

## Supplementary S1: Questionnaire

Questionnaire Identification Number   /  /  /  /  /  /  /  /  

### Part A: Respondent's Identification/Background

Country	_____	CCODE
District	_____	DICODE
County	_____	COUCODE
Sub Country	_____	SCOCODE
Division	_____	DIVCODE
Location	_____	LOCCODE
Ward	_____	WARDID
Sub Location	_____	SLCODE
Household	_____	HHCODE

Having read the informed consent form, would you like to participate in this interview?

[    ] 1 =Yes    [    ] 0 = No

Would you like to be anonymous?

[    ] 1 =Yes    [    ] 0 = No

(If yes, proceed to the type of household part if no enter the respondent name)

Respondent's Name: \_\_\_\_\_ Relationship with the farm owner \_\_\_\_\_ (see codes for A)

Who makes decisions related to the crops in the farming systems \_\_\_\_\_ (see codes for A)

Contact mobile phone No of the respondent \_\_\_\_\_

Name of Household Head \_\_\_\_\_ (if different from the respondent)

Interviewer's Name \_\_\_\_\_ Date of Interview \_\_\_\_\_

Language used in interview \_\_\_\_\_

GPS coordinates of residence:

NORTH: \_\_\_\_\_ EAST: \_\_\_\_\_ ALTITUDE (m.a.s.l.): \_\_\_\_\_

**Type of household**

1. In which year did the household start farming? \_\_\_\_\_
2. What type of farm is it? \_\_\_\_\_
3. Are you a member of a farmer group or association? [     ] 1 =Yes [     ] 0 = No
4. In how many group/association are you a member? \_\_\_\_\_
5. For group/association with the longest membership, how long have you been a member? \_\_\_\_\_ Years
6. Is soil erosion present in your farm [     ] 1 =Yes [     ] 0 = No
7. Have you participated in any land management or soil and water conservation related collective action during the last 12 months? [     ] 1 =Yes [     ] 0 = No
8. How many Parcels do you have (See definition of a field below)
9. What are the sizes of your 3 main Parcels

Parcel 1 \_\_\_\_\_

Parcel 2 \_\_\_\_\_

Parcel 3 \_\_\_\_\_

A PARCEL is a continuous and separate piece of land of any shape that is under same ownership and tenure system

If more than one we are interested in the three major ones that the farmer has!

Codes for part A	8. Fostered child	Codes 2	
1. Household head	9. Hired worker	1. Subsistence	
2. Spouse		2. Cash Crop Farming	
3. Son/daughter		3. Livestock Farming	
4. Parent		4. Subsistence + Cash Crop Farming	
5. Son/daughter in-law		5. Subsistence + Livestock Farming	
6. Grand child		6. Subsistence + Cash Crop Farming + Livestock Farming	
7. Other relative		7. Other relative	

## Part B. Crops grown and Land use and management

**B1.** Total area of owned farm land (hectares) \_\_\_\_\_

**Definitions:** *A PARCEL is a continuous and separate piece of land of any shape that is under same ownership and tenure system*

*A PLOT is a subunit (crop garden, fallow, woodlot, etc.) within a parcel under the same management*

**B2.** Total number of separate parcels you operated in the last 12 months \_\_\_\_\_

**B3.** During the second season of 2017 (September 2017-January 2018) was the number of PLOTS per PARCEL the same as in the first season of 2017 (February 2017 – June/July 2017)? 1= Yes, 0= No \_\_\_\_\_ :**If**

**Yes, fill in only Table B5i and skip Table B6i, otherwise fill both Tables**

**B4.** How many different crops does your household normally grow during the first season (February 2017 – June 2017)? \_ and during second season (September 2017 – January 2018)? \_\_\_\_\_

The homestead will be used as a reference point. Assign each parcel a name (preferably suggested by the farmer, e.g., Valley) and an ID according to the House Hold Code. Each plot will be entered in separate row, in this case 3 rows would be used for this one parcel. Do the same for all parcels.

