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Summary of Baseline Household Survey Results: Rakai District, South Central Uganda

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Abstract

Rakai District, in South Central Uganda, is predominantly agricultural, and people living here derive their livelihoods largely from crops, livestock and natural resources. A baseline household-level survey, led by the Climate Change, Agriculture and Food Security Consortium Research Program[1] (CCAFS) was undertaken in late 2010, aimed at describing the characteristics of farming systems and better understanding how they have changed over time. It also gathered information on the socio-economic and demographic characteristics of these farming households, basic livelihood and welfare indicators, agriculture and natural resources management practices and strategies, access to and use of climate and agricultural-related information, and current risk management, mitigation and adaptation practices. Randomly selected households were the units of analysis and a face-to-face questionnaire was the primary tool that was used for data collection.

Findings from this baseline household study reveal that Rakai farms are diversified, with most households producing and consuming a wide range of food crops. Two-thirds of households sell some of the food crops they produce. Three-quarters of households also produce a cash crop (typically coffee). Various fruits and vegetables are also produced. Eighty percent of households have small livestock (sheep, goats, chickens or pigs), and one-fifth own cattle.

Other sources of income are very important in Rakai – only 11% of households reported receiving no income from sources other than their own farms. Forty-one percent have a household member working on someone else's farm to earn income. Another 40% earn some off-farm income from employment, business or remittances/gifts. Formal credit is being accessed by only 16% of households, but informal loans are used by 28%.

Farmers have been making changes to their farming practices over the last 10 years in Rakai, and these changes and the reasons behind them are explored in this report. Bananas, beans and maize are currently the most important crops grown, and all three of these crops and being grown by more households than a decade ago. Most households (88%) have introduced new crop varieties. The biggest shifts have been towards higher yielding varieties, drought tolerant varieties, and disease and pest-resistant varieties. Introducing shorter-cycle varieties has been a key change made in relation to beans and maize, as has the introduction of intercropping. Between a third and a half of households reported preparing their land and planting beans earlier than they use to, and over one-third have done so for maize. Just over 40% of households have switched to planting pre-treated/improved maize seed.

Why are they making these changes? Climate-related reasons were less frequently given than other reasons by respondents. These other drivers of change included those related to prices, new pests and diseases, and availability of higher yielding varieties. With respect to climate-related reasons, changes made to bananas and maize were apparently partly driven by a perception of more overall rainfall, while for beans it was less overall rainfall. For all three crops, these households agree that an earlier start of the rains is a reason behind their change in behaviour.

[1] For more information about CCAFS, see: http://www.ccafs.cgiar.org A community-level survey was also conducted in Rakai and those survey guidelines and reports will also be available on the website.

Changes are also being made to livestock practices. Over three-quarters of households are now producing chickens, up from two-thirds a decade ago. Shifts away from pigs and dairy are also occurring, and warrant further exploration. The main reasons why the various changes have taken place within the livestock sector were market-related, including better prices for livestock products and new opportunities to sell livestock products. The introduction of more productive, and more disease resistant, livestock breeds, emerging diseases, and government and project influences were other important reasons cited. Weather or climate-related reasons were only mentioned by a few households, although more frequent floods and droughts were mentioned by 77% and 82% of households, respectively.

Chemical fertilizer use is very low in Rakai, with only one-fifth of households reporting using purchased fertilizers on their crops. Use of pesticides is much more widespread – 60% of households purchase and use pesticides. Half of the surveyed households reported buying seed.

Many households receive and use weather-related information, particularly forecasts of the start of the rains, extreme events, and pest or disease outbreaks. Only one-third of households receive daily weather forecasts. One-half receive longer-run (2 t o 3 month) weather forecasts. Radio is the predominant source of this information.

Agricultural and natural resource management-related groups are scarce in Rakai, with two-thirds of households reporting not being members of any such group. Improvements in soil, water and land management were reported. Three-quarters of households have introduced at least one type of improved soil management technique, and 80% have made some agroforestry-related management changes (e.g. planting trees on farms). However, no agricultural water management changes were made by 71% of households over the last decade.

Keywords

Climate change; agriculture; Uganda; farming system; food security, adaptation, mitigation

About the authors

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Table of Contents

1.0 Introduction

This report presents the results of an analysis of the CCAFS baseline household survey carried out in late 2010/early 2011 in 7 villages, with 140 households, in Rakai District, located in the South Western region of Uganda, west of Lake Victoria (Figure 1). Its southern boundaries are part of the international boundary between Uganda and Tanzania. It is bordered by Masaka District in the East, Kalangala District in the South-East and Mbarara District in the West and Lyantonde in the North. The District Headquarters is located in Rakai Town, which is a distance of about 190km from Kampala, the national capital. Rakai District has a total area of 4,124 km^2. In 2002, the national census estimated the population of the district at 405,600, with an annual growth rate of 3.8%. Given those statistics, it was estimated that in 2010, the population of the district would be approximately 546,600. Subsistence agriculture is the dominant economic activity, employing over 85% of the people. Crops grown include bananas, beans, potatoes, cassava, maize, sorghum, finger millet, fruits and vegetables like tomatoes, pineapples, onions and cabbage. Coffee is the main cash crop. Livestock raised includes cattle, goats, pigs and chicken. The rainfall is bimodal. The rainy seasons are from March/April to May and from October to December. Rakai District also experiences severe dry spells in the periods June–September and January–February.

The survey process is described in Appendix 1. The questionnaire and training materials associated with it, including data entry and management guidelines can be found at: www.ccafs.cgiar.org/resources/baseline-surveys. The list of villages randomly selected from the site (a 10x10 km2 block chosen as the sampling frame) is found in Appendix 2.

Figure 1 shows the location of the Rakai site in south-western Uganda. We now turn to a summary of the main findings of the analysis of the survey data, reported on according to each section of the questionnaire.

Figure 1. Rakai research site, south-western Uganda

1.1 Household Types and respondents

Almost 80% of the households that were interviewed in this survey were male-headed households, with a wife or wives, implying two potential decision makers in these homes (Table 1.1). Households with female heads (divorced, single or widowed) make up 19% of this sample. Roughly two-thirds of the actual respondents were male and one-third women.

