Liberia Global Agriculture & Food Security Project (GAFSP) Impact Evaluation

BASELINE SURVEY REPORT

Development Impact Evaluation (DIME)
Global Agriculture & Food Security Program (GAFSP)

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1 Introduction

This report presents the main findings of the baseline household survey for the Global Agriculture and Food Security (GAFSP) Liberia Impact Evaluation. The baseline survey was implemented from June to August 2017. The report provides descriptive statistics on the following topics: socioeconomic profile of the households, agriculture production and commercialization, household income, and food security. Preliminary findings include indications that use of improved varieties of major crops is not common. Cassava accounts for much of the value of agricultural production, which is the main component of household income of the SAPEC targeted households. Most the households suffer from moderate and severe hunger. The project will aim to improve these outcomes over the lifespan of this intervention.

2 Background

Liberia's agricultural sector is the backbone and the core of its economy following the civil war. However, assets and infrastructure remain major obstacles of growth to farmers in order to increase production beyond a subsistence level.

Production of paddy rice in 2009 was approximately 6,000 metric tons (1988 levels) and the reported area harvested for 2009 being 12,000 ha larger than that harvested in 1988 (Larbi 2012). The low productivity in an environment where yield potential can be high given historical experience presents an opportunity for a rigorous randomized controlled trial (RCT) on the constraints to technology adoption, where the adoption of improved techniques is know to be profitable on the average.

The Smallholder Agricultural Productivity Enhancement and Commercialization Project (SAPEC) was established as a cornerstone of the Liberia Agriculture Sector Investment Program (LASIP) to increase yields and improve nutritional outcomes in beneficiary communities. SAPEC has four pillars: Sustainable Crop Production Intensification, Value Addition and Marketing, Capacity Building and Institutional Strengthening; and Project Management. The Sustainable Crop Production Intensification pillar includes the development of lowland rice for production and the dissemination of improved agricultural technologies to farmers. The increased yields resulting from this strategy should improve the nutritional outcomes of farmers in the beneficiary group. The second and third pillars of SAPEC correspond to the activities related to the creation/encouragement of the value chains and improvements in Liberia's agricultural research and instructional capacity.

The development of inputs to be provided to farmers includes the identification of improved varieties

for rice and cassava and dissemination activities through partnerships with International Institute of Tropical Agriculture (IITA), Africa Rice Center. However, these efforts have followed a loose system of informally recruiting and tracking participants and the IE will seek improve on this mechanism. Firstly, the IE will improve the tracking of participants and non-participants in extension activities in order to assess the impacts of the inputs. Secondly, the invitation system for offering benefits to farmers will be tested through a pilot which will test the effectiveness of reaching farmers through SMS delivery of e-vouchers and whether delivery of SAPEC inputs such as tools increases the likelihood that farmers access other improved inputs such as improved varieties of fertilizer whether through other subsidy programs or through markets.

A tenet of SAPEC's approach is that at least 30% of its beneficiary farmers must be under 35 years of age. There is an underlying intuition that younger beneficiaries are more likely to adopt new technology to harvest better crops but little rigorous experimentation has been conducted to reveal whether this is certain in practice.

2.1 Impact Evaluation (IE) of SAPEC

In coordination with the Smallholder Agriculture Productivity Enhancement and Commercialization (SAPEC) the impact evaluation with focus on three core components:

- Sustainable Crop Production Intensification
- Value Addition and Marketing
- Capacity Building and Institutional Strengthening

The most common reason cited by farmers for not using modern inputs and methods is a lack of access to materials. This suggests that constraints to agriculture productivity in Liberia are necessary materials to practice high value agriculture and a lack of awareness among farmers at the local level that these methods are effective. In order to address these constraints, SAPEC distributes a package of inputs that are necessary to practice modernized farming. In the package are either 50Kg of seeds of improved rice varieties or cuttings of improved cassava varieties, poultry manure, a cutlass, a file, an exe, trap wire, flash tape, and a hoe. Farmers will receive these packages at a highly-subsidized rate. Furthermore, farmers will be provided with follow-up support from agricultural extension workers on how to cultivate the new improved varieties and how to use more efficient methods of farming.

The IE will determine whether farming households who receive SAPEC benefits are more likely to adopt effective farming techniques compared to farming households that do not receive the SAPEC

benefits. 100 communities in SAPEC treatment and control districts will be randomly selected to take part in the study, using a list of SAPEC-eligible communities. 50 communities will be randomly selected as treatment communities and 50 as control communities. There will be a minimum of 25 farmers per community. A counterfactual will be created by randomly selecting specific beneficiaries within SAPEC treatment communities. From the list of all farmers registered in the e-platform system, 10-11 farmers per community will be randomly selected to be SAPEC beneficiaries in the next round. Thus, there will be a sample of farmers within treatment communities as well as farmers who were randomly selected to not receive benefits this year, allowing for the causal impact of the input provision on the delivery of tools.

During the distribution of SAPEC benefits, additional inputs will be distributed under the Liberia Agriculture Transformation Agenda (LATA) program. LATA distributs fertilizer and improved varieties through private agro-dealers. E-vouchers are sent by SMS to farmers who are enrolled in the national e-registration platform. Farmers who receive the vouchers can purchase inputs from the agro-dealers. In order to track the potential for this system to improve access and use of these inputs, the IE will track which households enrolled in the SAPEC IE are sent messages and which farmers redeem the evouchers to purchase the subsidized inputs. A particular focus will be on whether the SMS messages are a particularly effective method of enrolling youth in farming.

3 Baseline household survey

3.1 Data collection

The IE will involve a combination of administrative data and large scale household surveys. The Development Impact Evaluation Unit (DIME) will standardize the administrative data on selection, invitation, and registration of beneficiaries in the communities participating in the IE. The collection management of the household data is overseen by DIME to ensure that all data collected are accurately tracked by the survey.

The agriculture household surveys are planned for a sample of 10-11 farmers in 50 randomly selected communities that receive the SAPEC benefits this year and 10 farmers in 50 communities that which will not receive benefits. In the treatment communities, an additional two households who would have been the next 2 on the randomly sorted list to receive benefits but were left out will be surveyed. Surveying these two farmers will allow for comparisons against the control community to assess whether there are spillovers in the form of non-treated farmers learning from their neighbors who are treated. The households surveys will capture relevant information to compute

yield and profit such as self-reported landholdings, crop choice, harvest, sales and input use as well as household characteristics and indicators of satisfaction with project processes. The baseline survey was launched in June 2017, following the harvest of the rice and cassava season in Liberia and ended in August 2017. The baseline survey will allow the project team to understand farming practices prior to the introduction of SAPEC programs. The endline survey is planned for October 2018, which will identify the impact on yield from using upgraded inputs. The endline survey will involve revisiting as many of the baseline farmers as possible to create a two-round panel, allowing us to control for differences in initial adoption and productivity of farmers.

The DIME field coordinator oversaw the process for selecting beneficiaries from the e-registration and the systems for tracking the administrative data on invitations, registration and receipt of inputs from SAPEC. In addition, the field coordinator also ensures the quality of the survey instrument, trains the surveyors and checks the quality and accuracy of data collected on a daily basis.

The data collection instruments were piloted extensively in the field before the baseline survey was launched. Enumerators participated in extensive training of the questionnaire and functioning of the tablets. The baseline data was collected using SurveyCTO - a cloud-based data collection software that delivers surveys through android tablets, which allowed for program consistency checks and quality checks on a daily basis. Audits were performed by recording parts of the interview and performing back-check interviews by a different team of enumerators. The cross-checking mechanism of the data provided immediate feedback to the field teams in case of divergences or other problems.