Consider only 3 main intercrops if you encounter more than 3 crops on a plot. **For intercrops, record information on main crop first, then put intercrop(s) in the next row(s) and make sure that PID and PLID are EXACTLY the same**

[illegible]

**CEREALS:** 01 = Maize; 2 = Sorghum; 3 = Millet; 4 = Rice; 5 = Teff; 6=Wheat. **TUBERS & ROOTS:** 7 = Cassava; 8 = Sweet potatoes; 9 = Irish potatoes; 10 = Yams; 11 = Carrots. **LEGUMES:** 12 = Beans; 13 = Groundnuts; 14 = Soyabeans; 15 = Pigeon Peas; 16 = Green grams; 17 = Cowpeas. **VEGETABLES:** 18 = Cabbage; 19 = Kale; 20 = Amaranth; 21 = Other green leafy vegetables; 22 = Onions; 23 = Green peppers; 24 = Eggplants; 25 = Chilies; 26 = Mushrooms; 27 = Okra. **FRUITS:** 28= Sweet Bananas; 29 = Banana; 30 = Tomatoes; 31= Orange; 32 = Avocado; 33 = Pineapple; 34 = Pumpkin; 35 = Mango; 36 = Papaya; 37 = Lemon trees; 38 = Watermelon; 39 = Passion fruit; 40 = Jackfruit. **SPICES:** 41 = Ginger; 42 = Cardamon; 43 = Chilies; 44 = Lemongrass; 45= Black pepper. **TREES/EXPORT CROPS:** 46 = Coffee; 47 = Cotton; 48 = Cocoa; 49 = Timber; 50 = Palm trees (for palm oil); 51 = Fuelwood trees; 52 = fodder; 53 = Sugarcane; 54 = Tobacco; 55 = Tea; 56: Others: specify

**Codes for organic input B15:** 1= Crop residues; 2= Animal manure; 3= Compost; 4 =Natural fallow; 5 =Improved fallow; 6 =Legume cover crop; 7 =Biomass transfer; 8=Agroforestry; 9=Household refuse, 10= Other (specify) \_\_\_\_\_

**Major agronomic practices (A PART FROM land preparation and weeding) B18:** 1= Row planting, 2= Plant spacing, 3= Mulching, 4= Thinning/desuckering, 5= Pruning 6=Minimum tillage/zero tillage, 7= other specify

**Stress/ pest /disease incidence on field B19:** 0. No stress; 1. Insect pests; 2. Diseases; 3. Water logging; 4. Drought; 5. Rodents; 6. Low soil fertility; 7.. Other, specify.....



**Part Ci. Input Use for All Crops Grown by the Household during first season of 2017 (February 2017 – June 2017).**

Consider only 3 main intercrops if you encounter more than 3 crops on a plot. **For intercrops, record information on main crop first, then put intercrop(s) in the next row(s) and make sure that PID and PLID are EXACTLY the same**

Parcel name	Parcel ID	Plot ID	Crop(s) grown (Crop codes C1)	Crop area (ha)	Cropping system 1 = monocropping 2 = Intercropping	Crop variety: 1 = Local 2 = Improved	Percent of area under main crop in intercrop (e.g. 50%)	Principle decision maker & manager Use codes for part A	Type of Inorganic Fertilizer 1 used (codes C7).	Quantity of fertilizer 1 (kg) in C7	Type of Inorganic Fertilizer 2 used (codes C9).	Quantity of fertilizer 2 (kg) in C9	Type of organic inputs (codes C11)	Quantity of organic inputs used (dry form equiv.). (kg)	Frequency of use of organic inputs (see codes C13)	MAJOR practices (up to 3, separated by comma) see codes C14)	Are you affected by pest /disease on the field (Code C15)	Use of crop residues after harvest (codes C16)	Total harvest	
																			Dry (kg)	Fresh/ Green (kg)
PName	PID	PLID	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18

**Code for crops grown: C1:**

**CEREALS:** 01 = Maize; 2 = Sorghum; 3 = Millet; 4 = Rice; 5 = Teff; 6 = Wheat. **TUBERS & ROOTS:** 7 = Cassava; 8 = Sweet potatoes; 9 = Irish potatoes; 10 = Yams; 11 = Carrots. **LEGUMES:** 12 = Beans; 13 = Groundnuts; 14 = Soyabeans; 15 = Pigeon Peas; 16 = Green grams; 17 = Cowpeas. **VEGETABLES:** 18 = Cabbage; 19 = Kale; 20 = Amaranth; 21 = Other green leafy vegetables; 22 = Onions; 23 = Green peppers; 24 = Eggplants; 25 = Chilies; 26 = Mushrooms; 27 = Okra. **FRUITS:** 28 = Sweet Bananas; 29 = Banana; 30 = Tomatoes; 31 = Orange; 32 = Avocado; 33 = Pineapple; 34 = Pumpkin; 35 = Mango; 36 = Papaya; 37 = Lemon trees; 38 = Watermelon; 39 = Passion fruit; 40 = Jackfruit. **SPICES:** 41 = Ginger; 42 = Cardamon; 43 = Chilies; 44 = Lemongrass; 45 = Black pepper. **TREES/EXPORT CROPS:** 46 = Coffee; 47 = Cotton; 48 = Cocoa; 49 = Timber; 50 = Palm trees (for palm oil); 51 = Fuelwood trees; 52 = fodder; 53 = Sugarcane; 54 = Tobacco; 55 = Tea; 56: Others: specify

