Agricultural Household Tracking Survey (AHTS)

Final Report

August 2011

Agricultural Household Tracking Survey

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Agricultural Household Tracking Survey

Final Report

Executive Summary

This report presents final results for the Agricultural Household Tracking Survey (henceforth, AHTS). The AHTS was conducted between March and May 2010 with the aim of providing a rigorous assessment of agricultural activities by smallholder farmers in Sierra Leone. The AHTS was commissioned and overseen by the Office of the President, and implemented collaboratively by the Ministry of Agriculture, Forestry and Food Security (MAFFS), Statistics Sierra Leone (SSL) and the Abdul Latif Jameel Poverty Action Lab (J-PAL) / Innovations for Poverty Action (IPA).

In general, agricultural household surveys, such as the AHTS, are used to provide a representative picture of the status of farming households in a country. The random selection of the sample and its large size allow for a high level of confidence in the final results, even after taking into account issues such as survey measurement error. The AHTS was designed with an exceptionally large sample size so the impact of measurement error on the country level aggregates would be minimal. The AHTS covered a final sample of 8,840 households, the largest household-level sample for an agricultural survey in Sierra Leone. However, since comparable agricultural data have not been collected before this, the AHTS results do not allow any comparisons over time.

The AHTS questionnaire was designed to capture the decisions farmers make, the yields and production levels achieved by the average household, as well as the access to services and technology, food security and other dimensions of agricultural households in Sierra Leone. The survey design followed international standards, with adaptations to local context through extensive field testing. The target sample size was chosen following rigorous power calculations based on SSL data available prior to the AHTS.

This report covers the most salient features of household agriculture in Sierra Leone from the AHTS. The results also highlight areas for policy interventions that could improve productivity, food security and livelihoods of farming households more generally in Sierra Leone. These areas include:

i. Improvements in inputs use and planting practices could dramatically improve productivity
    a. Levels of fertilizer use are low, particularly for the main staples, rice and cassava;
    b. The adoption of improved seed varieties remains low - for example, only 2% of rice farming households have ever cultivated one of the NERICA varieties;
    c. Planting practices often involve broadcasting on upland farms and tree crops are often intercropped (not just with other tree crops for shading purposes);
ii. Households' access to and interaction with markets remains low - for example, 92% of sampled households reported that their main point of sale for threshed rice was at farm gate (64% for clean rice). AHTS communities reported an average distance of 6.6 miles to the nearest market and 8.8 miles to the nearest permanent market;

iii. There is substantial scope to improve rural infrastructure. This includes both very localized infrastructure such as drying floors and storage facilities, as well as larger scale infrastructure such as roads. For example, 49% of farmers harvesting cereals stored their cereals in a room inhabited by the household; only 13% of households used a cement floor for drying. Out of 880 communities surveyed as part the AHTS community module, 25% reported a walking distance to the nearest motorable road of more than 30 minutes during the dry season. These communities are the most likely to lack access to markets for agricultural inputs and outputs. 67% of communities were listed as motorable during the dry season;
iv. Financial access - much as improved practices are important for farmers, the cost associated with some of these improved practices increases the need for financial services. A lack of these services can create a bottleneck for yield growth and productivity improvements. The AHTS data show that 68% of respondent households who did not borrow money said they had nobody to apply to for a loan and the majority of farmers with existing loans borrowed on the informal market;
v. There is need for continued dissemination of better, more sustainable cultivation practices, via continued investments in extension and investments in developing new cultivation techniques and new seed varieties.

The AHTS also illustrates areas of accomplishment in Sierra Leone, in particular:

i. MAFFS was the most cited source of extension and agricultural training and workshops. The AHTS data show that about 18% of households had spoken with an agricultural extension officer in 2009-2010. This number needs some context to interpret. The agricultural budget for Sierra Leone for Y2010 was about $3.5 per capita, relative to, for example, over $10 per capita in Kenya. Given these levels of expenditure, extension services reaching this fraction of farming households is an accomplishment. The comparable figure for Kenya is that 50% of households sought extension services (less than half of these were public), but Kenya spends about 3 times more than Sierra Leone per capita on agriculture. That said, only 7% of farmers had attended a training or workshop on agriculture and 6% were members of a farmer field school (FFS). Extension services were even more widely available for farmers cultivating cash crops. Promotion of such extension services should be continued and targeted to areas that most need them;
ii. The dissemination of information on new rice varieties, in particular NERICA, has been successful. The four NERICA project districts (Kambia, Moyamba, Port Loko and WA Rural) reported a very large proportion of farmers aware of NERICA rice varieties – up to 75% in Kambia. In addition, a number of households outside these specific districts had heard of NERICA. The national average was therefore high since close to 35% of households reported having heard about NERICA. Twenty percent of communities reported that at least one community member had already planted NERICA and 24% of farmers having cultivated NERICA said they received the seed from the government;
iii. The AHTS illustrates the diversity of agriculture in Sierra Leone. This is true for the crops side, where households are engaged in cultivating a large number of different crops, as well a range of different types of crops (cereals, tubers, legumes and tree crops). In addition, the

rates of livestock ownership are reasonably high with the majority of households (84%) owning livestock or poultry (though only 1% of households own cows). The diversification of agriculture is one way through which households smooth out the risk they face with regard to climate shocks, financial shocks, and other dimensions of agricultural production when financial markets are less developed.

The AHTS provides detailed data on a variety of aspects of crop production, a summary of which is given here. It confirms the diversity of crops cultivated in Sierra Leone as well as the importance of two core crops for production and consumption: rice and cassava, cultivated by 87% and 78% of farming households respectively during the past year. The other AHTS core crops – maize, groundnut and sweet potato – are grown by 69%, 50% and 39% of households respectively. While rice and cassava are grown by a large fraction of households in virtually all districts, cultivation of maize, groundnut and sweet potato are more unevenly spread across the country. Sorghum, yam, broad beans and okra are the dominant non-AHTS core crops, being cultivated by at least half of farming households.

While rice is the main staple for consumption for nearly all agricultural households in Sierra Leone (97%), it is not produced in sufficient quantity to fulfill the consumption needs of the entire farming population. Of the households that reported difficulties with food availability, the majority reported this to happen in August. To deal with these difficulties, households resorted to a variety of coping strategies, including reducing the frequency of meals (97%) and the quantity of food per meal (98%), borrowing money to purchase food (65%), selling livestock or possessions (56%) or eating seeds reserved for planting (35%).

The AHTS data on rice production reveals some important patterns:

i. Rice yields vary widely across households and are, on average, lower than some previous estimates. The average rice yield across ecologies is estimated at 484 kilograms per hectare. For comparison, per hectare yields (as measured by household surveys) are about 800 kg for Ghana, 1500 for Uganda (2006/2007), 2200 for Vietnam (2000), 2200 for the Philippines (2006/2007 for ordinary seed);
ii. There is a statistically significant difference between yields on the upland ecology and on the lowland ecologies, but this difference is not as large as expected: the average yield was 479 kilograms per hectare on upland farms while the average yield on lowland farms was 536 kilograms per hectare;
iii. Levels of fertilizer use, adoption of improved seeds, and planting practices are very low;
iv. Most households grow rice for self-consumption and only 6% of the average household harvest is sold;
v. Estimates of total production based on the AHTS suggest that national production by households (362,170 metric tons over the past year) is significantly lower than previously estimated by FAO and by MAFFS, but the area of land under rice cultivation is higher (826,578 hectares). However, as detailed in Section 2, production figures are based on reported household harvests and the AHTS does not capture large-scale commercial rice farms. In fact, the AHTS collects data on farms that range from less than an acre to a maximum of 150 acres. About 5% of rice farming households in the AHTS cultivate more

than 10 acres and 1% cultivate more than 19 acres. Households with rice farms totaling more than 150 acres probably occur with less than 1% probability and so these farms will not be picked up. In addition, the AHTS sample will not include commercial farms that are owned by households in Freetown or large commercial farms like Genesis (that has about 100 hectares of rice).

Collection and analysis of data on cassava is always difficult since cassava is not necessarily harvested the same year it is planted. However, a concerted effort was made in AHTS to measure the amount of harvest over the previous year, irrespective of the time the cassava was planted. Cassava stands out clearly as the second most important food crop after rice. Cassava cultivation is particularly widespread in Bonthe district, where the majority of households named the crop as their main staple food (65%). Bo and Port Loko districts had the highest area under cultivation and the highest total production of cassava, while Kambia and Bombali achieved the highest yields. The average cassava yield was estimated at 1,949 kilograms per hectare nationally. National production was estimated at 460,847 tons. This number is similar to the FAO reported numbers on harvests of cassava.

The AHTS covered three additional food crops in detail: maize, groundnut and sweet potato. The cultivation of these crops varied across districts. Maize was cultivated by a large proportion of households (69%) and was most common in Bo and Kenema. The national average harvest reported by households was 2.1 50kg (rice) bags of maize cobs. The yield of maize, measured in terms of 50kg bags of cobs to buttercups planted, was 0.5 of a 50kg bag. Groundnut was cultivated by 50% of households nationally, and was particularly prevalent in Bombali and Koinadugu. The average harvest reported by households was 144 kilograms of unshelled groundnut. Sweet potato was cultivated by 39% of households, and was most common in Kambia and Port Loko. Households harvested an average of 333 kilograms of sweet potato. The yield was 195 kilograms harvested to each bag of sweet potato vines cultivated.

In addition to these core food crops, the AHTS collected data on a number of tree crops, in particular coffee (grown by 20% of households), cacao (21% of households) and oil palm (41% of households). Tree crops were particularly important in the Eastern Province. Kailahun appears to be the largest cacao-producing district, while Kono has the highest production of coffee. The national production of cacao and coffee were estimated at 21,395 tons and 13,550 tons respectively. Oil palm was grown by significant proportions of households in almost all districts and national production was estimated at 22 million liters. Total household-level revenue from sales (for those households that sold that particular tree crop) was on average Le 684,000, Le 208,000, and Le 298,000 for cocoa, coffee and oil palm respectively.

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1. Introduction

The results presented in this report are based on the cleaned data from the Agricultural Household Tracking Survey (AHTS). This report presents the most important sections of the AHTS household and community data, as illustrated by the outline above. However, given the magnitude and breadth of the AHTS survey, not every question is covered in this report. The full questionnaire and dataset will be available from Statistics Sierra Leone and it will provide a much fuller and richer picture of agricultural households in Sierra Leone. This is the final report, released after the validation workshop held in July 2011. Finally, it is important to remember that the AHTS is just a baseline household survey. It provides a picture of farming households in Sierra Leone, but it cannot provide a picture of changes over time. The AHTS will be most valuable as the first of similar surveys, with similar methodology, that can then provide information on changes and trends.

The Government of Sierra Leone has made agriculture its top priority. Yet, a lack of information about the status of the sector can inhibit effective policy formulation, planning, implementation and performance evaluation. In view of this, in August 2009, the Government of Sierra Leone requested and supported an independent exercise, the Agricultural Household Tracking Survey (AHTS), to obtain accurate and credible agricultural data that can serve as a baseline for longitudinal analyses of Sierra Leone's progress in agricultural development over the next several years.

The AHTS focused on a subset of eight "core crops" comprised of five food crops (rice, cassava, maize, groundnut and sweet potato) and three tree cash crops (cacao, coffee and oil palm). Detailed data on these crops was collected in the eight "crop specific" sections of the AHTS and are provided in this AHTS Report. In addition, some basic data was collected across all crops as well as basic data on household characteristics. In addition, the AHTS collected some data on revenues, access to seeds from the formal sector and other aspects of agriculture that is designed to allow the Government of Sierra Leone to track whether subsistence farmers are becoming more linked to commercial systems over time.

1.1 Aims and Objectives of the AHTS

The AHTS was commissioned and overseen by the Office of the President of Sierra Leone, and implemented collaboratively by the Ministry of Agriculture, Forestry and Food Security (MAFFS), Statistics Sierra Leone (SSL) and the Abdul Latif Jameel Poverty Action Lab (J-PAL) / Innovations for Poverty Action (IPA). The main goal of the AHTS was to provide accurate and credible information about the agricultural sector in Sierra Leone from the household level. The AHTS was designed to capture decision-making by farmers, data on all aspects of cultivation from planting to harvest, and their access to services, technology, markets and infrastructure.

As stated in the AHTS Memorandum of Understanding (MoU), the aim of the AHTS was as follows[1]

"The Government of Sierra Leone has made agriculture its top priority. Yet, existing information about the status of the sector has questionable accuracy, reliability and robustness. This inhibits effective policy formulation, planning, implementation and performance evaluation. In view of this, the Government has decided to undertake an independent exercise to obtain more accurate and credible agricultural data which can serve as a baseline for longitudinal analyses of Sierra Leone's progress in agricultural development."

In order to achieve this, a Steering Committee was convened as well as a core Technical Team formed as per the AHTS MoU:

"To guarantee achievement of the Presidential objective of obtaining high quality baseline information on agriculture through the ATS, a steering committee has been formed to guide the survey process from the initial stage of mobilizing resources through to ensuring that the survey is completed and results are published in a timely manner. The committee is chaired by the Strategy and Policy Unit (SPU) in State House, and includes representatives from the primary Government agencies involved, Statistics Sierra Leone (SSL) and Ministry of Agriculture (MAFFS), along with representatives from the Abdul Latif Jameel Poverty Action Lab (J-PAL). The steering committee is to be used primarily as a forum to ensure that resources are mobilized for the survey, and to solve problems that threaten the timeliness and integrity of the survey. In addition, a core technical team has been formed comprising members from SSL, MAFFS, and J-PAL. This team will be responsible for all technical work and the day-to-day management of all ATS activities."

1.2 Socio-Economic Context

The Government of Sierra Leone has made agriculture its top priority. Agricultural production amounted to about 60% of Sierra Leone's GDP in 2007.[2] Sierra Leone emerged from a decade of brutal civil war in 2002, but political stability over the last several years has allowed the Government of Sierra Leone to focus on recovery and investment, more recently in the agricultural sector. In 2008, GDP in Sierra Leone was $4 billion at PPP, which amounts to a GDP per capita about of $700 (also PPP). Poverty rates in Sierra Leone were also quite high, with about 53% of the population living on less than a dollar a day, and 76% living on less than two dollars a day in 2003.

Agriculture is a large sector in Sierra Leone, accounting for 69% of the labor force, though value added in the agricultural sector in 2008 was approximately 41% of GDP. That said, there

[1] The AHTS MoU refers to the survey as the ATS, the Agricultural Tracking Survey, which was the original name given to the exercise before the validation workshop.
[2] All figures in this subsection are drawn from the World Development Indicators Online, accessed July 2011 except for the figure on agricultural production as a share of GDP that came from Statistics Sierra Leone.

is immense room for growth and improvement in Sierra Leone's agricultural sector. Only 25% of the arable land in Sierra Leone is being cultivated and that has allowed some commercial farmers to recently be able to set up operations in Sierra Leone (an example is Genesis Farms).

Much as the budgets of the Government of Sierra Leone are low (government expenditure made up 13% of GDP in 2008), agriculture is now an important priority for the Government moving forward. In addition, Sierra Leone actively participates in international markets for agricultural commodities both as an exporter and as an importer - for example in 2007, agricultural exports totaled $25 million (current US $) and agricultural imports were $150 million.

1.3 Relevant Literature

There are two relevant sets of studies here. The first are studies of agricultural production and yields conducted by the Planning, Evaluation, Monitoring and Statistics Division (PEMSD) at MAFFS as well as those conducted on a trial basis by the Sierra Leone Agricultural Research Institute (SLARI).

PEMSD conducts crop cutting exercises across the country to estimate yields. These are conducted by researchers first identifying fixed size yield plots across the country that are then visited by enumerators during harvest to collect data on harvests. The enumerators are responsible for measuring harvests alongside farmers with relevant adjustments made for drying and weighing. The 2008 PEMSD crop cutting exercises are based on 10 yield plots per district (which were either 25 M^2 or 50 M^2, depending on the ecology). The yields from these crop cutting exercises for 2008 and 2009 are higher than those reported in the AHTS surveys.

The second set of related studies are those on food security. It should be noted that the AHTS was not designed to be a food security survey, but purely an agricultural survey. The AHTS survey instrument had a short section on food purchasing ability and the coping mechanisms households use during times of food purchasing difficulties, which are reported on below. However, the questions in this module were limited and covered a small number of areas relative to existing food security studies - for more concrete and extensive food security measures, these additional comprehensive food security reports should be consulted. Three recent examples are the Sierra Leone Household Food Security Survey in Rural Areas, May 2007 (prior to which there was the 2005 Comprehensive Food Security and Vulnerability Analysis, CFSVA), the USAID Sierra Leone Food Security Country Framework, October 2009, and the 2011 CFSVA.

This brief review mentions just the last of these as it is the most relevant. The CFSVA reports look at various dimensions of food security: aggregate food availability at local/regional/national levels, household food access, and individual food utilization using a wide variety of indicators, none of which were collected in AHTS, The second study looks at food availability (which is close to the AHTS measure of purchasing), food access (that is more

to do with nutrition) and food utilization (proper biological use of food). The 2007 food security survey also highlighted a number of production numbers in addition to all the food security measures (the upland yield numbers are close to yield numbers in this report).

The 2011 CFSVA was designed to gain a deeper understanding of the state of food security and nutrition in Sierra Leone. The report covers a Food Consumption Score (FCS), a key indicator calculated by surveying households about the quantity of a wide variety of foods consumed over the past seven days and applying weights to the foods based on their relative nutritional value. The resulting FCS is used to define a household into one of three food consumption groups: poor, borderline or acceptable based on standard thresholds. Households that have poor and borderline food consumption are then classified as being food insecure. The report finds that 45% of households in Sierra Leone are food insecure. The report also notes that food imports have remained stable in recent years, but the trend of high and rising food prices poses a serious threat to food security. Producing food does not guarantee sufficient access to food as only 6% of rice cultivators can rely on their own production to feed their family for the entire year. Seasonal variation is an important consideration food security deteriorates drastically during the lean season from June to August when more than 2.5 million people (45%) in Sierra Leone become food insecure. The report also illustrates that, while, domestic food production has recovered since the end of the conflict in 2002, the growth has been driven by a strong increase in the area planted with rice and there is potential for greatly improving these numbers through increases in rice yields.

1.4 Structure of Report

The report is organized as follows. Section 2 below presents the sampling and the methodology of this complex and large scale nationally representative survey. In Section 3, the results on the two main staple crops (rice and cassava) are presented, as well as data on food security, crop failures and use of NERICA. This is followed by crop profiles for the other core crops, in particular, maize, groundnut and sweet potato in Section 4. Section 5 describes how farmers engage with the formal sector and the commercial participation of farmers in Sierra Leone, including profiles of the three main non-staple or tree crops, coffee, cocoa and oil palm (sometimes known as cash crops). Section 6 covers other aspects of agriculture, including livestock and access to services. Finally, even though earlier sections do show some of the data disaggregated by district, Section 7 presents some data on crop inventories at the district level. Section 8 concludes. Annexes provide more technical background to the survey.

2. Sampling and Methodology

The AHTS follows a two-level sampling methodology, which is the standard for household level surveys.

First, 920 Enumeration Areas (EAs) were sampled for the AHTS out of the 9,671 EAs from the 2004 census. The sampling was stratified by district to ensure that the results are representative at this level, allowing presentation of district averages. Second, within each sampled EA, a sample of up to 10 agricultural households was drawn using information collected during the AHTS Listing Exercise, conducted in October and November 2009. The total target sample size for the AHTS Survey was 9,030 agricultural households. For each EA, 5 additional replacement households were also drawn.

This section describes the sampling and other methodology for the AHTS in detail. In particular, it describes the sample sizes in detail and the relevant weights that were created. This section also describes the methods used to calculate any national aggregates from the AHTS data, such as total land cultivated in the country by crop and total production by crop, as well as any caveats to these calculations as they stand.

Note that the AHTS sampling methodology did not include stratification by ecology. The reason for this is that a detailed and accurate breakdown of each enumeration area or chiefdom into ecologies was not available and such information would have been needed for a stratification by ecology. However. the AHTS how provides this information, which can be used to stratify future surveys by ecology.

The fieldwork for the AHTS, which involved visiting EAs and contacting and interviewing target households one or more times, was conducted in March, April and May 2010.

2.1 Data Collection

2.1.1. Structure of field work

The main data collection exercise was designed to include multiple levels of data collection and supervision, namely: Enumeration Teams, Field Monitors, District Coordinators, and the AHTS Technical Team. The structure as pertaining to each level is described in detail below.

Level 1: 20 Enumeration Teams (each comprising one Enumeration Team Supervisor, four Enumerators, and one Driver)

The 920 EAs were divided across the 20 Enumeration Teams along geographic and linguistic lines such that each team was responsible for between 45 and 47 EAs. Each team was allotted 8 weeks to enumerate its designated EAs. Teams were instructed to cover one EA per day for six days every week, with the seventh day reserved for editing questionnaires, communicating progress and work schedules, and submitting edited questionnaires. This schedule was

designed to allow Team Supervisors to edit questionnaires on a regular basis, in order to identify potential inconsistencies, mistakes and other problems and correct them with enumerators, as well as to ensure a steady stream of edited questionnaires to District Coordinators and, ultimately, the Technical Team.

Level 2: 13 Field Monitors

Of the 920 EAs covered by Enumeration Teams, 616 were randomly selected for Field Monitoring. These 616 EAs were divided geographically across 13 Field Monitors, who were all MAFFS field staff. All monitors were assigned 48 EAs, with the exception of the monitor for Koinadugu District, who was assigned 40 EAs due to the difficulty of the terrain. Each Field Monitor was based in a different district, although some Monitors' areas of operations extended across district boundaries.

Level 3: District Coordinators

MAFFS and SSL district-level staff were responsible for jointly coordinating AHTS field activities. Each MAFFS District Agricultural Officer (DAO) and SSL District Statistician was responsible for overseeing the fieldwork in 70-75 EAs, with the exception of the District Coordinators for Koinadugu District, who oversaw work in 56 EAs. As with Field Monitors, each set of District Coordinators was based in a different district, although the areas of responsibility of some District Coordinators extended across district boundaries. However, because some Enumeration Teams worked across the areas of responsibility of multiple District Coordinators, these teams reported to different District Coordinators for different portions of their work. Each set of District Coordinators were therefore responsible for the work of between 2 and 6 Enumeration Teams.

Level 4: the AHTS Technical Team

The Technical Team consisted of members from each of the implementing partners of the AHTS (the Ministry of Agriculture, Forestry and Food Security (MAFFS), Statistics Sierra Leone (SSL) and the Abdul Latif Jameel Poverty Action Lab/Innovations for Poverty Action (J-PAL/IPA) and was headed by J-PAL/IPA as set out in the Memorandum of Understanding.

The role of the Technical Team was to design and implement the survey. During fieldwork the Team monitored the progress of fieldwork and resolved any issues arising. Monitoring was conducted through three country-wide supervisions. Supervision Teams were made up of members of the AHTS Technical Team.

2.1.2. Findings from fieldwork

The findings from AHTS fieldwork have been fully documented in a separate AHTS field report, a summary of which is presented in Annex 4 to this report. The purpose of the field report is to provide detailed information on all relevant aspects of the AHTS fieldwork and in particular:

(1) all issues relevant to the **quality of the information collected** as part of the AHTS, so as to inform users of the data about what types of information are more and less reliable, and why;

(2) the experiences of the AHTS, so that **lessons learned** during the AHTS can inform plans for future collection of high-quality (agricultural) data in Sierra Leone.

The report is divided into 3 sections: 1) a discussion of the intended structure of the fieldwork, and how successfully these plans were implemented in the field; 2) a discussion of issues potentially affecting the quality of information collected, including the selection and identification of Target Households, problems with the survey instruments themselves, and problems encountered during the administration of the survey instruments to respondents; 3) suggestions for future surveys.

2.1.3. Sample Size and Attrition

Attrition was moderate. The final AHTS sample has data on 8,840 households. As mentioned above, the target sample size was 9,030 households. Of these, 9,006 households were reached in 917 EAs (24 households were not reached and not replaced, over 3 different EAs). [3]

In addition to this, another 10 EAs initially sampled to be surveyed were dropped from the final sample as GPS coordinates reported by the surveyors did not match geographic data available to the Technical Team (raising questions about the validity of these data). Individual decisions concerning GPS coordinates outside the Target Enumeration Areas were fully documented in a specific report which can be made available by the Technical Team upon request. Listing problems (also detailed in the field report) led to the Technical Team dropping a further 3 EAs. In total this meant an additional 166 households were dropped from the sample (an additional 1.84% of the original target sample). This brings the final AHTS sample size to 8,840 households. Overall, this represents an attrition rate of only 2.1% at the household level from the target sample.

The listing and sampling procedures were designed to ensure that all households sampled were involved in agriculture. However, in the final AHTS dataset 417 households are reported as not having been involved in agriculture in the past twelve months even though they had reported undertaking farming activities in the initial listing exercise. It may be that some of this inconsistency is due to enumeration error. The weighting procedure used in the analysis phase was designed to ensure that this issue did not affect the representativeness of the final AHTS sample.

Finally, it should be noted that of the final sample of 8,840 households, 8,034 households come from the original sample of targeted households, 404 are replacements and 402 are from the re-listed EAs. There were a number of EAs where the Listing exercise was not done correctly. Most of these EAs (except for the 3 described above that were dropped by the Technical Team) were re-listed during the course of the AHTS fieldwork and new samples were drawn.

[3] This corresponds to an attrition rate of 0.3% at the household level.

2.1.4. Household Weights

Household and EA weights were created to accompany the AHTS. The EA weights come from the sampling design described above and represent the inverse of the probability that the EA was sampled. The household weights multiple this by the probability that the given household was sampled. Note that the household weights sometimes do vary within a given EA. This is partly because of the re-listing of some EAs and partly because there are multiple localities per EA of different sizes, which were sometimes combined in the sampling to try to ensure a sample of as close to 10 households per EA as possible.

Note that the final weights used in this report and all the analysis of the AHTS (including the national production figures) account for all the attrition (i.e. for both the attrition that was of 24 households due to EAs not being reached as well as the 166 households due to EAs where the data was not collected accurately). However, these weights assume that the attrition was random. In addition, the weights account for the 404 replacement households as well as the 402 re-listed households.

2.2 Data Entry, Processing and Analysis

Following the completion of fieldwork, data entry was conducted at SSL for the Household and the Community questionnaires and was completed on July, 29, 2010. Each questionnaire was entered independently by two different operators in order to minimize the risk of individual error and to maximize the reliability of the final dataset. Processing of the AHTS data was a three-stage process involving: (1) double entry reconciliation, (2) logical consistency checks and (3) other cleaning activities.

Double Entry Reconciliation involved identifying discrepancies between the two rounds of data entry for each questionnaire, and checking these entries against the physical questionnaires in order to obtain the correct data. Logical checks verified the consistency of answers given by each household across different sections of the questionnaire. The other cleaning activities involved 1) converting local measurement units into standardized units for the sake of aggregate analysis, and 2) setting rational value bounds for important variables and dealing with outliers – extreme or implausible values gathered in the process of data collection. The cleaning work was conducted collaboratively by J-PAL/IPA, MAFFS and SSL.

The outlier routines consisted of setting to missing observations that (at the household level) had more than five times the standard deviation greater harvests than the mean. For example, for cassava, this would mean setting observations to missing where the total harvest of cassava was greater than five standard deviations times the average harvest. A specific procedure was adopted for rice in order to account for the potentially large producers included in the AHTS sample. Observations in the rice data were considered outliers when the seeding rate was greater than 10 bushels per acre (the modal rate was 1 bushel per acre before conversions are run: 75% of observations were at the modal rate and 90% of observations were at or below the

modal rate). The outlier routines were run separately for each crop and in all cases, they only resulted in very few observations being set to missing for each crop.

2.3 Creating National Aggregates

This section describes the calculation of economy wide national aggregates from the AHTS data. Once the final household level weights were created for the final AHTS sample of 8,840 households (as described above, accounting for all the attrition), aggregate production was simply calculated as the weighted sum of individual production, i.e. $\sum Y_i \omega_i$ where Y_i is total household production and ω_i is the household level weight created as described above. For creating the national aggregates, the observations set to missing (because of the outliers routines described above and any non-response in the survey) were imputed with the mean for the district.

This was checked against alternative methods and the results are very similar. The main check conducted was as follows. The 2004 census data for the EAs sampled in the AHTS was used. The census population for each EA was scaled up using a 1.9% average annual population growth rate to a predicted 2010 population for each of the EAs. The average total production for each household in the EA was calculated from the AHTS survey and then scaled up using this predicted 2010 population. This check of course assumes that there is no sorting of population and each EA grew on net at the same rate as the national population growth rate. This check gave results of the same order of magnitude as those reported here.

There are a number of caveats to this computation of national aggregates. First and foremost, the AHTS is a household survey – it describes the agricultural lives of an average farming household in Sierra Leone, as reported by these households. The report presents aggregates mostly for output and acreage which are therefore based on reported planting and harvests.

Second, a household survey is based on population weights. The perfect measure of national production would be the perfect crop survey or crop cutting exercise, which is close to impossible to implement in practice. Such an exercise would use a sampling frame that is based on randomly selected plots that would represent an average unit of land (for example acre) of cultivated land for the given crop, for example rice. This would lead to a very different weighting scheme than a population weighted survey like AHTS. A household survey measures the production of the average household and multiplies this by the number of households while the crop cutting exercise described above would measure the average production per acre of land cultivated and multiply by the number of cultivated acres. The latter places a higher weight on productivity of large farmers compared to the methodology used here. Second, the national production numbers reported here are purely from households, and do not include commercial or community farms. A community survey was collected as part of the broader AHTS survey activities – numbers on rice harvests on community farms are provided from this survey. However, there is no information in the AHTS on commercial farms and their production. Third, the weights used for the AHTS were computed using a listing exercise which

does not follow census standards, but had to be conducted as the existing census was from 2004 and therefore too outdated to be used and a new census could not be conducted simply for the AHTS.

3. Main Results

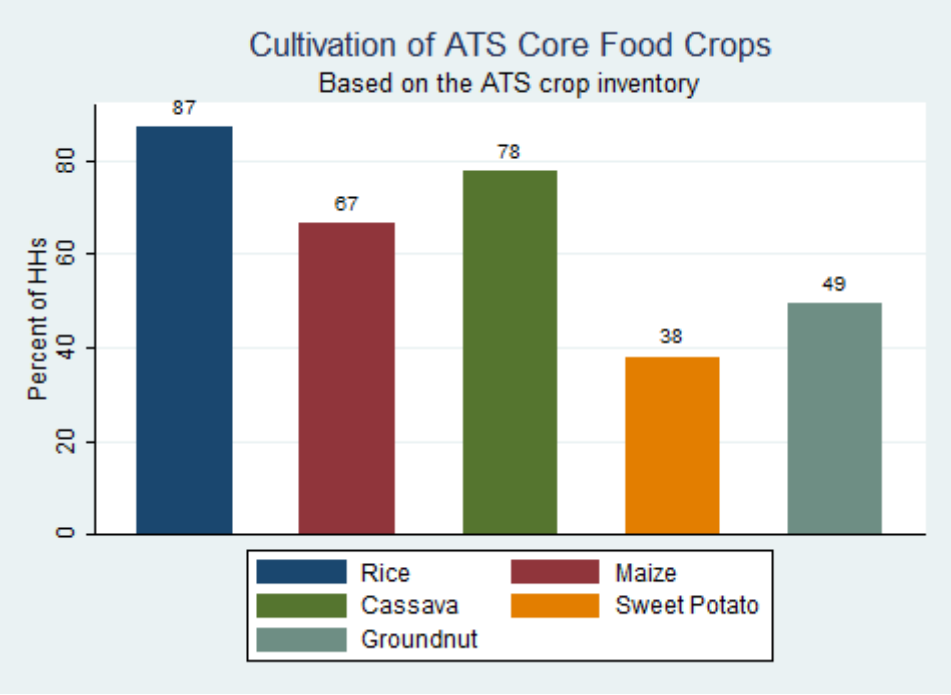
3.1 Overview of the agricultural sector in Sierra Leone

To give an overview of the agricultural sector in Sierra Leone, the main cropping activities of households are described. This section focuses on the crop inventory module of the AHTS, which served as the introductory section of the survey, and provides a broad picture of the diversity of agricultural production in Sierra Leone. The aim of the crop inventory section was to list all crops cultivated by farming households in the past 12 months, out of a list of 70 possible crops including cereals, tubers, beans, vegetables, tree crops and other crops.

3.1.1. AHTS Core Food Crops

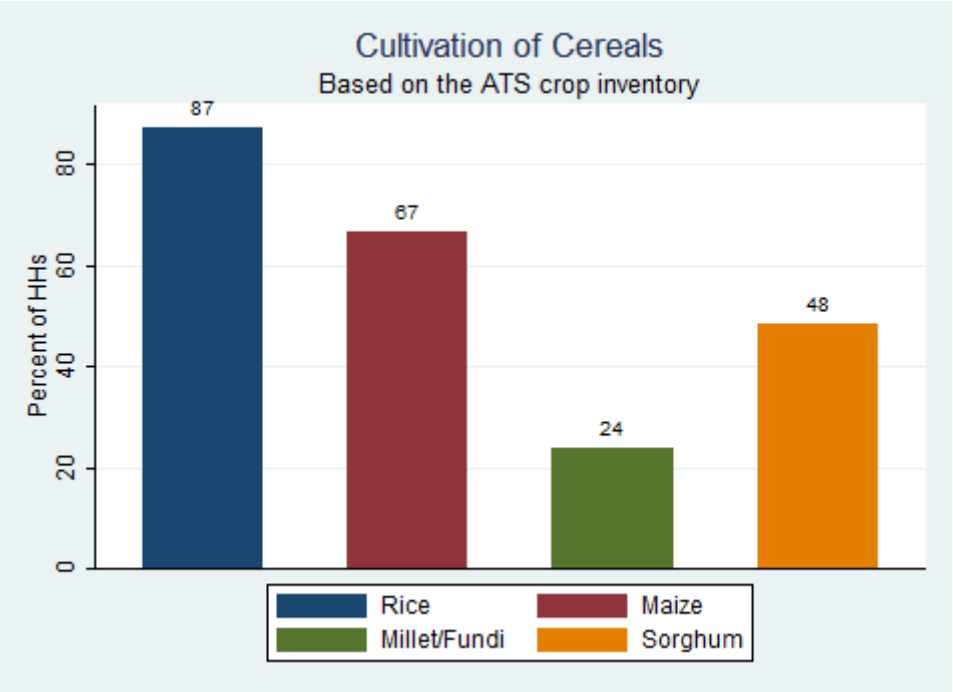
As mentioned, the AHTS focused on a subset of eight "core crops" comprised of five food crops (rice, cassava, maize, groundnut and sweet potato) and three tree cash crops (cacao, coffee and oil palm). Amongst the five core food crops, rice was cited by households as the dominant food crop (cultivated by 87% of farming households). The overwhelming majority of respondents also described rice as their most important staple food, as described in more detail in the food security section below. Cassava and maize were reported to be the second and third most important food crops, being cultivated by 78% and 67% of households, respectively.

Groundnut and sweet potato are also cultivated by a sizeable share of the sample (49% and 38%, respectively). However, sweet potato was cultivated by a smaller number of households than some of the other crops listed on the crop inventory, such as sorghum, yam and broad beans, as shown below.



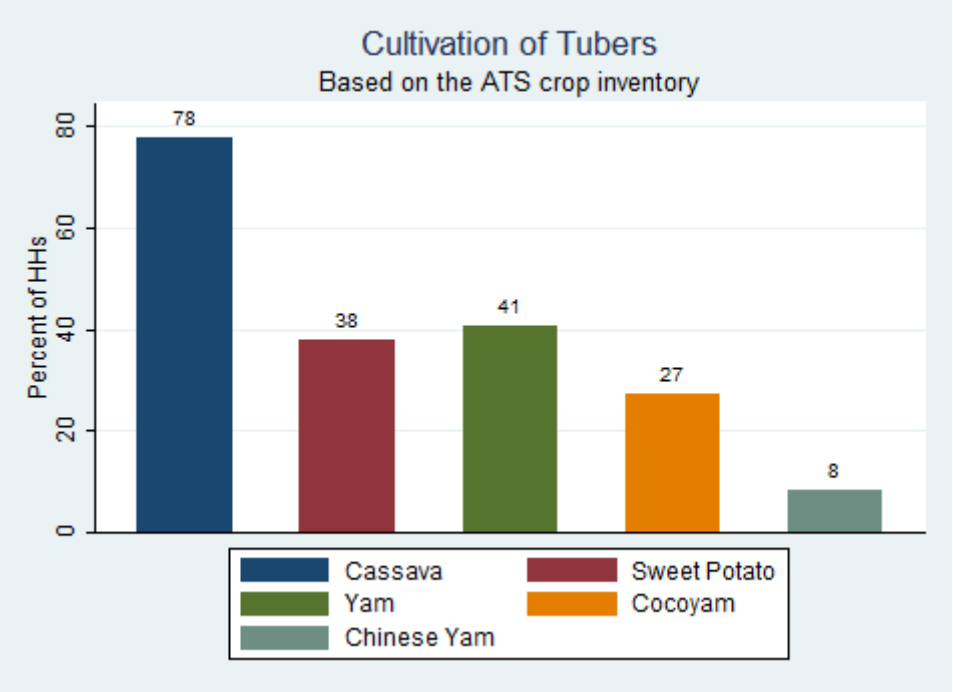
3.1.2. Cereals

While rice and maize are the cereals most cultivated in Sierra Leone, the crop inventory data also reveals the importance of sorghum/kuskus, which is cultivated by almost half (48%) of farming households throughout the country. The large number of farmers cultivating sorghum may reflect the common practice of cultivating sorghum with rice.



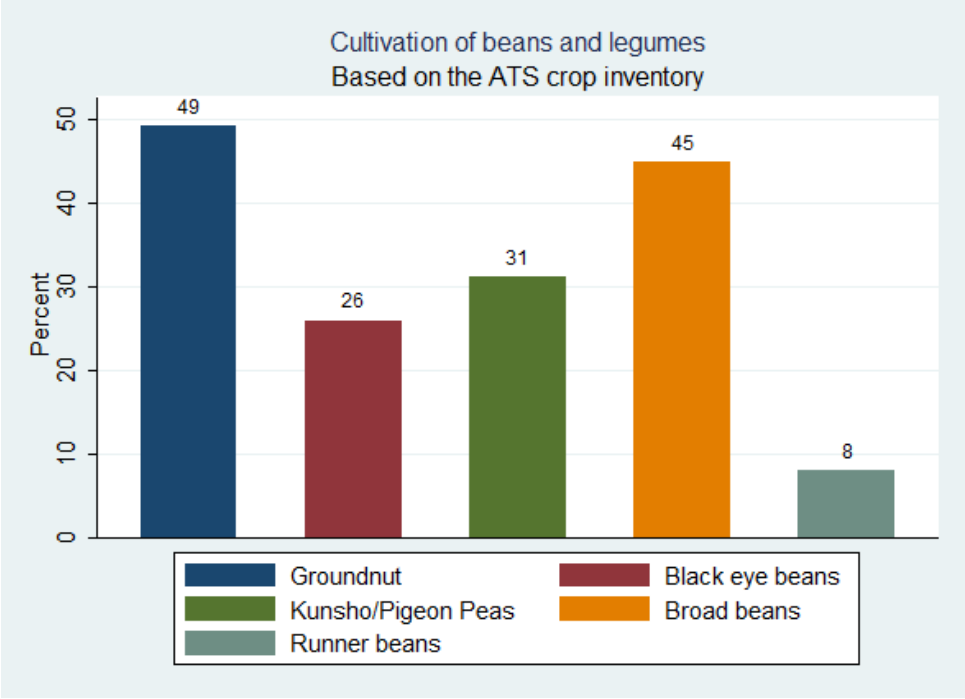
3.1.3. Tubers

Cassava was cited as the dominant crop in this category; being cultivated by 78% of farming households for its tubers and by 54% of households for its leaves (see the vegetables section below). The percentage of households cultivating cassava was highest in Bonthe (96%), Bo (91%) and Moyamba (90%). Yam (cultivated by 41% of households) and sweet potato (38%) were the second and third most important tubers. In addition, cocoyam was cultivated by 27% of households. Yam cultivation was highest in the southern districts, namely Bo (71%), Kenema (65%) and Kailahun (55%). This high incidence of yam cultivation may be a consequence of the long duration over which yam can be stored, making it a valuable staple during the lean season. According to the FAO, the top six world producers of yam in 2008 were West African countries, with Nigeria being the largest producer (FAOSTAT web database, accessed January 2011).



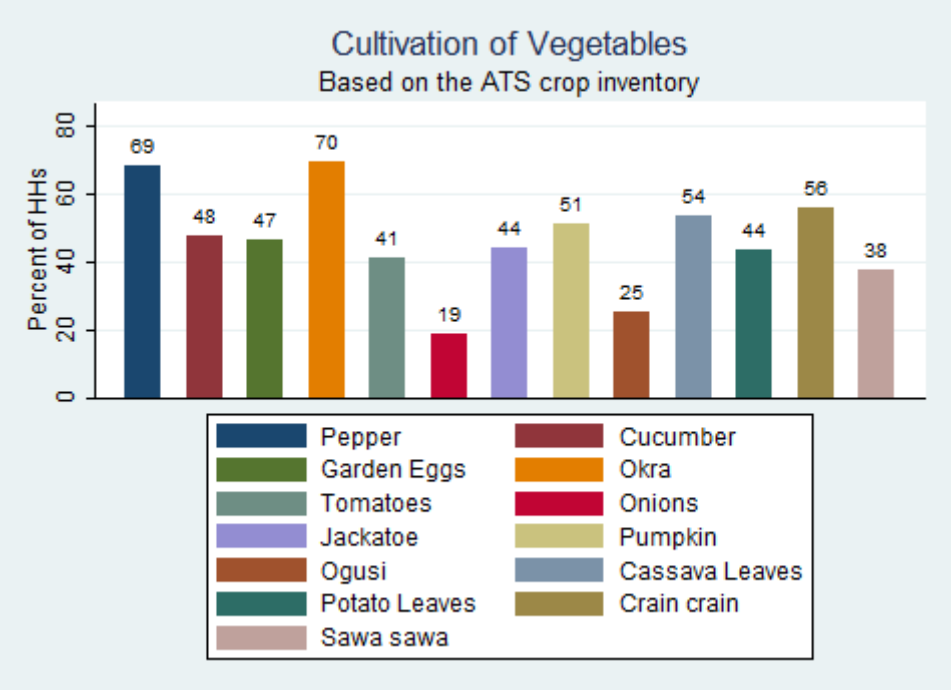
3.1.4. Beans and Legumes

Groundnut was the crop most frequently cited in the category of beans/legumes and was most frequently cultivated in Bombali, Koinadugu and Port Loko. Several varieties of beans were also cultivated by a large number of households: broad beans (45% of households), pigeon peas (31%) and black eye beans (26%). Broad beans cultivation was highest in Bo (82%), Kenema (74%) and Kailahun (57%). Runner beans were cultivated by a significantly smaller share of the sample (8%).



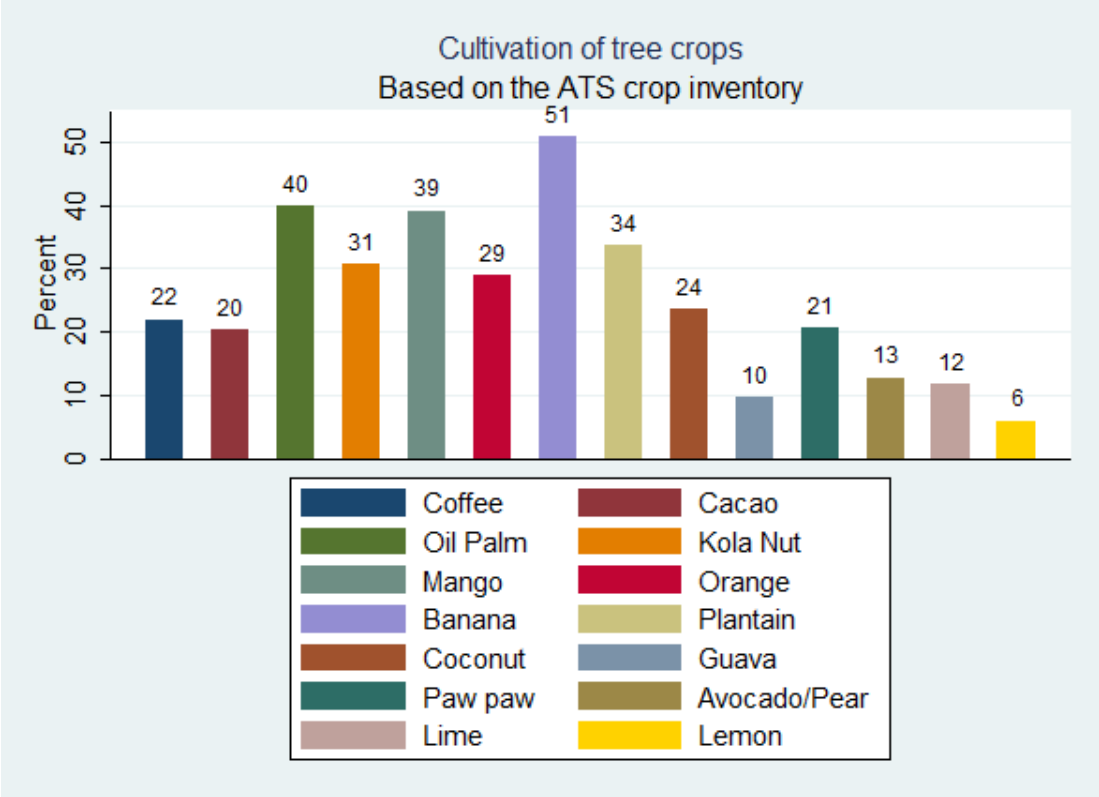
3.1.5. Vegetables

The vegetables section included many more crops than the other sections. The chart below presents the 13 vegetable crops most commonly cited by farming households. Okra and pepper, the most important crops in this category, were cultivated by 70% and 69% of households respectively. As with sorghum, cultivation of both crops is correlated with that of rice due to the intercropping of upland rice with these crops.



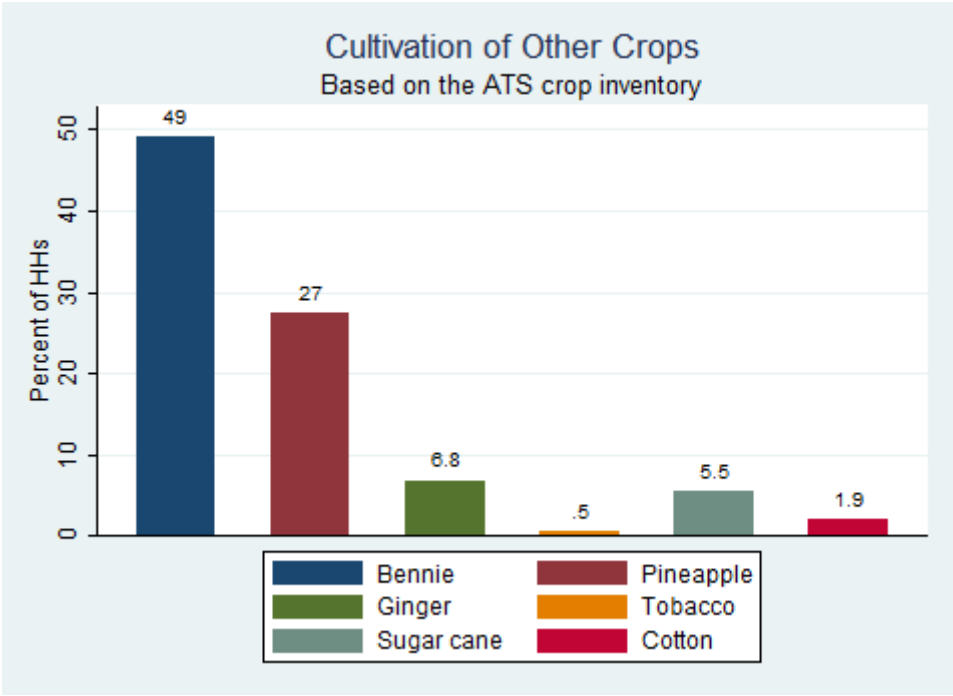
3.1.6. Tree Crops

This section on tree crops provides interesting results with regard to the relative importance of each crop. While coffee, cacao and oil palm are commonly known as the three major cash crops, only about one fifth of farming households engage in cacao (20%) and coffee (21%) cultivation. This implies that more than with other crops, coffee and cacao production is concentrated within a small subset of producers. Oil palm, unsurprisingly, was cited by a larger number of households (40%), with more farmers involved in oil palm in the South. Kailahun (57%), Bo (56%), Kenema (54%) and Bonthe (50%) all have more than half of their farmers engaged in oil palm cultivation. Banana topped the fruits category, being cultivated by 50% of farmers. Banana cultivation is most prevalent in Bo District (70% of farmers). Mangos, the second fruit most cultivated nationally, are most commonly cultivated in Kambia (64%) and Port Loko (60%).



3.1.7. Other Crops

Bennie and pineapple were frequently cited in the "Other Crops" category, being cultivated by 49% and 27% of farming households respectively. Bo (70%), Moyamba (65%) and Kenema (65%) had the largest shares of farming households engaged in the cultivation of bennie.



3.2 Main Staple: Rice

The AHTS data contains information on a total of 10,346 rice farms that were cultivated by 7,180 households, which is 81% (unweighted) of the final AHTS sample. The timing of the actual AHTS data collection was structured to coincide with the completion of the rice harvesting season, in order to maximize the accuracy of the rice data. Consequently, at the time of data collection, harvests had been completed on 98.8% of the rice farms and was "in progress" on 0.3% of farms. On the remaining 0.9% of rice farms harvest was reported as not completed. The results presented below focus on the sample of households that have completed harvest at the time of data collection.

Respondent farmers were asked to provide, inter alia, the size of their farms where rice was cultivated (regardless of whether other crops were simultaneously cultivated on the farm), details on the rice cultivation and planting practices of farmers, their harvests, the disposition of their harvests and sales and processing of rice. In addition, a lot of farm level information was collected for rice farms, including purchases of inputs and the use of labor including family labor by gender and age. Here, the production activities of rice farming households are presented. All results are presented at the household level unless otherwise indicated.

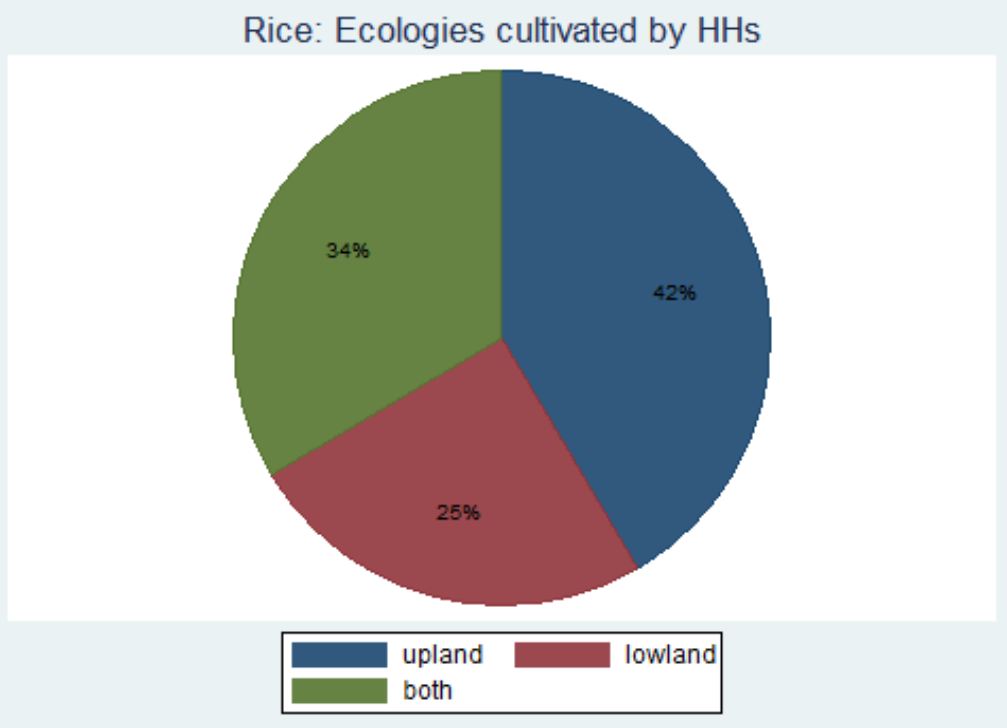
3.2.1 Rice Cultivation

Overall, 87% of farming households surveyed in the AHTS reported they had cultivated rice in the past 12 months – a percentage lower than expected. A few districts stand out as having distinctively different patterns in terms of rice farming: while in 10 of the 14 districts, 89% of farmers or more cultivated rice, only 44% of Bonthe farmers were engaged in rice cultivation. In addition, the majority of Bonthe farmers reported that cassava, not rice, was their main staple food (also see the food security section). The percentage of households cultivating rice was also lower in Western Area.

District	Did this household cultivate rice in the past 12 months? (Percent)
BO	90
BOMBALI	91
BONTHE	44
KAILAHUN	94
KAMBIA	95
KENEMA	92
KOINADUGU	93
KONO	92
MOYAMBA	89

PORT LOKO		83
PUJEHUN		89
TONKOLILI		98
WESTERN	**AREA**	37
WESTERN	**AREA**	2
NATIONAL		**87**

This can be separated by ecology. Households can cultivate upland rice, lowland rice or both. In the AHTS, 42% of households reported cultivating only upland rice, 25% only lowland rice and 34% reported cultivating both upland and lowland rice.