Table 1.1 Household type among study respondents in Rakai District

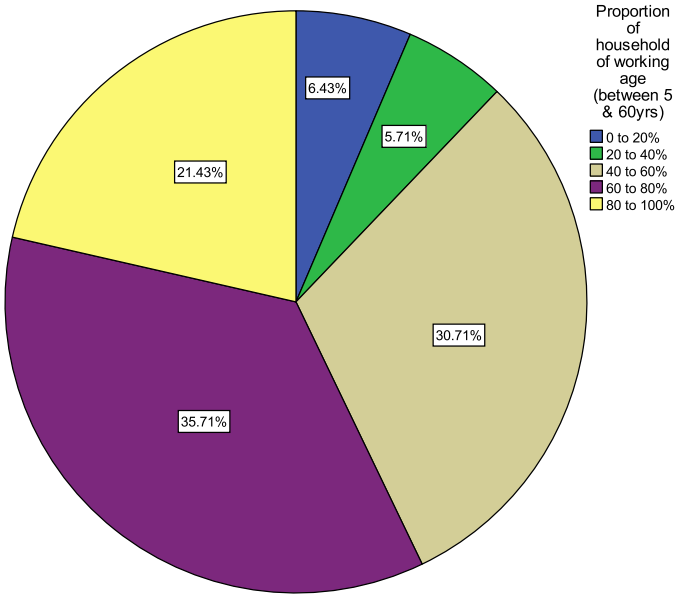
Household Type	Number of households	Percentage of households
Male headed with wife or wives	108	76
Male-headed (divorced, single, or widowed)	5	4
Female headed (divorced, single or widowed)	26	19
Female headed, husband away and not making most decisions	1	1
Total	140	100

A diverse range of ethnic groups is represented across the surveyed households, including ten different groups. The predominant ethnic group is Muganda (80% of surveyed households). Other minority groups found here include Munyarwanda, Munyankole, Mutanzania, Mufumbira, Munyoro, Mukiga, Mukoki, Murundi, and Madi, each with very small numbers of households.

2.0 Household Demographics

Household size varies between one and 30 persons, with a median size of 6 persons per household. With respect to the ratio of working age adults to dependents (people aged less than 5 years or over 60 years), we can see in Figure 2.1 that just over 12% of these households (the green and blue sections in Figure 2.1), may have issues with fewer working age adults in comparison to non-working family members (under 40% of the household member are of working age, i.e. over 60% are dependents).

Figure 2.1 Proportion of the household that is of working age



2.1 Education Levels

Table 2.1 indicates the highest level of education obtained by any household member in these randomly chosen and interviewed households. For the majority of households, a primary level of education (48%) was the highest level attained within their households, followed by secondary school graduates (41%). Very few households (1%) had no formal education at all, and only 9% of these households had a member with a post secondary education.

Table 2.1 Highest Level of Education Obtained by someone within the Household

Highest level of education of any resident household member	Number of households	% of households
No formal education	2	1
Primary	67	48
Secondary	58	41
Post-secondary	13	9
Total	140	100

3.0 Sources of Livelihoods

3.1 On-farm livelihood sources

Table 3.1 shows the diversity in production and the division of labour across these different agricultural products. All households are producing food crops, and three-quarters are producing a cash crop - coffee. Some type of processing of food crops is also happening in 75% of the households. Fruits and vegetables are also being produced by 95% and 81% of the surveyed households, respectively.

Table 3.1 Percentage of households producing various agricultural products and the division of labour

		Percentage of households that are producing the product, stating these household members do 'most of the work' in relation to this product:				
Product	% of households producing:	Man	Woman	Girls	Boys	Several hh members
Food crops (raw)	100	41	41	1	-	16
Food crops (processed – e.g. snack foods)	76	35	48	-	-	17
Other/cash crops (tea, coffee, sisal, cotton, jute, sugar cane, etc.)	75	51	27	-	1	19
Fruits	95	34	41	-	2	23
Vegetables	81	11	70	-	1	19
Fodder	16	35	35	-	-	30
Large livestock (cattle, buffalo, camels)	19	38	19	-		15
Small livestock (sheep, goats, pigs, chickens, donkeys)	81	25	51	-	2	21
Livestock products (milk, eggs, etc.)	61	23	50	1	1	23
Fish	0	-	-	-	-	-
Timber	13	72	6	-	-	22
Fuelwood	46	27	40	2	3	24
Charcoal	0	-	-	-	-	-
Honey	5	100	-	-	-	-
Manure/compost	61	32	52	1	1	14

Few households (19%) keep large livestock (cattle), though the majority (81%) keep small livestock such as sheep, goats, chicken and pigs. It is also important to note the relatively high proportions of households that produce manure (61%) and fuel wood (46%) for their own consumption on-farm.

Some products, such as fish and charcoal, were not produced at all on the selected farms, while timber (13%) and honey (5%) were also produced on farm by a few respondents.

With respect to the division of labour across the different types of agricultural products, Table 3.1 shows that for food crops, men and women equally share the bulk of the workload. For other products, particularly vegetables, small livestock and livestock products, fruits, fuelwood and manure, women bear the bulk of the workload. Men provide most of the labour for the care of the cattle and the cash crops. The participation of children (both girls and boys) was very minimal for the production of the various farm products.

Most farm products serve as food for consumption and for cash as well. Table 3.2 shows the percentages of surveyed households that are producing each product on their own farms, and are also consuming or selling it.

Table 3.2 Consumption and Sales of Products

Product	Percentage of households producing the particular product:	
	Consuming	Selling
Food crop (raw)	100	66
Food crop (processed – e.g. snack foods)	100	58
Other/cash crop (tea, coffee, sisal, cotton, jute, sugar cane, etc.)	15	95
Fruit	99	41
Vegetables	100	13
Fodder	94	13
Large livestock (cattle, buffalo, camels)	32	74
Small livestock (sheep, goats, pigs, chickens, donkeys)	84	73
Livestock products (milk, eggs, etc.)	100	41
Timber	62	77
Fuelwood	96	20
Honey	100	40
Manure/compost	97	2

All households consume the raw and processed food crops they are producing on their land as well as the fruits, vegetables and livestock products. Most households producing fodder and manure/compost on their farms are predominantly using it themselves.

In terms of selling, cash crops are of course important. Two-thirds of households are also selling raw food crops and 58% processed food crops (e.g. snack foods). Forty-one percent of fruit producers (which is almost all households) also sell some fruit.

The sale of small livestock and livestock products are also very important sources of livelihoods, with three-quarters of producing households also selling livestock.

Timber is also an important source of income (although for only 13% of farms), as three-quarters of those producing it on-farm are also selling it. Around half of households produce fuelwood on-farm and one-fifth of those sell some.

3.2 Off-farm livelihood sources

Various farm products were also obtained from off-farm sources (Table 3.3). The most common farm products obtained off-farm included food crops and fuel wood, as reported by 61% and 57% of the surveyed households, respectively. Fruit (30%) and fish (28%) are also sourced by quite a few households from off-farm sources. Fuelwood is gathered elsewhere by over half of households (57%). Honey (12%), manure (11%), fodder (7%), and charcoal (6%) are other products that are gathered off-farm by some households.

In terms of division of labour, it appears that men are more involved in gathering off-farm products than are women. For example, more men (65%) than women (32%) participated in obtaining food crops off-farm, and more men (52%) than women (31%) picked fruit. Men provided the labour for tasks involving fish, charcoal and honey gathering off-farm. Women bear the main responsibility and provide the labour for gathering wood for fuel, however. Like the on-farm products, the children's participation in tasks to obtain farm products off farm was minimal.