3.2 E-Registration Sample

The Ministry of Agriculture launched the Liberian Agriculture Transformation Agenda (LATA) program that will improve the access of all smallholder farmers to technology. The program involved the registration of over 184,000 farmers in a mobile wallet program that will allow these farmers to access subsidized fertilizer and other inputs. The messaging platform was used as the sampling frame from which the messaging intervention was implemented and the beneficiaries of the sample were chosen.

Farmers in the sampling frame were selected on criteria based on three key components: the farmer had to be in the e-registration platform, the farmer had to have land to cultivate crops, and the farmer had to be either a rice or cassava farmer. A priority list of households was developed from this frame and these farmers were randomly selected. The priority farmers would be targeted first before finding replacement farmers if the priority farmer could not be interviewed.

Table 1: Priority Sample Match: All HHs

District	No Match	Matched	Total
HHs in Baseline data	473	644	1117
Total	473	644	1117

Table 2: Priority Sample Match: Female Respondents

District	No Match	Matched	Total
HHs in Baseline data	152	243	395
Total	152	243	395

Although, the e-platform that was developed by LATA was used as the sampling for this study, there was some difficulty in finding priority households that were registered on the platform. There were 1,117 households that were sampled during the baseline survey and out of those households only 644 were originally from the priority farmer sample list. Table 1 indicates that only 57% of the priority households in the sample list were found by the enumeration team upon reaching the village. A considerable proportion of households on the priority sample were not in the village or community listed in the e-platform or the mobile number provided was the wrong number. This difficulty in finding farmers in the communities where they are registered suggests that targeted delivery through the e-registration platform will be challenging.

Table 2 & 3 displayed above reveal that more female respondents at 61% compared to male respondents at 55% were interviewed from the priority list. This finding suggests that there is not a strong gender dimension to the difficulty of locating farmers signed up in the e-registration platform.

Table 3: Priority Sample Match: Male Respondents

District	No Match	Matched	Total
HHs in Baseline data	321	401	722
Total	321	401	722

Table 4: E-Registration Priority Sample - Gender

	(1)
	Sample Matched
gender	-0.060*
	(0.031)
Observations	1117
R-squared	0.00

The result in Table **??** indicates that on average female respondents in the priority list were slightly more likely to be located for interview at rate of 5.8 percentage points more compared to male respondents in the priority list and this is significant at the 10% level. In other words, male respondents in sample were less likely to be successfully found and interviewed compared to female respondents. The priority households obtained from the e-platform used for this study was more reliable in having the accurate information to locate female respondents compared to male respondents. This may reflect differential travel by male or female members or likelihood of having a working contact number.

Table 5: Priority Sample Match Age: All Adults

District	No Match	Matched	Total
Age 21-30	47	96	143
Age 31-40	142	239	381
Age 41-50	137	166	303
Age 51-60	68	77	145
Age 61-70	48	40	88
Age 71-80	14	16	30
Age 81-90	17	10	27
Total	473	644	1117

Additionally, the baseline survey revealed that priority younger respondents are more likely to be found using the e-platform compared to priority older respondents. Depicted in Table 5 are different age categories for all adults in the sample and it demonstrates that younger adults were found and interviewed more compared to older adults. Table 6 & 7 dis-aggregates the results by gender. The results are fairly consistent with what was mentioned earlier, even though in some age categories male respondents are more likely to be found than female respondents.

Table 6: Priority Sample Match Age: Female Respondents

District	No Match	Matched	Total
Age 21-30	22	36	58
Age 31-40	47	99	146
Age 41-50	37	54	91
Age 51-60	19	30	49
Age 61-70	16	13	29
Age 71-80	4	6	10
Age 81-90	7	5	12
Total	152	243	395

Table 7: Priority Sample Match Age: Male Respondents

District	No Match	Matched	Total
Age 21-30	25	60	85
Age 31-40	95	140	235
Age 41-50	100	112	212
Age 51-60	49	47	96
Age 61-70	32	27	59
Age 71-80	10	10	20
Age 81-90	10	5	15
Total	321	401	722

Table 8: E-Registration Priority Sample - Age

	(1)
	Sample Matched
Farmer Age 35 or above	-0.103***
	(0.035)
Observations	1117
R-squared	0.01

The results displayed in Table 7 indicates that respondents age 35 or older in the e-platform are less likely to be reached by 10 percentage points more on average compared to respondents age 12-34 and this is significant at the 1% level of significance. The results displayed in Table **??** and 7. This is an early indicator that e-registration platform may be a more workable way to locate young farmers for input delivery or messaging than older farmers, but the rates of locating young farmers are still quite low. These findings suggest that while the e-registration platform may be a means of reaching some farmers, it may be challenging to acheive full coverage of targeted groups without futher efforts to verify contact data and ensure that registered farmers can be located after initial registration.

3.3 Household Sample

Research Solutions Africa, Ltd implemented the baseline survey from June to August 2017. The survey was conducted on android tablets using SurveyCTO - a data collection software which allowed the data to be submitted electronically. The survey focused on agricultural production and food security, and contained modules on housing, labor, education, food security, income, expenditures, personality trait, and assets.

The SAPEC project was conducted in 12 of Liberia's counties and across 97 communities. In most of the communities, 10-11 farmers were randomly selected to receive the SAPEC benefits while another 10 farmers were randomly chosen to not receive benefits during the 2017 round of distribution. Randomization was done at the community level for which communities will receive the SAPEC benefits then randomly chosen at the farmer level.

Before the baseline survey was launched, the study was piloted extensively in the field based on a rapid response survey that was commissioned by SAPEC, designed by DIME, and implemented with 570 households in 2016. As mentioned earlier the e-platform developed by LATA was used to

compose the sample frame. For each community a sample of 10 farmers were randomly selected in the 50 randomly selected communities to receive the SAPEC benefits. The sampling frame was coordinated closely with the focal SAPEC official in each community in order to ensure that sampled households were able to receive the SAPEC benefits.

The balance test presented in Table 8 shows the distribution of the sample across counties, separated into external control, SAPEC treatment and SAPEC control. There are very small differences in household characteristics, income, and agricultural production of the two sets of control groups and the treatment group.

Table 9: SAPEC Baseline Sample - County

County	External Control	SAPEC Treatment	SAPEC Control	Total
BOMI	110	118	22	250
GBARPOLU	20	21	4	45
GRAND BASSA	10	11	2	23
GRAND CAPE MOUNT	22	34	6	62
GRAND GEDEH	52	42	8	102
GRAND KRU	50	54	9	113
MARGIBI	13	10	2	25
MARYLAND	42	47	8	97
MONTSERRADO	63	85	30	178
RIVER CESS	8	19	4	31
RIVER GEE	39	43	9	91
SINOE	50	42	8	100
Total	479	526	112	1117

3.4 Validity of Control Group

The IE contains 50 treatment communities and 50 control communities. However, there are two types of control farmers. There are 10 control farmers from each of the control communities and 2 control farmers from each of the treatment communities and are therefore referred to as SAPEC control farmers.

