inputs			
Market place for agricultural produce			
Market place for household needs			
Stand/main road to catch public transport			
Primary school			
Secondary school			
Dispensary, health centre or hospital			
Remotest farm plot			

F5: Human capital

F5.1. Please provide the following information on the types of agricultural technologies introduced

Agricultural technology	Have you ever been in contact with extension agents from different sectors? 1 = Yes 2 = No			Number of extension visits last year		
	Public	Private	NGOs	Public	Private	NGOs
Improved maize varieties						
Control of *Striga*/other weeds						
Soil fertility management						
Improved food grain storage						
Collective product marketing						
Livestock technologies						

F6: Social capital

F6.1. If a member of the household belongs to any local association/group, please provide the following information

Household member name	Household member ID (See Section 1)	Association/ group*	Since when?	What are three main activities of the association/group		
				1.	2.	3.
				1.	2.	3.
				1.	2.	3.
				1.	2.	3.
				1.	2.	3.

*Association/group: 1 = Community development, 2 = Cooperative, 3 = Religious group, 4 = Credit and savings group, 5 = Informal insurance (safety net), 6 = Women's group, 7 = AIDS group, 8 = Others (Specify)_____

F6.2. What is the likelihood that you will adopt/copy a novel technology from people of ...

Type of new technology	Wealth status		Ethnic/tribe		Age category		Sex category		Occupation		Religious faith		Political denomination	
	Same	Different	Same	Different	Same	Different	Same	Different	Same	Different	Same	Different	Same	Different
Cash crop														
Food crop														
Seed/cultivar														
Fertiliser														
Agro–chemical														
Crop husbandry practice														
Market opportunity														
Socio-cultural aspect														

Likelihood codes: 1 = Not likely, 2 = Likely, 3 = Very likely

F6.3. In the past one year, how many people of […] you have interacted with in exchange of information on development issues?

Different wealth status	[ ]	Same wealth status	[ ]
Different ethnic/tribe	[ ]	Same ethnic/tribe	[ ]
Different age category	[ ]	Same age category	[ ]
Different occupation	[ ]	Same occupation	[ ]
Different religious faith	[ ]	Same religious faith	[ ]
Different political denomination	[ ]	Same political denomination	[ ]
Codes: 1 = None, 2 = Around ten people, 3 = More than ten people			

F7: Livelihood strategies and outcomes

F7.1. Please provide information on non-farm income sources, the family members involved, the average income per year, and the seasonal stability of income generated.

Major occupations/livelihood enterprises	Name of the most important INCOME ACTIVITY under this enterprise	Amount/ turnover per year from this enterprise	Propotionate contribution of this ENTEPRISE to the overall household income 1 = Up to a quarter (25%) 2 = Between a quarter to a half (25–50%) 3 = Between a half to three quarters (50–75%) 4 = Between three quarters to a hundred (75–100%)	How stable is this source of income (ENTERPRISE)? 1 = Stable 2 = Somewhat stable 3 = Unstable	How is the situation/ robustness of this enteprise now compared to the past ten years? 1 = Worsened 2 = Improved 3 = The same	If the enterprise situation has worsened what is the major drawback factor?
Crop production						
Livestock keeping						
Business						
Salaried/professional employment						
Wage work						
Technician						
Artisan/handcraft						
Natural resources (wood, charcoal, fish, minerals)						
Traditional medicine/healing						
Resource rent income						

Major drawback factor for enterprise: 1 = *Striga* infestation, 2 =Drought, 3 = Floods, 4 = Theft, 5 = Illness, 6 = Crop pest/disease outbreak, 7 = Livestock disease outbreak, 8 = Declining purchasing power of customers, 9 = Poor access to profitable markets, 10 = Others (Specify) _____

F8: Anthropometrics, morbidity and mortality

F8.1. Measurements on mothers and children below or equal to five years of age

Name of biological mother or female guardian	Marriage order (1st, 2nd, etc)	Age of mother or female guardian	Child's name	Sex Male = 1 Female = 2	Date of birth of the child (dd/mm/yy)*	Weight of mother/female guardian (kg) (A)	Pregnancy status of mother/ guardian Yes = 1 No = 2	Weight of mother/female guardian + child (B)	Was the child seriously ill in the past 7 days? Yes = 1 No = 2	Height of child (cm)	Height of mother/female guardian (cm)

*Use MCH card where available to confirm the exact age of the child

F8.2. Morbidity indicators (ENUMERATORS: This question, as much as possible, should be directed to mothers/female guardians within the household) Was there any member of the household who was sick in the year 2006? If yes, provide the following information on each person who was sick

ID code	Did [Name] get injured or diseased in the past 4 weeks? 1 = Yes 2 = No (If no go to next person)	Which injury or disease and how long did [Name] suffer from? (Mark most important injury/disease)		What measures did the household take when [Name] fell ill? Use codes[2] please (Up to three answers are possible)		
		Disease[1]	Duration	1st	2nd	3rd
01						
02						
03						
04						
05						
06						
07						

[1]Codes for injury/disease
1 = Fever/Malaria
2 = Dysentery/Diarrhoea
3 = Respiratory problems
4 = Measles
5 = Typhoid fever
6 = Undernutrition
7 = Tuberculosis
8 = HIV/AIDS
9 = Injurious accident
10 = Lifetime disease/disorder
11 = Others (Specify)_____

[2]Codes for measures taken
1 = No any measure was taken
2 = Taken to private dispensary/hospital
3 = Taken to public dispensary/hospital
4 = Taken to traditional healer
5 = Purchased drug from a pharmaceutical shop
6 = Others (Specify) _____

F.8.3: Mortality indicators. Was there any member of the household who died in the year 2006? _____ 1 = Yes, 2 = No, If yes, provide information in the following table

S/no	Gender of the deceased 1 = Male, 2 = Female	Age at death (Years)	Cause of death[1]
01			
02			
03			

Cause of death: 1 = Fever/Malaria; 2 = Dysentery/Diarrhoea; 3 = Respiratory problems; 4 = Measles;

5 = Typhoid fever; 6 = Undernutrition; 7 = Tuberculosis; 8 = HIV/AIDS; 9 = Injurious accident;

10 = Lifetime disease/disorder; 11 = Others (Specify) _____

Part G. Recalled and GPS determined areas for plots under maize during the first season in the year 2006

Crop system ID	Crop enterprise	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6	
		Recall (acres)	GPS (acres)	Recall (acres)	GPS (acres)	Recall (acres)	GPS (acres)	Recall (acres)	GPS (acres)	Recall (acres)	GPS (acres)	Recall (acres)	GPS (acres)
01	Local maize, sole												
02	Hybrid maize, sole												
03	Local maize, intercropped												
04	Hybrid maize, intercropped												

1 Market place: 1 = Village, 2 = Neighbouring village/location/road/junction, 3 = Nearby township, 4 = Distant township, 5 = Regional market, 6 = Others (Specify) _____

2 Trader typology: 1 = Local consumer, 2 = Small trader/broker (bicycle/on foot), 3 = Large trader (vehicle), 4 = Institution (school, prisons, etc), 5 = Others (Specify) _____

3 Constraint: 1 = Low producer price, 2 = Poor road to the market, 3 = Poor access to information, 4 = Lack of reliable transport, 5 = Others (Specify) _____



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