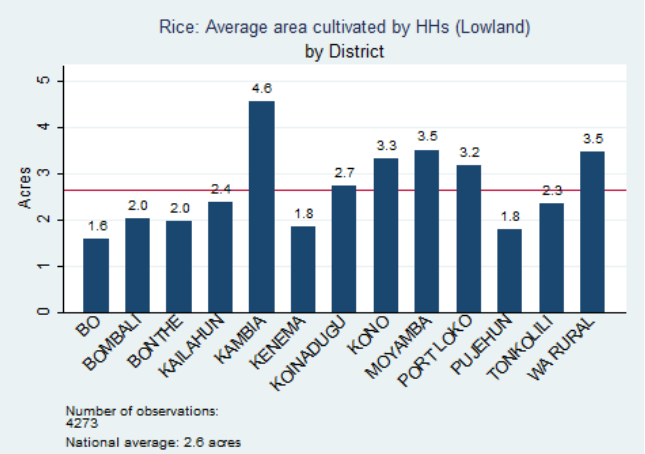


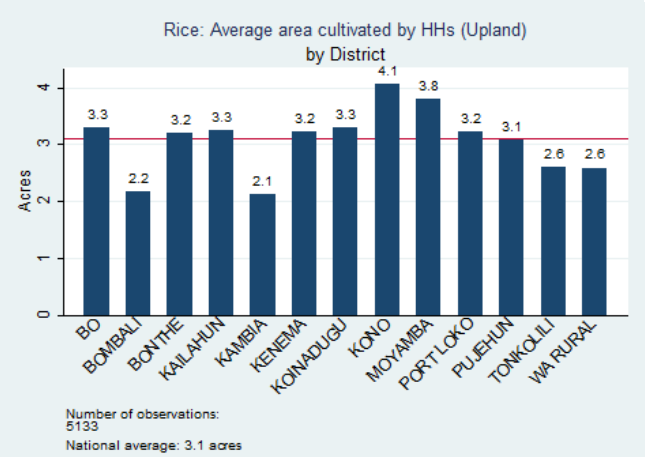
The total area of rice cultivated by households averaged 3.9 acres nationally. Port Loko, Kambia, Kono and Moyamba reported the largest average areas under cultivation.

District	Rice: average acreage cultivated by households (all ecologies)
BO	3.4
BOMBALI	3.1
BONTHE	2.6

KAILAHUN	4.0
KAMBIA	4.8
KENEMA	3.8
KOINADUGU	3.8
KONO	4.7
MOYAMBA	4.4
PORT LOKO	4.6
PUJEHUN	3.1
TONKOLILI	3.6
WESTERN AREA RURAL	2.9
NATIONAL	**3.9**

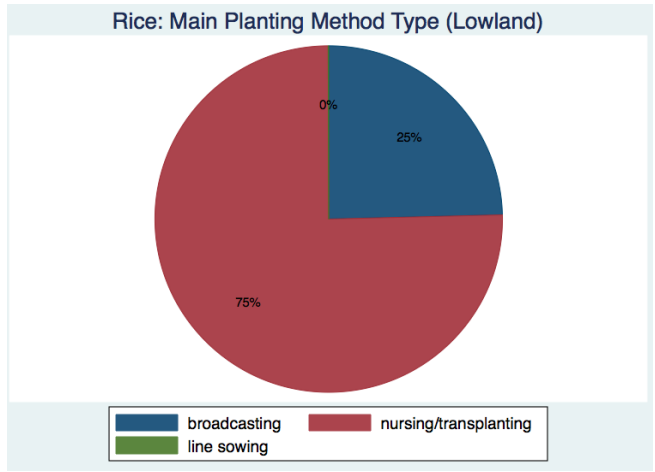
The area cultivated can also be separated out by ecology. For the upland ecologies, there is less variance in the areas planted with rice. The lowland ecologies are cultivated predominantly in Kambia, Moyamba and Western Area. Subsection 3.2.5 provides some analysis across the different types of lowland ecologies (inland valley swamps, mangroves bolilands and riverine).

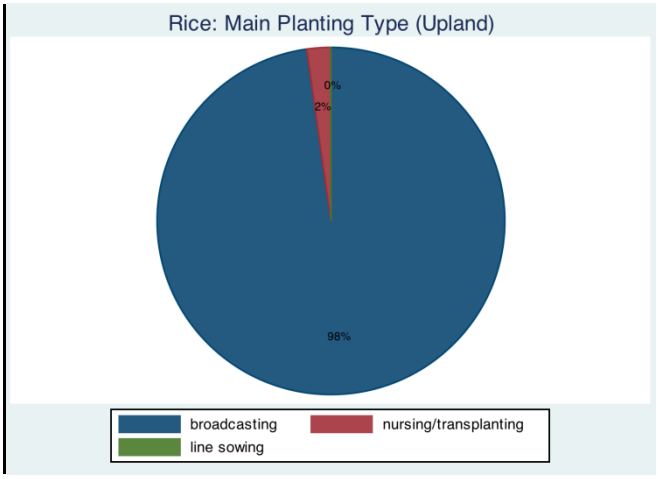




3.2.2. Rice Planting

Here, the rice cropping and planting practices of the AHTS households are reported. This covers the type of planting method, the quantity of seeds planted, the planting rates and the cropping patterns for upland farms.



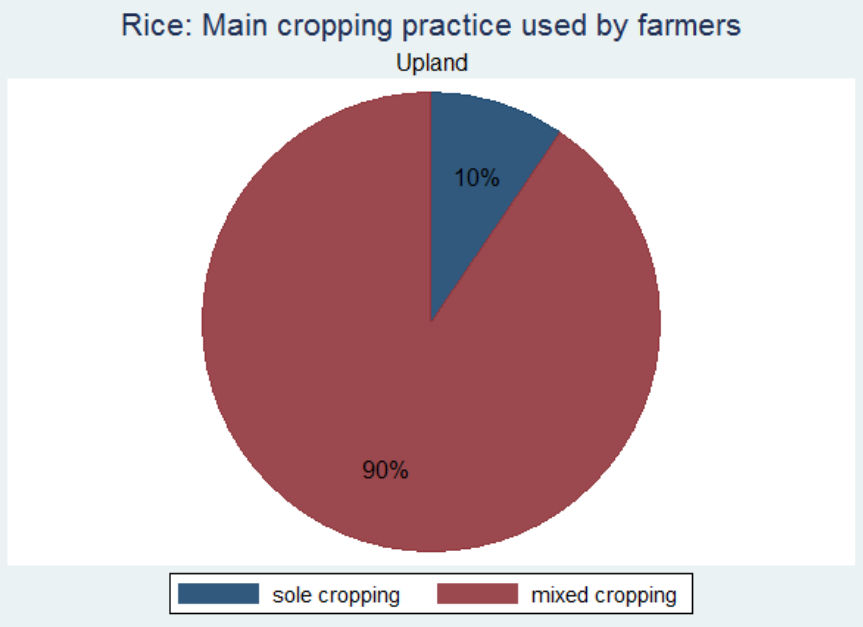


Looking at planting methods in the lowlands, nursing/transplanting was the most common method of planting. However, a significant share of households still broadcast (which tends to produce lower yields than other planting strategies) in the lowlands (25%). For the upland ecologies, broadcasting was the predominant planting method, with about 98% of households with an upland farm using this method on their upland farms.

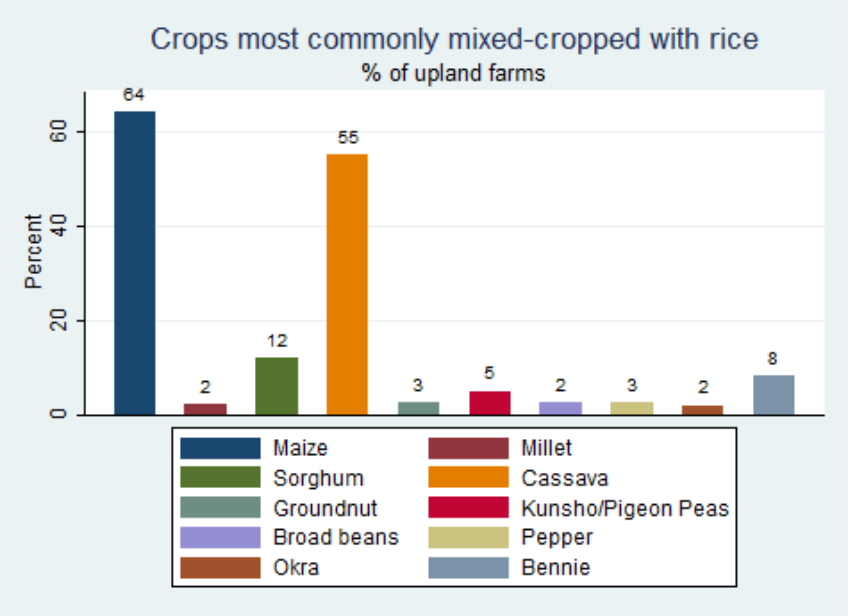
District	Rice: average seeding rate (bushels per acre)
BO	1.0
BOMBALI	1.1
BONTHE	1.2
KAILAHUN	1.1
KAMBIA	1.0
KENEMA	1.0
KOINADUGU	1.4
KONO	1.1
MOYAMBA	1.0

PORT LOKO	0.9
PUJEHUN	1.0
TONKOLILI	1.1
WESTERN AREA RURAL	1.3
NATIONAL	**1.1**

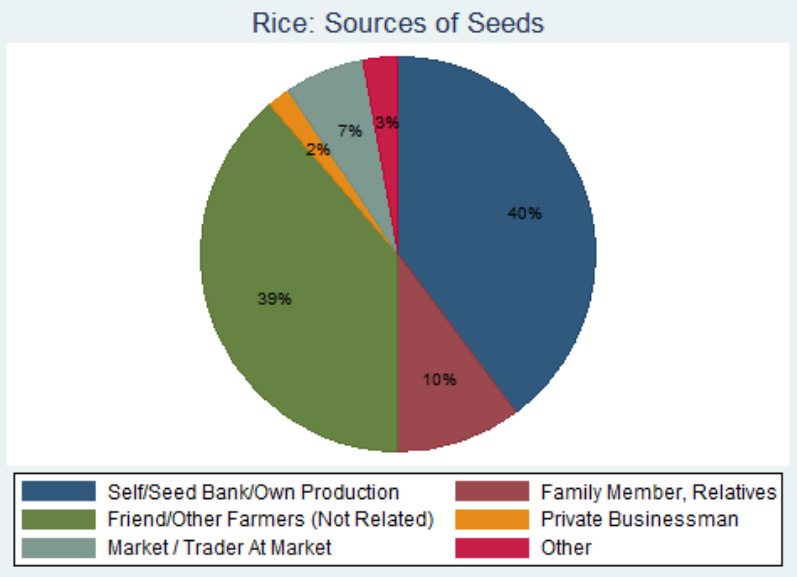
Looking at the seeding rates, the modal seeding rate in the sample is 1 bushel per acre (reported on 75% of rice farms). This is pretty consistent across the districts.



Looking at cropping practices, for the upland rice, a large fraction of households with upland farms use mixed cropping on their upland farms (90%).

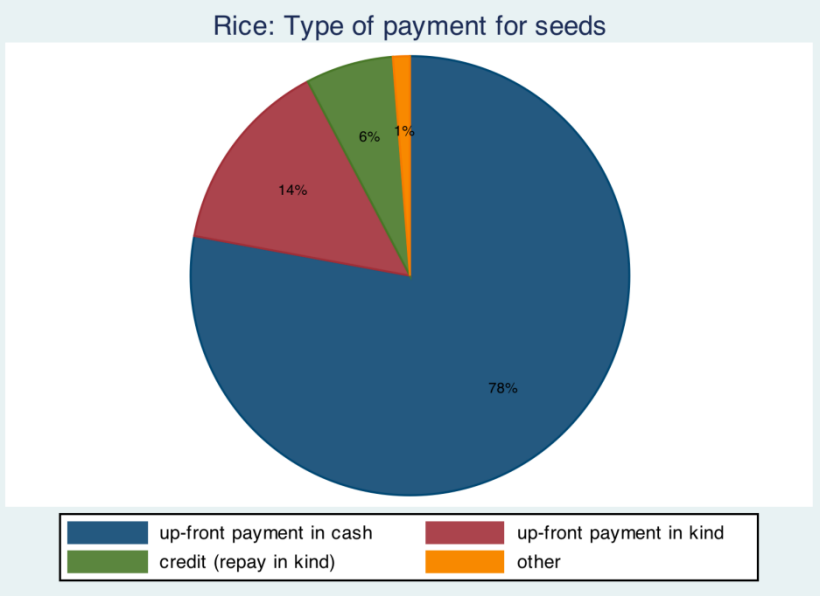


For the upland farms that are mixed cropped, looking at the farm level, rice is mainly intercropped with maize, cassava and sometimes sorghum (though to a much lesser degree). There seems to be little mixed cropping with legumes, which is sometimes used as a way of maintaining soil fertility. However, note that in the AHTS survey instrument, farms that were mixed cropping were asked for a maximum of three additional crops that rice was intercropped with and the core crops were listed first. So, this may underreport the true mixed cropping with non-core crops.



For the sources of seed, data is reported at the farm level (rather than the household level). For 39% of farms, seed rice came from the household's own seed bank or production. Friends, other farmers (39%), family members and relatives (10%) were the other main sources of seeds. The graph confirms that transactions regarding seed rice remain largely informal in

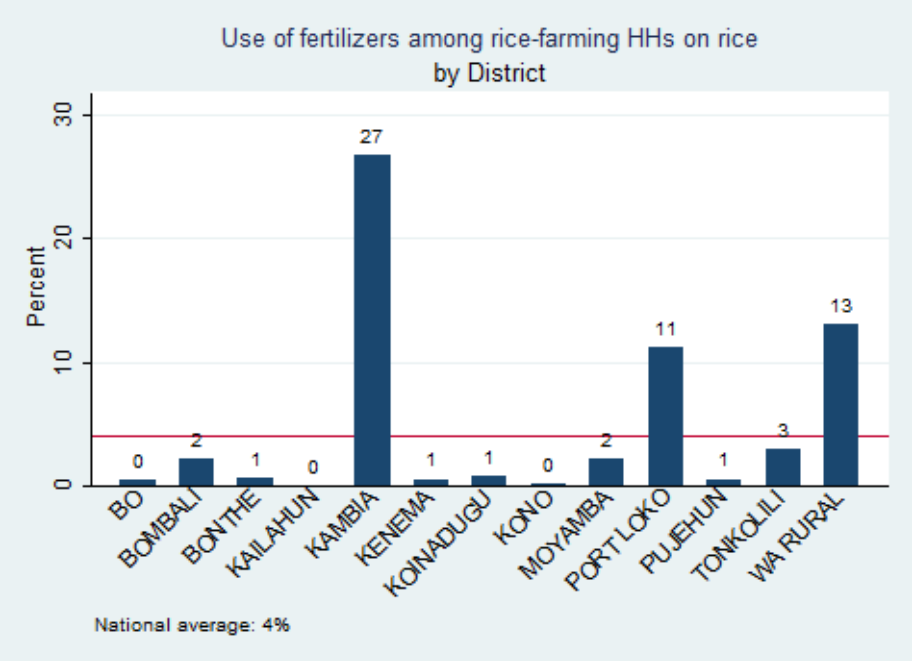
Sierra Leone, with only 7% of the sample reporting purchasing seeds through a private trader or businessman. This has important implications for disseminating new varieties.



Payment for seeds was made upfront in the large majority of cases (78%), and credit was used in only 6% of the sample.

3.2.3 Use of Fertilizer on Rice

The households surveyed in the AHTS reported very low fertilizer use. This section looks at the use of fertilizer for the main staple for households, rice.



Most of the fertilizer use on rice is in Kambia, Port Loko and Western Area, suggesting that ease of access to fertilizer (and price) may be driving use. Use is extremely low in all other districts.

On average, about 7% of households use fertilizer on rice, which is strikingly low. This is not unsurprising, given fertilizer costs– the price of a cup of NPK 15:15:15 was estimated at 1,450 Leones on average in the AHTS community survey.

District	Rice: average amount of fertilizers used by household on rice (among households who use fertilizer; kg)
BO	43
BOMBALI	69
BONTHE	50
KAMBIA	74
KENEMA	57
KOINADUGU	25
KONO	25
MOYAMBA	113
PORT LOKO	64
PUJEHUN	25
TONKOLILI	56
WESTERN AREA RURAL	132
NATIONAL	**70.8**

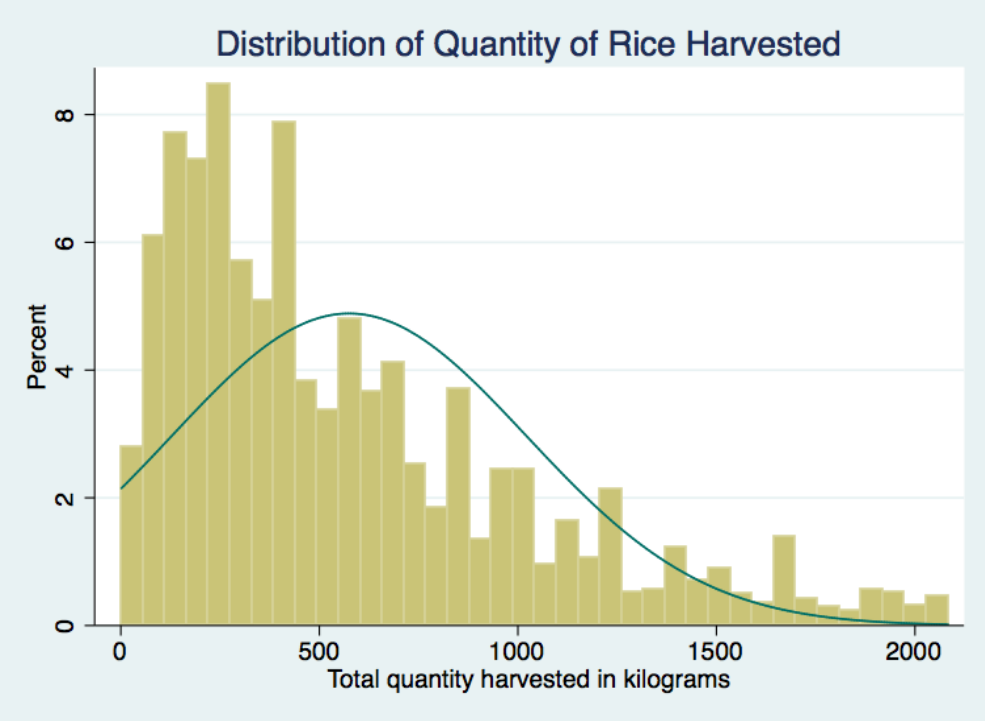
Note: Western Area Urban and Kailahun were left out due to insufficient data. 344 observations in the table.

Conditional on using fertilizer, households tend to use approximately 70.8 kilograms of fertilizer on rice and this translates into an application rate of 17 kilograms per acre. This is rather low - most recommendations suggest on the order of 50 kilograms per acre. The districts with the higher amounts of fertilizer use are Western Area (unsurprising given its proximity to Freetown and hence easier and cheaper fertilizer access) and Kambia, which may be due to close access to the Rokupr research station.

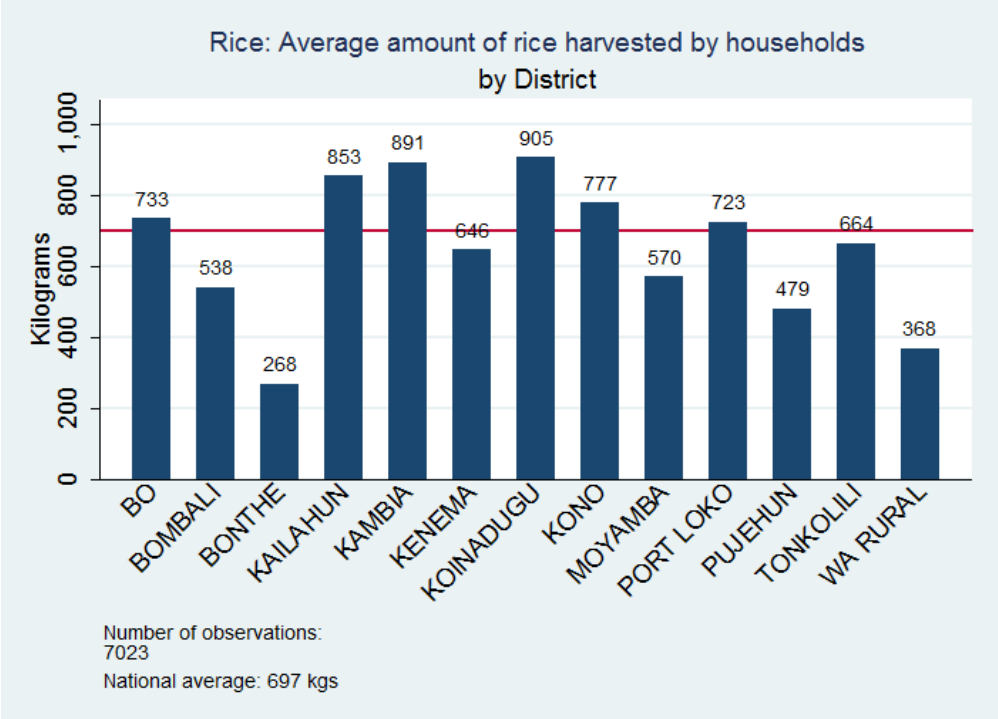
3.2.4 Rice Harvests and Yields

This section reports on rice harvests and yields. The harvest data was collected in self reported units, which were converted to bushels and then to kg using conversion rates provided by MAFFS. The conversion rate used for bushels to kg was 25kg per bushel.

The two figures below describe the data for two variables (both measured at the household level): rice harvest and rice yields (measured as the ratio between harvest and the area under cultivation for rice). To make the graph readable and only for these charts of the distributions of harvest, the top five percentile of harvests and yields were dropped from the illustrations.

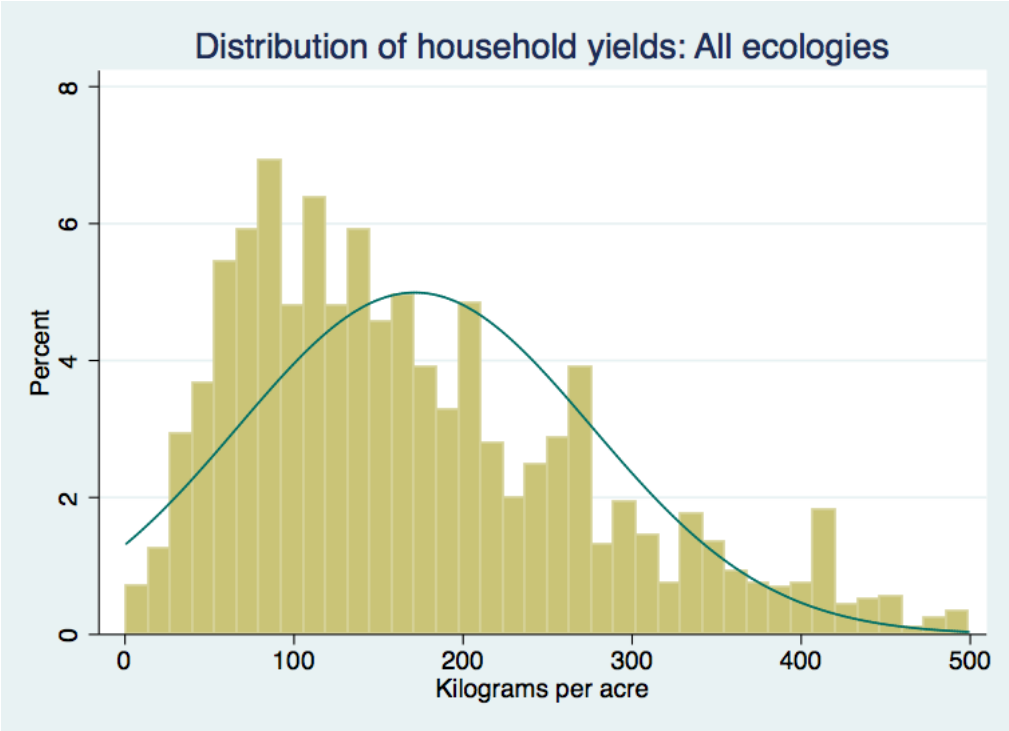


Using all harvest data (including the top five percentile of observations that are not in this graph), rice-farming households reported an average harvest of 740 kg of threshed rice. About one quarter of the sample (25.4%) reported harvesting 250 or less than 250 kg and about a third of households (29.4%) reported harvesting more than 800 kg. The value most frequently given as a response was 275 kg, cited by 4% of households.

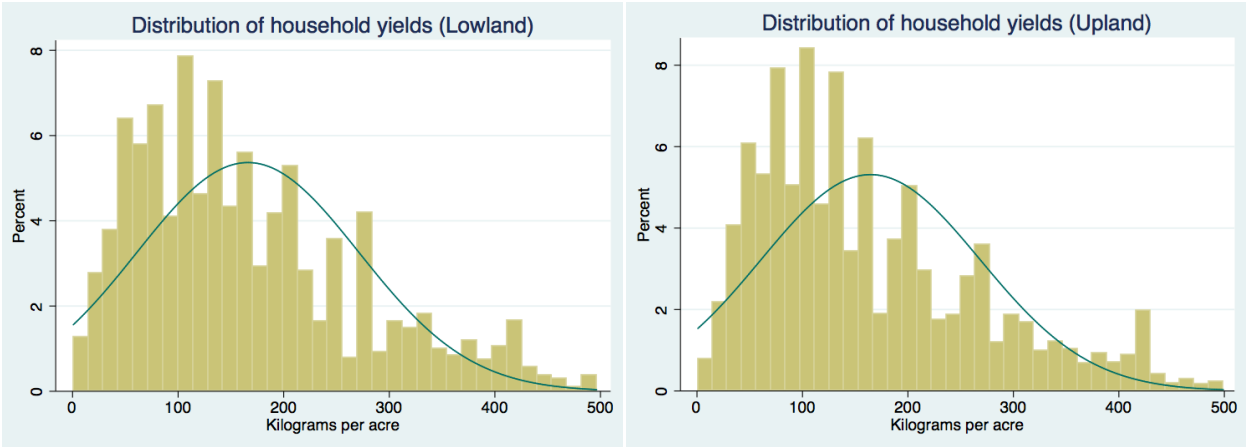


Looking at the quantities harvested across districts, the biggest rice producing households (on average) are in Kambia, Kailahun and Koinadugu. The districts where average household

production is the lowest are Bonthe, Pujehun and Western Area. The above figures showed average total household production, without accounting for the quantity of rice planted. A better measure to truly understand productivity is rice yields, where the harvest is normalized by the acreage planted to rice.

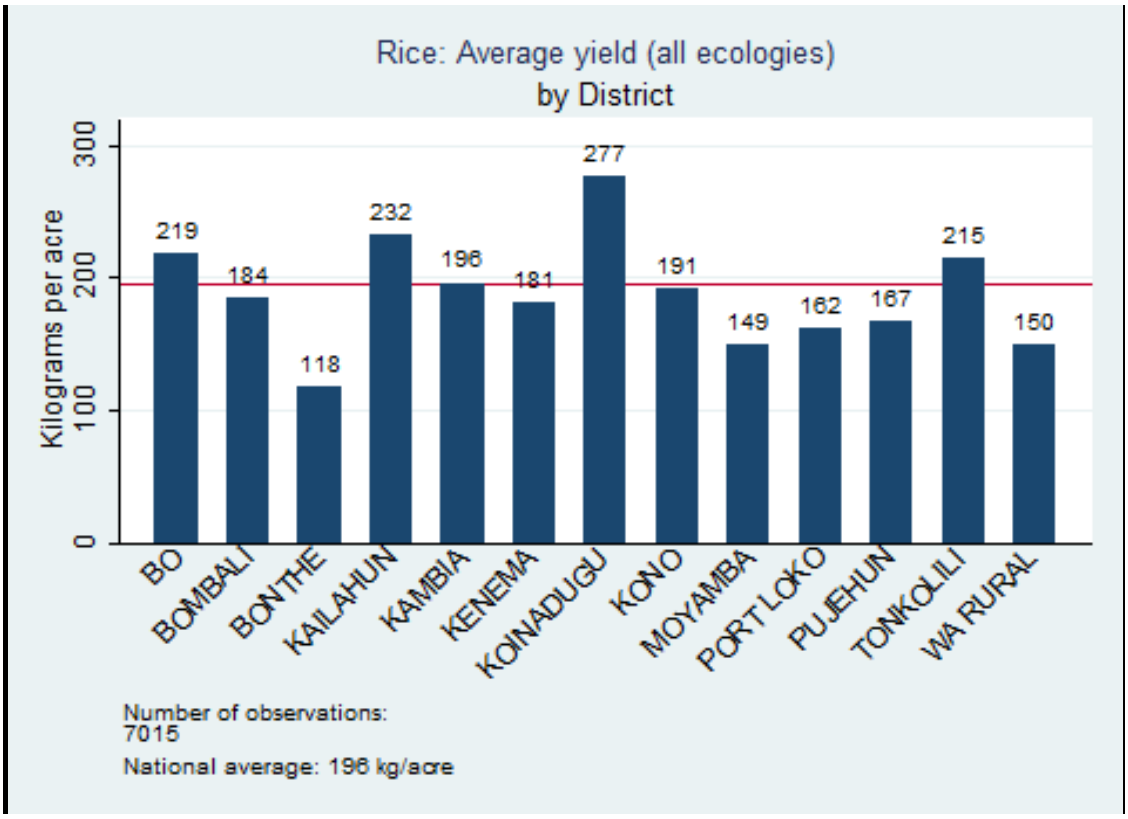


The vast majority of households (97%) reported yields between zero and 600 kilograms an acre. The average yield across ecologies was 196 kg per acre. There are a large number of households that are getting very low yields – almost one third of households (28.1%) report yields lower than 100 kg per acre. Many of the practices described below, however, point to the possible reasons for some of these low yield numbers.

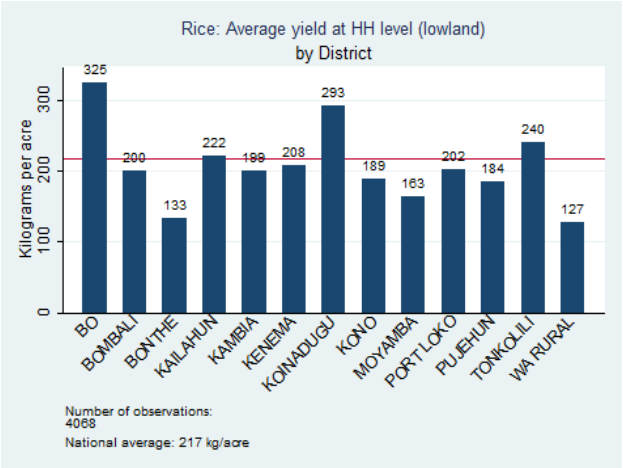


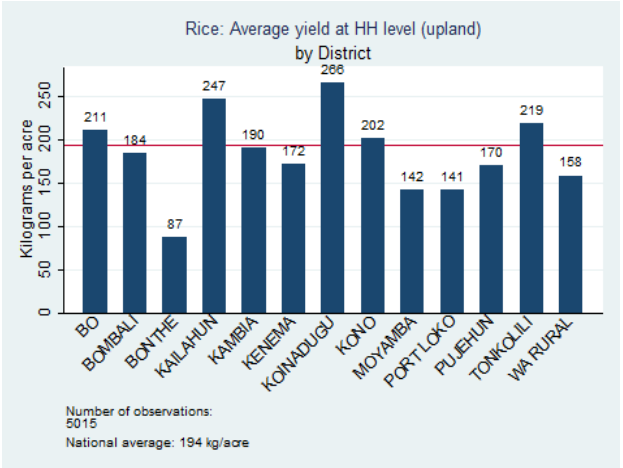
Given the different ecologies in Sierra Leone, rice yields should vary by ecology. It is clear that the yields do vary by ecology – the rice yields for the lowland ecologies are higher on average

than for the upland ecology: the average yield for the lowlands and uplands are respectively 217 kilograms and 194 kilograms per acre on average.



The average yield across households is about 196 kg per acre (this amounts to about half a tonne per hectare). Looking across districts, Koinadugu reports the highest yields at the household level (277 kg per acre). Kailahun, Kambia, Bo, Tonkolili and Kono reported yields around or above the national average. However, this picture merges all ecologies together.





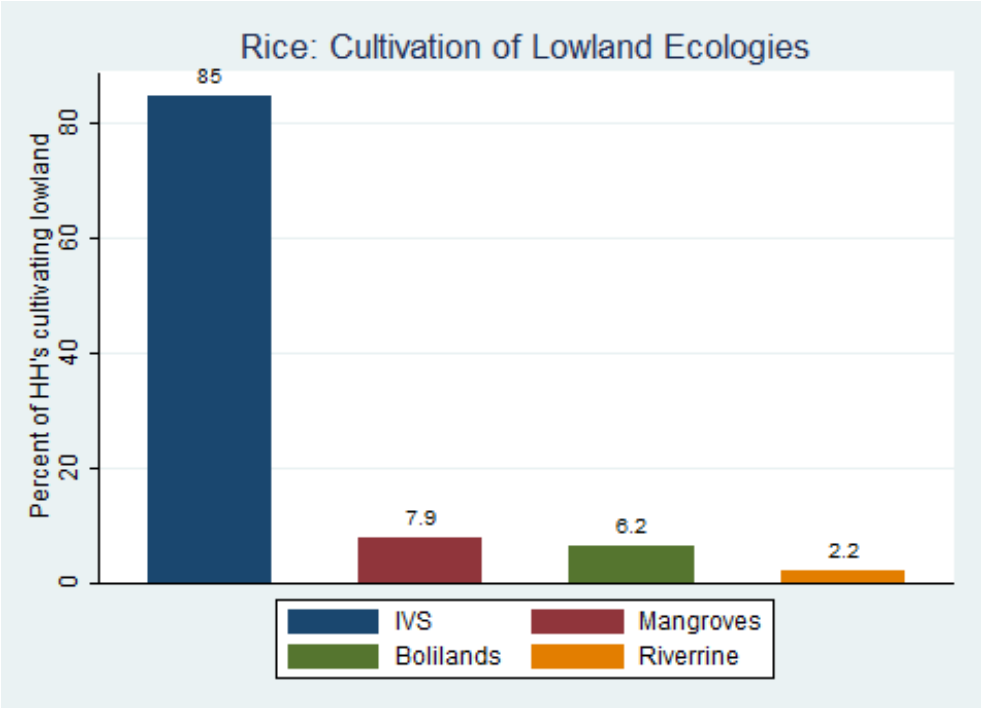
Looking separately at yields by district for lowland and upland farms, for the lowland farms, the yields are lowest in Western Area, Bonthe and Moyamba and highest in Bo and Koinadugu. For upland farms, Western Area, Bonthe and Moyamba also have the lowest yields and Koinadugu and Kailahun have the highest.

Nationally the difference between upland and lowland yields was statistically significant at the 1% level. Because of smaller sample sizes at the district level, the difference was only significant at the 10% level in 6 districts: Bo, Bonthe, Kenema, Koinadugu, Moyamba and Port Loko while in nearly all the others lowland yields were higher than uplands but not significantly different.

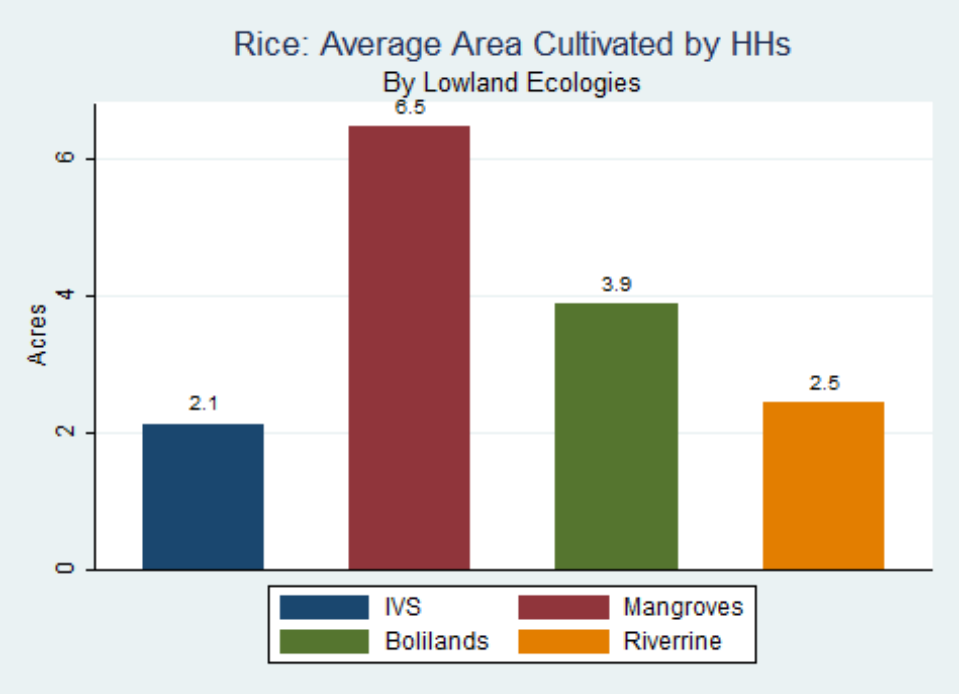
3.2.5 Lowland Rice

The AHTS collected rice data at the level of ecology. Above, all the lowland ecologies were combined - this section presents a summary of each of the lowland ecologies separately, in particular for the four different lowland ecologies: inland valley swamp (IVS), mangrove swamp, boliland and riverine.

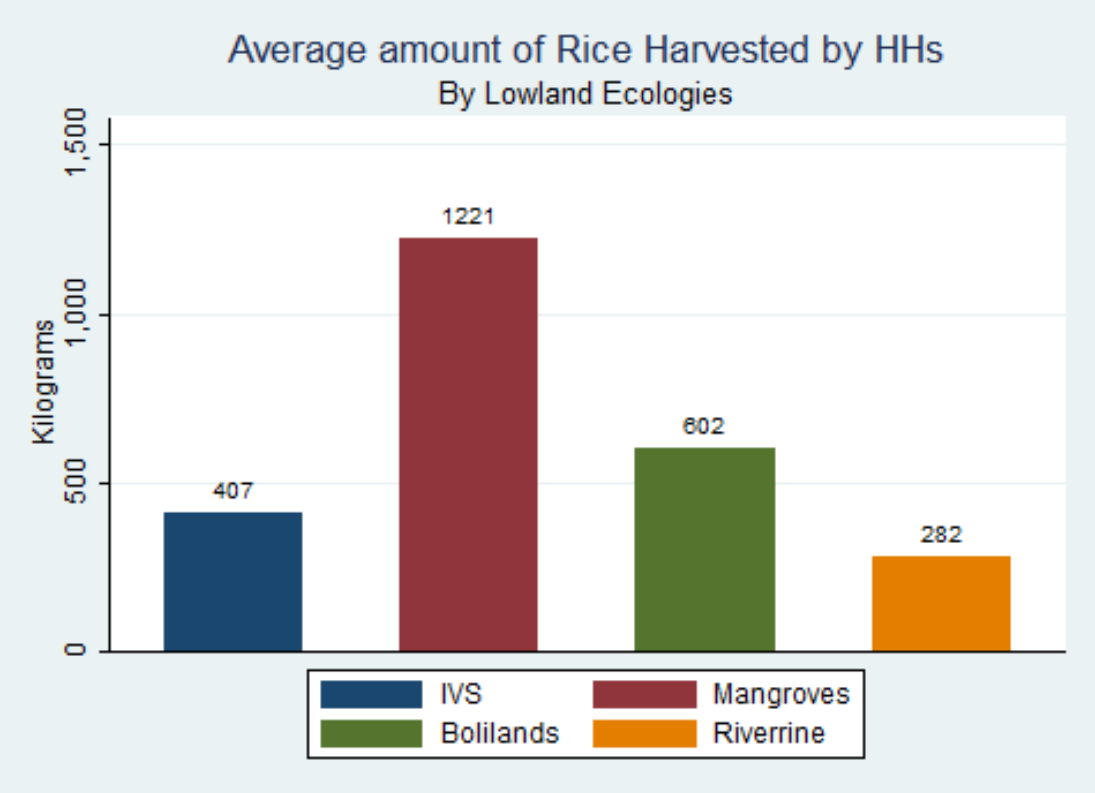
The data here is presented only for households cultivating at least one lowland farm. Overall, most of the households cultivating lowland farms are cultivating IVS farms - 85% of households involved in lowland rice farming have at least one IVS farm. Of households that have lowland farms only 8% cultivate mangrove farms, 6% bolilands and 2% a riverine.



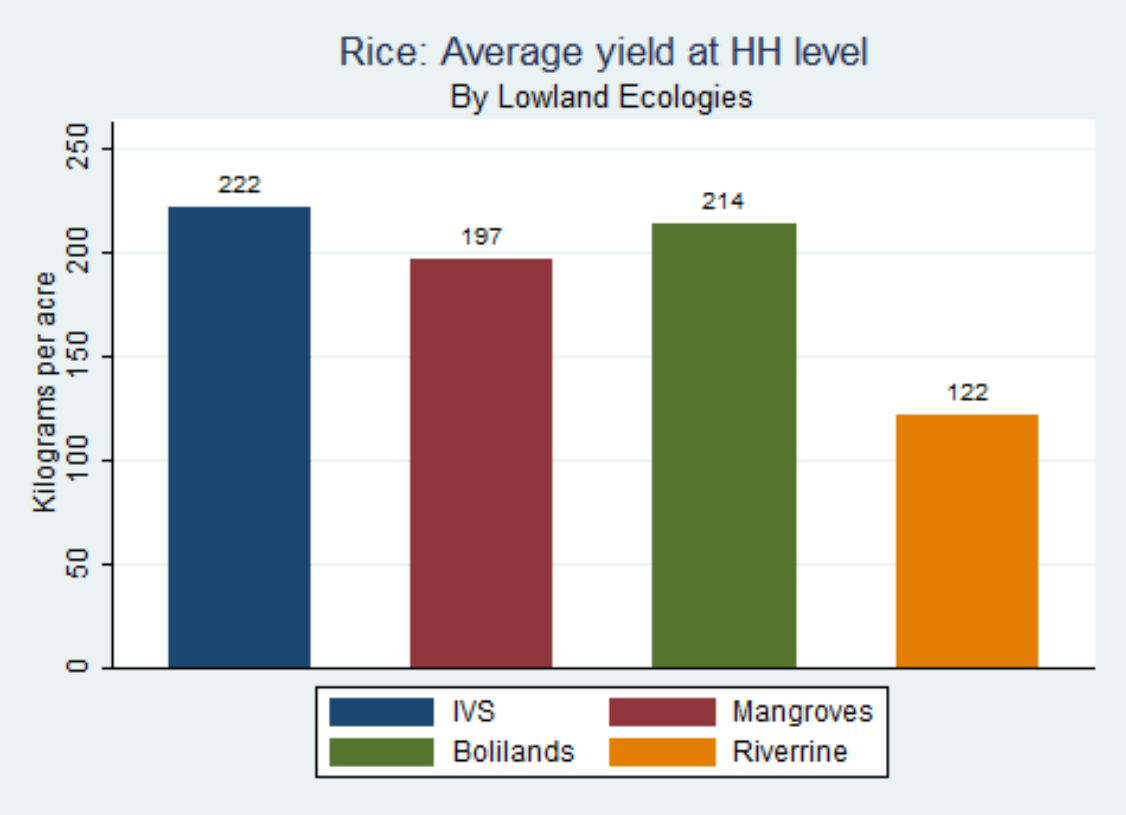
While more households are involved in IVS farming, if we examine the average area cultivated by household involved in these different ecologies mangroves had the largest average acreage, about 6.5 acres per household. These numbers are computed for the sample of households that are engaged in rice cultivation for each of these ecologies.



Looking at the harvests across these ecologies, mirroring the acreage, the largest harvest per household comes from the mangrove ecologies, followed by the bolilands, then the IVS and finally, the riverine areas. These differences are all different at the 1% level.



Turning to lowland yields, the various ecologies have yields varying between 122 kg/acre for riverrine areas and 222 kg/acre for Inland Valley Swamps.



3.2.6 Disposition of Harvest

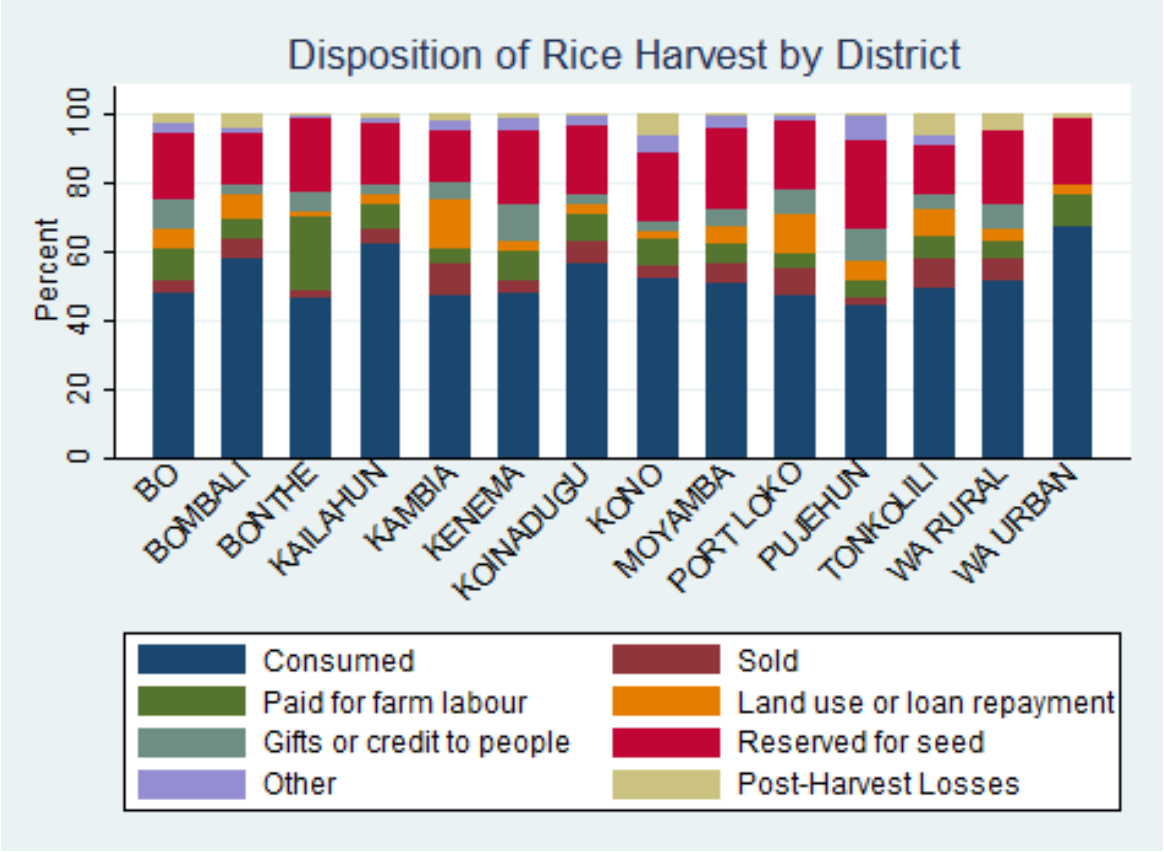
Respondent households were asked how much of their harvest they allocated to various purposes, including consumption, sales, payments for land use, loan reimbursement, gifts, etc.

The rice harvest of farming households is primarily allocated to consumption: on average slightly less than half (47%) of the harvest is consumed by the household. This percentage is lowest in Kenema, Kambia and Pujehun, where more than half of the rice harvested is allocated to other purposes.

District	Proportion of harvest that is consumed (percent)	Proportion of harvest that is sold (percent)
BO	44	4
BOMBALI	56	6
BONTHE	59	2
KAILAHUN	56	5
KAMBIA	40	9
KENEMA	36	4
KOINADUGU	53	6

KONO	49	4
MOYAMBA	48	6
PORT LOKO	44	8
PUJEHUN	41	2
TONKOLILI	44	8
WESTERN AREA RURAL	45	6
WESTERN AREA URBAN	62	
NATIONAL	**47**	**6**

Overall the AHTS households sell approximately 6% of their harvest. A fairly large proportion of the rice harvest (16%) was sold in Western Area Urban where rice might be more easily marketable than in rural provinces, given the proximity to Freetown. This percentage was much lower in other districts. More detail on rice sales and marketing is reported in Section 5 below.



Another common usage of the rice harvest was to keep seeds for future planting: on average 18% of the harvest was allocated to this purpose. Payments for land use or credit

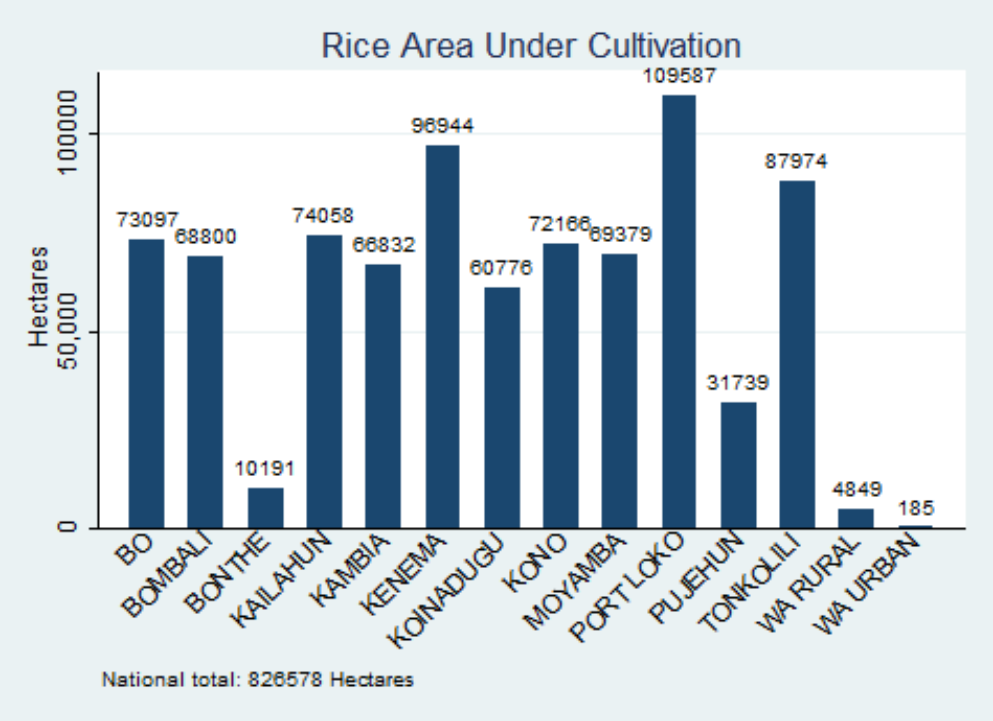
reimbursements were frequently cited in Port Loko and Kambia. Bo, Kenema, the Western Area Rural and Tonkolili reported post-harvest losses most frequently.

3.2.7 Economy Aggregates for Rice: Area Under Cultivation and Production

This section reports aggregate rice area under cultivation and the aggregate production from the AHTS data. The calculation of these aggregates is described in the sampling section earlier in this report.

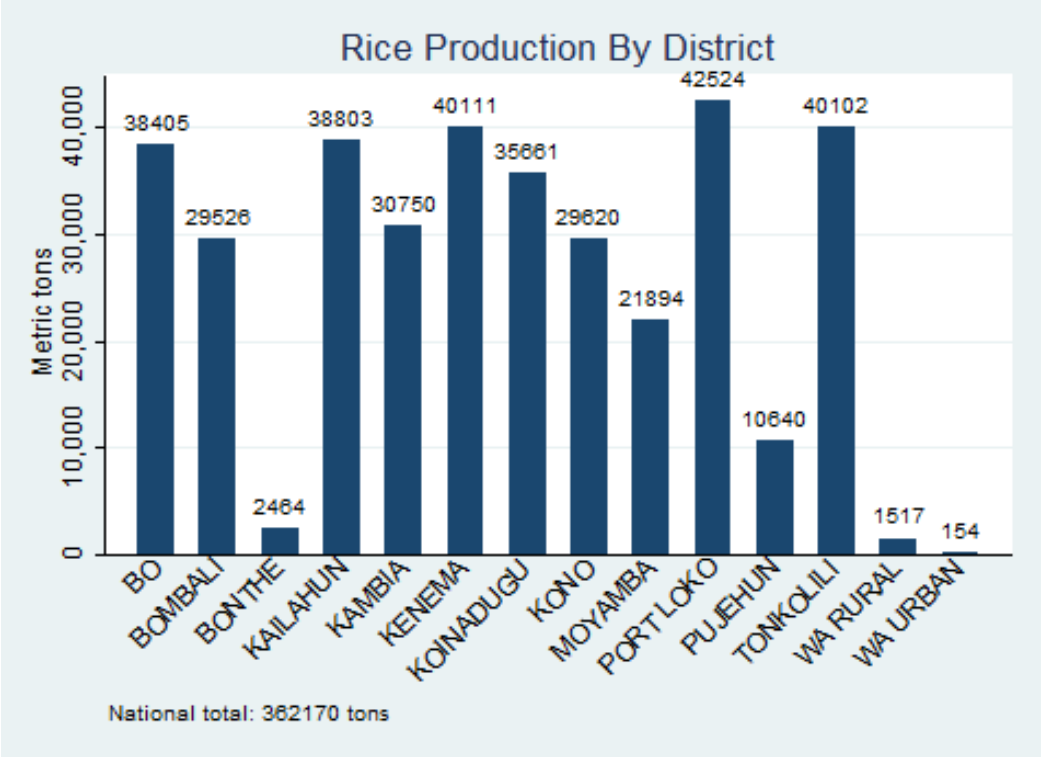
Aggregate production figures for rice reveal significant disparities across districts. Port Loko, Kenema and Tonkolili have the largest area under cultivation for rice. The areas under rice cultivation for Bonthe and Pujehun are extremely low - some of this was due to crop failures including flooding in Pujehun, as discussed in more detail below.

