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Yam Improvement for Income and Food Security in West Africa

Characterization of Yam-growing Households in the Project Areas of Ghana

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Acronyms and abbreviations

AEZ	Agroecological zone
CBO	Community based organization
DFID	Department for International Development
DS	Derived savanna
FAOSTAT	FAO Statistical Databases
FGT	Foster, Greer, and Thorbecke
GDP	Gross Domestic Product
GM	Gross Margin
GPS	Global Positioning System
HF	Humid forest
IITA	International Institute of Tropical Agriculture
LGA	Local Government Area
PD	Person-day
MEDA	Mennonite Economic Development Associated
MLE	Maximum Likelihood Estimation
MoFA	Ministry of Food and Agriculture
NARP	National Agricultural Research Project
NGO	Nongovernmental organization
NPAFS	National Programme for Agriculture and Food Security
R&D	Research and Development
SGS	Southern Guinea savanna
SPSS	Statistical Package for Social Science
SSA	sub-Saharan Africa
UNDP	United Nations Development Programme
YIIFSWA	Yam Improvement for Income and Food Security in West Africa

Executive Summary

The Yam Improvement for Income and Food Security in West Africa (YIIFSWA) project was initiated to assess and understand yam-based systems in order to identify the opportunities of interventions that could potentially help to increase productivity in the region. The project consists of two phases: the inception and impact study phase. During the inception phase, a baseline study was conducted in different yam-growing communities aggregated on agroecological zoning into southern Guinea savanna (SGS), derived savanna (DS), and humid forest (HF). A complementary baseline survey was commissioned in addition to the substantive data collected within the same yam belt of Ghana aiming at measuring directly yam yield from farmers' fields in order to get more accurate crop yield estimates. The baseline studies aimed at understanding farmers' livelihoods in yam-growing areas to increase agricultural productivity in Ghana, and serve also as benchmarks to assess changes brought about by the YIIFSWA project in future. The goal of the baseline surveys was to measure the key economic and social indicators before the major components of the project implementation.

Data was collected by means of structured questionnaire and a set of qualitative interview questions for focus group discussions to capture household and community specific information. The intent of the survey was to sample households within the yam belt. The survey design was based on a multistage random sampling procedure, drawing on households from yam-growing areas of Ghana; thus 600 households were selected using a sampling frame developed by extension agents in collaboration with community heads as a source list.

Characteristics of sample households

Female-headed households are uncommon within the study area (10%) with no female-headed household being reported in the SGS and the average of age of household heads being considerably high (about 50 years). Few household heads attended school (30%) with a low average number of years of schooling (2.7) and no one attended school in the SGS. The majority could not therefore complete 3 years of primary education. A large household size (about 9 persons) was reported which may be attributed to the propensity of adult sons and daughters to remain in the parental household. Moreover, a large household size tended to be allied generally with rural areas characterized by pronatalism and extended family relations.

Livelihood capitals

Land was by far the major natural capital for smallholder farmers in yam-growing areas of Ghana. The average amount of land available for farming was about 2.7 ha. The area of available land was largest in SGS, followed by DS; the smallest was found in HF. About 59% of the farming land was allocated to yam and about 6% of the total farming land was owned and used by women. In all the households surveyed every active member of a household had at least his own hand hoe considered as the prerequisite for farming except in the SGS where the number of hoes reported was found insufficient for all active members. The machete was the only asset most frequently owned by households. Other productive and household assets owned, important in managing yam fields, were not common in the sampled households, providing evidence that farmers do not achieve the proper management of croplands. Items such as carts, grain mills, pumps, CD players, television sets, motorbikes, tractors, jewelry, wooden and metal boxes, and sofas were almost non-existent in the households' assets basket. Pumps, cars, and fish ponds were absent from the list.

Most rural economies in developing countries have diversified income-generating activities, and farming was the most important occupation of the heads of households especially for the females that all had farming as their primary occupation. Other occupations were relatively minor occupations in the study area.

About 14% of respondents had access to information on yam new varieties during the last cropping season and most of them mainly through government extension services (55%) and neighbor/relative farmers (15%). These sources appeared therefore to be the most promising avenues for promoting new technologies. Other common sources of information in use reported were radio, mobile phones, town criers, and religious leaders.

Few respondents in the surveyed area had access to extension/information services of all types during last cropping season under consideration. Minority of the respondents (about 14%) had access to training/ information on yam new varieties during the same period. There is an indication that information on family health/planning and sanitation was provided for an important number of respondents (about 40%) and this could be helpful in protecting them from diseases and keeping them fit for farming activities. Among the few households reported having information on yam new varieties, most of them had access to the information through the government's extension services and their neighbors, or relatives. These sources appeared to be promising avenues for promoting new technologies. Other common sources of information in use reported were the radio, mobile phones, town criers, and religious leaders.

Up to 61% of respondents needed credit to buy farm inputs and pay for all services and less than 22% of the needy had access to it.

About 19% of households mostly kept poultry; other non-working livestock enterprises were negligible or absent.

In rural communities, membership of formal or informal institutions offers opportunities to increase agricultural production by providing various forms of support to farmers. In the surveyed area only about 24% of farmers reported being members to formal/informal institution in the last 3 years. Results indicate that the main types of membership are in farmers' and religious associations. Institutions of other types, including yam producer and marketing groups, had a poor membership size probably because they were limited in group formation or did not provide much assistance to members.

Yam-based systems

In the surveyed area, priority has been given to yam over cash crops and food crops of less importance. Apart from the major crops grown, such as yam, maize, sorghum, rice, groundnut, and cassava, a variety of subsidiary crops and vegetables was also grown and the industrial tree crops were uncommon. Farming practices vary depending on the farmers' production objectives, such as food and income. Mixed cropping or intercropping and rotation were adopted for the efficient utilization of resources in yam areas. About 30% and 49% of households intercropped and rotated their yam, respectively, with other crops. The practice of rotation increased progressively from SGS to HF and intercropping was more practiced in HF. Mounds are constructed manually in rows or at random and the average number in the surveyed area is lower (8099) than the recommended 10000 mounds/ha with a spacing of 1 m × 1 m probably due to the size of the mounds they make and the space they leave between mounds. The number of stands varies, depending on the mound size and spacing and certainly according to the perception of the producer as well, as reported.

Fertilization is crucial to sustaining crop productivity under continuous land-use. The use of commercial inorganic fertilizer in yam production was uncommon and generally the application rates seem to fall short of the nutrient levels "recommended" by extension to expect good yields. Failure to apply fertilizer or to use the proper rate is explained by the fact that (i) farmers lack information about the specific type and quantity of fertilizer to apply; (ii) the use of fertilizer affects the taste and the storage of yam negatively. Also the low quantity of fertilizer applied is linked to its exorbitant prices.

Yam yield and profitability

The productivity level from recall-based information was low (7 t/ha), most probably as a consequence of declining soil fertility resulting from intensified land use and poor soil management, high pressure of pests and diseases associated with poor management practices, and a lack of adequate inputs. High yielding crop varieties and improved practices would be necessary to increase productivity in the study area. Yield from the field measurement was about 18 t/ha). Yam yields measured were higher than those reported through the recall-based information technique. This might not be unconnected with the freshness of tubers with high water content and farmers' inability to recall accurately. The difference in yields between the two approaches could also be linked to farmers milking patterns.

The annual estimated costs per hectare of yam production were about GH¢ 5434 (equivalent to about US$2937) and GH¢3835 ($2073) with and without family labor taken into consideration. The production of yam is severely constrained by two very important cost items: the seeds and labor. The seeds had the largest share of the total (about 58%) followed by labor (about 36%) of which family labor was the most important (83% of the total labor charges). There are substantial variations in gross margins (GM) across the zones. The difference in profitability is no surprise as this could also be attributed to differences in productivity, as well as to differences in input and output prices. As depicted in the findings, the GM is positive in all the surveyed areas (GH¢5298 or $2864) except in the SGS with the inclusion of family labor costs. Yam production in the SGS was less profitable due to the high production costs and low farm-gate prices received. Yam production is profitable with a relative advantage in the DS with the highest average GM pronounced. It may be concluded that the production practices were more rational and efficient compared with those in other zones and the positive GM suggests that there is potential for the adoption of new yam varieties. The use of improved practices should be encouraged to reduce labor costs and stimulate profitability for yam enterprises.

Apart from the high cost of seed and labor in yam production, a range of other factors constrained yam production and storage such as insect pests and disease (the most important). Households reported about 17% of their yam stored rotten and 20% sprouted. Only 4% of the yam was lost through other causes, such as rodents and theft. Among AEZs, the rotting rate was predominant in the while sprouting was highly pronounced in the SGS. The highest level of other losses was observed in the HF. Among the agroecological zones (AEZs), rotting, sprouting, and other losses were predominant in the SGS. Controlling fungi and insects during storage is necessary to increase the shelf life of yam and coping facilities were developed by farmers to control the losses that occur. An important number of farmers (about 61%) reported they had raised sheds in the field as a major yam storage facility. Then follow other methods as options to prevent losses, such as keeping tubers under trees, raising huts, creating yam barns in the compound, and even leaving the crop in the soil after maturity. Among the AEZs, limited storage facilities were used in the SGS with others including covering tubers with weeds.

Crop utilization and marketing

In the survey, farmers provided information on how they utilized the yam they have as total available stock; 5.8% was reported as carry-over stock from the previous harvest. Yam utilization does not vary significantly across AEZ. The proportion sold from recall-based information is 53% while from farmers' fields; about 60% of yam harvested was designated for sale. Therefore, yam is more of a cash crop and a potential crop for income generation. The results indicate that the main/district market is the most important point of sale followed by the village market. Yam is primarily considered a man's crop, and all the agricultural activities are predominantly carried out by men. However, this does not exclude women from involving themselves in some of the activities, such as marketing and trading. Results indicate that farm-gate selling remains almost entirely a male domain. Since men mostly produce the crop, this leads them to take the decision about the disposal of their output. The situation is reversed at the main market where women mainly dominate sales. On the other hand, brokers/ middlemen buy yam directly from farmers for resale and get the major share of the profit, though they also take the most risk. Cutting out this intervening layer between farmers and customers might help farmers to get a higher price for their produce. The study called for regulatory measures to be set for improving the yam marketing system at the rural/primary market level. The marketing problems of small farmers as some reported emanated from their dependence on brokers/middlemen for credit. This puts farmers in a highly unequal trading relationship with the buyers of their produce. Therefore, improving the ability of farmers to have access to the market and strengthening their bargaining position are recommended as the central focus of any policy for yam market reform.

Adoption of yam varieties

No improved varieties were identified in farmers' fields. No adoption of improved yam varieties in the surveyed communities was therefore reported for the main reason that farmers had no access to seeds of improved varieties. Other reasons considered to have inhibited the adoption of improved varieties could be (i) a minimum requirement of cultivable land for demonstrations; and (ii) continuous seed multiplication might have affected

improved varieties released so they were no longer easily distinguished from a wide range of local genotypes, especially since these new varieties were released without any friendly local name. Adoption under the current situation suffers from a lack of reliable identification of improved varieties which might have been renamed or mixed with existing landraces. For easy tracking, the project should focus on giving friendly names to new varieties before their release and effective varietal introduction schemes need to be set in order to ensure the stable integration of the new variety into the local seed system. This would ensure a better transfer and adoption level of improved yam varieties. Low awareness about the most preferred landraces was reported. Varietal characterization needs to be investigated to confirm or otherwise any relationship of those improved yam varieties that were released to the commonest landraces reported as most preferred varieties. Main factors hich hindered farmers from planting their best variety were the availability of the seeds followed by financial abilities.

Livelihood shocks and poverty

A high number of households (62.4%) experienced food unavailability in the study area; of this number about 1% experienced a shortage through the year. Households which reported having experienced food shortages ranged from about 60 to 86%. The SGS had the highest proportion of households with food unavailability, followed by the DS with about 62%; the HF had the lowest number. These proportions are high, probably because of the decline in productivity attributed to factors including deteriorating soil structure and fertility; the inadequate yield potential of popular varieties; prevalence of noxious weeds as well as increasing levels of field and storage pests and diseases; and severe tuber losses in storage. However, they are an indication of food insecurity in the region because when an important proportion of households claim they are experiencing food shortages it is an indication of vulnerability. Among the households with food shortages the most common coping strategies used to mitigate the shock were, in order of importance, borrowing food or relying on help from friends/relatives; reducing the number of meals eaten daily; limiting portion sizes at meal-times; limiting the variety of foods eaten; and relying on less preferred foods.

On average, households spent a considerable share (79%) of their budget on foods. When the food ratio is compared by AEZ, the highest was reported in the DS and it is clear that those who live in the SGS and HF spent more on housing, education, transport, electricity, and health, etc., compared with those who live in the DS. The high level of the food ratio in the surveyed area is characteristic of most poor countries.

About 48% of respondents were found poor with the relative poverty line; about 45% of households were found poor using the absolute poverty line. Poverty indices vary across the AEZs with households in the SGS at higher risk of poverty. This risk decreases from the SGS to the HF via the DS. In conclusion, poverty in this surveyed yam zone is positively related to the poverty gap and severity. The further households get from the poverty line, the greater the inequality among them. At the level of gender, male-headed households had a higher risk of being in poverty and their poverty tended to be more severe and deeper than that of the female-headed households. The types of interventions needed to help the two groups are therefore likely to be different.

Institutional issues

The households reported to rely on government's support were a minority (about 38%) and the government was trusted more in the DS (about 40%) compared with other zones. Half of the respondents did not have confidence in extension workers' skills and rely on their own knowledge, with the worse scenario (about 71%) being observed in the SGS. In conclusion, from the farmers' perspective, confidence has been lost in government's support in the case of crop failure and also reliance on the skills of officials.

From the survey many other issues were raised by respondents aiming at redesigning programs and policies intended to maximize production, reduce exportation barriers and costs, ensure food security, and improve the lives of yam farmers. These include the following: (i) Rural infrastructure development; (ii) Taxes on yam exports; (iii) Agricultural inputs or related purposes are often unable to respond to the needs of yam producers; (iv) Financial facilities need to be provided and yam to be promoted as one of the mandate crops; (v) More support for extension services, etc. Programs and policies should be designed to regain trust and foster increased production.

Introduction

1

Background information

Yam (*Dioscorea* spp.), a vegetatively propagated crop cultivated for its underground edible tubers, is a very important source of food and income for millions of producers, processors, and consumers in West Africa. About 48 million t are produced annually in this sub-region on 4 million ha of land. The five major yam producing countries (Bénin, Côte d'Ivoire, Ghana, Nigeria, and Togo) account for 93% of world production. Yam is important for food security and income generation. In Ghana, 26.2% of the population depends on yam for food income and food security (IITA 2012). Farmers participate in yam production for three main reasons: household food supply; income generation through marketing ware yam; and production of planting material (seed yam) to meet their own needs with some income from the sale of the surplus.

Despite its importance in the economy and lives of many people, yam production faces a number of constraints that significantly reduce the potential to support rural development and meet consumers' needs as an affordable nutritional product. Through consultations with stakeholders and value chain actors in 2010 the major constraints affecting the yam value chain sector in West Africa were listed and prioritized.

The unavailability and high cost of high-quality, disease-free seed yam emerged as the first constraint, followed by the high levels of on-farm losses of tubers (almost 30%) during harvesting and storage, low soil fertility, and high labor costs associated with land preparation and staking. Other constraints included diseases due to viruses, nematodes, and fungi (anthracnose). Scale insects and termites were reported to affect tuber yields in some areas. These constraints identified by the stakeholders conform with the earlier research findings by Manyong et al. (2001) who attributed the declining trend in yam production to deteriorating soil structure and low fertility, prevalence of noxious weeds such as speargrass, and low yield of varieties grown by farmers. These effects are experienced more in the dry savanna agroecologies where yam cultivation is rapidly expanding since the area of available arable land is shrinking in the traditional moist/humid areas. Increasing intensification of yam cultivation has also raised the incidence and severity of field pests and diseases. Pests such as nematodes, mealybugs, and scale insects are transferred from the field into storage where they continue to multiply and cause damage leading to higher rates of tuber loss and reduced market value (Ampofo et al. 2010; MEDA 2011). These prioritized constraints have therefore formed the basis for interventions by the Yam Improvement for Income and Food Security in West Africa (YIIFSWA) project.

Therefore, the objective of this study is to collect primary data on a number of indicators to be used for measuring the progress in production, storage, and marketing which may be attributed to the implementation of the current YIIFSWA project in the target areas in Ghana. There is no updated information available on what people know, do, and would like to do in relation to yam. However, this information is extremely important for monitoring progress as a result of the project. Therefore, the baseline survey seeks to do the following:

- Establish baseline values of indicators of intended outcomes against which future measurements can be made of changes in behavior, systemic capacity, and impact on the conditions of households and individuals.
- Gather and analyze information that will assist the YIIFSWA project's stakeholders/partners in designing or modifying appropriate interventions or generate information for further refining the project's logframe and M&E plan.
- Validate the needs and priorities of communities identified in the project document.

The Yam Improvement for Income and Food Security in West Africa Project

The Yam Improvement for Income and Food Security in West Africa (YIIFSWA) project is a 5-year initiative granted by the Bill & Melinda Gates Foundation (BMGF) for the International Institute of Tropical Agriculture (IITA) to work with other stakeholders in West Africa to identify the opportunities that could potentially help to increase yam productivity in the region.

The project aims at doubling the productivity of yam; this would stimulate a sustainable increase in incomes for smallholder producers and contribute to their food security and economic development.

The project is concerned mainly with the major producing countries, Ghana and Nigeria, in addressing the major challenges in the yam sector through the following objectives: (i) Strengthen small-scale farmer and trader market linkages, particularly in less accessible production areas, to realize benefits from increased ware yam productivity and market demand. (ii) Strengthen capacities and empower smallholder farmers in the yam value chain. (iii) Establish sustainable availability of high-quality seed yam on a commercially viable (price competitive) basis in targeted areas. (iv) Reduce postharvest losses and improve product quality. (v) Develop technologies for high ratio propagation of high quality breeder and foundation seed yam. (vi) Evaluate and scale out yam production technologies with improved and local popular varieties. (vii) Identify more effective prevention and management tools and strategies for pests and diseases. These objectives are supported by cross-cutting components: monitoring, evaluation, and learning, and communication and information dissemination.

In addition to the above objectives the project seeks to answer the following questions during implementation: (a) Will the competition at the farm level between the use of yam for seeds and for food be reduced as a result of the increased use of other productive seed propagation methods? (b) Will productivity and the area planted to yam increase as a result of the reduced production costs? (c) Will the reduced production costs allow more smallholder farmers, especially women, to engage in increased production? (d) Will more smallholder farmers, especially women, be engaged in commercial production as a result of an effective marketing infrastructure? (e) Will reduced production costs lead to reduced prices while ensuring profits for smallholder farmers?

In order to achieve its goal, the project adopts a holistic and sustainable approach in which technology development is grounded in a partnership of researchers (national, regional and international), service providers and supporting organizations (such as extension agencies, NGOs), the private sector, farmers, and traders.

To this end, a series of related activities involving key stakeholders from the pilot communities and other relevant groups has been implemented in the planned project countries to date. These include the socioeconomic survey.

Outline of this report

This report consists of eleven sections. Section one gives an introduction to the study. Section two presents the methodology used for the study. Section three describes the characteristics of the households and their livelihood capitals. Section four depicts the yam-based cropping system in place in the surveyed area. Section five provides estimates on yield and profitability in producing yam. Section six discusses yam utilization and marketing while adoption of yam varieties is presented in section seven. Section eight gives the livelihood shocks and poverty indicators in the study area. Section nine expresses some institutional issues. Section ten reports the complementary survey commissioned to measure yam yield from farmers' fields. Lasly section eleven gives a summary of findings and draw implications of the study.

Methodology

2

This section provides the details of the baseline survey design in terms of collection methods, questionnaire design, and applied statistical analysis.

Study area and sampling procedure

The sample for the baseline survey was drawn up to provide estimates of the "before Project" measurements of selected indicators related to yam production. For this purpose, many communities were targeted including those in the current project and those likely to be included in future. In addition to the Project villages, non-intervention communities with similar socioeconomic characteristics were considered as control communities.

The survey design was based on a multistage random sampling procedure, drawing on all households from the yam-growing areas of Ghana.

In the first stage, several strata were considered subsequent to the project's first planning meeting, including administrative boundaries (districts), areas with high potential for yam production, represententiveness in different production systems (staking, no staking, drought, and low fertility). During the project planning, five districts were purposefully selected: Ejura-Seykedumase, Atebubu-Amantin, Kintampo, East-Gonja, and Mion (Table 1). The production systems/environments considered are appended in Annex 6.

The second stage involved the selection of communities based on probability proportional to the existing communities in each district.

The third stage retained for the study 100 communities based on probability proportional to size in each selected district. The communities selected included the sample communities (project clients) and control communities from the same geographical zoning. The selected communities were considered on a limited set of variables. These included type of agricultural activity, size of landholding, gender of farmer, location, and (to the extent possible) poverty level, in such a way that the treatment and comparison communities would have roughly comparable levels of yam production at the baseline.

Finally a total of 600 households was selected from all communites with an equal probability of selection. The sampling frame including all households in the surveyed communities was developed by extension agents in collaboration with community heads as a source list. The last stage involved a random selection of farm households through a random number generator available in Microsoft Excel: RAND().

The surveyed areas in Ghana are therefore depicted in Figure 1.

Table 1. Sampling structure.

Districts	#Communities	#Communities selected	#Households selected
Mion	30	10	60
East Gonja	71	23	138
Kintampo	93	30	180
Atebubu-Amantin	66	21	126
Ejura-Seykedumase	50	16	96
Total	**310**	**100**	**600**

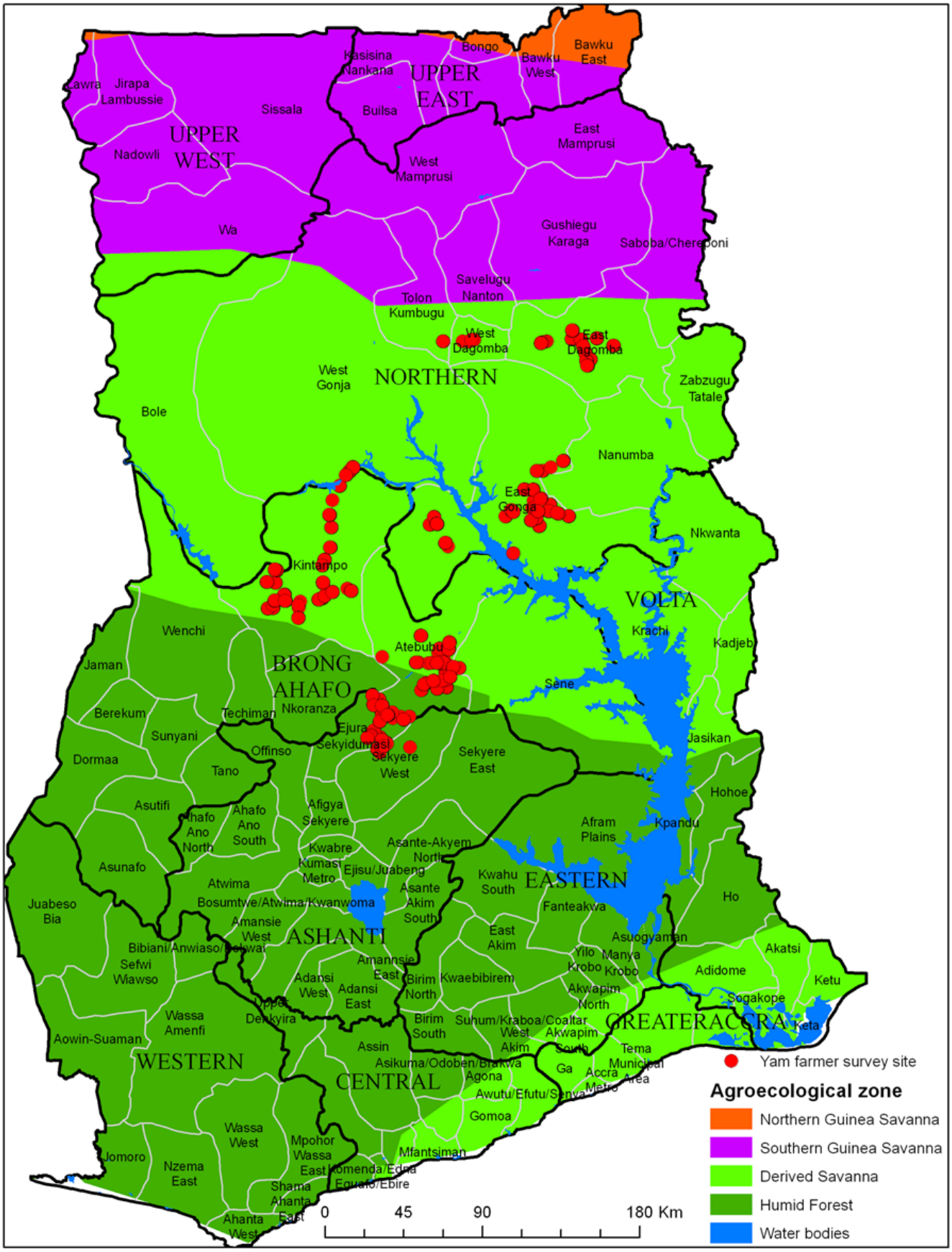


Figure 1. Map of surveyed areas in Ghana, 2012.

Sample size determination

The need for quantitative and qualitative information about households requires a statistically plausible sample of the target population. Accurate sampling is important to minimize the risk of sampling bias and to allow inferences to be drawn about the population with a statistically estimatable level of confidence. The Confidence Interval Approach was used to estimate the sample size.

Under ***simple random sampling***, at 95% confident level desired, the sample size *n* must satisfy the formula:

$$n \geq \frac{Z_{0.95}^2 NP(1-P)}{(N-1)e^2 + Z_{0.95}^2 P(1-P)} \Rightarrow n \geq \frac{Z_{0.95}^2 P(1-P)}{e^2}, \text{ if N} > 10{,}000 \quad \text{..... (1)}$$

Where,

Z = value of the standard variate at a given confidence level and to be worked out from the Table showing the area under normal curve at 1.96 corresponding to 95% confidence level;

N = Total population

$$n \geq \frac{(1.96)^2 \times 0.45 \times 0.55}{0.05^2}$$

$n \geq 380$ Provided that response rate is 100%

n_{srs} = 380/r = 380/0.95 = 400 given 95% response rate.

Under ***cluster sampling***, in order for the results to be usably reliable, we apply a default value of design effect of 1.5 as follows:

$$n_{cls} = \delta \times n_{srs} \quad \text{..... (2)}$$

Where,

n_{cls} = Sample size under cluster sampling;

$\delta =$ Design effect, given the default effect δ =1.5 (United Nations 2005)

n_{cls} = *1.5 × 400 = 600*

Baseline indicators

To assess and measure the impact of the YIIFSWA project on producers' income and food security, a list of indicators related to income and food security, as well as to aspects associated with yam, was established through brainstorming ideas, assessing each, and narrowing the list using the SMART technique. The technique summarizes key criteria, asking, "Is the indicator Specific, Measurable, Attainable, Relevant, and Trackable"? Table 2 presents the indicators used for the survey.