Table 3.3 Agricultural products coming from off-farm sources/areas and division of labour

Product		Percentage of households stating these household members do 'most of the work' in relation to this product:				
	% of households	Man	Woman	Female Child	Male Child	Several
Food crop (raw)	61	65	32	0	0	2
Fruit	30	52	31	0	0	17
Fodder	7	60	0	0	0	40
Fish	28	85	5	0	3	8
Timber	9	92	8	0	0	0
Fuel wood	57	21	53	4	0	20
Charcoal	6	57	43	0	0	0
Honey	12	76	18	0	0	0
Manure/compost	11	80	13	0	0	7

3.3 Diversification Indicators

A production diversification indicator was created by adding up the total number of agricultural products produced on-farm:

1=1-4 products (low production diversification)

2=5-8 products (intermediate production diversification)

3=more than 8 products (high production diversification)

On the selling/commercialization side, the total numbers of agricultural products produced on their own farms, with some of the products sold were added up:

0=no products sold (no commercialization)

1=1-2 products sold (low commercialization)

2=3-5 products sold (intermediate commercialization)

3=more than 5 products sold (high commercialization)

The results of these diversification indices for our surveyed households in Rakai are shown in Table 3.4. One-quarter of these households are highly diversified, producing more than 9 different types of agricultural products. Almost 60% produce between 5 and 8 products, and 14% of these households rely on a very few types of agricultural products for their livelihoods.

Very few households (7%) sell no agricultural products whatsoever. Another 28% sell only a couple, and just below half sell between 3 and 5 different products. One-fifth of surveyed households are highly diversified with respect to their farm income sources, selling more than 6 types of products.

Table 3.4 Production and Commercialization Diversification Indices

Production Diversification:	% of households
1-4 products (low production diversification)	14
5-8 products (intermediate production diversification)	59
9 or more products (high production diversification)	27
Selling/Commercialization Diversification:	
No products sold (no commercialization)	7
1-2 products sold (low commercialization)	28
3-5 products sold (intermediate commercialization)	45
6 or more products sold (high commercialization)	20

3.4 Sources of cash income

Table 3.4 shows diversity of cash income sources from off-farm activities. Employment on other peoples' farms, other types of jobs, business, and remittances, are the most important sources of cash income (other than from their own farms), with roughly 40% of these households reporting receiving cash income from each of these sources.

Eleven percent of households receive no cash income from any off-farm sources. Loans are received by 16% of households from a formal source (e.g. a bank) in the last year, but more (28%) have received credit from an informal source (e.g. a group).

Table 3.4 Sources of cash income other than from own farm

Source of Cash Income	% of households
Employment on someone else's farm	41
Other off-farm employment	41
Business	40
Remittances/gifts	37
Payments for environmental services	1
Payments from gov't or other projects/programs	14
Loan or credit from a formal institution	16
Informal loan or credit	28
Renting out farm machinery	6
Renting out your own land	9
No off-farm cash source	11

4.0 Crop, Livestock, Tree, Soil, Land, Water Management Changes

4.1 Most important crops and animals and changes made

94% of surveyed households had been living and farming in Rakai for at least 10 years. These households were asked what their 3 most important crops are (from an overall livelihoods perspective) now, and 10 years ago. These crops are banana (produced by 67% of the surveyed households now and 52% then), beans (59% now and 55% then) and maize (54% now and 45% then). So bananas, beans and maize have all increased in importance in this area.

Other relatively important crops cited were coffee (34%), cassava (30% of households included this as one of their three most important crops), potatoes (19%), and sweet potatoes (12%). Fruits being grown include mango, passion fruit, avocado and jackfruit, and important vegetables mentioned were tomatoes and leafy vegetables.

With respect to livestock, the main animals now versus 10 years ago are: chickens (77% of household now, 65% then), goats (62% now, 64% then), and pigs (44% now, 59% then). Dairy cow ownership is also interesting to note, down from 38% of households 10 years ago versus 25% now.

They were then asked about what changes they had made in terms of introducing or testing any new crops, or no longer growing a crop. Only 8% of households had not made any crop-related changes. 20% had made one change, 28% made two changes, 31% made three changes, and 13% made four changes over the last 10 years.

The most commonly introduced new crops were potatoes (26% of households), cassava (25%), avocado (16%) and beans (16%). Crops completely dropped by over one-third of households were sorghum and peanuts. 30% of households had stopped growing peanuts, 24% beans, and 18% maize in one growing season.

Crop management related changes

With respect to crop management-related changes, we examined whether households had made one or more of the following changes over the last 10 years:

- Introduced intercropping;
- Earlier land preparation;
- Earlier planting;
- Later planting;
- Expanded area;
- Reduced area;
- Started using pesticides/herbicides;
- Integrated pest management;
- Integrated crop management.

The results showed that one-half of households had made 3 or more of these cropping related changes in the last decade, 43% had made one or two of these changes, and 6% had made none of these changes.

Water management related changes

For the water management-related changes, the following changes in practice were considered:

- Started irrigating;
- Introduced micro-catchments;
- Introduced improved irrigation;
- Introduced improved drainage.

Here, we found that 71% of households had made none of these water management-related changes, 23% had made one such change, and 6% had made two or more changes over the last decade.

Soil Management related changes

For the soil management related changes, we considered the following behavioural changes:

- Stopped burning;
- Introduced crop cover;
- Introduced ridges or bunds;
- Introduced mulching;
- Introduced terraces;
- Introduced stone lines;
- Introduced contour ploughing;
- Introduced rotations;
- Started using or using more mineral/chemical fertiliser;
- Started using manure/compost.

The results show that one-quarter of these Rakai households have not made any of these soil management-related improvements, one-quarter have introduced one new soil management practice, and almost one-half reported having made two or more of these types of changes in the last 10 years.

Tree/Agroforestry management related changes

The results show that 80% of households have made some tree/agroforestry management related changes in the last decade.

Specific crop and animal management related changes

We found that Rakai households have made many changes to their farming practices over the last 10 years, affecting a wide diversity of crops, including cereals, legumes, roots, fruits, vegetables and other crops. Table 4.1 shows the most common types of crops being newly introduced by farmers, tested, or abandoned over the last decade.

It shows that while some farmers have stopped growing sorghum, maize or millet, other farmers have tested or adopted them. This pattern also shows up for legumes, roots, fruits and vegetable crops.