The total area under cultivation by households in Sierra Leone was estimated at 826,578 hectares.



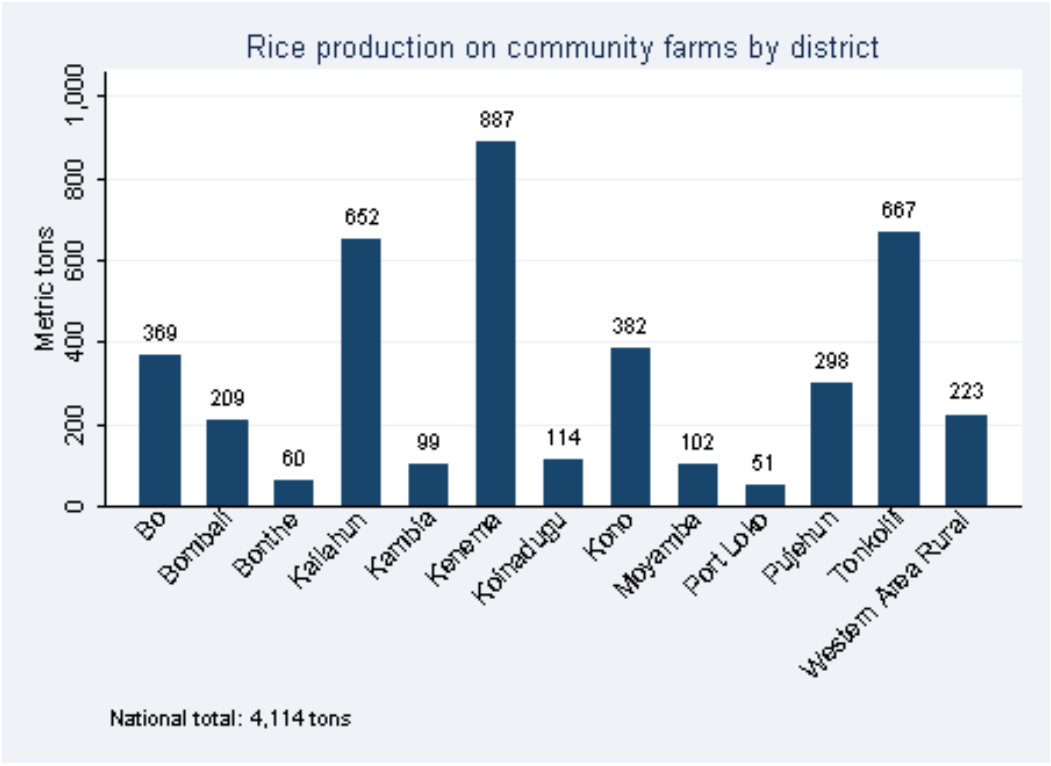
Looking at aggregate production of rice, Tonkolili, Kenema and Port Loko also reported the largest rice harvests in the country but Bo and Kailahun are close behind. Rice production was lowest in Bonthe, Pujehun and the Western Area.

Based on the AHTS sample the total amount of rice reported as harvested by smallholders in the country in the past 12 months amounted to 362,710 metric tons.



3.2.8 Community Rice Farms

Twenty one percent of communities reported cultivating rice on a community farm in the past 12 months. Total production on these communities was estimated at 4,114 metric tons, with Kenema, Tonkolili and Kailahun reporting the highest production by community farms.



3.3 Second Staple: Cassava

The second main staple in Sierra Leone is cassava. Cassava is a very different crop to rice with very different production attributes. Cassava can be left in the ground for multiple seasons and does not need to be harvested the season or the year it is planted. This affords households a way of smoothing risk and using cassava as a lean season crop. It also means cassava can better withstand droughts. However, this attribute of cassava makes it complicated to compute areas under cultivation and yields.

The AHTS chose a particular approach to this. The ideal approach is to compute a rate of return measure of yield by looking at the harvests as a function of the planted material with some accounting for when it was planted. This is extremely difficult to do in practice as it involves collecting data on all the cassava in the ground and when it was planted, which farmers may not remember. Instead, AHTS focused on the cassava that was harvested in the last 12 months and computed the harvest and yield of just that cassava. This is the most important number for food security and for production aggregates, but the yield numbers will be on a base of acreage planted to what was harvested (which may have spanned many seasons).

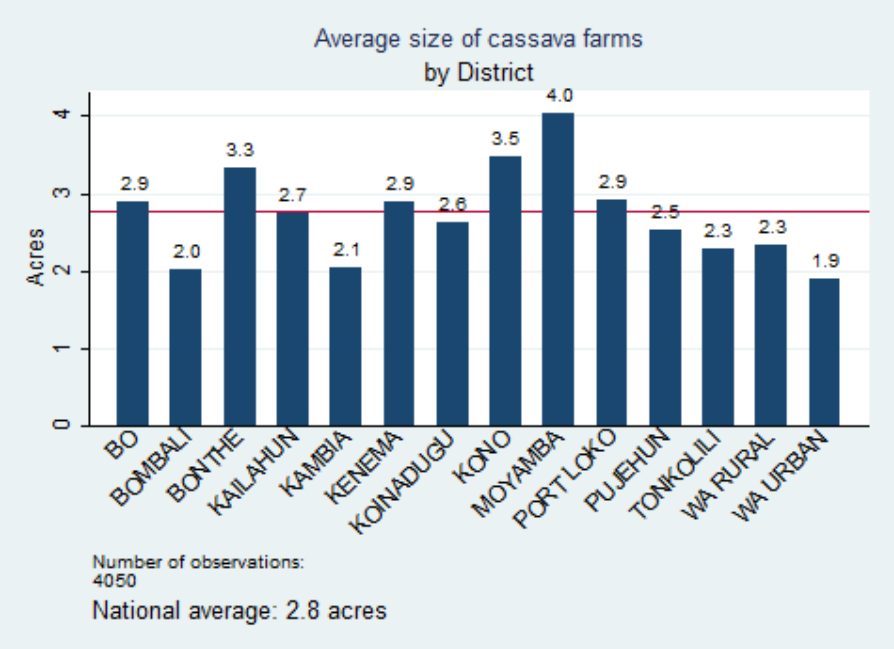
3.3.1 Cassava Cultivation

The results for the cassava-specific module of the AHTS are presented in this section of the report. As mentioned above, this does not include any cultivation that is ongoing, i.e. that was not harvested in the 12 months before the survey.

District	Did this household harvest any cassava in the last 12 months? (percent)
BO	79
BOMBALI	53
BONTHE	84
KAILAHUN	77
KAMBIA	63
KENEMA	65
KOINADUGU	63
KONO	69
MOYAMBA	46
PORT LOKO	68
PUJEHUN	52
TONKOLILI	60

WESTERN AREA RURAL	41
WESTERN AREA URBAN	67
NATIONAL	**64**

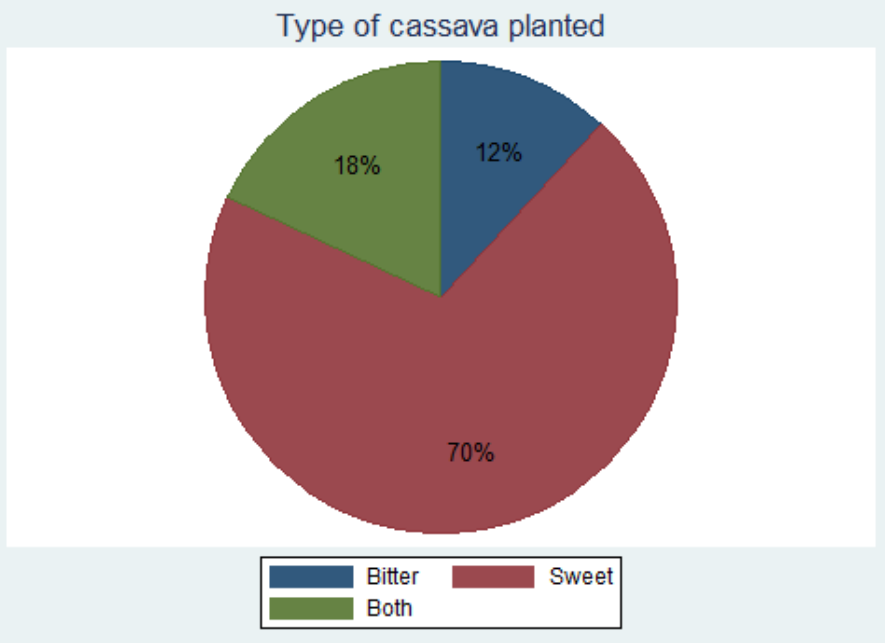
Cassava is the second crop most commonly cultivated in Sierra Leone after rice: 64% of farming households nationally reported that they harvested cassava in the 12 months prior to AHTS. This percentage was highest in Bonthe (where rice cultivation was also found to be less widespread), Bo and Kailahun districts.



The area planted with cassava is on average 2.8 acres. Looking across districts, this is highest in Moyamba, Kono and Bonthe.

3.3.2 Cassava Planting

Under this section we report, the type of cassava planted, the status of intercropping and the seeding rates.

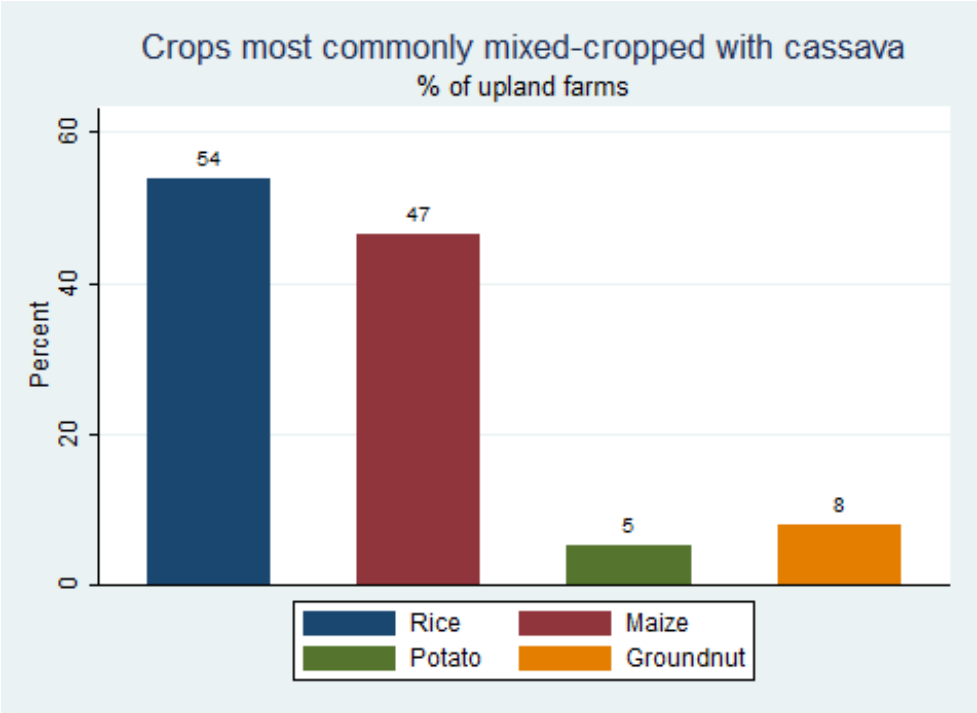


About 70% of farms report planting sweet cassava, 18% bitter cassava and the remainder reported planting both.

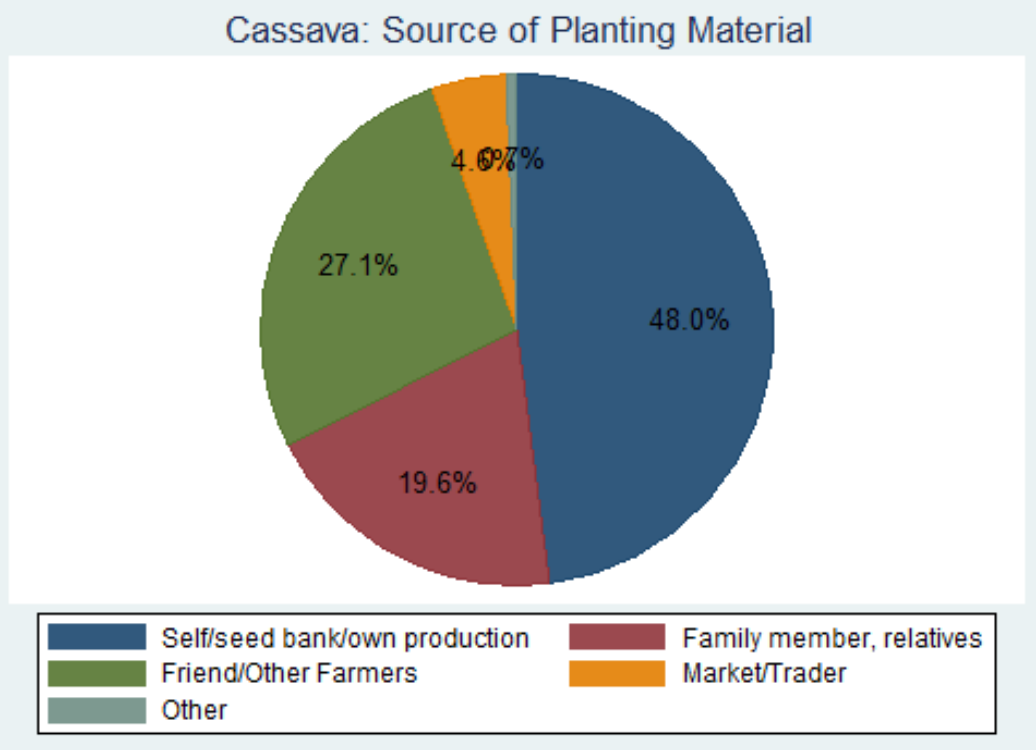
District	Average amount planted by households cultivating cassava (bundles)
BO	13
BOMBALI	10
BONTHE	38
KAILAHUN	10
KAMBIA	19
KENEMA	9
KOINADUGU	7
KONO	12
MOYAMBA	25
PORT LOKO	13
PUJEHUN	19
TONKOLILI	11
WESTERN AREA RURAL	9
WESTERN AREA URBAN	6
NATIONAL	**14**

The quantity of cassava planted is reported in bundles. The average number of bundles planted in the 12 months before the AHTS was about 14 bundles. Note, again, that this refers to farms that were harvested at any time in the 12 months prior to the AHTS survey. The districts where higher than average cassava was planted were Bonthe and Moyamba, with Pujehun and Kambia not far behind. On the low end, in Western Area, Kenema and Koinadugu, households planted less than ten bundles.

Looking at the cassava crop, a large fraction of households use mixed cropping on their cassava farms: rice is mixed-cropped with cassava on 54% of the cassava farms, while maize is mixed-cropped on 47%. Maize and groundnut are only rarely intercropped with cassava.



For the farms that are mixed cropped, looking at the farm level, the predominant crops cassava is intercropped with are rice, maize and groundnut. As with the rice farms, farms that were intercropped were asked for a maximum of two additional crops that cassava was intercropped with and the core crops were listed first. So, this may underreport the true intercropping with non-core crops.

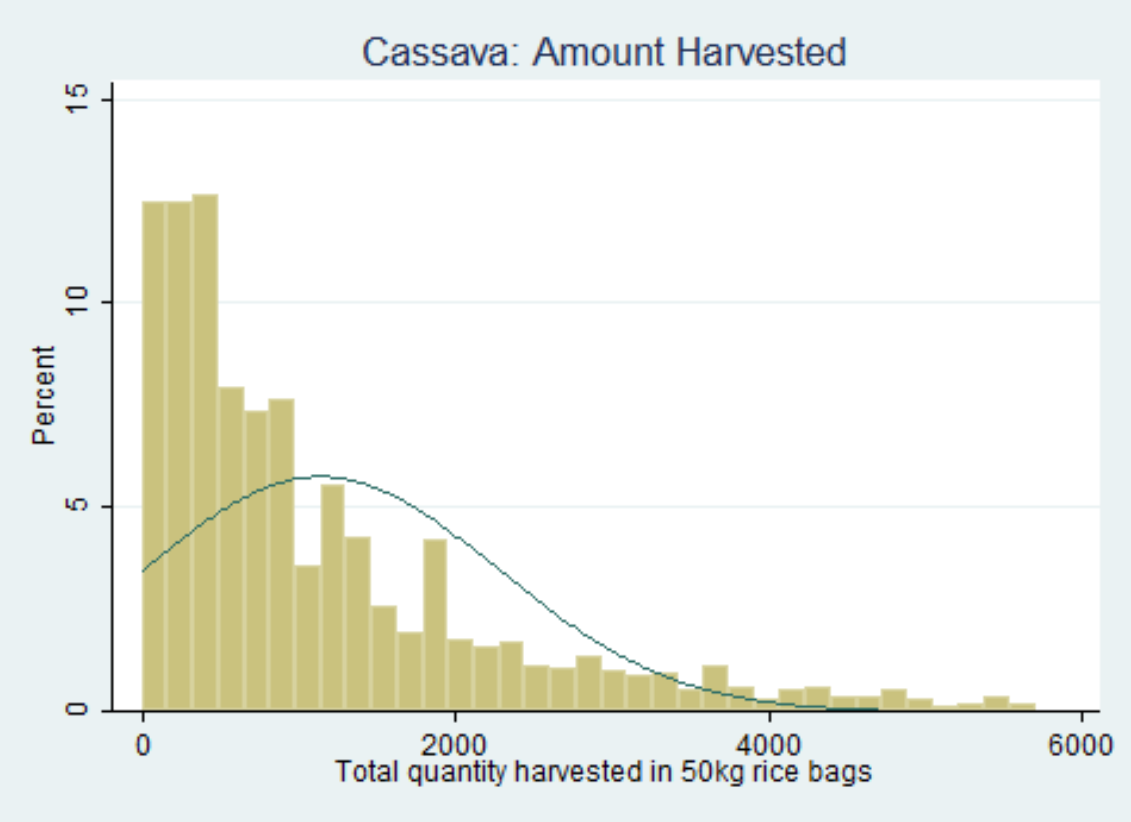


The main source of planting material for cassava is the farmers' own production: 48% of households obtain their planting material from this source. Family members, relatives and friends are also important sources of planting material for cassava farmers (27%).

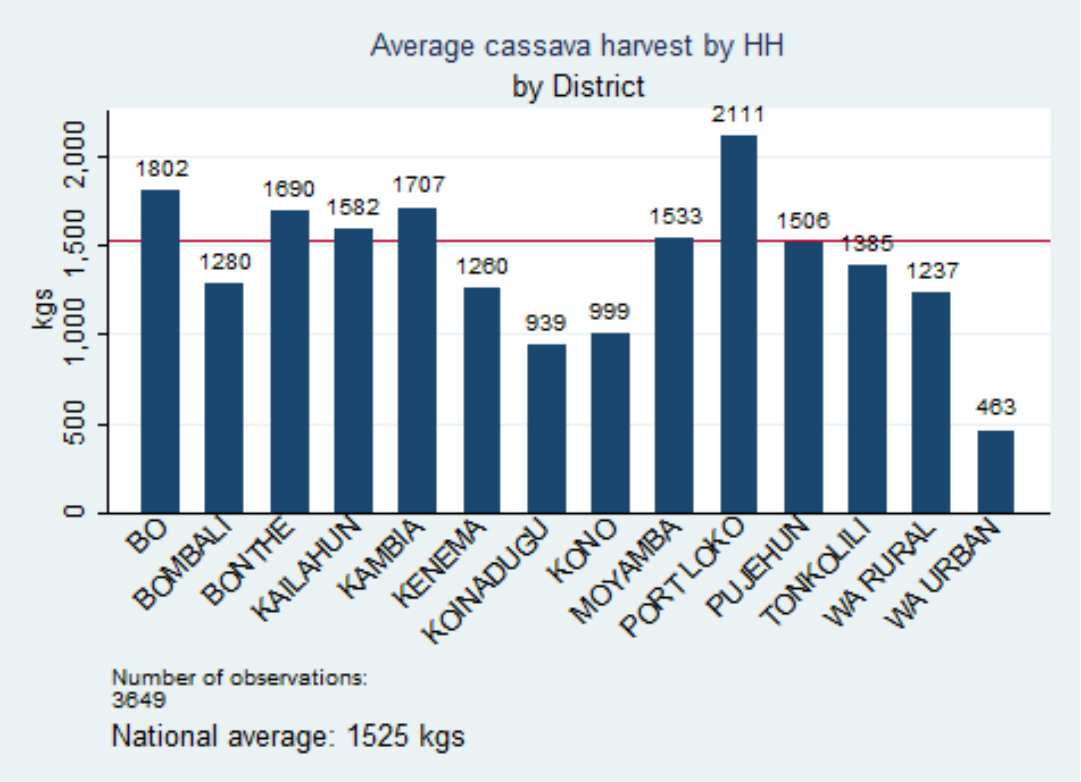
3.3.3 Cassava Harvests

This section reports on cassava harvests and yields. The harvest data was collected in self reported units, which were converted to 50 kg rice bags and then to kilograms using conversion rates provided by MAFFS. The conversion rate use for the conversion of a 50kg bag of cassava to kg was 60kg.

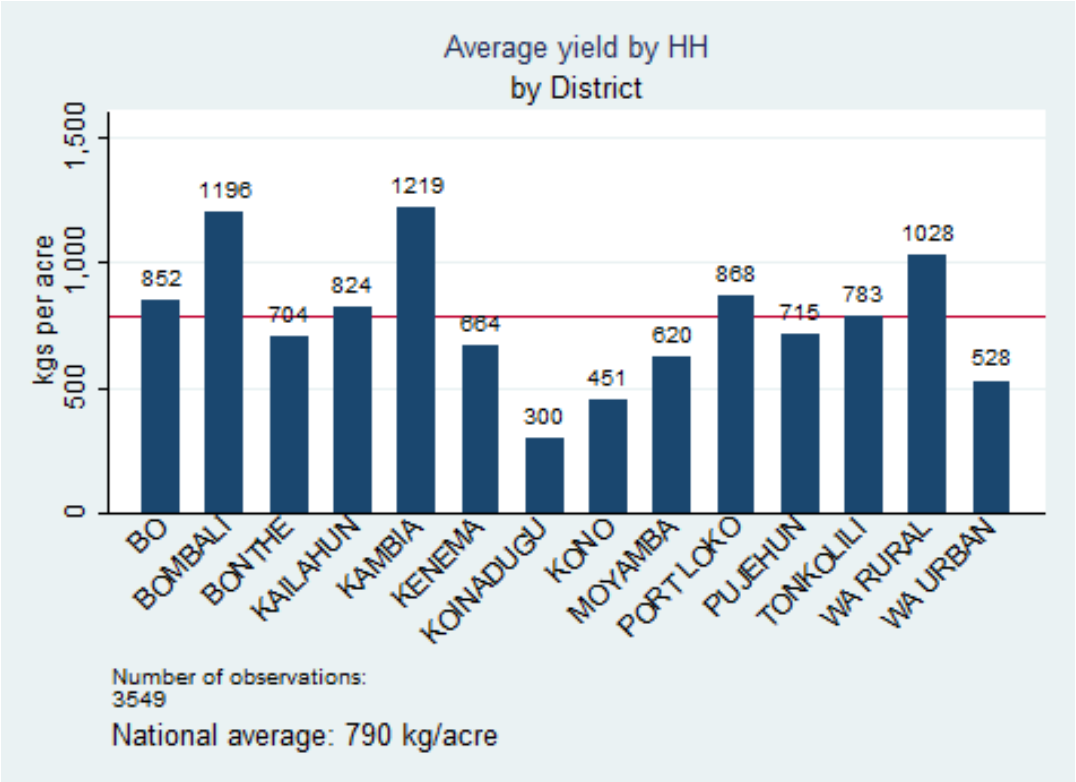
The two figures below describe the data for two variables (both measured at the household level): cassava harvest and cassava yields (measured as the ratio between harvest and the area that was cultivated that produced this harvest). As with rice, to make the graphs readable and for the purpose of these two following illustrations only, the top 5% of observations has been dropped.



Reported cassava harvest averaged 1,525 kgs at the household level. This average is clearly driven by the large cassava producers as shown in the distribution above. The highest harvests were in Port Loko, Bo and Kambia and the lowest in Western Area Urban, Koinadugu and Kono.

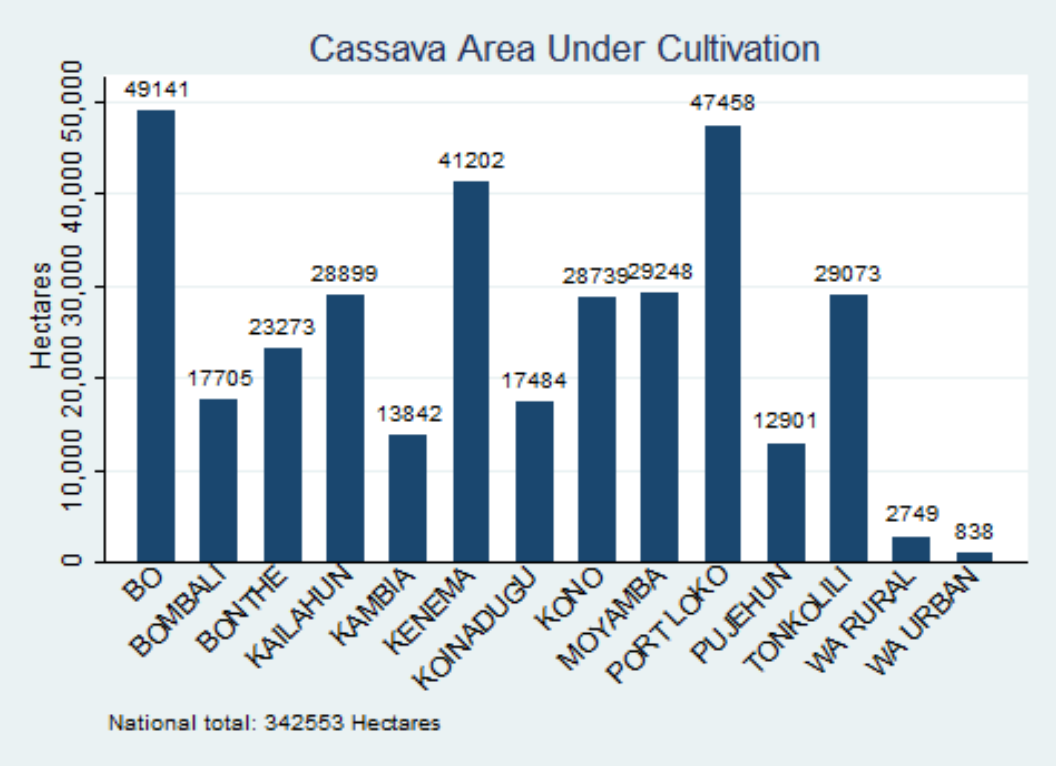


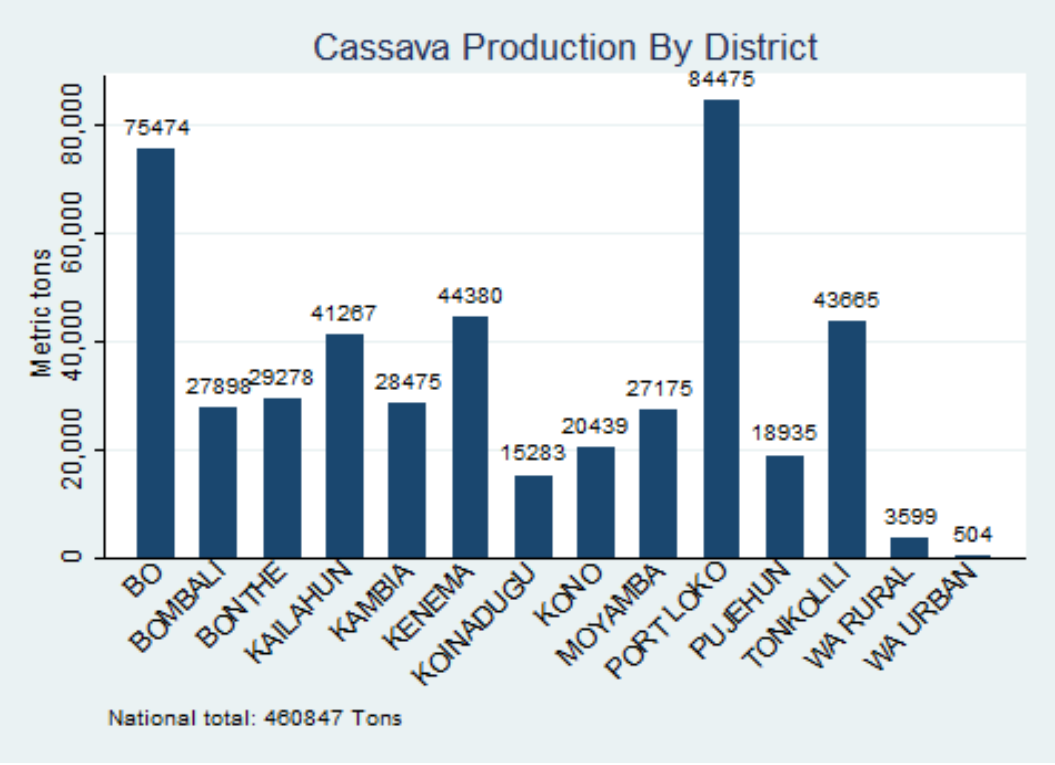
As mentioned above, cassava yields here are measured in a very specific way: only based on farms that were harvested in the 12 months before AHTS. Given this definition, the average yields of cassava were 790 kilograms per acre. The highest yield districts were Bombali and Kambia and the lowest were Koinadugu and Kono.



3.3.4 Economy Aggregates for Cassava: Area Under Cultivation and Production

This section reports aggregate cassava area under cultivation and aggregate production for the Sierra Leone economy. The aggregates are calculated as described in the sampling and methodology sections.





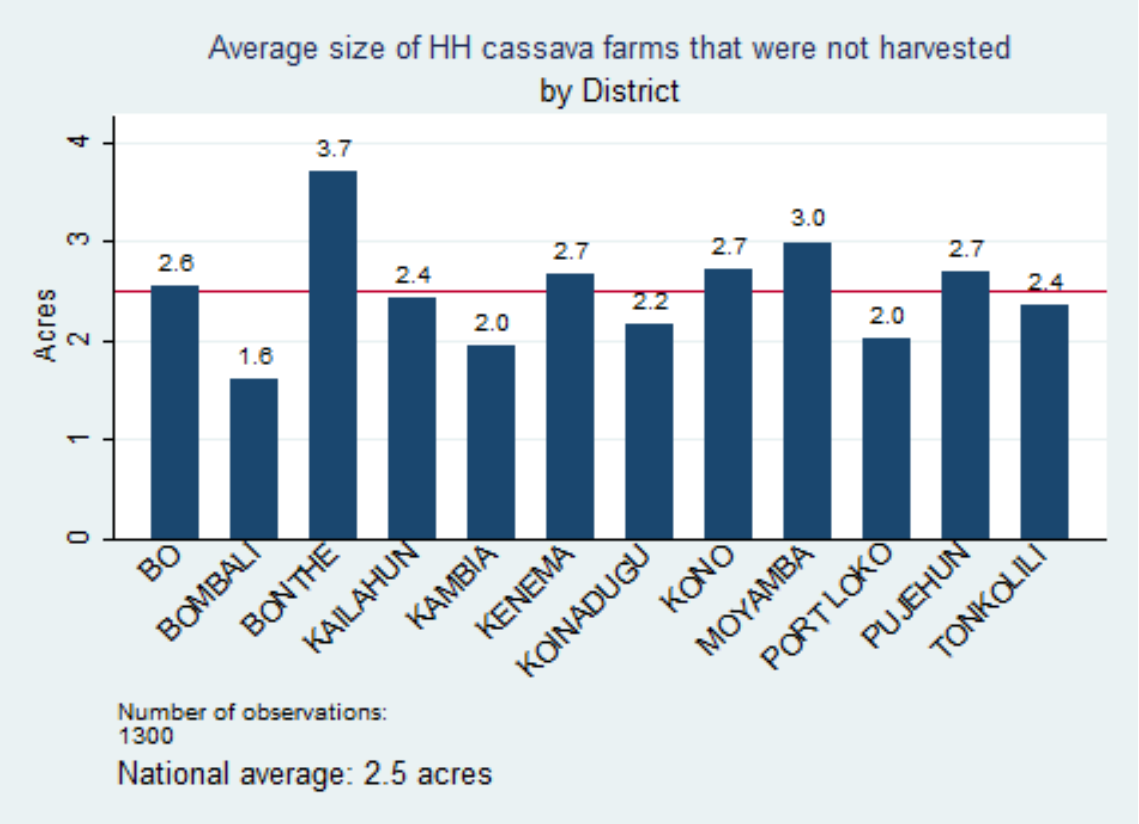
Five districts appeared as the largest cassava-producing areas in the country in terms of the total area under cultivation and the total harvest in the past 12 months. These are, by order of importance: Port Loko, Bo, Kenema, Tonkolili and Kailahun. Cassava production is lowest in the Western Area and Koinadugu.

Nationally, there are 342,553 hectares that had cassava harvested from them across the country. And, in total, national production was 460,847 tons.

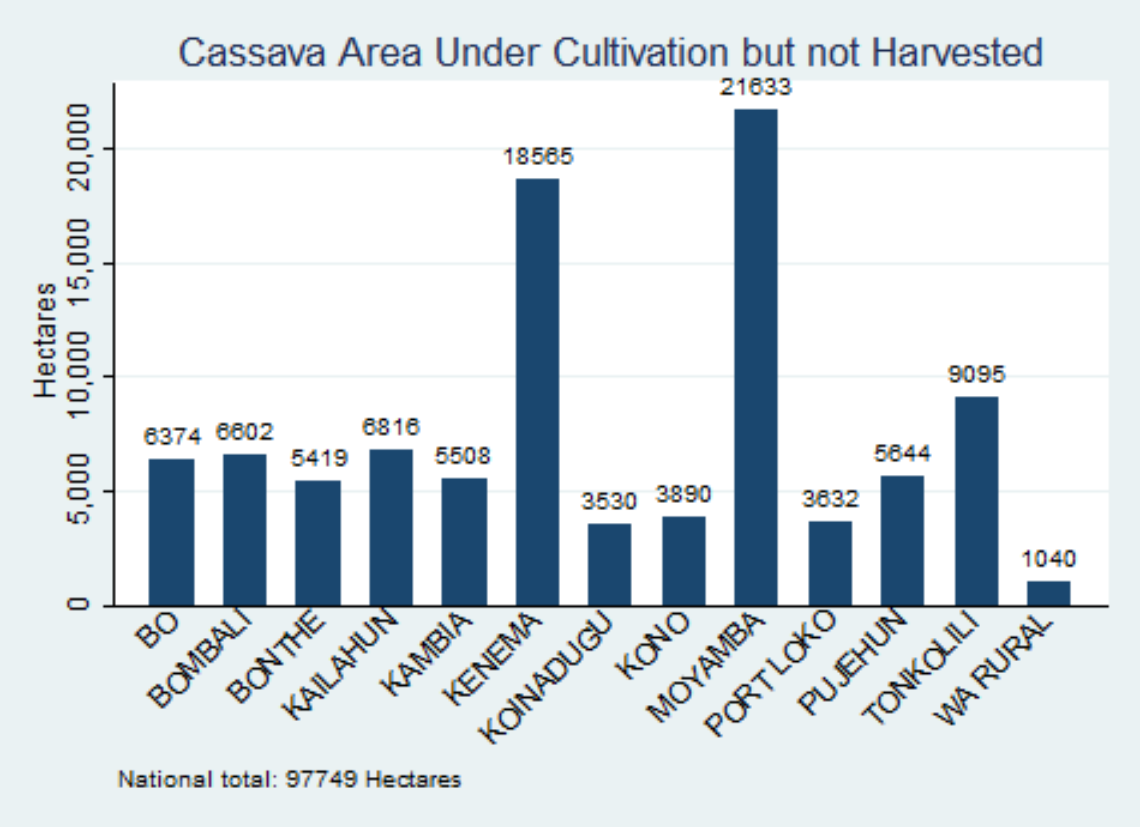
3.3.5 Ongoing Cassava Cultivation

The AHTS questionnaire was designed to collect the production and harvesting of cassava. As mentioned earlier, this focused primarily on cassava farms that were harvested in the 12 months prior to the survey, as this is the correct measure for national production of cassava over the year.

However, given the nature of cassava, households did plant farms that were not harvested over the 12 months prior to AHTS survey. This sub-section reports on these farms, in particular the average household acreage that was planted to cassava but not harvested and the total national acreage. Cassava is a crop that can stay in the ground for multiple seasons and therefore helps households smooth some of the risk they face - in a good year, households may choose to leave cassava unharvested in case the following year is worse.



On average, about 2.5 acres of cassava was planted, but left in the ground to be harvested at a future date (WA Rural had only one observation and therefore was not included in the figure above).



Aggregating these acreages to the national level, overall there was about 97,749 hectares cultivated, but not harvested over a total of 1325 households. The largest acreage of this sort was in Moyamba and Kenema.

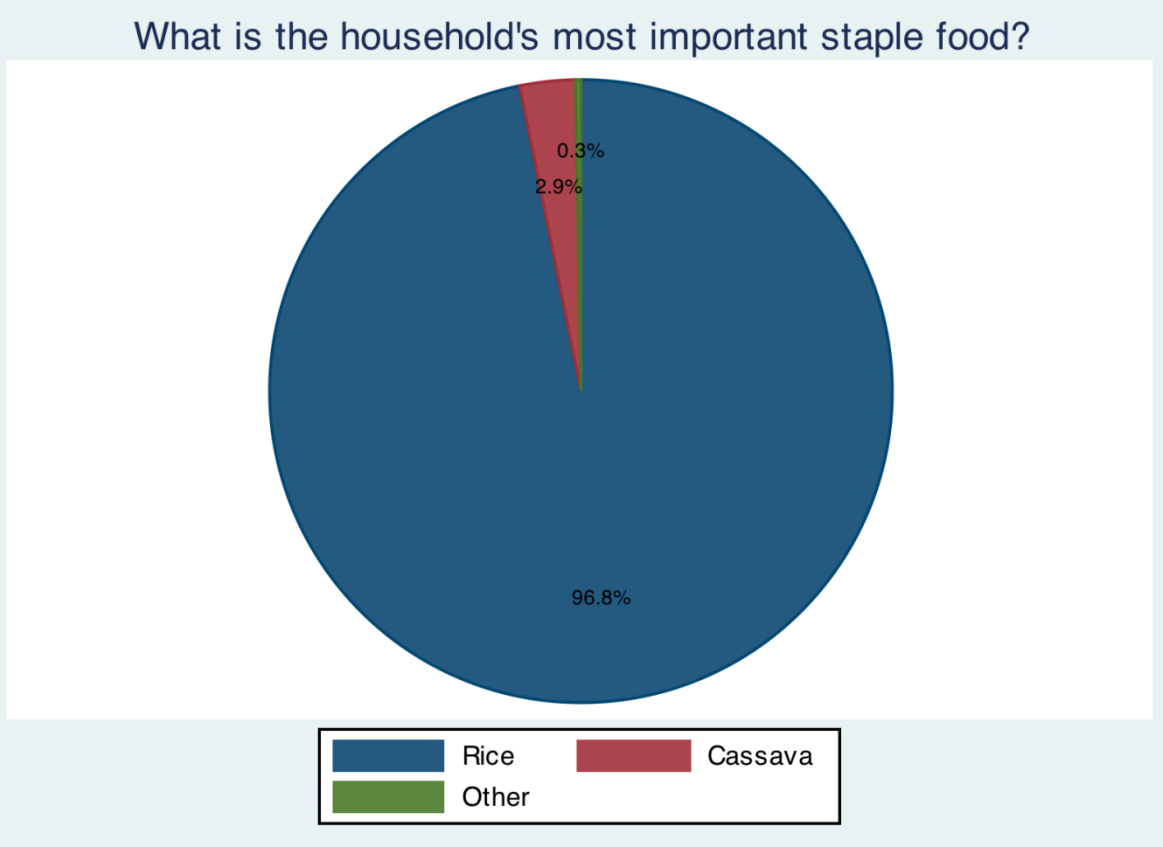
3.4. Food Availability

As mentioned, the AHTS was not designed to include a comprehensive food security module. This would require the collection of a rather large module and given the length of the agricultural components of the AHTS, adding any extensive food security modules was simply not feasible.

Instead, the AHTS was designed to capture a few very basic (as well as simple) indicators of the ability of households to purchase and consume food, as well as some basic measures that indicate the food security position of the households in the country. More extensive food security information for Sierra Leone can be found in the CFSVA 2011, the results of which were briefly mentioned above, as well as the USAID Sierra Leone food security country framework for 2009.

3.4.1 Staple Foods Nationally and by District

As expected, rice was named as the most important staple food by the majority of households: 97% overall. Cassava was named as the most important staple food by a further 3% of households nationally.



This picture is largely replicated at a district level with households in most districts overwhelmingly reporting rice as their most important staple food.

However, sixty five percent of farming households in Bonthe named cassava as their most important staple food. Pujehun had the next highest proportion with 6% of households. Apart from rice and cassava, other crops named as most important staple foods include maize, millet and chinese yam. However, these were named by a very small minority of households.

Households were asked whether they had stocks of their staple food from their own production in the past twelve months and if so, whether those stocks ran out during that period.

District	Did you have stocks of your staple food from your own production (percent)
BO	75
BOMBALI	43
BONTHE	72

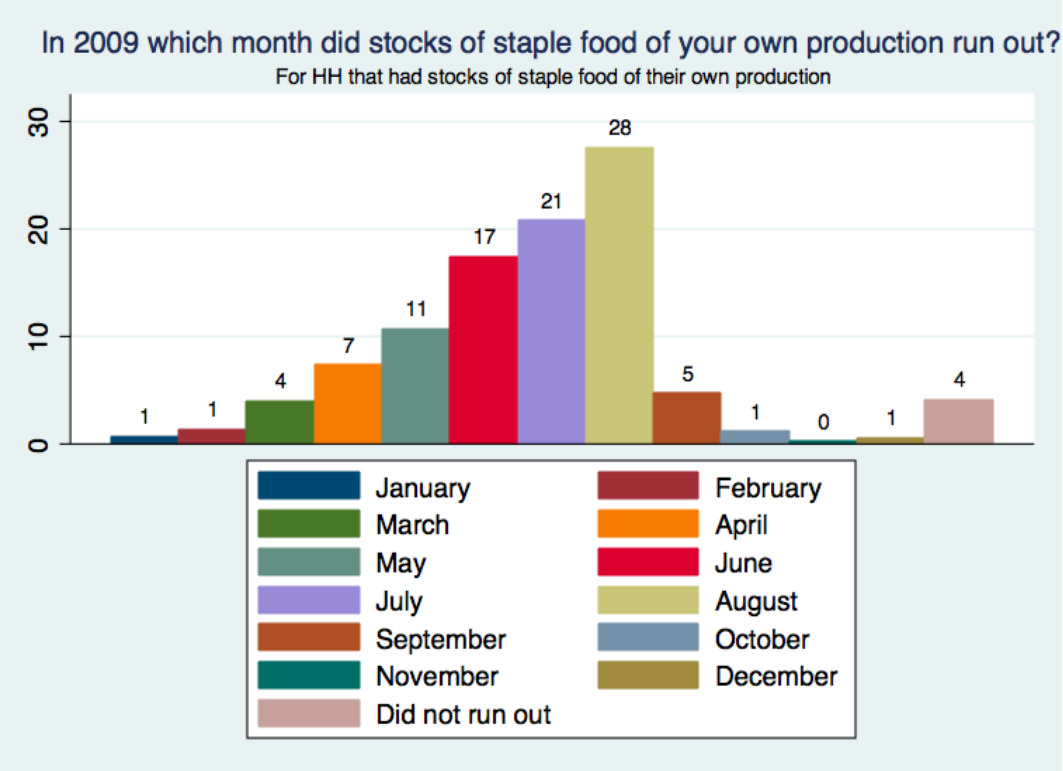
KAILAHUN	80
KAMBIA	82
KENEMA	84
KOINADUGU	61
KONO	86
MOYAMBA	83
PORT LOKO	55
PUJEHUN	49
TONKOLILI	85
WESTERN AREA RURAL	27
WESTERN AREA URBAN	1
NATIONAL	**69**

The majority of farming households (69% overall) had stocks of their staple food from their own production at some point in the past twelve months. The main exceptions to this were Western Area, Bombali and Pujehun districts. In these districts under half of households had stocks of their staple food at any time.

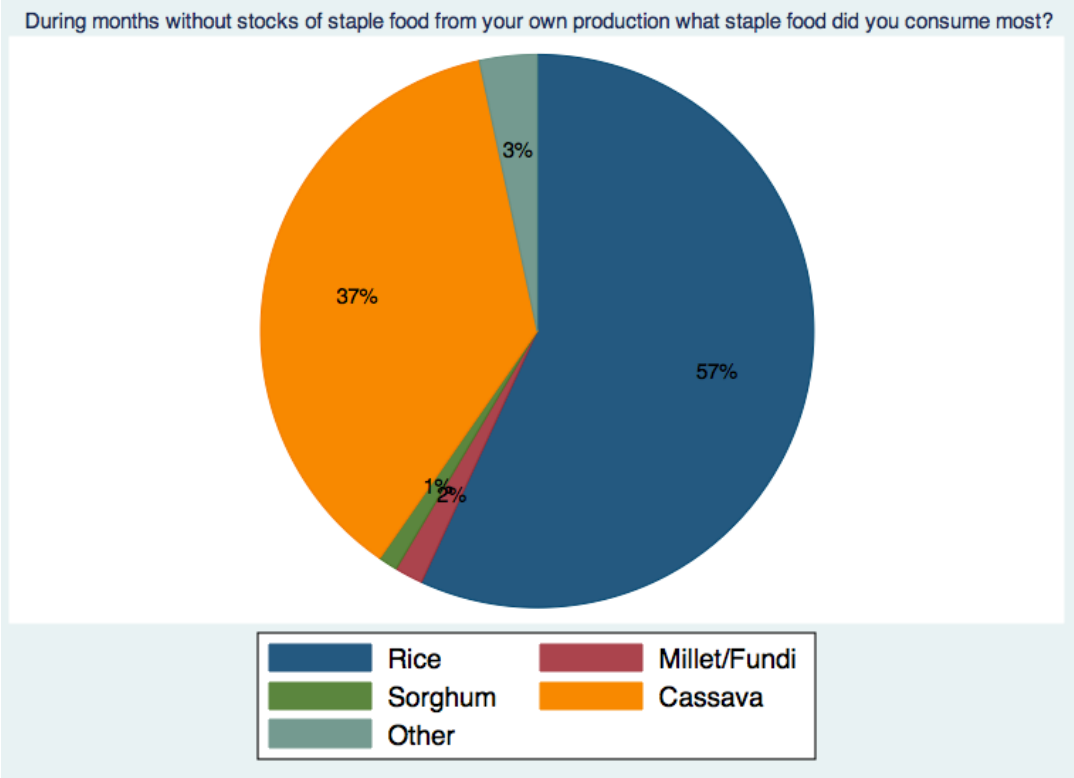
To measure food security issues, households that had stocks of their staple food were asked when these stocks ran out in the past twelve months. The majority of households stated that stocks of the staple food from their own production ran out at some point in the past twelve months.

Only 4% of households said that stocks of their staple food from their own production did not run out in 2009.[4] For the remaining households, the data show a steady increase in the number of households whose staple food crop stocks ran out as the year progressed, culminating in August where 28% of households said that their staple food ran out. Just 7% of households stated that their reserves ran out in the months after August.

[4] 79% of these households which stated that stocks of their staple food from own production did *not* run out, nevertheless reported that they experienced a hunger period (see section 2.1). This suggests either that these households rationed their stocks to last the entire hunger period, or that there is inconsistency in households' reporting of their food security situation. However, the AHTS did not specify the exact length of the hunger period, which could have been as short as a few days. This is why the data on the time when households ran out of stocks can be considered a more objective measure of food security.

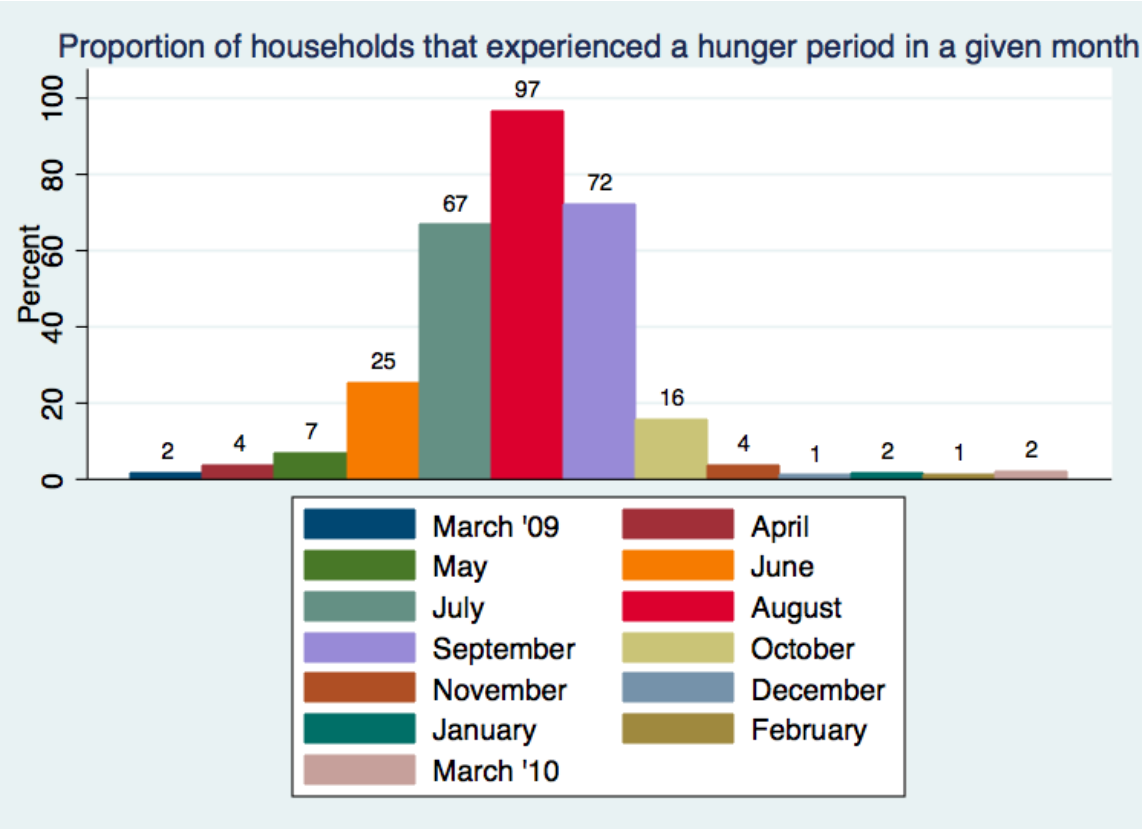


In the months without staple food crop stores from their own production, 57% of households ate rice the most and 37% cassava.



3.4.2 Ability to purchase food

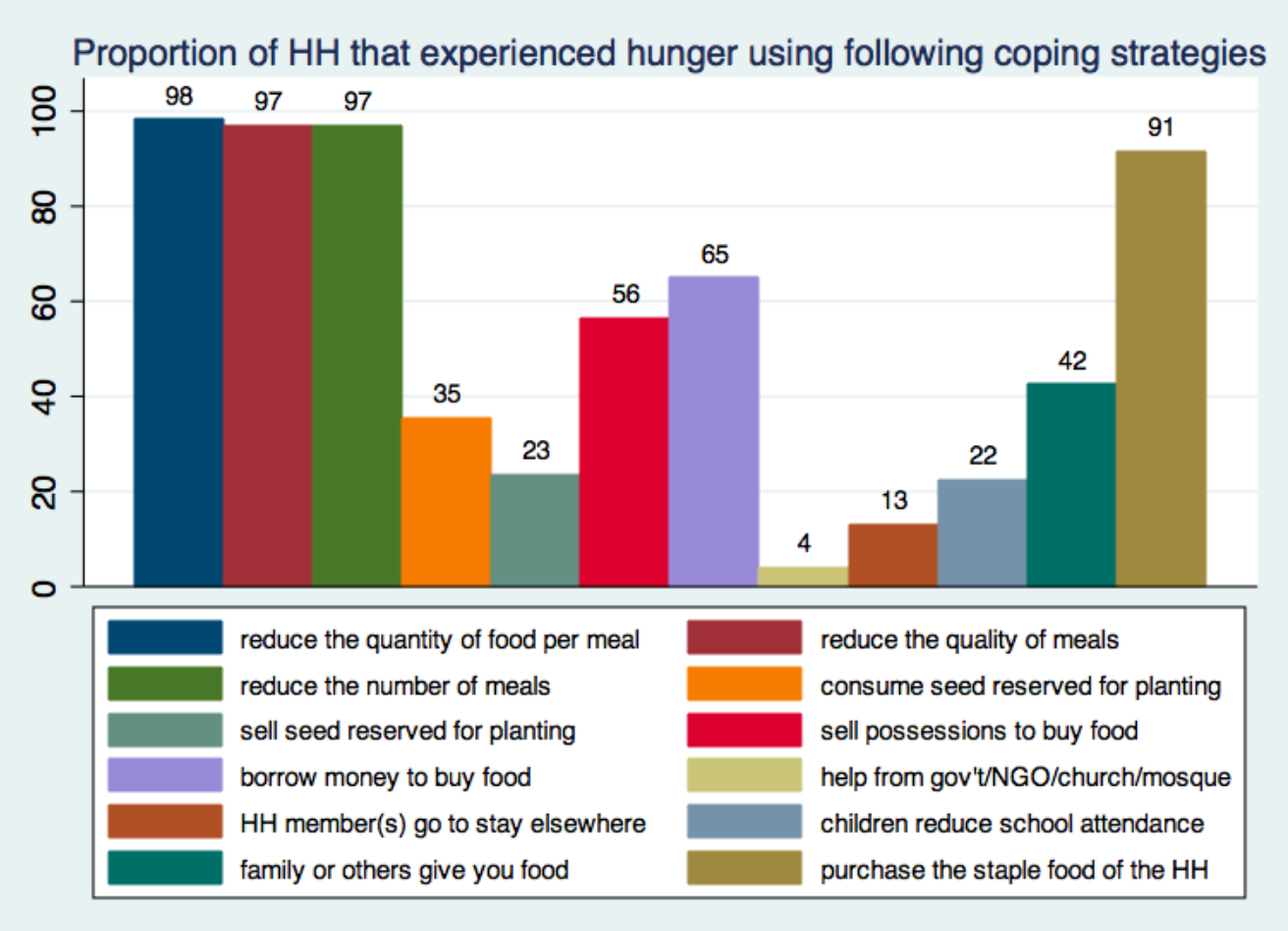
Respondents were asked during which months they experienced any difficulties purchasing food (between March 2009 and March 2010): 97% of households experienced these difficulties in August. July and September were also difficult months with 67% and 72% of households experiencing production and purchasing problems, experiencing it in that time.