Table 2. Indicators used in the baseline.

Main areas	Indicators	Measurement technique
Livelihood status	Human, social, natural, physical, and financial capital (composition and value)	Descriptive statistics and tabulation. An attempt made to measure individual and common livelihood capitals, useful to assess the change at the end of the project.
Livelihood patterns and consumption expenditure	Economically active household members, types of rural households visited and frequencies, volume of harvested/ marketed yam/ household, household consumption expenditure	Household annual expenditure will be measured through disaggregated sources by individual expenditures and then expenditures from common sources such as agriculture will be added. Some alternative variables, such as the proportion of the main occupation of the household head and asset ownership, will also be measured.
Poverty and vulnerability	Households living below poverty lines, food security status, coping ability with different shocks	Frequencies of shocks/crisis households faced in the last year and the strategies used to manage loss and damage from the crisis. Anthropometric measurements Poverty incidence, gap, and severity
Competitiveness in agriculture and food sector	Age and gender structure in agriculture, farm structure, labor productivity in agriculture	Frequencies
	Harvested crop yields/ha	Output/area (kg/ha)
	Percentage of crop losses during storage	Loss rate per time period × amount stored (%)
	Number of ha (or households) with improved yam varieties	None (number)
Technology adoption and productivity	Number of farmers planting improved yam varieties, area under improved yam varieties, Innovative farm technologies and adoption, willingness to pay for new yam varieties, agricultural diversity and cropping intensity, intensification yield and net returns/ha	List of technologies adopted by the households (not so large). To calculate cropping intensity, first, gross cropped area will be calculated and then divided by the net cropped area and multiplied by 100. The number and percentage of participating farmers that have adopted appropriate technologies will be measured, diversity index, Yield and net return in terms of monetary value/unit of land will be calculated at both full and cash cost basis for yam.
Infrastructure, linkage development, and access to services	Distance to farms and markets, modes of transport to farms and markets, access to services and inputs to improve food security	The number and percentage of farmers/farmers' groups that have access to services and inputs will be measured and also their linkages with sources of innovative technologies.
	Frequency of visits between farmers and service delivery agencies	The number and types of services received by the farmers through visits between farmers and service delivery agencies will be recorded.

These indicators form only a part of all the data collected for the study. Thus, it is possible to complement the indicators with additional data. In addition to these indicators, qualitative data were collected about the surveyed communities and community lives and especially about the sources of vulnerability affecting them. The qualitative data were used to link the results to the local context and to provide more profound information about the interrelations between different aspects affecting local livelihoods and yam production.

Field data collection and management

Data collection instruments

Data were collected by means of existing information (studies, reports, etc.), a structured questionnaire, and a set of qualitative interview questions for focus group discussions to capture community-specific information. The household questionnaire (Annex 11) included sections on (i) Interview background; (ii) Household identification; (iii) Household composition and characteristics; (iv) Social capital and networking; (v) Household assets; (vi) Improved yam variety knowledge and adoption; (vii) Crop production for all crops grown by the household during last cropping season; (viii) Transfers and other sources of income last year; (ix) Household expenditure; and (x) Access to capital and support services.

Community focus group discussions guided by a community profile form (Annex 12) were carried out with groups in all the surveyed communities. The community survey teams mobilized 8–12 men and women representatives from the community groups. The survey captured details on existing infrastructure and facilities; active community-based groups, local decision-making systems; new yam varieties, major livelihood strategies and constraints, and gender issues. The surveys were facilitated by extension officers.

Training of enumerators and supervisors

Obtaining high quality data was the motto of the survey and, as recommended by Puetz (1993), this depends on enumerators who are motivated, well trained, and well supervised.

The structured questionnaires were administered by enumerators under supervisors, all trained in two different methodology workshops organized by IITA. The enumerators' training was conducted for two full days and the training agenda included project background, survey objectives and review of questionnaires, practice sessions, demonstration, and logistics/scheduling. A number of simulation sessions were done to familiarize enumerators with household questionnaire for a successful collection of information. Also a complete review of the questionnaires was done on the same day in the vicinity of the sample households to permit revisits for errors to be corrected where necessary.

Enumerators for each district were identified after training and testing for the whole survey. The process was guided by factors such as (a) Academic qualifications and minimum level of experience in data collection, (b) Willingness to work for long period of time, (c) Ability to speak fluently the local language in each specific area as well as the ability to interact with people of different ethnic groups in different environments, and (d) Familiarity with places where the field work would be conducted.

Supervisors were chosen based on great experience in data collection and familiarity with the survey areas. They were trained and confirmed after an interview to make a follow-up of the whole data collection process. They were associated with the whole data collection process and undertook the second quality check right in the field before the questionnaires were accepted.

A field data collection schedule was developed with the assistance of Ministry of Food and Agriculture (MoFA) extension agents to organize teams and assign communities according to geographic proximity. Geographic proximity in this case refers to the relative distance between the selected communities and a logical sequence for traveling without retracing routes, rather than simply those communities that were most conveniently near to the road. Regarding the number of communities and the distance among them, often up to three supervised teams were deployed in separate vehicles to each of the targeted administrative districts to complete household interviews following a schedule. Data collection was undertaken from 20 May to 9 July 2012 for the first phase covering three districts (Ejura-Sekyedumase, Atebubu-Amantin, and Kintampo) before the second phase was undertaken from 7 to 21 September 2012 with coverage of two remaining districts (Mion and East-Gonja).

Field teams participated in coordination and debriefing meetings which were held each evening following each day's data collection. This gave each team the opportunity to correct forms and review any question or

concern. After the first day, survey teams had progressively fewer concerns about how to ask questions or code responses. The survey team leader had regular communication with all team supervisors to ensure progress and respond to questions generated during data collection, via phone or in person, depending on the limitations of communication technology.

IITA was responsible for quality control of the primary data. Every evening, the enumerators and field supervisors checked each household questionnaire for inconsistencies and errors. Data were regularly packed after a detailed check and sent to IITA-Ibadan for entering into the SPSS database. Data entry work was centralized in Ibadan and six data entry clerks including two ladies were consulted for the task.

Data analysis

The scale of analysis or level of aggregation defines the extent of the proposed intervention and depends on the goals and availability of data and information. In general different levels of targeting could be distinguished and lower-level scales could be aggregated or merged into a higher level scale, thus reducing precision but increasing the extent. Criteria to distinguish uniform clusters differ between targets from domain to domain and depend on the goals of targeting. Interventions could be relevant at the district level; recommended yam varieties are relevant at the level of the farming system and not at the AEZ level. Traditionally, the farming systems approach has given strong emphasis to the targeting of recommendation domains. In practice, this has often led to agroecological zoning, which is relatively time and development neutral. Considering geography as a critical factor affecting the livelihoods of the poor, this study uses general geographical zoning which combines geographic information with physical, biological, or socioeconomic data. Therefore data on agroecological zoning was considered by classifying communities in Ghana into southern Guinea savanna (SGS), derived savanna (DS), and humid forest (HF). The main characteristics of these AEZ are provided in Annex 8.

Data analysis at the first level made use of computations which generated secondary variables such as indices and yields.

The yield for yam enterprise means the total farm output/unit of land. The equation for calculating average yield is as follows:

$$Y_{ij} = \frac{1}{n}\sum_{i=1}^{n}\frac{O_j}{P_j} \quad \text{..... (3)}$$

Where,

Y_{ij} = average yield by i^{th} household for j^{th} yam enterprise in kg/ha,
O_{ij} = output for i^{th} household from j^{th} yam enterprise in kg,
P_{ij} = plot of land for i^{th} household for j^{th} yam enterprise in ha,
n = number of households involved in j^{th} yam enterprise.

Profitability can be assessed using different methods including benefit–cost ratio, economic surplus models, economic efficiency estimation, and gross margin (GM) analysis. In this study, GM was used as a proxy for profitability. Profitability analysis allows the viability of yam enterprises across various zones to be verified and helps in the selection of the most efficient enterprise, having some influence in the allocation of resources. The merit of GM includes enabling the profitability of most economic activities to be assessed. An added advantage of GM is that it can be easily understood and has an interrelationship between economic and technological parameters. Fixed costs have not been included because for most poor rural people fixed costs were not reliable. In most cases, farmers do not have permanent working tools. Tools such as pangas, hoes, machetes, buckets, and utensils that farmers possess and use in the production process are not properly recorded in terms of monetary value and purpose of purchase. GM was therefore taken to establish whether the use is economically profitable. The basic equation for GM computation is presented as follows in equation 4:

$$GM_{ij} = \frac{1}{n}\sum_{i=1}^{n}\left(P_{ij}Q_{ij} - TVC_{ij}\right) \quad \text{..... (4)}$$

Where,

GM_{ij} = average GM earned by i^{th} household for j^{th} yam enterprise in GH¢;
P_{ij} = unit output price received by i^{th} household for j^{th} yam enterprise in GH¢/kg;
Q_{ij} = quantity marketed/valued by i^{th} household for j^{th} yam enterprise in kg;
TVC_{ij} = total variable costs incurred by i^{th} household for j^{th} yam enterprise in GH¢;
n = number of households involved in j^{th} yam enterprise.

The GM is generally quoted per unit of the most limiting resource, which is usually land, on a per hectare basis (Malcolm et al. 2005).

At the second level, descriptive analysis offered a general picture of the livelihood situation such as ownership and distribution of livelihood assets, contexts, and strategies.

The unit of analysis used in poverty measurement continues to receive critical scrutiny. The debate revolves around what is the most appropriate unit: the family, the household, or some other entity. The poverty estimates should be calculated for individuals and not for households, even though the data are almost always related to households.

The most common practice in setting relative poverty lines is to use some proportion of the arithmetic mean or median of the distribution of consumption, as in many studies. Consumption expenditure/capita is then used to determine whether the household falls below the poverty line set as two-thirds of mean annual expenditure/capita. Legitimate comparisons of poverty rates between one country and another can be made only if the same absolute poverty line is used in both countries. To allow such notoriously difficult cross-country comparisons of poverty rates this study makes also use of the World Bank international poverty line of average daily consumption equivalent to US$1.25/day/capita. The monetary unit used in this study is the US dollar at an exchange rate of GH¢1.85 for US$1.

The concept of poverty is applied in this study to situations at the household level. A recall period was used to capture information on the different sub-components of household expenditure: on food, beverages, and tobacco, non-durable goods and frequently purchased services; semi-durable and durable goods and services; and non-consumption expenditure. For details on the household consumption module refer to the household questionnaire in Annex 11.

All purchases by household members and items received as free gifts were valued and recorded at the current prices. The items consumed out of home produce were valued at the current farm-gate/producer prices; rent for an owner-occupied house was computed at current market prices. Food consumption includes food from own production, purchases, and free collection/gifts.

Expenditure data were collected on an item-by-item basis. The expenditure was then aggregated according to the recall period used and by broader sub-components to the household level. After which, all the different sub-components were aggregated to derive the total expenditure at the household level. There is a distinction between consumption expenditure and total expenditure. The former refers to expenditure excluding non-consumption expenditure, whereas the latter includes the non-consumption expenditure sub-component.

Further adjustments were made in the construction of the consumption aggregate that was later used in the estimation of poverty estimates. These adjustments included accounting for inter-emporal and spatial price variations, revaluation of foods derived from own-consumption into market prices, and finally accounting for household composition.

There are a number of aggregate measures of poverty that can be computed. The formulas presented here are all based on the fact that the survey represents a simple random sample of the population which makes them relatively easy to understand.

Headcount index

By far the most widely-used measure is the *headcount index*, which simply measures the proportion of the population that is counted as poor, often denoted by P_0. Formally,

$$P_0 = \frac{N_p}{N} \quad \text{..... (5)}$$

Where;

Np is the number of poor and *N* is the total population.

For reasons that will be clearer below, it is often helpful to rewrite (5) as (6):

$$P_0 = \frac{1}{N}\sum_{i=1}^{M} I(y_i < z) \quad \text{..... (6)}$$

Where;

I (.) is an indicator function that takes on a value of 1 if the bracketed expression is true, and 0 otherwise. So if expenditure (y_i) is less than the poverty line (*z*), then *I* (.) equal to 1 and the household would be counted as poor.

The greatest virtues of the headcount index are that it is simple to construct and easy to understand. These are important qualities. However the measure has some weaknesses. First, the headcount index does not take the intensity of poverty into account. Secondly, the headcount index does not indicate how poor the poor are, and hence it does not change if people below the poverty line become poorer. Moreover, the easiest way to reduce the headcount index is to target benefits to people just below the poverty line, because they are the cheapest to move across the line. But by most normative standards, people just below the poverty line are the least deserving of the poor.

Poverty gap index

A moderately popular measure of poverty is the *poverty gap index*, which adds up the extent to which individuals, on average, fall below the poverty line and expresses it as a percentage of the poverty line. More specifically, it defines the poverty gap (*Gi*) as the poverty line (*z*) less actual expenditure (*yi*) for poor individuals; the gap is considered to be zero for everyone else. Using the index function, we have:

$$G_i = (z - y_i)\, I(y_i < z) \quad \text{..... (7)}$$

Then the poverty gap index (P_1) may be written as:

$$P_1 = \frac{1}{N}\sum_{i=1}^{M} \frac{G_i}{z} \quad \text{..... (8)}$$

This measure is the mean proportionate poverty gap in the population (where the non-poor have a zero poverty gap). Some people find it helpful to think of this measure as the cost of eliminating poverty (relative to the poverty line) because it shows how much would have to be transferred to the poor to bring their incomes or expenditure up to the poverty line (as a proportion of the poverty line). The minimum cost of eliminating poverty using targeted transfers is simply the sum of all the poverty gaps in a population; every gap is filled up to the poverty line. However this interpretation is reasonable only if the transfers could be made perfectly efficiently, for instance, with lump sum transfers, which is implausible. Clearly this assumes that the policymaker has a lot of information; one should not be surprised to find that a very "pro-poor" Government would need to spend far more than this in the name of poverty reduction. At the other extreme, one can consider the maximum cost of eliminating poverty, assuming that the policymaker knows nothing about who is poor and who is not. From the form of the index, it can be seen that the ratio of the minimum cost of eliminating poverty with perfect targeting (i.e., *Gi*) to the maximum cost with no targeting (i.e., *z*, which would involve providing everyone with enough to ensure they are not below the poverty line) is simply the poverty gap index. Thus, this measure is an indicator of the potential saving to the poverty alleviation budget from targeting: the smaller the poverty gap index, the greater the potential economies for the poverty alleviation budget from identifying the characteristics of the poor—using a survey or other information—so as to target benefits and programs.

Squared poverty gap ("poverty severity") index

To construct a measure of poverty that takes into account inequality among the poor, some researchers use the *squared poverty gap index*. This is simply a weighted sum of poverty gaps (as a proportion of the poverty line), where the weights are the proportionate poverty gaps themselves; a poverty gap of (say) 10% of the poverty line is given a weight of 10% while one of 50% is given a weight of 50%; this is in contrast to the poverty gap index where they are weighted equally. Hence, by squaring the poverty gap index, the measure implicitly puts more weight on observations that fall well below the poverty line. Formally:

$$P_2 = \frac{1}{N}\sum_{i=1}^{M}\left(\frac{G_i}{z}\right)^2 \quad \text{..... (9)}$$

The measure lacks intuitive appeal; because it is not easy to interpret, it is not used very widely. It may be thought of as one of a family of measures proposed by Foster, Greer and, Thorbecke (FGT) (1984), which may be written, quite generally, as

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{M}\left(\frac{G_i}{z}\right)^\alpha, \ (\alpha \geq 0) \quad \text{..... (10)}$$

Where;

> α is a measure of the sensitivity of the index to poverty and the poverty line is *z* defined in this study as 2/3 of mean annual per capita expenditure, the value of expenditure per capita for the i^{th} person's household is *xi*, and the poverty gap for individual *i* is *Gi* = *z*-*xi* (with *Gi* = 0 when *xi* >*z*)

When parameter α = 0, P_0 is simply the headcount index. When α = 1, the index is the poverty gap index P_1, and when α is set equal to 2, P_2 is the poverty severity index. For all α > 0, the measure is strictly decreasing the living standard of the poor (the lower your standard of living, the poorer you are deemed to be). Furthermore, for α > 1, it also has the property that the increase in measured poverty due to a fall in one's standard of living will be deemed greater, the poorer that one is. The measure is then said to be "strictly convex" in incomes (and "weakly convex" for α =). Another convenient feature of the FGT class of poverty measures is that they can be disaggregated for population sub-groups and the contribution of each sub-group to national poverty can be calculated.

Although the FGT measure provides an elegant unifying framework for measures of poverty, it leaves unanswered the question of what is the best value of α. Moreover, some of these measures also lack emotional appeal.

The measures of poverty depth and poverty severity provide complementary information on the incidence of poverty. It might be the case that some groups have a high poverty incidence but low poverty gap (when numerous members are just below the poverty line), while other groups have a low poverty incidence but a high poverty gap for those who are poor (when relatively few members are below the poverty line but with extremely low levels of consumption).

Characteristics of Household and Livelihood Capitals

3

Characteristics of sample households

The distribution of household heads by gender is shown in Table 3 where female-headed households accounted for only about 10% in the study area; there were no female-headed households in the SGS. This pattern of headship distribution is one of the characteristics of most rural communities in developing countries. The highest number of female-headed households was found in the HF. Age has been found to determine how active and productive the household head could be and the average age of household heads was quite high (about 50 years). The level of education determines the level of opportunities available to improve livelihood strategies and enhance food security; this study revealed that few household heads had attended school and had low average years of schooling. The majority could not complete 3 years of primary education. Household size determines the availability of household labor supply. Table 3 indicates a large household size for the study area which may be attributed to the propensity of adult sons and daughters (unmarried or married) to remain in the parental household. Moreover, a large household size tends to be allied generally with rural areas characterized by pronatalism and extended family relations. The dependency ratio shows that there are equal numbers of adults (children above 15 years and adults below 64 years) compared to dependents (below 15 years and above 64 years) in the study area. More households in the DS tended to have more able-bodied members than in the SGS; more dependents were reported in the HF. Detailed information on the demographic and socioeconomic characteristics of respondents by districts is presented in Annex 1.

Livelihood capitals

Natural capital

Natural capital refers to the natural resource stock from which resource flows and services important to livelihoods are derived. Land was by far the major natural capital for smallholder farmers in the yam-growing areas of Ghana. The average amount of land available for farming was about 2.7 ha (Table 4). The area of available land was highest in the SGS, followed by the DS; the smallest area was found in the HF. Out of the total farming land about 59% was allocated to yam and 6% of the yam land was for seeds. About 6% of the total farming land was owned and used by women. Women are in a disadvantaged position in terms of access to land, not being associated to inheritance practices.

Figure 2 shows in Ghana the inequality of yam land distribution with the smallest holding category for smallholder farmers with less than 2 acres. This is confirming the fact that in yam production area most of the land is allocated for yam.

Table 3. **Characteristics of sample households.**

Characteristics		All	SGS	DS	HF
	N	600	14	436	150
Male-headed households (%)		89.8	100	90.1	88.0
Average age of household heads (years)		48.7	55.2	48.1	49.9
Attended school for household heads (%)		30.0	0.0	30.7	30.7
Average years of schooling for household heads		2.7	-	2.7	2.7
Experience in yam growing for household heads (years)		23.4	34.6	24.4	19.6
Household size (number)		9.3	15.6	9.3	8.5
Dependency ratio		1.0	0.8	0.9	1.1

N = Number of respondents; SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest

Strengthening women's rights to land ownership would contribute to gender equality and poverty reduction since women are responsible for most food production.

Physical capital

Physical capital is created by economic production. It includes basic infrastructure and producer goods needed to support livelihoods. Basic infrastructure refers to the physical environment that helps people to meet their basic needs and be more productive in livelihoods; producer goods refer to productive capital that enhances income and personal consumption. It comprises productive assets, household quality, and consumer durables. The productive and household assets include machinery, tools, and items of equipment that are important determinants for production.

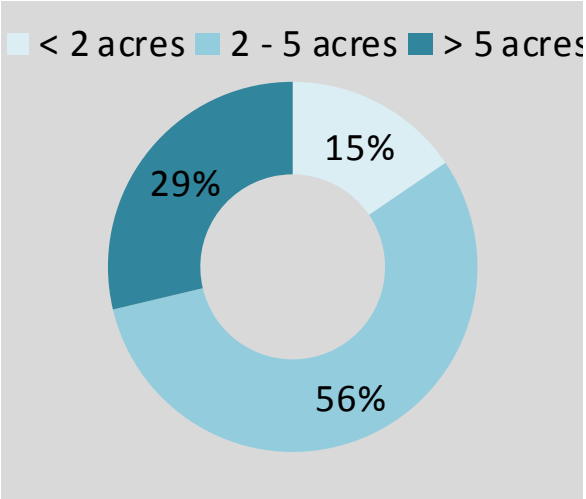


Figure 2. Percentage of yam farms by holding size.

As for the ownership of working animals, some of the animals are used as means of transport, pack animals (horses and donkeys), or as draft animals (oxen). The average number of oxen owned by respondents was small in the entire surveyed area with the highest number in SGS and the lowest in HF. Some traces of donkeys were reported in the DS and HF and their number is negligible; there were none in the SGS. Ownership of horses was reported only amongst the respondents in the DS. Detailed information on the ownership of working animals is presented in Table 5.

Table 4. Mean value of land holding (ha).

Land	All	SGS	DS	HF
N	600	14	436	150
Total	2.68	3.03	2.69	2.63
Allocated to yam	1.57	1.56	1.58	1.55
Allocated for seed yam	0.10	0.30	0.11	0.07
Allocated for women	0.17	0.03	0.14	0.24

N = Number of respondents; SG S = Southern Guinea Savanna;
DS = Derived Savanna; HF = Humid Forest

Table 5. Ownership of working animals (means).

	All	SGS	DS	HF
Oxen	4.10 (177)	8.93 (7)	4.37 (143)	2.87 (27)
Donkeys	0.04 (6)	0.00 (0)	0.04 (3)	0.04 (3)
Horses	0.02 (5)	0.00 (0)	0.03 (5)	0.00 (0)

Note: Figures in parentheses represent number of valid respondents.
SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

Other productive and household assets per capita are required for agriculture in all its ramifications. As shown (Table 6), in all the households surveyed, every active member[1] of a household had at least his own hand hoe considered as prerequisite for farming except in the SGS where it was reported that there were not enough hoes for the active members. The machete was the only most frequently reported asset owned by households. The other productive and household assets owned, important in managing yam fields, were not common in all the sampled households, providing evidence that farmers do not achieve the proper management of croplands. Items such as carts, grain mills, CD players, television sets, motorbikes, tractors, jewelry, wooden and metal boxes, and sofas were almost nonexistent in the households' assets basket. Pumps, cars, and fish ponds were absent from the list.

The mode of transport used from residence to field was an issue to look at, as it affects productivity. Farmers travel within a given radial distance from their residence to the field for farming. The most important means of transport used were riding a bicycle and going on foot with a different perception of the distance between the residence and farms expressed in terms of minutes of walking time. Farmers took a minimum of half an hour to walk to their farms and could use up to 1.20 hours (Table 7). Motorcycles were used by a few farmers; vehicles/ tractors were generally used occasionally for the most distant farms and were almost absent.

Table 6. Average productive and household assets/capita.

Assets (/capita)	All	SGS	DS	HF
N	600	14	436	150
Axes	0.30 (350)	0.23 (10)	0.27 (244)	0.36 (96)
Machetes/cutlasses	0.86 (574)	0.46 (14)	0.80 (413)	1.08 (147)
Hoes	1.32 (568)	0.78 (13)	1.26 (410)	1.55 (145)
Sprayers	0.28 (338)	0.05 (3)	0.25 (222)	0.39 (113)
Spades or shovels	0.05 (69)	0.06 (3)	0.04 (39)	0.07 (27)
Radios	0.30 (435)	0.15 (11)	0.28 (308)	0.38 (116)
Cell phones	0.32 (402)	0.26 (12)	0.30 (290)	0.39 (100)
Stoves	0.10 (84)	0.00 (0)	0.08 (49)	0.16 (35)
Bicycles	0.46 (493)	0.28 (12)	0.44 (362)	0.51 (119)
Beds	0.32 (412)	0.11 (10)	0.31 (305)	0.38 (97)
Chairs	0.71 (406)	0.16 (6)	0.67 (289)	0.89 (111)
Tables	0.29 (357)	0.08 (7)	0.28 (251)	0.34 (99)
Thatched houses	0.25 (337)	0.09 (9)	0.22 (230)	0.34 (98)
Houses roofed with corrugated iron sheets	0.13 (207)	0.02 (3)	0.12 (159)	0.15 (45)
Panga knives	0.14 (122)	0.22 (7)	0.15 (96)	0.12 (19)

N = Number of respondents; SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest
Figures in parentheses represent number of valid responses.

Table 7. Mode of transport used from residence to field (% response).

Mode of transport	All		SGS		DS		HF	
	%	Dist. (min)	%	Dist. (min)	%	Dist. (min)	%	Dist. (min)
Walking	41.3	46.7	30.0	55.0	36.4	51.2	57.7	37.6
Bicycle	48.1	53.0	40.0	37.5	51.7	52.0	37.4	58.7
Motorcycle	10.2	53.2	30.0	34.3	11.4	50.8	4.9	80.0
Vehicle/tractor	0.4	150.0	0.0	-	0.5	150.0	0.0	-

Dist = Distance in minutes of walking time.

[1] Active agricultural population in the study area using these assets to be more productive refers to the population in agricultural households that is within the age group from 15 to 64 years.

The distance to fields could have effects on labor input and productivity and thus on yields and total production. Walking to farms for between 34 minutes and more than an hour reduces field work time. Chisholm (1979) provides numerous cases, mainly from West Africa where, for instance, intensive cultivation tends to drop off beyond 2 to 4 km (i.e., one hour's walk) from the homestead. Apart from the labor intensity (person-days/ season) being reduced, other concerns as follows might need to be taken into consideration:

- The quality of the labor input (i.e., the care and attention,) could also suffer because of the extra weariness and the need to perform most of the labor during the midday heat.
- Protection of pre-harvest yam against vermin and wandering livestock could be very difficult on distant fields with other source of losses such as human theft of standing yam being similarly harder to prevent.
- Use of land by poor smallholder farmers could be reduced and distant landholdings can become concentrated in the hands of richer peasants who own good means of transport.

In conclusion, reduced labor intensity, land shortage with land disputes and general social insecurity, and the choice of crop could be the salient effects of the journey-to-field problem.

Human capital

Human capital refers to farming and non-farming occupations, labor availability, and the education, skills, nutrition, and health of household members. Most rural economies in developing countries have diversified income-generating activities which might have an effect on a household's decision whether to adopt improved agricultural technologies or not. The major types of these income-generating activities that were identified in the course of the study are not diversified for the main occupation in the project area as shown in Figure 3. It is evident that farming was the most important occupation of the heads of households and especially for the females who headed households which all had farming as their primary occupation. Others were relatively minor occupations in the study area.