Table 4.1 Changes and crops affected

Type of Change	Types of Crops					
	Cereals	Legumes	Roots	Fruits	Vegetables	Others
New Crops Introduced	Sorghum Maize Finger millet	Beans Peanuts Peas Sesame Soya beans	Cassava Sweet potato Potato Yam	Mango Citrus Passion fruit Pineapples Jackfruit Avocado	Leafy vegetables Carrots Tomatoes Pepper Eggplants Pumpkins	Banana Coffee Sugarcane Tobacco Cocoa Vanilla Trees
New Crops Being Tested	Wheat Finger millet	Peanuts Peas Sesame soya beans	Cassava Sweet potato Potato Yam	Citrus Passion fruit Pineapples Jackfruit	Cabbage Carrots Leafy vegetables Peppers Pumpkins Onions Tomatoes	Bananas Coffee Tobacco Vanilla
Crops that households abandoned totally	Sorghum Maize Finger Millet Millet	Beans Peanuts Peas Sesame Soya beans	Cassava Sweet potato Yams Potato	Pineapple	Leafy vegetables Onions Tomatoes Cabbage Pumpkin	Banana Coffee Sugarcane Tobacco Vanilla
Crops that household abandoned for a growing season	Sorghum Maize Millet Soybean	Beans Peanuts Peas	Sweet potato Cassava Potato Yams		Cabbage Tomatoes Peppers Pumpkins	Tobacco Vanilla

Changes made with respect to crop varieties

Table 4.2 shows that the most prominent changes that have taken place across all crops (households reported on up to 5 crops) included: (i) introduction of new varieties of crops; (ii) planting higher yielding varieties; (iii) stopping planting a variety; (iv) planting better quality varieties; (v) switching to shorter cycle varieties, and (vi) planting drought-tolerant varieties.

Table 4.2 Changes made with respect to crop varieties

	Percentage of households
Introduced new variety of crops	88
Planting higher yielding variety	85
Planting better quality variety	68
Planting pre-treated/improved seed	27
Planting shorter cycle variety	62
Planting longer cycle variety	20
Planting drought tolerant variety	59
Planting flood tolerant variety	2
Planting salinity-tolerant variety	15
Planting toxicity-tolerant variety	5
Planting disease-resistant variety	53
Planting pest-resistant variety	50
Testing a new variety	18
Stopping planting a variety	72
Other changes	1

Changes in land and crop management practices

Table 4.3 presents the land and crop management practice changes that have been made by the surveyed households (each household reported on the changes they had made for up to 5 crops). Twenty-nine different changes were mentioned across all crops. The most frequently mentioned changes were: reductions, and in other cases, expansion in the area planted; introduction of mulching (in the case of bananas); earlier land preparation and planting; starting to use manure or compost; introducing intercropping; starting to use (or using more) pesticides; and introducing micro-catchments.

Table 4.3 Changes with respect to land and crop management practices

Changes Made	Percentage of households	Changes Made	Percentage of households
Expanded area	62	Introduced improved irrigation	2
Reduced area	63	Introduced improved drainage	3
Started irrigating	10	Introduced mechanized farming	0
Stopped irrigating	5	Earlier land preparation	33
Stopped burning	0	Earlier planting	40
Introduced intercropping	41	Later planting	17
Introduced crop cover	4	Started using more mineral/chemical fertilisers	13
Introduced micro-catchments	22	Started using manure/compost	50
Introduced/built ridges or bunds	15	Stopped using manure/compost	1
Introduced mulching	57	Started using or using more pesticides/herbicides	39
Introduced terraces	1	Started using integrated pest management	11
Introduced stone lines	1	Started using integrated crop management	5
Introduced hedges	5	Others	1
Introduced contour ploughing	1		
Introduced rotations	24		

Some of the changes that have only been made by very few households in this area include: (i) use of irrigation; (ii) introduction of crop cover; (iii) introduction of stone lines; (iv) introduction of hedges; (v) introduction of contour ploughing; (v) introduction of improved drainage; (vi) use of integrated crop management. There has been no introduction of mechanized farming by these households.

Changes and reasons for changes to the most important crops

Table 4.4 examines the changes made to the most commonly grown crops — bananas, beans and maize.

Table 4.4 Changes made in farming practices to Bananas, Beans and Maize (percentage of cases for households growing these crops)

Change	Bananas	Beans	Maize
New variety introduced	70	84	76
Higher yielding variety introduced	48	69	69
Better quality variety introduced	37	45	39
Drought tolerant variety introduced	26	23	30
Stopped using a variety	30	52	44
Shorter-cycle variety introduced	15	42	56
Planted pre-treated or improved seed	9	20	41
Introduced mulching	68	0	0
Started using manure/compost	55	3	6
Expanded planted area	34	24	25
Reduced planted area	20	34	21
Introduced intercrops	14	34	45
Earlier land preparation	2	40	29
Earlier planting	3	44	34

For all these crops, widespread changes have included the introduction of new varieties, particularly higher yielding and better quality varieties. Also for all three crops, the introduction of drought tolerant varieties has been a change made by many. Introducing shorter-cycle varieties has been a key change made in relation to beans and maize, as has the introduction of intercropping. Between a third and a half of these households have prepared their land and planted beans earlier than they use to, and over one-third have done so for maize. Just over 40% of households have switched to planting pre-treated/improved maize seed.

Table 4.5 shows the three most frequently cited reasons for making these changes for each of the three main crops. Note that the number of responses regarding climate-related reasons falls far short of the number of non-climate related reasons cited. In other words, prices, new pests and diseases, and better yielding varieties becoming available were more likely to drive the changes in farming practices seen to date in Rakai.

With respect to climate-related reasons, changes made to bananas and maize were apparently partly driven by a perception of more overall rainfall, while for beans it was less overall rainfall. For all three crops, these households agree that an earlier start of the rains is a reason behind their change in behaviour.

Table 4.5 Reasons for changes made in farming practices to Bananas, Beans and Maize

Climate-related reasons	**Percentage of responses**	**Non Climate-related reasons**	**Percentage of responses**
Bananas (44 hhs)		**Bananas (84 hhs)**	
More frequent droughts	48	New pests/diseases have come	34
Strong winds	30	Better yield	32
More erratic rainfall/Less overall rainfall	18	Land is less productive	24
Beans (54 hhs)		**Beans (94 hhs)**	
Less overall rainfall	44	Better yield	57
More frequent droughts	31	Better price	43
More overall rainfall	30	More opportunities to sell	32
Maize (53 hhs)		**Maize (73 hhs)**	
More frequent droughts	41	Better yield	56
More erratic rainfall	40	Sufficient labour	26
More overall rainfall	36	More resistant to pests/diseases	26

4.3 Livestock-related changes

The types of changes Rakai households have been making over the last 10 years with respect to their livestock holdings are shown in Table 4.6. Over half have stopped keeping one or more types of animals during this period, and 44% have reduced their herd size. At the same time, another one-fifth of households has managed to increase the number of animals held.

Introduction of new breeds or changes to herd composition (e.g. proportion of females versus males, or younger versus older animals) have been made by 16% of households.