A very low proportion of households experienced such problems in March 2009 and March 2010 (2% of households for both). This figure matches very closely with the figure showing when households ran out of stocks of staples above, which justifies the use of the latter when measuring food security.

Finally, households were asked when the "most difficult" time of the year was for producing and purchasing food was. August was named by the majority of households (75% nationally), followed by September (18%) and July (5%). July, August or September were therefore the most difficult months for 97% of households, with August being the most difficult for the majority of households.

Households were asked which coping strategies they used during periods when production and purchasing were difficult. The proportions of households nationally employing each coping strategy are displayed below.



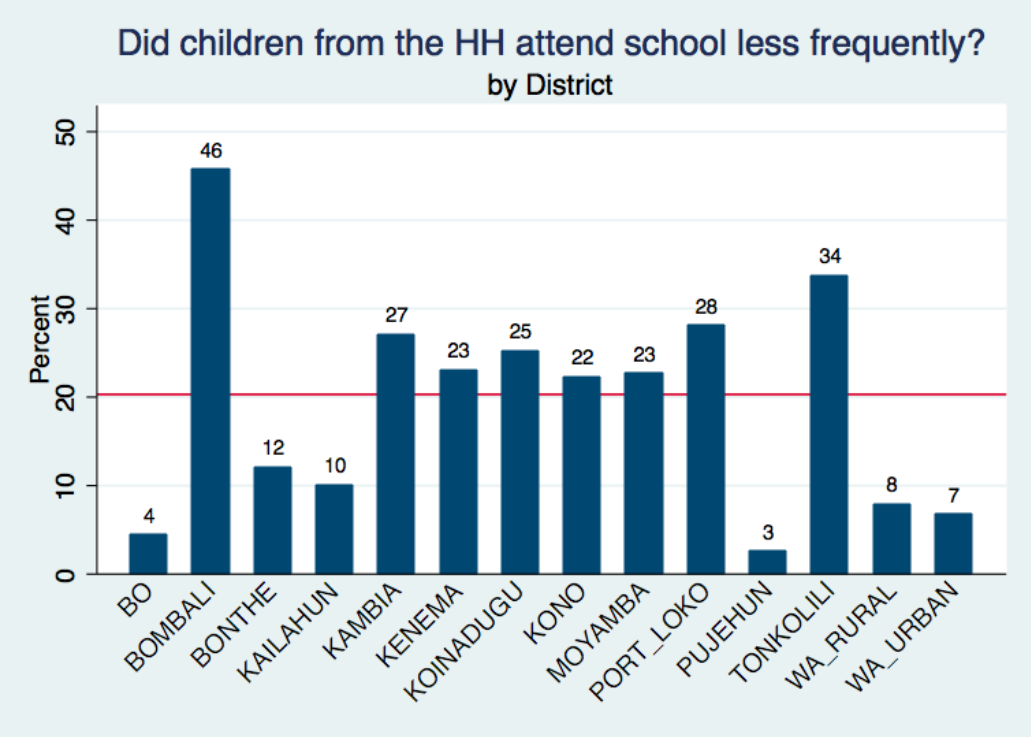
The most commonly employed coping strategies were to reduce the number of meals and the quality and quantity of food per meal.

Over 90% of households also purchased the staple food of the household. These four coping strategies were employed by the majority of households

Out of the other coping strategies listed, selling possessions to buy food and reducing the school attendance of child household members were also coping strategies employed by over 50% of households nationally.

Selling possessions or livestock to buy food was a coping strategy most employed in Tonkolili (by 69% of households), Kailahun (63% of households) and Port Loko (63% of households).

Reduction in school attendance varied fairly widely across districts as displayed in the graph below.



A coping strategy of particular concern to long-term agricultural sustainability is households' sales or consumption of seed reserved for planting, because this may diminish their capacity for production in the following year and hence the future food stock reserves. Nationally, 35% of households consumed all or part of the seed reserved for planting and 23% sold some or all of this seed in order to buy food. By-district proportions of households employing these strategies are presented below.

Consuming stored seed is employed by over half of households in Tonkolili, 47% of households in Bombali and 45% of households in Kono. The strategy is employed by the lowest proportion of households in Bo (19% of households) and Kailahun (16% of households).

District	Did you consume all/part of the seed reserved for planting?	Did you sell all/part of the seed reserved for planting?
BO	19	9
BOMBALI	47	39
BONTHE	40	34
KAILAHUN	16	15
KAMBIA	38	24
KENEMA	34	16
KOINADUGU	31	24
KONO	46	24

MOYAMBA	29	19
PORT LOKO	37	21
PUJEHUN	32	19
TONKOLILI	52	38
WESTERN AREA RURAL	25	21
WESTERN AREA URBAN	20	9
NATIONAL	**35**	**23**

A similar pattern can be seen in sales of seed reserved for planting: the highest proportion of households following this strategy can be found in Tonkolili (38%) and Bombali (39%), whereas Kailahun (15%) and Bo (9%) had the lowest proportion of households employing this coping strategy.

3.4.3 Food availability results for non-farming households

Four hundred and seventeen households surveyed in the AHTS reported that they were not involved in agriculture and thus could not be included in the sample of farming households.

These 417 households were asked to complete the food purchases and food security module in order to provide indicative results on the food security of households not involved in agriculture. The results can only be considered purely indicative since the 417 respondents are not representative of the larger population of non-farming households. In addition, the sample size is extremely small so statistical precision of these numbers is an issue.

Out of the 417 non-farming households, 96% named rice as their most important staple food while 4% named cassava.

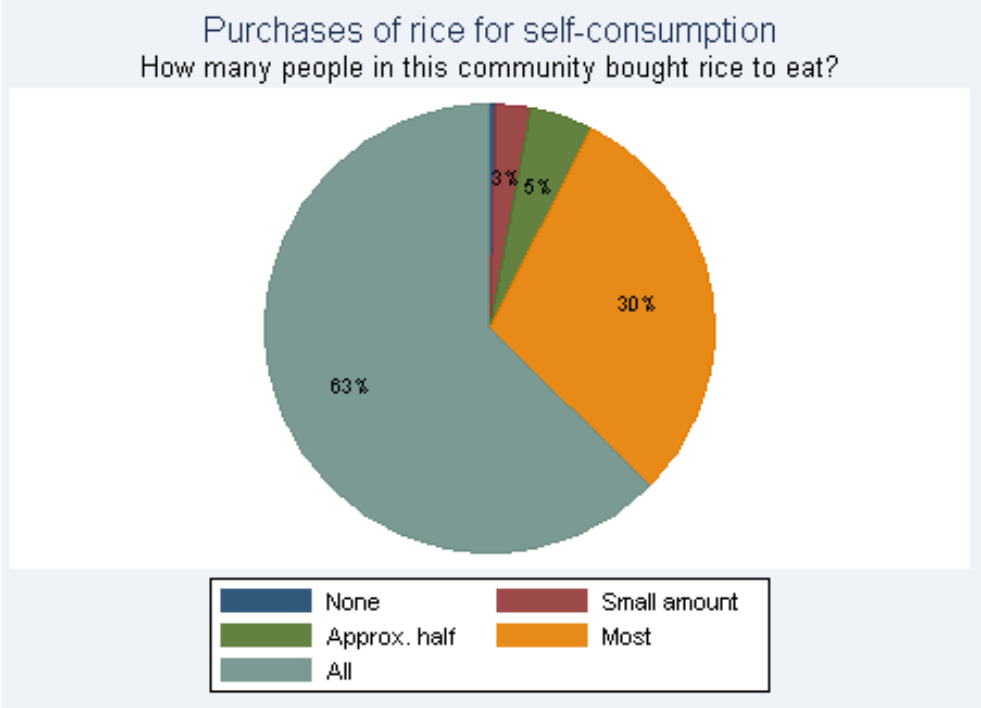
August was widely cited (95%) as the most difficult time and reducing the quantity or the frequency of meals were the most employed coping strategies, being adopted by respectively 97% and 95% of non-farming households. 60% reported they borrowed money to buy food.

3.4.4 Community data on purchases of local and imported rice

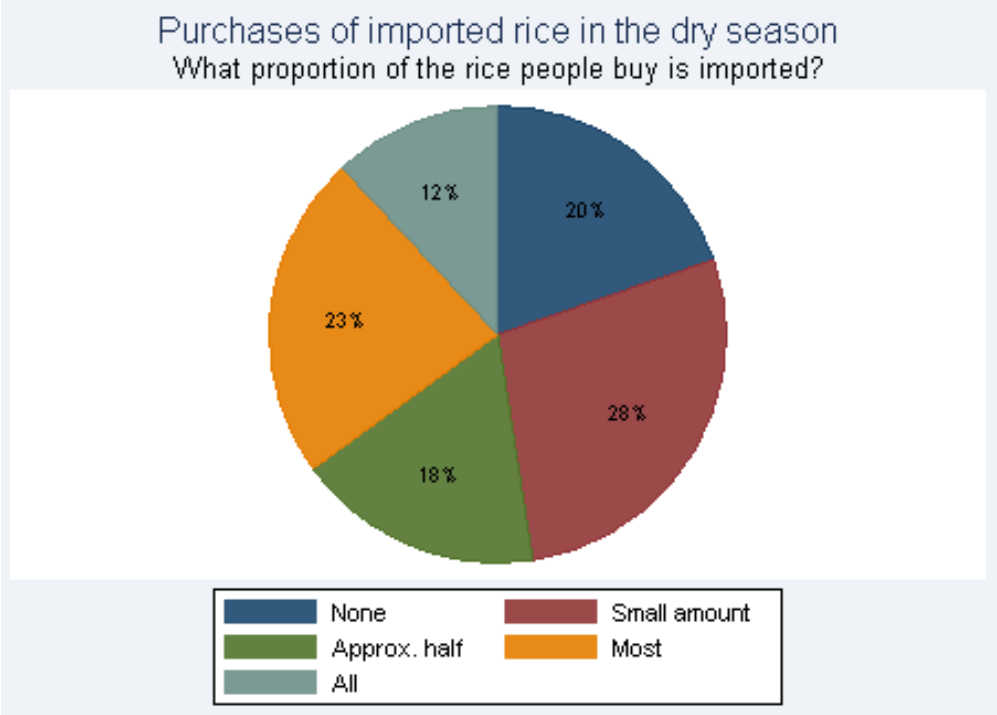
The AHTS community survey collected data that highlights the magnitude and prevalence of rice purchases across Sierra Leone.

This section reports on the purchases of local rice, and the purchases of imported rice across the dry and rainy seasons. This also has direct implications for food security, especially given the vast seasonal differences.

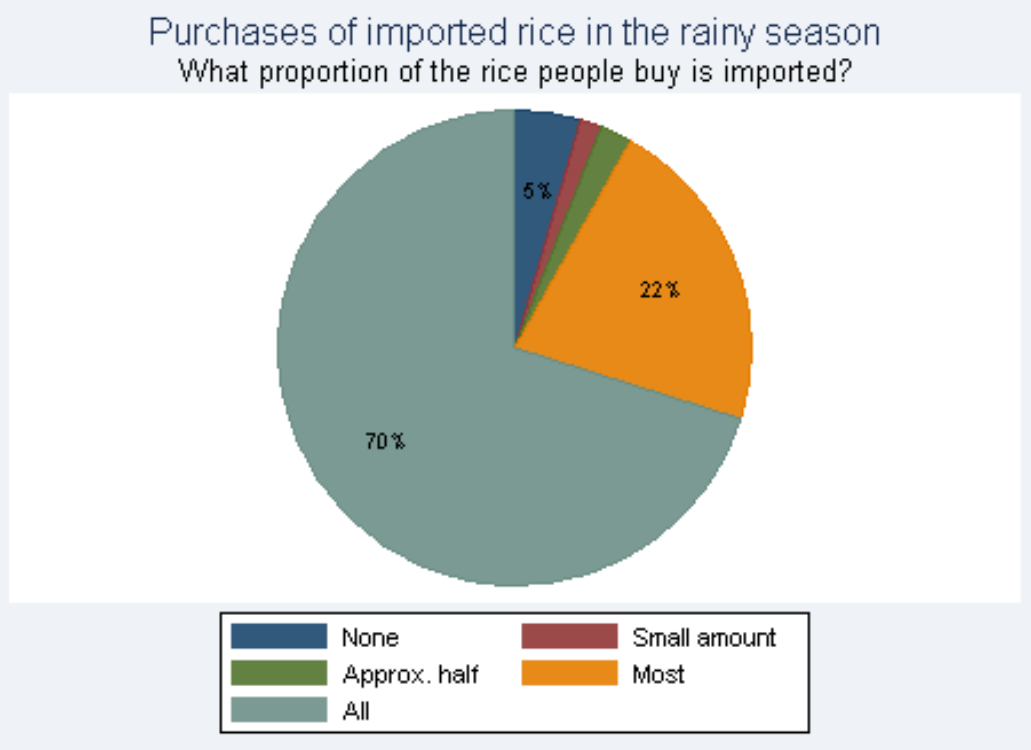
About 63% of communities reported that all households in the community purchased some rice for their own consumption over the course of the past 12 months. An additional 30% of communities reported that most households in that community had purchased rice.



Communities were also asked whether households had purchased imported rice for consumption, separately by season. In the dry season, only 35% of communities reported that most or all of the households in those communities had purchased imported rice.

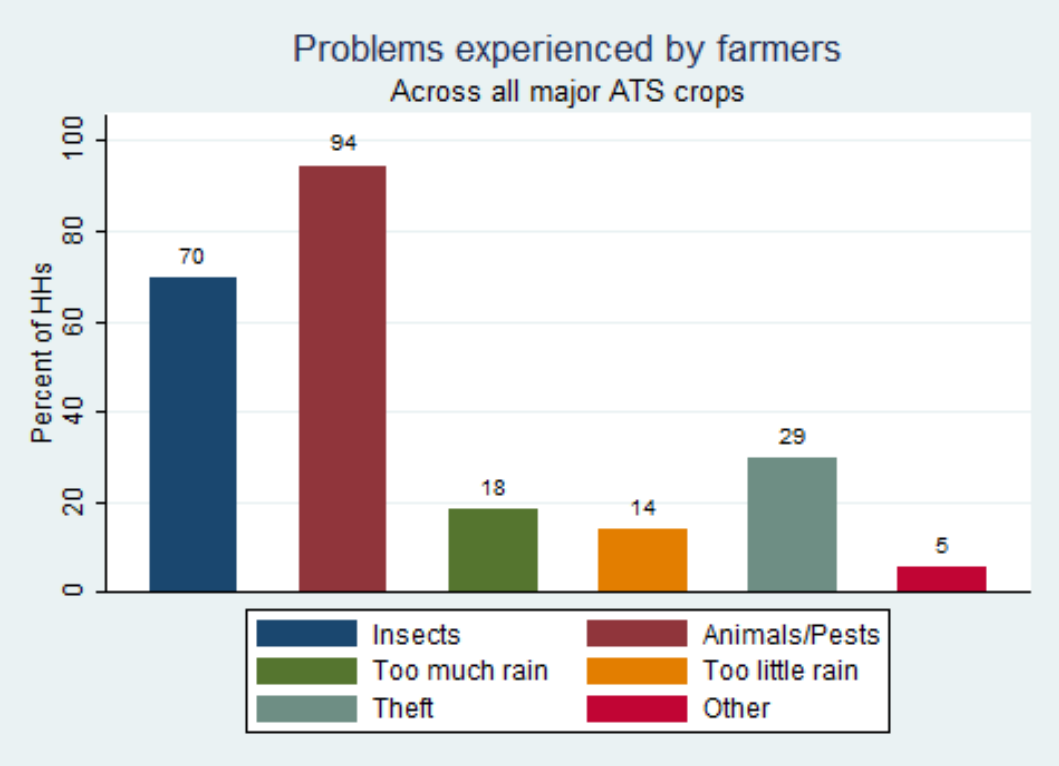


In the rainy season, these numbers look vastly different. In this case, 70% of communities reported that all households in the community had purchased imported rice at some time during the rainy season. An addition 22% of communities reported that most of their households had purchased imported rice during the rainy season.



3.5. Crop Failures

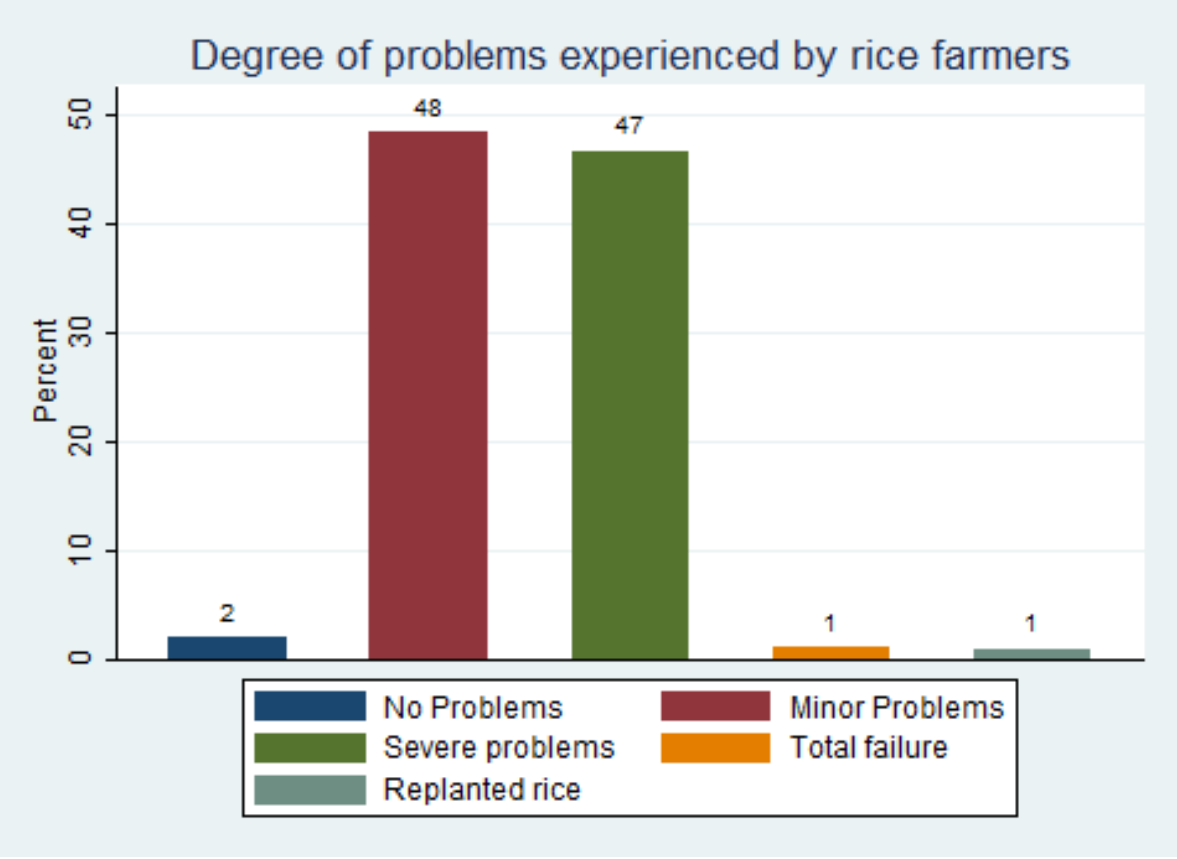
This section documents the problems that farmers had across their crops, including crop failures and the causes of these crop failures.



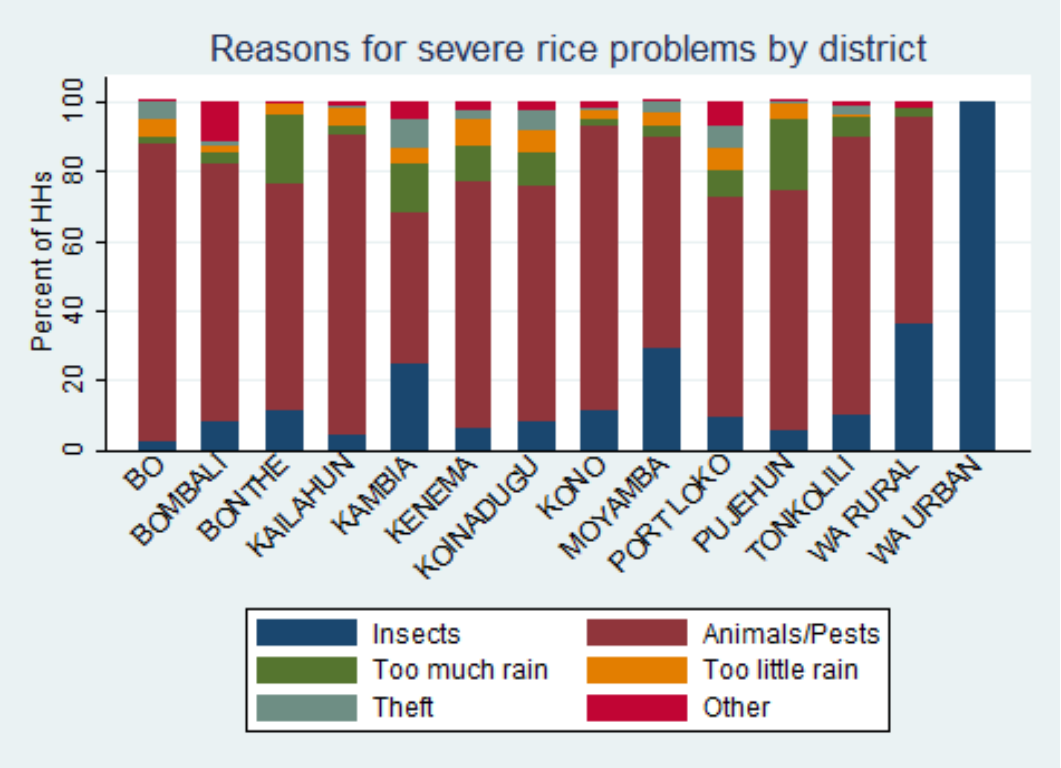
About 94% of farming households reported experiencing problems due to animals and/or pests on at least one of their crops: 70% of households reported insects being a problem, 29% theft, 18% too much rain, and 14% too little rain. There were very few cases of other problems reported.

The AHTS also collected data on the severity of each of the problems that households faced, distinguishing between those that were minor, those that were severe and those that resulted in total crop failure.

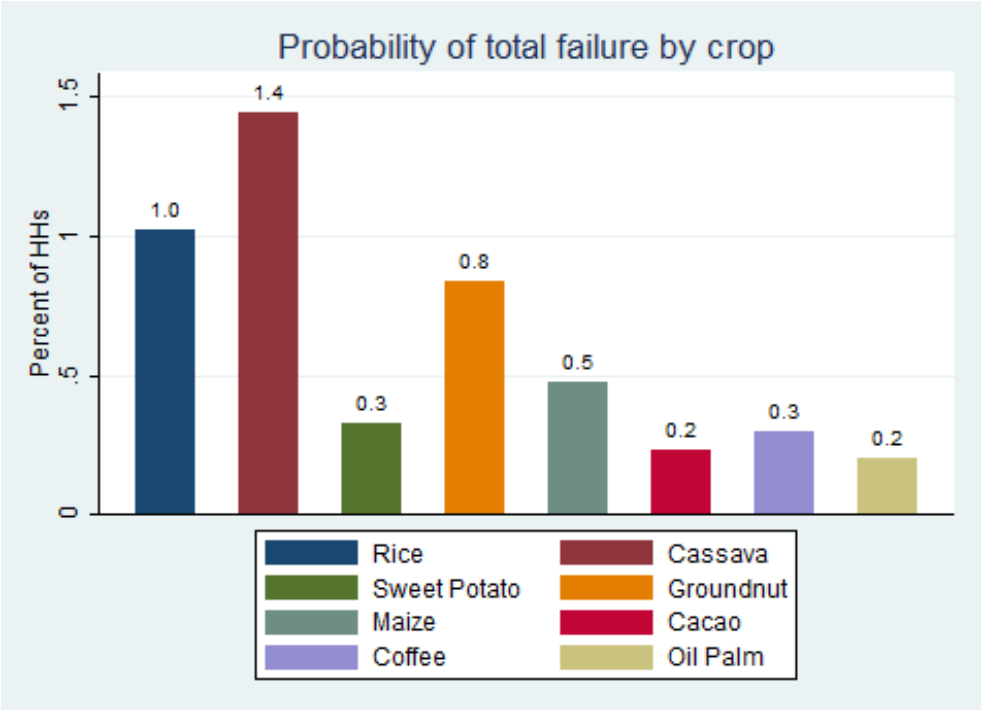
In particular, only 2% of households reported no problems across all their crops, but for 48% of households the problems they reported were only minor. An additional 47% of households reported problems that were severe, while 1% of households in total reported a total crop failure. In addition to this, 1% of households reported having had to replant rice due to crop failure.



Looking at the households that reported having severe problems on one or more of their crops, most issues were related to insects and animals/pests destroying crops. This is true across districts as shown, however, a sizeable fraction of the problems were due to too much rain in Bonthe and Pujehun.

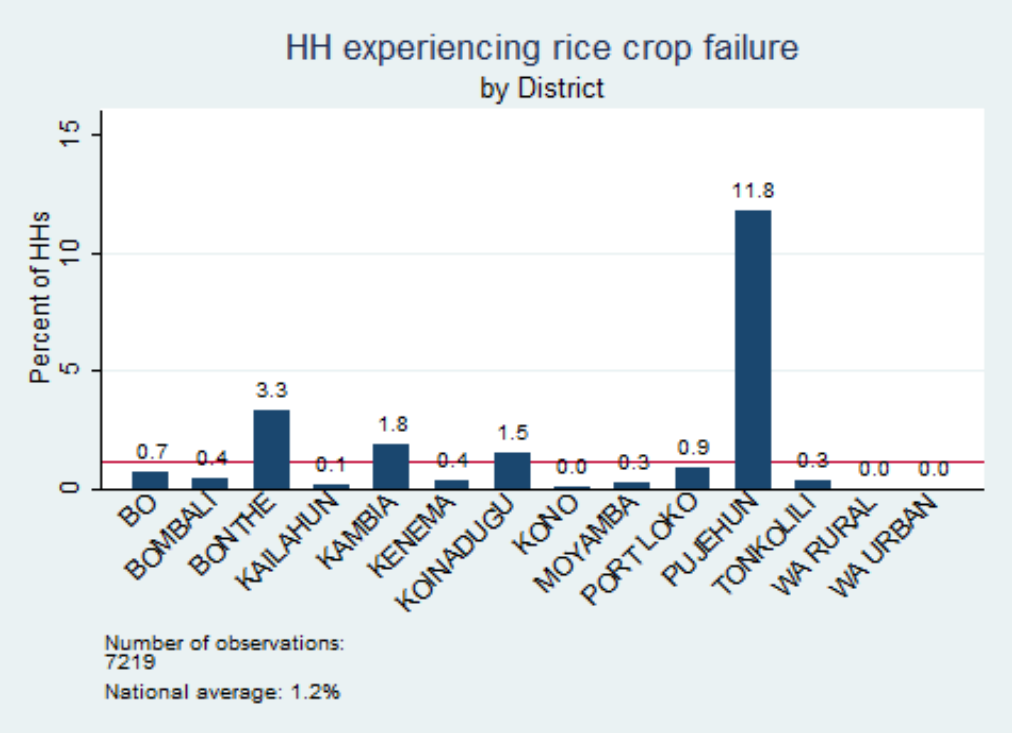


Looking at the cases of crop failure, it appears to be the case that crop failures were more prevalent in rice and cassava, unsurprising given that large fractions of households cultivate these crops.

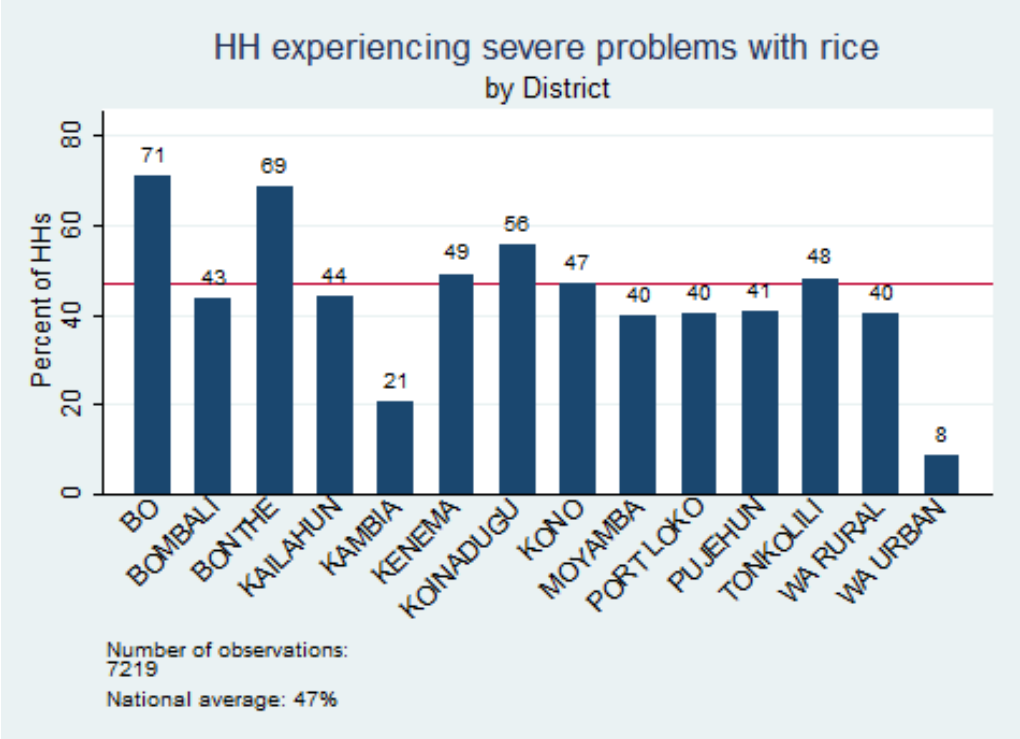


Looking at rice in particular, overall the fraction of AHTS households reporting crop failures was about 1%, with little variation across districts except for Bonthe and Pujehun. About 12%

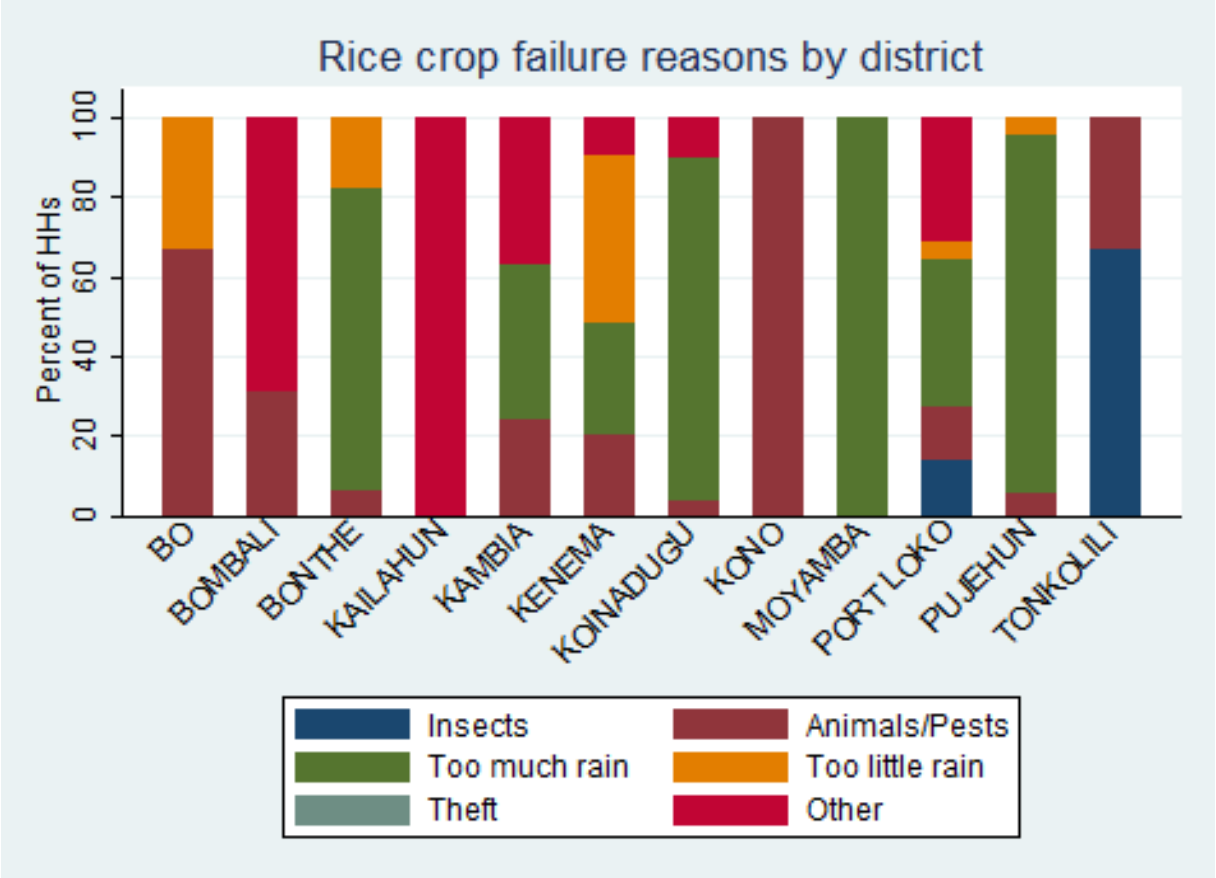
of households in Pujehun reported crop failures, which is extremely high. The fraction reporting crop failures in Bonthe was also high at about 3%.



About 47% of households nationally reported having severe problems with their rice, with a lot of variation across districts. Households in Bo and Bonthe were most likely to have experienced severe problems with rice. Note that the numbers for Pujehun look comparatively low, but this is simply because a lot of households in Pujehun reported complete crop failures.



Looking at the reasons for rice crop failures, it is clear that the issues in Pujehun and Bonthe were due to floods and too much rain. This also explains the low harvests of rice and cassava in these two districts.



3.6. Improved Seed: NERICA

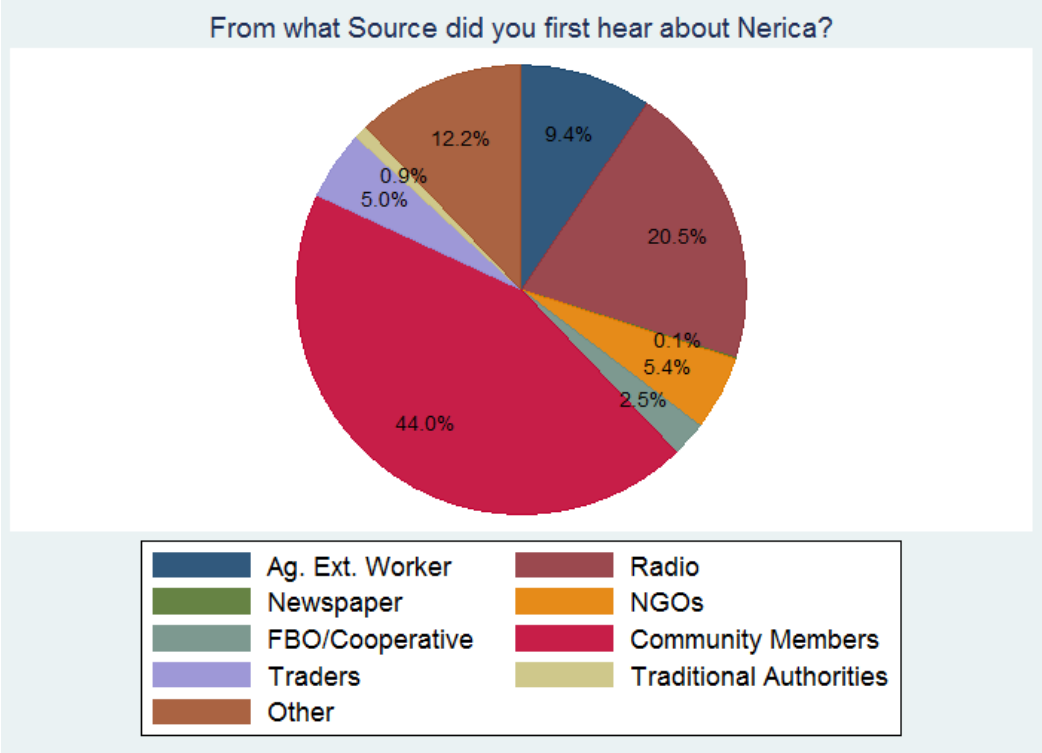
The AHTS collected data on the use of improved seed for rice, with a focus on the NERICA seed varieties. In general, the AHTS highlights how successful the dissemination of information about NERICA varieties has been - clearly the first step to improving adoption of the varieties.

Overall, close to 35% of households report having heard about NERICA. This is a relatively high proportion of households and should be considered a great start in terms of information dissemination on NERICA.

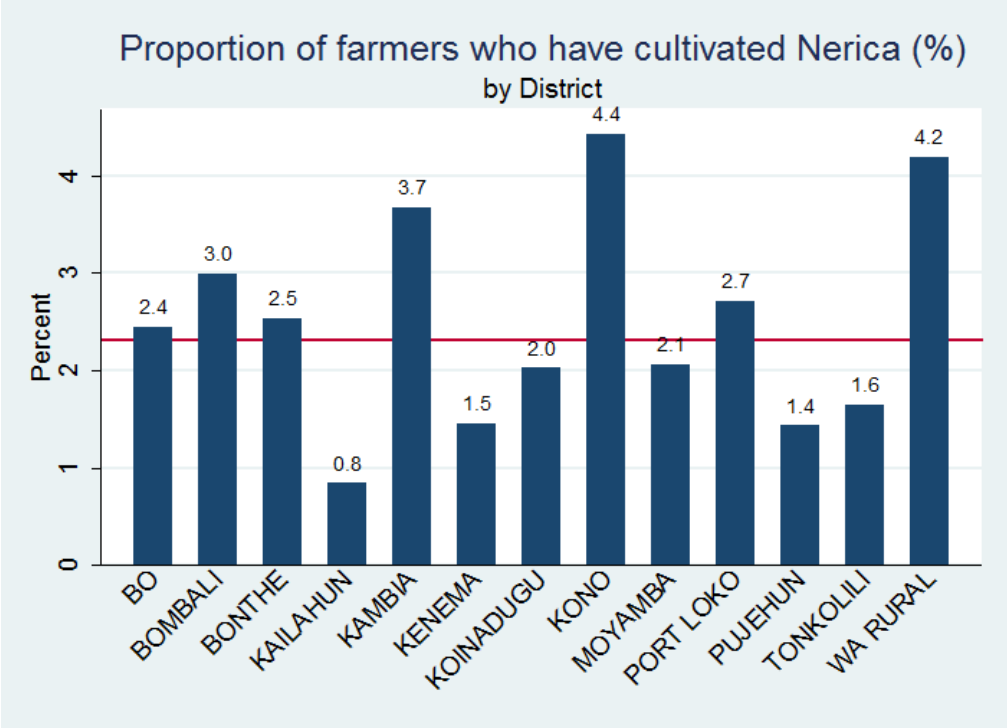
This proportion varied tremendously across districts, with 75% of households in Kambia reporting having heard of NERICA, and close to half of farmers in Moyamba and Western Area. Bombali and Pujehun have the lowest awareness of NERICA, with Koinadugu and Bonthe not far behind.

District	Proportion of farmers who have heard about NERICA (percent)
BO	37
BOMBALI	14
BONTHE	18
KAILAHUN	30
KAMBIA	75
KENEMA	22
KOINADUGU	17
KONO	38
MOYAMBA	49
PORT LOKO	39
PUJEHUN	15
TONKOLILI	35
WESTERN AREA RURAL	48
NATIONAL	**35**

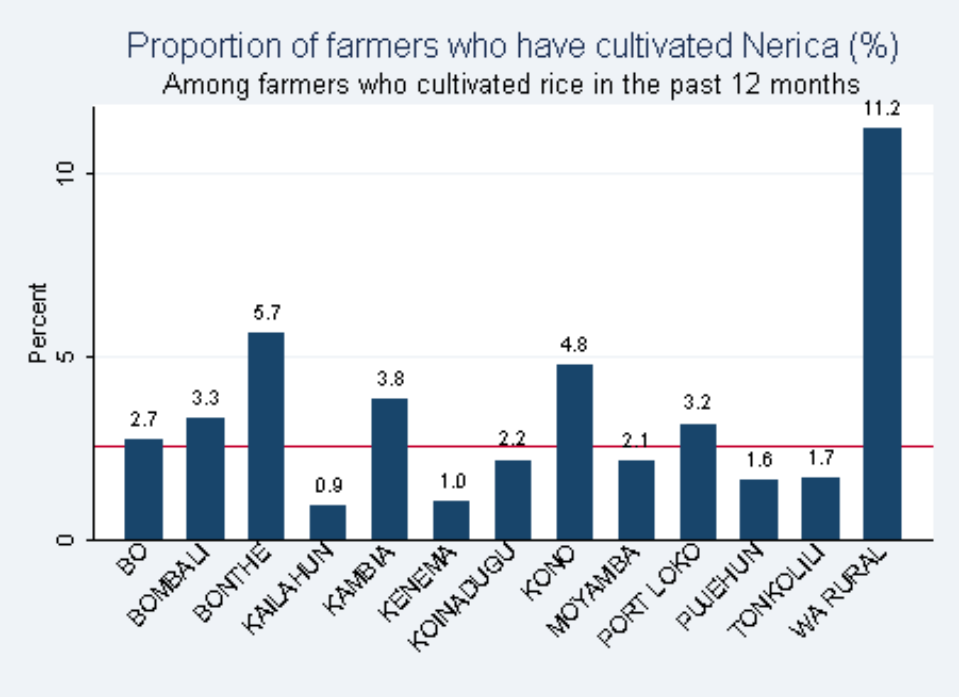
When households were asked where they first heard about NERICA from, 44% mentioned community members. Over 9% had first heard from agricultural extension workers and 20% from the radio.



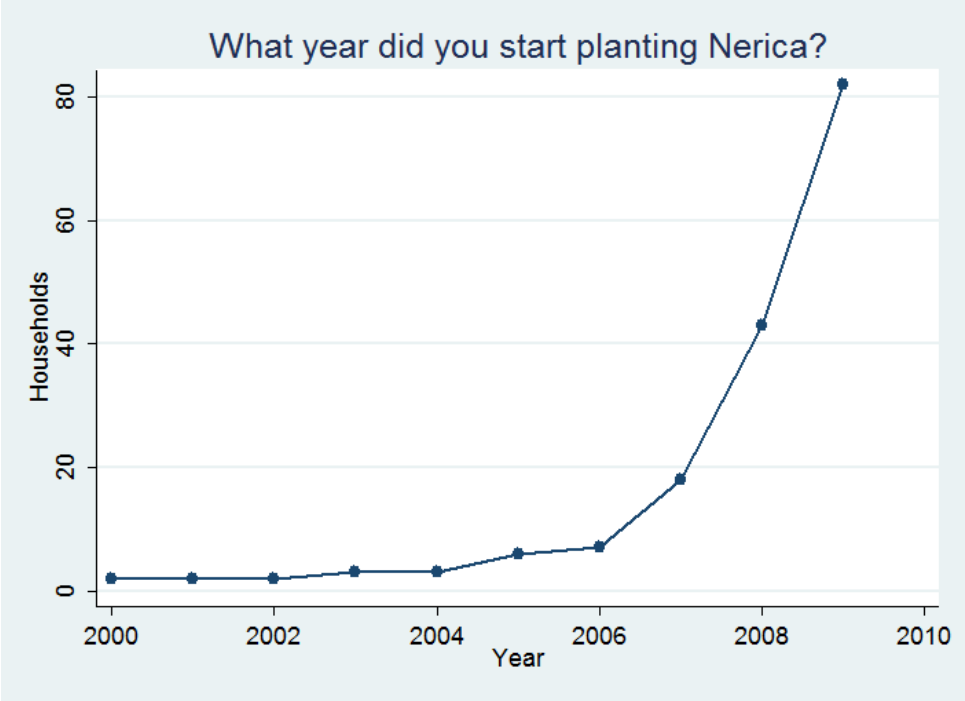
The proportion of farmers that reported cultivating a NERICA variety was just over 2% nationally, though it varied from about 0.8% in Kailahun to about 4% in Western Area, Kono and Kambia.



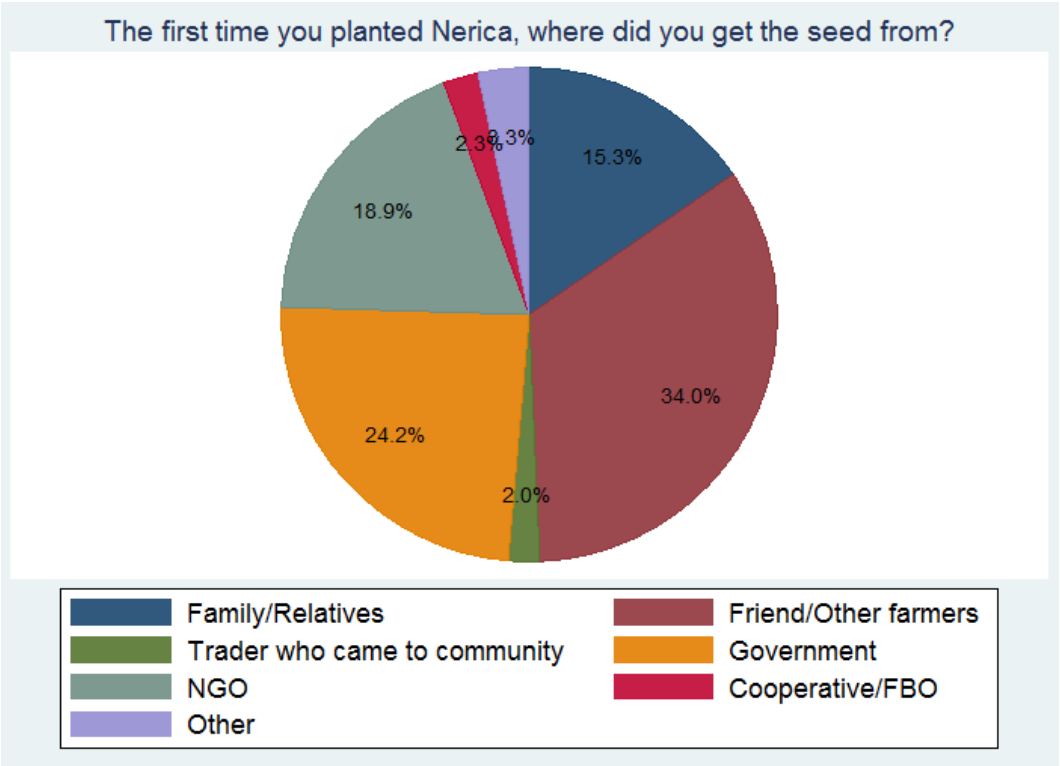
Among farmers who reported cultivating rice in the past 12 months, the proportion who had ever cultivated NERICA was 2.6% nationally. This proportion was as high as 11.2% in WA Rural.



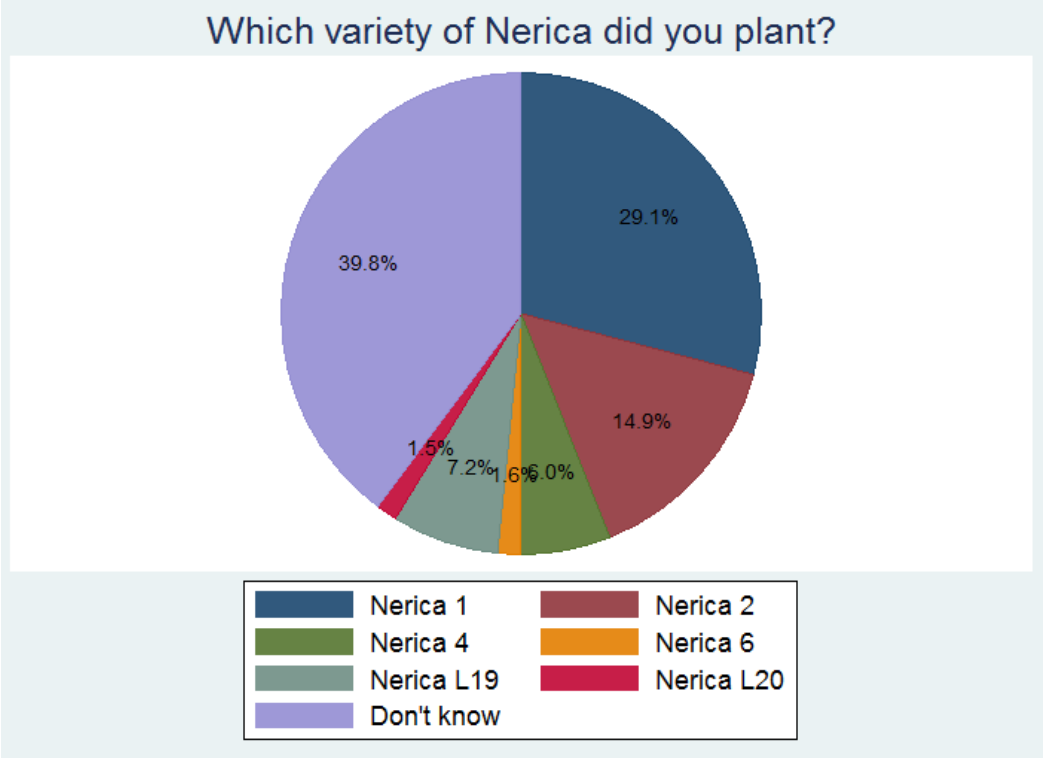
The AHTS survey also asked farmers that cultivated a NERICA variety, what year they started planting NERICA. Very few reported anything before 2006, the large share started using NERICA in the last year or two before the AHTS.



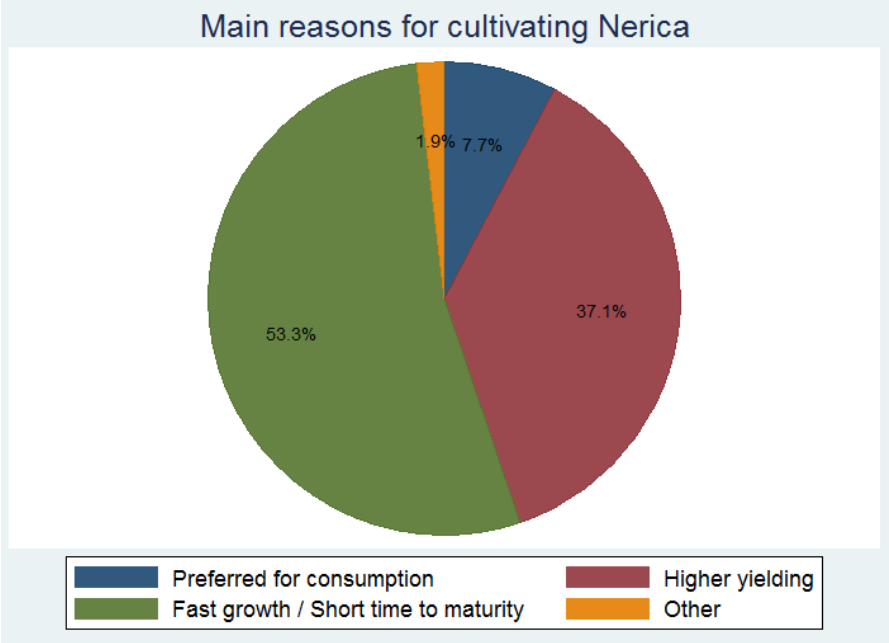
Thirty four percent of households got their NERICA seed from friends or other farmers, with an additional 15% getting it from family. However, a very large share got the seed from the government (24% of households) and a further 19% got it from an NGO.



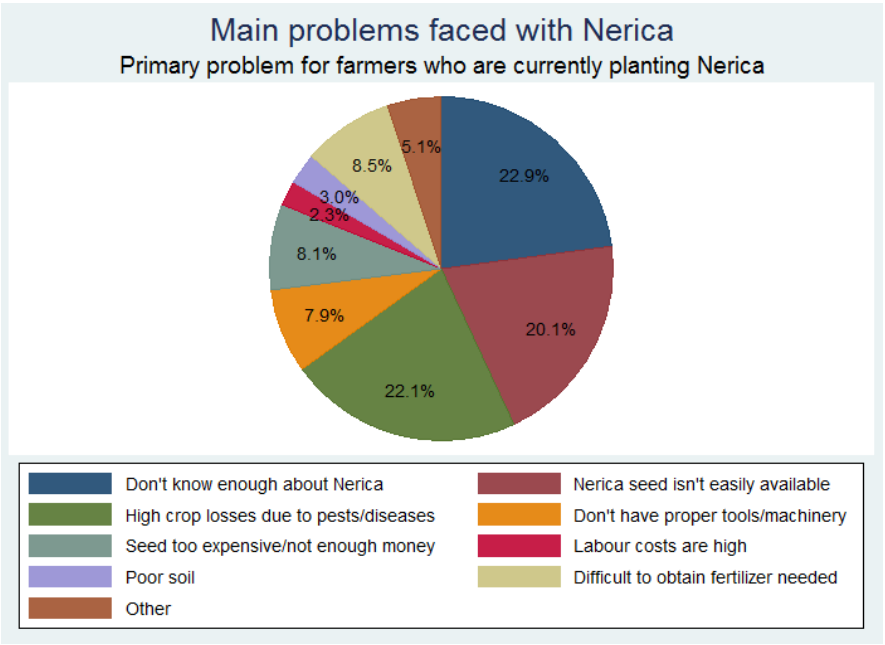
Farmers often did not know what exact variety of NERICA they had planted (close to 40% reported not knowing): 29% of farmers reported using NERICA 1, 15% reported using NERICA 2 - all other NERICA varieties were not used much.