Extension workers or information providers help farmers to translate research results into an improvement in livelihoods. Extension or information services are expected to make farmers more likely or more able to adopt improved technologies and practices, and thus increase yield. Training or spreading information is one of the prime movers of the agricultural sector and has been considered a major means of technology dissemination. This aims at improving the productivity of agricultural systems and enhances the quality of life of rural farm households.

Few respondents had access to extension/information services in the surveyed area during last cropping season under consideration in services of all types. A negligible number of respondents (about 14%) had

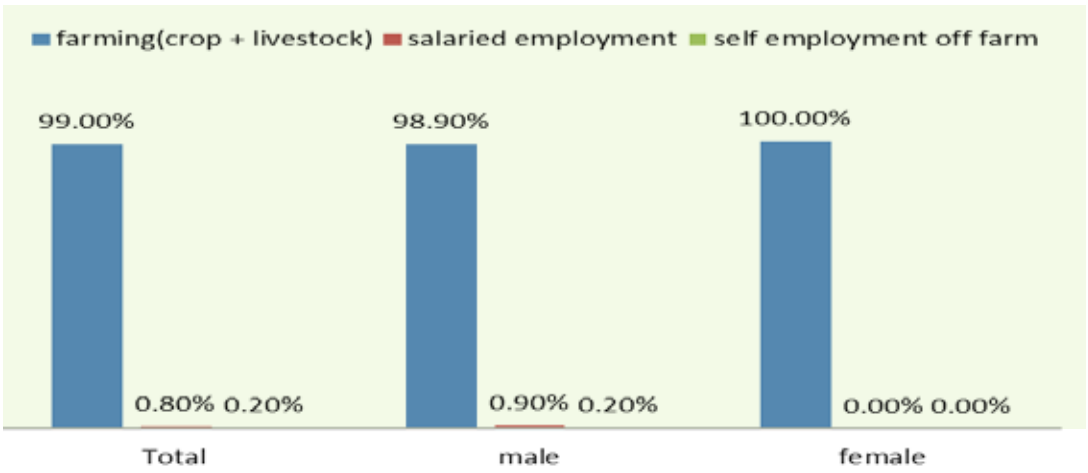


Figure 3. Percentage distribution of household heads by occupation and gender.

Table 8. Extension/information services (% of respondents).

Training/Information received on	All*	SGS	DS	HF
N	600	14	436	150
Yam new varieties	13.7	14.3	12.4	17.3
Other new crop varieties	14.8	7.1	13.3	20.0
Yam pest/disease control	16.5	7.1	14.2	24.0
Other crops pest/disease control	20.0	7.1	14.2	38.0
Soil and water management	10.8	7.1	9.9	14.0
Crop rotation	13.0	0.0	9.9	23.3
Output market and price	15.3	14.3	14.4	18.0
Input market and price	14.0	7.1	12.6	18.7
Livestock production	12.8	14.3	11.2	17.3
Family health/planning	39.0	21.4	38.8	41.3
Sanitation	40.2	42.9	40.6	38.7
Food processing	7.2	0.0	5.7	12.0

N = Number of respondents; SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

*The total for percentage exceeds 100 due to multiple responses.

Table 9. Percentage distribution of households by source of information/training on new varieties of yam.

Training/Information received on	N	SGS	DS	HF
N	600	14	436	150
Government's extension service	***55***	***0***	***34***	***21***
Farmers' cooperatives or groups	***2***	0	2	0
Neighboring farmers/relatives	***15***	1	12	2
NGOs	***5***	1	3	1
Farmers' field school	***2***	0	1	1
Radio/TV	***2***	0	2	0

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.
N = Number of respondents on which the analysis is based.

received training or information on new yam varieties during the same period (Table 8). The highest number of respondents who had access to information on yam new varieties was in the HF, followed by the SGS; the DS scored the lowest. There is an indication that an important number of respondents (about 40%) were provided with information on family health/planning and sanitation which could be helpful in preventing them from catching diseases and keeping them fit for farming activities.

Among the few households which reported having information on new yam varieties, none was from a private company, research center, newspaper, mobile phone, town hall meeting, farmers' training center, trader, or agrodealer. A negligible number got the information from farmers' groups, farmers' field schools, or radio/TV (Table 9). An important number had access to information services through the Government's extension service and neighboring farmers/relatives. Apart from the Government's extension service, the sources which appeared to be promising avenues for the promotion of new technologies are neighboring farmers/relatives followed by others such as NGOs, the farmers' field school, farmers' groups, and radio/TV.

Despite moderninformation technology when telecenters should provide the rural farmers with prompt and reliable information about what is happening in areas of improved varieties, better methods of cultivation, fertilizer application, and pest and weed control/eradication, old sources of communication still exist in the surveyed area. These include town criers, secretaries of village heads, religious leaders, town hall meetings, radio, TV, newspapers, and mobile phones focused on varietal information dissemination.

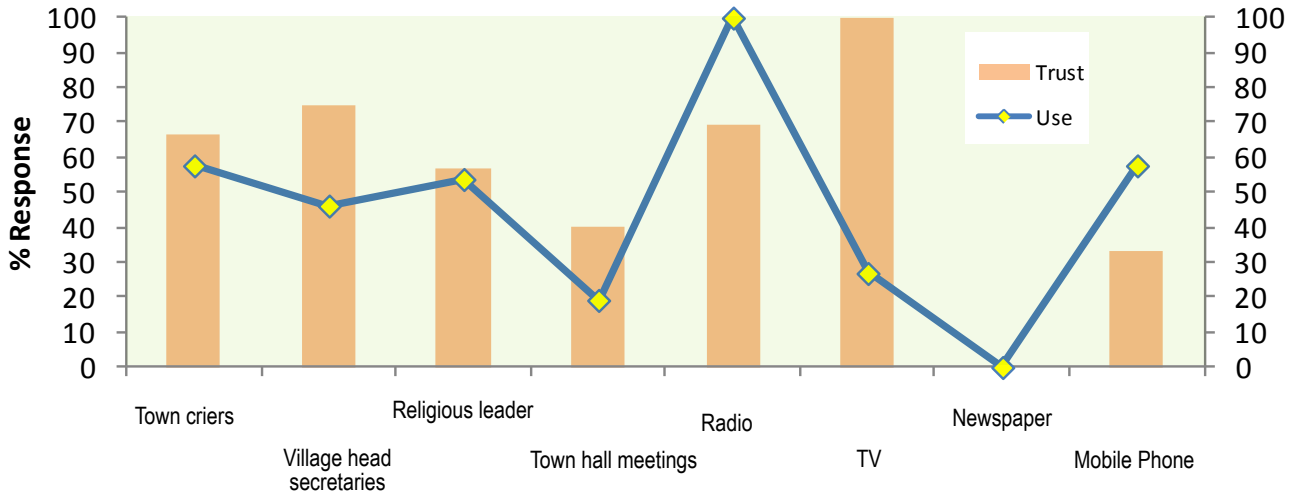


Figure 4. Percentage distribution of other communication mechanisms, existing and used.

Table 10. Percentage distribution of household by credit needs.

Credit need to	All	SGS	DS	HF
N	600	14	436	150
Buy local seeds	47.3 (7.0)	64.3	46.8	47.3
Buy improved seeds	42.0 (3.6)	57.1	42.7	38.7
Buy fertilizer	61.2 (10.4)	57.1	59.4	66.7
Buy herbicide/pesticide	53.2 (7.5)	42.9	54.6	50
Buy farm inplements	46.8 (4.3)	57.1	47.9	42.7
Buy livestock	37.8 (3.1)	42.9	37.8	37.3
Invest in irrigation system	21.8 (0.8)	35.7	21.8	20.7
Non-farm business or trade	36.0 (4.2)	50	34.6	38.7
Buy food	27.8 (7.8)	64.3	27.3	26
Take care of medical expenses	37.3 (10.7)	57.1	37.4	35.3
Pay school fees	40.2 (8.7)	71.4	39.7	38.7

N = Number of respondents; SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.
Figures in parentheses represent the percentage of respondents who had access to credit.

Discussions with 26 separate groups of men and women, each with a minimum of eight members, indicated that the radio is the most common source of information in use (Fig. 4). All households reported the use of a radio and about 69% among the radio users trusted the information they had from the radio. Apart from the radio, the common means used were mobile phones, town criers, and religious leaders. Other methods were uncommon or absent.

Other ways of delivering messages or information to the rural farmers reported in the surveyed area include video/film centers, dance, folklore, group discussions, meetings, exhibitions, and demonstrations not focusing necessarily on agriculture. Most of these occur rarely while a few are inaccessible to all.

Financial capital

Financial capital refers to the financial resources that people use to achieve their livelihood objectives and includes flows and stocks that can contribute to production and consumption. It includes savings, income levels, variability over time, and distribution within society of financial savings, flows or stocks of capital, for example, livestock holdings, and access to credit (formal or informal). The financial capital enables people to adopt different livelihood strategies.

Investment in agricultural technologies by smallholders is often limited by financial capital constraints such as credit. Access to credit facilities is an important tool for poverty reduction because it enables additional income to be generated. Results from the surveyed areas show that a larger percentage (up to 61%) of respondents needed credit to buy farm inputs and pay for all services and only a small number (less than 22%) of the needy had access to it (Table 10 and Fig. 5).

Non-working livestock are life-supporting assets to the poor. They represent financial capital that enhances the quality of life as they have the potential to generate quick cash for owners when there is an urgent need for money; they can feed humans with meat/milk and add manure to the soil. They are also a source of security to the smallholders who depend heavily on such assets during periods of unexpected crop failure.

Poultry was kept by most households in the study area, followed by goats, and then sheep, and finally pigs and doves (Table 11). Instances of piggery enterprises and dove keeping were negligible; rabbits and other animals, such as grasscutters and dogs, were almost absent.

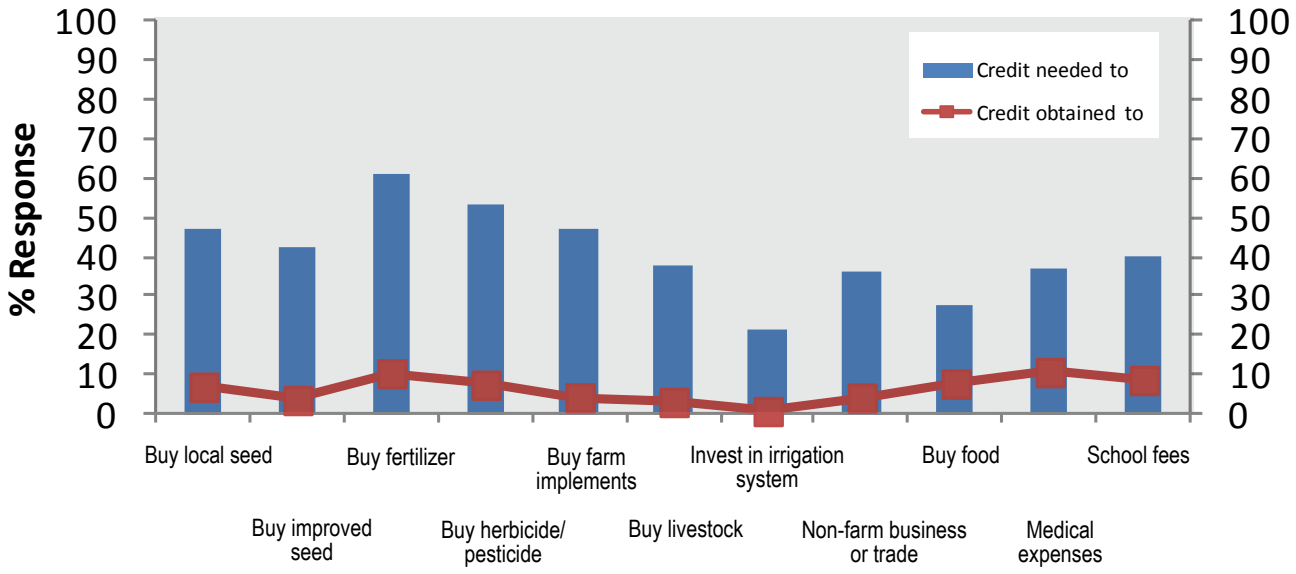


Figure 5. Percentage distribution of households by credit needed versus obtained.

Table 11. Average number of non-working livestock owned by households.

	All	SGS	DS	HF
Goats	5.91 (372)	8.43 (11)	5.57 (271)	6.65 (90)
Rabbits	0.08 (8)	0.00 (0)	0.06 (4)	0.13 (4)
Sheep	3.15 (237)	5.57 (8)	3.16 (179)	2.92 (50)
Poultry	19.10 (547)	20.57 (12)	18.86 (394)	19.65 (141)
Doves	0.53 (15)	0.57 (1)	0.34 (7)	1.07 (7)
Pigs	0.73 (46)	0.00 (0)	0.69 (34)	0.91 (12)
Other	0.04 (7)	0.00 (0)	0.03 (3)	0.08 (4)

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest
Figures in parentheses represent number of respondents

Social capital

Social capital refers to the social resources upon which people draw in pursuit of their livelihoods. This includes any membership of a social group or network that increases trust, ability to work together, access to opportunities, reciprocity, and informal safety nets.

In rural communities, membership in formal or informal institutions offers opportunities to increase agricultural production by providing various forms of support to farmers. In the surveyed area only about 24% of farmers reported they had been members of any the institution in the last 3 years. Male and female groups were reported and some respondents belonged to more than one group. Results (Table 12) indicate that the main form of membership is in farmers' associations (44.6% in the male group) and religious association (42.1% from the female group). Groups of other types, including yam producer and marketing groups, had poor membership sizes, probably because they were limited in formation or did not provide much assistance to members. Other memberships were uncommon or nonexistent. Farmers were involved in memberships seven decades ago and this had increased after three decades from 4 to 86% in the male group; in the female group, membership increased from 8 to 92% after four decades. Most farmers from the male group (91%) were still involved in institutions, more as ordinary members (66.9%). On the other hand, in the female group (97%), most of them were ordinary members (83.3%).

Table 12. Distribution of household heads and spouse(s) by membership to formal/informal institution and gender.

	Type of group by gender	All	SGS	DS	HF
Male responses	Input supply/farmers' cooperative/union	7.9 (11)	50.0 (1)	6.1 (5)	9.1 (5)
	Yam producer and marketing group	7.9 (11)	0.0 (0)	4.9 (4)	12.7 (7)
	Other crop/seed producer and marketing group	3.6 (5)	50 (1)	3.7 (3)	1.8 (1)
	Local administration	4.3 (6)	0.0 (0)	2.4 (2)	7.3 (4)
	Farmers' association	44.6 (62)	0.0 (0)	47.6 (39)	41.8 (23)
	Women's association	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
	Youth association	3.6 (5)	0.0 (0)	3.7 (3)	3.6 (2)
	Religious association	11.5 (16)	0.0 (0)	8.5 (7)	16.4 (9)
	Savings and credit group	5.0 (7)	0.0 (0)	7.3 (6)	1.8 (1)
	Funeral association	5.8 (8)	0.0 (0)	9.8 (8)	0.0 (0)
	Government team	2.9 (4)	0.0 (0)	2.4 (2)	3.6 (2)
	Water users' association	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
	Cooperative farming	1.4 (2)	0.0 (0)	2.4 (2)	0.0 (0)
	Other	1.4 (2)	0.0 (0)	1.2 (1)	1.8 (1)
Female responses	Input supply/farmers' cooperative/union	10.5 (4)	0.0 (0)	0.0 (0)	20.0 (4)
	Yam producer and marketing group	5.3 (2)	0.0 (0)	0.0 (0)	10.0 (2)
	Other crop/seed producer and marketing group	5.3 (2)	0.0 (0)	5.6 (1)	5.0 (1)
	Local administration	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
	Farmers' association	13.2 (5)	0.0 (0)	27.8 (5)	0.0 (0)
	Women's association	7.9 (3)	0.0 (0)	11.1 (2)	5.0 (1)
	Youth association	2.6 (1)	0.0 (0)	5.6 (1)	0.0 (0)
	Religious association	42.1 (16)	0.0 (0)	44.4 (8)	40.0 (8)
	Savings and credit group	7.9 (3)	0.0 (0)	5.6 (1)	10.0 (2)
	Funeral association	2.6 (1)	0.0 (0)	0.0 (0)	5.0 (1)
	Government team	2.6 (1)	0.0 (0)	0.0 (0)	5.0 (1)
	Water users' association	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
	Cooperative farming	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
	Other	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.
Figures in parentheses represent number of valid respondents with multiple responses.

Table 13. Average number of years households have lived in the community.

Period (years)	All	SGS	DS	HF
Less than 10	13.7	21.4	10.8	21.3
10-50	71.8	50.0	73.9	68.0
More than 50	14.5	28.6	15.4	10.7

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

Table 14. Average number of people to rely on for critical support.

Type of relation	All	SGS	DS	HF
Average number of people to rely on for critical support within the community				
Relatives	6.0	9.2	6.1	5.3
Non-relatives	5.3	3.9	5.3	5.7
Average number of people to rely on for critical support outside the community				
Relatives	6.2	5.1	6.3	6.0
Non-relatives	4.9	3.8	4.8	5.3
Friend/relative in leadership position in an institution within and outside your community				
Yes	41.3	57.1	39.7	44.7

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

Table 15. Average number of potential yam buyers.

Type of yam	All	SGS		HF
Average number of potential yam buyers known inside community				
Seed yam	1.0	1.3	0.5	0.7
Ware yam	1.5	1.8	1.6	1.4
Average number of potential yam buyers known outside community				
Seed yam	2.3	2.7	2.4	2.2
Ware yam	2.9	2.1	3.0	2.7

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

Apart from membership of institutions, other social resources upon which households draw in pursuit of their livelihood objectives are developed through interactions, relationships that could facilitate cooperation and increase the ability to work together. Results (Table 13) indicate that about 86% of respondents have been living in their community for more than 10 years, sufficient time for people to have developed confidence in one another other.

Despite their life together within the community, respondents could rely only on about 4 to 6 relatives/ non-relatives in a critical situation within/outside the community. In the surveyed area, farmers trust more non-relatives within and relatives outside their community for critical support. More reliance was built on non-relatives in the HF and on relatives in the SGS, with outside relationships predominant in the DS (Table 14).

The number of potential yam buyers inside the community is lower and more negligible than that outside (Table 15). There was no clear competition among buyers who could have taken advantage of the situation.

Yam-based Systems

4

Cropping systems across the zones are characterized by tremendous diversity and the predominant form of crop husbandry in the case study area is the yam-based system. Within the system, farmers combine crops with different growing periods and develop highly diversified cropping patterns. This behavior must be explained by the intention of maximizing returns from limited resources.

Areas under cultivation are generally small and the primary objective of farmers is to meet subsistence needs followed by income generation through the sale of surplus food production. The range of local soil and climatic conditions, resource availability, and markets or farmers' tastes and preferences allows a wide variety of crops to be grown across the different zones. The most widely cultivated crops were roots and tubers. Of these, yam was the most important and most widely cultivated. Cereals were next to roots and tubers in terms of relative importance, as reflected in the percentage of households growing them, especially maize (Table 16). On the other hand, grain legumes and vegetables were not widely grown; the industrial crops were barely seen.

Cropping pattern

Farming practices vary depending on farmers' production objectives, such as food and income. In the surveyed area, mixed cropping or intercropping and rotation were used for the efficient utilization of resources in yam areas.

Table 16. Percentage distribution of households growing various crops.

	Crops grown	All	SGS	DS	HF
Roots/tubers/ banana	Yam	46.5 (1)	36.2 (1)	50.4 (1)	37.5 (1)
	Cassava	7.3 (3)	1.7	8.4 (3)	5.2
	Cocoyam	0.2	0.0	0.2	0.2
	Plantain	0.1	0.0	0.2	0.0
	Other roots/tubers/banana	0.6	0.0	0.0	2.2
Cereals	Maize	23.5 (2)	24.1 (2)	21.1 (2)	29.5 (2)
	Rice	2.9	3.4	3.2	2.0
	Sorghum	0.2	0.0	0.3	0.0
	Millet	1.1	3.4	1.5	0.0
	Guinea corn	0.8	5.2	0.9	0.2
Grain legumes, oil seed, spices & vegetable	Cowpea	4.4	3.4	1.8	11.1 (3)
	Groundnut	6.2	13.8 (3)	6.7	4.0
	Bambara nut	0.7	0.0	0.4	1.5
	Cotton seed	0.1	0.0	0.1	0.0
	Soybean	0.7	6.9	0.7	0.2
	Ginger	0.1	0.0	0.1	0.0
	Other legumes/seed/spice	0.3	0.0	0.2	0.7
	Vegetable	4.0	0.0	3.4	5.9
Industrial tree crops	Cashew	0.1	1.7	0.1	0.0
	Cocoa	0.1	0.0	0.1	0.0

Ranking of most important crops grown is in parentheses.

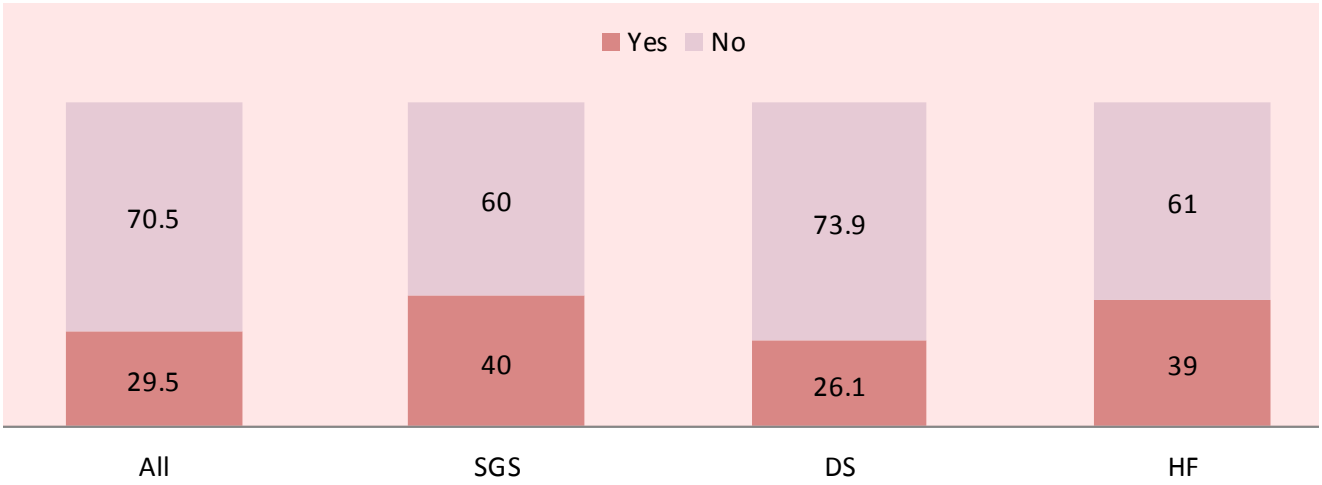


Figure 6. Percentage distribution of yam plots intercropped with other crop.

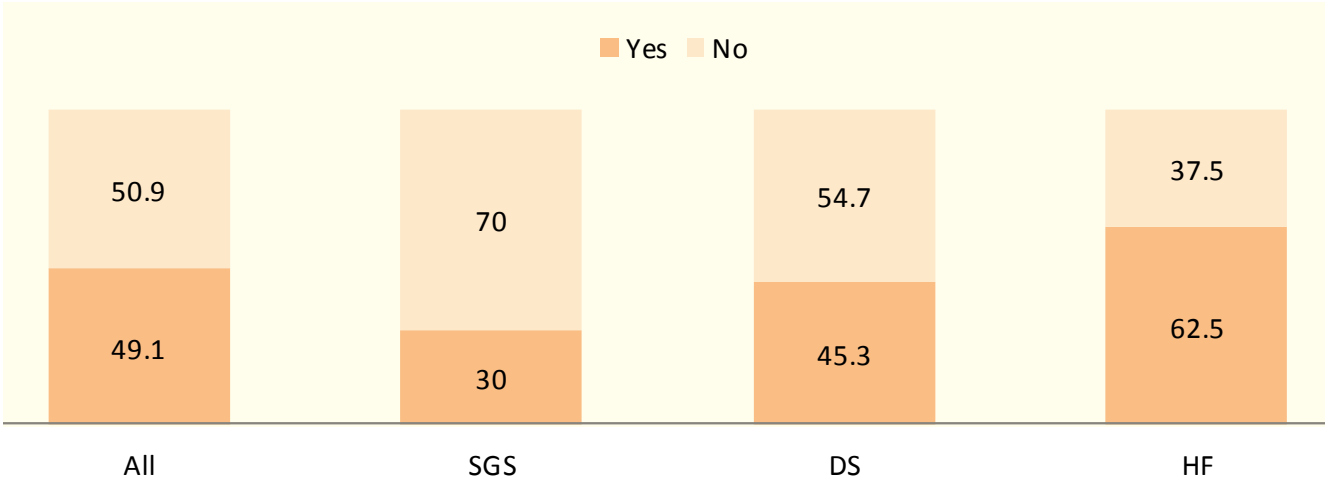


Figure 7. Percentage distribution of yam plots in rotation with other crops.

Yam is grown sometimes as an intercrop with other crops. Intercropping is practiced in Ghana because farmers are mindful of food security and year-round subsistence needs. Intercropping seems to help in maximizing the space, water, and nutrients available. About 66% of households intercropped their yam plots with cassava, 17% with maize, and about 7% with vegetable as the main second crop (Fig. 6).

Apart from intercropping, rotation was also used to restore fertility to the land. About 49% of households reported the use of rotation with other crops. The pattern varies from zone to zone and more households used rotation in the HF (Fig. 7). Cassava (67% of cases) was the first previous season main crop grown followed by maize (10% of cases) and guinea corn (7% of cases).

Yam farm ownership and management

Almost all the yam plots were owned in all the AEZs; a few were rented or borrowed (Fig. 8).

As for the yam plot management, almost all plots were managed by men; women were involved progressively from the DS to the HF but have never been involved in yam growing in the SGS (Fig. 9).