Table 10: Balance Test - Sample of Households

	(1) External Control		(2) SAPEC Treatment		(3) SAPEC Control		(4) Total		T-test Difference		
Variable	N	Mean/SE	N	Mean/SE	N	Mean/SE	N	Mean/SE	(1)-(2)	(1)-(3)	(2)-(3)
Upland Rice	479	0.610	526	0.574	112	0.518	1117	0.584	0.035	0.092*	0.056
		(0.022)		(0.022)		(0.047)		(0.015)			
Lowland Rice	479	0.294	526	0.323	112	0.232	1117	0.302	-0.029	0.062	0.091*
		(0.021)		(0.020)		(0.040)		(0.014)			
Cassava	479	0.656	526	0.631	112	0.670	1117	0.645	0.024	-0.014	-0.038
		(0.022)		(0.021)		(0.045)		(0.014)			
Improved Upland Rice	479	0.424	526	0.392	112	0.366	1117	0.403	0.032	0.058	0.026
		(0.023)		(0.021)		(0.046)		(0.015)			
Improved Lowland Rice	479	0.205	526	0.253	112	0.152	1117	0.222	-0.048*	0.053	0.101**
		(0.018)		(0.019)		(0.034)		(0.012)			
Improved Cassava	479	0.426	526	0.426	112	0.411	1117	0.424	0.000	0.015	0.015
		(0.023)		(0.022)		(0.047)		(0.015)			
Gender of Household head	479	0.643	526	0.654	112	0.634	1117	0.647	-0.011	0.009	0.020
		(0.022)		(0.021)		(0.046)		(0.014)			
Age of Household head	471	44.507	515	43.309	112	42.232	1098	43.713	1.199	2.275*	1.077
		(0.600)		(0.548)		(1.166)		(0.383)			
Household size	479	3.956	526	3.791	112	3.589	1117	3.842	0.165	0.367*	0.202
		(0.094)		(0.086)		(0.186)		(0.060)			
Completed Primary School or less	281	0.438	300	0.387	63	0.381	644	0.408	0.051	0.057	0.006
		(0.030)		(0.028)		(0.062)		(0.019)			
Completed Secondary School or more	281	0.715	300	0.740	63	0.730	644	0.728	-0.025	-0.015	0.010
		(0.027)		(0.025)		(0.056)		(0.018)			
Gender of Person Resp. for Farming	479	0.626	526	0.641	112	0.661	1117	0.637	-0.014	-0.034	-0.020
		(0.022)		(0.021)		(0.045)		(0.014)			
Age of Person Resp. for Farming	471	44.331	515	43.355	112	42.214	1098	43.658	0.976	2.117	1.141
		(0.600)		(0.555)		(1.167)		(0.385)			
Completed Primary School - Person Resp. for Farming	281	0.438	300	0.387	63	0.381	644	0.408	0.051	0.057	0.006
		(0.030)		(0.028)		(0.062)		(0.019)			
Secondary Primary School - Person Resp. for Farming	281	0.715	300	0.740	63	0.730	644	0.728	-0.025	-0.015	0.010
		(0.027)		(0.025)		(0.056)		(0.018)			
Total farm income	479	365.770	526	349.562	112	347.235	1117	356.279	16.207	18.534	2.327
		(30.535)		(57.092)		(60.682)		(30.498)			
Total non-farm income	479	75.600	526	91.646	112	96.546	1117	85.256	-16.046	-20.945	-4.900
		(8.766)		(12.036)		(23.088)		(7.182)			
F-test of joint significance (F-stat)									0.601	1.422	1.122
F-test, number of observations									575	343	358

Notes: The value displayed for t-tests are the differences in the means across the groups. The value displayed for F-tests are the F-statistics. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

Table 9 compares values of key indicators in treatment and both control groups (control communities and non-selected farmers within communities). Across the groups, it is evident that the controls are a valid counterfactual. The External control and the SAPEC treatment group are very similar to one another except when it comes to households that grew improved lowland rice which confirms that randomization achieved its goal of creating two sample groups that were highly similar before SAPEC delivered the agricultural inputs. However, there is an imbalance on two indicators between SAPEC treatment and SAPEC control, in order to correct for these differences in baseline values of these indicators will be added as controls in the IE analysis of follow-up survey data.

4 Agricultural inputs

4.1 Access to Extension Workers

In general, the farmers in the sample have very limited usage of extension services. About 67% of farmers were not visited by either a government, SAPEC, or NGO extension worker in the past year.

Table 11: Extension Worker Visited Household

	Households(Percent)
SAPEC worker	0.22
Ministry of Agriculture worker	0.11
NGO worker	0.14
SAPEC & Ministry of Ag worker	0.07
SAPEC & NGO worker	0.06
Ministry of Ag & NGO worker	0.05
None Visited	0.67
N	1117

Farmers in the sample have an average of 1.16 hectares of agricultural land, divided into more than 1 plot. Farmers cultivate more than 1 crop over the course of the year. Landholdings are slightly larger than the average plot size of each household.

Table 12: Agriculture and Crop Summary

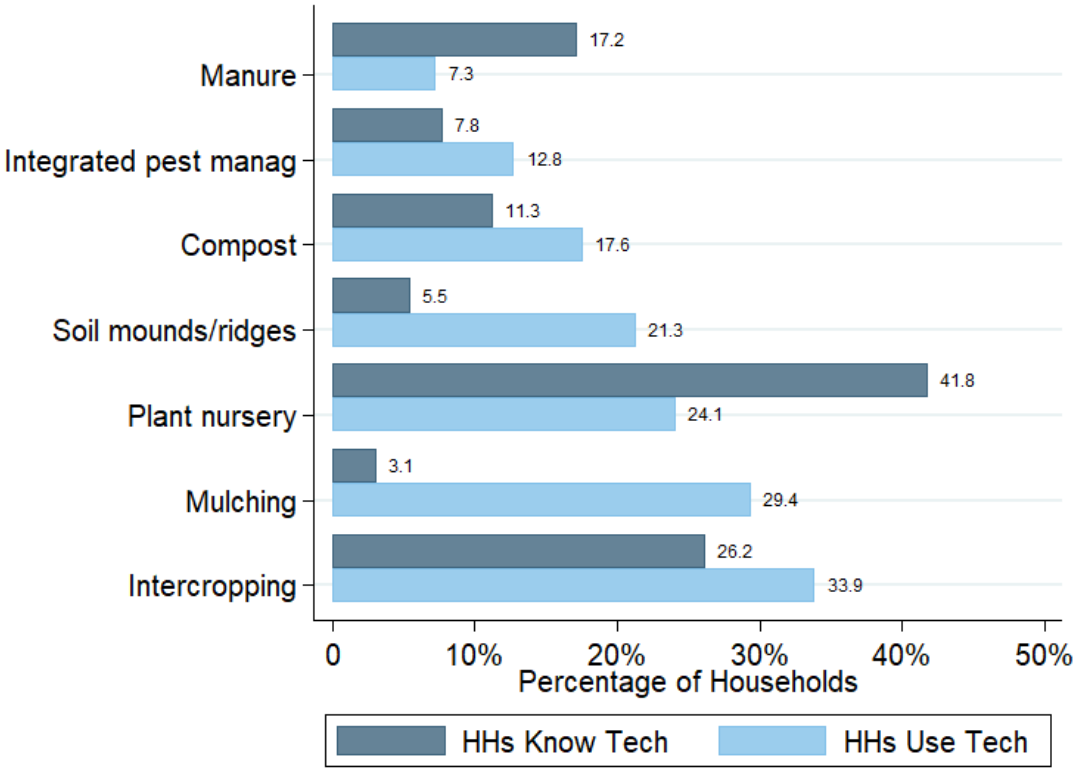
	Mean	SD
HH No. of plots	1.30	0.6
HH average plot size (Ha)	1.16	1.1
HH agricultural landholdings	1.44	1.4
HH No. of Crops planted(one year)	1.75	1.0
N	1117	

The survey included information on the usage of a number of improved agricultural technologies that farmers commonly use. The most practiced technology at baseline is plant nursery, which is used by 23% of farmers in the sample. It is also the most commonly known technology among farmers in the sample. The least commonly used practiced technology is mulching which is evident by the 3% of farmers that know about the technology.

Figure 2 also indicates that majority of farmers in the sample are not aware of the different types of agricultural technologies. The most commonly know technology is plant nursery at 41% of farmers and the least known technology is mulching at 3% of farmers. These results reveal that majority of farmers are completely unaware of several important agricultural technologies that can improve irrigation of their crops and in turn increase crop yields. The lack of knowledge presents an avenue of opportunity for more resources to be placed into increasing farmer knowledge and use of the different types of agricultural technologies.