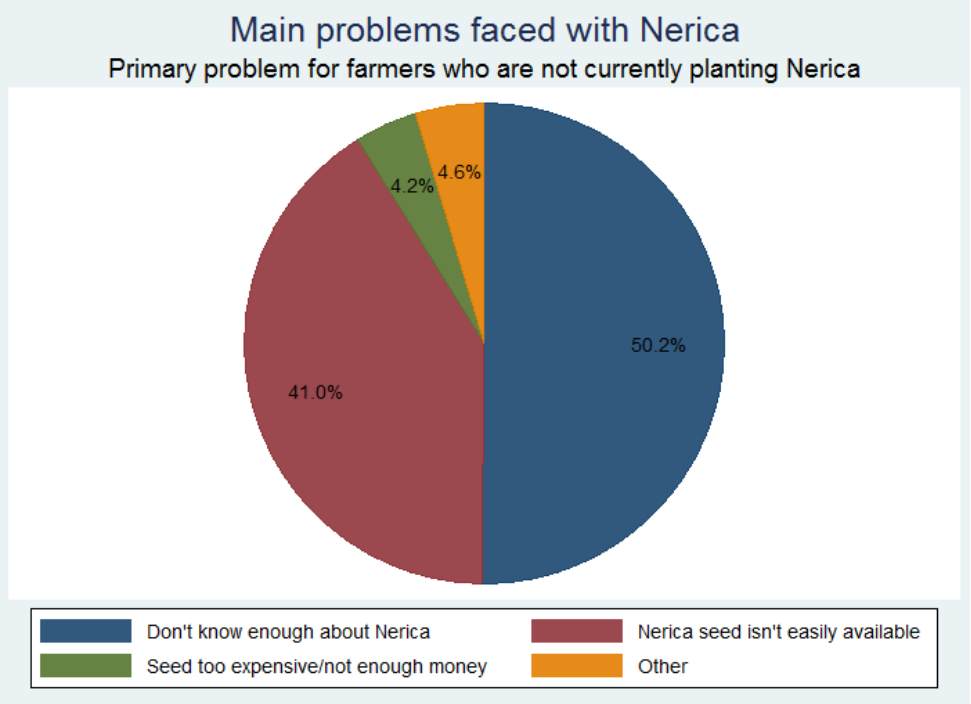
Farmers were also asked why they had chosen to cultivate a NERICA variety: 53% reported having chosen NERICA for its short duration to maturation and 37% because it is higher yielding. These appear to be the most preferred traits of the NERICA seeds.



Farmers also appear to be facing some of the common problems associated with NERICA. In fact, about 22% of farmers who chose to cultivate NERICA reported high crop losses due to pests/disease. A further 23% said they had insufficient knowledge about NERICA and 20% reported that the NERICA seed is not easily available. These were the predominant issues with the NERICA varieties.



The farmers who chose not to cultivate NERICA were also asked what problems they thought they would face with NERICA varieties: 50% reported that they did not know enough about NERICA. An additional 41% reported that the NERICA seeds are not easily available.



4. Other Crop Profiles

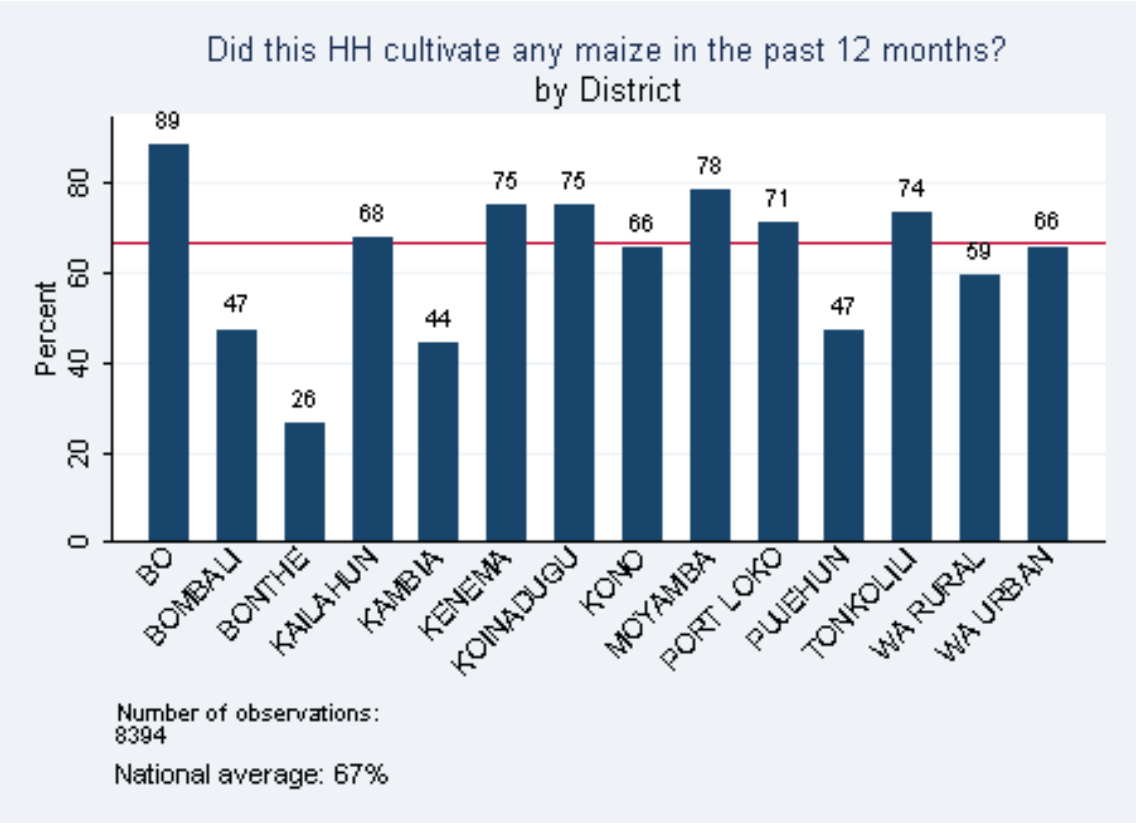
This section covers the three remaining core crops (aside from the tree crops) collected in the AHTS survey, which were maize, groundnut and sweet potato. The tree crops are discussed in Section 5 below.

4.1 Maize

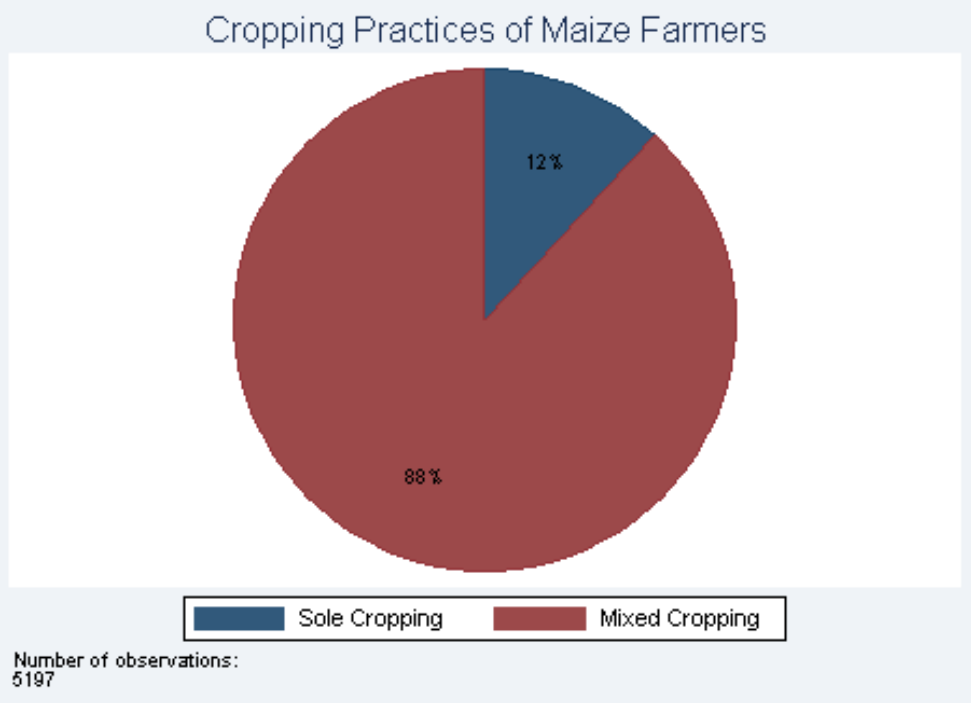
The majority of households (98%) had harvested all of their maize during the period of data collection for the AHTS.

4.2.4 Cultivation and Cropping Patterns

At a national level, 67% of households cultivate maize. This cultivation takes place mainly on farms, but 24% of households cultivated maize on small plots or gardens not considered farms.



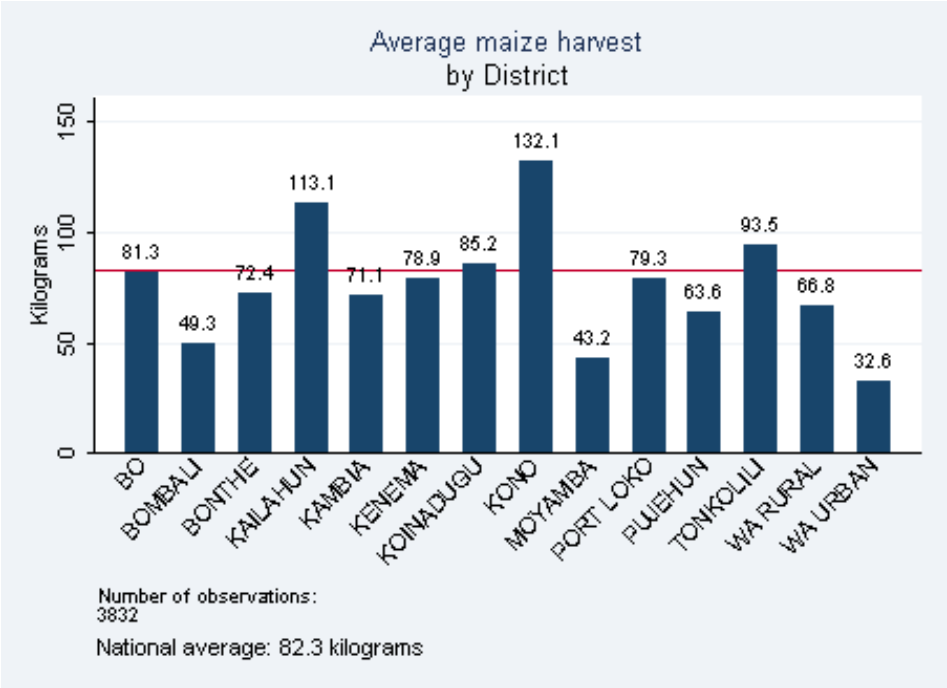
Maize production was predominant in Bo, Kenema and Moyamba, though a large share of farmers (more than 70%) in Tonkolili, Koinadugu and Port Loko also cultivate maize. Maize cultivation is low (below 50%) in Bonthe, Kambia and Pujehun.



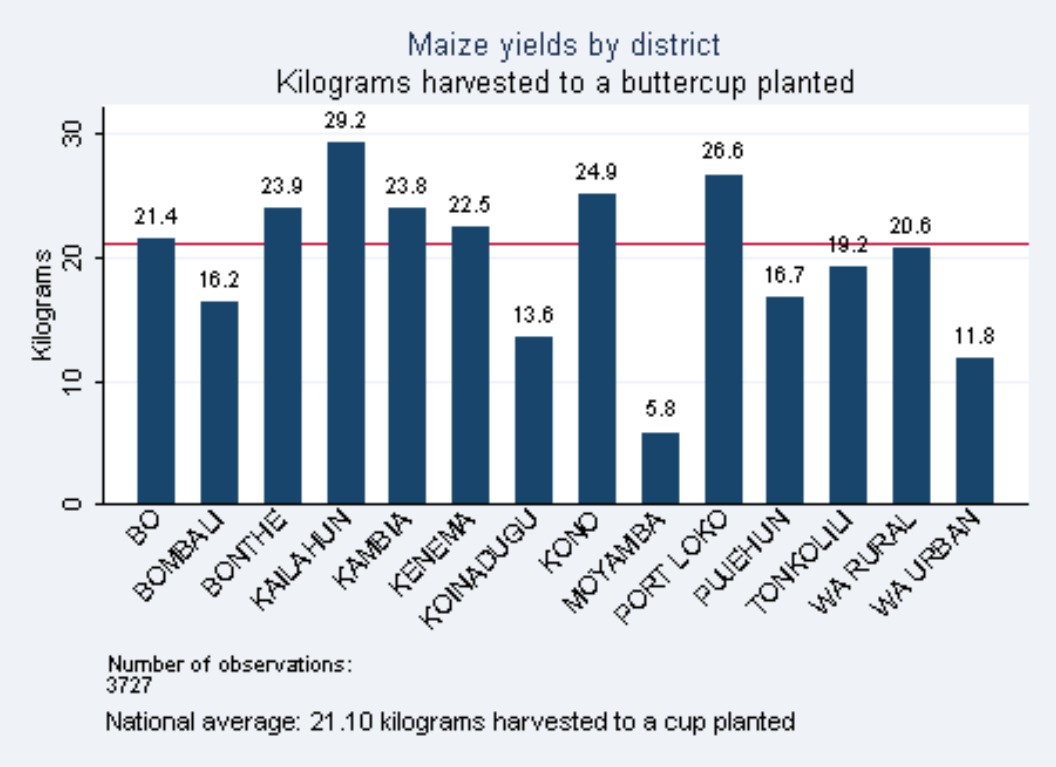
Looking at the cropping patterns, 88% of farmers named mixed cropping as their main cropping practice. The districts which showed low proportions of farmers using mixed cropping were Bombali, Kenema and Kono.

4.2.5 Harvests and Yields

This section reports on the harvests and yields of maize for the AHTS sample of households cultivating maize. Throughout this section, a 50 kg bag refers to a 50 kg rice bag from imported rice.



There was large variation in the amount harvested across districts. Some households reported harvests far above the national average of 82.3 kilograms (a conversion unit of 1:1 for bags of dried cobs to bags of fresh cobs was used). Looking across districts, the highest average household harvest was found in Kono and Kailahun and the lowest in Bombali, Moyamba, Pujehun and the Western Area.



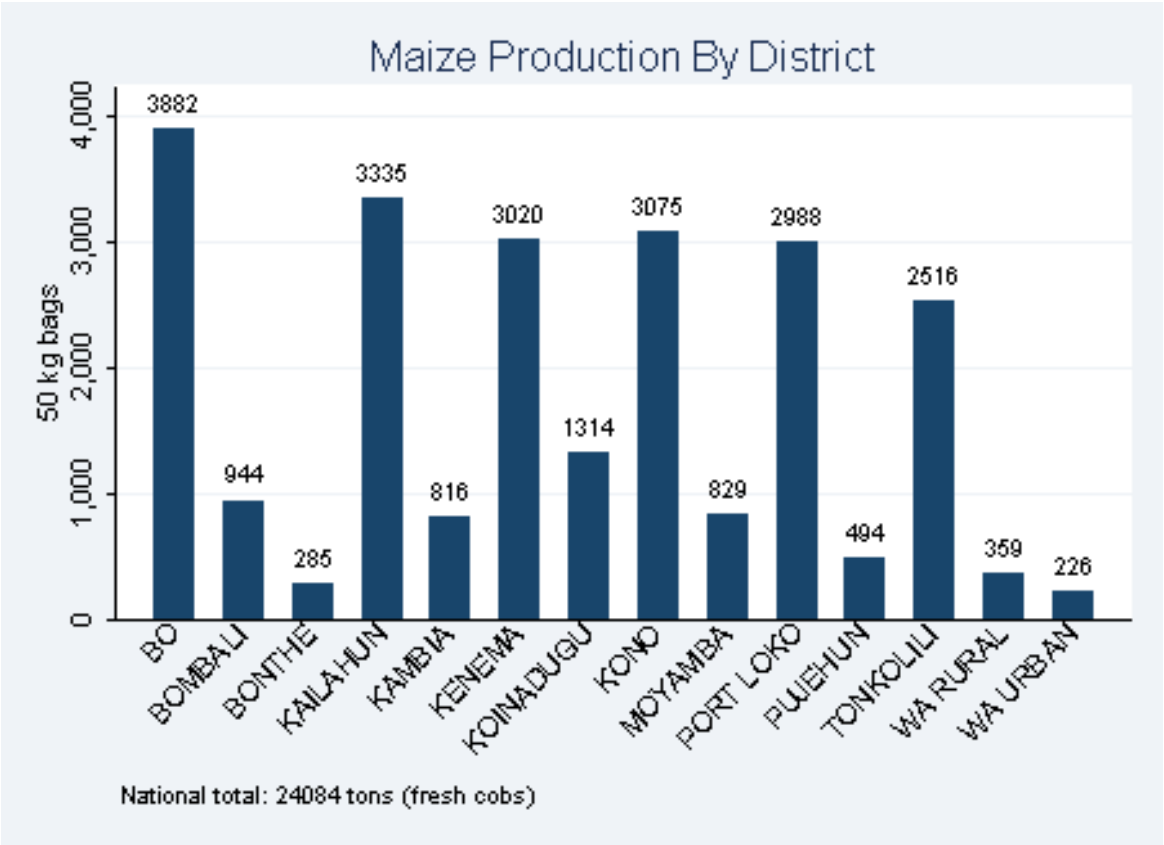
Yields of maize are reported as the ratio of the number of 50kg bags harvested to the number of buttercups planted (there are no conversion units from buttercups to 50 kg bags).

In addition, the yields are not reported by acre here given the extremely large amount of mixed cropping reported in farms that maize was planted on. Also, the mixed cropping is not systematic and has widely varying numbers of crops that are mixed with maize across households. The Technical Team opted for this as an initial description for yields. The most common planting unit for maize was a buttercup.

There was large variation in the yields of maize across districts. The average yield was slightly over 21 kilograms of fresh cobs per buttercup planted. Looking across districts, Kailahun and Kono were the high yield districts while Moyamba and Koinadugu were on the lower end.

4.2.6 Economy Aggregates for Maize: Production

This section reports aggregate production for maize. Household level data were aggregated to give national figures using the methodology described in Section 2.



Bo had the highest production of maize, with a number of other districts close behind (Kailahun, Kenema, Kono, Port Loko and Tonkoli). Maize production is relatively low in the other districts.

National production was estimated at 24,084 tons of fresh cobs of maize.

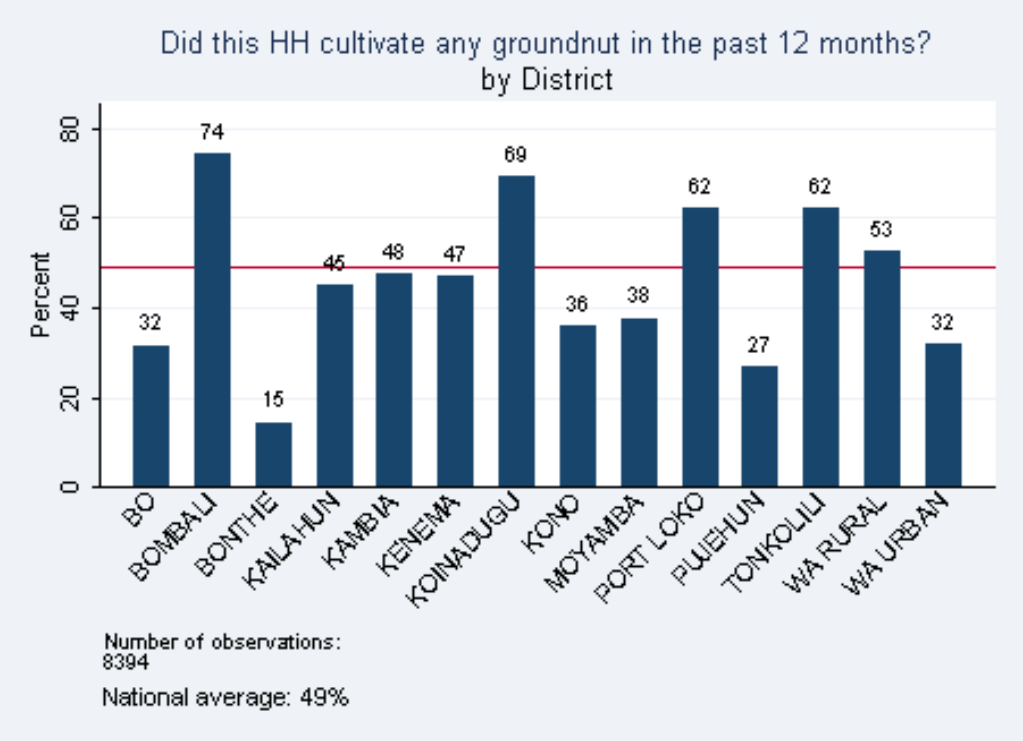
4.2 Groundnut

Most households, 97%, had harvested their entire groundnut crop at the time of the survey.

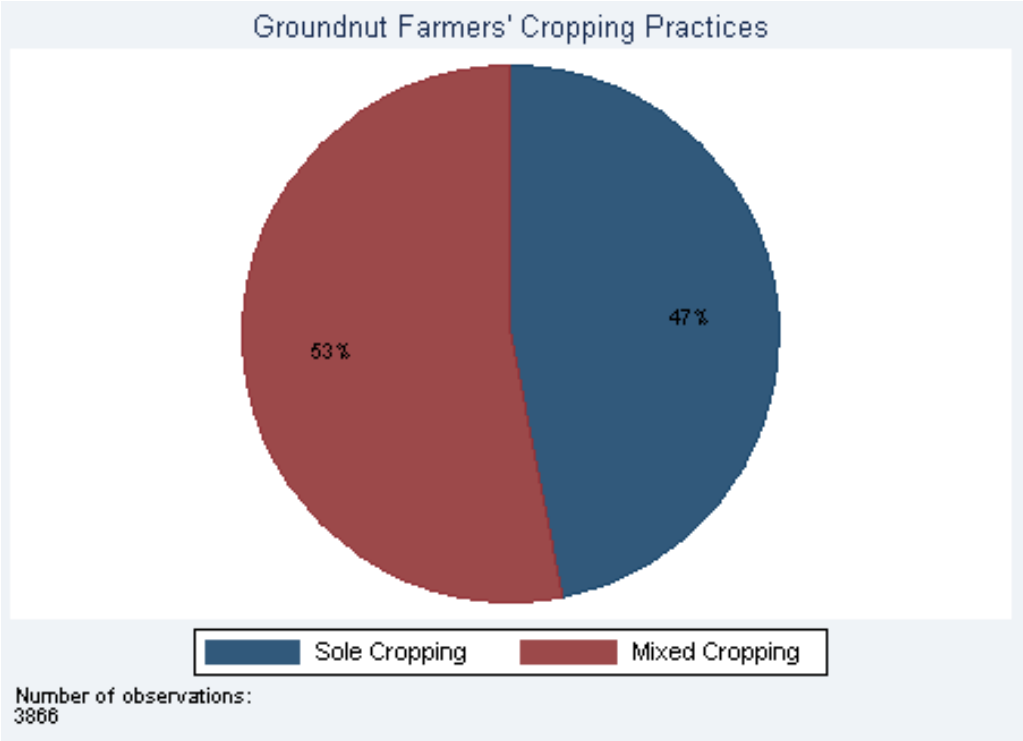
4.2.1 Cultivation and Cropping Patterns

Forty seven percent of households in Sierra Leone cultivated groundnut in the 12 months preceding the AHTS survey.

The majority of this cultivation took place on farms but 10% of households cultivated groundnut on small/scattered plots of land and not farms.

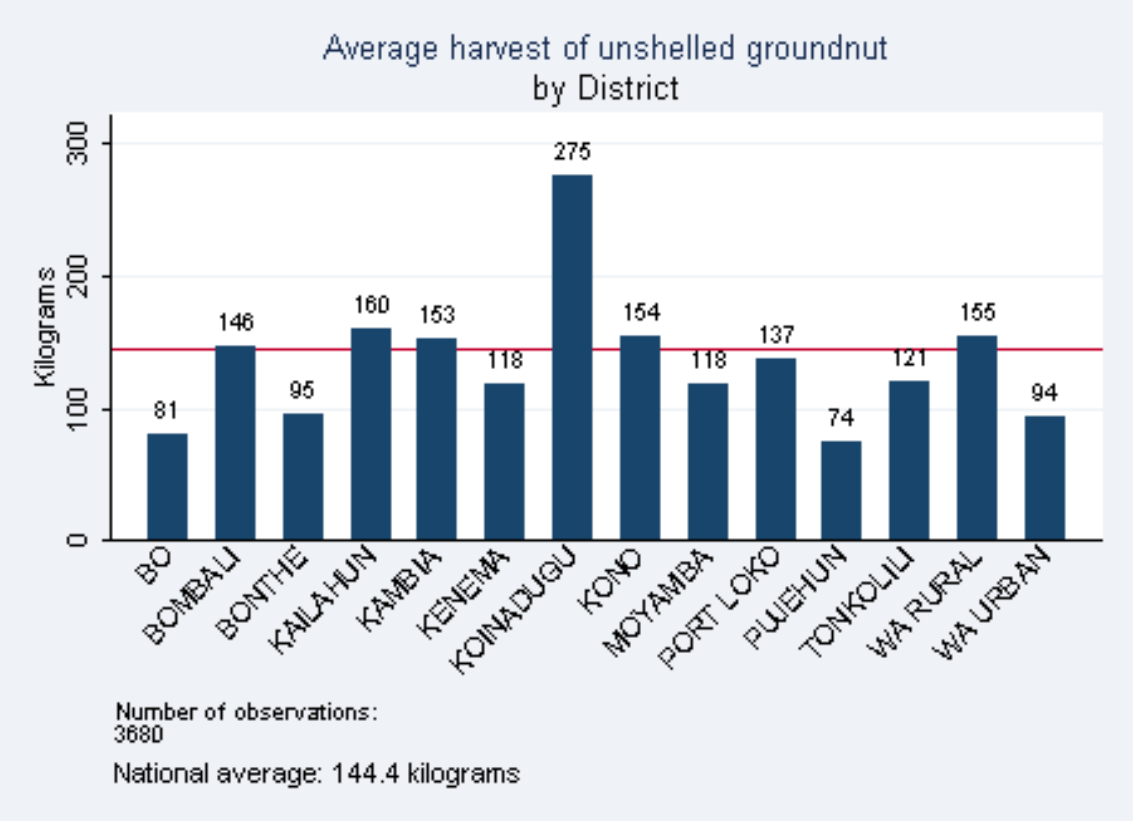


The districts with the highest proportion of groundnut cultivating farmers were Bombali, Koinadugu, Port Loko and Tonkolili. The fewest were in Bonthe, Pujehun and Bo.



Looking at cropping patterns, 47% of farmers used sole cropping as their main cropping practice. However, sole cropping was used by the majority of groundnut farmers in some districts, including Kenema and Pujehun.

4.2.2 Harvest



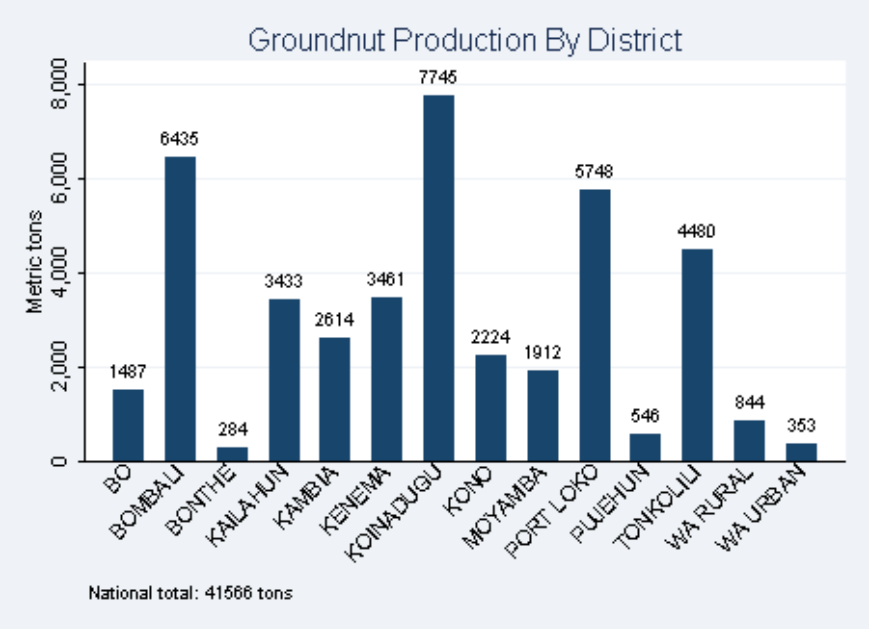
Households in Koinadugu had a much higher harvest than average. The average household harvest of groundnut was 275 kilograms in Koinadugu, whereas the national harvest average was only half as much.

While in a number of the other districts, households produced close to the national average, in Pujehun, Bo, Bonthe and Western Area Urban, harvests were quite a bit lower than the national average.

4.2.3 Economy Aggregates for Groundnut: Production

Household level data was aggregated to give national figures using the methodology described in Section 2.

National Production of groundnut was 41,566 metric tons.

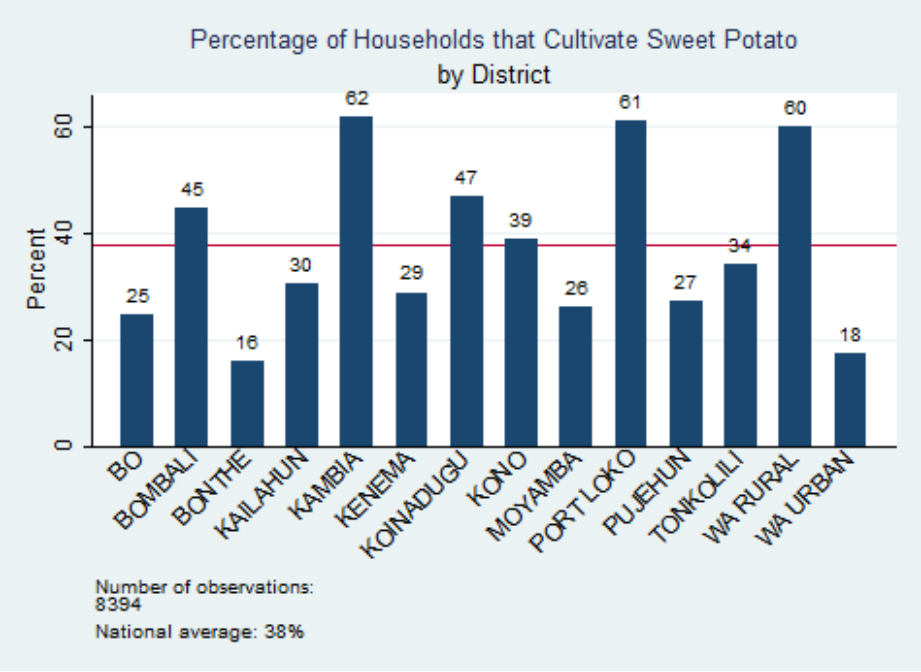


4.3 Sweet potato

The sweet potato section of the AHTS provides information on sweet potato cultivation nationally and by district, and on planting and harvest. The majority of households, 76%, had harvested all of their sweet potato during the AHTS enumeration period.

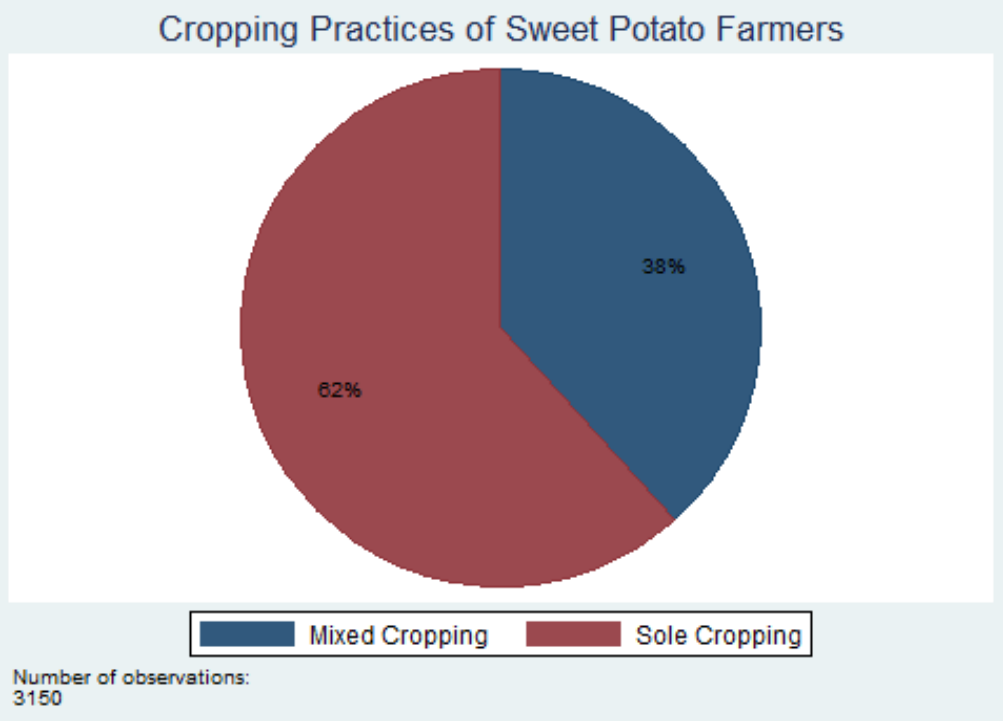
4.3.1 Cultivation and Cropping Patterns

Thirty nine percent of households nationally cultivate sweet potato. The majority of this takes place on farms: just 17% reported that sweet potato was grown on small/scattered plots.



There is considerable district-level variation in sweet potato cultivation. The districts with the largest proportion of sweet potato cultivating households are Kambia, Port Loko and Western Area Rural.

However, while a large number of households in Western Area Rural cultivate sweet potato, this district has a high proportion (46%) of households cultivating sweet potato on a very small scale (on scattered plots of land or gardens rather than farms).

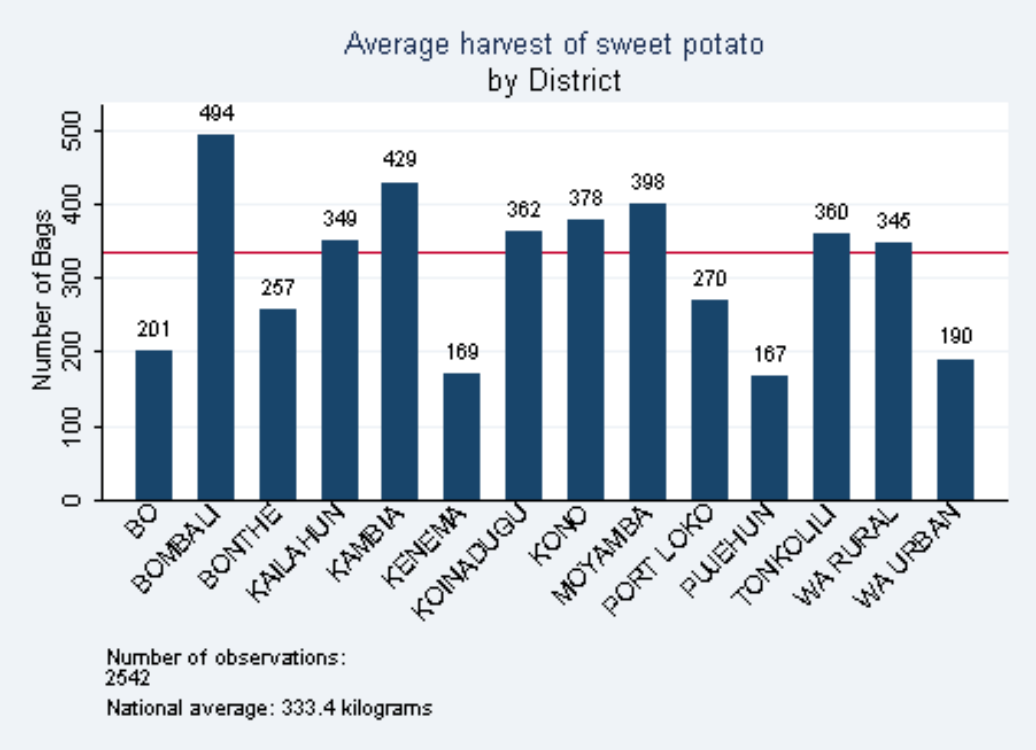


Looking at cropping patterns, 62% of household practiced sole cropping as their main cropping practice for sweet potato with the rest use mixed cropping. Western Area, Moyamba and Koinadugu were the districts where the majority of farmers used mixed cropping rather than sole cropping as their main cropping practice.

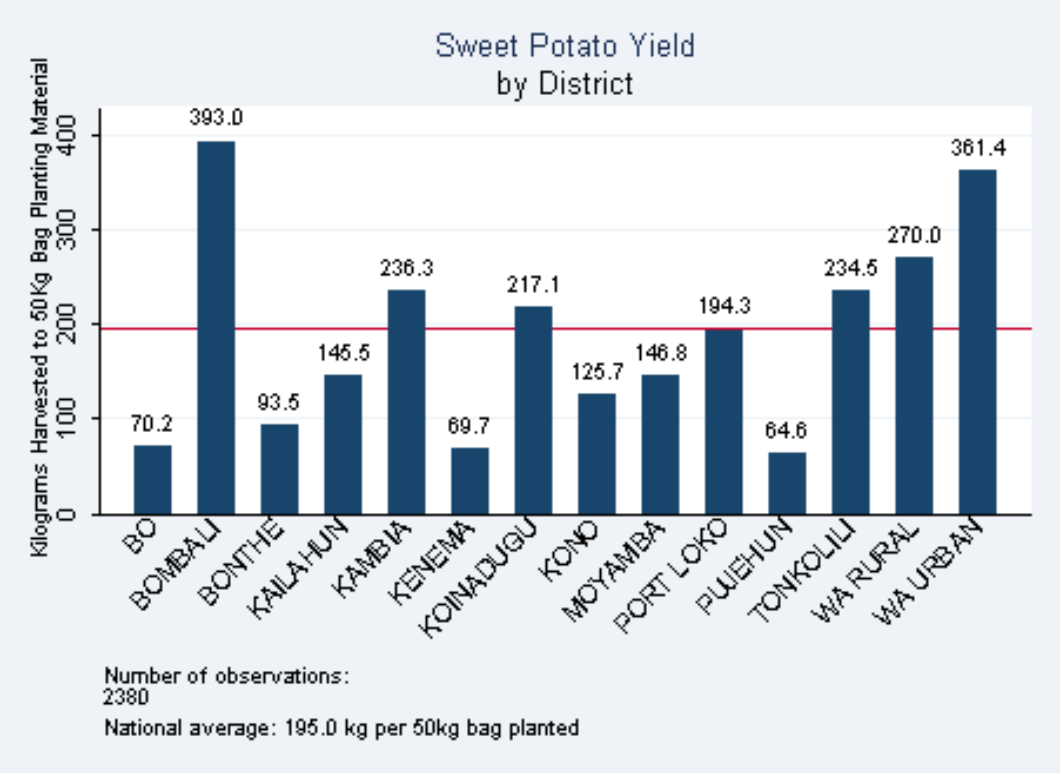
4.3.2 Harvests and Yields

There is a wide spread variation in the quantity harvested by households with a very small number of households reporting larger harvests than the national average.

The national average of quantity harvested by farmers who cultivated sweet potato was 333kgs. The average harvest varied by district, with farmers in Bo, Kenema and Pujehun harvesting significantly less than the national average. Bombali farmers harvested the most sweet potato on average, followed by farmers in Kambia and Moyamba.



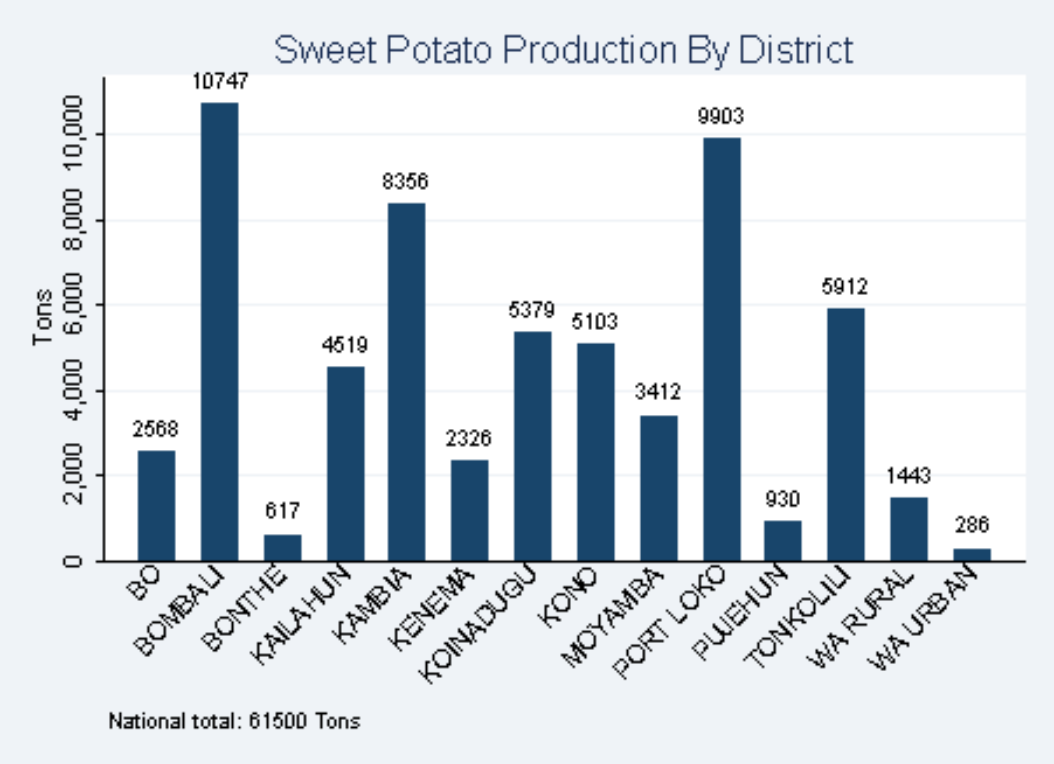
The yield for sweet potatoes is measured as the ratio of kg of tubers harvested to the number of 50kg (rice) bags of vines planted. This varied across households with a small number of households reporting a much greater yield than the average. Average household yields of sweet potato were 195 kg of tubers per 50 kg bag of vines planted.



4.3.3 Economy Aggregates for sweet potato: Production

Household production was aggregated to the national level using the methodology described in Section 2.

National production of sweet potato was 61,500 metric tons.



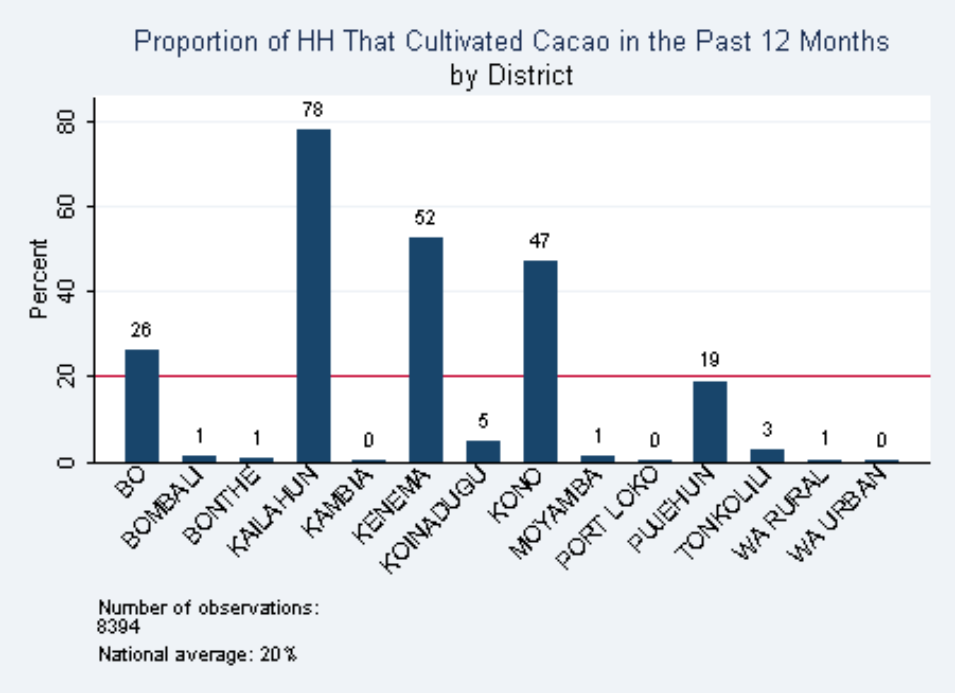
5. Commercialization of Agriculture

5.1 Non-Staple/Tree Crops

The AHTS collected detailed crop information on 3 separate tree crops (also known as non-staple or cash crops), in particular cocoa, coffee and oil palm. This section reports on the cultivation, the number of producing trees, the harvest, yield and sales for each of these three tree crops.

5.1.1 Cacao

This section discusses the AHTS data on cacao, in particular cultivation, cropping practices, harvests, revenues from sales and aggregate production.

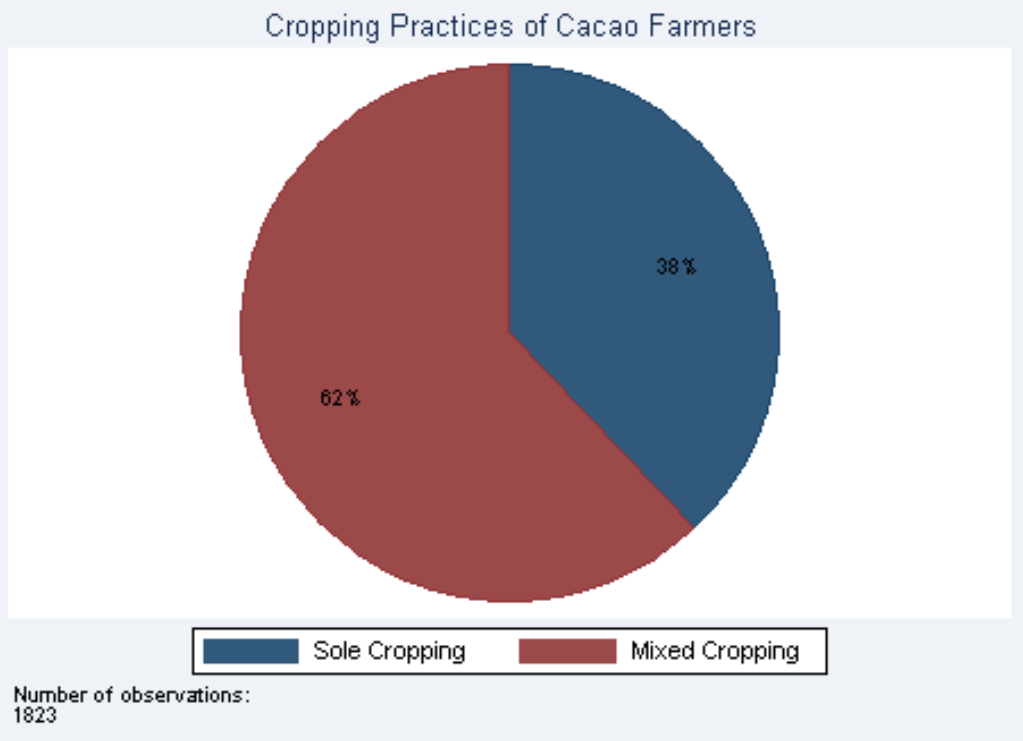


Overall, about 20% of households cultivated cacao in the 12 months preceding the AHTS survey. Of these, the largest share is in Kailahun, Kenema and Kono. Bo also has more cacao farmers than the national average and Pujehun has just under the average number of farmers. There is very little cacao cultivation in all the other districts.

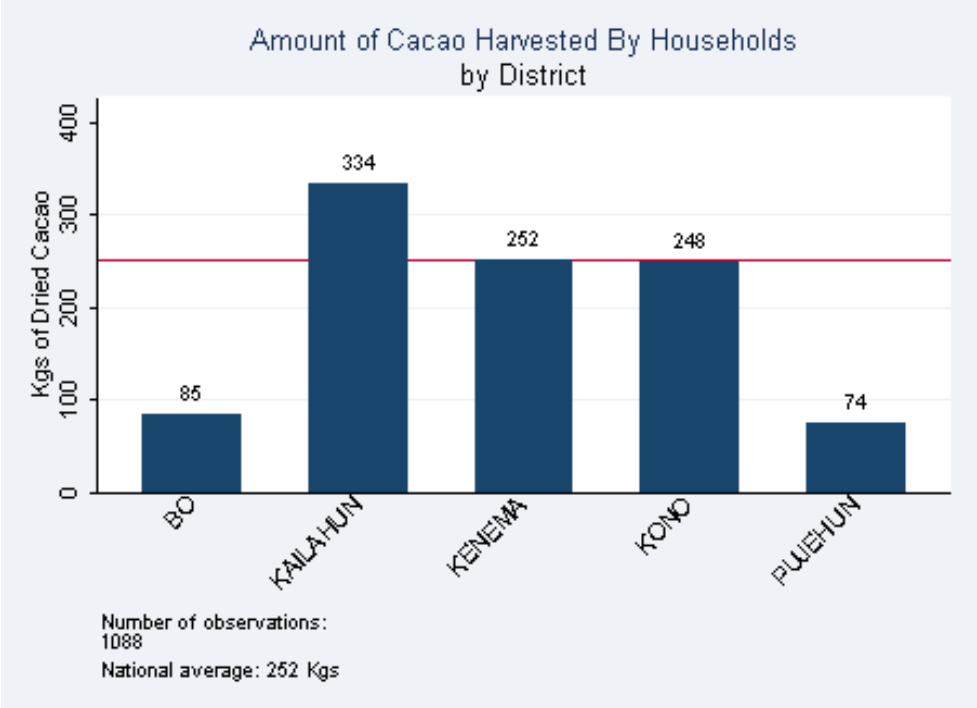
In producing the figures on household level production and sales of cacao, the following districts were dropped from the analysis, since there are so few households in these districts cultivating cacao: Bombali, Bonthe, Kambia, Koinadugu, Moyamba, Port Loko, Tonkolili and Western Area.

Unfortunately, most cacao farmers do not know how many trees they have planted – this was the case for 88% of cacao farms. Analysis on the number of trees is therefore not reported here. In addition, cacao is heavily intercropped, with intercropping reported on 60% of cacao farms. The cacao in these cases is reported as mostly intercropped with coffee, kola nut, oil

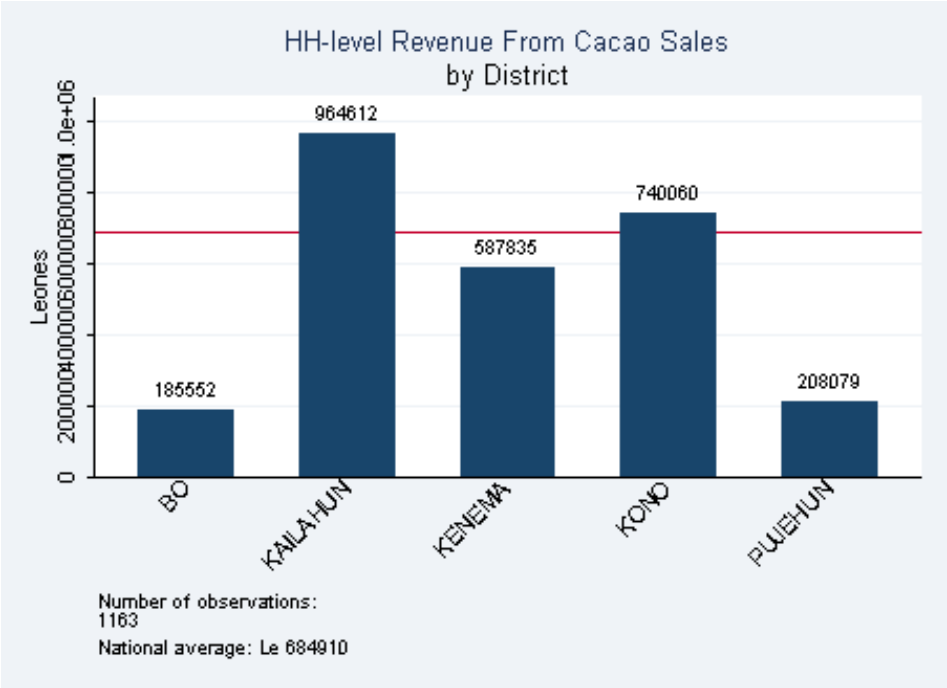
palm and banana. Of these intercrops, some of the intercrops can provide shade for the cocoa, but probably mostly the banana and cola nut trees. Coffee and cocoa should not be intercropped as both of them require shading.