Table 4.6 Changes that Have Occurred Within the Livestock Sector

Livestock-related changes	Percentage of households
New farm animal introduced	38
New farm animals being tested	7
Stopped keeping one or more types of farm animals	60
New breed introduced	16
Reduction in herd size	44
Increase in herd size	21
Change in herd composition	17
Stall keeping introduced	9
Fencing introduced	9
Cut and carry introduced	11
Growing fodder crops	10
Improved pastures	4
Fodder storage (e.g. hay, silage)	1
Other kinds of changes	1

Few respondents (less than 10%) reported making the following changes: introduction of new farm animals being tested, introduction of stall keeping, introduction of fencing, introduction of cut and carry, growing of fodder crops, use of improved pastures, or fodder storage.

Table 4.7 Reasons for Changes in the Livestock Sector

Reasons	Percentage of hh's citing reason related to specific animal types	Percentage of hh's citing reason as not animal specific	Overall Percentage of households
Better price	38	58	96
New opportunity to sell	37	58	95
More productive	37	57	94
More frequent droughts	11	82	92
More frequent floods	1	77	78
Higher tides	0	15	15
Frequent cyclones	0	11	11
More salinization	0	16	16
Insufficient labour	23	67	88
Able to hire labour	6	86	91
More resistant to diseases	19	75	92
New diseases are occurring	45	53	96
Government/ project told us to	5	89	94
Government/ project showed us how	6	86	92
Policy changes	1	89	90
Others	24	1	24

Results in Table 4.7 show the main reasons why the various changes have taken place within the livestock sector. Most of the weather or climate-related reasons were only mentioned by a few households, although more frequent floods and droughts were mentioned by 77% and 82% of households respectively when we consider reasons that were not animal specific. The most prominent causes for the changes in the livestock sector that affected specific animal types were

market-related, including better price for livestock products, new opportunities to sell livestock products. The introduction of more productive, and more disease resistant, livestock breeds were other important reasons cited. Emerging diseases within the livestock sector were also a key reason behind these changes. Government and project influences were high when considering changes not specific to particular animal types.

4.4 Adaptability/Innovation Indicator

An adaptability/Innovation Indicator was defined as the following:

0-1=zero or one change made in farming practices over last 10 years (low level)
1=2-10 changes made in farming practices (intermediate level)
2=11 or more changes made in farming practices (high level)

We see in Table 4.8 that only two households made zero or only one change in what and how they farm over the last 10 years, 31% of households made between 2 and 10 changes, and 67% made 11 or more changes. In other words, two-thirds of these households have been adapting to their changing circumstances and making a significant number of adjustments or changes in their farming practices over the last 10 years. Further analysis, particularly of these more adaptive households, is needed to better understand exactly what adaptations they have made and why.

Table 4.8 Adaptability/Innovation index

Number of changes made in farming practices in last 10 years:	**% of households citing**
Zero or One (low)	2
2-10 changes (intermediate)	31
11 or more changes (high)	67

4.5 Mitigation Indices

Several climate mitigation-related behavioural changes were used to create the following indices:

Tree management:
This index shows whether a household has either protected or planted trees within the last year.

Soil amendments:
This index shows if the household has used fertilizer in the last year, or have started using fertilizer or manure on at least one crop.

Input intensification

There are 7 'changes in agricultural practices/behaviour over the last 10 years' considered here to create an index with 3 levels - no intensification (none of the following), low intensification (1-3 of the following), and high intensification (4-7 of the following). They are:

- Purchased fertilizer
- Started to irrigate
- Started using manure/compost
- Started using mineral/chemical fertilizers
- Started using pesticides/herbicides
- Started using integrated pest management techniques
- Planted higher yielding varieties

Productivity Index

This index shows if a household has reported achieving a better yield from any crop, or that their land is more productive for any crop over the last 10 years – such households are classified as showing an "increase in productivity".

Table 4.9 shows the results for the mitigation-related indices for the surveyed households in Rakai. 94% of households reported some tree management activities over the last year, and 59% undertook soil amendment (e.g. fertilization) actions. Virtually all surveyed households had experienced increases in agricultural productivity. 9% have not increased their input use, 74% have intensified their input use at a low level, and 17% at a higher level.

Table 4.9 Mitigation-related indices

Index	**No** **(% of hh's)**	**Yes** **(% of hh's)**
Tree management	6	94
Soil amendments	41	59
Increase in productivity	1	99
Input intensification	9	Low-74 High-17

5.0 Food Security

The monthly source of food for the family was queried, i.e. whether it came mainly from their own farm, or elsewhere for each month (in an average year). Households were also asked during which months of the year they struggled to have enough food to feed their family, from any source.

Figure 5.1 indicates that most households are getting their food main from their own farms in January, February, July and August. During the period September through December, over one-half of these households are relying largely on markets and other sources to feed their families.

Figure 5.1 Main source of food for the household

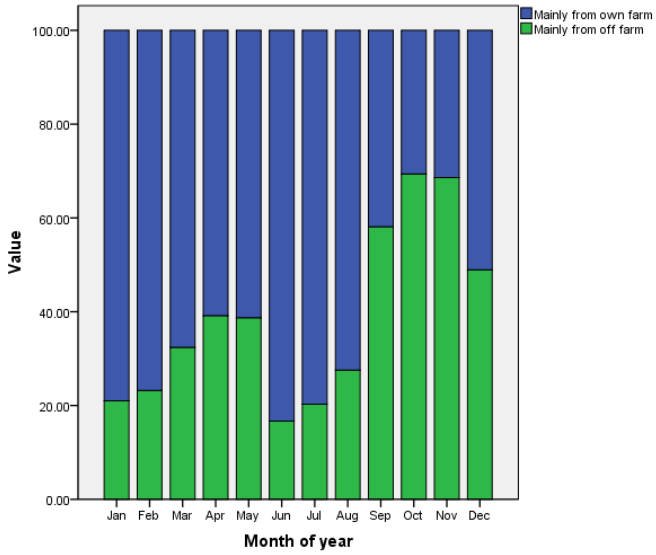
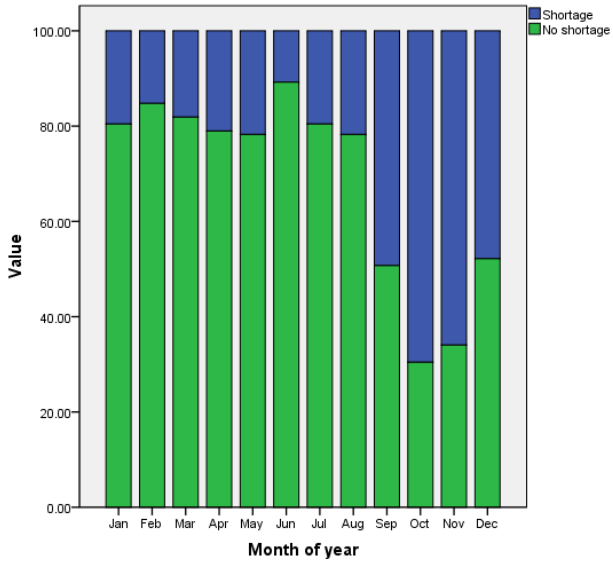


Figure 5.2 shows that over half of households actually experience food shortages from September through December.