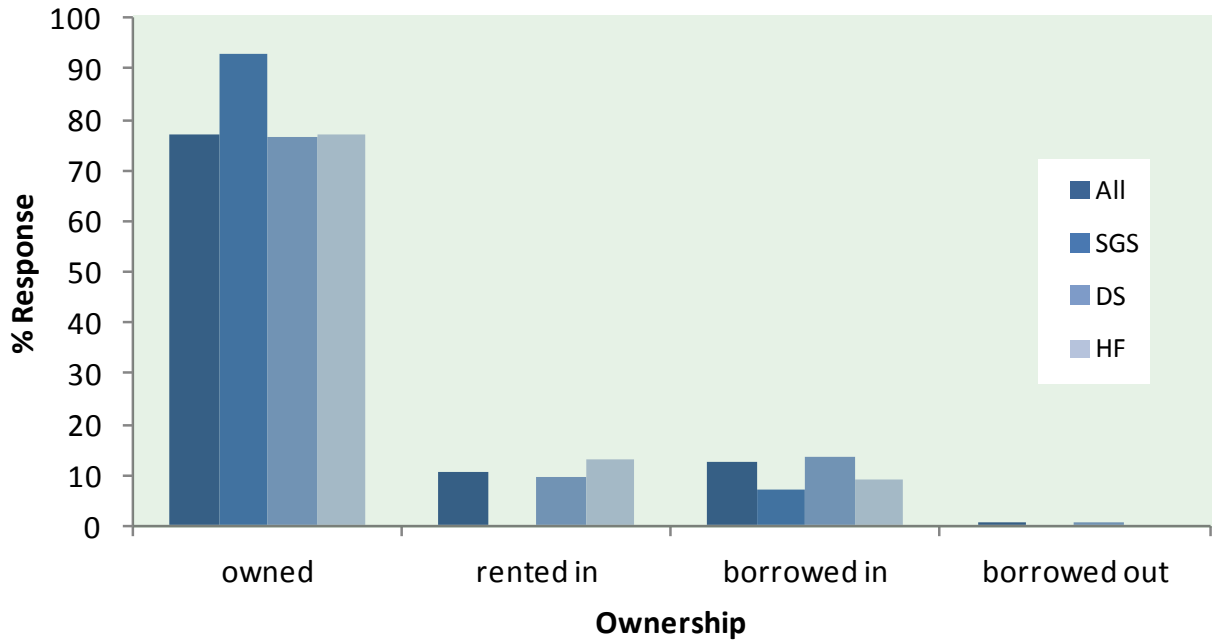


Figure 8. Percentage distribution of yam plots by ownership.

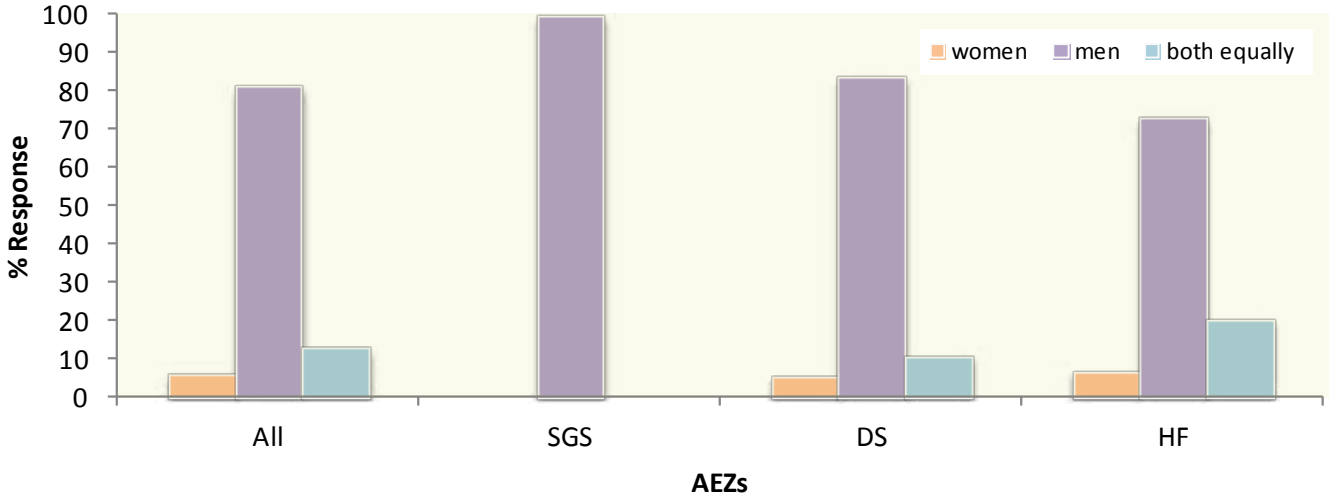


Figure 9. Percentage distribution of yam plots by management and gender.

The major soil types in the study area in Ghana, according to FAO/IIASA/ISRIC/ISSCAS/JRC (2009) soil taxonomy, are fluvisols, leptosol, plinthosols, acrisols, ferrasols, lixisols, luvisols, nitosols, and vertisols. Farmers perceived the soils in the SGS to be quite different from those in the DS which, in turn, are different from those in the HF in terms of soil fertility, slope, depth, and type/color. These soil types vary in their potential for agricultural use (Fig. 10). Soils were reported to be more fertile in thr DS and to slope less than those in other zones. Shallow soil depth was perceived more in the SGS and black soil in the HF.

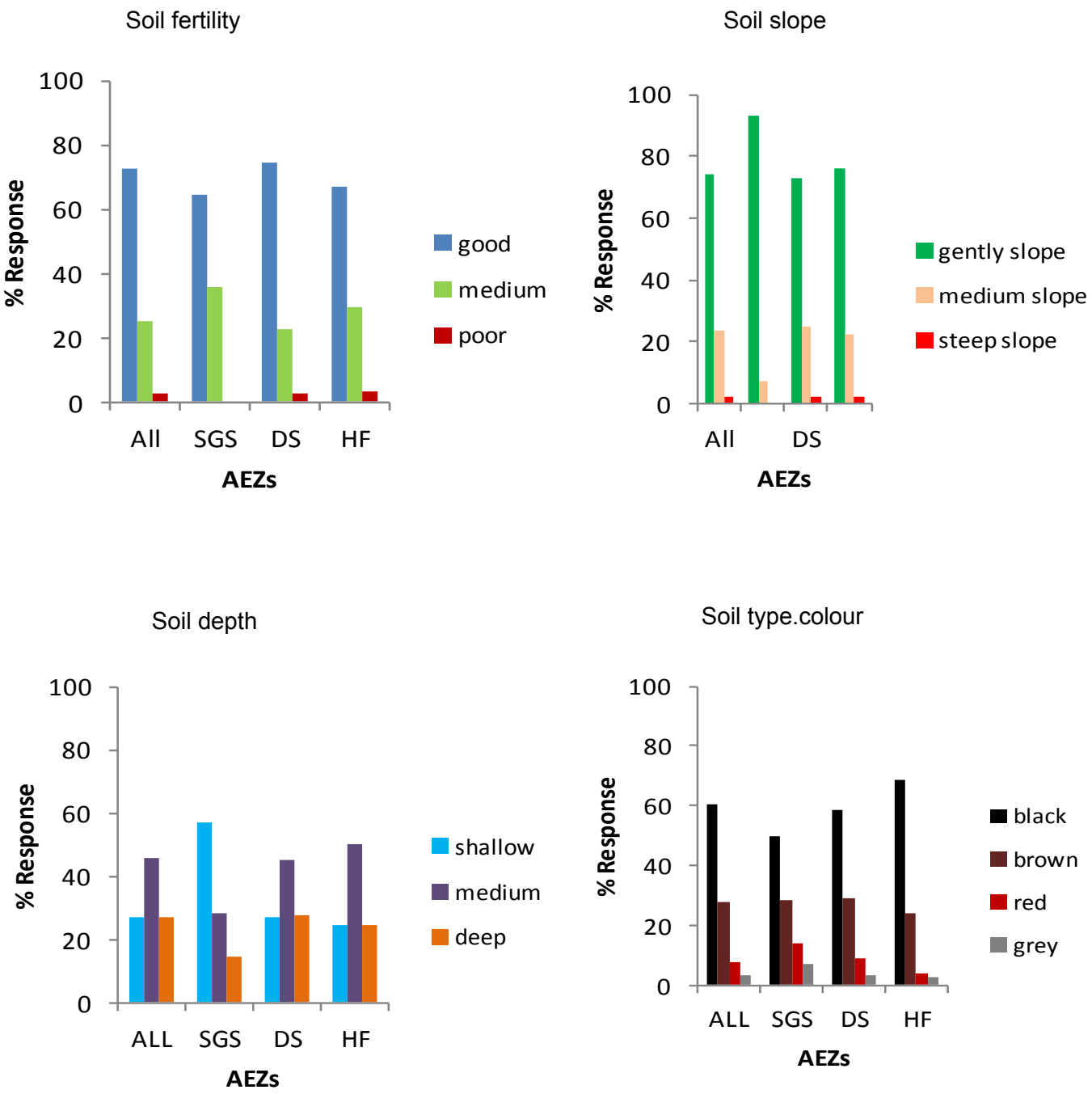


Figure 10. Percentage distribution of households' perception of soils characteristics.

An important number of farmers do not use any soil or water conservation methods (Fig. 11). Only mulching was considered, followed by terracing. Other methods were uncommon.

In the project zone, as depicted (Fig. 12), mounding is the most widespread seed preparation method used for yam production as it enhances rooting depth.

Mounds are constructed manually in rows or at random. The average number of mounds reported varies from one household to another and from one zone to another (Table 17). The average number of mounds is lower than the recommended number of 10000 mounds/ha with a spacing of 1 m × 1 m, probably due to the size of the mounds they make and the space they leave between mounds. This number of stands varies depending on the mound size and yam spacing and certainly the perception of the producer in maximizing his/her returns as well.

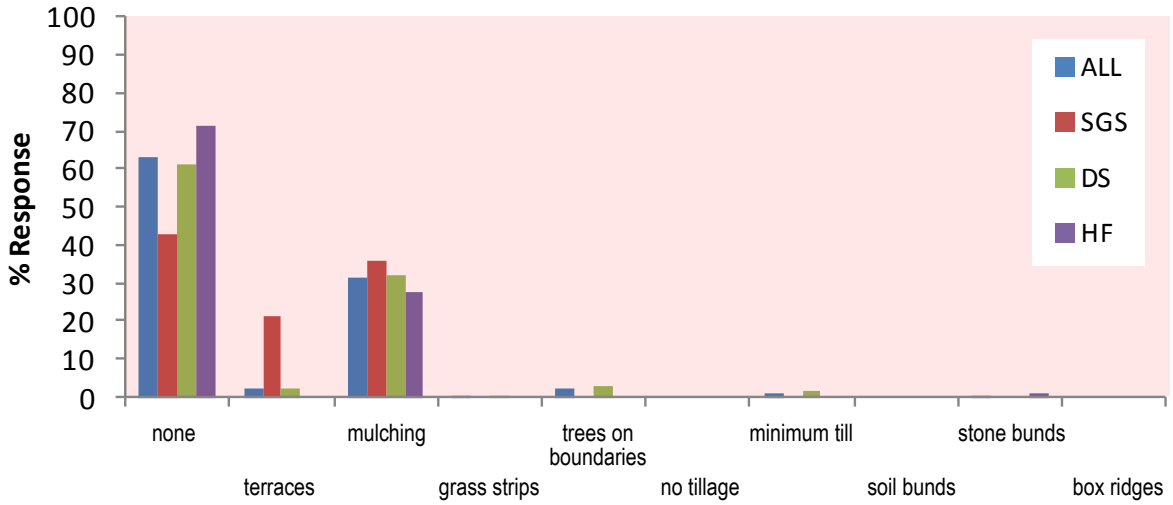


Figure 11. Percentage distribution of yam plots by soil and water conservation method.

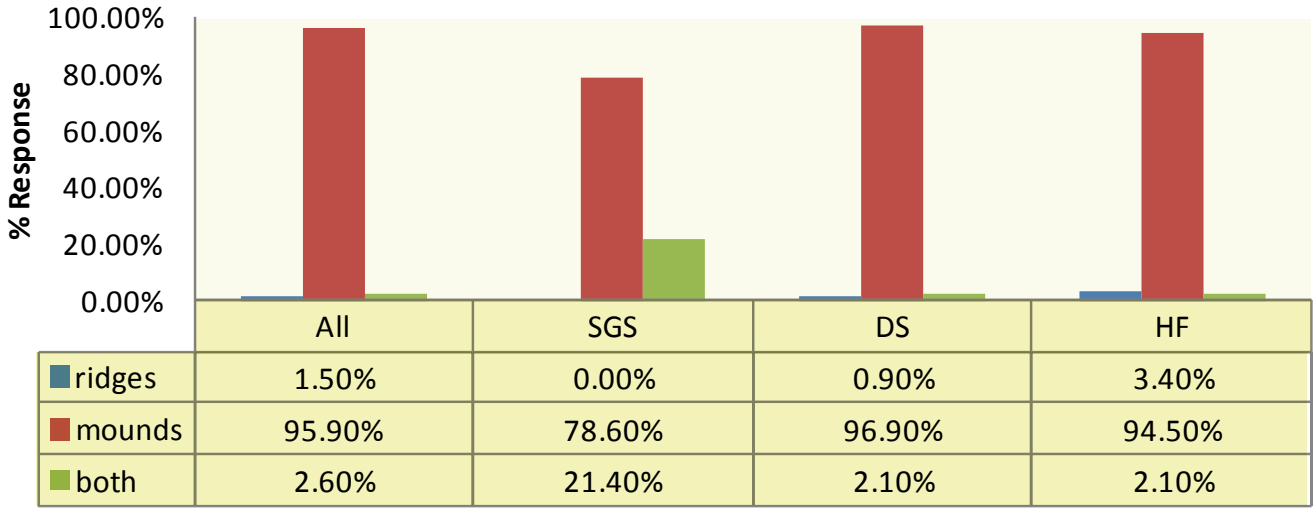


Figure 12. Percentage of distribution of yam plots by seedbed preparation method.

Table 17. Average number of stands planted per hectare.

Number of stands planted		All	SGS	DS	HF
	N	600 (585)	14 (14)	436 (424)	150 (147)
Mean		8099	8821	8112	7994
Std. Deviation		1247	2691	1228	1069

N = Number of respondents; Figures in parentheses represent valid entries for analysis.
SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

Intensification of yam farming systems

The analysis on intensification in this study refers only to the use of inputs such as fertilizer, herbicide and pesticide within the farming system.

The common means of enhancing soil fertility in small farm agriculture has been to use chemical fertilizers to increase food production. Unit fertilizer use in Ghana has declined from 21.9 kg/ha in 1978 to 8 kg/ha in 2006 (MOFA 2008). Nowadays, increased pressure on land caused by natural catastrophes, the ever-increasing

human population, and the use of agricultural land for housing, roads, industry, and other human activities, has drastically reduced the fallow period, resulting in a decline in the fertility of soils and the loss of their ability to support the required biodiversity (Ojating 1997). Fertilization is crucial to sustain crop productivity under continuous land use. Today, the recommendation for fertilizer application is about 100 kg/ha for basal fertilizer and 50 kg/ha for top dressing. Few respondents use fertilizer in yam production. The use of fertilizer varies tremendously in the surveyed area. Generally, the application rates fall short of the nutrient levels "recommended" for good yields to be expected (Table 18). Also, as yam is susceptible to pests and diseases, the crop requires a proper use of chemicals at a "recommended rate" for their control. No study has been done with recommended rates of pesticide.

The steady decline in yam yields and profitability is attributed to low farm-input use associated with agronomic and husbandry practices. Failure to apply a proper rate of fertilizer or not to use it at all is explained by the fact that (i) farmers lack information about the specific type and quantity of fertilizer to apply; (ii) the use of fertilizer affects negatively the taste and the storage of yam. Also the low quantity of fertilizer application is linked to its exorbitant prices. The prices were perceived by farmers as staggering and unaffordable. High input cost is also linked to inadequate competition among dealers and the inefficient distribution system of farm inputs. Detailed information on fertilizer and pesticide use by districts is available in Annex 2.

Table 18. Percentage distribution of households by fertilizer and pesticide use.

Cropping systems	All	SGS	DS	HF
N	600	14	436	150
Yam (pool)				
Basal fertilizer (kg/ha)	1.69 (14.7)	0.00 (0.0)	1.54 (13.9)	2.30 (17.4)
Top dressing-urea (kg/ha)	1.13 (10.3)	17.13 (51.9)	0.71 (7.5)	1.15 (7.3)
Manure own (kg/ha)	0.02 (0.4)	0.00 (0.0)	0.03 (0.4)	0.00 (0.0)
Manure bought (kg/ha)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)
Herbicide (lt/ha)	4.91 (9.4)	4.11 (5.8)	5.28 (9.3)	3.82 (10.1)
Pesticide (lt/ha)	0.81 (3.7)	0.05 (0.2)	0.98 (4.2)	0.33 (1.4)
Yam sole				
Basal fertilizer (kg/ha)	0.59 (7.0)	0.00 (0)	0.52 (7.5)	0.89 (5.4)
Top dressing-urea (kg/ha)	0.80 (7.6)	0.00 (0)	0.70 (7.5)	1.26 (8.5)
Manure own (kg/ha)	0.02 (0.4)	0.00 (0)	0.03 (0.4)	0.00 (0.0)
Manure bought (kg/ha)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)
Herbicide (lt/ha)	4.96 (10.0)	2.73 (4.3)	5.14 (9.5)	4.47 (12.2)
Pesticide (lt/ha)	1.10 (4.4)	0.08 (0.2)	1.29 (4.9)	0.46 (1.6)
Yam intercropped				
Basal fertilizer (kg/ha)	4.58 (25.2)	0.00 (0.0)	4.68 (24.6)	4.76 (27.6)
Top dressing-urea (kg/ha)	2.07 (15.4)	42.81 (81.3)	0.85 (8.4)	1.10 (5.6)
Manure own (kg/ha)	0.03 (0.3)	0.00 (0.0)	0.04 (0.4)	0.00 (0.0)
Manure bought (kg/ha)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)	0.00 (0.0)
Herbicide (lt/ha)	5.18 (8.5)	6.18 (7.9)	6.12 (9.3)	3.10 (6.1)
Pesticide (lt/ha)	0.18 (1.1)	0.00 (0.0)	0.19 (1.2)	0.16 (0.9)

SGS = Southern Guinea Savanna; DS = Derived Savanna; H = Humid Forest.

N = Total number of respondents; Figures in parentheses represent standard deviation.

Yam Yield and Profitability

5

Production and yield estimates from recall-based information

It has been not easy to determine the harvest. Yam harvests were determined from farmers' memory recall on the quantity/number of tubers harvested per given area in each locality and using average weights of randomly sampled series of tubers in the given locality. For more information on calculation, refer to metrics in Annex 7. The cropping system generally affects the crop yield and the productivity of yam was low compared with its potential (Table 19). Yam sole yielded higher than that intercropped; an exception was observed in the SGS where intercropping might have helped to alleviate the pest and disease problems.

In conclusion, the productivity level in farmers' fields was generally low, especially in the SGS and the HF, certainly due to the high pressure of pests and diseases associated with poor management practices, lack of knowledge and use of adequate inputs. High yielding crop varieties might be necessary to increase productivity in the study area. Detailed information on yam harvests by districts is available in Annex 3.

Another study was commissioned on yield estimates from field measurement within the same yam belt using different methodology and for more details on the findings from field measurement; an interested reader is referred to Chapter 10.

Cost and profitability of yam production

Various costs were incurred in producing yam. The major items were basal fertilizer, top dressing fertilizer-urea, seeds, labor (land preparation and planting, staking and roping, weed control, harvesting and transportation), and the total cost of oxen/tractor hire, herbicides and pesticides, and land rent.

All costs were reported with fixed costs excluded because, for most poor rural farmers, fixed costs are not reliable. In most cases, farmers do not have permanent working tools. Tools such as hoes, machetes, buckets, and utensils that farmers possess and use in the production process are not properly recorded in terms of monetary value and purpose of purchase. Labor, the primary input most farmers put into agriculture, is one of the more difficult items to value because for most farm-household members off-farm employment is not really an option. Valuation of rural family labor has been an area of economic debate. Also for most household members (e.g., women, children, old men, and young boys), there are no paying alternatives to on-farm work. Unpaid family members have stronger incentives for getting farm work done in a careful and timely fashion than hired workers who are not family members. This because members of the farm family can expect to share directly or indirectly in net farm income but hired farm labor generally does not. Assuming the labor market is

Table 19. Average yam yield estimates (kg/ha).

Cropping pattern		All	SGS	DS	HF
	N	600	14	436	150
Yam (pool)					
Mean		6750 (508)	5377 (10)	7562 (376)	4359 (122)
Std. Deviation		6852	7733	7198	4870
Yam sole					
Mean		7082 (344)	4482 (6)	7834 (266)	4517 (72)
Std. Deviation		7168	6034	7555	4825
Yam intercropped					
Mean		6273(143)	6720 (4)	7203 (94)	4292(45)
Std. Deviation		6391	6034	6586	5143

N = Number of respondents; Figures in parentheses represent valid entries for analysis.
SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

competitive, rural wages for hired labor are used to approximate the (replacement) cost of the days utilized or required by a farmer for various tasks. The labor was retained as man-days and a man-day is the work one person would normally do in one working day of 8 hours (official work hours) to carry out a specific activity (Oduor 2002). In farming activities, the number of working hours in a day varies depending on the area and activity. The labor cost of various activities may also vary, not only from place to place, but also from season to season, depending on the demand for labor and its availability (Oduor 2002). However, for the development agent to survey and establish the actual unit cost for different activities in a particular area, we consider the wage rate in the community as the basis for estimating labor cost (Oduor 2002) as depicted in Table 20.

The valuation of rural family labor has been an area of economic debate and two cases were considered in this section: (i) the returns to land and management excluding the opportunity cost of family labor and (ii) the returns to land where the opportunity cost of family labor is included in the total variable costs. The estimated annual costs of yam growers including (incl) family labor were about GH¢5434/ha and about GH¢3835 when excluding (excl) the family labor (Table 21). Among the cost components, two were important: seeds had the

Table 20. Inputs use in man-days and amount in Cedis per hectare.

Labor/inputs Gh¢	All		SGS		DS		HF	
	MD	Amount	MD	Amount	MD	Amount	MD	Amount
Land preparation and planting	25	21	36	21	29	21	14	21
Staking and roping and materials	14	20	18	20	16	20	8	20
Weed control	18	10	31	10	20	10	11	10
Harvesting and transportation	28	22	50	22	31	22	18	22
Hired labor	-	334	-	116	-	320	-	395

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest

Table 21. Average total costs of yam production in GH¢.

Costs	All		SGS	DS	HF
	Mean amount	Percentage of cost			
Family labor	*1599.09*	-	*2493.90*	*1787.48*	*933.61*
Hired labor	*334.02*	-	*115.78*	*320.15*	*395.41*
Labor	1933.11	35.57	2609.68	2107.63	1329.01
Seeds	3161.37	58.17	3924.18	3332.59	2560.61
Oxen/tractor hire	65.33	1.20	133.48	64.80	61.49
Herbicides	125.17	2.30	65.91	122.62	137.59
Pesticides	14.51	0.27	20.72	13.17	18.30
Basal fertilizer	76.17	1.40	60.89	75.86	78.26
Top dressing fertilizer	49.00	0.90	5.03	46.76	59.33
Total input	***5423.14***	-	***6804.63***	***5762.77***	***4242.21***
Land rent*	11.22	0.21	0.00	11.45	11.42
Costs (excl. family labor)	**3835.27**	-	**4310.73**	**3986.74**	**3320.02**
Total costs (incl. family labor)	**5434.36**	**100**	**6804.63**	**5774.22**	**4253.63**

*Extra charges supported by a few farmers to meet their land requirements for yam production.

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

Table 22. Profitability of yam production per hectare.

	All	SGS	DS	HF
Price sold/kg of yam (GH¢)	1.59	0.88	1.79	1.02
Yield (kg/ha)	6750	5377	7562	4359
Gross revenue (GH¢)	10732	4732	13536	4446
Costs (excl family labor) in GH¢	3835	4311	3987	3320
Total operational costs (GH¢)	5434	6805	5774	4254
GM in GH¢/ha (excl. family labor)	***6897***	***421***	***9549***	***1126***
GM in GH¢/ha (incl. family labor)	***5298***	***(2073)***	***7762***	***192***

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

largest share of the total cost (about 58%) followed by labor (about 36%) in which family labor predominates. Contrary to empirical studies (Agbaje et al. 2005), the costs of seed in this study have been undervalued most probably due to the milking system commonly adopted for seed multiplication. Detailed information on costs of production by districts is available in Annex 4.

Different prices were received from farmers for the sale of their produce, as they reported. Total production was valued by multiplying the production by the farmgate price received for the product. Value/ha of the total production of land was about GH¢10732 in all the surveyed areas with the highest pronounced in the DS and the lowest in the HF (Table 22).

The relative profitability of the crops was conducted by computing the gross margins (GM) for yam planted across the different zones. This was done by subtracting the value of variable costs from the value of the total production. In this study we compute two forms of GM (i) the returns to land and management excluding the opportunity cost of family labor and (ii) the returns to land where the opportunity cost of family labor is included in the total variable costs. The gross incomes and variable costs for selected crops excluding the opportunity cost of family labor are presented in Table 22. The gross revenue is the monetary value of the total produce or total harvest. It measures total receipts received from the sales of produce including the value of any retained output. Operational costs for this study included the monetary values of all inputs used, including seeds, fertilizer, manure, oxen/tractor hire, purchased chemicals, and labor (hired and family). The results for the three components of profitability (gross revenues, operational costs and GM) are further disaggregated by AEZ and presented in Table 22. There are substantial variations in GM across the zones. The differences in profitability are no surprise as these could also be attributed to differences in productivity, as well as to differences in input and output prices. As depicted in Table 22, the GM is positive in all the surveyed areas except SGS with the inclusion of family labor costs. Yam production in SGS was less profitable due to the high production costs and low farmgate price received. Also in a broader development perspective, this can be interpreted as a presence of excess family labor that can be redeployed into other alternative livelihood ventures. Yam production is profitable with a relative advantage in the DS with the highest average GM pronounced.

It may be concluded that the yam production practices in the DS were more rational and efficient compared to those in other zones and the positive GM suggest that there is potential for the adoption of new varieties in the surveyed area. Encouragement to improve practices should be initiated to reduce the labor costs and stimulate profitability for yam enterprises.

Yam productivity constraints

Constraints limiting yam production and postharvest handling need to be identified to provide a basis for appropriate interventions. A range of factors constrained yam production and storage. These factors include insect pests, diseases, waterlogging, drought, rodents, low soil fertility, shortage of staking material, inadequate input supply and storage facility, land shortage, high cost of labor, lack of improved varieties, and others such as theft (Table 23). Results presented in Table 23 indicate that the high cost of labor was reported to be the most important constraint in all the surveyed zones followed by diseases and insect pests. Other important

Table 23. Percentage distribution of households reporting production and postharvest constraints.