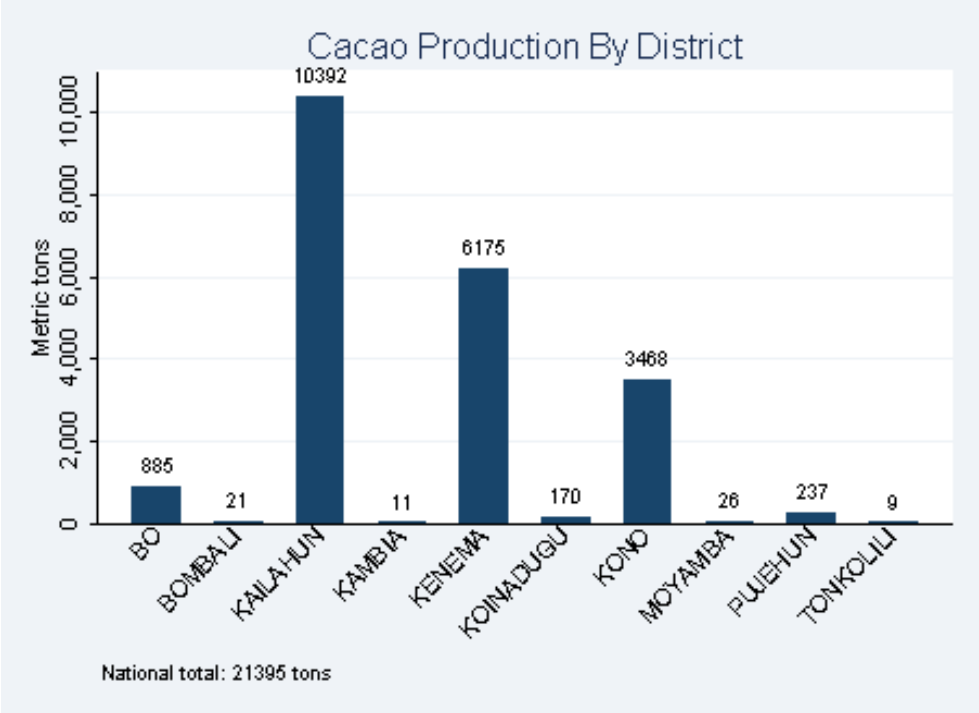
As a result of the high proportion of mixed cropping, without the number of trees, the acreage reported is rather misleading. Therefore, average production and revenue numbers are reported rather than yields.



The national average for household cacao production is 252 kg, (with all the cacao converted into dried state) with the largest share coming from Kailahun. Pujehun and Bo have lower production. Looking at revenues (below), the national average for household revenues from cacao production is Le 684,910, with a large share again coming from Kailahun, Kenema and Kono.



Looking at national aggregate production, the total cacao produced was over 21,000 Mt, about half of which was produced in Kailahun. Districts with negligible production are not displayed below, but were included in the national total.



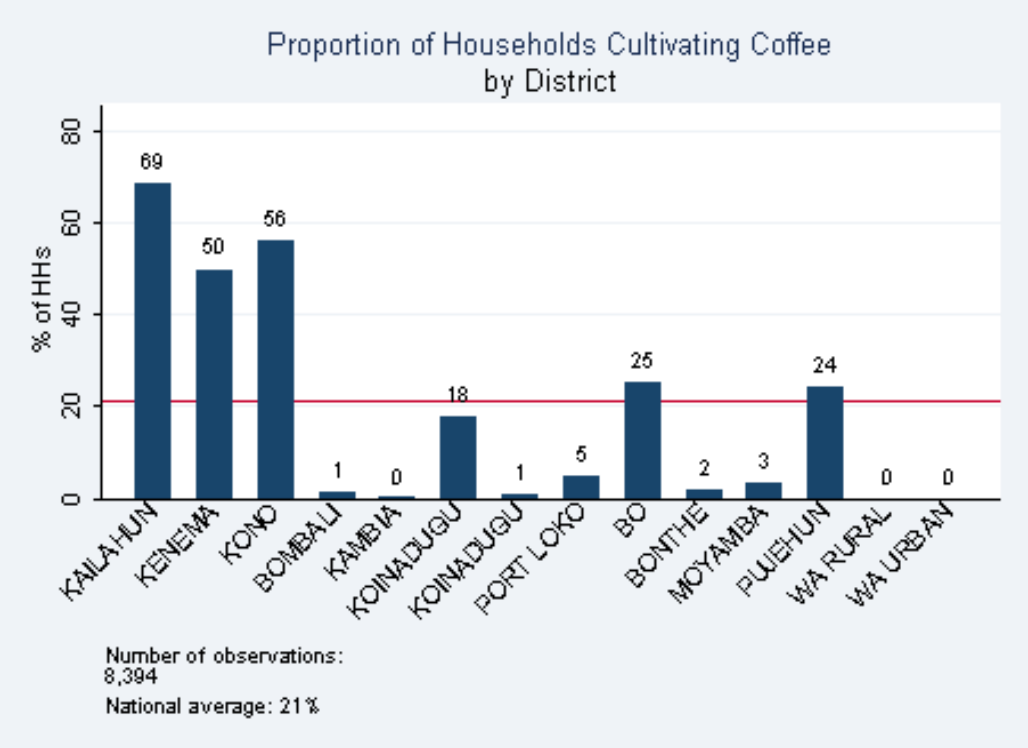
5.1.2 Coffee

About 21% of households across Sierra Leone cultivated coffee in the 12 months preceding the AHTS survey. While most of this cultivation took place on farms, 6% of households reported that coffee was grown on small or scattered plots of land not considered to be farms.

Coffee cultivation is predominant in the three Eastern districts of Kailahun, Kenema and Kono, and is also cultivated by a significant number of households in Bo, Koinadugu and Pujehun.

While a small number of households reported cultivating coffee in Bombali, Bonthe, Kambia, Moyamba, Port Loko and Tonkolili, the number of observations was not large enough to generate statistically meaningful results for these districts. These districts were excluded from the household-level analysis presented below, but they were included in the national aggregates presented at the end of this section.

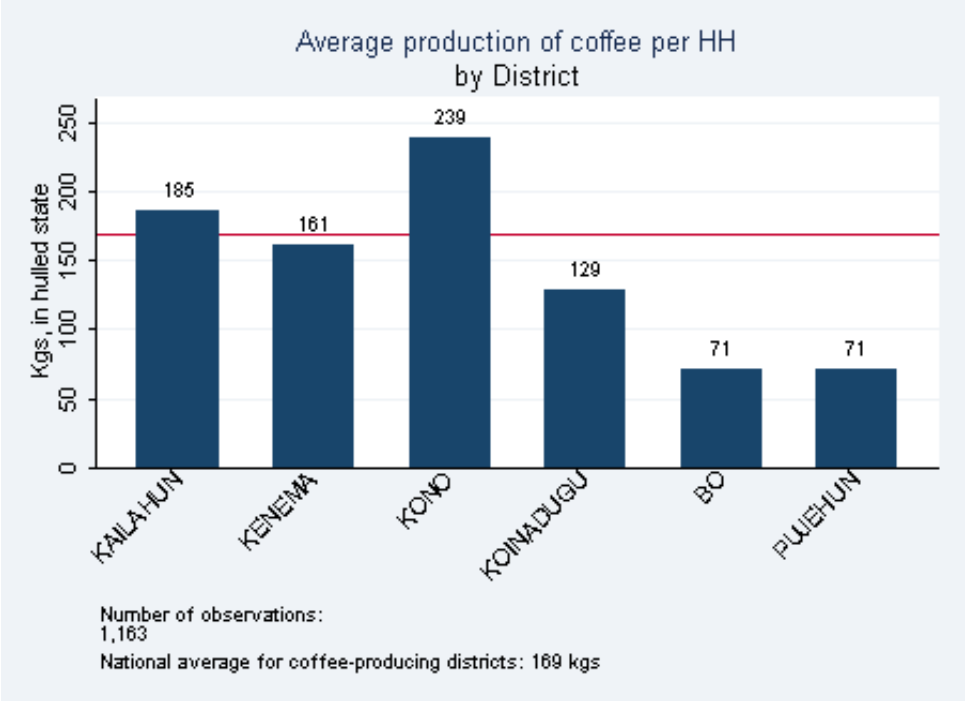
Overwhelmingly, households growing coffee do not know the number of coffee trees planted on their farms (unknown for about 93% of farms). As with cacao above, this makes computing yields extremely hard especially given the added complexity of intercropping. Instead, average household level production and revenues are reported.



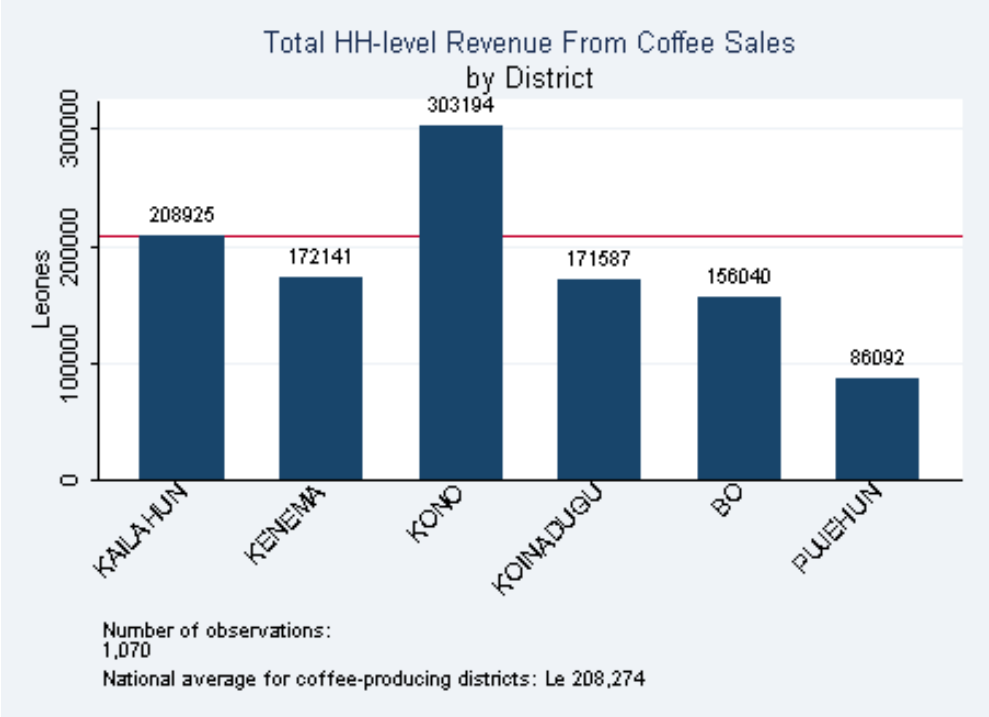
Looking at mixed cropping, about 61% of coffee producing households report mixed cropping coffee. The main crops mixed with coffee are cacao, kola nut, and some fruit trees including orange and banana.

Average household harvests and revenues for coffee are shown below. The overall national average of coffee production was 169 kgs per household. The districts with more production

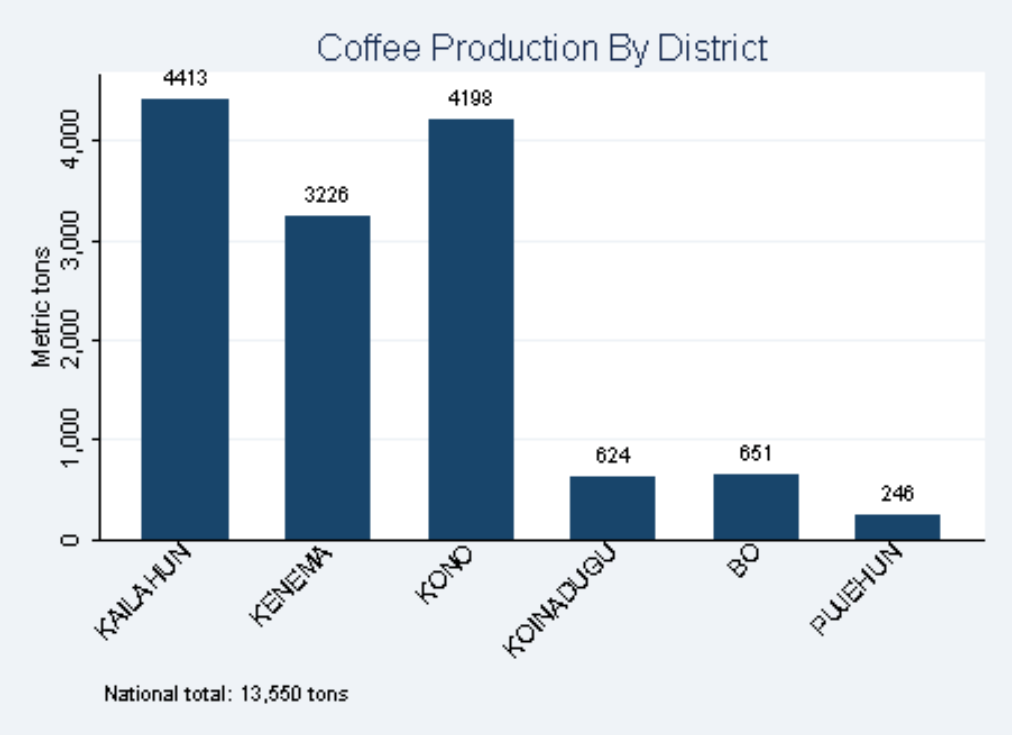
than the national average were Kono, and Kailahun. Kenema and Koinadugu were not far behind, though Bo and Pujehun lagged far behind, with an average of 71 kgs of harvest per household.



Looking at revenues from coffee production, the average household (nationally, for only the cultivating districts) made about Le 208,274 of revenue from coffee. The households in the two districts of Kailahun and Kono have revenues higher than the national average, while the other districts, with the exception of Pujehun, perform about the same.

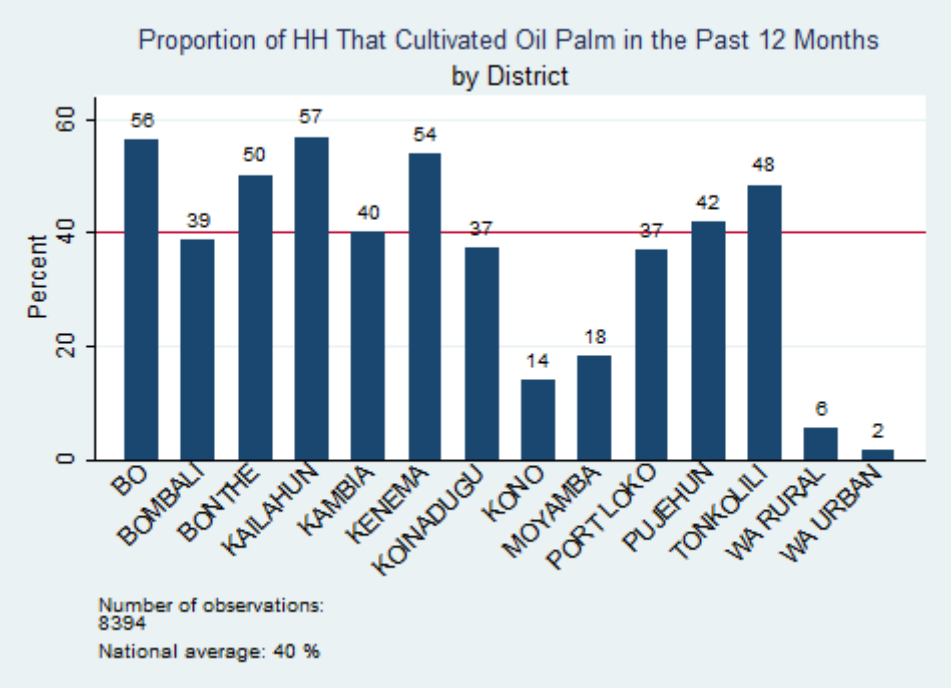


National aggregated production of coffee was calculated to be close to 14,000 Mt, with the largest shares of that coming from Kailahun and Kono.



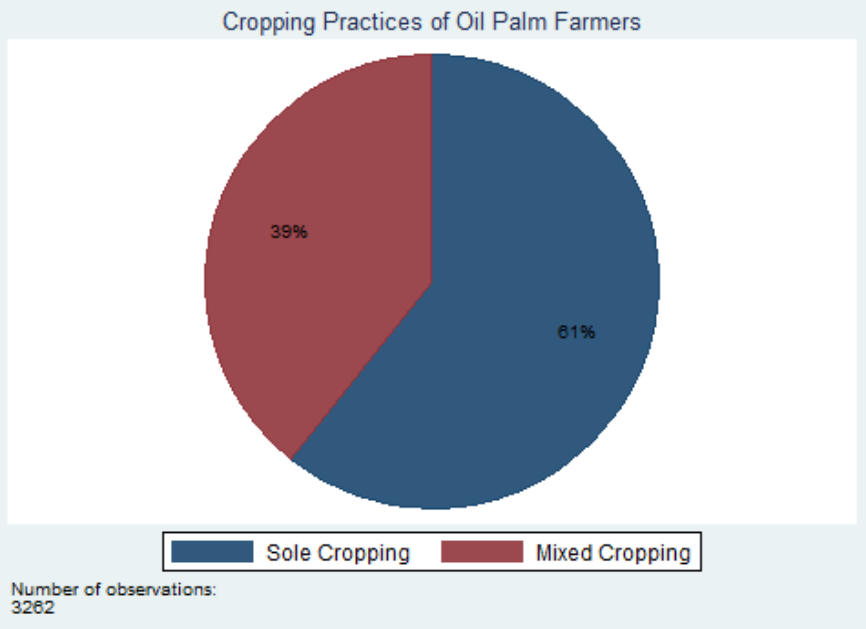
5.1.3 Oil Palm

Forty one percent of households reported that they cultivated oil palm in the 12 months preceding the AHTS Survey. The majority of this cultivation took place on farms, however, 11% of households reported cultivation that took place on small plots or gardens.

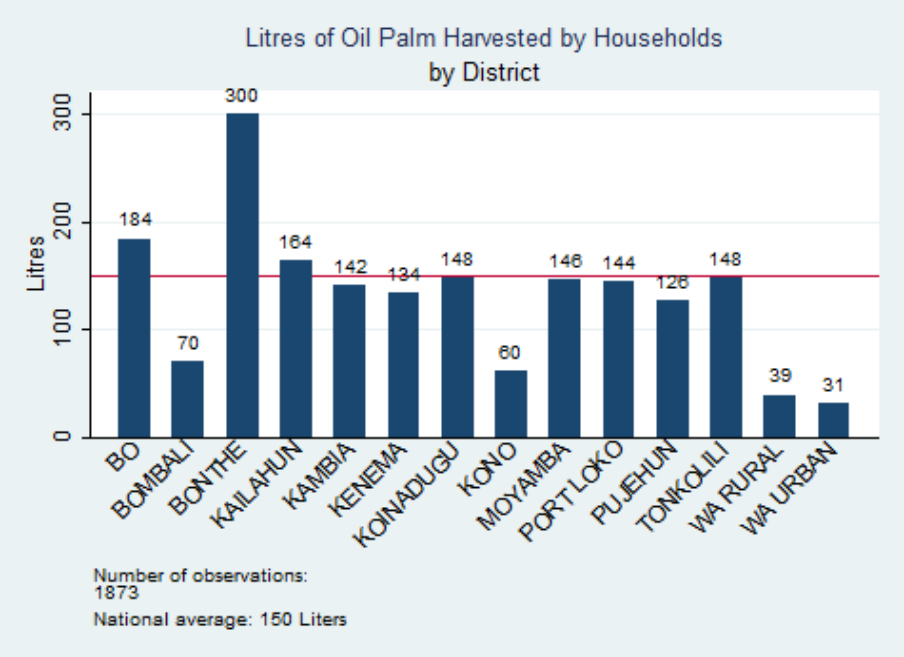


Oil palm cultivation is prevalent in most districts, and in Kailahun, Bo and Kenema in particular. Kono, Moyamba and Western Area have the lowest proportion of households cultivating oil palm. For 34% of farms, households reported that they did not know the number of trees.

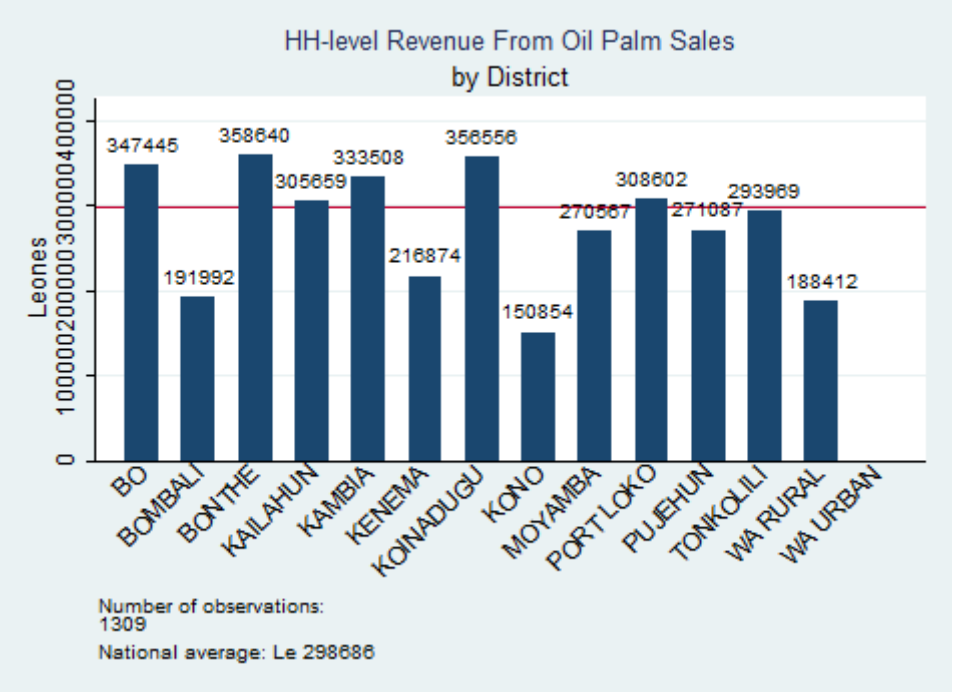
Farmers reported practicing mixed cropping on 36% of their farms. The main crops mixed with oil palm were mango, pineapple and kola nut.



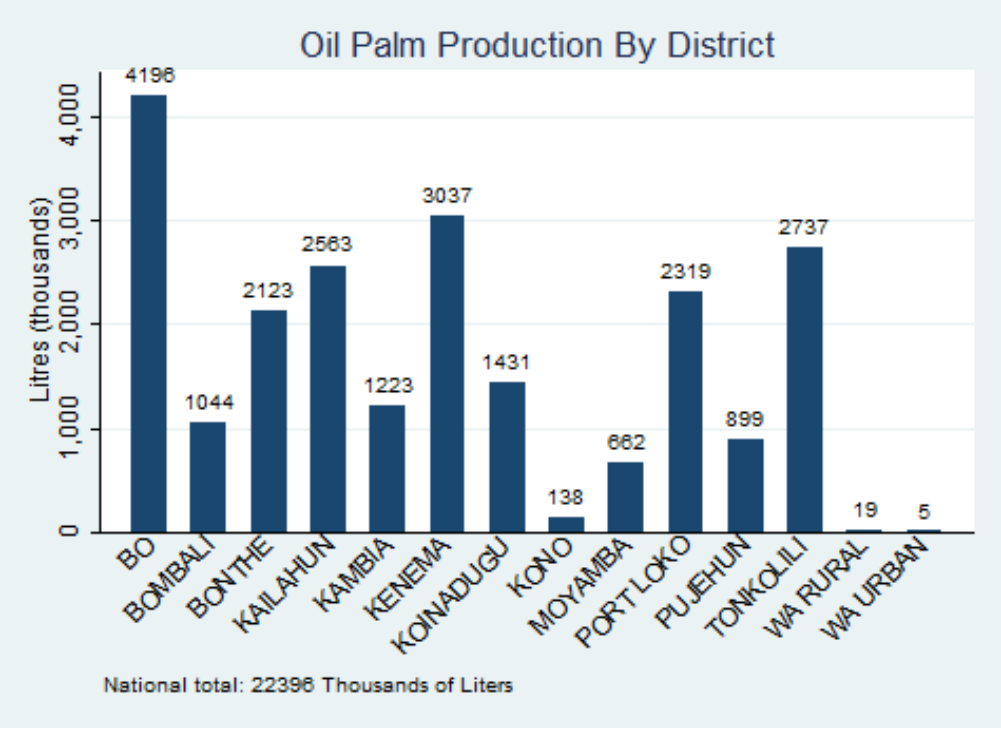
Turning to harvest, the average production of oil palm per oil-palm producing household was 150 litres. However, households in Bonthe reported production significantly greater than the national average. Households in Bombali, Kono and the Western Area reported the lowest average production.



Turning to revenue, households in Bonthe reported the highest earnings from sales of oil palm, which matches the higher household level production reported by these households. The lowest earnings were reported in Kono, Moyamba, Bombali and the Western Area.



National production of oil palm was slightly below 22 million liters. Production was highest in Bo and Kenema. While Bonthe reported high household revenues, Bonthe farmers contributed less than many other districts to total oil palm production in Sierra Leone.



5.2 Commercial Activities of Farmers

The AHTS collected a wealth of data on how much farmers interacted with markets, either through sales of their crops or through the purchases of seeds and inputs. This section reports on these parts of the AHTS.

5.2.1 Sales of food crops

The first way to illustrate sales of crops from the AHTS data is to use the measures in the crop inventory. Respondent households were asked what proportion of their total harvest had been sold for each crop. The answer was conditional on having harvested the crop in the past 12 months.

What % of the harvest of the following core food crops was sold?					
Maize	None	56%	**Sweet potato**	None	46%
	Small Amount	23%		Small Amount	23%
	Approx. Half	9%		Approx. Half	13%
	Most	12%		Most	16%
	All	1%		All	2%
Cassava	None	53%	**Groundnut**	None	42%
	Small Amount	23%		Small Amount	27%
	Approx. Half	7%		Approx. Half	13%
	Most	14%		Most	15%
	All	3%		All	3%

For most core crops there seems to be an even split between households that sold some of their harvest and households that did not sell any. Interestingly, of households that did sell, the most common response that they had only sold a "small amount" of their harvest.

Overall, therefore, while sales of these core crops are not insignificant, cultivation appears to be geared more towards self-cultivation than sales, at least for these core crops.

Eighteen percent of households who harvested groundnuts have sold most or all of their harvest, and almost one third of households (31%) sold one half of the harvest or more. The percentages of households selling most or all of their harvest of maize, cassava and sweet potato are 13%, 17% and 18%, respectively.

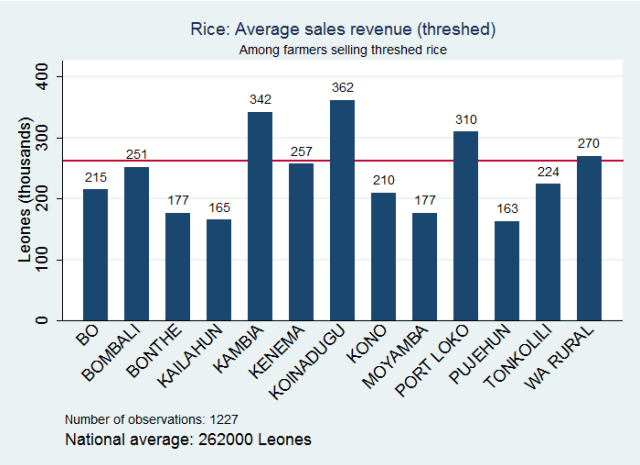
As the table below shows, a similar picture emerges for the food crops that are not considered core crops in the AHTS:

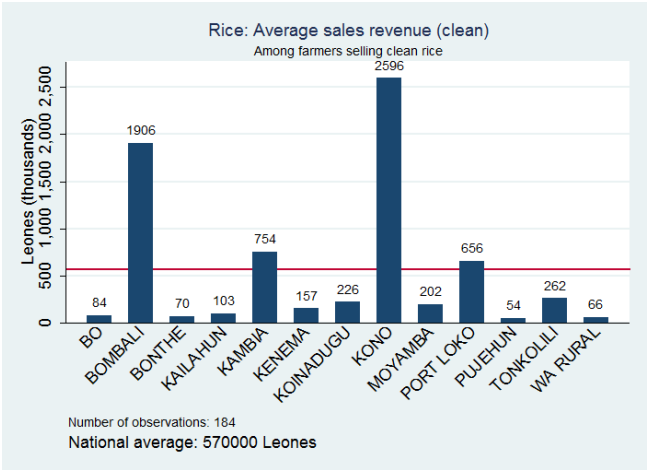
What % of the harvest of the following food crops was sold?					
Sorghum	None	85%	**Broad beans**	None	76%
	Small Amount	8%		Small Amount	14%
	Approx. Half	3%		Approx. Half	5%
	Most	3%		Most	5%
	All	0%		All	1%
Yam	None	73%	**Pepper**	None	46%
	Small Amount	15%		Small Amount	22%
	Approx. Half	5%		Approx. Half	10%
	Most	6%		Most	19%
	All	0%		All	3%
Okra	None	58%	**Mango**	None	77%
	Small Amount	23%		Small Amount	11%
	Approx. Half	7%		Approx. Half	7%
	Most	10%		Most	4%
	All	1%		All	0%
Bennie	None	63%	**Banana**	None	51%
	Small Amount	18%		Small Amount	26%
	Approx. Half	8%		Approx. Half	11%
	Most	10%		Most	11%
	All	2%		All	1%

Most other crops cultivated are grown primarily for self-consumption. This is the case particularly for sorghum (for which 85% of households have sold none of their harvest), yam (73%) and broad beans (76%). However, a significant number of households engage in marketing of pepper: 22% of farming households have sold most or all of their harvest.

5.2.2 Rice Sales and Buyers

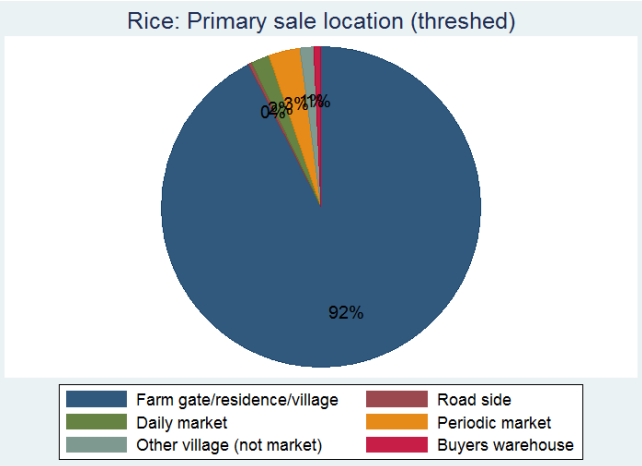
The AHTS also allows a better understanding of how farmers interact with markets in the case of rice and how important rice sales and revenue are. The average revenue per household, the main buyer type and the location of the biggest sale are reported separately for clean rice and for threshed rice. There are too few observations on the sales of unthreshed rice so those are not reported here.

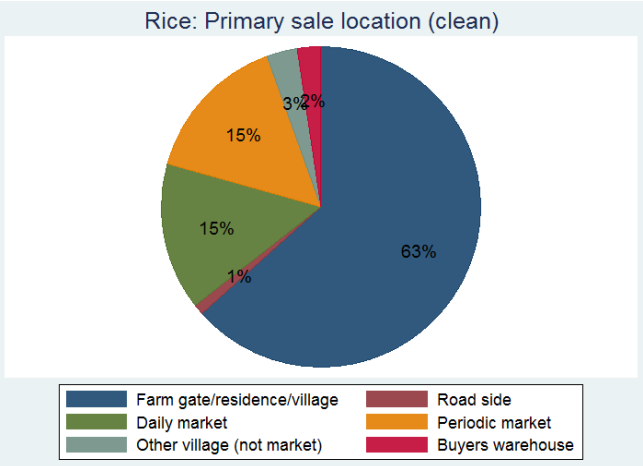




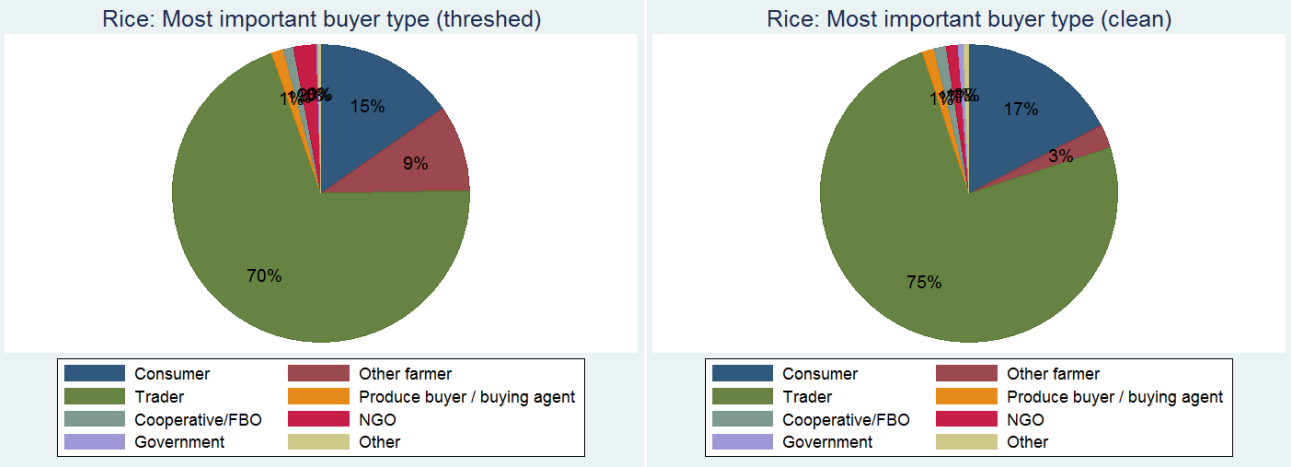
The graphs above report the average revenue per household from sales of threshed and clean rice separately (conditional on selling each type of rice).

The highest sales for threshed rice are found in Koinadugu, Kambia, Port Loko and Western Area Rural. The highest sales for clean rice are in Kono, Bombali, Kambia and Port Loko. Note that there are very few households that sell clean rice (a total of 184 in the graph above, with between 5 and 20 observations per district).





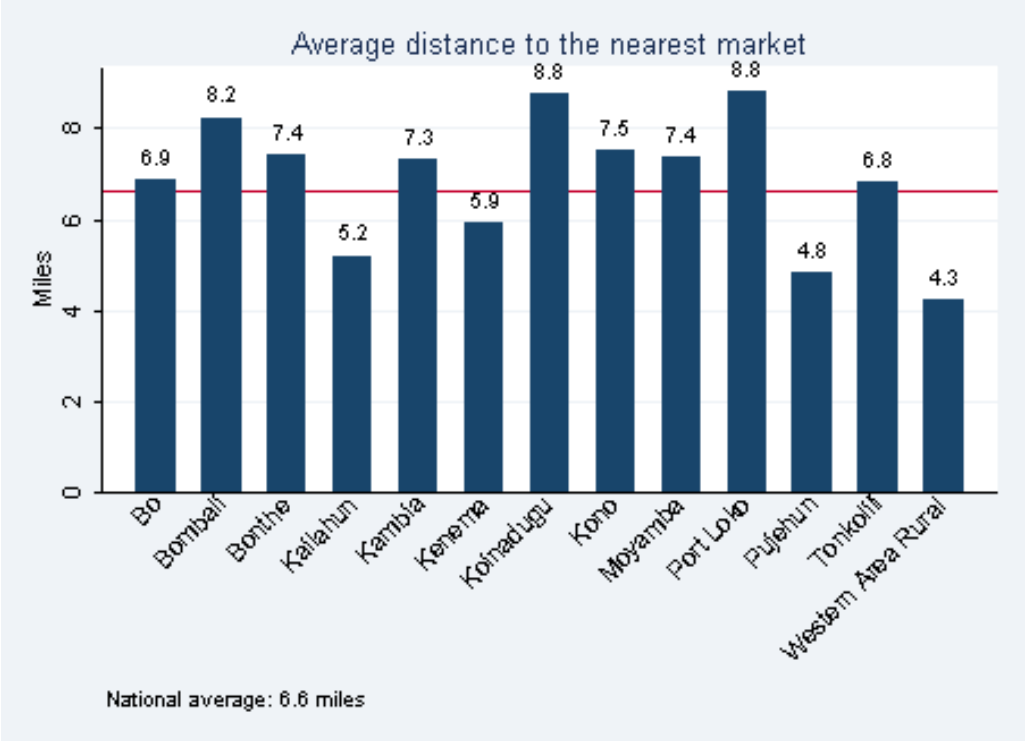
The predominant primary sale location for threshed rice is at the farm gate (92%), which is the case for clean rice as well. However, in the case of clean rice, there are a number of households where sales happen in the daily market (15%) as well as in the periodic market (also 15%). Once again, note that there are many fewer observations for the sales of clean rice than for threshed rice.



Looking at the most important buyer types for threshed rice, the most prevalent are traders, followed by consumers. The same is true for clean rice.

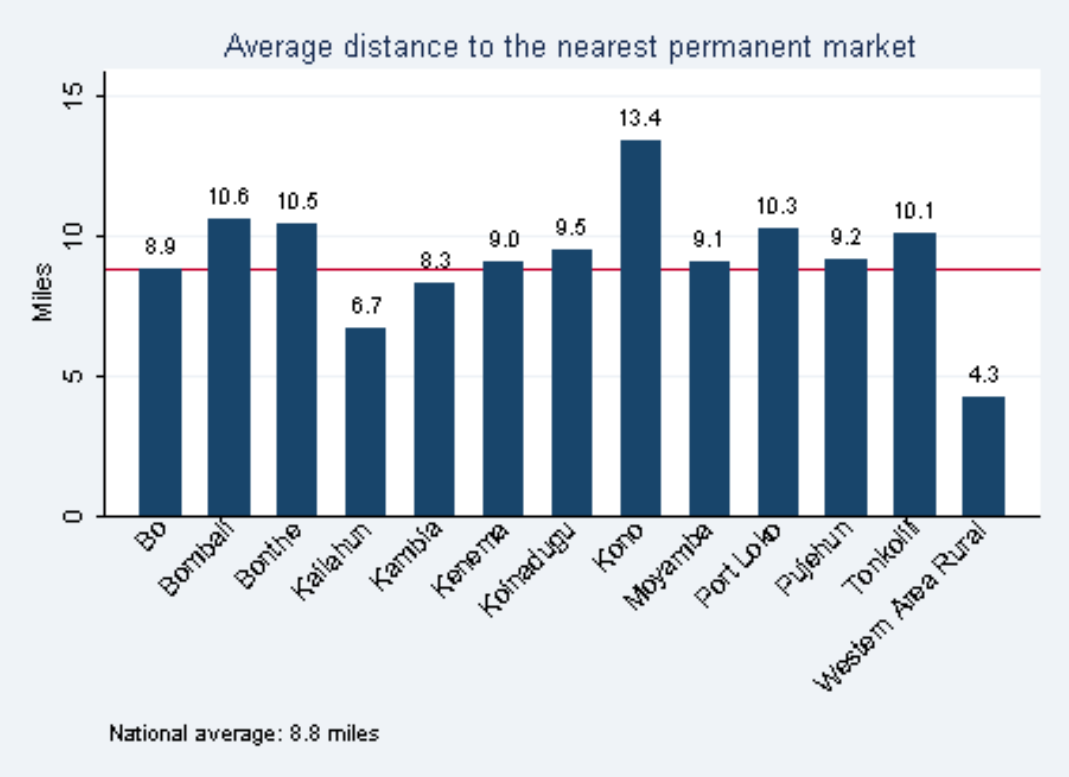
5.2.3 Access to Markets

The AHTS community survey also collected data relevant to describing the access of households to markets. In particular the AHTS community survey asked what the distance from the community was to the closest market. Nationally, the average distance was about 6.6 miles. However, there was variation in this across districts, with communities Pujehun and WA Rural being on average less than 5 miles from the closest market and those in Koinadugu and Port Loko being, on average, almost 9 miles away.



Communities were also asked how far the closest permanent market was. Here, the national average was about 8.8 miles (almost a third further than any other market). As expected, the

communities in WA Rural are closest to a permanent market, with those in Kono, by far, the furthest. Communities in other districts are mostly about 10 miles from the nearest permanent market.



6. Other Agricultural Services and Infrastructure

6.1. Access to Services

The services section of the AHTS contains detailed information on access to all types of agricultural services at the level of the household, including training and extension services, farmer field schools (FFS), financial services (access to credit), relevant agricultural infrastructure, in particular, drying and storage facilities. In addition, the community survey collected data on the agricultural infrastructure available at the community. This section reports on these data.

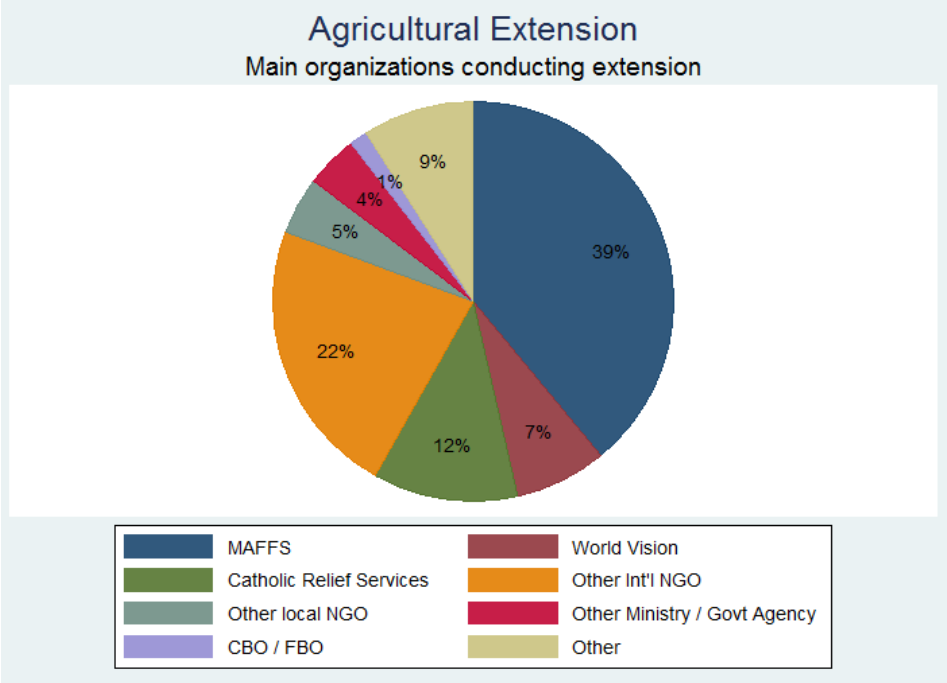
6.1.1 Training and extension

Respondent households were asked about three different types of access to information: whether they had spoken to an extension officer; whether they had attended a workshop in agriculture; and whether one or more of the household members had been a member of a farmer field school (FFS).

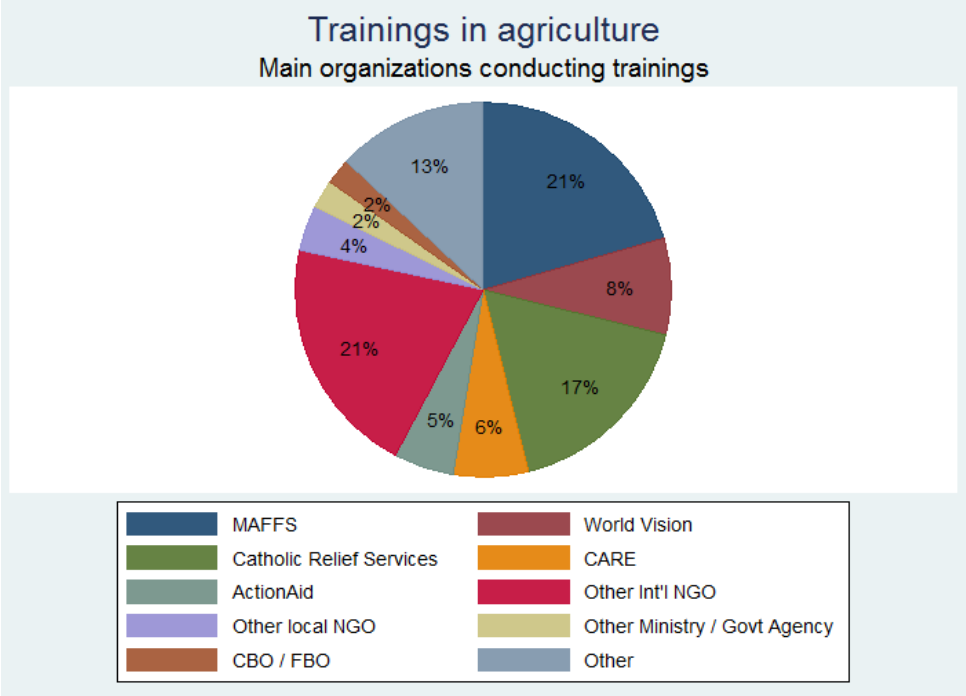
District	In the past 12 months, have you or anyone in your household spoken with any agricultural extension officer?	Have you or anyone in your household attended any training/workshop in agriculture?	Have you or anyone in your household been a member of a Farmer Field School?
BO	24%	6%	3%
BOMBALI	21%	11%	2%
BONTHE	8%	3%	4%
KAILAHUN	31%	19%	15%
KAMBIA	21%	4%	2%
KENEMA	10%	3%	4%
KOINADUGU	16%	8%	14%
KONO	21%	11%	13%
MOYAMBA	12%	5%	2%
PORT LOKO	11%	3%	1%
PUJEHUN	26%	6%	5%
TONKOLILI	25%	7%	8%
WA RURAL	9%	7%	2%
WA URBAN	3%	1%	1%
NATIONAL	18%	7%	6%

Extension officers are the most frequently cited source of agricultural information, with 18% of farming households having spoken to an extension officer in the past 12 months. This number varies from 8% in Bonthe to 31% in Kailahun. When asked which organization the extension

officer belonged to, the majority of respondents cited MAFFS (39%) while international NGOs (World Vision, CRS) were also frequently cited.

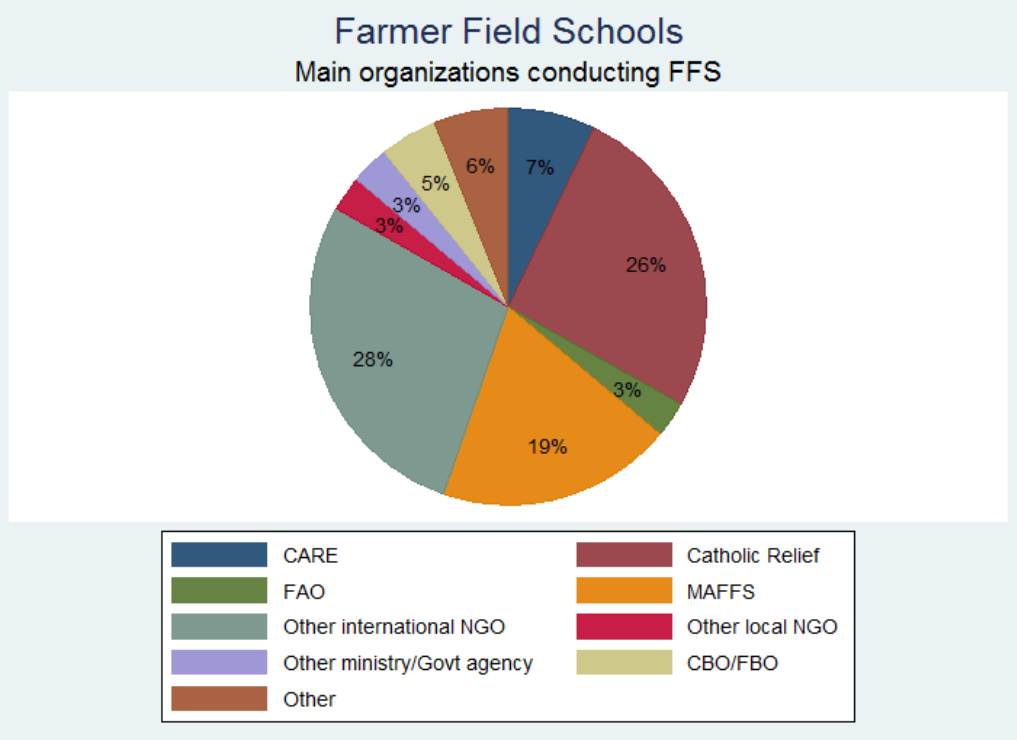


The percentages of households having attended any training or a workshop on agriculture were, unsurprisingly, smaller, averaging 7% nationally and varying from 3% in Bonthe, Port Loko and Kenema to 19% in Kailahun. When asked which organizations conducted this training, respondents cited a number of different agencies, including by order of importance MAFFS (21%), Catholic Relief Services (17%), ActionAid (13%) and World Vision (8%). In total international NGOs represented 57% of organizations conducting agricultural trainings.



Disparities across districts are also important with regard to farmer field schools (FFS). Kailahun (15%), Koinadugu (14%) and Kono (13%) had the largest proportions of farmers who had been a member of a farmer field school (FFS) in the past month, while this percentage was lowest in Bombali, Kambia, Moyamba and the Western Area Rural (2%), and Port Loko (1%).

The organizations organizing the largest numbers of FFS include Catholic Relief Services (26%) and MAFFS (19%). International NGOs accounted together for the majority of organizations conducting FFS (64%).



Overall, it is clear that MAFFS plays a very strong role in providing farmers access to relevant agricultural information as well as in organizing the venues for farmers to access this information. This is particularly notable given the low density of population compared to other countries and the weak transport infrastructure.

Disaggregating the access to services across the eight AHTS core crops reveals interesting patterns.

Access to extension and information services is relatively homogenous amongst households cultivating food crops (rice, cassava, sweet potato, groundnut and maize). However, there is a greater proportion of households reporting access to extension, training and FFS amongst those cultivating tree/cash crops. Thus, about one quarter of the subset of farmers cultivating cacao, coffee and/or oil palm reported having spoken to an extension officer.

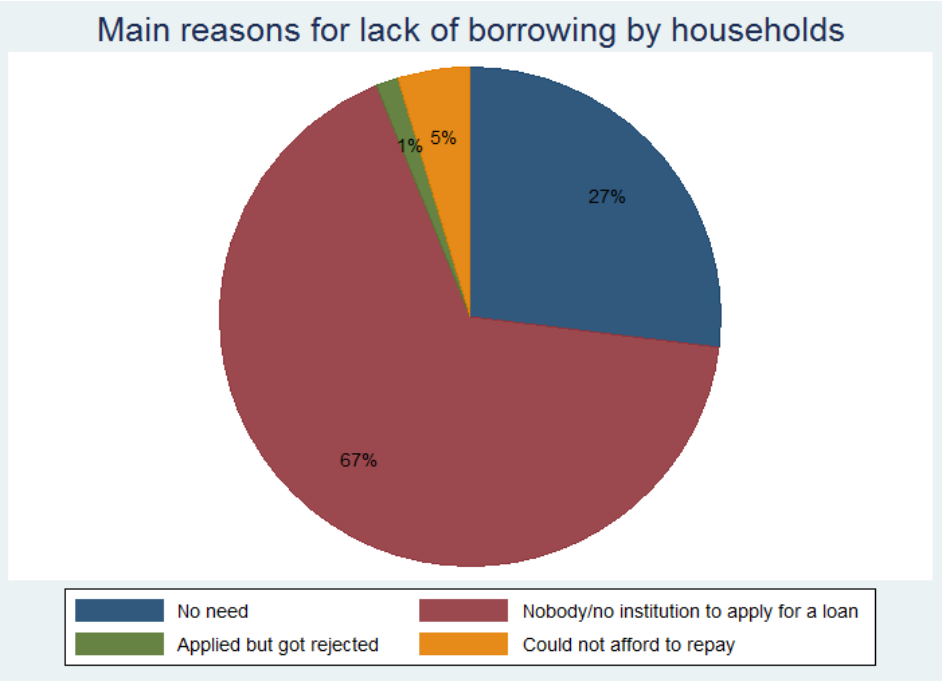
Households cultivating…	In the past 12 months, have you or anyone in your household spoken with any agricultural extension officer?	Have you or anyone in your household attended any training/workshop in agriculture?	Have you or anyone in your household been a member of a Farmer Field School?
Rice	20%	8%	7%
Cassava	19%	8%	6%
Sweet potato	20%	8%	7%
Groundnut	20%	8%	6%
Maize	19%	7%	6%
Cacao	25%	13%	12%
Coffee	24%	12%	12%
Oil palm	24%	9%	8%

6.1.2 Access to agricultural credit

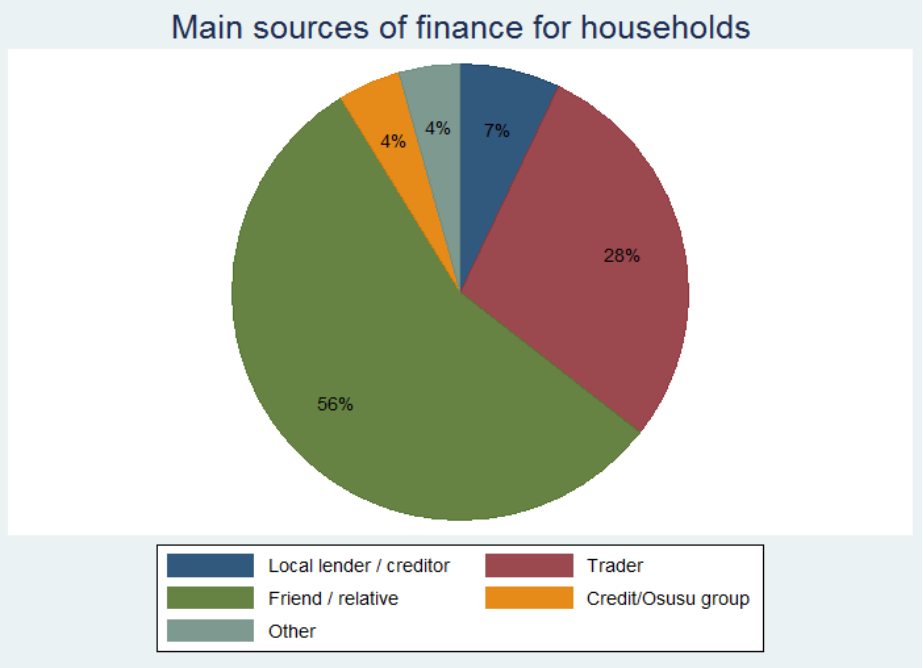
Agricultural credit can play an important role in improving rural livelihoods. As part of the AHTS survey, households were asked whether they had borrowed money for any agricultural purpose in the past 12 months. The number of positive responses averaged 51% nationally, with the highest percentages recorded in Kambia (73%), Koinadugu (70%), Moyamba (67%) and Kailahun (67%).