Figure 5.2 Hunger/Food shortage months



5.1 Food Security Index

The food security index we created is based upon the number of months that the household has difficulty getting food from any source (i.e. from their own farm or stores, gifts, purchases or transfers).

For our surveyed households in Rakai, only 10% are 'food secure' all year long. 15% have enough for at least 10-11 months of the year. 74% of these households struggle to get enough food to feed their family for more than 2 months out of a year.

Table 5.1 Food Security Index

Percent of surveyed households reporting:				
More than 6 hunger months/year	**5-6 hunger months/**	**3-4 hunger months/**	**1-2 hunger months/**	**Food all year round/No hungry period**
10	25	39	15	10

6.0 Land and Water

6.1 Water for Agriculture

For the on-farm water sources (used for agricultural purposes, not for household use), we see the number and percentage of households using each water source, and that 74% of households have none of these agricultural water sources on their own farms (Table 6.1). Very few households are using any type of irrigation (13%), or have tanks (12%) or dams/waterholes (8%).

Table 6.1 Water sources for agriculture on-farm

On-farm agricultural water source	**% of households**
Irrigation	13
Tanks for water harvesting	12
Dams or waterholes	8
Boreholes	1
Water pumps	0
None of the above	74

In examining how this varies by household type (table not shown), the results showed that only 6 (22%) female-headed households had access to any on-farm source of agricultural water whereas 40 male-headed households (36%) did, so it appears that female-headed households are even more at a disadvantage in this area.

6.2 Land Use

The land available for each household includes both land that is owned by the household and land that is rented. As seen in Table 6.2, just over half of households have access to less than one hectare of land and just under half have access to between 1 and 5 hectares. Only a couple of households have more than 5 hectares.

Table 6.2 Total land size accessed by households

Number of hectares of land owned and rented in	% of households
Less than one hectare	51
1-5 hectares	48
Over 5 hectares	1

Mean land size in Rakai was 1.2 ha (median: 0.8 ha). Sixty-eight percent of households reported that all the land they cultivate was owned by the household (i.e. none was rented-in). On the other hand, 84% of households reported that the land they use for grazing is rented-in, though only 4% use communal land for grazing. Fifty-six percent of households allocated all the land they owned to food production.

Hired Machinery or Labour

The results show that 42% of households sometimes hire farm labour, and male and female-headed households are equally likely to hire farm labour. Farm machinery is seldom hired by these households.

7.0 Inputs and Credit

Table 7.1 shows that for our surveyed households, almost half bought seed in the last 12 months, 20% purchased fertilizer, 60% purchased pesticides, and 59% bought veterinary medicines. 26% of households receive some credit for agricultural activities. Only one household had purchased agricultural insurance.

Table 7.1 Purchased Input use

In the last year, did you use:	% of households
Purchased Seeds	48
Purchased Fertilizers	20
Purchased Pesticides	60
Veterinary medicine	59
Received credit for agricultural activities	26
Bought crop or livestock insurance	1

7.2 Fertilizer Use

Table 7.2 shows the types of fertiliser households were using. As we saw above, only 1/5 of households in this area are applying any types of chemical fertilizers at all. The most common fertilizers applied are DAP, Urea and NPK. Percentages in this table are with respect to the households that applied fertiliser.

Table 7.2 Type of fertilizers used

Fertilizer type	% of households
Urea	30
NPK	18
DAP	37
CAN	4
Rock Phosphate	4
Local mixture	7

This survey did not obtain information on quantities of fertilisers applied. Just over 50% of households who used fertiliser applied it to their most important crop. The crops to which fertiliser was applied by the most households were maize (52% of those using fertiliser) and coffee (37% of those using fertiliser).

8.0 Climate & Weather Information

An analysis of which households are receiving any type of climate or weather information shows that most households (84%) are receiving some type of weather or climate-related information. We next looked at who is receiving what kinds of weather-related information within the households.

8.1 Types of weather-related information

We see in Table 8.1 that the majority of farmers received forecasts of extreme events (79%), pests and disease outbreaks (63%); and forecasts on the start of the rains (80%). Only 51% and 32% of the respondents said they had heard a 2-3 month weather forecast, or a short-term forecast of the weather for the next 1-3 days.

Table 8.1 Type of weather-related information received and used

	Proportion of Farmers Receiving and Using Weather-related Information to Change Practices		
Type of information	**% of households receiving information**	**% of those households also receiving advice with information**	**% of households receiving advice that were able to use it**
Forecast of extreme event	79	76	88
Forecast of pest or disease outbreak	63	77	76
Forecast of the start of the rains	80	78	87
Forecast of the weather for 2-3 months	51	78	96
Forecast of the weather 1-3 days	32	78	94

For households that had received all these types of information, roughly three-quarters said they also received some agricultural advice on how to use it. And it appears that the advice was useful, as the vast majority receiving the advice were also able to use it to make adaptive changes to their farming practices.

Tables 8.2 and 8.3 report on where these households are getting their weather information, and who received it.

Table 8.2 Type and Sources of Climate and Weather Information

	Percentage of Households Receiving Information from Various Sources							
Type of information	**Radio**	**TV**	**Govt**	**NGOs**	**Friends**	**News-paper**	**Obser vation**	**Local groups**
Forecast of extreme event	87	1	2	2	13	1	11	14
Forecast of pest or disease outbreak	81	-	9	-	16	2	2	16
Forecast of the start of the rains	90	1	1	-	12	1	10	11
Forecast of the weather for 2-3 months	89	1	-	-	15	-	13	11
Forecast of the weather for 1-3 days	69	2	-	-	24	-	31	-

Radio is by far the most common source of weather-related information. These households are also relying on friends and their own observations. Government agricultural extension officers were cited as a source of information on predicted pest or disease outbreaks, but only by 9% of households. Very few respondents received information from the television.

8.2 Who is receiving and using weather-related information?

Table 8.3 shows which household members are receiving weather-related information.

Table 8.3 Gender breakdown of different kinds of weather-related information

Type of information	**Who within the Household is Receiving Weather Information**		
	Men	**Women**	**Both men and women**
Forecast of extreme event	34	20	46
Forecast of pest or disease outbreak	30	19	51
Forecast of the start of the rains	32	22	46
Forecast of the weather for 2-3 months	32	15	52
Forecast of the weather 2-3 days	20	13	67

For most types of weather-related information the information is received by men in about 30% of households, by women in about 20% of households and by both men and women in 50% of households. The exception is short-term weather forecast for the next 2 to 3 days which is received by both men and women in two-thirds of the households that receive this information. These figures are shown in Table 8.3 where the percentages are with respect to the households receiving the information.