4.2 Use of Agricultural Technology and Inputs

Figure 2: Use of Agricultural Technologies



In terms of agricultural inputs, majority of farmers do not use most inputs on their plots. Figure 3 shows that the most used input is organic/natural fertilizer with only 17% of farmers reporting using it on at least one of their plots. The least used input is improved seeds at 8% of farmers report using it.

Figure 3: Use of Agricultural Inputs

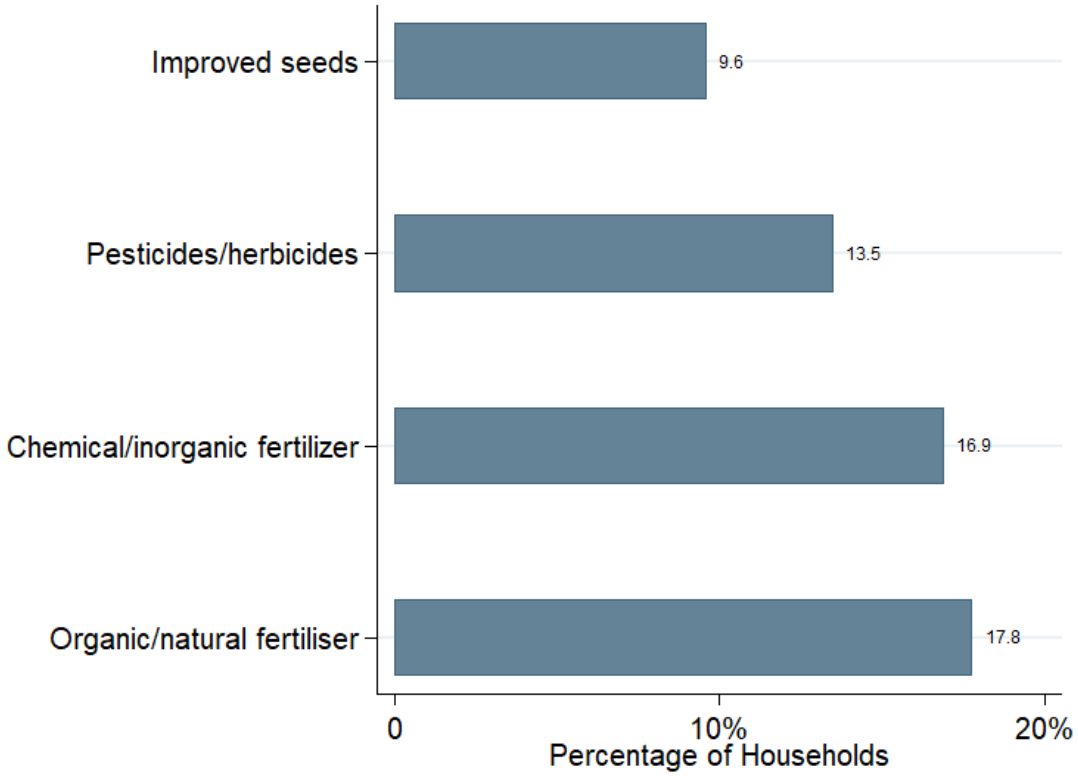
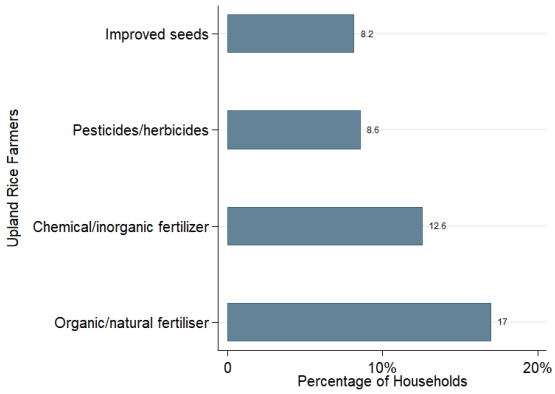
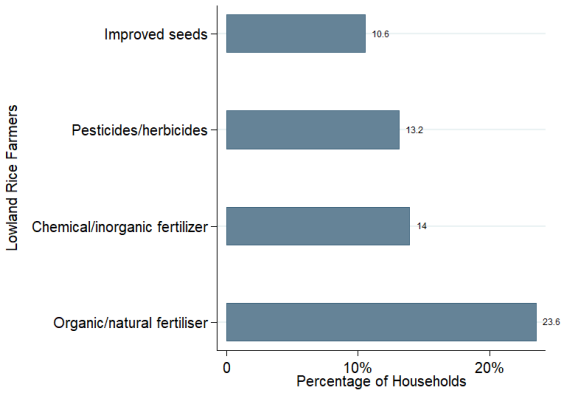


Figure 4a indicates that farmers in the sample are not using much of the inputs to culitvate upland rice. Farmers may be using less inputs on upland rice in order to use it more on other crops.

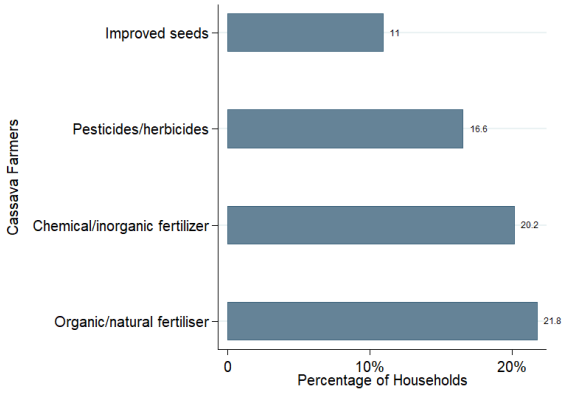
(a) Lowland Rice Farmers



(b) Upland Rice Farmers



(c) Cassava Farmers



The use of inputs on cultivating lowland rice is smaller compared to the use on upland rice as depicted in Figure 4b. Cultivating cassva has the highest share of input use as shown in Figure 4c. Which reveals that most farmers see cassava a profitable crop and are choosing to produce more it compared to upland and lowland rice. The high use of inputs on cassava is not surprising given that cassava production at baseline was substantial higher compared to upland and lowland rice.

5 Household Income and Assets

Total farm income is measured through income from crops, livestock, and other agricultural and livestock income. Total non-farm income includes income from non-agricultural personal business, renting land, sale of land, remittances, interests and dividends, pension, allowances, earning from labors, and other sources. Table 12 shows a summary of income sources, and indicates that farm income is the primary driver of household income. The most important sources of non-farm income are remittances and wages.

Table 13: Annual Household Income Total (USD)

	Mean	SD
Total household income	392.97	487.2
Total farm income	302.20	391.4
Total non-farm income	72.22	142.5
N	1117	

Variables winsorized at upper 2% tail

Income from crops is defined as the total amount of money received from all crops that were harvested and the earnings from all crops that were sold. Income from livestock is measured through sales of livestock, livestock products, and sale of own farm enterprise. Table 13 demonstrates that income from crops and livestock for male-headed households is higher compared to female-headed households.