	All	SGS	DS	HF
Insect pests	15.5	7.1	14.7	18.7
Diseases	15.7	14.3	15.1	17.3
Waterlogging	1.7	0.0	1.4	2.7
Drought	5.5	14.3	7.1	0.0
Rodents	5.5	0.0	5.7	5.3
Low soil fertility	4.2	7.1	3.2	6.7
Shortage of staking material	2.2	7.1	2.3	1.3
Inadequate input supply	5.2	7.1	5.5	4.0
Inadequate storage facility	1.7	0.0	2.1	0.7
Land shortage	0.7	0.0	0.7	0.7
High cost of labor	36.5	35.7	35.6	39.3
Lack of improved varieties	3.2	7.1	3.7	1.3
Other	2.7	0.0	3.0	2.0

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

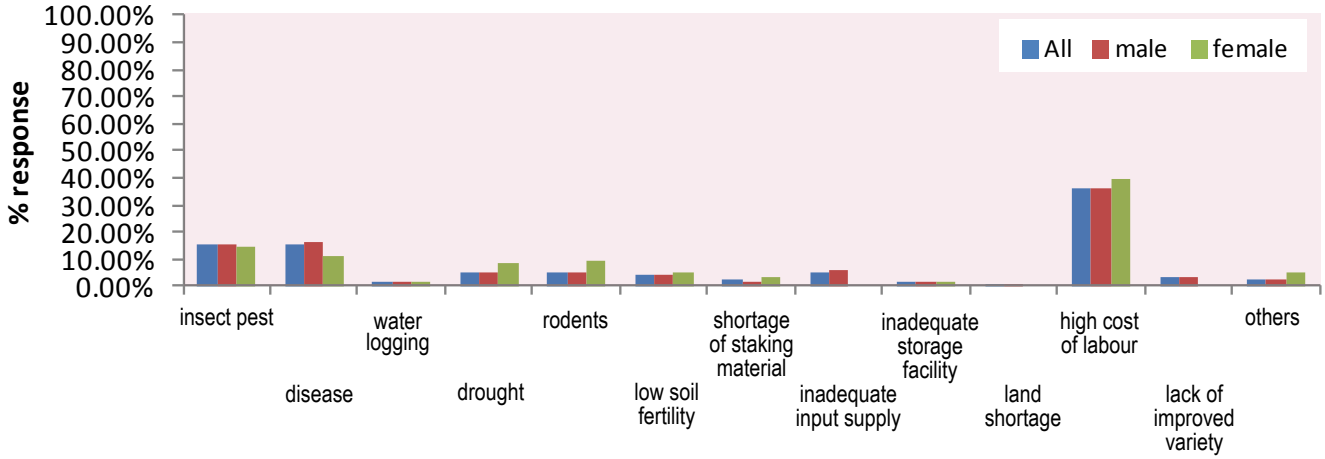


Figure 13. Percentage distribution of households by production and postharvest constraint and gender.

constraints mentioned were: drought, more pronounced in the SGS while absent in the HF, rodents, more reported in the DS and excluded in the SGS, inadequate input supply, highly pronounced in the SGS, low soil fertility, more reported in the SGS than in other zones; lack of improved variety more prominent in the SGS, and other constraints such as theft more important in the DS and the HF.

The results by gender (Fig. 13) show that female- and male-headed households had almost the same perception of constraints in their production and storage of yam produce except that the female-headed households did not perceive inadequate supply input, land shortage, and lack of improved varieties as major constraints.

Lack of seed yam is an important constraint to yam production which was not mentioned for the fact that most farmers use seed for planting from their own produced seed yam which is either a tuber, i.e., the crop or a milked yam. Serious complaints were made during discussions had in focus groups with men and women about seed yam. All farmers reported lacking “good quality” seed yam defining good quality as yam that is pest and disease resistant and can consequently yield better; revealing seed yam as one of the major constraints.

Respondents in the surveyed area reported stress led by various constraints during production and post-harvest periods at different levels of severity, from less severe to highly severe, (Fig. 14). In general, about 33% of all the respondents reported the level of constraints faced as severe and 24% as highly severe with negligible differences among different AEZs.

Poor storability of harvested yam pushes farmers sometimes to sell their tubers immediately after harvest, generally at uneconomical prices resulting in low income or reduced profits; they do this to avoid postharvest losses. The bulky nature of yam tubers and the fast rate of perishability due to their high moisture content make them less convenient for transportation and storage compared with other crops such as cereals, hence increasing losses after harvest. It has not been easy to establish a reasonable estimate for the percentage of postharvest losses that may be sustained by a yam crop. Postharvest losses at the production level were determined using farmers' memory recall, limited to major causes of loss. Mück (1994) estimated that after storage (2 to 6 months) the general losses of root and tuber crops in Ghana were of the order of 10 to 50%. Alhassan (1994), also reporting from Ghana, estimated postharvest losses were 30% of the total crop. It has been reported that white yam varieties such as *Pona*, *Larbako*, and *Dente* that are preferred by most consumers, could not be stored for a long time due to attack by rot organisms.

About 97% of households during the last cropping year reported the loss at the end of storage, on average, of about 17% of their yam from rotting. About 88% of households had 20% of their yam sprouting; only 10% of households reported they had lost 4% of yam through other causes, such as rodents and theft (Table 24). Among the AEZs rotting, sprouting, and other losses were predominant in the SGS.

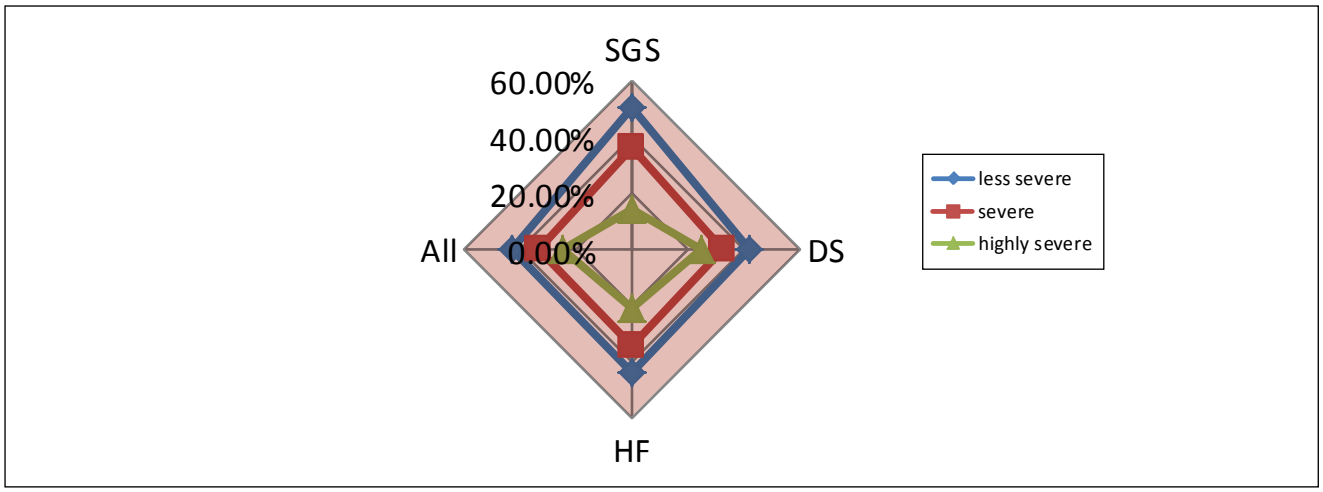


Figure 14. Perception of stress incidence from yam production and postharvest constraints.

Table 24. Percentage distribution of yam losses at the end of storage.

Losses from		All	SGS	DS	HF
	N	600	14	436	150
Rotting (%)		16.5 (583)	22.2 (13)	16.6 (421)	15.7 (149)
Sprouting (%)		19.7 (527)	24.0 (11)	20.5 (378)	17.2 (138)
Others (%)		4.2 (61)	10.0 (2)	3.6 (34)	4.4 (25)

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.
Figures in parenthesis are valid cases for corresponding means.

Yam is subject to several diseases caused by viruses, bacteria, and fungi. Fungi, however, are the major causes of postharvest rots of yam tubers (Coursey 1967; Noon 1978; Okigbo and Ikediugwu 2002). The major microorganisms causing rot diseases in yam include *Aspergillus flavus* Lark ex Fr., *Aspergillus niger* Van Tiegh, *Botryodiplodia theobromae* Pat, *Fusarium oxysporum* Schecht ex Fr., *Fusarium solani* (Mart.) Sacc., *Penicillium chrysogenum* Thom, *Rhizoctonia spp., Penicillium oxalicum* Currie and Thom, *Trichoderma viride* Pers. ex S.F. Gray, and *Rhizopus nodosus* N'amyslowski (Okigbo and Ikediugwu 2002).

Nine fungal species, *Aspergillus flavus, Aspergillus niger, Botryodiplodia theobromae, Fusarium culmorum, Fusarium oxysporum, Fusarium spp*., *Penicillium brevi-compactum, Penicillium spp*., and *Rhizopus stolonifer,* and a bacterium, *Erwinia carotovora,* were identified to be associated with tuber rots in Ghana (Aboagye-Nuamah et al. 2005).

Controlling fungi and insects during storage is necessary to increase shelf life and coping facilities were developed by farmers to control the losses that occur. An important number of farmers reported they had raised sheds in the field as a major yam storage facility (Table 25). Other methods such as keeping yam under trees and raising huts as yam barns in the compound were also used. Leaving tubers in the soil after maturity was also an option to prevent losses. Among the AEZs, limited storage facilities were used in the SGS with other methods, including covering tubers with weeds.

When households are compared by gender (Fig. 15), female-headed households reported more coping facilities for storage than male-headed households, such as room storage, raising sheds in the field, having barns in the compound, and even leaving yam in the soil.

Table 25. Percentage distribution of households with storage facilities.

Storage facilities	All	SGS	DS	HF
Room storage	2.3	0.0	1.8	4.0
Under tree	11.2	0.0	10.6	14.0
Raised sheds in the field	60.8	57.1	60.3	62.7
Yam barns in the compound	10.7	0.0	11.2	10.0
Raised huts	10.7	35.7	11.5	6.0
Left in the soil after maturity	1.2	0.0	1.4	0.7
Other	3.2	7.1	3.2	2.7

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

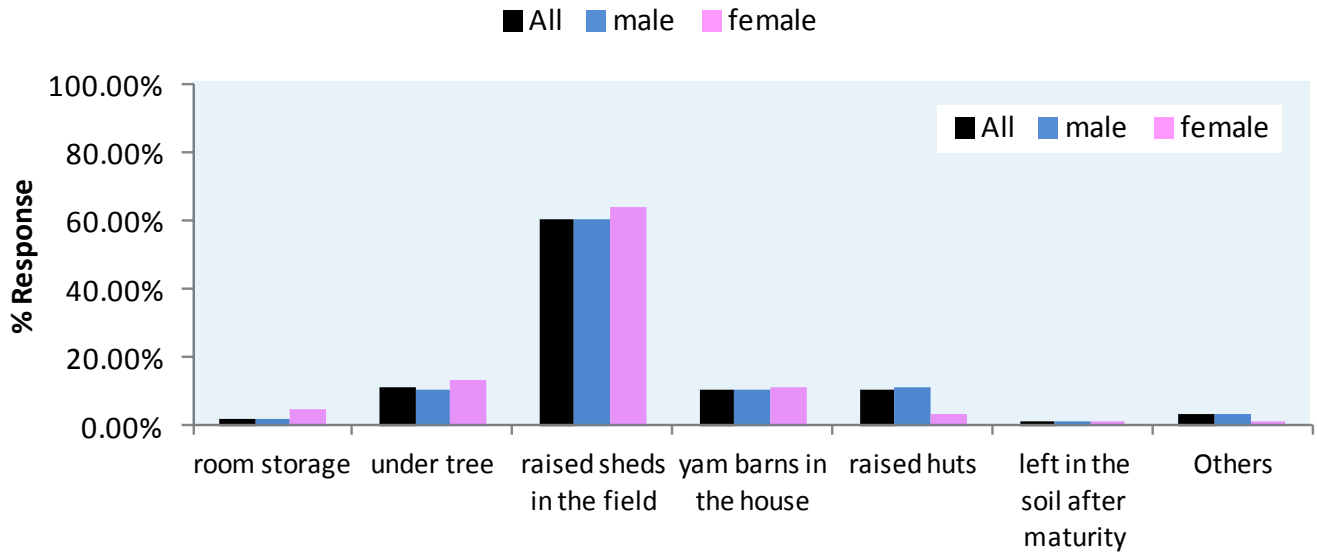


Figure 15. Percentage distribution of households by yam storage structure and gender.

Yam Utilization and Marketing

6

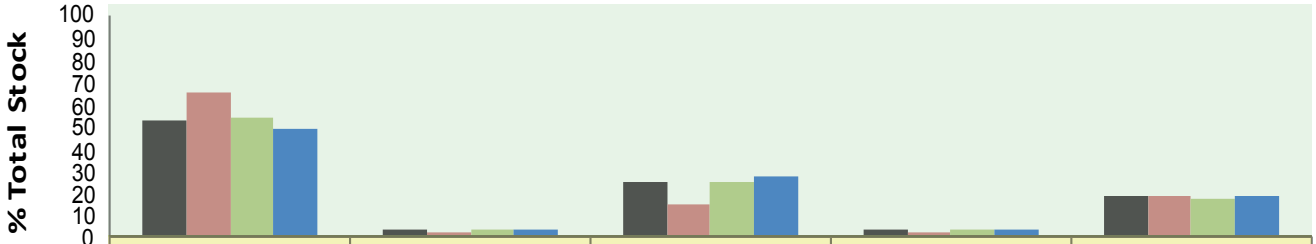
Yam utilization

In the survey, farmers provided information on how they utilized the yam they have as total available stock; 5.8% were reported as carry-stock from the previous harvest. Information was collected for the quantity sold, used as in-kind payments, used as seeds, given out as gifts/ donations, and consumed. Based on this information, percentage shares of the quantity allocated to each of the five purposes were computed. Figure 16 depicts information on yam utilization which does not vary significantly across the AEZs .Yam is mostly grown for sale. An important share of about 25% is allocated for seeds and 18% for home consumption. Other forms of utilization were uncommon or absent.

In conclusion, yam is more of a cash crop with 53% sold; only 18% is consumed and yam is therefore a crop with potential for income generation.

Yam marketing and trading

Farmers travel within a given radial distance to local market either to buy or sell goods. In the surveyed zone, farmers perceived differently the distance between their residence and local market and expressed this in terms of minutes of walking time. An important number of respondents (about 40%) frequently use a bicycle as a main means of transport to reach the local market with a distance of about 72 minutes (Table 26). Apart from



	Quantity Sold	In-kind payments	Used as seed* (*Some also consumed)	Gift/donations	Quantity consumed
All	52.85	2.44	24.77	2.41	17.53
SGS	65.85	1.19	14.14	0.72	18.1
DS	53.92	2.34	24.31	2.36	17.07
HF	48.26	2.86	27.47	2.78	18.63

Figure 16. Percentage distribution of households by yam utilization.

Table 26. Percentage distribution of households by means of transport used from residence to market.

Mode of transport	All		SGS		DS		HF	
	%	Dist. (min)	%	Dist. (min)	%	Dist. (min)	%	Dist. (min)
Walking	16.0	72.28	0.0	-	16.7	75.89	15.3	60.83
Bicycle	39.5	71.94	35.7	78.00	42.2	68.42	32.0	84.65
Motorcycle	14.0	59.46	50.0	98.86	14.4	54.63	9.3	62.14
Tractor	1.8	108.18	0.0	0.00	1.1	58.00	4.0	150.00
Vehicle	26.2	75.76	14.3	90.00	23.2	78.90	36.0	69.43
Cart	0.8	42.60	0.0	-	0.7	55.00	1.3	24.00
Others	1.7	-	0.0	-	1.6	-	2.0	-

Dist. = Distance in minutes of walking time; SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

those using a bicycle, those who used a vehicle followed with a longer distance to travel. The use of a tractor to market is rare with a longer distance, probably because those who used it lived relatively far from the local market or the quality of the road was poor.

The findings depict a situation where either the road infrastructure is of poor quality or respondents live far from the market in the surveyed communities. This could be the source of high transport costs.

Three main types of market exist in or surrounding farmers' areas. The results indicate that the main/district market is the most important point of sale followed by the village market (Fig. 17). The significance of the main and village market sales is explained partly by the relatively higher retail price farmers could get outside their farms.

Various reasons push farmers to sell their yam at different periods. Two main reasons led them to a particular sales period: they either made early sales just after harvest at an uneconomic price because of a "hot" need of money or good sales at a later period when yam had become scarce. Sales fluctuate during the whole year. In the SGS, sales reach a peak in January immediately after harvest and no sales were reported from June to November. In the DS, two peak periods were observed in April and September after a minimum was reached in July which is a "dead" period for all. In the HF, the peak month was April (Fig. 18).

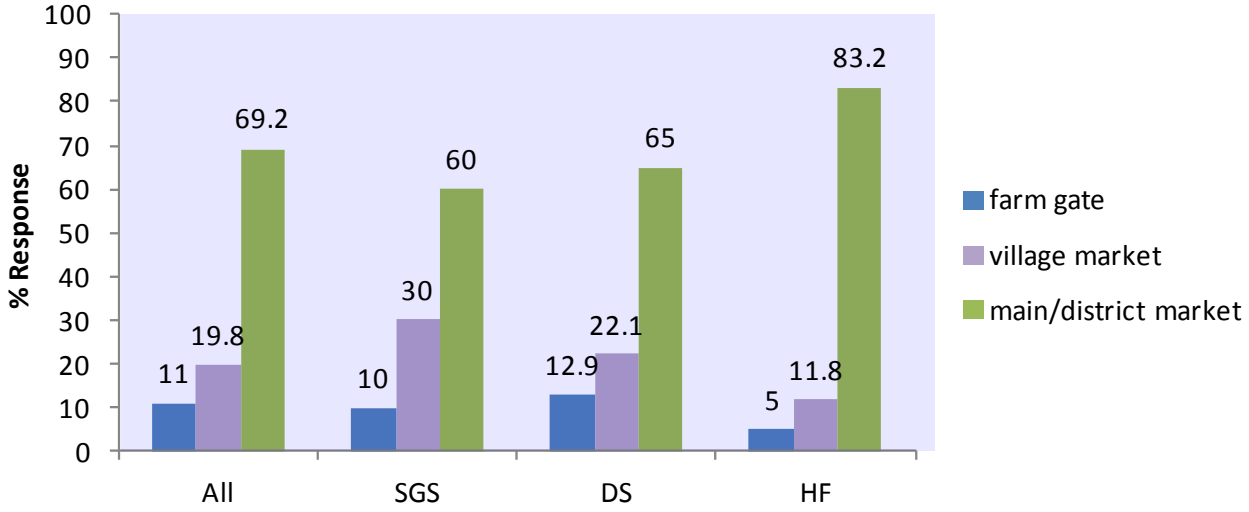


Figure 17. Percentage distribution of households by type of market used.

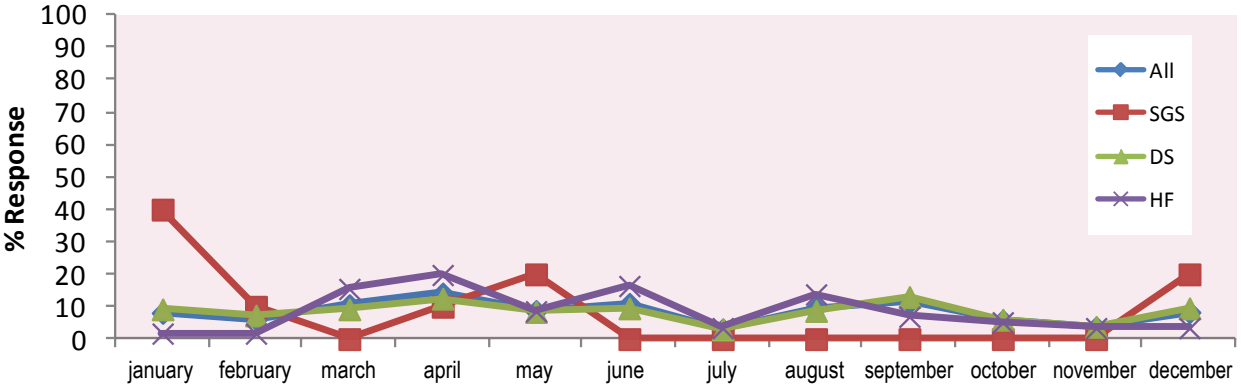


Figure 18. Percentage distribution of households by period of yam sales reported.

Yam is primarily considered to be a man's crop, and all the agricultural activities are predominantly carried out by men. However, this does not exclude women from involving themselves in some of the activities, such as selling. Results (Fig. 19) indicate that farmgate selling remains almost entirely a male domain. Since men mostly produce the crop, this leads them to take the decision about the disposal of their output. Women mainly dominate sales at the market level. In a few cases, the responsibility of sales is from joint decisions of both men and women. Most farmers live in rural areas and are not ready or well equipped to add to their gross sales by attempting to sell directly to buyers in urban areas. As a result, they get a lower price from traders. For the farmers, farmgate sales are the easiest option as they do not have to worry about buying bags and organizing transport. The traders buy on the farm or in the village, so minimizing the farmer's workload and the time he spends in selling his yam.

According to the respondents (Fig. 20), the main buyers of yam for the entire population were brokers/ middlemen followed by urban grain traders or wholesalers with a difference among the AEZs. Most of the sellers were brokers/middlemen in the DS and the HF; rural grain traders/wholesalers predominate in the SGS.

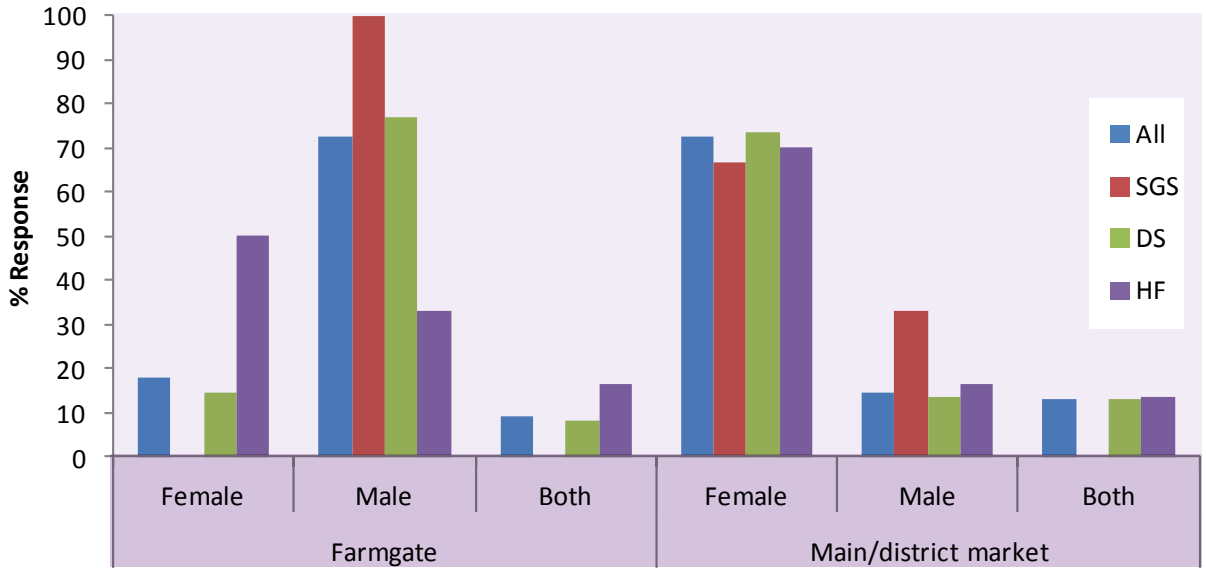


Figure 19. Percentage distribution of sellers by type of market and gender.

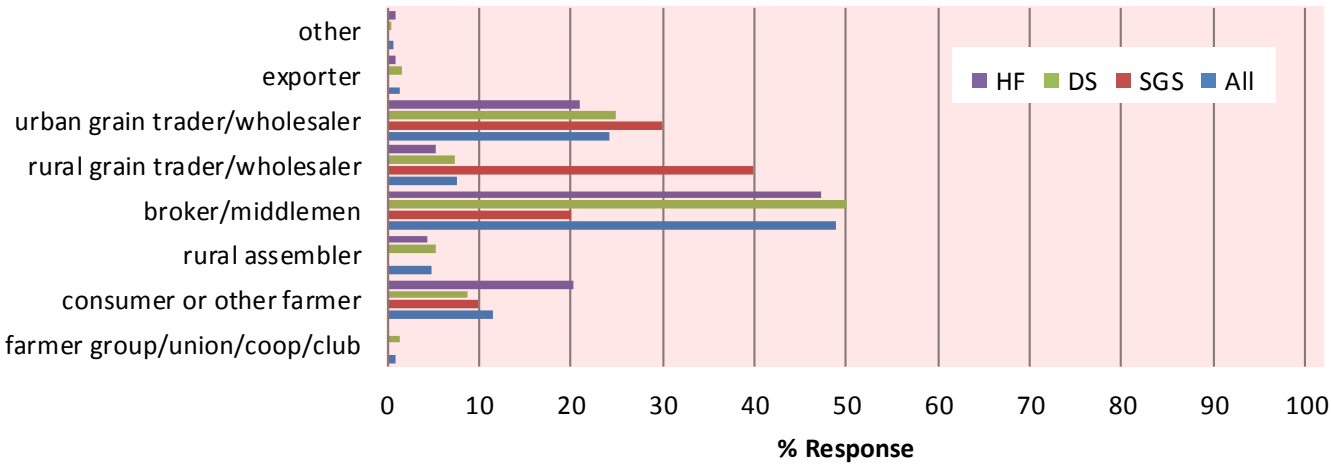
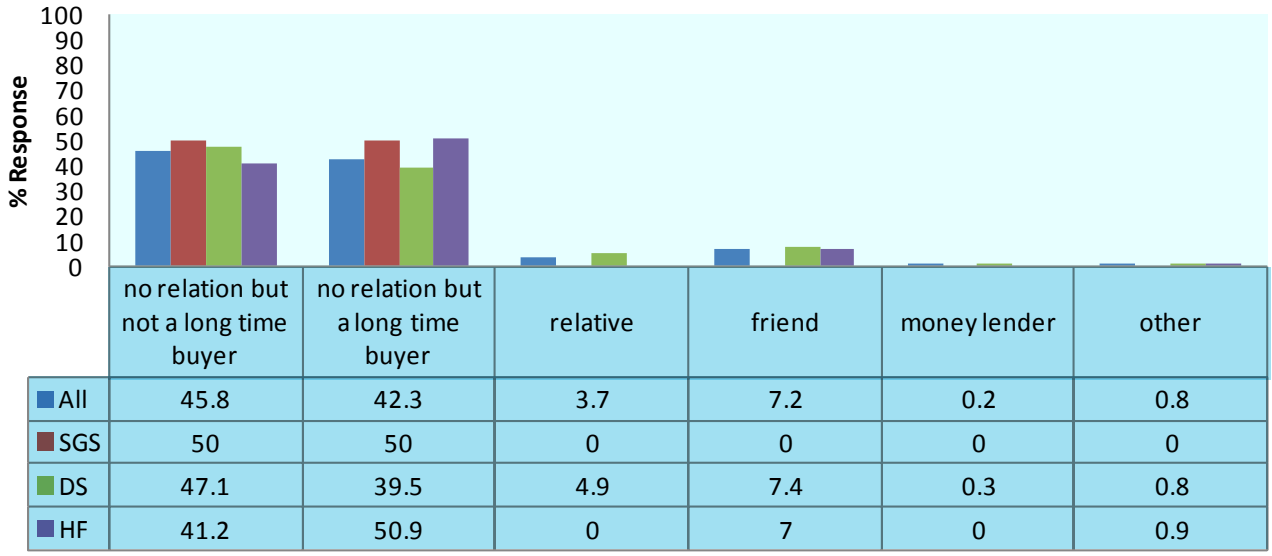


Figure 20. Percentage distribution of buyers.