**Code for fertilizers: add possible combination C7 & C9:** 0: No fertilizer; 1=Diammonium Phosphate (DAP); 2=UREA; 3=NPK; 4=Calcium Ammonium nitrate (CAN); 5=MonoAmmonium Phosphate (MAP); 6=Triple Super phosphate (TSP); 7=Single superphosphate (SSP); 8=Other (Specify) \_\_\_\_\_

**Codes for organic input C11:** 1= Crop residues; 2= Animal manure; 3= Compost; 4 =Natural fallow; 5 =Improved fallow; 6 =Legume cover crop; 7 =Biomass transfer; 8=Agroforestry; 9=Household refuse, 10= Other (specify) \_\_\_\_\_

**Codes on frequency of organic input application C13:** 1=every cropping season; 2=major cropping season only; 3=Minor cropping season only; 4=other (specify) \_\_\_\_\_

**Major agronomic practices (A PART FROM land preparation and weeding) C14:** 1= Row planting, 2= Plant spacing, 3= Mulching, 4= Thinning/desuckering, 5= Pruning 6=Minimum tillage/zero tillage, 7= other specify

**Stress/ pest /disease incidence on field C15:** 0. No stress; 1. Insect pests; 2. Diseases; 3. Water logging; 4. Drought; 5. Rodents; 6. Low soil fertility; 7.. Other, specify.....



#### D: Other information on crop rotations and management practices

1. What crop rotations are applied to different by this household? Specify the recent crop rotations cultivated by the household starting with the current crop.

Each plot from the parcel will be entered in a separate row, but with the same parcel ID. Do the same for all parcels. The Parcel ID's and plot ID's should match those from Part B and C

[illegible]

**Code for crops grown: D1:**

**CEREALS:** 01 = Maize; 2 = Sorghum; 3 = Millet; 4 = Rice; 5 = Teff; 6=Wheat. **TUBERS & ROOTS:** 7 = Cassava; 8 = Sweet potatoes; 9 = Irish potatoes; 10 = Yams; 11 = Carrots. **LEGUMES:** 12 = Beans; 13 = Groundnuts; 14 = Soyabeans; 15 = Pigeon Peas; 16 = Green grams; 17 = Cowpeas. **VEGETABLES:** 18 = Cabbage; 19 = Kale; 20 = Amaranth; 21 = Other green leafy vegetables; 22 = Onions; 23 = Green peppers; 24 = Eggplants; 25 = Chilies; 26 = Mushrooms; 27 = Okra. **FRUITS:** 28= Sweet Bananas; 29 = Banana; 30 = Tomatoes; 31= Orange; 32 = Avocado; 33 = Pineapple; 34 = Pumpkin; 35 = Mango; 36 = Papaya; 37 =





**Codes for reason condition (Dvii):** 1= Before short rainfall starts; 2= After short rainfall ends; 3= Before long rainfall starts 4 = After long rainfall ends; 5 = During dry period 6 = Other (specify)\_\_\_\_\_

**Example Field**

Parcel ID (as in Table D1)		Plot ID	Date	Operation (see codes Dii)	Type					Reason (see codes Dvii)
					Crop type (see codes Di)	Equipment (see codes Diii)	Fertilizer (see codes Div)	Organic Input (see codes Dv)	Quantity (see codes Dvi)	
PID		PLID		Dii	Di	Diii	Div	Dv	Dvi	Dvii
			10/08	6 (Tillage)		Oxen plough (2)				Before short rain season starts (1)
			12/08	3 (Fertilizer)				Manure (2)	25 kg/ha (1)	After long rainfall ends (4)
			12/08	1 (Planting)	Maize (1)					During dry period (5)
			05/10	3 (Fertilizer)				Manure (2)	25 kg/ha (1)	
			22/11	(Harvest/Remove) 5						

**E) Changes in cultivation**

1. What has prompted you, in the past 10 years, to grow crops that you previously had not grown on the farm before? (please circle all relevant factors by ranking the following where 1=very important, 2 = medium, and 3=low. If nothing has changed in the past 10 years, tick this box: ☐)

Speaking with farmers/neighbors/friends	1	2	3
Advice from agronomists/experts/government officials	1	2	3
Minimize the risk from crop failure	1	2	3
Financial factors or incentives (including government subsidies)	1	2	3
Market factors (e.g. sale difficulties, changing demands)	1	2	3
Pests, diseases, weeds	1	2	3
Climate factors	1	2	3
Access to new information (e.g. production guides, internet)	1	2	3
Access to new technology (e.g. new machines)	1	2	3
Other (please explain)_____	1	2	3