Table 14: Household Farm Income by Gender (USD)

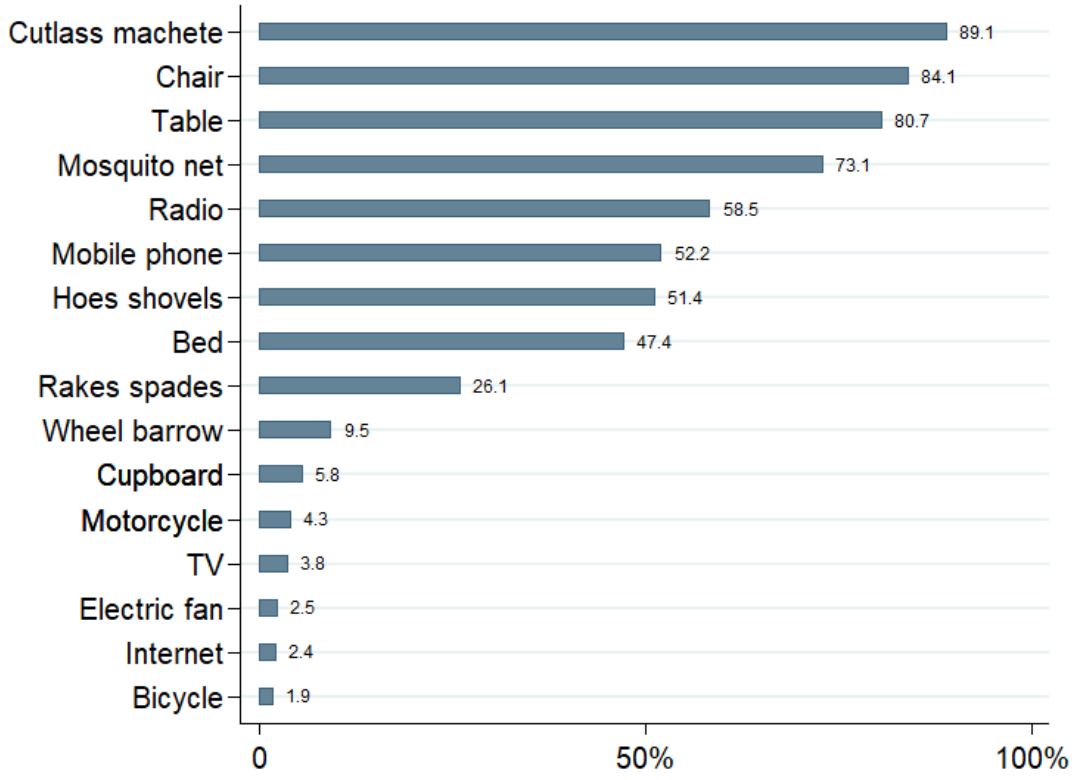
	Female-headed HH		Male-headed HH	
	Mean	SD	Mean	SD
Income from crops	132.49	233.6	196.86	308.6
Income from livestock	52.28	110.8	65.44	122.2
N	394		723	

Variables winsorized at upper 2% tail

The baseline survey included data on ownership of a variety of common household and agricultural assets. Figure 5 displays percentage of households with common household assets. The commonly

owned asset is a cutlass/machete with about 89% of farmers own at least one. About 84% of farmers own a chair, 52% of farmers have access to a mobile phone, and 58% of households have radios. Only 47% of farmers have at least one bed which reveals that majority of households must use mats to sleep on due to the lack of access to affordable beds.

Figure 5: Household Ownership of Common Assets

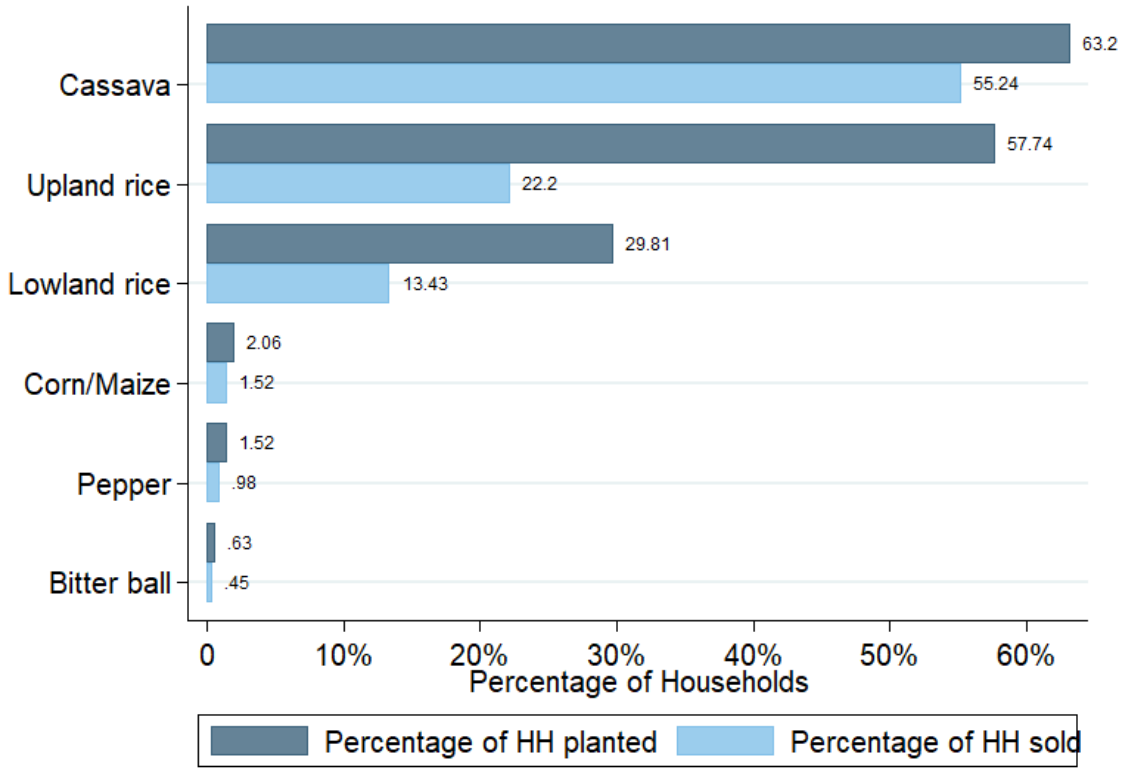


6 Agriculture production

Most agricultural production is for home production and majority of farmers sell cassava at their local market. Figure 6 indicates that majority of farmers planted cassava at 63% and 55% of those farmers sold some amount of the harvested cassava they produced. The secondly most planted crop is upland rice with 57% of farmers reporting have planted the crop followed by lowland rice at 29%

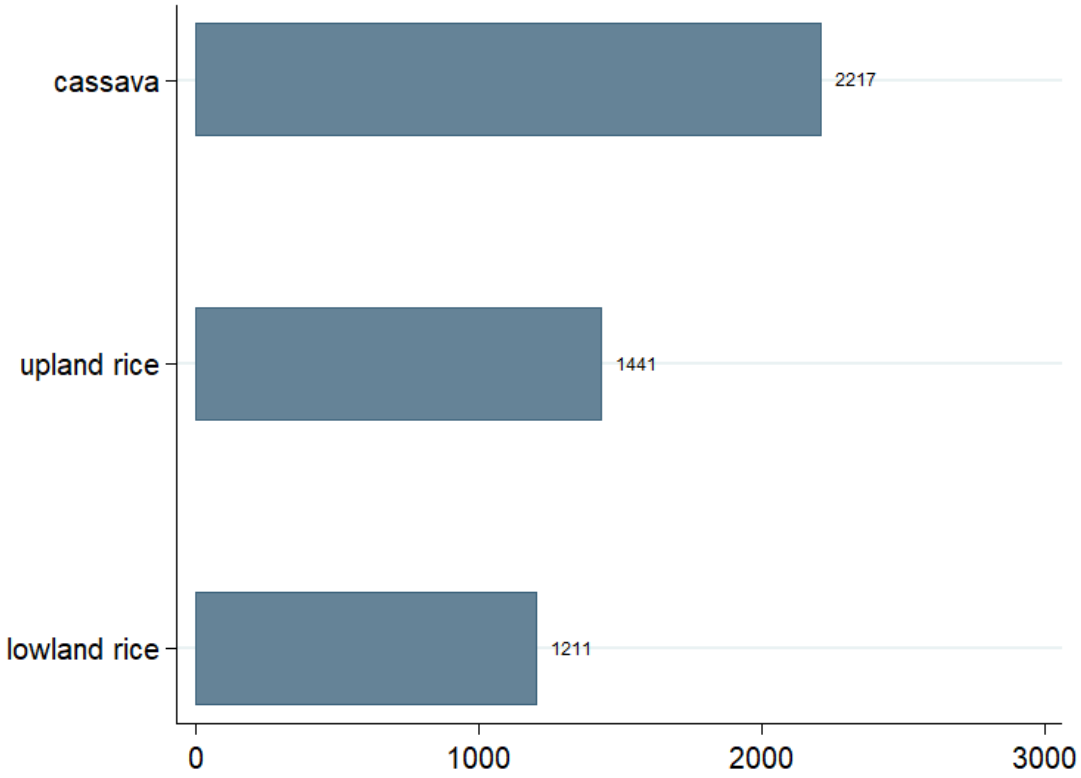
of farmers. The top three planted crops is not surprising given that the program aimed to focus on farmers that regularly cultivated upland rice, lowland rice or cassava.