In conclusion, brokers/middlemen and urban grain traders or wholesalers, acting as both buyers and later as sellers, mainly buy yam directly from farmers for resale. In the absence of market information, farmers do not receive fair prices and the middlemen get the major share of the profit, though they also take the most risk. Cutting out this intervening layer between farmers and customers might help farmers to get a higher price for their produce. The study called for regulatory measures to be set for improving the yam marketing system at the rural/ primary market level. The marketing problems of small farmers, as some of them reported, emanated from their dependence on brokers/middlemen for credit. This puts them in a highly unequal trading relationship with the buyers of their produce. Therefore, improving the ability of farmers to have access to the market and strengthening their bargaining position are recommended as the central focus of any policy for yam market reform.

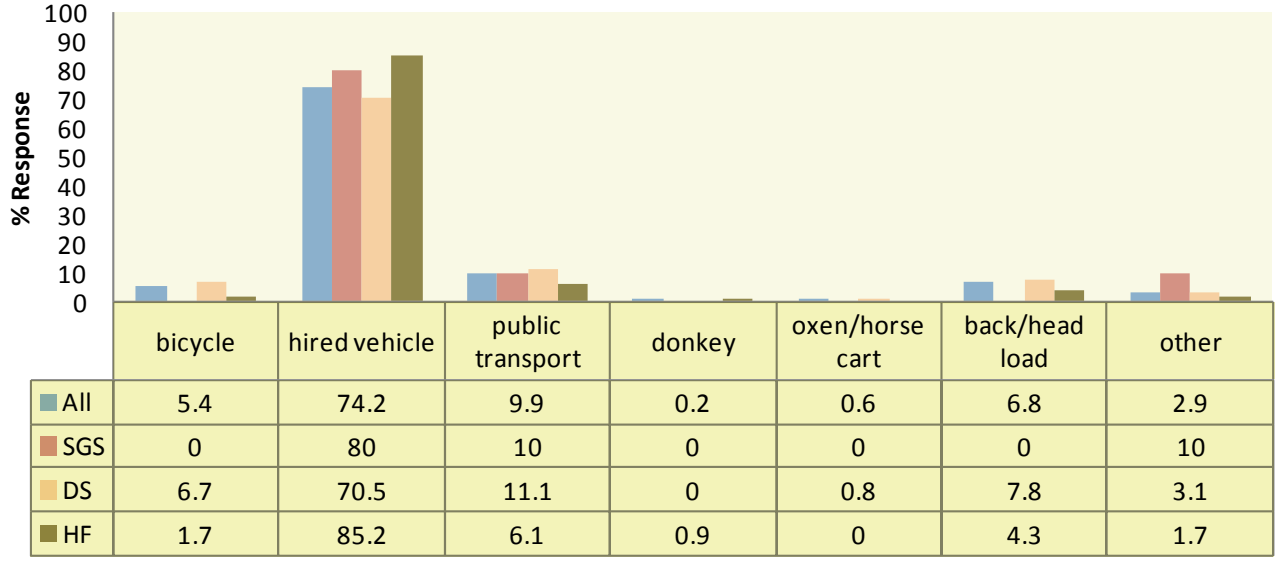
According to the respondents (Fig. 21), no specific relationship exists between the yam producer/seller and the buyer. Short- and long-time buyers were reported in the surveyed area with short-time buyers holding the upper hand.

The most important mode of transport used for conveying yam to market was the hired vehicle (Fig. 22). Canoes/ boats were mentioned in a few places but other means were negligible and almost absent.



	no relation but not a long time buyer	no relation but a long time buyer	relative	friend	money lender	other
All	45.8	42.3	3.7	7.2	0.2	0.8
SGS	50	50	0	0	0	0
DS	47.1	39.5	4.9	7.4	0.3	0.8
HF	41.2	50.9	0	7	0	0.9

Figure 21. Relationship yam producer–buyer.



	bicycle	hired vehicle	public transport	donkey	oxen/horse cart	back/head load	other
All	5.4	74.2	9.9	0.2	0.6	6.8	2.9
SGS	0	80	10	0	0	0	10
DS	6.7	70.5	11.1	0	0.8	7.8	3.1
HF	1.7	85.2	6.1	0.9	0	4.3	1.7

Figure 22. Percentage distribution of households by means of transport used for conveying yam to market.

Adoption of Yam Varieties

7

Farmers' perceptions of yam varieties

The perception of farmers gave an insight into the three types of attributes likely to motivate them in selecting and using a certain type of yam: agronomic, market, and economics; cooking, and utilization. To understand better farmers' criteria of selection and determine their perceptions on yam varieties, the study used a qualitative analysis based on ranking, weighing varieties against the attributes using their frequency of occurrences reported by households in each AEZ. Communities and households assign priorities and rank varieties they produce as summarized in Table 27. The assessment of farmers' preferences among local alternative varieties could provide useful feedback for research and extension. New technologies to be developed for households to adopt should be based on this range of criteria in addition to financial profitability, such as risk, compatibility with farmers' values, and

Table 27. Yam varietal ranking against various attributes by AEZ.

Criteria	R	SGS	DS	HF
		Agronomic		
Tuber yield	1	*Larbako*	*Larbako*	*Matches*
	2	*Kpendzo*	*Pona*	*Pona*
	3	*Atakpama/Fusseini/Kpene/Yeri*	*Matches*	*Dente*
	4	–	*Serwaa*	*Muchumudu*
	5	–	*Dente*	*Lili*
Drought tolerance	1	*Fusseini*	*Larbako*	*Matches*
	[d]	*Larbako*	*Matches*	*Pona*
		Kpene/Yeri	*Pona*	*Dente*
	4	–	*Fusseini*	*Muchumudu*
	5	–	*Dente*	*Afasie/Serwaa*
Disease tolerance	1	*Fusseini/Kpene*	*Larbako*	*Matches*
	2	*Larbako*	*Pona*	*Pona*
	3	*Gbeadele*	*Fusseini*	*Dente*
	4	–	*Matches*	*Muchumudu*
	5	–	*Dente*	*Bayere pa/Akaaba*
Early maturity	1	*Larbako*	*Pona*	*Pona*
	2	*Kpene*	*Larbako*	*Matches*
	3	–	*Dente*	*Larbako*
	4	–	*Matches*	*Dente*
	5	–	*Kpene*	*Muchumudu*
Uniformity in maturity	1	*Kpene*	*Larbako*	*Matches*
	2	*Juuna/Limo*	*Pona*	*Pona*
	3	–	*Matches*	*Muchumudu*
	4	–	*Dente*	*Larbako/Lili/Dente*
	5	–	*Fusseini*	*Afasie/Kpendzo*
Tuber size	1	*Larbako*	*Matches*	*Matches*
	2	*Kpene*	*Pone*	*Pona*
	3	*Fusseini*	*Serwaa*	*Dente*
	4	–	*Larbako*	*Muchumudu*
	5	–	*Dente*	*Afasie*
Labor input requirement	1	*Larbako*	*Larbako*	*Matches*
	2	*Kpene*	*Pona*	*Pona*
		–	*Matches*	*Dente/*
	3			*Larbako?Muchumudu*
	4	–	*Dente*	*Afasie*
	5	–	*Muchumudu*	*Serwaa*
Stake requirement	1	*Larbako*	*Larbako*	*Matches*
	2	*Kpene*	*Pona*	*Dente/Pona*
	3	*Kpendzo*	*Matches*	*Afasie*
	4	–	*Dente*	*Larbako*
	5	-	*Fusseini*	*Lili*

Table 27, continued. Yam varietal ranking against various attributes by districts.

Criteria	R	SGS	DS	HF
		Market and economics		
Marketability	1	*Larbako*	*Pona*	*Pona*
	2	*Kpene*	*Larbako*	*Dente*
	3	–	*Dente*	*Larbako*
	4	–	*Serwaa*	*Muchumudu*
	5	–	*Kpene*	*Matches*
Tuber flesh color	1	*Larbako*	*Larbako*	*Pona*
	2	*Kpene*	*Pona*	*Dente*
	3	*Fusseini/Juuna/Kpendzo*	*Dente*	*Matches*
	4	–	*Serwaa*	*Larbako*
	5	–	*Kpene*	*Muchumudu*
Tuber price	1	*Larbako*	*Pona*	*Pona*
	2	*Kpene/Limo*	*Larbako*	*Dente*
	3	–	*Dente*	*Larbako*
	4	–	*Serwaa*	*Matches*
	5	–	*Kpene*	*Muchumudu*
		Cooking and utilization		
Storability	1	*Fusseini*	*Matches*	*Matches*
	2	*Kpene*	*Serwaa*	*Dente/Muchumudu*
	3	*Atakpama/Juuna*	*Fusseini*	*Afasie*
	4	*Larbako*	*Dente/Kpendzo*	*Serwaa*
	5	–	*Afasie*	*Pona*
Cooking time	1	*Larbako*	*Larbako*	*Pona*
	2	*Gbeadele*	*Pona*	*Matches*
	3	–	*Dente/Matches*	*Larbako*
	4	–	*Serwaa*	*Dente*
	5	–	*Kpendzo*	*Muchumudu*
Taste	1	*Larbako*	*Larbako*	*Pona*
	2	*Kpene*	*Pona*	*Larbako*
	3	–	*Dente*	*Dente*
	4	–	*Serwaa*	*Lili/Muchumudu*
	5	–	*Kpene*	*Matches*
Nutritional value	1	*Larbako*	*Larbako*	*Pona*
	2	*Kpendzo/Kpene*	*Pona*	*Larbako*
	3	–	*Dente*	*Dente*
	4	–	*Kpene/Serwaa*	*Muchumudu*
	5	–	*Lili*	*Matches*
		All		
All	1	*Larbako*	*Larbako*	*Pona*
	2	*Kpene*	*Pona*	*Matches*
	3	–	*Serwaa*	*Larbako*
	4	–	*Dente*	*Dente*
	5	–	*Kpene/Muchumudu*	*Bayere pa/ Muchumudu*

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest; R = Ranking

difficult-to-quantify benefits that were often omitted from economic analyses. This analysis could not only provide a list of selection criteria used by farmers, but could also help clarify the relative weighting of the criteria employed by farmers when making selections.

About 14% of the varieties were reported unnamed. Some of the names found across different AEZs (Table 27) could be duplications and this might be due to the composition of the ethnic groups existing in the surveyed district.

The study found that there were many different local names of yam within the three AEZs surveyed. The most common varieties observed across the zones are *Larbako, Kpene, Fusseini,* and *Kpendzo* in the SGS*; Larbako, Pona, Dente,* and *Serwaa* in the DS*; Pona, Dente, Matches, Larboko,* and *Muchumudu* in the HF (Table 27).

This difference in the zones could probably be due to their geographic position. Farmers seem to be oriented to a commercial cultivation of a few varieties in response to market demands.

From the results by gender (Table 28), the perceptions differ in terms of preferences between households headed by males and by females. This could probably be due to the fact that different varieties might be favored if they have some desired qualities.

Adoption of improved yam varieties

Improved yam varieties, such as *CRI Pona, Mankrong Pona, CRI Kukrupa*, etc., with multiple resistances to pests and diseases, have been released in Ghana but these varieties did not reach farmers' fields. No released improved varieties were identified in the field during the survey. Lack of access to seeds, as reported, was the main reason for the failure of good, new varieties to spread among farmers. Breeders are usually responsible for breeder seed multiplication. A Government seed company may be responsible for the multiplication and distribution of certified seeds with the commercial seed production sector to market and distribute the seeds. This system may not have been effective, giving farmers little or no opportunity to obtain seeds. Other reasons considered to have inhibited the adoption of improved varieties could be the following: (i) a minimum requirement of cultivatable land for demonstrations; and (ii) continuous seed multiplication might have affected the improved varieties so that they are no longer easily distinguishable from a wide range of local genotypes, especially since these new varieties were released without any friendly local name. Improved varieties might have been renamed or mixed with existing landraces, so making adoption difficult.

Effective varietal introduction schemes need to be set for several years to ensure the stable integration of the new variety into the local seed system. Although the dissemination of information about new varieties is often viewed as an extension function, breeders may need to actively encourage and help the extension service by (a) preparing information packages for new releases, (b) leading participatory varietal selection and front-line demonstration programs, (c) ensuring that large enough quantities of seeds are available for on-farm testing and demonstration, (d) organizing field days, and (e) participating in agricultural fairs, to ensure a better transfer and adoption level of farm technologies. However, knowledge about landraces' varietal preference could be of help in planning new interventions. Varietal characterization needs to be investigated to confirm or otherwise any relationship of these most preferred varieties to the improved varieties released. Also, for easy tracking, the project should focus on giving friendly names to new varieties before their release.

Awareness is one of the significant predictors of the decision to adopt. Among the available yam landraces, farmers reported varieties they consider as most preferred for their specific characteristics, such as yield potential, maturity period, taste, color of the flesh, poundability, storability, etc. About 21% of the surveyed households (Table 29) reported awareness about their most preferred varieties. The total number of such varieties has been reported as 23, with more diversity pronounced in the DS, followed by the HF. The smallest number has been reported in the SGS.

Table 28. Yam varietal ranking against various attributes by gender.

Ranking	Male-headed households	Female-headed households
1	*Pona*	*Matches*
2	*Larbako*	*Pona*
3	*Matches*	*Dente*
4	*Dente*	*Serwaa*
5	*Serwaa*	*Afasie/ Akaaba*

Table 29. Percentage distribution of households by awareness of most preferred yam landraces.

	All	SGS	DS	HF
N	600	14	436	150
Awareness level of preferred landraces (%)	20.7	14.3	17.9	29.3
Varieties heard of (number)	23	2	20	6

N = Number of respondents; SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

As shown (Fig. 23), more male- than female-headed households were aware of the best landraces. Also, male-headed households had heard of a higher number of varieties than female-headed households, probably because, from the beginning, yam was perceived primarily as a man's crop.

"Exposed" households in the surveyed area learned about their most preferred varieties from multiple sources (Table 30). The most important channel was government's extension followed by relatives/neighbors. Extension services played an important role especially in HF and DS; farmers' cooperatives and groups were only source of information in SGS.

Government's extension mainly provided awareness to both male- and female-headed households but mostly to female-headed households. The second important source was farmers' groups and relatives/neighbors from where male-headed households obtained more information (Fig. 24).

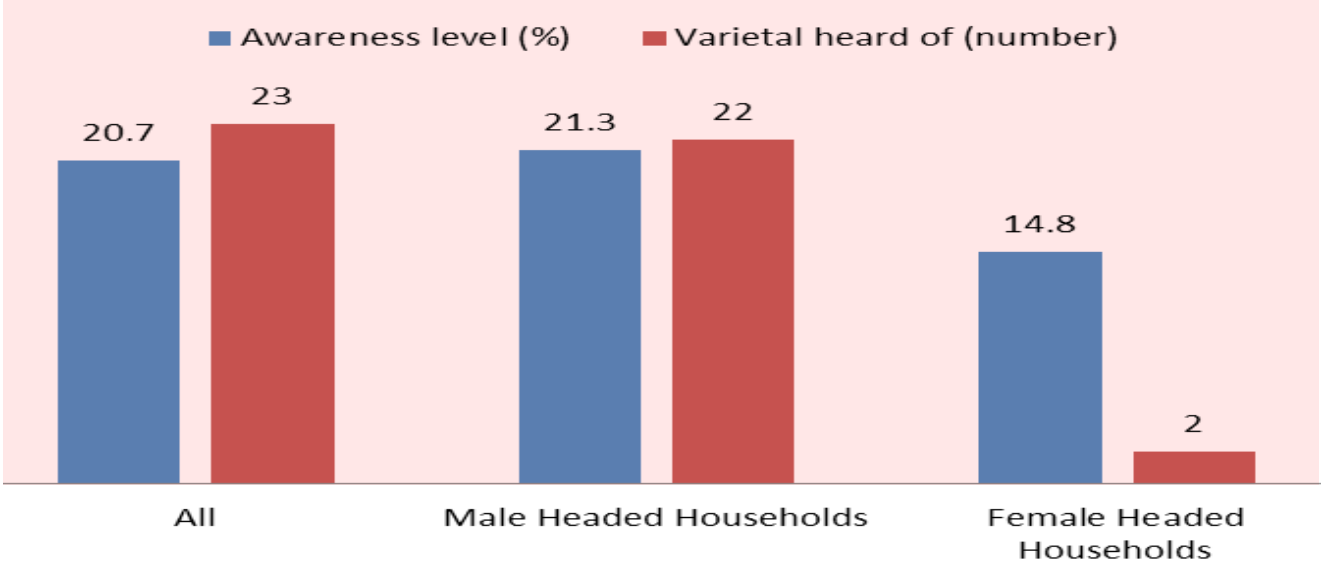


Figure 23. Percentage distribution of households by awareness of best landraces and gender.

Table 30. Percentage distribution of households by main source of variety information.

	All	SGS	DS	HF
N	600 (122)	14 (2)	436 (77)	150 (43)
None other	4.9	0.0	6.5	2.3
Government's extension	42.6	0.0	37.7	53.5
Farmers' cooperative/union	4.1	50.0	1.3	7.0
Farmers' group	9.0	50.0	3.9	16.3
NGO/CBO	0.0	0.0	0.0	0.0
Research center	0.0	0.0	0.0	0.0
Seed stockist	1.6	0.0	2.6	0.0
Relative/neighbor	28.7	0.0	36.4	16.3
Radio/newspaper/TV	4.1	0.0	5.2	2.3
Other	4.9	0.0	6.5	2.3

N = Number of respondents; SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.
Figures in parentheses represent number of valid responses.

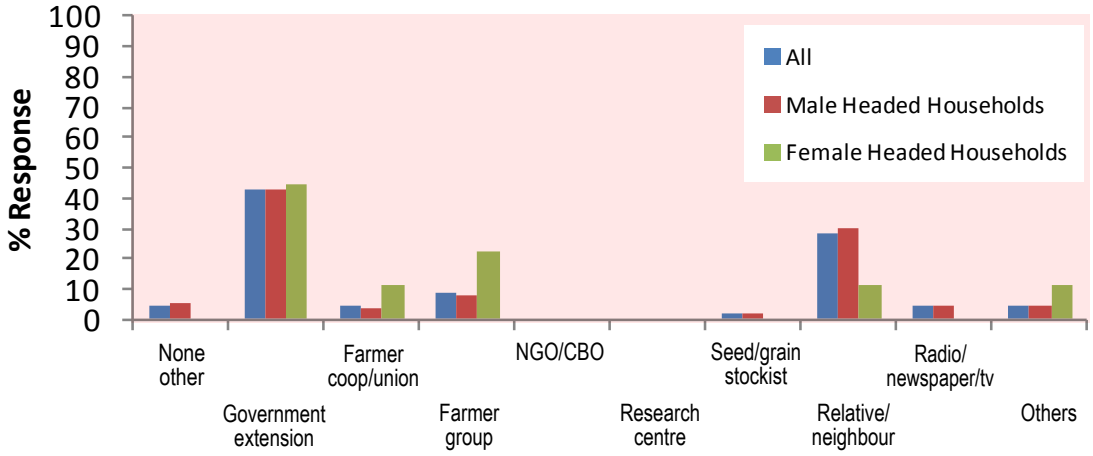


Figure 24. Percentage distribution of households by main source of variety information and gender.

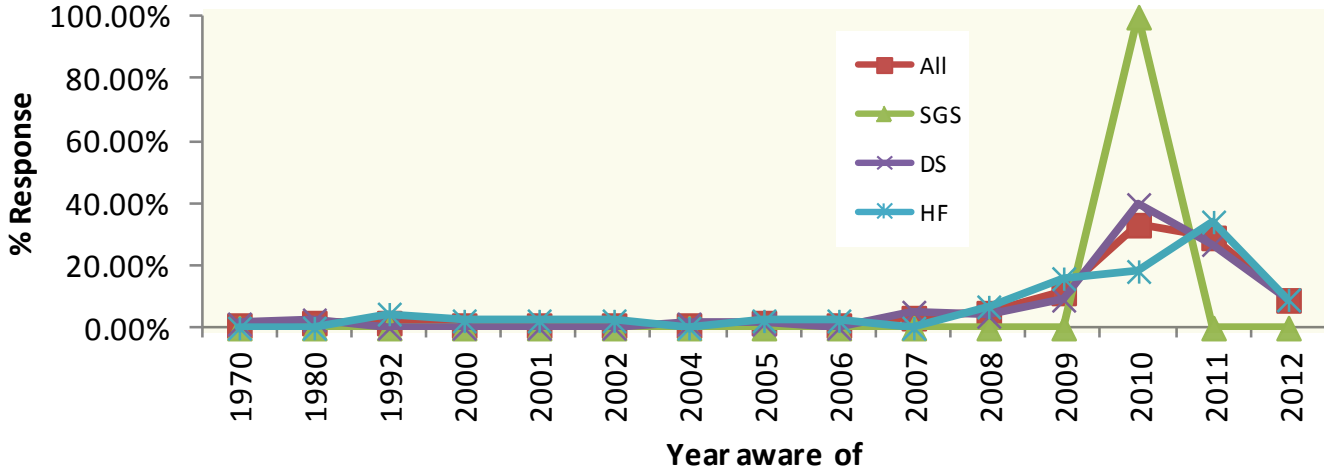


Figure 25. Percentage distribution of awareness dynamics.

Figure 25 shows the diffusion of best landraces from the year when they had first been heard of. About 1% of households in the DS reported that awareness started from 1970; about 5% of households in the HF reported awareness since 1992. In the SGS, all households were reported to be aware of the best landraces in 2010.

The graphic (Fig. 25) indicates a small, gradual increase denoting a slower creation of awareness that reaches an optimum before slowing down. A strategic analysis could be considered to maintain the awareness rate going well or growing rapidly.

Out of the responses from some households that did remember the source of their first seeds, about 26% (Table 31) stated they had got the first seeds from extension/demonstration fields, followed by farmers' groups, farmer-to-farmer seed exchange, local seed producers, and on-farm trials as sources; others were less important. The source varies according to the AEZ. Extension/demonstration fields and farmers' groups were important in providing seeds in the SGS and HF; farmer-to-farmer seed exchange and local seed producers played an important role in the DS (Table 32).

The findings in Table 32 show that most of the first seeds were bought with cash, followed by those that were given. Subsidy was applied in yam seed acquisition only in the SGS.

According to Asumugha et al. (2007), acquiring seed yam accounts for over 40% of yam production costs because of many constraints in the seed yam system. Many factors determine the quantity of first seeds that farmers could acquire and this quantity is low in this study, from 1 tuber to a maximum of 1200 (Table 33). Despite the information the farmers might have received on the quality of the variety they are still not well equipped to acquire much of it for the first time. Farmers lacked confidence in the added credibility of different sources on the quality of first seeds and this could have impeded their interest and demand.

Table 31. Percentage distribution of households by source of first seed.

Source	All	SGS	DS	HF
N	600 (31)	14 (2)	436 (21)	150 (8)
On-farm trials	12.9	0.0	9.5	25.0
Extension/demonstration fields	25.8	50.0	19.0	37.5
Farmers' groups/cooperatives	19.4	50.0	9.5	37.5
Local seed producers	16.1	0.0	23.8	0.0
Seed retailers	3.2	0.0	4.8	0.0
Farmer-to-farmer seed exchange	19.4	0.0	28.6	0.0
Other	3.2	0.0	4.8	0.0

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.
Figures in parentheses represent number of valid responses.

Table 32. Percentage distribution of households by main means of acquiring first seed.

Mean	All	SGS	DS	HF
N	600 (31)	14 (2)	436 (21)	150 (8)
None other	12.9	0.0	14.3	12.5
Gift/free	22.6	50.0	23.8	12.5
Borrowed seeds	3.2	0.0	4.8	0.0
Bought with cash	35.5	0.0	28.6	62.5
Exchanged with other seeds	16.1	0.0	23.8	0.0
Subsidy	3.2	50.0	0.0	0.0
Other	6.5	0.0	4.8	12.5

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.
Figures in parenthese represent number of valid responses.

Table 33. Average quantity of first seeds acquired (number of tubers).

	All	SGS	DS	HF
N	600 (32)	14 (2)	436 (22)	150 (8)
Mean	208.03	15.50	121.59	493.88
Std. Deviation	307.38	20.51	183.24	436.09
Minimum	1.00	1.00	2.00	1.00
Maximum	1200.00	30.00	800.00	1200.00
Sum	6657.00	31.00	2675.00	3951.00

N = Number of respondents; Figures in brackets indicate number of valid cases.
SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

An important number of the surveyed households which were aware of the most preferred varieties had planted them at some time (Table 34). Rather fewer planted them this season and all intended to plant them in future, certainly because of how good they have found them and depending on how available they are. The proportion of households planting various good varieties decreases progressively from SGS to HF regardless of the population. All the households in the different AEZ were willing to plant the best landraces in future.

More male-headed than female-headed households (Fig. 26) had planted the most preferred landraces in the past and planted them this season. Both kinds of household were willing to plant them in future, thus depicting the full interest they develop towards such varieties.

Several factors can limit farmers from planting a best variety. The households which were aware of the best varieties and responded to this question gave a number of reasons hindering them from planting. The main and most important reason was the availability of the seeds. Others, such as financial abilities, were also mentioned (Table 35) with few household-specific reasons which vary from one AEZ to another.

Table 34. Percentage distribution of households by most preferred varieties of planting status.