2. Do you plan to grow the same crops on your fields in the future?

☐ Yes

☐ No

If **No**, what would you want to change on your farm (see crop codes Di above )



## Supplementary S2: Statistical data for a priori sampling distribution estimation

Table S 2a: Kenya

District	Subcounty	Pop.	Pop. density	Area	Area shared	Pop. in study area	Agr. Households in study area	Number of a priori samples	Weighted Population density
[-]	[-]	[-]	[Pers/km <sup>2</sup> ]	[km <sup>2</sup> ]	[km <sup>2</sup> ]	[-]	[-]	[-]	453.21
Bungoma	Bumula	31917	475.9	67.1	67.1	31917	3835	4.7	13.58
Bungoma	Cheptais	28639	282.3	101.4	101.4	28639	3842	5.9	12.19
Bungoma	Chepyuk	25329	113.5	223.2	60.4	6849	875	2.6	2.91
Bungoma	Cheskaki	23874	187.9	127.1	127.1	23874	3130	6.3	10.16
Bungoma	Kabuchai / Chwele	35395	679.7	52.1	10.2	6908	662	0.8	2.94
Bungoma	Kabula	20704	490.1	42.2	25.9	12671	1213	1.7	5.39
Bungoma	Kapkateny	28628	296.5	96.5	7.3	2171	308	0.4	0.92
Bungoma	Khalaba (Kanduyi)	23951	2654.5	9.0	0.7	1817	51	0.1	0.77
Bungoma	Khasoko	13073	516.9	25.3	25.3	13073	1323	1.7	5.56
Bungoma	Kimaeti	36520	545.1	67.0	67.0	36520	4381	5.1	15.54
Bungoma	Lwandanyi	39776	464.0	85.7	85.7	39776	5432	6.4	16.93
Bungoma	Malakisi/South Kulisiru	35001	435.9	80.3	80.3	35001	4578	5.7	14.90
Bungoma	Marakaru	19628	701.9	28.0	17.9	12544	1727	1.7	5.34
Bungoma	Musikoma	37663	814.8	46.2	40.3	32852	2138	2.7	13.98
Bungoma	Namwela	27263	594.8	45.8	34.2	20363	2791	3.0	8.67
Bungoma	Siboti	32497	543.6	59.8	59.8	32497	4890	5.2	13.83
Bungoma	South Bukusu	23132	482.9	47.9	47.9	23132	2741	3.4	9.85
Bungoma	Township	16976	5261.1	3.2	2.1	10935	282	0.3	4.65
Bungoma	Tuuti	15373	702.1	21.9	15.3	10711	1178	1.3	4.56
Bungoma	West Bukusu	19965	517.3	38.6	38.6	19965	2472	2.9	8.50
Busia	Ageng'a Nanguba	25354	299.2	84.8	31.0	9273	882	1.6	3.95
Busia	Amukura Central	20736	402.3	51.5	51.5	20736	2585	3.4	8.83
Busia	Amukura East	23309	325.2	71.7	71.7	23309	2631	4.1	9.92
Busia	Amukura West	17419	435.8	40.0	40.0	17419	2025	2.7	7.41
Busia	Ang'orom	25303	1160.6	21.8	21.8	25303	815	1.3	10.77
Busia	Ang'urai East	15199	415.5	36.6	36.6	15199	1863	2.4	6.47
Busia	Ang'urai North	23341	416.1	56.1	56.1	23341	3121	3.9	9.93
Busia	Ang'urai South	20690	378.2	54.7	54.7	20690	2808	3.7	8.81
Busia	Bukhaya Central	18187	377.6	48.2	48.2	18187	2519	3.3	7.74
Busia	Bukhaya East	21654	366.1	59.1	59.1	21654	2412	3.5	9.22
Busia	Bukhaya North/Walatsi	22448	366.4	61.3	61.3	22448	3115	4.1	9.55
Busia	Bukhaya West	32721	449.8	72.7	72.7	32721	3150	4.5	13.93
Busia	Burumba	24826	4976.3	5.0	5.0	24826	269	0.3	10.57
Busia	Busibabo	11321	342.9	33.0	33.0	11321	1615	2.2	4.82
Busia	Chakol North	18651	371.0	50.3	50.3	18651	2294	3.2	7.94
Busia	Chakol South	31393	449.1	69.9	69.9	31393	4389	5.2	13.36
Busia	Elugulu	18647	448.2	41.6	38.3	17176	2115	2.7	7.31
Busia	Kingandole	18237	564.1	32.3	32.1	18083	1939	2.3	7.70
Busia	Malaba Central	24109	904.0	26.7	26.7	24109	1451	1.8	10.26