Figure 6: Crops Planted and Sold



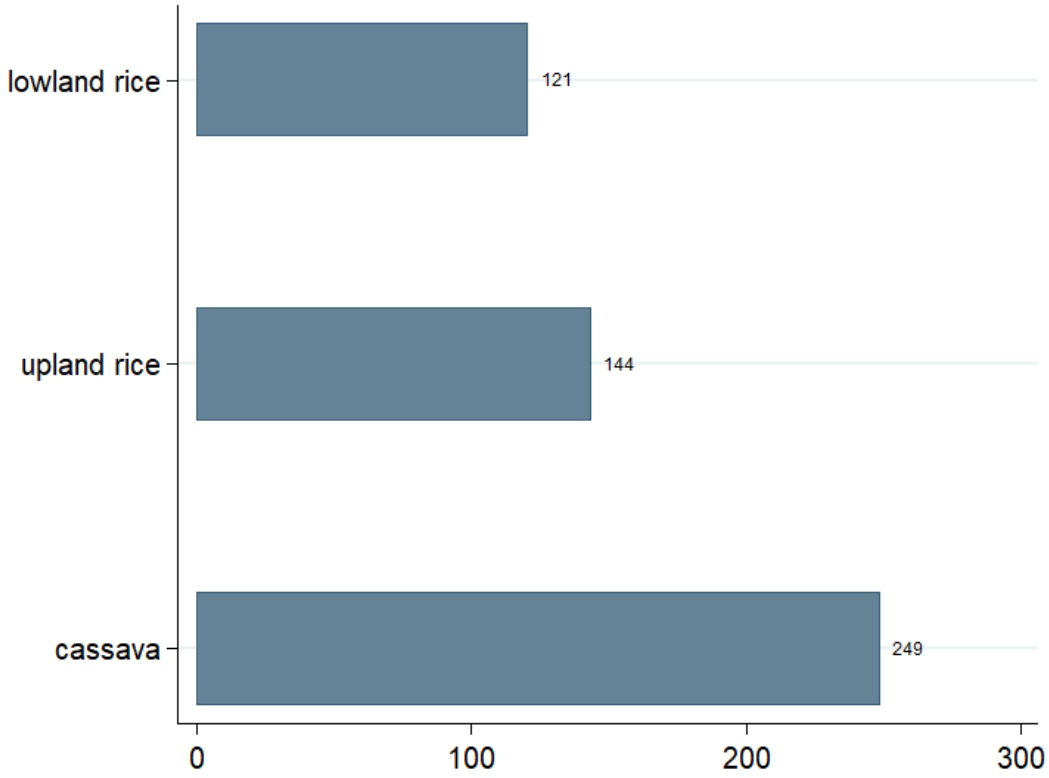
Agriculture production is measured in weight(kg) and agriculture production value is measured in USD dollars calculated based on self-reported sales data at the household level. Figure 7 shows that cassava is the highest produced crop compared to upland and lowland rice.

Figure 7: Average Annual Production of Common Crops (kg/household)



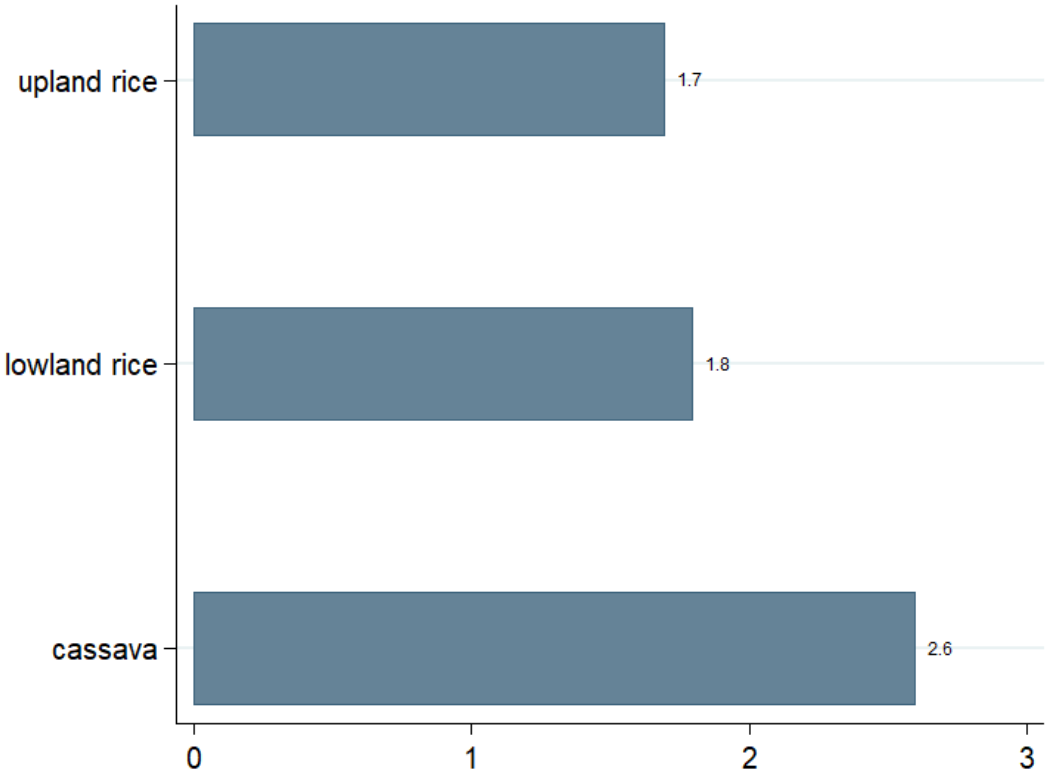
Total production value is highest for cassava which was expected given that it is the most produced crop by farmers.

Figure 8: Average Annual Production Value of Common Crops (USD)



Yields are calculated using self-reported production and plot size. Figure 9 shows that cassava yield is 2.6 tons/HA, which is significantly higher than lowland and upland rice.

Figure 9: Average Annual Yield of Primary Crops (tons/Ha)



6.1 Use of Improved Varieties

The use of improved varieties can lead to higher agricultural yields and improved outcomes, as measured by dietary diversity scores. Figure 10 displays the share of farmers that report using improved varieties seeds of the most common crops on their plots. About 24% of farmers report using improved variety of lowland rice on their plot and 12% of farmers report using improved variety of upland rice. The project will further encourage farmers to use improved rice and cassava varieties, allowing them to learn about their effectiveness. The hope is that after a season of experiencing the subsidized inputs, the farmers will both have higher income from improved yields and greater demand for these varieties in the future. By assessing availability of new varieties at endline, and willingness to pay for new varieties, it will indicate whether subsidies can create

sustainable market for improved varieties.