	All	SGS	DS	HF
N	600 (124)	14 (2)	436 (78)	150 (44)
Ever planted (%)	24.2	50.0	26.9	18.2
Planted this season (%)	23.4	50.0	26.9	15.9
Will plant in future (%)	100.0	100.0	100.0	100.0

N = Number of respondents; Figures in brackets indicate number of valid cases.
SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

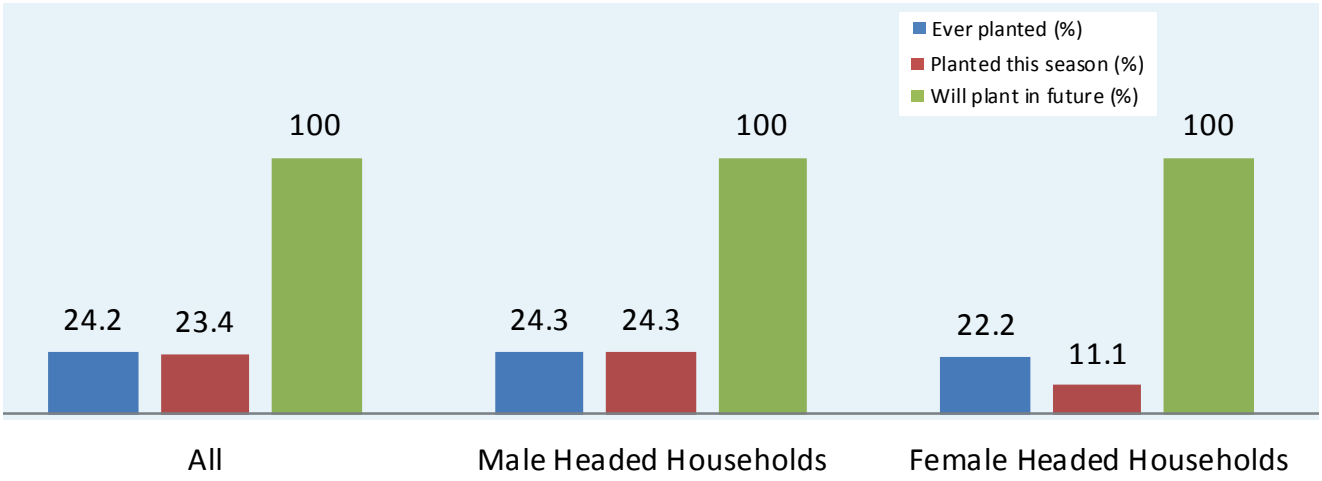


Figure 26. Percentage distribution of households by most preferred varieties planting status by gender.

Table 35. Percentage distribution of major reasons given by households for not planting best varieties.

Reason	All	SGS	DS	HF
N	600 (100)	14 (2)	436 (58)	150 (41)
None other	5.0	0.0	3.4	4.9
Seeds not available	81.0	100.0	87.9	73.2
Lack of cash/credit	9.0	0.0	5.2	14.6
Susceptible to diseases and pests	1.0	0.0	1.7	0.0
Price too high	2.0	0.0	1.7	2.4
Lack of enough land	1.0	0.0	0.0	2.4
Content with current	1.0	0.0	0.0	2.4

Figures in brackets indicate number of valid cases.
SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

In conclusion, best varieties are expected to enhance performance and farmers need to be armed with the information to realize the benefits of such varieties.

Willingness to pay is a reflection of the maximum amount a farmer thinks a best variety is worth. Exact measurement of consumers' willingness to pay is essential for pricing product innovations. In this case, market researches often rely on hypothetical approaches to gauge consumer demand. These methods are known to be considerably biased. To date, there is no convincing approach to eliminate these biases. A non-incentive-aligned direct approach, i.e., direct questioning, was used in this study.

The price point that most farmers could be willing to pay for a variety that has the desired qualities and is enough for planting one hectare varies across the area (Table 36) and about 19% were willing to pay above the average amount indicated. The difference might depend on the personal assessment of the value of the product.

Table 36. Amount farmer are willing to pay in Cedis for planting one hectare.

Amount		All	SGS	DS	HF
	N	600 (579)	14 (14)	436 (419)	150 (146)
Mean		2631	2646	2632	2629
Std. Deviation		777	449	774	813

N = Number of respondents; Figures in parentheses represent valid entries for analysis.
SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

Livelihood Shocks and Poverty

8

This section depicts the shocks faced by a household in pursuit of its livelihood strategy and exposes the values of poverty indices by comparing the household data collected on food and non-food consumption and expenditure. The use of income as a poverty indicator has been criticized as being more difficult to measure accurately and instead the use of expenditure as a poverty indicator has been preferred. Household expenditure, which is the cost of goods and services acquired for private use during a survey reference period, is considered to be a suitable substitute because it is relatively less variable than household income since consumers may not make long-term adjustments to spending if they believe that changes in their income are only temporary.

Shocks experienced by households

In pursuit of its livelihood strategy, a household always faces shocks, either common or specific in nature. Food deficit was the main shock experienced by the majority of households across the surveyed areas. This type of vulnerability was drawn from the qualitative analysis considering the respondents' perception about the number of households influenced by food shortages and the frequency of food shortages during the season.

Perceived food shortages and surplus food production

The assessment of families' food consumption in the past 12 months uses farmers' memory recall on different food shortage scenarios. A high number of households (62.4%) have experienced food unavailability in the study area and about 1% of these had shortages through the year (Table 37). Households which reported food shortages range from about 60 to 86%, with the SGS holding the highest proportion of households that experienced food unavailability, followed by the DS with about 62%; the HF had the lowest. These proportions are high, probably because of the decline in productivity attributed to factors including deteriorating soil structure and fertility; inadequate yield potential of popular varieties; prevalence of noxious weeds, as well as increasing levels of field and storage pests and diseases and severe losses of tubers in storage. However, they are a sign of food insecurity in the region because when an important proportion of households claim they are experiencing food shortages it is an indication of vulnerability.

Food surpluses for sale could not be produced by all households. As indicated, (Table 37 and Fig. 27), the households able to produce a surplus are negligible in proportion compared with those unable to do so.

Table 37. Percentage distribution of households' perception on food shortage.

Perceived food shortage/surplus		All	SGS	DS	HF
	N	600	96	126	174
Food shortage through the year		0.7	0.0	0.7	0.7
Occasional food shortage		61.7	85.7	61.7	59.3
No food shortage but no surplus		29.8	7.1	29.6	32.7
Food surplus		7.8	7.1	8.0	7.3

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest

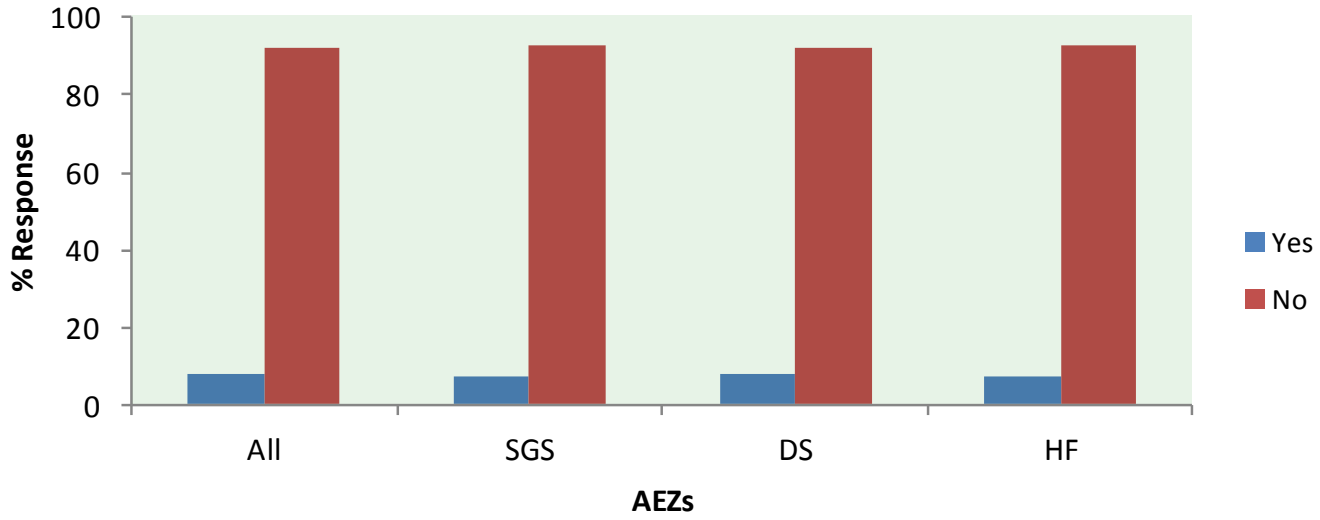


Figure 27. Perceived surplus food production.

Table 38. Percentage distribution of households by food shortage coping strategy.

Strategies	All	SGS	DS	HF
N	600	174	96	138
Rely on less preferred food	11.4 (43)	0.0 (0)	10.6 (29)	15.4 (14)
Limit variety of foods eaten	16.2 (61)	0.0 (0)	16.1 (44)	18.7 (17)
Limit portion size at meal-times	17.8 (67)	0.0 (0)	17.9 (49)	19.8 (18)
Reduce number of meals eaten in a day	18.4 (69)	25.0 (3)	19.4 (53)	14.3 (13)
Restrict consumption by adults in favor of children	1.1 (4)	0.0 (0)	0.4 (1)	3.3 (3)
Borrow food or rely on help from a friend/relative	21.5 (81)	58.3 (7)	23.4 (64)	11.0 (10)
Have no food of any kind in your household	0.3 (1)	0.0 (0)	0.4 (1)	0.0 (0)
Go to bed hungry because of not enough food	0.3 (1)	0.0 (0)	0.4 (1)	0.0 (0)
Go a whole day and night without eating anything	0.3 (1)	7.1 (1)	0.0 (0)	0.0 (0)
Seek jobs inside the community	4.0 (15)	0.0 (0)	3.7 (10)	5.5 (5)
Migrate to urban centers in search of non-farm jobs	1.6 (6)	0.0 (0)	0.7 (2)	4.4 (4)
Other	7.2 (27)	8.3 (1)	7.0 (19)	7.7 (7)

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.
Figures in parentheses represent the valid number of responses.

Strategies to mitigate food shortages

Among the households experiencing food shortages the most common coping strategies used to mitigate the shock were by importance as given in Table 38: borrowing food or relying on help from friends/relatives (22%); reducing the number of meals eaten daily (18%); limiting portion size at meal-times (18%); limiting the variety of foods eaten (16%); and relying on less preferred foods (11%). The coping strategies vary in the studied area as shown (Table 38). The top strategies used in different AEZs were borrowing food or relying on help from their friends or/and relatives for households in the SGS and DS, and limiting portion size at meal-times for households in the HF.

Household expenditure and poverty

Household expenditure

Household expenditure, the cost of goods and services acquired for private use during a survey reference period, is considered to be a suitable substitute for household income because it is relatively less variable than household income since consumers may not make long-term adjustments to spending if they believe that changes in their income are only temporary. The total expenditure included household expenditure on

Table 39. Consumption expenditure of sample households.

Consumption expenditure	All	SGS	DS	HF
N	600	96	126	174
Total expenditure (*GH¢*	5502 (5336)	5089 (4138)	5346 (5368)	5993 (5339)
Expenditure on food & beverages (*GH¢*)	4519 (5035)	4100 (4150)	4487 (5217)	4649 (4573)
Food ratio	0.79	0.73	0.80	0.76
Expenditure on non-food items (*GH¢*)	1010 (1347)	1065 (804)	885 (933)	1363 (2115)

N = Number of respondents; Figures in brackets indicate standard deviation.
SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

consumables and expenses on non-food items. Under food expenditure, all the food items consumed by the household during a year were collected. Food consumption includes food that the household has purchased, grown, and received from other sources. The total expenditure on food was obtained by aggregating expenditure on all food items; the total expenditure on each food group was obtained by aggregating expenditure on all food items falling within a group.

The different types of staple foods consumed in each household were enumerated and the physical quantity of each food item consumed in a year was estimated. Staple foods that were purchased, self-produced, or received as a gift were included in this estimation. The foods were then aggregated to give total staple consumption. Staple foods consumed outside the home were left out of this estimate because of the difficulties associated with accuracy in the conversion of purchased food into physical quantities. A comparison among staple foods (Annex 9) indicates that yam is still the most consumed staple in the surveyed area using consumption figures for each household which were converted into per capita consumption by dividing the total quantity consumed in a year by the number of adult equivalents. For non-food expenditure, all non-food items and services purchased by the household during the given reference period were also collected. On average, households spent a considerable share, 79%, of their budget on foods. When the food ratio is compared by AEZ, the highest amount was reported in the DS and it is clear that those who live in the SGS and HF spent more on housing, education, transport, electricity, and health, etc., compared with those who live in the DS (Table 39).

The high level of the food ratio is characteristic of most poor countries and the poverty measurement can be calculated on a household basis, i.e., by assessing the share of households who are below the poverty line. However, it might be better to estimate the measures on a population basis, in terms of individuals, in order to take into account the number of individuals within each household. From the welfare measure, such as per capita consumption and the poverty line, a number of aggregate measures of poverty are computed.

Poverty measurements

Individual consumption is used to generate poverty measurements that belong to the family of indices derived from the Foster, Greer, and Thorbecke equation to answer the following questions: *How many are poor within the yam-growing areas of Ghana? How poor are they? And how deprived are they?*

According to the Department of Census and Statistics (2008), poverty or the poor exists where some persons fall short of reasonably defined minimum levels of well-being, such as access to certain consumption or income levels, housing, health and education facilities, and certain rights recognized according to the standards of human needs and socioeconomic conditions of the society.

The basic measure of poverty is the size of the poor population which falls below the poverty line and the same is reported as the incidence of poverty by the poverty Headcount Index as a percentage of the total population. The depth of poverty or the poverty gap provides information regarding how far off the population is from the poverty line. Poverty severity takes into account not only the distance separating the poor from the poverty line but also inequality among the poor.

As already mentioned earlier, two poverty lines were used for poverty measurement: the relative poverty line set as 2/3 of the mean annual expenditure/capita and the standard international poverty line of $1.25/capita/day to allow cross-country comparisons of poverty rates that are notoriously difficult. In the surveyed area (Table 39) the poverty measures using the two different methods have the same trend even though the two measures cannot be directly compared. About 48% of respondents were found poor with the relative poverty line and about 45% of households were found poor using the absolute poverty line. Poverty indices vary across the AEZs with households in the SGS at greater risk of poverty. The risk decreases from the SGS to the HF via the DS (Table 40).

In conclusion, poverty in this surveyed yam zone is positively related to the poverty gap and severity and the farther households get from the poverty line, the greater is the inequality among them.

At the level of gender from Table 41, male-headed households had a higher risk of being in poverty and their poverty tends to be more severe and deeper than that in the female-headed households. The types of interventions needed to help the two groups are therefore likely to be different.

Table 40. Poverty measurements by AEZ.

AEZ	***N***	Headcount	Rank	Poverty gap index	Rank	Poverty severity index	Rank
Poverty line set as 2/3 of the mean annual per capita expenditure							
All	***600***	48.3		0.21		0.13	
SGS	***14***	78.6	(1)	0.44	(1)	0.32	(1)
DS	***436***	50.5	(2)	0.23	(2)	0.14	(2)
HF	***150***	39.3	(3)	0.15	(3)	0.08	(3)
International poverty line of average daily consumption of US$1.25/capita/day							
All	***600***	45.0		0.20		0.11	
SGS	***14***	71.4	(1)	0.42	(1)	0.30	(1)
DS	***436***	47.2	(2)	0.21	(2)	0.12	(2)
HF	***150***	36.0	(3)	0.13	(3)	0.07	(3)

N = Number of respondents; SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest
Figures in parentheses represent the ranking among the AEZ.

Table 41. Poverty measurements by gender.

Type of households	***N***	Headcount	Rank	Poverty gap index	Rank	Poverty severity index	Rank
Poverty line set as 2/3 of the mean annual expenditure/capita							
All	***600***	48.3		0.21		0.13	
Male-headed households	***539***	49.2	(1)	0.22	(1)	0.13	(1)
Female-headed households	***61***	41.0	(2)	0.13	(2)	0.07	(2)
International poverty line of average daily consumption of US$1.25/capita/day							
All	***600***	45.0		0.20		0.11	
Male-headed households	***539***	45.5	(1)	0.20	(1)	0.12	(1)
Female-headed households	***61***	41.0	(2)	0.12	(2)	0.06	(2)

Figures in parentheses represent the ranking among the type of households.

Institutional Issues

9

The development of the agricultural sector is possible through policies and institutional arrangements. During the survey, households were asked to provide information on services received from government officials and to assess the effectiveness of the government's policies on agriculture. Households were asked whether they (i) rely on the government's support (subsidies, food aid, etc.) if their crop fails; and (ii) are confident about the skills of the government's officials including extension workers to do their job. This section also brings in some of the institutional issues discussed in the previous sections.

Reliance on government's support and officials' skills

The types of support provided by the government, such as subsidies, food aid, etc., play a key role in the development of the agricultural sector. As depicted (Fig. 28), not all the households rely on the government's support, especially in the case of crop failure. The households reported to rely on government support were in a minority in proportion (about 38%) in the surveyed area. Confidence in the government was better in the DS compared with other zones.

Government's officials working in agriculture have a crucial role to play in fostering agricultural development for agriculture to be one of the most satisfying and rewarding ways to make a living. For some yam-growing households, complaints were made concerning the government's officials, such as extension workers. Some reported that they did not know their extension agents, others that they are not there when they are most needed, and that they could not rely on them. In the surveyed area (Fig 29), half of the respondents did not have confidence in extension workers' abilities and skills and prefer to live as if extension agents were not there; the worse scenario (about 71%) was observed in the SGS.

In conclusion, from the farmers' perspective, trust has been lost in government support in cases of crop failure and confidence also in the skills of officials. Programs and policies should be designed to regain trust and foster increased production.

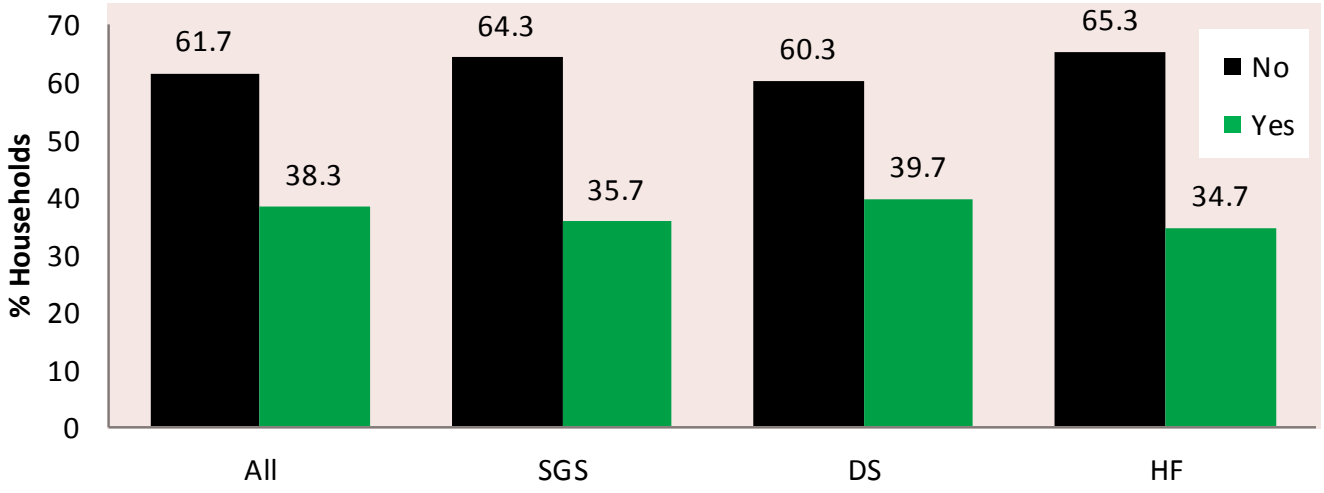


Figure 28. Percentage distribution of households' perceptions on reliability of government's support.

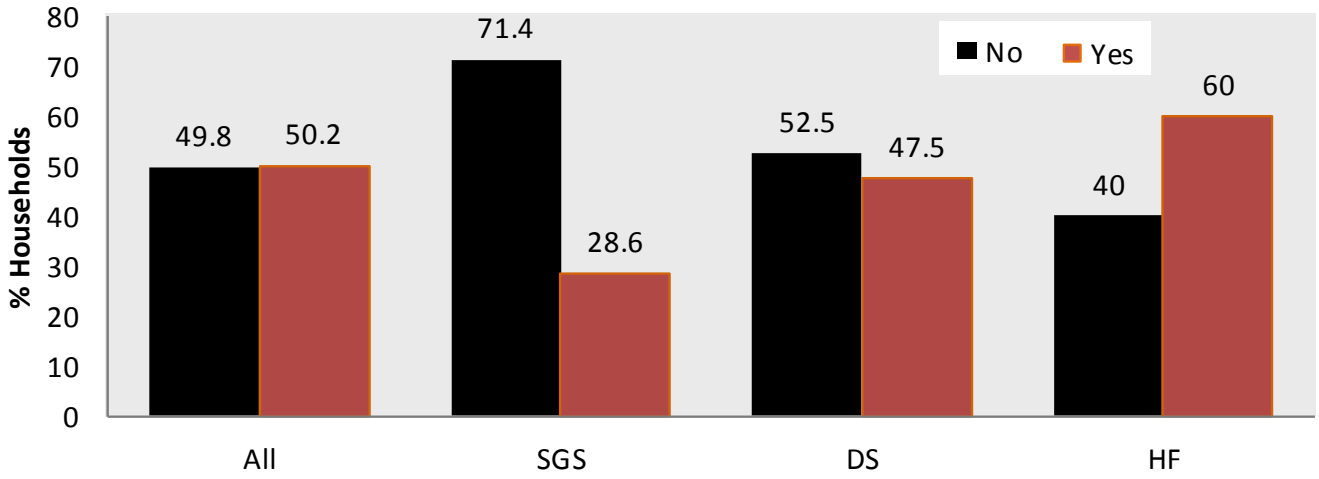


Figure 29. Percentage distribution of households' perceptions on confidence in government officials' skills.

Other issues reported

From the survey, many other policy and institutional issues were raised by respondents aiming at redesigning programs and policies intended to maximize production, reduce export costs, ensure food security for the country, and improve the lives of yam farmers. These include the following.

- Rural infrastructure development will be needed to improve rural–urban transport and market linkages.
- Taxes and tariffs on farm products will be revised.
- Inputs subsidies will be given to yam farmers as they have been given to maize farmers.
- Agrodealers, used mainly to distribute agricultural inputs or related purposes, are often not able to respond to the needs of yam producers.
- A major effort in education, training, and the provision of credit for small and medium enterprise development will be needed.
- Rural agricultural cooperatives in agroprocessing, storage facilities, and marketing will have to be developed and, where necessary, rehabilitated. Producer groups need to be organized and trained as market-oriented entrepreneurs, able to develop production capacities that are based upon the diversification of their produce and specifically driven by urban market demand.

Complementary Baseline Survey and Yield Measurement

10

A complementary baseline survey was commissioned in addition to the substantive data collected within the same yam belt of Ghana. This study aims mainly at measuring directly yam yield from farmers' fields in order to get more accurate crop yield estimates. Some related socioeconomic and community level characteristics were also collected.

Methodology

Sample design

This survey was based on a sample survey of yam producing areas of Ghana and all yam agroecologies, namely the humid forest, derived savanna, and southern Guinea savanna were covered in selecting five districts namely: Ejura-Sekyedumase, Atebubu-Amantin, Kintampo, East Gonja, and Mion. In each district, two communities were selected randomly making a total of 10 communities (Figure 30 and Annex 10). The sample

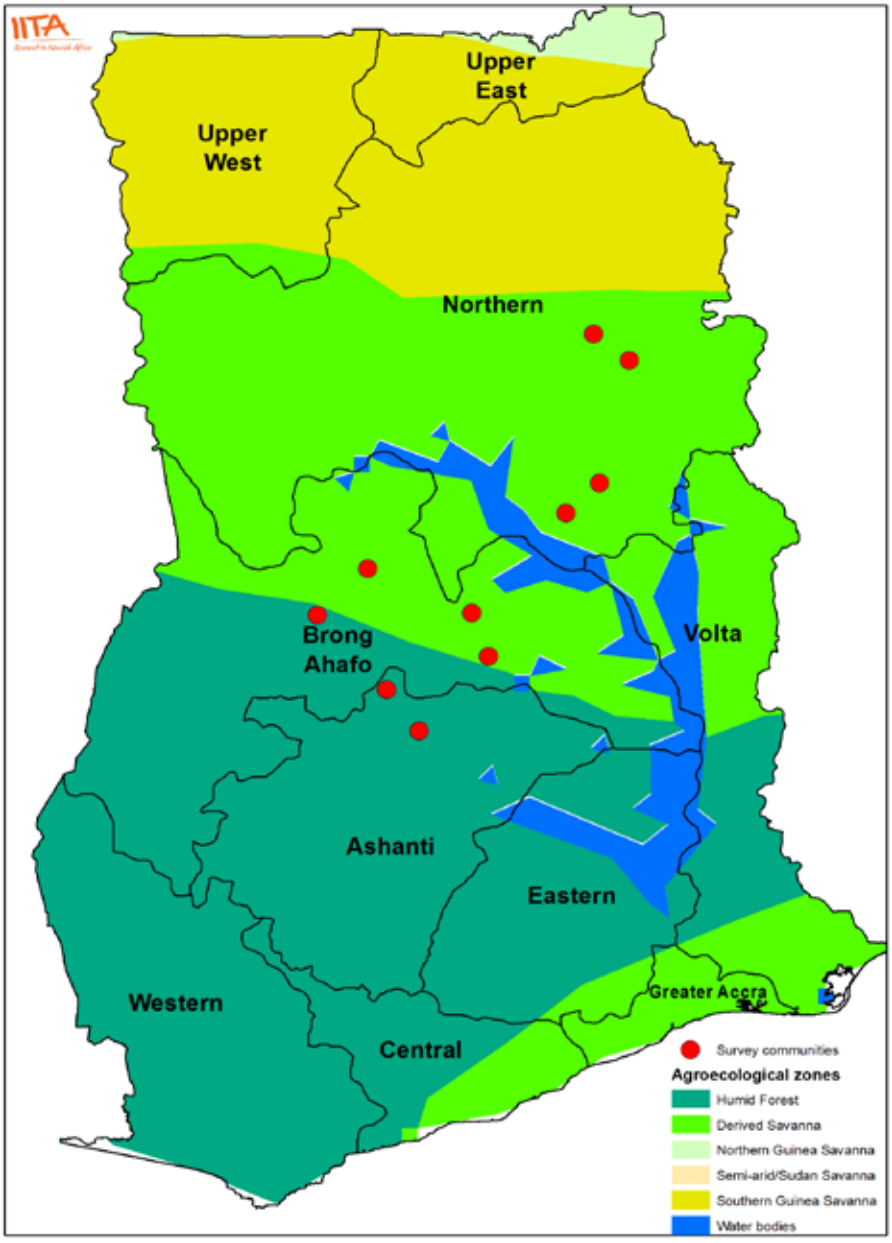


Figure 30. Map of surveyed areas for field measurements in Ghana, 2013.

size was determined by the time resource available for the survey which was November and December 2013. In each community a stratified random sample of three households was selected. Members of the community were assembled and requested to group themselves into three by size of their yam production operations, large, medium and small; in each group one farm household was selected randomly. The household yam farm size categories were unique to each community and varied across communities. Field level data was generated from 32 yam fields cultivated in the 2013 season by 30 farm households across agroecologies surveyed. However random sampling of surveyed communities resulted in selecting two agroecological zones: the derived savanna (DS) and humid forest (HF).