District	Did you or any member of the household borrow money for <u>any agricultural purpose</u> in the past 12 months?
BO	54%
BOMBALI	41%
BONTHE	39%
KAILAHUN	67%
KAMBIA	73%
KENEMA	46%
KOINADUGU	70%
KONO	31%
MOYAMBA	67%
PORT LOKO	57%
PUJEHUN	32%
TONKOLILI	44%
WA RURAL	16%
WA URBAN	5%
NATIONAL	51%

The absence of borrowing within one half of the farming population is the consequence of supply and demand factors, with the former clearly playing a very important role in Sierra Leone. For example, of 3,966 farmers who gave reasons why they did not borrow money, 67% answered they had nobody/ no institution to apply to. On the demand side, 27% responded they did not need to borrow.

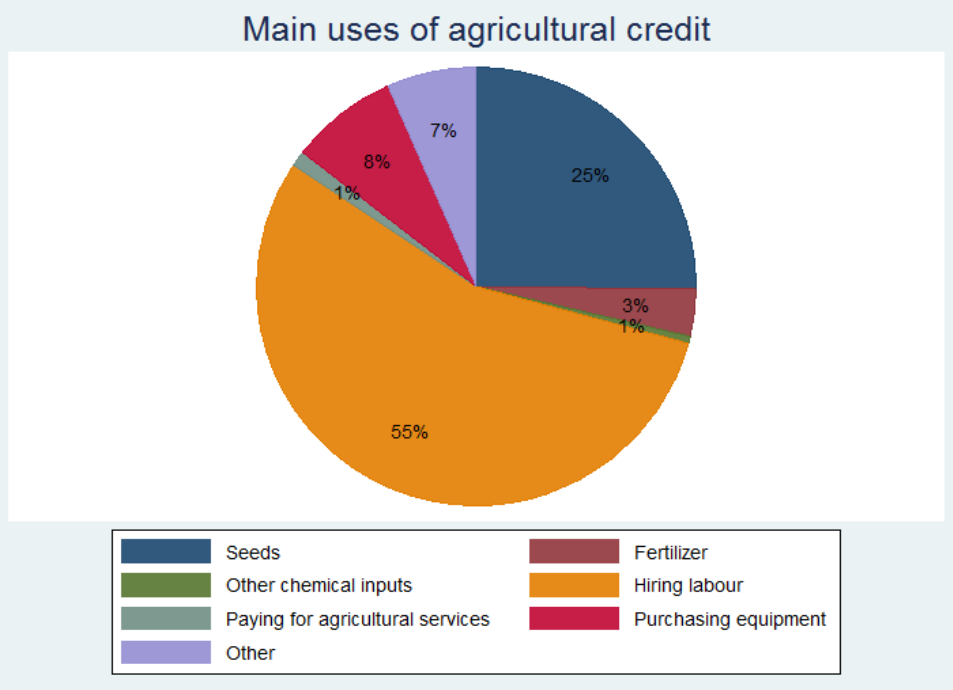


Amongst those who had borrowed money in the past 12 months, 4,009 respondents named the organization(s) from which they had received credit. In the majority of cases (56%) the lender was a friend or relative. The analysis of responses confirms the scarcity of lending through the formal credit market.



As depicted in the graph below, agricultural credit was mostly used to hire agricultural labor (55%). Based on preliminary analysis of other sections of the questionnaire, it seems that most of these labor activities are allocated to the rice farms with the bulk of expenditure going to land preparation, planting and harvesting.

Other frequent uses of credit include purchasing seeds (25%) and equipment (8%). The importance of borrowing for purchasing seeds implies that a sizeable number of farmers are unable to keep their seeds for the subsequent planting season - this resonates with the food security results from above.



Respondent households were also asked whether they were members of a credit/savings (Osusu) group. Northern districts such Kambia (50%) Port Loko (46%) had the largest shares of positive responses.

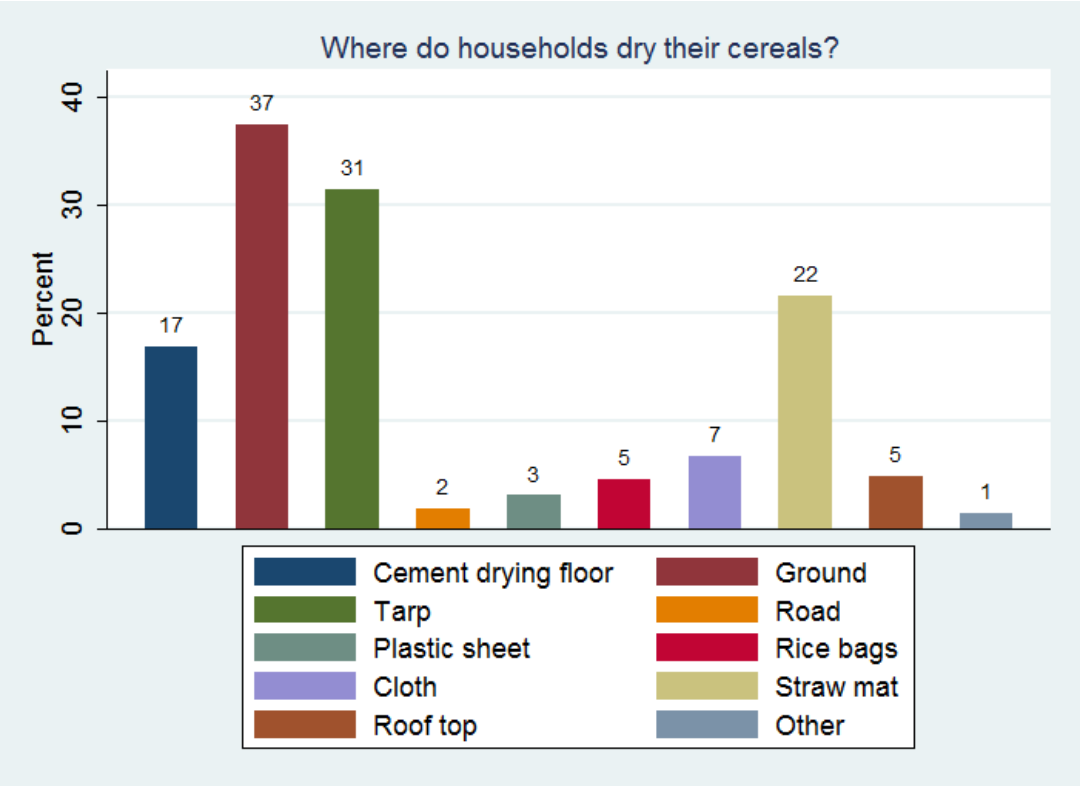
District	Is anyone in this household a member of a credit/savings group?
BO	31%
BOMBALI	23%
BONTHE	18%
KAILAHUN	34%
KAMBIA	50%
KENEMA	35%
KOINADUGU	38%
KONO	11%
MOYAMBA	18%
PORT LOKO	46%

PUJEHUN	20%
TONKOLILI	21%
WA RURAL	17%
WA URBAN	23%
NATIONAL	30%

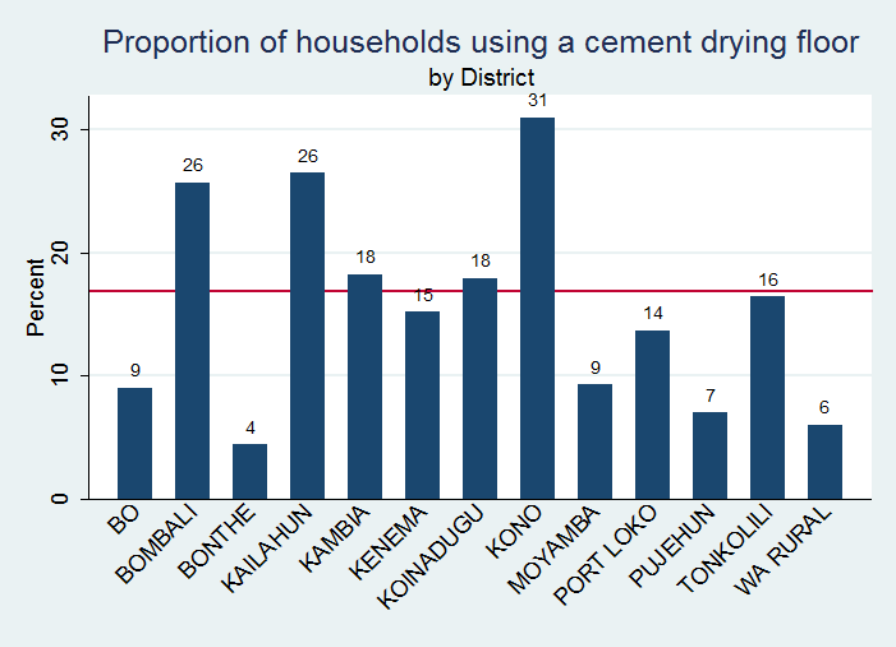
6.1.3 Infrastructure I: Drying facilities for cereals

A large number of households harvesting cereals (7,265) provided information on where they dry their cereals.

The responses most frequently given were a tarp (used by 31% of the farmers harvesting cereals), a straw mat (22%), the ground (37%), and a cement floor (17%).

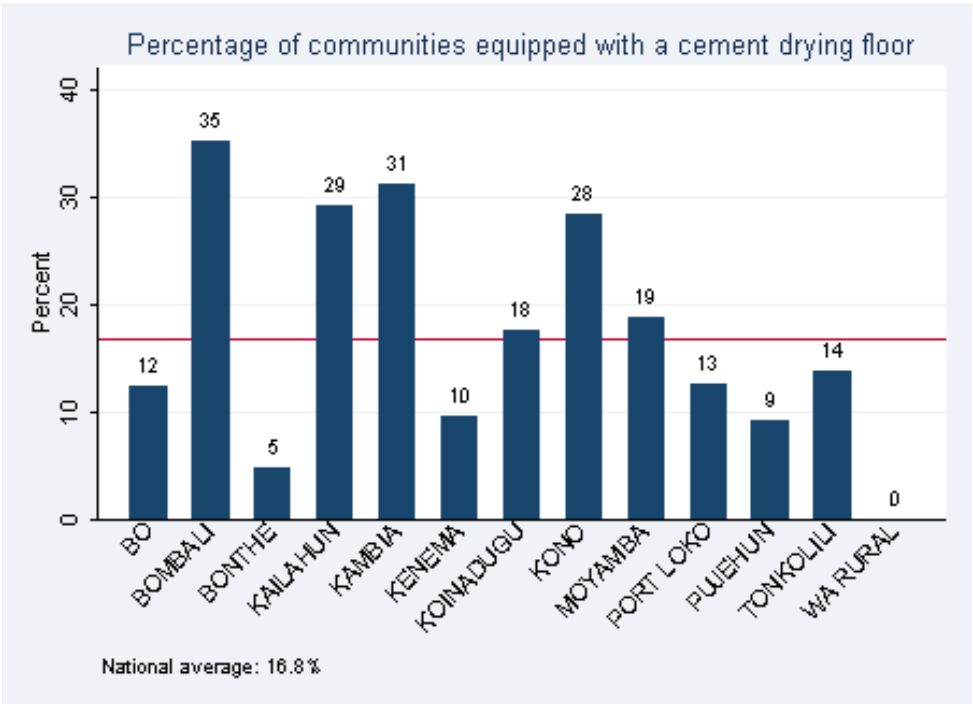


There is a lot of variation across districts in the proportion of households (of the subset of 7,265 AHTS households farmers who have harvested cereals and reported a drying space) that use a cement drying floor to dry their cereals. Cement drying floors are considered the best drying space for farmers.

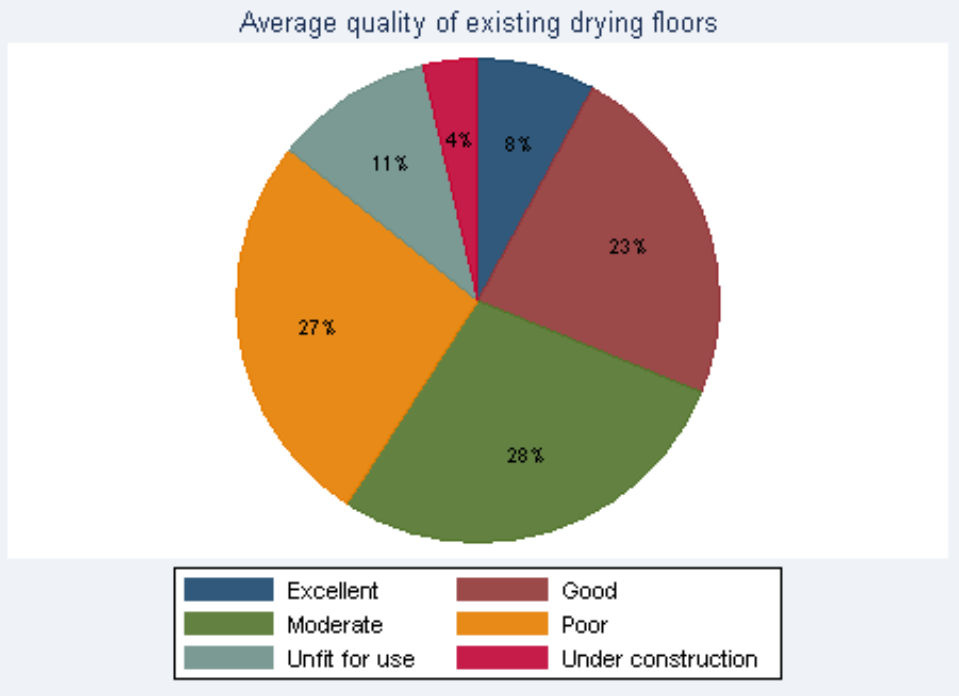


The use of a cement floor amongst farmers harvesting cereals is highest in Kono (31%), Kailahun (26%), and Bombali (26%). Conversely Bonthe (4%), WA-Rural (6%), Pujehun (7%) Bo (9%) and Moyamba (9%) all have the percentages less than 10%. Bonthe and Pujehun cereals farmers overwhelmingly use a straw mat as drying space, with percentages of 46% and 50% respectively. Cereals in Moyamba are most often dried on the ground (50%).

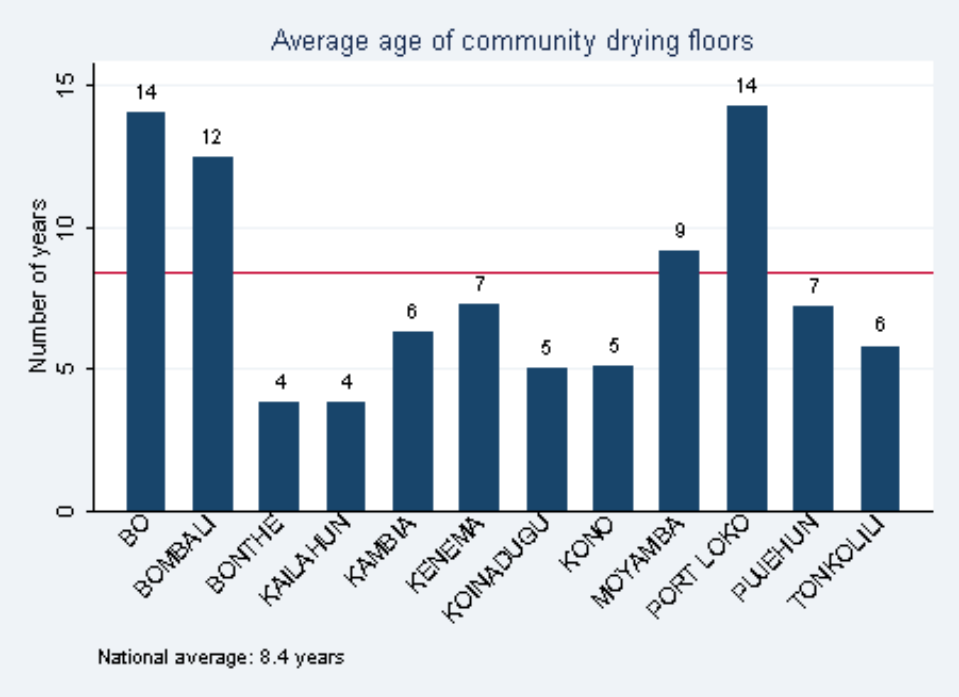
The community survey provides data on whether there were community level drying facilities available to households. Overall, about 17% of communities had an available cement drying floor. Across districts, this fraction varied from 5% or less in WA Rural and Bonthe to over 30% in Bombali and Kambia, with Kailahun and Kono not far behind.



The community surveys also tried to ascertain the quality of the existing community level drying floors. On average, only 8% of communities reported excellent facilities. However, about 23% reported good facilities and 28% moderate. A large number of communities (38%) still reported facilities that were poor in quality or unfit for use.

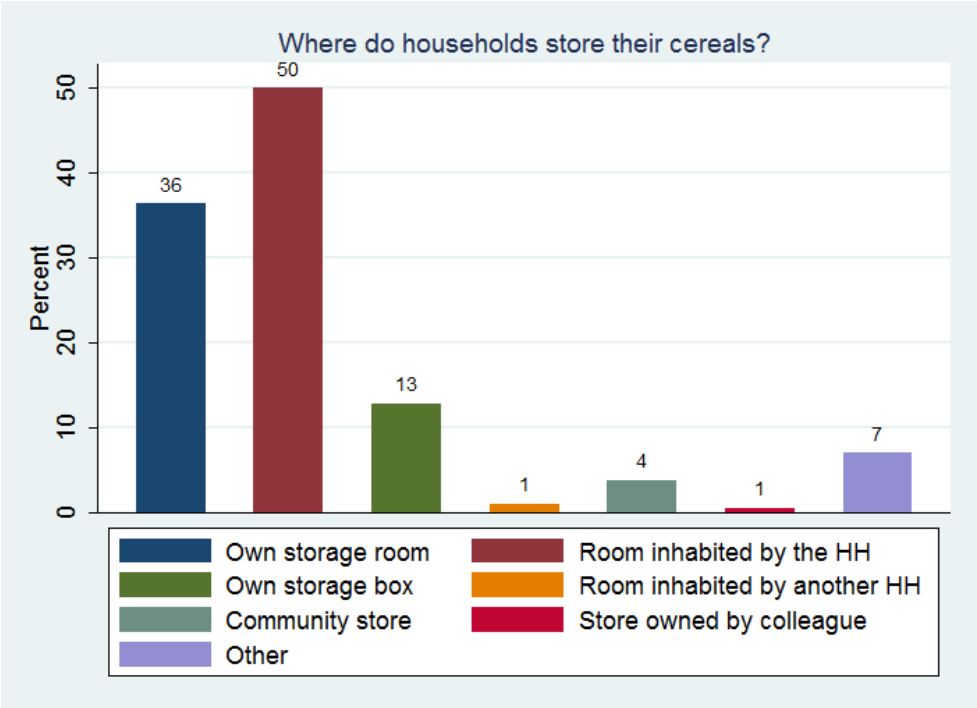


Looking at the age of the available community drying floors, the communities in a number of districts had relatively new facilities that were on average 5 years old or less (Bonthe, Kono, Kailahun and Koinadugu). However, the facilities in communities in Bo, Bombali and Port Loko were extremely old, on average between 12 and 14 years old.

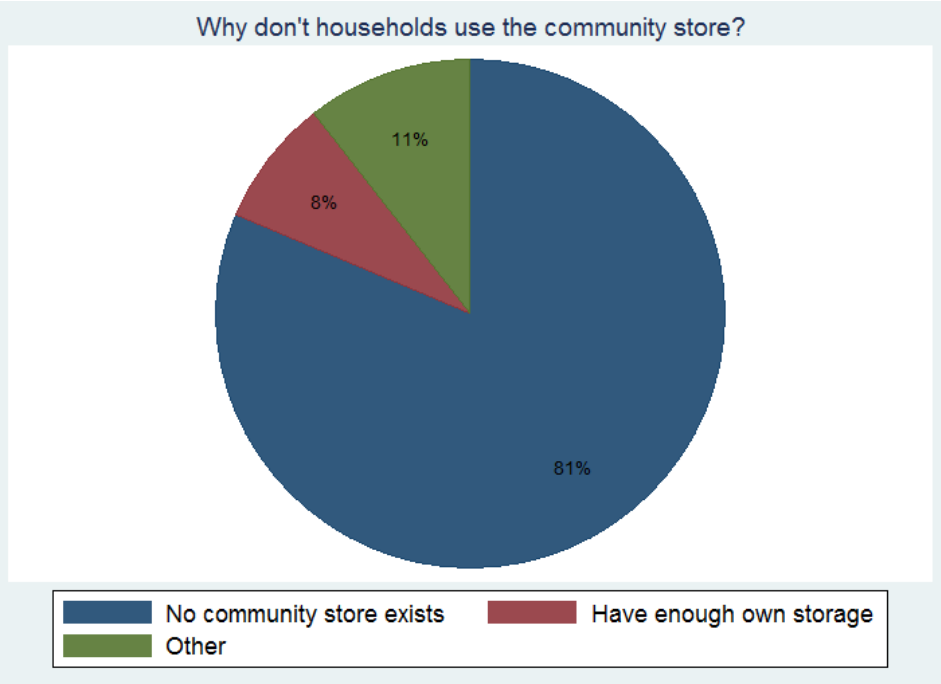


6.1.4 Infrastructure II: Storage facilities

The farmers harvesting cereals were asked what type of storage space they had been using during the past 12 months: 50% of farmers harvesting cereals stored their cereals in a room inhabited by the household and 36% used a private storage room.



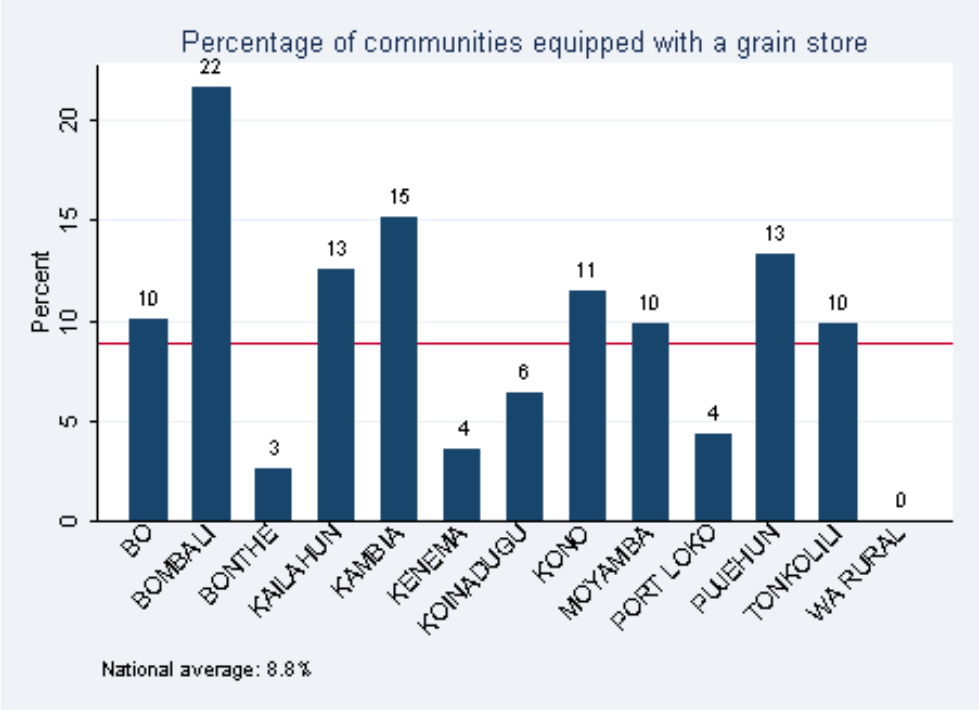
The results seem to illustrate a lack of use of community or cooperative facilities for storage: 4% of farmers have used a community store (below we report on the availability of such community facilities from the AHTS community survey).



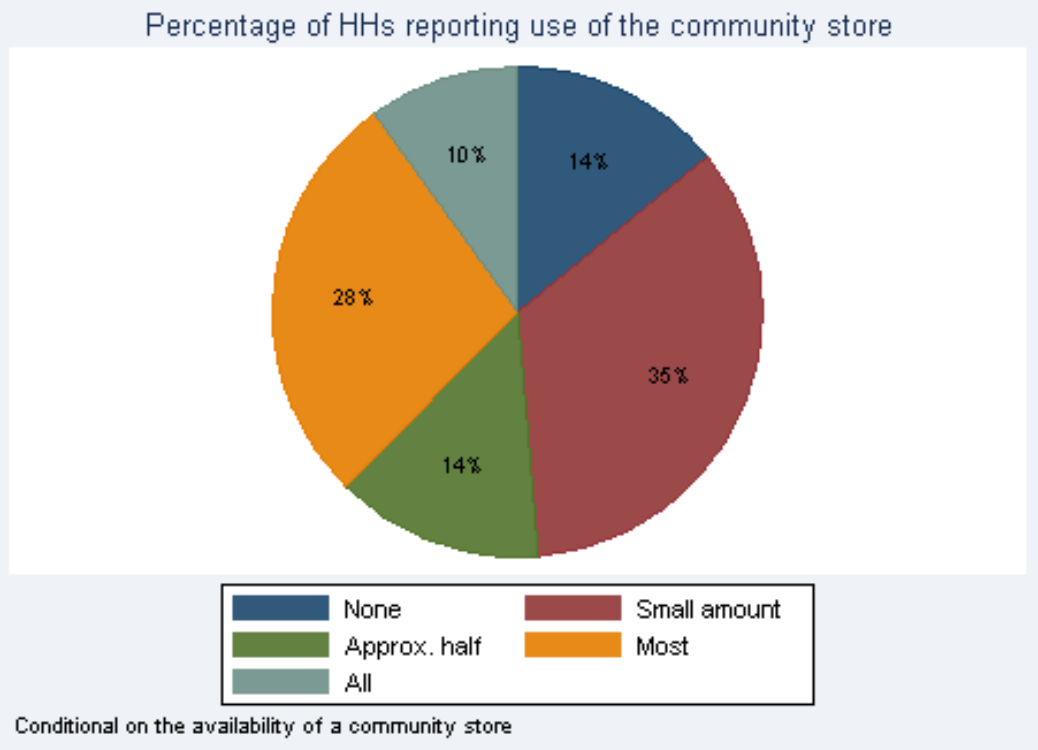
The main reason why households say they do not use a community store is a lack of supply: the overwhelming majority of farmers (81% out of 6711 respondents) responded that no community store existed; while only 8% responded they had enough private storage space. A small number of farmers responded that the community store was full or poor quality (1%), that they were worried about theft (2%) or that they did not want others to see how much they harvested (1%).

Looking at the community data, nationally, just under 9% of communities report having a community grain store. However, this varies dramatically across districts.

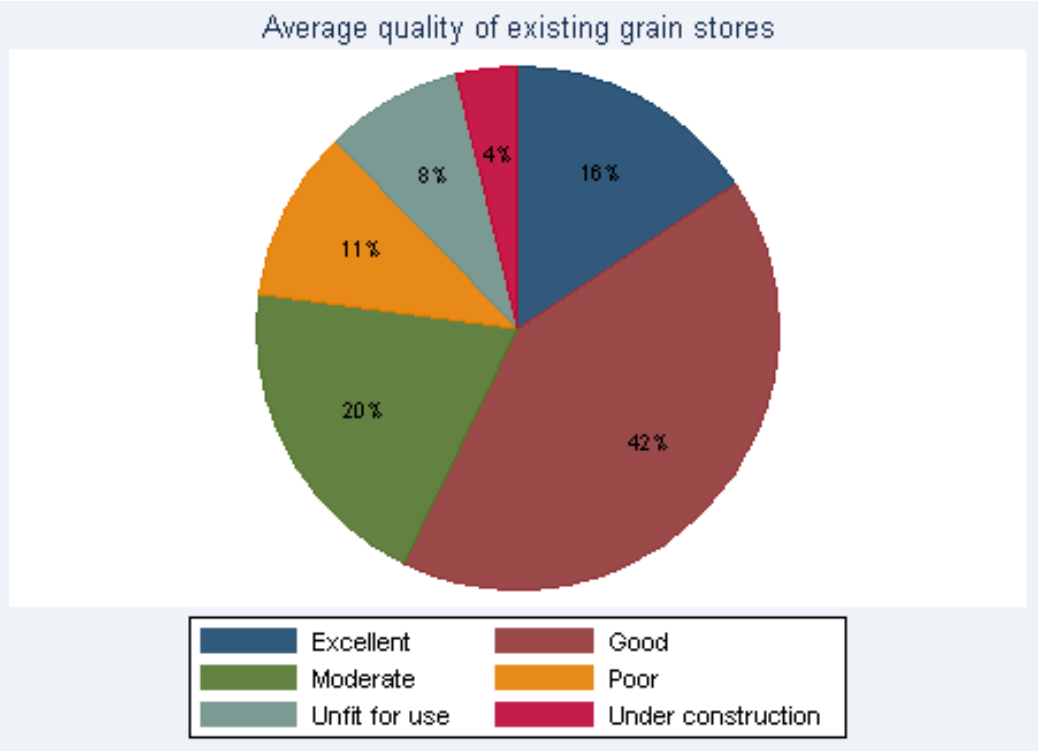
In Bombali, as many as 22% of communities report having a grain store. The access to grain stores is also particularly good in Kambia, Kailahun, Kono and Pujehun (all above 10%). However, there is very poor access to community level grain stores in Bonthe (only 3%), Kenema (4%), Port Loko (4%) and WA Rural (0%).



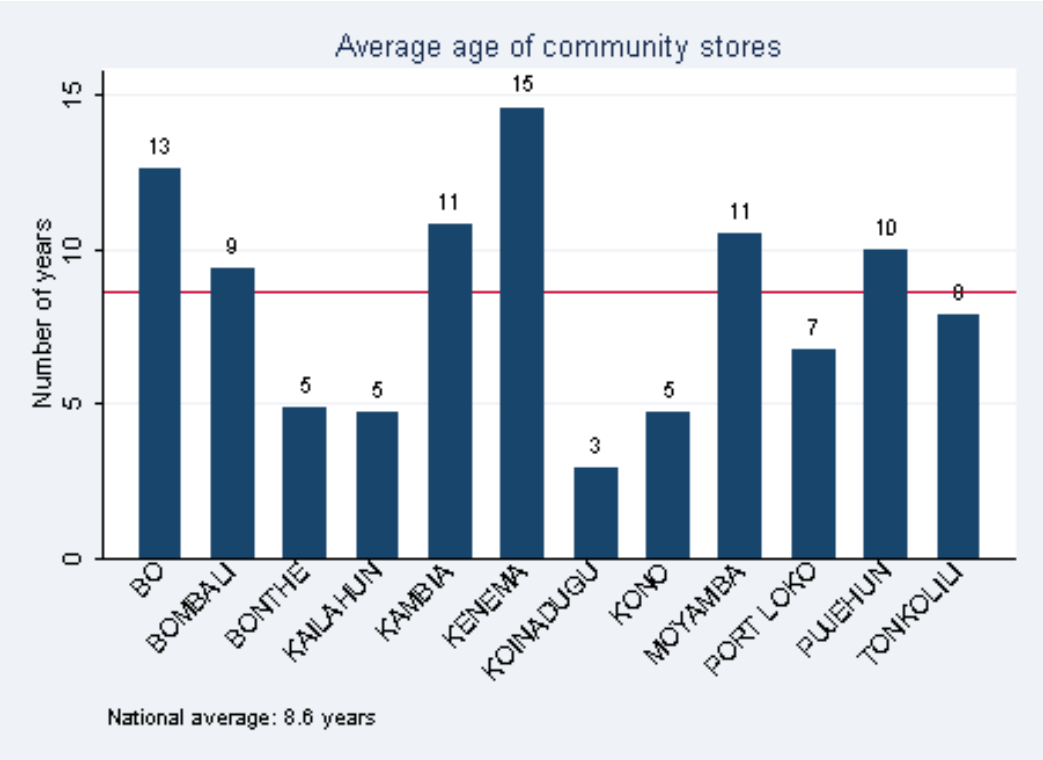
Conditional on the availability of a community grain store, respondents to the community survey reported what fraction of households in that community used the storage. In about 35% of these communities, only a small number of households used the storage. However, in about 38% of the communities, the community stores were used by most or all the households. In a total of 14% of communities the storage facilities were not used by any households.



The community survey also ascertained the quality of the community grain stores. About 16% of communities reported having excellent grains stores. However, 42% of stores were good and an addition 20% moderate. Only a total of 19% of households in communities with stores reported poor quality grain stores or stores that were unfit for use.



Looking at the average age of these community stores as a second measure of their quality, it appears that the stores in Bonthe, Kailahun, Koinadugu and Kono are relatively new (all are five years old or less, on average). However, those in Kenema, Kambia, Bo and Moyamba are relatively old (all are more than 10 years old, on average).

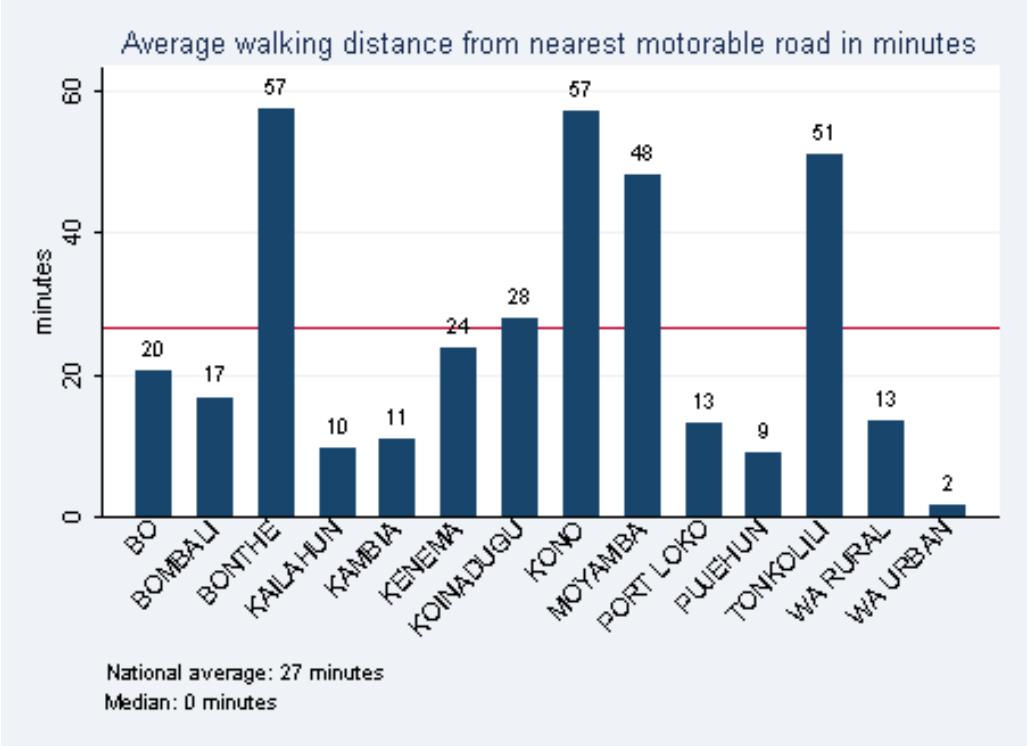


6.1.5 Other Infrastructure

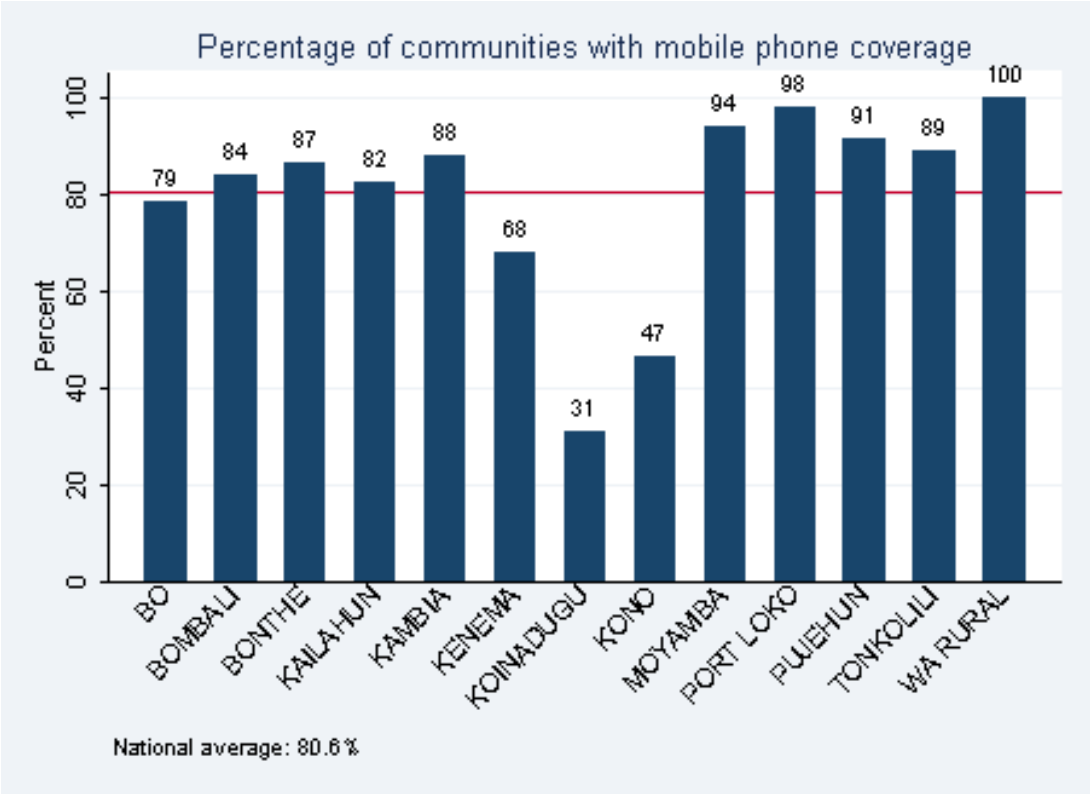
As final measures of infrastructure, the listing data that was collected to enable sampling for the AHTS, asked respondents how far the communities were from the nearest motorable road.

On average, nationally, communities were about a 27 minute walk from a motorable road.

This varied a lot across districts, ranging from as low as around 10 minutes (in Pujehun, Kailahun and Kambia) to as high as almost an hour (in Bonthe, Kono and Tonkolili). However, across the country the median for the walking distance to the nearest motorable place was zero. Sixty-seven percent of communities were listed as fully motorable during the dry season; 25% reported a walking distance to a motorable place equal or more than 30 minutes.



Looking at mobile phones, about 80% of communities reported having coverage in their communities. There is less variation in this, except for Koinadugu and Kono where less than half the communities reported having mobile phone coverage. Almost all communities in WA Rural and Port Loko reported having coverage.

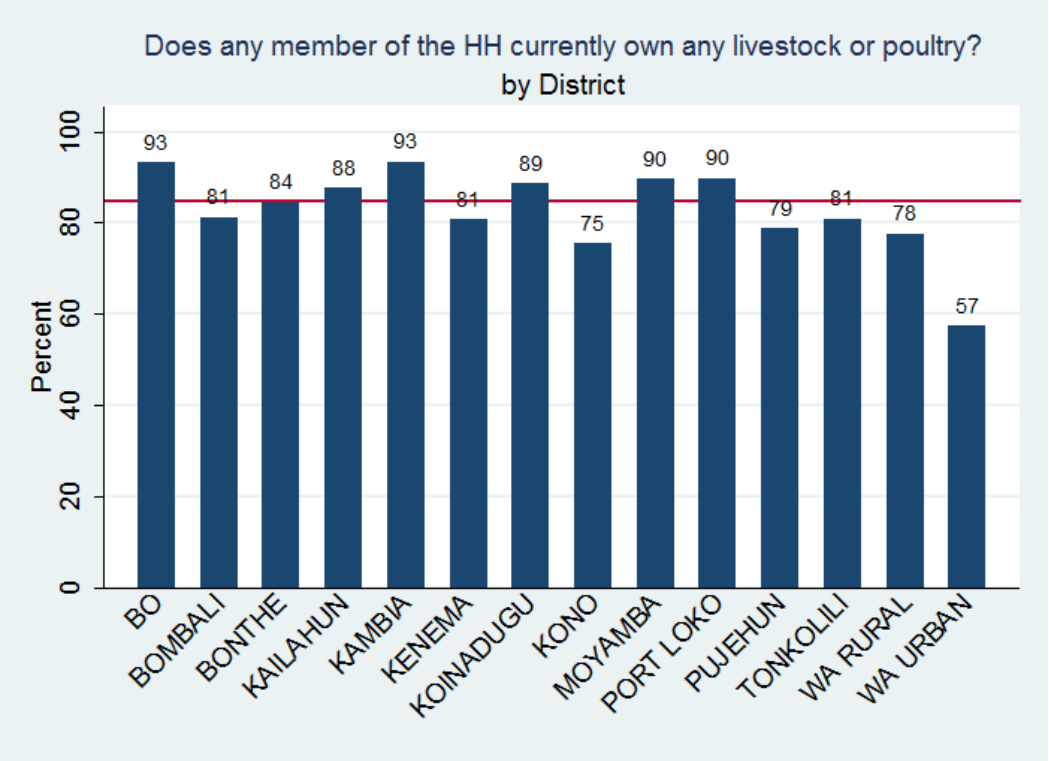


6.2. Livestock and Poultry

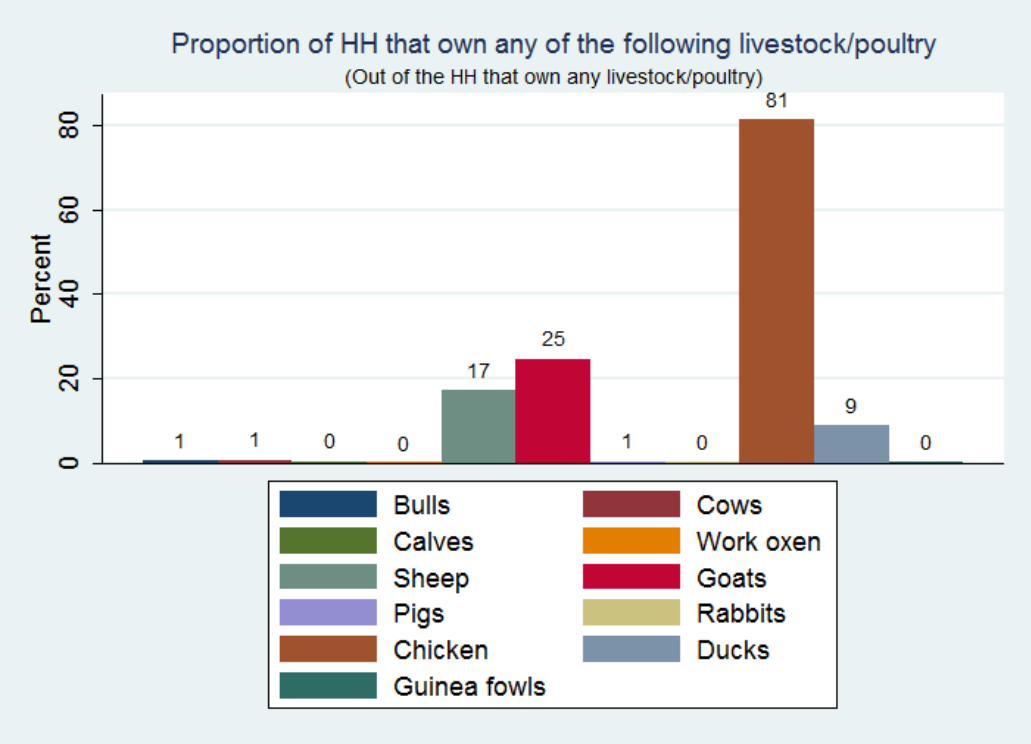
This section of the AHTS provides information on farming households' ownership of livestock and poultry as well as their access to veterinary services.

9.1.6 Household ownership of livestock and poultry

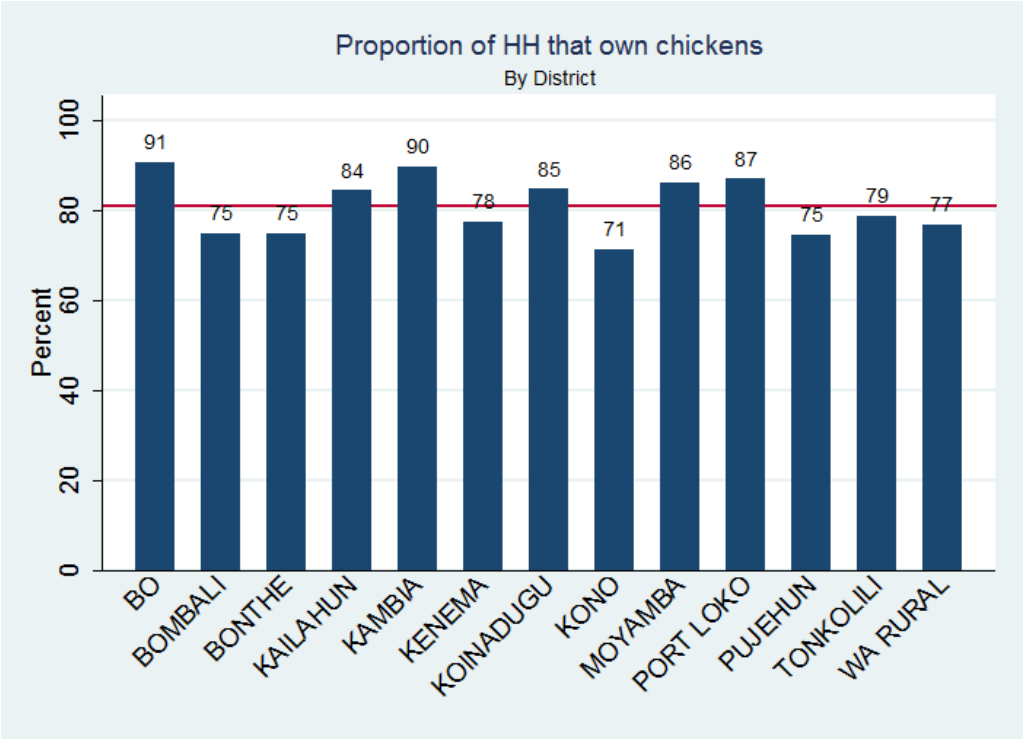
The majority of households (85% is the national average) are livestock or poultry owners. This is true across districts: even in Western Area Urban over 50% of households own livestock or poultry. The districts with the highest rates of ownership of livestock or poultry were Bo and Kambia, with Moyamba and Port Loko not far behind (the rates of ownership were at least 90% in these districts).



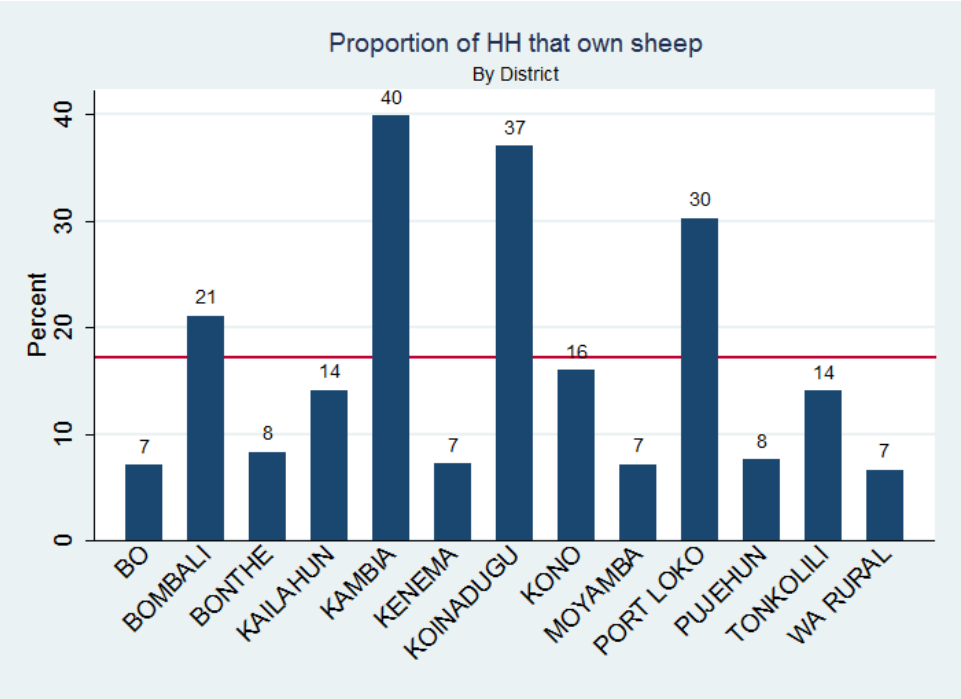
The majority of households are chicken owners: 81% of farming households nationwide own at least one chicken. At a national level, other commonly owned animals are goats (owned by 25% of households), sheep (17%) and ducks (9%). Other livestock and poultry are not owned by a high percentage of farming households nationally. For example, bulls and cows are only owned by about 1% of households nationally, and the same applies to pigs. The rates of ownership of calves, work oxen, rabbits and guinea fowls are much less than 1%.



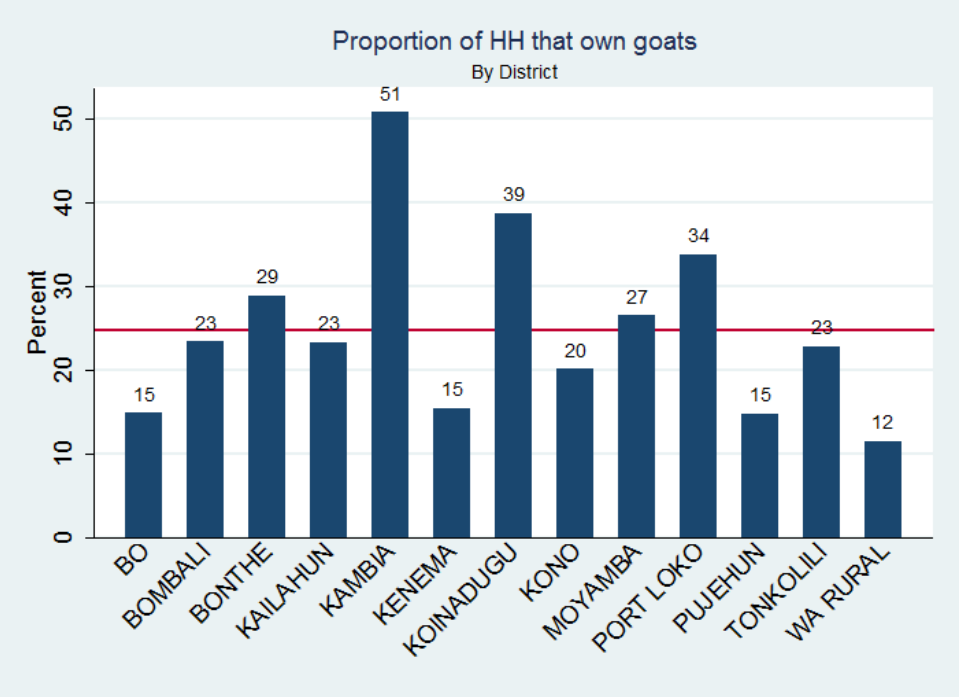
As shown above, chickens are owned by over 70% of farming households in all districts except for Western Area Urban. Bo and Kambia have the highest proportion of chicken ownership.



Sheep ownership varies considerably by district, ranging from 7% of households in Bo, Kenema, Moyamba, and Western Area Rural to 40% of households in Kambia and 37% in Koinadugu.

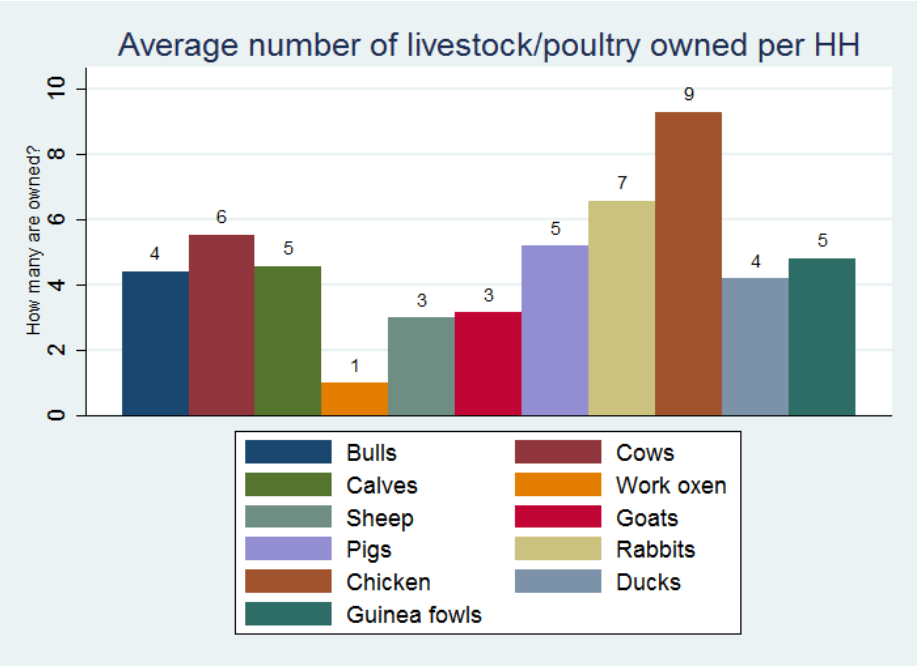


Kambia is also the district with the highest proportion of households owning goats (51% of households). Koinadugu (39%) and Port Loko (34%) also fare well on goat ownership. In Western Area Rural, Bo, Kenema and Pujehun, only 12-15% of households own goats.