Figure 10: Use of Improved Varieties

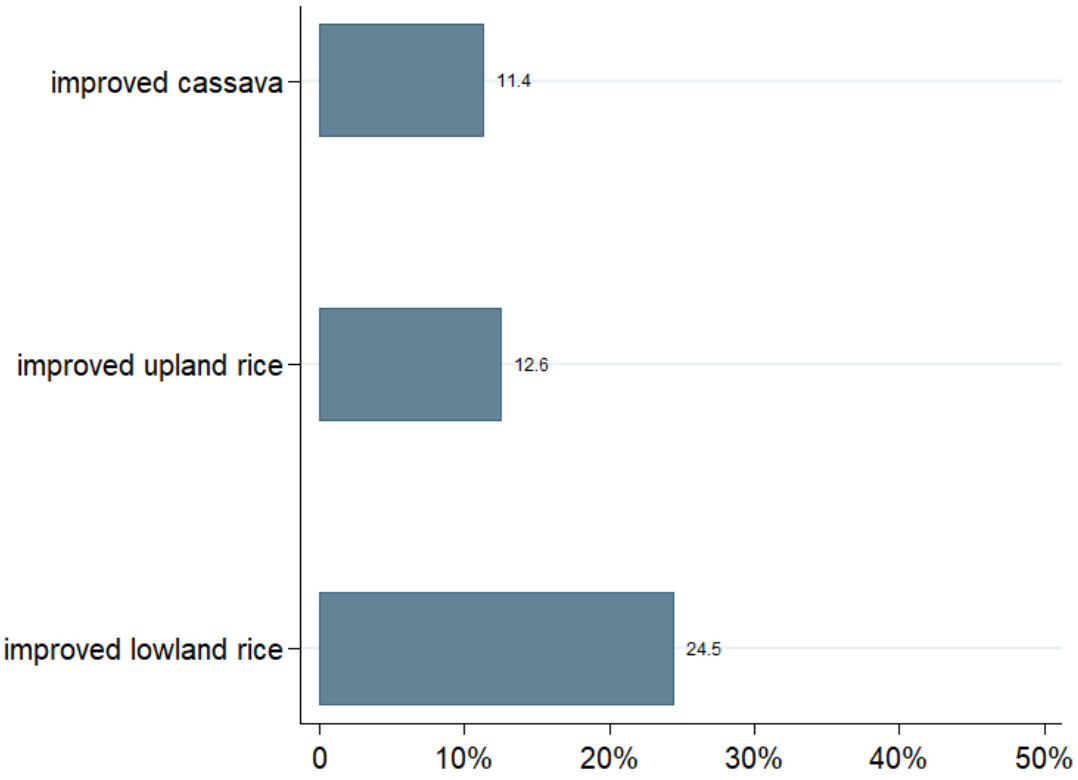
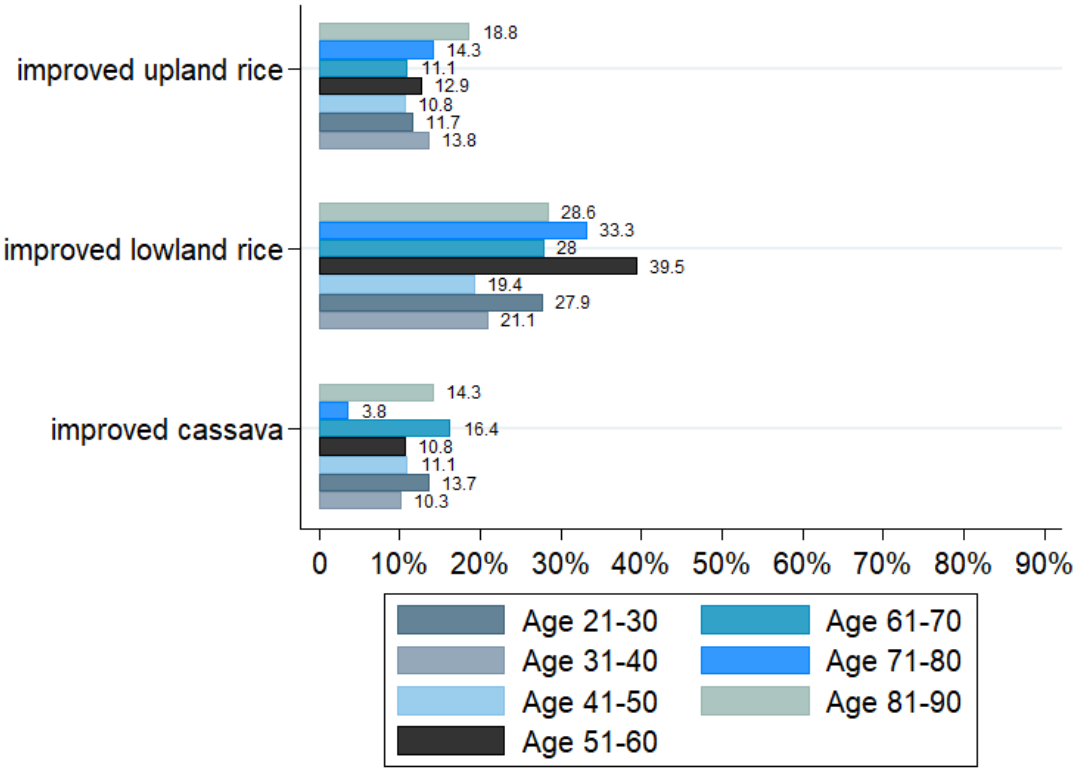


Figure 11 depicts the use of improved varieties by age of the person responsible for farming in the household. The figure suggests that households with older farmers appear to be using more improved varieties of improved cassava and improved upland rice than younger farmers. But regardless of age, a majority of farmers are using improved varieties for upland rice and improved cassava but not for lowland rice.

Figure 11: Use of Improved Varieties by Age group



7 Food security

The baseline survey included a few measures of food security that were designed and tested culturally by the Food and Agriculture Organization (FAO) of the United Nations. The FAO Voices of the Hungry (VOH) developed a Food Insecurity Experience scale (FIES) that was used in this survey to measure hunger prevalence rates.

The FIES is based on a common metric for measuring food insecurity at several levels of severity. The version of the FIES that was used in the baseline survey is based on the following questions:

1. You were worried you would run out of food because of a lack of money or other resources?

2. Still thinking about the last 12 months, was there a time you were unable to eat healthy and nutritious food because of a lack of money or other resources?

3. You ate only a few kinds of foods because of a lack of money or other resources?

4. You had to skip a meal because there was not enough money or other resources to get food?

5. Still thinking about the last 12 months, was there a time when you ate less than you thought you should because of a lack of money or other resources?

6. Your household ran out of food because of a lack of money or other resources?

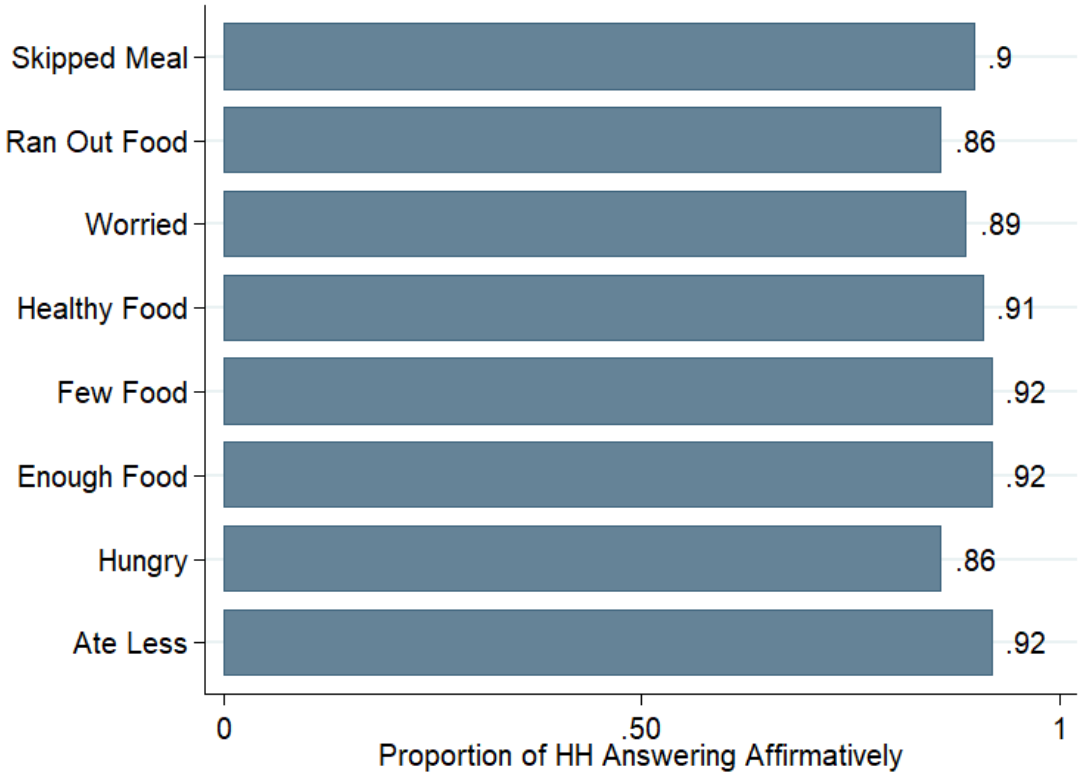
7. You were hungry but did not eat because there was not enough money or other resources for food?