Busia	Malaba North	13711	395.7	34.7	34.7	13711	1856	2.4	5.84
Busia	Malaba South	19111	409.0	46.7	46.7	19111	2757	3.4	8.13
Busia	Marachi Central	19688	471.6	41.7	30.6	14446	1594	2.1	6.15
Busia	Marachi East	20758	513.1	40.5	40.2	20641	2443	2.9	8.78
Busia	Marachi North	23573	468.0	50.4	27.0	12619	1486	1.9	5.37
Busia	Marachi West	20104	536.7	37.5	17.5	9397	1053	1.3	4.00
Busia	Matayos South	30870	448.6	68.8	68.7	30839	3099	4.3	13.13
Busia	Mayenje	9142	541.7	16.9	16.9	9142	716	1.0	3.89
Busia	Nambale	31816	490.1	64.9	64.9	31816	2904	4.1	13.54
Busia	Namboboto/Nambuku	28136	408.5	68.9	68.9	28136	3365	4.5	11.97
Busia	Nangina	20131	400.9	50.2	48.8	19570	1588	2.7	8.33
Kakamega	Kholera	28780	518.8	55.5	20.4	10584	797	1.2	4.50
Kakamega	Koyonzo	35804	517.2	69.2	27.3	14115	1137	1.7	6.01
Kakamega	Mayoni	30414	602.0	50.5	1.2	695	62	0.1	0.30
Kakamega	Namamali	31501	528.7	59.6	59.6	31495	2559	3.7	13.40
Siaya	East Ugenya	22657	237.6	95.3	0.3	80	9	0.0	0.03
Siaya	North Ugenya	16506	237.6	69.5	0.0	11	1	0.0	0.00
Siaya	West Ugenya	22351	237.6	94.1	1.6	383	41	0.1	0.16

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Table S 1b: Uganda

Population	Population density	Area	Area shared	Population in study area	Agr. Households in study area	Number of a priori samples	Weighted Population density
[-]	[Pers/km <sup>2</sup> ]	[km <sup>2</sup> ]	[km <sup>2</sup> ]	[-]	[-]	[-]	517.43
6983	99.1	70.4	48.5	4806	1081	2.0	7.14
12906	211.2	61.1	16.8	3554	739	0.8	5.28
19908	373.0	53.4	51.1	19051	3714	2.9	28.32
31935	8536.1	3.7	3.1	26840	6754	2.2	39.89
22863	6490.1	3.5	0.8	5266	1255	0.4	7.83
17340	281.5	61.6	1.5	411	77	0.1	0.61
27540	468.2	58.8	33.8	15826	3053	2.1	23.52
29142	578.6	50.4	19.1	11033	2033	1.3	16.40
14714	373.8	39.4	32.1	11985	2487	1.9	17.81
10865	196.7	55.2	22.6	4438	842	1.0	6.60
23377	337.2	69.3	2.5	834	162	0.1	1.24
19997	457.3	43.7	37.1	16954	3180	2.2	25.20
18628	534.4	34.9	1.3	683	130	0.1	1.02
11117	83.1	133.7	0.5	43	8	0.0	0.06
23224	603.9	38.5	33.7	20336	3909	2.4	30.23
11262	821.2	13.7	13.7	11262	2371	1.2	16.74
19498	1001.4	19.5	19.5	19498	3750	1.8	28.98
16595	1089.1	15.2	11.1	12050	2361	1.1	17.91
19278	850.0	22.7	22.7	19278	3962	2.0	28.65
11873	477.0	24.9	4.7	2236	444	0.3	3.32
13637	269.8	50.5	31.2	8404	1756	1.6	12.49
9148	946.9	9.7	9.7	9148	2038	1.0	13.60
20582	925.2	22.2	9.7	8995	1862	0.9	13.37
8022	227.5	35.3	18.4	4177	895	0.9	6.21
10258	716.6	14.3	14.3	10258	1838	1.1	15.25
20160	473.1	42.6	18.3	8645	1602	1.1	12.85
17824	293.6	60.7	32.5	9537	1797	1.7	14.17
17968	1214.2	14.8	14.8	17968	4551	1.9	26.71
19261	385.5	50.0	45.8	17652	3232	2.5	26.24
45882	399.9	114.7	91.3	36500	7227	5.3	54.25
36526	455.0	80.3	2.3	1064	204	0.1	1.58
19073	1079.1	17.7	8.7	9362	2121	1.0	13.92
22942	1695.8	13.5	0.0	28	7	0.0	0.04