Few changes in practices were reported in response to the reception of weather information (Table 8.4). The most common change made in response to all types of weather information received was in the timing of farming activities (e.g. planting). Pest and disease outbreak information was used to inform changes in pesticide use. We see very little responsiveness in terms of changing crop types or varieties in response to weather information.

Table 8.4 How Weather Information was used

	Percent of households receiving information regarding:				
Practices changed	**extreme event info**	**start of the rains prediction**	**pest & disease outbreak prediction**	**2-3 month weather forecast**	**2-3 day weather forecast**
Timing of farming activities	60	89	20	87	67
Crop type	4	3	4	6	3
Crop variety	1	0	4	0	0
Input use (seed, fertiliser, pesticides)	0	1	33	2	0
Manure/compost/mulch use	4	0	0	0	0
Field location	0	1	0	0	0
Planted trees	11	0	2	0	0
Land management practices	7	5	6	2	0
Soil and water conservation practices	8	7	2	0	3
Irrigation practices	1	0	0	0	0
Water management practices	5	1	0	0	3
Feed management	1	0	6	0	0

Note: the percentages above are with respect to households receiving information with advice that they were able to use.

8.3 Sources of assistance to climate crises

Eight-seven percent of respondents stated they had experienced a climate crisis in the past 12 months. However, only 17% of these said they had ever received any assistance to overcome the crisis. Table 8.5 indicates the sources of assistance for the different respondents

Table 8.5 Sources of Assistance to Climate Crises

Source of Assistance	% of households receiving
Friends, relatives, neighbors	22
Government agencies	50
Politicians, e.g. MPs	1
NGOs/CBOs	22
Religious organizations	6
Local community group	17

Note: Percentages here are with respect to the number of households receiving assistance for climate related crises.

9.0 Community Groups

Respondents were asked if someone in the household was a member of an agricultural or natural resource management related group. Such group membership appears to be quite low for Rakai surveyed households. The most frequently joined group appears to be savings/credit groups, with 21% of households belonging to this type of group (Table 9.1). Sixty-four percent of households are reportedly not members of any agricultural/natural resource management-related group.

Table 9.1 Group membership

Type of group	% of households	Type of group	% of households
Tree nursery/tree planting	7	Agricultural productivity enhancement related	15
Water catchment/management	6	Seed production	5
Soil improvement related	7	Vegetable production	7
Crop introduction/substitution	6	Other group not mentioned above?	4
Irrigation	2	Agricultural product marketing	7
Savings/credit related	21	No groups	64

10.0 Assets

10.1 Asset Indicator

Households were asked about household assets they had, from a set list. The assets they were asked about include the following:

Energy: Solar panel, Generator (electric or diesel), Battery (large, e.g. car battery for power), Biogas digester;

Information: Radio, Television, Cell phone, Computer, Internet access;

Production means: Tractor, Mechanical plough, Mill, Thresher;

Transport: Bicycle, Motorcycle, Car or truck;

Luxury items: Fridge, Air conditioning, Electric fan, Bank account, Improved Stove.

The total number of assets in all categories was added up and the following asset indicator created:

0=no assets (basic level)
1=1-3 assets (intermediate level)
2=4 or more assets (high level)

It is important to note that this indicator is not intended to include every possible type of asset, and that the checklist includes some indicators that we expect to see becoming more important in the future than they may be at present. It also does not include a critical asset for resource-poor households, livestock assets.

The results of the analysis for these Rakai households show that 10% have none of the household assets we inquired about, 66% of the surveyed households have between 1 and 3 of these assets, and 24% own 4 or more of these assets (Table 10.1).

Table 10.1 Asset Indicator

Number of queried assets	% of households
None (basic level)	10
1-3 (intermediate level)	66
4 or more	24

Table 10.2 shows the percentage of households with various assets and access to utilities. 85% of households own a radio and just over half have a cellphone. Sixty-one percent own a bicycle, and 16% have a motorcycle, but only 1% own a car or truck. Next to none have electricity or running water in their homes. Only 16% of these households have a bank account.

Table 10.2 Asset Ownership

Type of Asset	% of hhs	Type of Asset	% of hhs
Radio	85	Electric fan	2
Television	5	Thresher	0
Cell phone	54	Liquid pressurised gas	0
Bicycle	61	Internet access	0
Motorcycle	16	Boat	1
Car or truck	1	Fishing nets	2
Computer	1	Bank account	16
Solar panel	6		
Tractor	1	Improved food/feed storage facility	12
Mechanical plough	0	Water storage tank (domestic water)	9
Mill	0	Improved housing (brick, concrete)	61
Improved stove	17	Well/borehole (for household water)	4
Generator (electric or diesel)	1	Running water in dwelling	1
Battery (large, e.g. car battery)	6	Electricity from a grid	3
Water pump/treadle pump	15	Improved housing (brick, concrete)	61
Biogas digester	1	Improved roofing (tin, tiles)	89
Refrigerator	2	Separate livestock housing	30
Air conditioning	0		

With respect to food security-related assets, only 12% of households have some type of improved grain/food storage facility, although 30% of them have separate housing facilities for their livestock, suggesting how important those are to these families' wellbeing. We see evidence of improved housing/roofing by the majority of households, which is typically one of the first investments rural households make when they have met their food and other basic needs. Encouraging to see is that improved stoves have been adopted by 17% of households, and a few households have already obtained solar panels (and one has a computer).

Appendix 1: Survey Process and Implementation

In Rakai District, the unit of analysis for the CCAFS baseline survey was the household. Households that were interviewed were selected through a rigorous sampling scheme that involved a three level hierarchical multistage sampling procedure including: the Block, the Villages, and eventually the Households. The procedures that follow explicitly describe how these sampling techniques were conducted.

Block Selection

The research team carried out discussions with the District Agricultural Officer (DAO) to select the block based on the criteria generated within the training manual. The criteria were discussed with the DAO and the following criteria was agreed upon to select the 10×10 km block. The block should:

- Represent research sites under different institutional arrangements.
- Have contrasting climate-related problems and opportunities for intervention.
- Have high potential sites where community members will produce impact and accept to enhance up scaling.
- Have key social economic issues including urbanization and gender participation.
- Have evident participation of local and political leaders to scale up the generated results as well as ensure the sustainability of the project result(s).
- Have active presence of NGOs, research organization(s) as well as community based organization(s) to facilitate the scaling up of the project activities Be safe to work in and be accessible by the project team.