8. You went without eating for a whole day because of a lack of money or other resources?

Each question of the FIES is based on domains of a given level of severity of food security to which it is assumed to correspond. Questions 1-3 are considered mild on the severity of food security. Questions 4-6 are considered moderate on the severity of food security and questions 7-8 are considered severe on the severity of food security. All eight questions in the survey are dichotomous (1/0, for affirmed/denied) and the FIES scale is a summation of all eight questions.

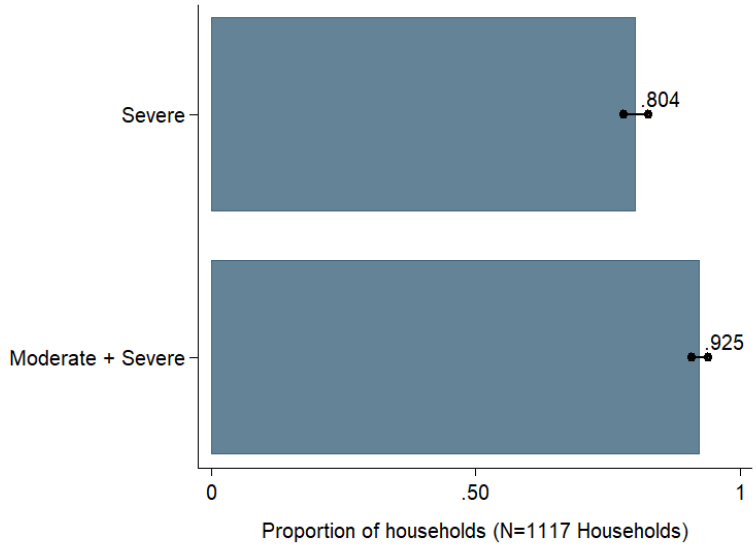
As depicted in table 12, majority of households in the sample suffer from severe hunger with 86% of them reporting that they were hungry but did not eat because they lacked the resources or money to make food. The high rates of food insecurity reported in the table reinforces the need to increase production of crops in order to improve food security among households in the sample.

Figure 12: Food Insecurity Experience Scale Affirmative Responses: Baseline Sample]

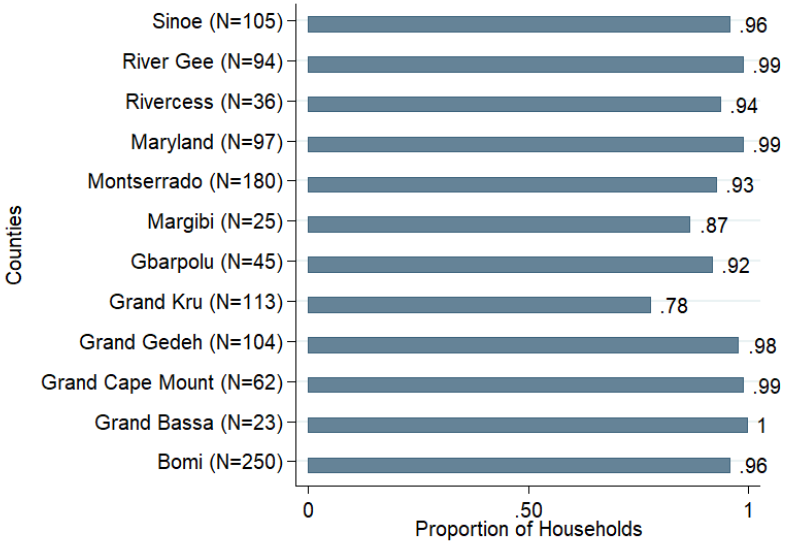


A majority of households in the sample are suffering from moderate or severe hunger at 92% and 80% of households suffer from severe hunger. It is evident that households in the sample are not getting a regular and sustained intake of food which means they lack vital nutrients and vitamins essential for a healthy lifestyle.

(a) Food Insecurity Experience Scale: Percentage of Households - Nationally



(b) Food Insecurity Experience Scale: Percentage of Households - By Counties



7.1 The Rasch Model for FIES

The issue with food security measures is that the questions comprising the measures vary across a wide range of severity of food security. The Rasch model provides statistical methods to estimate the severity of each item and each household to determine which response pattern in the dataset are consistent with the severity-order concept. It combines multiple dichotomous (yes/no) questions that vary as to the point on the continuum that each question uniquely reflects. The mathematics behind the model posits that the probability of a specific household affirming a specific question depends on the difference between the severity-level of the household and the severity of the question.

It should be noted that a core assumption of the Rasch model is that the questions are conditionally independent. Therefore, the question responses by households with the same true level of severity of food security are uncorrelated.

In order to determine the food insecurity prevalence rates using the Rasch model, an R package was developed by the Voices of the Hungry (VoH). The package allows one to conduct statistical validation of the FIES and to estimate prevalence rates of a given population.

Table 15: Sample Hunger Prevalence Rates

Moderate + severe	N	Severe	N.1
93.555	1,117	64.700	1,117

Table 15 depicts the moderate and severe prevalence rates for households in the baseline sample. It indicates that 93% of households in the sample are suffering from moderate or severe hunger and 64% of households are suffering from severe hunger. A majority of the households are currently experiencing severe hunger and this has negative consequences for social and mental health. The project will seek to alleviate some of these negative outcomes and reduce the hunger prevalence rate for treatment households in the sample.

Table 16: Female Hunger Prevalence Rates

Moderate + severe	N	Severe	N.1
97.959	394	67.751	394

Table 16 shows the moderate and severe prevalence rates for all women in the sample. About 97% of women in the sample are suffering from moderate or severe hunger and 67% are suffering from severe hunger. The project aims to increase crop production and income thereby, reducing hunger

prevalence among women and improving nutrition outcomes.

Table 17: Male Hunger Prevalence Rates

Moderate + severe	N	Severe	N.1
91.396	723	64.093	723

Table 17 reveals the moderate and severe prevalence rates for all men in the sample. Around 91% of men in the sample are suffering from moderate or sever hunger, while 64% of them are suffering from severe hunger. The hunger prevalence rates are slightly lower for men compared to women in sample.

It should be noted that the prevalence rates change depending on the number of measures included to compose the FIES. Based on the results presented above, the 7th measure: You were hungry but did not eat because there was not enough money or other resources for food? seems to driving the high prevalence rates.

8 Next steps

During 2018, DIME will coordinate with SAPEC to track delivery of further inputs to the treatment areas before planning an endline survey to assess impacts in September-October, 2018.