9.1.7 Number of Livestock/poultry owned by households

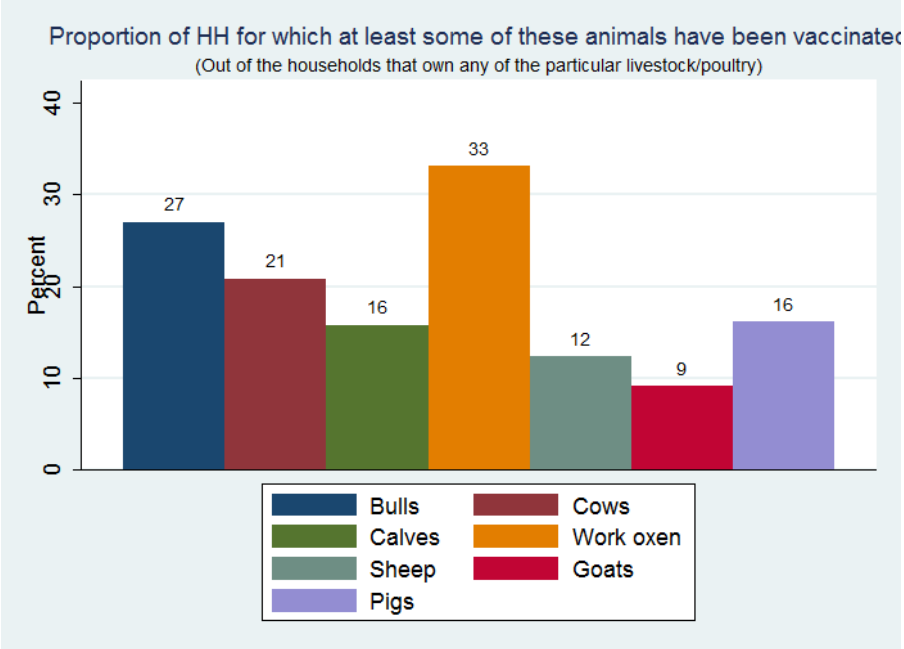
The figure below shows the national average number of animals owned by households. Note these figures only include households that own at least one of the particular livestock/poultry reported.



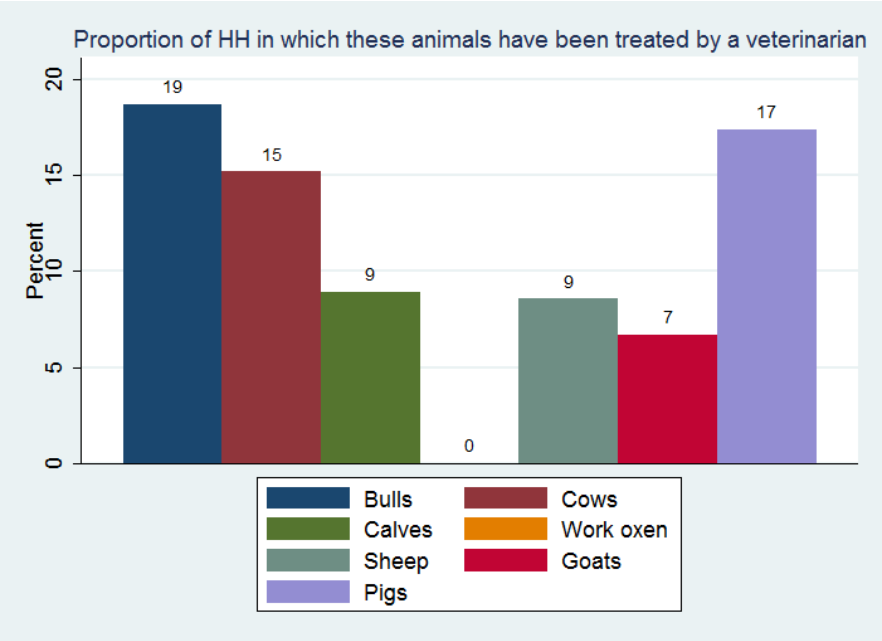
Households that own chickens have on average 9 chickens, for example, while the 0.7% of households that own bulls, own an average of 4 bulls.

9.1.8 Vaccinations and Veterinary Services

Households which owned animals were asked if any of these animals had been vaccinated.



Bulls are the animals most likely to have been vaccinated: 27% of households said that at least one of their bulls had been vaccinated. Note that while work oxen are the most likely to be vaccinated, there are only three in total owned in the entire AHTS sample. Cows, calves and pigs were all vaccinated by at least 15% of households. Goats were the least likely to have been vaccinated by households.



Similarly, about 19% of households that own bulls had at least one of their bulls treated by a veterinarian. About 17% of the households owning pigs and bulls had them treated by a veterinarian, 15% for cows.

7. District Crop Profiles

This section reports the district level crop profiles. The tables below display results on the percent of households cultivating each crop disaggregated at the district level. A brief agricultural portrait of each district can be drawn based on this data.

Bo

Of all districts, Bo appears to be the one where cultivation is the most diversified across crops. Bo has close to 90% of households cultivating each of the three core food crops (rice, cassava, maize) and is also engaged in cash crop production on a rather large scale (26% of households have cultivated cacao and 25% coffee, and 56% have cultivated oil palm). In addition, Bo has large proportions of households engaged in yam, pepper, broad beans, and okra cultivation (all above 70%).

Bombali

Bombali has the highest share of households involved in the cultivation of groundnut (74%) and is also involved in the cultivation of sweet potato (45%) on a fairly large scale. Thirty-nine percent of farming households in the district have cultivated oil palm. Sorghum, pepper and mango are also cultivated by a percentage of households higher than the national average.

Bonthe

The particularity of Bonthe stems from the relatively small proportion of households cultivating rice (44%), while cassava was by far the most important crop grown by households (96%) and the most important staple from a food security angle (cf. the food security section). However, this may be partly due to the flooding of the district in 2009 which led many households to lose a large share of their rice harvest.[5] Half of the farming population has cultivated oil palm (50%), a lot higher than the national average. Bonthe farmers also cultivate fruits (mango, banana) on a large scale (more than 50% of households).

Kailahun

Kailahun has the highest share of farmers engaging in the cultivation of cash crops: 69% have cultivated coffee, 78% have cultivated cacao and 57% have cultivated oil palm. Yam and broad beans are also cultivated by the majority of households (55% and 57% respectively). Concomitantly the share of farmers cultivating maize, cassava and sweet potato are lower than the national average.

Kambia

As expected, Kambia appears amongst the major "rice districts" with 95% of farming households engaged in rice cultivation. Kambia also has the highest proportion of farmers

[5] Households which cultivated rice but lost it before harvesting will, however, be reported as having cultivated rice under the AHTS definition of cultivation (engaging in agricultural activity of any kind).

cultivating sweet potato (62%). Pepper and fruits (mango, banana) are cultivated by a percentage of households higher than the national average.

Kenema

Together with Kailahun and Kono, Kenema is one of the major cash crops districts (about half of households cultivate coffee, cacao and oil palm) but it is also heavily involved in the cultivation of maize (75% of households), sorghum (64%), yam (65%) and broad beans (74%).

Koinadugu

Koinadugu farmers are heavily involved in the cultivation of core food crops. Rice, maize, sweet potato and groundnut are cultivated respectively by 93%, 75%, 47% and 69% of the farming population – all significantly above the national average. Koinadugu also has a significant share of farmers engaged in oil palm (37%) and coffee (18%) cultivation.

Kono

Kono is the third main cash crop district, although oil palm cultivation takes place on a much smaller scale than in other districts (14% of farmers). 56% and 47% of households cultivate coffee and cacao respectively. In addition, Kono comes second after Bo in terms of the percentage of households cultivating banana (66%).

Moyamba

Together with Bo and Bonthe, Moyamba is amongst the most important districts for cassava with 90% of farmers engaged in the cultivation of the crop. The proportion of farmers cultivating maize (78%) and sorghum (62%) are much higher than the national average.

Port Loko

Port Loko has a large proportion of the population involved in agriculture for each of the five major food crops. Sweet potato in particular is cultivated by 61% of households – the second highest percentage nationally. Mango and banana are also cultivated on a large scale (59% and 56% respectively).

Pujehun

Pujehun is trailing Kailahun, Kenema and Kono with regard to the proportion of farmers cultivating cash crops: 24%, 19% and 42% of the farming population have cultivated coffee, cacao and oil palm respectively. Pujehun is also an important district with regard to cultivation of cassava (89%).

Tonkolili

Tonkolili is the only district in the north with a large share of households involved in oil palm cultivation (48%). It also has the largest share of households growing rice (98%), implying that

virtually all farming households grow rice in the district. The percentage of farmers growing sorghum, broad beans and bennie are above the national average.

Western Area Rural

Western Area Rural has the lowest percentage of rice-farming households amongst rural districts (37%), while other food crops (cassava, groundnut, maize and sweet potato) are widely cultivated.

Western Area Urban

Due to its peculiar characteristics for agriculture, Western Area Urban displays patterns differing widely from the rest of the country. Freetown farmers are mostly involved in the cultivation of maize (66%), groundnut (32%), okra (70%) and mango (44%).

Cultivation of the AHTS core crops by district								
	Rice	**Maize**	**Cassava**	**Sweet potato**	**Groundnut**	**Coffee**	**Cacao**	**Oil palm**
BO	90%	89%	91%	25%	32%	25%	26%	56%
BOMBALI	91%	46%	69%	45%	74%	1%	1%	39%
BONTHE	44%	26%	96%	16%	15%	2%	1%	50%
KAILAHUN	94%	68%	70%	30%	45%	69%	78%	57%
KAMBIA	95%	44%	74%	62%	48%	0%	0%	40%
KENEMA	92%	75%	81%	29%	47%	50%	52%	54%
KOINADUGU	93%	75%	61%	47%	69%	18%	5%	37%
KONO	92%	66%	72%	39%	36%	56%	47%	14%
MOYAMBA	89%	78%	90%	26%	38%	3%	1%	18%
PORT LOKO	83%	71%	84%	61%	62%	1%	0%	37%
PUJEHUN	89%	47%	86%	27%	27%	24%	19%	42%
TONKOLILI	98%	74%	86%	34%	62%	5%	3%	48%
WA RURAL	37%	59%	63%	60%	53%	0%	1%	6%
WA URBAN	2%	66%	14%	18%	32%	0%	0%	2%
NATIONAL	87%	67%	78%	38%	49%	21%	20%	40%

Cultivation of non-core crops by district								
	Sorghum	Yam	Broad beans	Pepper	Okra	Bennie	Mango	Banana
BO	65%	71%	82%	82%	89%	70%	59%	70%
BOMBALI	53%	29%	28%	72%	61%	45%	52%	44%
BONTHE	8%	17%	37%	50%	49%	20%	54%	52%
KAILAHUN	19%	55%	57%	80%	71%	47%	12%	47%
KAMBIA	44%	31%	9%	75%	67%	41%	64%	58%
KENEMA	64%	65%	74%	70%	79%	65%	25%	57%
KOINADUGU	57%	27%	17%	73%	69%	33%	25%	44%
KONO	22%	45%	48%	64%	67%	26%	42%	66%
MOYAMBA	62%	42%	50%	55%	64%	65%	31%	41%
PORT LOKO	49%	27%	31%	72%	71%	53%	59%	56%
PUJEHUN	42%	41%	46%	58%	58%	37%	24%	37%
TONKOLILI	70%	29%	52%	66%	72%	63%	30%	39%
WA RURAL	15%	17%	13%	48%	43%	19%	39%	36%
WA URBAN	1%	20%	3%	29%	70%	1%	44%	20%
NATIONAL	48%	41%	45%	69%	70%	49%	40%	50%

8. Conclusions

The AHTS was an agricultural data collection exercise using household surveys in Sierra Leone, a method used across many developing countries, including a number in Africa. As such, the AHTS data offers unique insights into farming households' agricultural and commercial activities, prevailing ecological and crop conditions and the services they access in their communities. AHTS data collection was undertaken in accordance with the research protocol envisioned at the beginning of the survey which in turn were based on international standards. The AHTS Technical Team took steps to address field work issues as they arose – many of which had been anticipated at the onset – and the impact of these issues on the quality and reliability of the final dataset are minimal. This is discussed in more detail in Annex 4 to this report.

The survey results confirm much existing knowledge about agriculture in Sierra Leone – for example, the national importance attached to rice and cassava, the concentration of cacao and coffee in the East of the country, and the existence of a seasonal hungry season. The results also point to various challenges faced by farming households. If these can be addressed, there is potential for large scale improvements across the country. The AHTS results suggest that policy interventions in the agricultural sector should be intensified and expanded.

Fertilizer use, the adoption of improved varieties and the dissemination of better cultivation practices (e.g. through better planting and intercropping practices) can all significantly contribute to an increase in smallholder yields. It is also crucial to build on existing extension and training services and broaden the dissemination of information on seed varieties and improved practices. However, improved access to inputs and financial services will also be important if farmers are to improve their farming practices across a range of areas. In addition, local infrastructure provision such as better drying and storage facilities will increase farmer surpluses; while continued rehabilitation of the national rural roads network will extend access to markets. Such policy directions appear to be promising ways to achieve higher domestic production, self-sufficiency in agriculture and reduced food insecurity for the large population of smallholder farmers in Sierra Leone.

There are limitations to the use of the AHTS data. The AHTS was not designed to capture production by large commercial farms, and it cannot address how agricultural productivity has evolved from previous years to its position in 2010. This is an interesting direction for further data collection exercises. For this reason, the AHTS results do not point to an increase or a decrease in national production and yields. Capturing trends in yields, use of fertilizer and technology, national production, etc., will only be possible during the second round of the Agricultural Household Tracking

Survey, when another survey is conducted using the same methodology (random sampling of farming households) throughout the entire country.

End users of the AHTS dataset should be aware of the information that the survey can uniquely provide. The Government of Sierra Leone and its partners and a number of different NGOs and stakeholders are intensifying their efforts to improve farmers' access to inputs, extension, infrastructure and rural finance. In this context the AHTS is particularly well suited to helping researchers and policy makers understand the conditions farmers in Sierra Leone face and the decisions they make throughout the entire production process. It also highlights the need for continued surveys of this type to monitor the trends as the Government and others invest in the sector.

9. Annexes

9.1 Annex 1: Additional Means and Standard Deviations

9.1.1 National-Level Household Figures

Rice	Mean	Standard Deviation
Household Harvest (kg)	696.62	1012.33
Yield (kg per acre)	196.15	198.15
Seed Quantity (bushels)	3.90	3.78
Seeding Rate (bushels per acre)	1.07	0.64
Fertilizer used on rice (kg)	4.06	19.73
Fertilizer used on rice (kg) among farmers using fertilizer	70.82	71.08
Fertilizer used on rice per acre (kg) among farmers using fertilizer	17.01	17.07

Cassava	Mean	Standard Deviation
Farm Size (acres)	2.78	2.22
Total Planting (bundles)	13.83	15.50
Household Harvest (kg)	1525.07	2390.75
Yield (kg) per acre	789.52	1342.03
Cost of Bundle	5542.78	21462.16

Sweet Potato	Mean	Standard Deviation
Household Harvest for Sweet Potato Producers (kg)	333.44	480.20
Yield (kg) per 50 kg rice bag of vines planted	195.03	358.72

Maize	Mean	Standard Deviation
Harvest of maize for maize producers in kilograms	82.28	89.39
Maize yield in kilograms of fresh cobs to a cup of kernels planted	21.10	25.45

Oil palm	Mean	Standard Deviation
Harvest of oil palm producers in liters	150.41	242.53
Revenue for households selling oil palm (SLL)	298686	420924

Cacao	Mean	Standard Deviation
Harvest of cacao producers in kilograms	251.66	289.61

Revenue for households selling cacao (SLL)	684910	1011748

Coffee	Mean	Standard Deviation
Harvest of coffee producers in kilograms	168.76	201.51
Revenue for households selling coffee (SLL)	208274	246970

Livestock	Mean	Standard Deviation
Number of chicken owned	9.30	9.06
Number of sheep owned	3.00	2.95
Number of goats owned	3.16	2.91
Number of bulls owned	4.42	7.84
Number of cows owned	5.54	10.28
Number of calves owned	4.58	6.00
Number of pigs owned	5.21	5.39

Community reported prices	Mean	Standard Deviation
Buttercup of unshelled groundnut - highest price (SLL)	1674	4014
Buttercup of unshelled groundnut - lowest price (SLL)	883	1364
Bushel of husk rice - highest price (SLL)	48937	15129
Bushel of husk rice - lowest price (SLL)	28123	10116
Cup of country rice - highest price (SLL)	805	157
Cup of country rice - lowest price (SLL)	507	150
Cup of imported rice - highest price (SLL)	852	171
Cup of imported rice - lowest price (SLL)	703	125
Pint of red oil palm - highest price (SLL)	1684	436
Pint of red oil palm - lowest price (SLL)	917	339
Pint of masankay oil palm - highest price (SLL)	1283	701
Pint of masankay oil palm - lowest price (SLL)	731	433
50kg bag of raw cassava - highest price (SLL)	15442	11557
50kg bag of raw cassava - lowest price (SLL)	10074	7703
Cup of garri - highest price (SLL)	383	169
Cup of garri - lowest price (SLL)	303	319
50kg bag of NPK 15-15-15	60697	84642
50kg bag of urea	50494	77174

Agricultural labour	Mean	Standard Deviation
Daily wage for standard agricultural labour (SLL)	5259	2137
Hourly wage for standard agricultural labour (SLL)	922	494
Daily wage for brushing (SLL)	4330	2936

Hourly wage for brushing (SLL)	929	761
Daily wage for ploughing (SLL)	4416	2999
Hourly wage for ploughing (SLL)	957	756
Daily wage for harrowing/puddling (SLL)	2765	3037
Hourly wage for harrowing/puddling (SLL)	877	695
Daily wage for transplanting (SLL)	3498	3116
Hourly wage for transplanting (SLL)	908	722
Daily wage for harvesting (SLL)	4050	3405
Hourly wage for harvesting (SLL)	939	756
Daily wage for pest control (SLL)	1480	2551
Hourly wage for pest control (SLL)	956	1153

9.1.2 District-Level Household Figures

Rice

	Harvest (kg)	Yield (kg/acre)	Seeding Rate (bushels/acre)	Fertilizer Use (% HH)
BO	733.08 (912.73)	218.87 (199.56)	1.01 (0.36)	0.44 (6.60)
BOMBALI	538.32 (938.71)	184.29 (170.91)	1.07 (0.82)	2.13 (14.44)
BONTHE	267.99 (334.60)	118.28 (105.32)	1.19 (1.30)	0.56 (7.49)
KAILAHUN	853.31 (864.83)	232.05 (190.75)	1.08 (0.56)	-- --
KAMBIA	891.32 (1,139.86)	196.19 (170.18)	1.00 (0.26)	26.75 (44.29)
KENEMA	645.74 (704.45)	180.84 (146.31)	1.04 (0.62)	0.53 (7.25)
KOINADUGU	905.02 (1,097.81)	277.28 (211.74)	1.39 (1.11)	0.76 (8.69)
KONO	777.27 (965.96)	191.21 (190.20)	1.12 (0.49)	0.09 (2.96)
MOYAMBA	569.53 (919.25)	149.23 (142.33)	1.02 (0.81)	2.16 (14.55)
PORT LOKO	723.39 (1,623.40)	162.18 (285.03)	0.95 (0.21)	11.10 (31.43)
PUJEHUN	479.01 (596.25)	167.05 (189.20)	1.01 (0.20)	0.53 (7.28)
TONKOLILI	663.92	214.99	1.08	2.90

	(820.87)	(201.51)	(0.57)	(16.79)
WESTERN AREA RURAL	367.57 (382.60)	149.68 (129.79)	1.30 (0.86)	12.97 (33.91)
WESTERN AREA URBAN	747.55 (639.46)	275.33 (173.48)	2.84 (2.25)	60.78 (59.80)
NATIONAL	**696.62 (1,012.33)**	**196.15 (198.15)**	**1.07 (0.64)**	**4.06 (19.73)**

Cassava

	Farm Size (acres)	Harvest (kg)	Yield (kg/acre)
BO	2.90 (1.99)	1,801.59 (2,845.16)	851.83 (1,204.53)
BOMBALI	2.01 (2.24)	1,279.60 (1,840.56)	1,195.88 (2,155.65)
BONTHE	3.32 (2.21)	1,690.28 (2,006.97)	703.79 (844.92)
KAILAHUN	2.74 (1.90)	1,581.91 (2,430.40)	824.17 (1,437.41)
KAMBIA	2.05 (2.25)	1,707.44 (1,860.00)	1,219.37 (1,548.60)
KENEMA	2.89 (2.29)	1,260.44 (2,044.83)	663.92 (1,383.06)
KOINADUGU	2.62 (1.94)	938.85 (2,214.93)	300.32 (447.02)
KONO	3.47 (2.73)	999.08 (1,248.68)	450.89 (605.53)
MOYAMBA	4.04 (3.19)	1,532.87 (2,870.44)	619.52 (1,623.18)
PORT LOKO	2.92 (2.26)	2,111.13 (3,096.36)	868.27 (1,192.15)
PUJEHUN	2.52 (1.75)	1,506.43 (2,866.00)	714.53 (1,193.16)
TONKOLILI	2.28 (1.49)	1,384.62 (1,962.62)	783.39 (1,236.55)
WESTERN AREA RURAL	2.34 (1.77)	1,237.36 (2,049.69)	1,027.80 (2,302.97)
WESTERN AREA URBAN	1.91	463.32	527.52

	(1.57)	(912.70)	(318.91)
NATIONAL	**2.78 (2.22)**	**1,525.07 (2,390.75)**	**789.52 (1,342.03)**

Secondary Crops:

	Harvest (kg)		Yield[1]	
	Sweet Potato	**Maize**	**Sweet Potato**	**Maize**
BO	201.19 (197.39)	81.25 (93.56)	70.23 (90.99)	21.37 (26.21)
BOMBALI	493.56 (698.14)	49.26 (50.83)	392.98 (618.51)	16.24 (24.13)
BONTHE	256.83 (331.70)	72.45 (75.08)	93.54 (236.65)	23.94 (24.17)
KAILAHUN	348.87 (372.21)	113.08 (97.38)	145.54 (269.79)	29.21 (27.05)
KAMBIA	429.20 (489.82)	71.06 (70.06)	236.26 (365.58)	23.84 (32.21)
KENEMA	168.98 (164.04)	78.92 (73.77)	69.71 (67.36)	22.45 (22.22)
KOINADUGU	361.71 (468.83)	85.17 (71.97)	217.10 (282.36)	13.57 (13.53)
KONO	377.56 (688.42)	132.10 (111.09)	125.66 (238.23)	24.95 (26.63)
MOYAMBA	398.32 (569.93)	43.16 (71.77)	146.84 (211.19)	5.84 (11.04)
PORT LOKO	269.92 (430.82)	79.26 (99.58)	194.33 (396.28)	26.63 (33.23)
PUJEHUN	167.34 (186.25)	63.61 (79.94)	64.64 (104.26)	16.65 (17.76)
TONKOLILI	359.78 (400.42)	93.52 (90.42)	234.46 (305.68)	19.19 (19.88)
WESTERN AREA RURAL	345.48 (327.00)	66.77 (76.79)	269.98 (323.61)	20.61 (24.09)
WESTERN AREA URBAN	189.90 (368.95)	32.57 (29.77)	361.37 (393.51)	11.84 (12.17)
NATIONAL	**333.44**	**82.28**	**195.03**	**21.10**

	(480.20)	**(89.39)**	**(358.72)**	**(25.45)**

1) Sweet potato yields in kilograms per 50 kilogram rice bag of vines planted. Maize yields in kilograms of fresh cobs per cup of kernels planted.

Cash Crops:

	Harvest[1]			Revenue (Leones)		
	Oil Palm	**Cacao**	**Coffee**	**Oil Palm**	**Cacao**	**Coffee**
BO	184.14 (278.59)	85.14 (99.66)	70.58 (70.73)	347,445 (466,065)	185,552 (327,428)	156,040 (257,041)
BOMBALI	70.33 (109.91)	56.74 (69.65)	-- --	191,992 (301,573)	44,256 (42,856)	-- --
BONTHE	300.38 (391.56)	-- --	-- --	358,640 (454,846)	140,000 (0.00)	-- --
KAILAHUN	163.70 (234.80)	334.34 (336.51)	185.44 (199.73)	305,659 (351,016)	964,612 (1,255,415)	208,925 (223,865)
KAMBIA	141.55 (199.84)	325.00 (0.00)	-- --	333,508 (533,834)	1,200,000 (0.00)	-- --
KENEMA	134.23 (228.94)	251.65 (280.93)	160.59 (198.21)	216,874 (262,437)	587,835 (862,929)	172,141 (235,200)
KOINADUGU	147.99 (177.86)	202.48 (214.94)	128.98 (131.20)	356,556 (429,961)	423,639 (462,665)	171,587 (167,767)
KONO	60.48 (72.38)	247.95 (247.03)	238.56 (250.04)	150,854 (157,979)	740,060 (880,386)	303,194 (288,061)
MOYAMBA	145.59 (259.00)	71.86 (74.71)	-- --	270,567 (298,319)	100,674 (100,581)	-- --
PORT LOKO	144.48 (238.92)	-- --	-- --	308,602 (474,117)	-- --	-- --
PUJEHUN	125.87 (162.53)	74.46 (114.76)	71.25 (103.88)	271,087 (306,534)	208,079 (347,231)	86,092 (74,060)

TONKOLILI	148.50 (266.18)	25.72 (25.71)	-- --	293,969 (502,251)	165,083 (59,838)	-- --
WESTERN AREA RURAL	39.13 (30.19)	-- --	-- --	188,412 (220,144)	-- --	-- --
WESTERN AREA URBAN	30.91 (27.86)	-- --	-- --	-- --	-- --	-- --
NATIONAL	**150.41 (242.53)**	**251.66 (289.61)**	**168.76 (201.51)**	**298,686 (420,924)**	**684,910 (1,011,748)**	**208,274 (246,970)**

1. Oil palm harvests in liters. Cacao and coffee harvests in kilograms.

9.2 Annex 2: Conversion Units Used in the Analysis

Crop and State	Measurement Unit	Conversion rate into kilograms	Conversion rate into standard unit for the crop
Seed rice	Bushel(s)	25	1
Seed rice	Can / Kerosene Tin	12.5	0.5
Seed rice	Threepence/Truppence pan	1.136364	0.0454545
Seed rice	Rice(50kg) bag / Big Chinese bag	50	2
Seed rice	Rice(25kg) bag / Small Chinese bag	25	1
Seed rice	Bulgur bag(s)	62.5	2.5
Seed rice	Jute bag(s) / Banga bag(s)	100	4
Seed rice	Bucket (34cm)	12.5	0.5
Seed rice	Big Baf pan	50	2
Seed rice	Small Baf pan	25	1
Seed rice	Kilogram(s)	1	0.04
Unthreshed rice	Bundles/Ties	4.166667	0.1666667
Unthreshed rice	Bunches	4.166667	0.1666667
Threshed rice	Bushel(s)	25	1
Threshed rice	Can / Kerosene Tin	12.5	0.5
Threshed rice	Threepence/Truppence pan	1.136364	0.0454545
Threshed rice	Rice(50kg) bag /Big Chinese bag	50	2
Threshed rice	Rice(25kg) bag /Small Chinese bag	25	1
Threshed rice	Bulgur bag(s)	62.5	2.5
Threshed rice	Jute bag(s) / Banga bag(s)	100	4
Threshed rice	Butter cup(s)	0.25	0.01
Threshed rice	Bucket (34cm)	12.5	0.5
Threshed rice	Big Baf pan	50	2
Threshed rice	Small Baf pan	25	1
Threshed rice	Drum	125	5
Threshed rice	Kilogram(s)	1	0.04
Clean rice	Bushel(s)	50	2
Clean rice	Rice(50kg) bag /Big Chinese bag	100	4
Clean rice	Rice(25kg) bag /Small Chinese bag	50	2
Clean rice	Bulgur bag(s)	125	5
Clean rice	Butter cup(s)	0.5	0.02
Cassava planting material	Sticks		0.02
Cassava planting material	Bundles/Ties		1
Cassava produce	Can / Kerosene Tin	15	0.25
Cassava produce	Rice(50kg) bag / Big Chinese bag	60	1
Cassava produce	Rice(25kg) bag / Small Chinese bag	30	0.5

Cassava produce	Bulgur bag(s)	77.92208	1.298701
Cassava produce	Jute bag(s) / Banga bag(s)	120	2
Cassava produce	Basket	20	0.3333333
Cassava produce	Bucket (34cm)	24	0.4
Cassava produce	Big Baf pan	60	1
Cassava produce	Small Baf pan	30	0.5
Cassava produce	Bundles/Ties	6	0.1
Cassava produce	Drum	240	4
Cassava produce	Heaps	6	0.1
Cassava produce	Piles	6	0.1
Cassava unprocessed	Can / Kerosene Tin	15	0.25
Cassava unprocessed	Rice(50kg) bag /Big Chinese bag	60	1
Cassava unprocessed	Rice(25kg) bag /Small Chinese bag	30	0.5
Cassava unprocessed	Bulgur bag(s)	77.92208	1.298701
Cassava unprocessed	Jute bag(s) / Banga bag(s)	120	2
Cassava unprocessed	Basket	20	0.3333333
Cassava unprocessed	Bucket (34cm)	24	0.4
Cassava unprocessed	Big Baf pan	60	1
Cassava unprocessed	Small Baf pan	30	0.5
Cassava unprocessed	Bundles/Ties	6	0.1
Cassava unprocessed	Heaps	6	0.1
Cassava unprocessed	Piles	6	0.1
Garri	Dozen (group of 12 units/pieces)		0.04
Garri	Rice(50kg) bag / Big Chinese bag		1
Garri	Rice(25kg) bag / Small Chinese bag		0.5
Garri	Bulgur bag(s)		1.298701
Garri	Jute bag(s) / Banga bag(s)		2
Garri	Butter cup(s)		0.0033333
Garri	peak milk cup(s)		0.0025
Garri	Big Baf pan		1
Garri	Small Baf pan		0.5
Fufu	Rice(50kg) bag / Big Chinese bag		1
Fufu	Rice(25kg) bag / Small Chinese bag		0.5
Fufu	Bulgur bag(s)		1.298701
Fufu	Jute bag(s) / Banga bag(s)		2
Fufu	Basket		0.3333333
Fufu	Big Baf pan		1
Fufu	Small Baf pan		0.5
Flour	Can / Kerosene Tin		0.25
Flour	Threepence/Truppence pan		0.0454545
Flour	Rice(50kg) bag / Big Chinese bag		1
Flour	Rice(25kg) bag / Small Chinese bag		0.5
Flour	Bulgur bag(s)		1
Flour	Jute bag(s) / Banga bag(s)		2
Flour	Basket		0.3333333
Flour	Bucket (34cm)		0.4

Flour	Big Baf pan		1
Flour	Small Baf pan		0.5
Potato vines	Rice(50kg) bag / Big Chinese bag		1
Potato vines	Rice(25kg) bag / Small Chinese bag		0.5
Potato vines	Bulgur bag(s)		1.298701
Potato vines	Jute bag(s) / Banga bag(s)		2
Potato vines	Basket		0.3333333
Potato vines	Big Baf pan		1
Potato vines	Small Baf pan		0.5
Potato vines	Bundles/Ties		0.1
Potato vines	Bunches		0.1
Potato vines	Heaps		0.1
Potato tubers	Bushel(s)	31.5	0.5
Potato tubers	Can / Kerosene Tin	15.75	0.25
Potato tubers	Rice(50kg) bag / Big Chinese bag	63	1
Potato tubers	Rice(25kg) bag / Small Chinese bag	31.5	0.5
Potato tubers	Bulgur bag(s)	81.81818	1.298701
Potato tubers	Jute bag(s) / Banga bag(s)	126	2
Potato tubers	Basket	21	0.3333333
Potato tubers	Bucket (34cm)	25.2	0.4
Potato tubers	Big Baf pan	63	1
Potato tubers	Small Baf pan	31.5	0.5
Potato tubers	Heaps	3.15	0.05
Potato tubers	Piles	3.15	0.05
Seed groundnut	Bushel(s)		72
Seed groundnut	Can / Kerosene Tin		36
Seed groundnut	Threepence/Truppence pan		6.5
Seed groundnut	Rice(50kg) bag / Big Chinese bag		144
Seed groundnut	Rice(25kg) bag / Small Chinese bag		72
Seed groundnut	Bulgur bag(s)		187.2
Seed groundnut	Jute bag(s) / Banga bag(s)		288
Seed groundnut	Butter cup(s)		1
Seed groundnut	salmon cup(s)		1
Seed groundnut	Bucket (34cm)		36
Seed groundnut	Big Baf pan		144
Seed groundnut	Small Baf pan		72
Unshelled groundnut	Bushel(s)	18	0.5
Unshelled groundnut	Can / Kerosene Tin	9	0.25
Unshelled groundnut	Threepence/Truppence pan	1.636364	0.0454545
Unshelled groundnut	Rice(50kg) bag / Big Chinese bag	36	1
Unshelled groundnut	Rice(25kg) bag / Small Chinese bag	18	0.5
Unshelled groundnut	Bulgur bag(s)	46.75325	1.298701
Unshelled groundnut	Jute bag(s) / Banga bag(s)	72	2
Unshelled groundnut	Butter cup(s)	0	
Unshelled groundnut	Basket	12	0.3333333
Unshelled groundnut	Bucket (34cm)	9	0.25

Unshelled groundnut	Big Baf pan	36	1
Unshelled groundnut	Small Baf pan	18	0.5
Unshelled groundnut	Kilogram(s)	1	0.0277778
Shelled groundnut	Bushel(s)	18	72
Shelled groundnut	Can / Kerosene Tin	9	36
Shelled groundnut	Threepence/Truppence pan	1.625	6.5
Shelled groundnut	Rice(50kg) bag / Big Chinese bag	36	144
Shelled groundnut	Rice(25kg) bag / Small Chinese bag	18	72
Shelled groundnut	Bulgur bag(s)	46.8	187.2
Shelled groundnut	Jute bag(s) / Banga bag(s)	72	288
Shelled groundnut	Salt bag(s)	4.5	18
Shelled groundnut	Butter cup(s)	0.25	1
Shelled groundnut	Bucket (34cm)	9	36
Shelled groundnut	Big Baf pan	36	144
Shelled groundnut	Small Baf pan	18	72
Pods of cacao	Rice(50kg) bag / Big Chinese bag		1
Pods of cacao	Rice(25kg) bag / Small Chinese bag		0.5
Pods of cacao	Bulgur bag(s)		1.298701
Pods of cacao	Jute bag(s) / Banga bag(s)		2
Pods of cacao	Basket		0.6666667
Unfermented cacao beans	Threepence/Truppence pan	0.8125	0.0227273
Unfermented cacao beans	Rice(50kg) bag / Big Chinese bag	35.75	1
Unfermented cacao beans	Bulgur bag(s)	46.42857	1.298701
Unfermented cacao beans	Jute bag(s) / Banga bag(s)	71.5	2
Unfermented cacao beans	Pound(s)	0.1254386	0.0035088
Dried beans of cacao	Bushel(s)	32.5	0.5
Dried beans of cacao	Can / Kerosene Tin	16.25	0.25
Dried beans of cacao	Threepence/Truppence pan	1.181818	0.0181818
Dried beans of cacao	Rice(50kg) bag / Big Chinese bag	65	1
Dried beans of cacao	Rice(25kg) bag / Small Chinese bag	32.5	0.5
Dried beans of cacao	Bulgur bag(s)	84.41558	1.298701
Dried beans of cacao	Jute bag(s) / Banga bag(s)	130	2
Dried beans of cacao	Salt bag(s)	16.25	0.25
Dried beans of cacao	Butter cup(s)	0.3823529	0.0058824
Dried beans of cacao	Small Baf pan	32.5	0.5
Dried beans of cacao	Drum	260	4
Dried beans of cacao	Pound(s)	0.4482759	0.0068966
Raw berries coffee	Bushel(s)	13.566	0.19
Raw berries coffee	Can / Kerosene Tin	2.907	0.0407143
Raw berries coffee	Threepence/Truppence pan	0.1938	0.0027143
Raw berries coffee	Rice(50kg) bag / Big Chinese bag	40.698	0.57
Raw berries coffee	Rice(25kg) bag / Small Chinese bag	20.349	0.285

Raw berries coffee	Bulgur bag(s)	20.349	0.285
Raw berries coffee	Jute bag(s) / Banga bag(s)	40.698	0.57
Raw berries coffee	Basket	1.5504	0.0217143
Raw berries coffee	Big Baf pan	40.698	0.57
Raw berries coffee	Small Baf pan	20.349	0.285
Raw berries coffee	Drum	203.49	2.85
Dried berries coffee	Bushel(s)	30.345	0.425
Dried berries coffee	Can / Kerosene Tin	15.1725	0.2125
Dried berries coffee	Threepence/Truppence pan	1.379318	0.0193182
Dried berries coffee	Rice(50kg) bag / Big Chinese bag	60.69	0.85
Dried berries coffee	Rice(25kg) bag / Small Chinese bag	30.345	0.425
Dried berries coffee	Bulgur bag(s)	78.81818	1.103896
Dried berries coffee	Jute bag(s) / Banga bag(s)	121.38	1.7
Dried berries coffee	Butter cup(s)	0.2023	0.0028333
Dried berries coffee	Basket	20.23	0.2833333
Dried berries coffee	Bucket (34cm)	24.276	0.34
Dried berries coffee	Drum	303.45	4.25
Dried berries coffee	Kilogram(s)	0.85	0.0119048
Dried berries coffee	Pound(s)	0.3865605	0.005414
Hulled berries coffee	Bushel(s)	35.7	0.5
Hulled berries coffee	Can / Kerosene Tin	17.85	0.25
Hulled berries coffee	Threepence/Truppence pan	1.622727	0.0227273
Hulled berries coffee	Rice(50kg) bag / Big Chinese bag	71.4	1
Hulled berries coffee	Rice(25kg) bag / Small Chinese bag	35.7	0.5
Hulled berries coffee	Bulgur bag(s)	92.72727	1.298701
Hulled berries coffee	Jute bag(s) / Banga bag(s)	142.8	2
Hulled berries coffee	Salt bag(s)	17.85	0.25
Hulled berries coffee	Butter cup(s)	0.238	0.0033333
Hulled berries coffee	Basket	23.8	0.3333333
Hulled berries coffee	Bucket (34cm)	28.56	0.4
Hulled berries coffee	Big Baf pan	71.4	1
Hulled berries coffee	Small Baf pan	35.7	0.5
Hulled berries coffee	Kg packet	270.2784	3.785412
Hulled berries coffee	Batta	17.85	0.25
Hulled berries coffee	Drum	285.6	4
Hulled berries coffee	Kilogram(s)	1	0.0140056
Hulled berries coffee	Pound(s)	0.42	0.0058824
Raw oil palm	None (individual units/pieces)	1.125	0.05
Raw oil palm	Dozen (group of 12 units/pieces)	13.5	0.6
Raw oil palm	Bunches	1.125	0.05
Raw oil palm	Sets/heads	1.125	0.05
Processed oil palm	Can / Kerosene Tin	22.5	1
Processed oil palm	Pint	0.375	0.0166667
Processed oil palm	Batta	22.5	1
Processed oil palm	Drum	225	10
Processed oil palm	Litre(s)	1	0.0444444

Processed oil palm	Gallon(s)	4.5	0.2
Maize kernels	Dozen (group of 12 units/pieces)	0.7575758	3.030303
Maize kernels	Bushel(s)	25	100
Maize kernels	Can / Kerosene Tin	12.5	50
Maize kernels	Threepence/Truppence pan	1.25	5
Maize kernels	Rice(50kg) bag / Big Chinese bag	50	200
Maize kernels	Rice(25kg) bag / Small Chinese bag	25	100
Maize kernels	Bulgur bag(s)	32.5	130
Maize kernels	Jute bag(s) / Banga bag(s)	50	200
Maize kernels	Butter cup(s)	0.25	1
Maize kernels	Tomatoe cup(s)	0.1	0.4
Maize kernels	salmon cup(s)	0.25	1
Maize kernels	peak milk cup(s)	0.1666667	0.6666667
Maize kernels	Small Baf pan	25	100
Maize kernels	Kg packet	0.625	2.5
Maize kernels	Bundles/Ties	0.75	3
Maize kernels	Heaps	1.25	5
Maize kernels	Piles	1.25	5
Maize kernels	Kilogram(s)	0.625	2.5
Fresh Maize	None (individual units/pieces)	0.3416666	0.0083333
Fresh Maize	Dozen (group of 12 units/pieces)	0.41	0.01
Fresh Maize	Bushel(s)	20.5	0.5
Fresh Maize	Can / Kerosene Tin	10.25	0.25
Fresh Maize	Threepence/Truppence pan	1.863636	0.0454545
Fresh Maize	Rice(50kg) bag / Big Chinese bag	41	1
Fresh Maize	Rice(25kg) bag / Small Chinese bag	20.5	0.5
Fresh Maize	Bulgur bag(s)	53.24675	1.298701
Fresh Maize	Jute bag(s) / Banga bag(s)	82	2
Fresh Maize	Salt bag(s)	10.25	0.25
Fresh Maize	Basket	13.66667	0.3333333
Fresh Maize	Bucket (34cm)	16.4	0.4
Fresh Maize	Big Baf pan	41	1
Fresh Maize	Small Baf pan	20.5	0.5
Fresh Maize	Cubs	0.3416666	0.0083333
Dried Maize	None (individual units/pieces)	0.3416666	0.0083333
Dried Maize	Dozen (group of 12 units/pieces)	0.41	0.01
Dried Maize	Bushel(s)	20.5	0.5
Dried Maize	Can / Kerosene Tin	10.25	0.25
Dried Maize	Threepence/Truppence pan	1.863636	0.0454545
Dried Maize	Rice(50kg) bag / Big Chinese bag	41	1
Dried Maize	Rice(25kg) bag / Small Chinese bag	20.5	0.5
Dried Maize	Bulgur bag(s)	53.24675	1.298701
Dried Maize	Jute bag(s) / Banga bag(s)	82	2
Dried Maize	Salt bag(s)	10.25	0.25
Dried Maize	Basket	13.66667	0.3333333
Dried Maize	Bucket (34cm)	16.4	0.4

Dried Maize	Big Baf pan	41	1
Dried Maize	Small Baf pan	20.5	0.5
Dried Maize	Cubs	0.3416666	0.0083333

Note of caution: MAFFS experts consider that the following units cannot apply to shelled groundnut:

- bushel
- 50kg rice bag
- 25 kg bag
- bulgur bag
- jute bag
- salt bag(s)
- Bucket (34cm)
- Big Baf pan
- Small Baf pan

For these units, it has therefore been assumed that respondents were referring to quantities of unshelled groundnut which they themselves shelled. These have been converted into shelled groundnuts using the conversion: 1 bushel unshelled gives 72 buttercups shelled. This conversion is a conversion **between states** and not only a volume conversion.

9.3 Annex 3: Non Technical Overview of Sampling

This annex describes the sampling frame for the AHTS in a little more detail. In total, there were 920 Enumeration Areas (EAs) selected. These were classified into four types:

1. EAs located in Freetown (33 sampled). Since agriculture is practiced in Freetown and because the aim of AHTS is to describe agriculture at a national level, it is necessary that Freetown be included in the AHTS. However, agriculture is practiced on a very small scale in Freetown (1.5% of households). [6] Therefore, in Freetown, the sample size was calculated with intent to provide only very basic information on agriculture (e.g. what percentage of the population is engaged in agriculture of any type and what crops are grown).

2. EAs located in the other 5 urban areas governed by Town Councils: Bo, Kenema, Makeni, Koidu and Bonthe (40 sampled). Here, agriculture is practiced on a relatively small scale in these urban areas compared to the remained of the country (23.6% of households), though more so than Freetown. [7] As in Freetown, the main goal is to provide basic descriptors of the practice of agriculture in these areas. In order to provide some information for each Town Council, a minimum number of EAs have been assigned to each of the 5 urban areas (resulting in Bonthe Town being assigned 4 EAs and Koidu Town being assigned 5 EAs). However, given the small number of EAs for Town Councils, the information provided for each individual Town Council will be limited. Therefore, the main aim of this sub-sample and that described above is to be able to provide information on agriculture within all urban areas combined.

3. EAs located in rural areas where there is no ongoing/planned road reconstruction/ rehabilitation (556 sampled). Combined with type 4, these are the areas where the bulk of detailed information about agricultural production will be captured. The number of these EAs has therefore been maximized within the 920 EAs, relative to types 1 and 2 above. Given this sample size, it is conservatively estimated that a 6-8% increase in national rice production could be detected. At the district level, only large differences (approximately 25-30%) in rice production can be detected. [8]

4. EAs located in rural areas where there is ongoing or planned road reconstruction/ rehabilitation (282 sampled). These are areas where agriculture is the predominant activity, but in order to provide additional policy-relevant information on the overall effect of road reconstruction / rehabilitation, the location of road reconstruction / rehabilitation projects has been explicitly taken into account in the sampling design. After reweighting to account for different sampling probabilities, this sample will be combined with Type 3 to add to the detailed picture of agricultural production.

[6] Unweighted. Source: IRCBP National Public Services survey (2007)
[7] Unweighted. Source: IRCBP National Public Services survey (2007)
[8] Minimum detectable effect calculations performed using data on bushels of rice harvested from the SSL Core Welfare Indicators Questionnaire (2007)

9.4 Annex 4: Summary of Field Report

This annex provides a summary of the field work for the AHTS (a more detailed report can be requested from the Technical Team). Given the challenges and practical constraints of collecting agricultural data at the household level in Sierra Leone, as was expected at the onset of the survey, a number of practical and logistical issues relating to transport and co-ordination arose during data collection in the field. Many of these issues were addressed during fieldwork and these logistical issues are unlikely to impact data quality. Another issue relating to data collection was enumeration error, which we discuss in a little more detail below. The AHTS Technical Team had anticipated these problems and established a robust monitoring system involving multiple levels of supervision, and took corrective measures where possible.

Another factor affecting data quality in household surveys is the inability or the unwillingness of some respondents to provide accurate responses to the questionnaire. Thus some questions may not have been answered because of recall problems, literacy problems or because the respondents may have believed it was in their interest to respond to the questionnaire untruthfully. However, there is no evidence that the magnitude of these issues was greater in the AHTS than in similar surveys conducted in other countries. In addition, general inaccuracies will likely even out over the extremely large AHTS sample - in fact, a large enough sample was chosen precisely so that the impact of these issues on the overall numbers remains low.

The purpose of this annex is to provide brief guidance for users of the data by highlighting which areas were most affected by these issues and the actions taken by the Technical Team. The majority of the AHTS data is considered by the Technical Team to be reliable. In keeping with the initial objectives of the AHTS, it is hoped that these results will inform policy planning and formulation in Sierra Leone in the years to come.

This annex briefly covers the following items: 1) a discussion of the intended structure of the fieldwork, and how successfully these plans were implemented in the field; 2) a discussion of issues potentially affecting the quality of information collected, including the selection and identification of Target Households, problems with the survey instruments themselves, and problems encountered during the administration of the survey instruments to respondents; 3) suggestions for future surveys.

9.4.1 Basic outcomes of the fieldwork

In the course of the three supervision trips, the Technical Team found that the enumeration teams were generally performing well when under direct supervision and were well received within communities. The Technical Team was able to correct problems identified with the survey instruments and was generally satisfied with the administration of questionnaires by the Enumeration Teams when the enumeration teams were under the direct supervision of the Technical Team.

9.4.2 Issues affecting quality

The second and third supervision trips highlighted several issues including:

1. Coordination problems between Enumeration Teams and District Coordinators: there were some coordination problems between District Coordinators from MAFFS and SSL as well as with Enumeration Teams, resulting in delays.

2. Discrepancies between monitoring and household questionnaires: members of the Technical Team returned to selected EAs where this problem appeared to be acute and re-administered sections of the questionnaire. To understand how much this affected the quality of the AHTS, the Technical Team looked at measures of reliability across pairs of surveys using statistical tools for repeated measures of the same variables. From this analysis, the supervision data verified the enumerator data extremely well (even though it is a small sample size). The reliability ratios (which are a measure of the amount of signal relative to the total variation in the data) were high for a number of different variables and were over 0.8 for rice harvests.[9] This gives the Technical Team a measure of faith in the enumerator data, especially since the supervisors re-administered surveys where they thought the enumerator data was the worst.

3. Problems with the survey instrument itself: these included incorrectly coded skip patterns and mis-phrasings of questions. These were largely rectified during the first supervision trip and the impact on the final quality of the data was minimal.

4. Enumeration errors: some enumerators appeared to be noting incorrect responses in order to speed up the amount of time which it took to administer the questionnaire.[10] In general, measures were taken to rectify these where possible with some teams sent back to re-administer questionnaires. The Technical Team studied the data and found that these issues had a minimal affect on the quality of AHTS. In particular, they looked to see if there was evidence of enumerators systematically skipping sections. First, they found that the average length of the survey was two hours with only 10% of surveys lasting less than an hour. The AHTS time distribution looks reasonable given the experience of members of the Technical Team with agricultural surveys in other African countries. In addition, there is no bunching of the survey length at common durations, which indicates no fabrication of survey lengths. Second, one section where skipping could have been expected was the labor section, but 99% of households answered at least one labor section.

[9] As a comparison, the reliability for years of education in the US is about 0.9 from responses from twin pairs.

[10] Two common examples were the Farm Picture and the crop inventory. However, given that a farm picture is not used in most agricultural household surveys, the Technical Team does not think this affected the relative data quality of the AHTS. On the crop inventory, there was some_incorrect use of skip patterns among some teams. Given that the focus of the AHTS is on the core crops, this is not deemed a particularly important issue. The Technical Team also found little evidence to support strategic misreporting.

5. Inability and/or unwillingness of respondents to answer some questions correctly: some respondents had difficulty answering or were giving inaccurate answers (in the hopes of receiving assistance) or had recall issues. Enumerators had been trained to deal with strategic responses. Also a close look at the data suggests little evidence for strategic reporting being a systematic issue. The responses from AHTS are often lower than those from field testing of the instrument, but this is because field tests are never conducted on random samples, but often on more complex, wealthier households. In addition, the Technical Team analyzed the data carefully to understand whether there was evidence of strategic misreporting. First, the Technical Team compiled measures of yields from SLARI from their field trials (which are likely to be with better, more educated, larger farmers) from 30 different studies between 1993 through 2007 and found that yields on the control plots ranged from 0.2 tons/ha to 1.9 tons/ha – this range compares well to that found in AHTS. Second, the distribution (low use) of good planting practices and inputs in AHTS is consistent with the AHTS rice yields. Third, if there was extensive strategic misreporting, this would greatly mute the relationship between rice output and measures of wealth - this is not borne out in the data. Fourth, it is important to note that it is standard for different methods of measuring yields to result in different numbers and this is true of a wide variety of countries. The AHTS does not include commercial farms and it may under represent large farms relative to an ideal sample as described. However, this is the case for all countries. For example, in Kenya, survey data and FAO data on maize yields differ by approximately a factor of two. The same is true for rice in Ghana. Finally, the matching between supervision and enumerator reports and the internal consistency of practice and yield data does not support significant strategic reporting as people who fabricated would not be able to do so with such consistently.

9.4.3 Lessons learned and suggestions for future surveys

Overall, given all this evidence, the Technical Team suggests that the overall picture of practices and yields provide a good basis for policy planning. Yields are a useful summary measure of the productivity of farmers and more reliable than any attempt to provide total output estimates. These yield and practice data will allow policy makers to understand what rice productivity is and how best to improve it by looking at farmer practices.

AHTS data collection was undertaken in keeping with the protocol envisioned at the beginning of the survey. The Technical Team took various steps to address field work issues – many of which had been anticipated at the onset – as they arose and the impact of these issues on data quality was ultimately minimal for the majority of the data. It should be noted that none of the issues discussed above are unique to the AHTS; problems such as enumeration error and incorrect responses are common to all such surveys across Africa and more generally in developing economies. Many lessons on the

organization and coordination of such surveys and improved ways of monitoring the data collection activities were generated. In addition, the Technical Team learnt a set of new strategies to test for systematic misreporting. The Technical Team also realized the value of parts of the AHTS survey that were new to agricultural surveys (like the farm picture, which was extremely useful and should be a permanent fixture in such survey instruments).

It is hoped that the lessons learned during that AHTS will inform plans for future collection of high-quality agricultural data in Sierra Leone.

9.5 Annex 5: Glossary of Key Terms

AHTS	Agricultural Household Tracking Survey
CBO	Community-Based Organization
DAO	District Agricultural Officer
EA	Enumeration Area
FAO	Food and Agriculture Organization
FBO	Farmers Based Organization
FFS	Farmer Field School
GPS	Global Positioning System
HH	Household
IPA	Innovations for Poverty Action
IVS	Inland Valley Swamp
J-PAL	Abdul Latif Jameel Poverty Action Lab
MAFFS	Ministry of Agriculture, Forestry and Food Security (MAFFS)
MDE	Minimum Detectable Effect
MOU	Memorandum of Understanding
NERICA	New Rice for Africa
NGO	Non-Governmental Organization
PEMSD	Planning, Evaluation, Monitoring and Statistics Division
SLL	Sierra Leonean Leone
SSL	Statistics Sierra Leone
SPU	Strategy and Policy Unit
SLARI	Sierra Leone Agricultural Research Institute
WA	Western Area