Using the above criteria, the team with the assistance of the District Agricultural Officer generated a 10km×10 kilometer block which included 4 sub-counties namely; Ddwaniro, Rakai, Byakabanda and Lwanda. The block also had several NGOs/CBOs supporting agricultural related activities. Among these were; World Vision, RACA, CIDI, LOVEM, CONCERN, Masaka District Diocese Development Organisation (MADDDO), Rakai Aids Information Network (RAIN), and Community Enterprise Development Organization (CEDO).

Village Selection

Subcounties are large administrative units that were further sub-divided into parishes to make it easier to compile the village lists. The parishes are smaller administrative units that comprise the sub-county and can further be sub-divided into villages. It was thus important for the team to consult with the sub-county chiefs to generate the names of the parishes and subsequently the names of the villages that comprised each parish. The parish was only used to make it easy for the sub-county and parish chiefs to accurately identify the villages (see annex 1). All the villages in the parishes were identified and also verified with the different parish chiefs. The list of villages was used as a sampling frame to randomly select 7 villages to participate in the survey using the table of

random numbers adopted from the Statistical Package for the Social Sciences. This was a divergence from the manual table of random numbers that was proposed in the trainer's manual. Table 1 shows the villages that were selected to participate in the study.

Household Selection

The villages served as the entry points to develop a list of households that comprised the village. The Local Council (LC) chairperson for each village was contacted and requested to identify four other community members who were knowledgeable about the village boundaries as well as the names of the households in each of the villages. Thus a total of five to ten persons was engaged in a focus group meeting and facilitated to generate a participatory village map. Like the manual stipulates, the village mapping was carried out in an open environment where other community members dropped in and contributed towards the list. It was also made clear to the focus group participants that participation in the village mapping did not necessarily confirm their participation in the detailed household survey.

Also the maps were generated on pieces of manila sheet, where each household was allocated a number on the map and written notes were taken to assign a household name to a household number. These household names and numbers were entered into SPSS and computer based random selector was used to generate the list of the households that will participate in the baseline survey. It is also important to note that the number of households differed from village to village. Annex 2 shows the names of households in each of the village as well as the households that were selected to participate in the survey.

Data Collection Procedures and Quality Assurance Strategies

Team Composition

The Rakai team was made up of six members with proven experience in conducting surveys. The team included a Team Leader, a Site Supervisor, four enumerators and two data clerks (see the table below).

Names and positions of responsibility for Rakai Site Team

Position	Name
Site Coordinator	Dr. Florence Birungi Kyazze
Site Supervisor	Mr. Ahmed Zziwa
Enumerators	Ms. Rebecca Mukebezi
	Ms. Patria Nyabahutu
	Mr. Owen Sseremba
	Mr. Henry Magala
Data Clerks	Ms. Judith Asiimwe
	Ms. Stella Namazzi

To ensure that a competent and high quality team was assembled, a rigorous recruitment process, as described below, was undertaken.

Enumerator and Supervisor Recruitment Process

The enumerators to participate in the baseline survey were recruited through an advertisement process. Adverts were posted on public notice boards in Makerere University requesting for well qualified research assistants to participate in a data collection exercise due in the month December. The adverts emphasized the quality of the research assistants based on the guidelines that were stipulated in the trainer's manual. Ability to speak, write and read the local languages in the study site was a requirement. The persons that were recruited were given an informal verbal interview by the team leader but were also given the task of back translating the instrument that had been translated in the common local language spoken in Rakai District. Four enumerators were thus recruited to participate in the study.

The field supervisors were recruited through a solicitation process based on their wide experience in designing and conducting qualitative and quantitative research. In addition, field supervisors were recruited for their ability to effectively lead team as well as carry out an unbiased quality assurance exercise. Also note that roles and duties of the different members were outlined as stipulated in the training manual for CCAFS baseline study

Description of Data Collection Tools

The questionnaire, the major data collection instrument was development through joint efforts between the CCAFS coordinating team and the national team leaders. After several consultations, a final version written in English was recommended. The questionnaire, initially written in English, was translated into Luganda, the local language spoken in Rakai District, to ensure that all enumerators collected reliable of information. To ensure the quality of the translation, it was necessary to get the questionnaire back-translated into English by another person. It was important to translate the questionnaire into the local language because most of the study respondents were non-English speakers.

Supervisor/Enumerator Training and Field Preparation Activities

Training of supervisors and enumerators was crucial to this exercise to ensure that good quality data for the baseline. The training was carried out for both the supervisor and enumerators by the team leader as per guidelines that are stipulated in training manual for the CCAFS baseline study. The training was carried out using the local language as well as the translated questionnaire. Basically the training;

- Introduced the supervisor and enumerators to the objectives and the general outlay of the survey instrument and the sampling procedures
- Explained the roles of both the enumerators and supervisors as outlined in the training manual
- Provided hands on experience of how to collect the required data.

Data Collection Procedures

A formal appointment was made with each of the household that was selected to participate in the survey. The LC village chiefs in each of the villages were requested to assist in delivering verbal

request to the selected households and receive confirmation on the best time and day when the respondents will be available for the interview. On each of the days, enumerators were dropped and picked from the various households to collect the required information, while the field supervisor took the GPS reading for each of the household. At the end of each day, the field supervisor scrutinized each of the completed questionnaires and held a one on one discussion with the enumerator to effect the collection. At the end of the individual discussion, the field supervisor convened a general meeting to forge and plan a way forward for the next day.

Data Entry Procedure and Analysis

Data was entered using CS-Pro software with technical backstopping from the CCAFS coordinating desk. Since this was a new program, training activities on how to use the programme were undertaken to ensure that data was entered accurately. The data entry process was entrusted to data clerks each working parallel to the other on the same data set. It was critical that this was done to ensure that clean data was entered. This was ensured by a feature in the CS-Pro software component that could do comparison to identify if any difference existed within the same data set. The compatibility of CS-Pro software with the SPSS software was an advantage that enabled the team to export to data from CS-Pro to SPSS for basic descriptive statistical analyses. The major statistical tools that were used were frequencies and means that enable the description of the farming system as well as the trends for major socio-demographic characteristics of the farming communities, basic livelihood and welfare indicators, agriculture and natural resources management practices and strategies, access and use of climate and agricultural-related information; and current risk management, mitigation and adaptation practices. Note that whereas applicable, the frequencies are generated through the multi-responses feature of the SPSS program to ensure that clear trends for the variation within the components of the farming system are captured concisely.

Appendix Two: Randomly selected villages for the baseline study

No.	Village Selected	Parish	Sub-county
1.	Kakumbiro	Byakabanda	Byakabanda
2.	Bubba	Kamukalo	Byakabanda
3.	Kyengeza	Kasensero	Lwanda
4.	Kituntu	Kiyovu	Lwanda
5.	Gosola	Kiyovu	Lwanda
6.	Kijuna B	Buyamba	Ddwaniro
7.	Kateera B	Lwakaloolo	Ddwaniro