The time period when the survey was conducted was also an element of sampling. Yam planting dates vary depending on agroecology and in some cases on the yam variety, such as early or late maturing varieties. Each variety has a growing period at the end of which the variety must be harvested to avoid crop losses to damage. This means that the harvesting time for different varieties with differing growing periods and planting times was spread over several months in the year which could not be accommodated by the limited time frame and other resources available for the study. For this reason, the peak season of November and December when most mature yam was still in the field was purposely selected; most early maturing varieties had already been harvested and could not be represented in the yield sample taken.

Data collection

Data were collected through oral interviews of the selected farmers and through direct measurements in the yam fields. Oral interviews were conducted with structured questionnaires which were designed and pretested. There were three structured questionnaires, one administered at the community level (Annex 13), one at the household level (Annex 14), and the last at the field level (Annex 15). Respondents to the community level interviews were all yam producers, men and women, in the community who were interviewed as a group. Information collected at this level was such as would not vary with farm household, such as availability of market and other rural infrastructure. The community level interview was conducted in the village square and in some occasions in the community hall depending on the wishes of the community leaders.

The head of the household and spouse, where applicable, were interviewed at the household level in their home for information that would vary across households such as characteristics of the household, available resources, yam production objectives, etc. At the field level, the field owner responded to the oral interview for information such as production methods, yam varieties grown, plans for sale, and for home consumption of yams to be harvested, etc. The field level interviews were conducted in the various yam fields.

Yam yield and field area were measured with guidance from the owner of the field. Field area measurement was done with global positioning system (GPS). Yield measurement was based on a sample plot of about 50 square meters harvested close to the center of the field, weight and numbers of stands and tubers were counted. The yam was purchased from the farmer at the market rate; the initial plan was to leave the yam for the farmer after he was paid but extension guides and survey labor scrambled for it. Measurement was done regardless of yam variety and fields that had been milked for seed yam production were skipped in yield measurement.

Local farmers were used as labor for harvesting, they and the survey farmers were paid the wage rate obtained in the community. Enumerators who conducted the interviews and took the field area and yield measurements were in all cases experienced scientists from IITA and the national R&D institutions in the survey countries.

Data collection and management

A few days after the field work for data collection which lasted 10 days between November and December 2013, the questionnaires were reviewed by the YIIFSWA scientists who led in the field data collection. The data were transcribed by data entry clerks who were university graduates. After the transcription, the YIIFSWA scientists went through the data in a verification exercise before analyses began. The verification was a continuous process because in spite of cross checking the questionnaire before transcription and the

transcribed data, errors kept showing in the process of analyses. But none of the problems observed at the various stages of checking called for a revisit to survey sites. This is credit to the use of scientists to serve as the enumerators. Data were entered into Excel sheet.

Field data analysis

Data were analyzed using *Stata* and the production/yield data for yam were reported in terms of clean weight, i.e., free of earth and mud.

Estimation of area

The GPS was used to measure area. This system is very accurate compared to previous methods used like farmers' estimation and P^2/A methodology, based on the unique relationship and relatively stable relationship between a given field's perimeter squared (P^2) and its area (A). The measurements of the sample plot and total area were recorded.

Estimation of production

Production is estimated using a weighing scale. As the field is harvested, all harvested yam from the field were weighed and recorded.

Findings from field survey

Yam production contexts

One reason for limited R&D attention to labor-saving technologies in African agriculture is the wrong assumption in R&D circles that relative to other inputs such as fertilizers farmers have labor because of large farm household sizes. The implication of the observed large yam farm households, with an average of about 12 persons and ranging from 3 to 25, is that on-farm labor availability depends on the composition of the households (Table 42). Many of the large households are composed of aged women in polygamous families and many school age or younger children whose contributions to farm work are minimal. This means that household size could be a misleading proxy for labor availability in yam production.

The yam fields

Most of the yam farm households had one yam field each; less than 5 percent of them had more than one. Average yam field size was 1.6 ha per household (Table 43). In Ghana the yam fields surveyed are situated at distances of up to 15 kilometers from the village centers. Yam is produced under the shifting cultivation system;

Table 42. Household size.

Household size	All	DS	HF
Mean	11.95 (21)	12.28 (18)	10.00 (3)
Std. Deviation	6.06	6.51	1.00
Minimum	3	3	9
Maximum	25	25	11

Figures in parentheses represent valid entries for analysis; DS = Derived Savanna; HF = Humid Forest.

Table 43. Yam field size (ha/farmer).

Yam field size	All	DS	HF
Mean	1.60 (21)	1.59 (18)	1.64 (3)
Std. Deviation	1.74	1.77	1.88
Minimum	0.11	0.15	0.11
Maximum	6.74	6.74	3.74

Figures in parentheses represent valid entries for analysis.
SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

Table 44. Yam yield from field measurement (kg/ha).

Production scale	All	DS	HF
Mean	18,223 (27)	20,348 (20)	12,152 (7)
Std. Deviation	8,683	8,295	7,125
Minimum	4,388	9,878	4,388
Maximum	35,926	35,926	24,375

Figures in parentheses represent valid entries for analysis.
SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest.

each season famers move into new forest land in search of suitable land for yam production, suitable in terms of high fertility soil, low incidence of yam pests and diseases, and the availability of yam stake trees, without ever returning to land that has already been used for yam production.

The result is long and increasing distances between farmers' homes and yam fields along forest tracks with dense growth of sharp grasses such as *Imperata* and across rivulets some of which are knee deep. On-farm transportation is on foot, by bicycles, or motorcycles for men; it is on foot for virtually all women who leave home early in the mornings and return late in the evenings with head loads of firewood in the planting season and firewood and crops in the harvesting seasons.

In Ghana yam is produced under shifting cultivation rather than long fallow and distances between home and yam fields are long. The fresh tuber yield was higher in the DS than that in the HF probably due to less observed pest and diseases (Table 44).

An attempt was made to disaggregate results by scale of production however the observations with respect to some of the categories were not accompanied with enough degree of freedom to make assertive statements. Therefore it was dropped.

In some agroecologies yam is staked, sometimes elaborately. In Ghana, yam producers use pre-existing small trees in the field as stakes for yam. During land clearing for yam cultivation, farmers collect and burn the residue around small trees which die and the yam vines are guided to twine on them.

Sole cropping was not common. Most of the farmers practiced intercropping and relay cropping. Farmers aim at maximizing yield on a given piece of land by making use of resources that would otherwise not be utilized by a single crop through intercropping and relay cropping. Cassava is the most common crop intercropped or relayed with yam. Other crops include rice, sorghum, melon, and beans. In virtually all cases, yam is gown in mounds. In Ghana, the mounds are almost of uniform size. The near uniform size of yam mounds in all the surveyed villages has a negative effect on the yam tuber shape in areas where the soil is too shallow for the standard mound size.

Yam mound making is not only laborious, it is backbreaking; other major constraints are yam pests and diseases and the high cost, scarcity, and low quality of seed yam. But apart from mound making all yam production operations are labor intensive because all of them are performed with the hand hoe, machete, and digging sticks without any form of a labor-saving technology.

Problems of yam pests and diseases, especially nematodes and viruses are ubiquitous. In Ghana, the yam beetle is causing considerable damage to yam tubers and it is a serious cause of distress to yam producers in that country.

In yam production, the seed is the tuber, i.e., the crop. Yam producers purchase part and produce part of the seed yam they plant. Yam is widely produced with purchased inputs, especially the seed yam and hired labor; chemical fertilizer, herbicide, and pesticides are used but not commonly. About 60 percent of yam harvested after discounting for seed yam is sold. This observation constitutes indisputable evidence that yam is produced as a cash crop in Ghana.

The study reveals that yam is mostly produced in villages that are remote from urban centers with limited health, sanitation, educational, farm input, etc. facilities. Some of the heads of most yam producing households are aged; the young ones are among them because of family traditional obligations or lack of exposure to urban employment opportunities. The mainline yam farmers have zero or little formal education. All these have negative implications for progress toward improvement of the yam food sector.

Yam production demand for labor, seed, and other materials such as stakes is high; if these inputs are not provided as required or even if provided but not in a timely manner, suboptimal crop performance results. For this reason, inputs available in the household are frequently supplemented by purchase from external sources, especially when the crop is produced for sale, which is more often than not the case. This section assesses levels of use of various purchased inputs in yam production and tries to establish the circumstances under which the inputs are purchased with an aim of suggesting measures that if implemented can motivate farmers to expand the level of use of the purchased inputs where such can help improve resource-use efficiency in yam production.

Yam production with purchased inputs

Inputs used in yam production which may be secured from sources external to the household include seed yam, labor, farmland, chemical fertilizer and herbicides, and mechanical and mechanized vehicles for use in field-to-home transportation. Only one or two yam fields in the survey were cleared mechanically. Therefore, the use of machinery in yam production was uncommon.

Yam fields surveyed were on plots of farmland acquired by inheritance, plots allocated by the village central authority, or plots purchased or rented from neighbors for a fee in cash or kind. Farmland was considered a purchased input if it was purchased or rented for a cash or kind payment. Hired labor, i.e., labor paid for in cash or kind, was used in various combinations with family labor for land clearing, seedbed preparation, sowing, weeding and harvesting operations. For each operation hired labor was considered used if the operation was executed mostly or in full with hired labor.

Farm transportation is here referred to as field-to-home transportation because in areas where yam is not stored in the field it is stored at home, often for security reasons. Mechanical field-to-home transportation was by bicycle and hand-pushed carts or wheel barrows; mechanized transportation was by motorized vehicles such as motorcycles, tractors, and other four-wheeled motor vehicles. Bicycles, hand-pushed carts or wheel barrows, and the motorcycles were usually owned by some of the smallholders. Four-wheeled motorized vehicles such as taxis and tractors were available locally for hire on a custom basis. Farmers with large quantities of yam output often rented tractors or taxis for transporting yam on an individual basis where farm road condition permits. On-farm transportation equipment is considered a purchased input if it is a such as bicycles, carts or wheel barrows or motorized vehicles such as motorcycles, tractors, or other motor vehicles even if owned by the farmer since the equipment is purchased and is maintained with running expenses incurred in cash.

Farmland

In Ghana, 3% of the yam fields surveyed was acquired by purchase, 41% by renting, 34% by inheritance, and 22% by allocation from community leaders. In conclusion use of farmland as purchased input in yam production was common.

Seed yam

Frequently, a yam field is planted partly with purchased and partly with farmer's own produced seed yam. Farmers interviewed were asked to state, for each field, how many out of 10 seed yams planted were purchased and how many were own produced; this information was converted to a percentage. Approximately 40 percent of seed yams used by the surveyed farmers were purchased and 60% own produced. There were fields planted with only purchased seed yams while others planted with only farmer's own produced seed yams (Fig. 31).

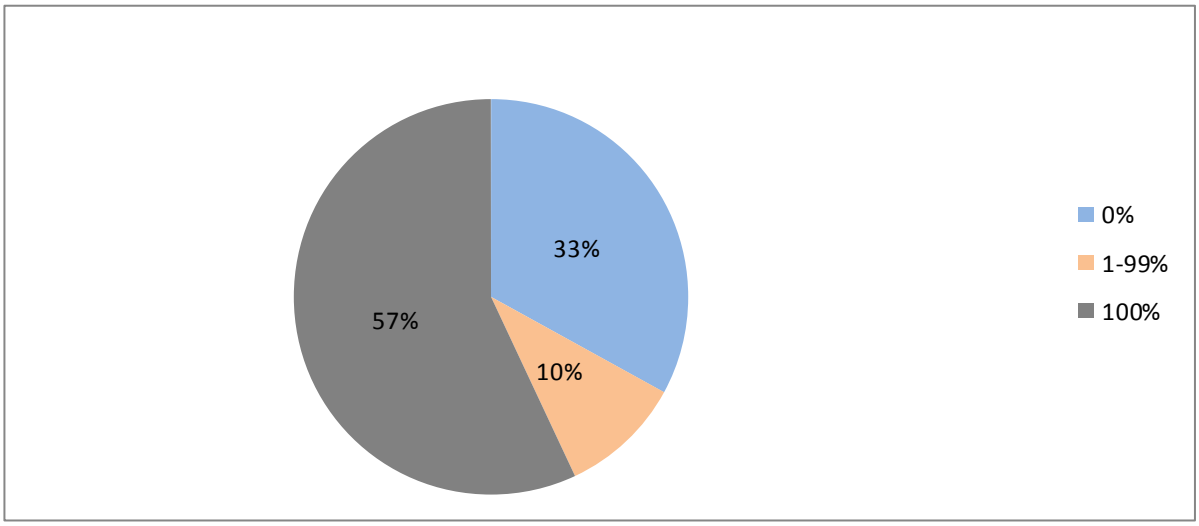


Figure 31. Distribution of yam fields by percentage of seed yam planted that was purchased, 2013.

Table 45. Percentage frequency of yam fields by operation by source of labor, 2013.

Operation	Source	All
No. of obs.		40
Land Clearing	Hired	81
	Family	19
	Total	100
Seedbed prep	Hired	81
	Family	19
	Total	100
Sowing	Hired	48
	Family	52
	Total	100
Weeding	Hired	67
	Family	33
	Total	100
Harvesting	Hired	33
	Family	67
	Total	100

Hired labor

Usage of hired labor in yam production is widespread. For example, hired labor was used for at least one of the five farm operations, namely land clearing, seedbed preparation (mounding), planting, weeding, or harvesting in about 80% of the fields in Ghana (Table 45). The widespread use of hired labor can be explained by the high labor requirement in yam production. The hired labor was more commonly used in land clearing, seedbed preparation, and weeding than in sowing and harvesting. More detailed analyses of the survey data presented elsewhere reveal that mounding and weeding require more man days of work than land clearing, planting, and harvesting.

Inorganic fertilizers

Inorganic fertilizers were not used in any of the yam fields surveyed in Ghana. Limited farmer access to chemical fertilizer could be a factor in non-use of the purchased input in yam production in Ghana but more important, Issahaq Suleman reported that Ghanaian farmers are uncertain about the value of fertilizer in yam production. There is a concern of farmers that fertilizer may have negative effects on food quality and storability of yam produced.

Herbicide

Herbicide was used either for land clearing, weeding or both. For land clearing, herbicide was used in 46% of the surveyed yam fields. In Ghana, yam is planted in new forest land each year which is described as short fallow.The chemical was used for weeding in about 38 percent of the surveyed yam fields.

Mechanized field-to-home transportation

In Ghana, yam was transported from 17% of the fields surveyed to home by head load, from 20% by non-motorized vehicles, and from 63% by motorized vehicles. Yam cultivation in new forest lands each year makes use of certain motorized vehicles for field-to-home transportation of yam difficult because of the inadequacy of farm roads.

Yam production for sale

Proportion of yam production designated for sale

Yam sales information is based on farmer estimates of how they planned to use yam in the field when harvested. To facilitate the estimation process, the information was solicited on a field-by-field basis. Each farmer was asked how many out of 10 portions of total yam in the field he or she planned to sell for each of his or her yam fields. This represents the yam planted purposely for sale and not surplus over consumption needs.

The result shows that about 60% of yam harvested after discounting for seed was designated for sale on average. The farmers' estimates of the number of portions of yam they planned to sale varied from a minimum of about 43% to a maximum of 90% (Table 46). There was no field in the survey where a percentage of yam harvest was not designated for sale.

In conclusion most yam is produced in villages remote from urban centers with limited facilities. The mainline yam farmers have zero or little formal education. All these have negative implications for progress toward improvement of the yam food sector.

Yam is produced with low technologies for labor saving, seed production, and yam pest and disease control. But among the most critical constraints to yam production in Ghana is shifting cultivation which exposes the farmers to unproductive and tortuous commutation between home and yam fields. Although some men are able to accomplish on-farm transportation through forest tracks by bicycles and motorcycles, women commute on foot on a daily basis with head loads of firewood and crops over the long-distant bush tracks. The practice of shifting cultivation which is rooted in the farmers' continuous search for fertile land, low yam pest and disease incidence, and stake trees have negative implications for environmental degradation.

Table 46. Percentage of yam harvest designated for sale.

Yam harvest for sale	All	DS	HF
Mean	59.9 (21)	57.8 (18)	72.1 (3)
Std. Deviation	12.3	8.3	25.5
Minimum	42.9	50.0	42.9
Maximum	90.0	71.4	90.0

Figures in parentheses represent valid entries for analysis.
SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest

Yam is grown on uniform sizes of yam mounds in all the surveyed villages resulting in poor yam tuber shape in some areas where the soil is not deep enough. Making ofthe yam mounds is laborious and backbreaking. The difficulty of finding sufficient seasonal migrant hired labor for yam mound making is one of the biggest constraints to yam production expansion; other critical constraints are the yam pest and disease problem and the high cost, scarcity and low quality of seed yam.

Yam is widely produced with purchased inputs, especially the seed yam and hired labor; chemical fertilizer, herbicide, and pesticides are used but not commonly. The findings show indisputable evidence that yam is produced as a cash crop in Ghana.

Hired labor is the most frequently used purchased input in yam production among the farmers surveyed because family supplies are too low compared with need.

Conclusions and Recommendations

11

The results of the baseline study provide an overview of the livelihoods of the surveyed yam-producing communities in Ghana. All aspects of people's lives and livelihoods are certainly not covered but the aspects that are dealt with are those connected with yam-growing areas and could be controlled by new interventions. Thus a number of implications are relevant to be taken into consideration during the implementation of various activities.

- This study establishes that the majority of the rural household heads are engaged in farming activities as the major source of income with an attendant low income despite the priority given to yam over cash crops and food crops of less importance. Yam is produced with low technologies for labor saving, seed production, and yam pest and disease control leading to a low level of productivity. Therefore there is need to develop a yam seed system and to encourage farmers to adopt improved agronomic and husbandry practices, such as ridging as a seedbed preparation method, to reduce labor costs. This should be associated with the introduction and adoption of high yielding crop varieties and advocacy on efficient inputs use, necessary to increase productivity. A significant gap was observed between yam yields measured and those reported through the recall-based information technique. This might not be unconnected with the freshness of tubers with high water content and farmers' inability to recall accurately. The difference in yields between the two approaches could also be linked to farmers' milking pattern.
- It became apparent that a lack of finance at critical periods in the yam-growing calendar is a major impediment to many farmers being able to obtain as much good planting material as they want or to grow as much yam as they would like to. There is a need to improve farmers' financial status through functional action plans for them to be self-sustaining in financing and using better technologies.
- The need to improve the postharvest storage and handling of yam is underlined, suggesting that any significant reduction in postharvest losses will be possible only if measures are developed either to improve postharvest storage and handling or to promote appropriate processing and value-adding technologies. Otherwise, the absence of such techniques is likely to be a major impediment to any production promotion initiative.
- No improved varieties were identified in the field during the survey. The adoption of improved yam varieties in the surveyed communities has been non-existent. The main reason has been that farmers had no access to seeds of new varieties. Other reasons considered to have inhibited the adoption of improved varieties could be: (i) a minimum requirement of cultivatable land for demonstrations; and (ii) continuous seed multiplication might have affected the released improved varieties so they are no longer to be easily distinguished from a wide range of local genotypes, especially since these new varieties were released without any friendly local name. In the current situation, a lack of reliable identification of improved varieties which might have been renamed or mixed with existing landraces makes any level of adoption uncertain.

Effective varietal introduction schemes need to be set for several years to ensure the stable integration of the new variety into the local seed system. Although the dissemination of information about new varieties is often viewed as an extension function, breeders may need to actively encourage and help the extension service by: (a) preparing information packages for new releases, (b) leading participatory varietal selection and front-line demonstration programs, (c) ensuring that large enough quantities of seeds are available for on-farm testing and demonstration, (d) organizing field days, and (e) participating in agricultural fairs, to ensure better transfer and adoption levels of farm technologies. Varietal characterization needs to be investigated to confirm or otherwise any relationship of these most preferred varieties to the improved varieties released. Also, for easy tracking, the project should focus on giving friendly names to new varieties before their release.

- There is no consensus among economists—and policymakers, businessmen, academics, and practitioners as well—on how best to address poverty but from this study, producers work hard to produce a lot of yam, yet they live in penury. Tackling the various constraining factors limiting productivity might be the right prolog to fast-tracking poverty reduction. This may suggest the need to revisit food and poverty policies. A mix of effective policy actions is required, including that designed to specifically benefit women to reduce the number of poor (incidence of poverty) but this might be done by lifting out of poverty only those who are closest to the poverty line (impact on poverty gap). Other interventions could better address the situation of the very poor by bringing them closer to the poverty line by focusing on raising productivity in yam-growing areas in ways that promote broad-based increases in food security and incomes.
- The findings from this study showed the prime role the government must play in developing the yam sector. Farmers have lost confidence in government's support in case of crop failure and the trust should be regained. Thus, government should promote yam and its devolvement in the pricing policies. This needs to be accompanied by other measures such as infrastructure development, export incentives, and subsidies on inputs, as it is done with maize farmers. Other policy interventions needed include more financial support to the extension services for more efficient work.
- Increasing awareness and acceptance of multiple contemporary forms of households and family life should be initiated to use women's potentialities fully and their capacity to introduce interventions and promote food security. A new strategy for agriculture and rural development should be formulated in this sense to encourage the equal participation of women and men in decision-making that might foster the adoption of new interventions to reduce poverty and stimulate economic growth. Greater collaboration is called upon for this in analysis, policy, and action for gender equality across the region.
- Yam attracts a high price in the urban markets because of being patronized by high-income consumers and the lack of market information in the surveyed area is still a biggest drawback for Ghanaian agriculture. The current information base is low and even the limited information available does not get disseminated due to a lack of adequate channels for dissemination. As a result, farmers are in a predicament as they are unable to attune their production practices in accordance with the market's changes. Therefore, improving the ability of farmers to have access to the market and strengthening their bargaining position is recommended as the central focus of yam market reform policy.

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Annexes

1. Characteristics of sampled households by districts.

Characteristics	All	1	2	3	4	5
N	600	96	126	180	138	60
Male (%)	89.8	88.5	80.2	86.2	100	98.5
Age of hhh (years)	48.7	48.3	50.9	48.8	45.9	50.5
Attended school for hhh (%)	30.0	31.2	39.7	36.8	21.7	9.1
Average years of schooling for hhh	2.7	2.6	3.3	3.5	2.0	0.7
Experience in yam growing for hhh	23.4	18.8	20.7	21.2	28.4	30.7
Household size (number)	9.3	8.3	7.5	7.2	11.6	14.4
Dependency ratio	1.0	1.1	0.9	1.1	0.9	0.8

N = Number of respondents; Hhh = household head; 1 = Ejura; 2 = Atebubu; 3 = Kintampo; 4 = East-Gonja; 5 = Mion

2. Fertilizer and pesticide use by districts.

Yam cropping systems	All	1	2	3	4	5
N	600	96	126	180	138	60
Yam (Pool)						
Basal fertilizer (kg/ha)	1.69 (14.7)	3.77	2.55	1.08	0.00	3.29
Top dressing-urea (kg/ha)	1.13 (10.3)	1.88	0.00	0.49	0.00	8.99
Manure own (kg/ha)	0.02 (0.4)	0.00	0.00	0.07	0.00	0.00
Manure bought (kg/ha)	0.00 (0.0)	0.00	0.00	0.00	0.00	0.00
Herbicide (lt/ha)	4.91 (9.4)	3.07	5.95	4.51	6.19	3.36
Pesticide (lt/ha)	0.81 (3.7)	0.41	0.41	0.37	2.19	0.25
Yam sole						
Basal fertilizer (kg/ha)	0.59 (7.0)	1.49	0.00	0.11	0.00	4.39
Top dressing-urea (kg/ha)	0.80 (7.6)	2.11	0.00	0.03	0.00	6.27
Manure own (kg/ha)	0.02 (0.4)	0.00	0.00	0.08	0.00	0.00
Manure bought (kg/ha)	0.00 (0.0)	0.00	0.00	0.00	0.00	0.00
Herbicide (lt/ha)	4.96	3.86	6.83	3.57	6.34	1.76
Pesticide (lt/ha)	1.10 (4.4)	0.55	0.59	0.50	2.24	0.33
Yam intercropped						
Basal fertilizer (kg/ha)	4.58	8.11	6.72	2.66	0.00	0.00
Top dressing-urea (kg/ha)	2.07	1.88	0.00	1.23	0.00	17.1
Manure own (kg/ha)	0.03	0.00	0.00	0.06	0.00	0.00
Manure bought (kg/ha)	0.00	0.00	0.00	0.00	0.00	0.00
Herbicide (lt/ha)	5.18	2.17	4.86	6.30	0.00	8.17
Pesticide (lt/ha)	0.18	0.28	0.19	0.16	0.00	0.00

N = Number of respondents; Hhh = household head; 1 = Ejura; 2 = Atebubu; 3 = Kintampo; 4 = East-Gonja; 5 = Mion

3. Yam yield (kg/ha) by districts.

Yam cropping systems	All	1	2	3	4	5
N	600	96	126	180	138	60
Yam (pool)						
Mean	6750 (508)	4069	6192	6568	9975	4482
Std. Deviation	6852	4790	5686	6029	8933	5798
Yam sole						
Mean	7082	4976	6101	6071	9932	4443
Std. Deviation	7168	5529	5427	5605	9029	5573
Yam intercropped						
Mean	6273	2838	6439	7567	13965	4596
Std. Deviation	6391	3286	6415	6791	1849	6728

N = Number of respondents; Hhh = household head; 1 = Ejura; 2 = Atebubu; 3 = Kintampo; 4 = East-Gonja; 5 = Mion

4. Average total costs of yam production in in GH¢ by districts.

Costs		All	1	2	3	4	5
	N	600	96	126	180	138	60
- Family labor		*1599*	588	1306	1349	*2845*	*1543*
- Hired labor		*334*	411	425	370	*225*	*126*
Labor		1933	999	1730	1719	3070	1669
Seeds		3161	2680	2710	3045	3588	4479
Oxen/tractor hire		65	44	86	47	77	92
Herbicides		125	130	168	163	55	51
Pesticides		15	11	21	20	3	15
Basal fertilizer		76	75	93	92	50	45
Top dressing fertilizer		49	55	74	71	5	6
Total input		***5423***	3989	4884	5156	6847	6353
Land rent*		11	7	10	12	15	11
Costs (excl family labor)		**3835**	3408	3588	3818	4017	4822
Total costs (incl family labor)		**5434**	3996	4893	5167	6862	6364

* charges supported by a few farmers to meet their land requirements for yam production;.
N = Number of respondents; Hhh = household head; 1 = Ejura; 2 = Atebubu; 3 = Kintampo; 4 = East-Gonja; 5 = Mion

5. YIIFSWA Project Communities.

Regions	Districts	Communities	Aezs
Ashanti	Ejura-Sekyedumase	Bisiw 1	Humid Forest
Ashanti		Bisiw 2	Humid Forest
Ashanti		Bompa	Humid Forest
Ashanti		Ejura Nkwanta	Humid Forest
Ashanti		Hiawoanwu	Humid Forest
Ashanti		Kasei	Humid Forest
Ashanti		Kramokrum	Humid Forest
Ashanti		Krampong	Humid Forest
Ashanti		Kropong	Humid Forest
Ashanti		Leafu Kura	Humid Forest
Ashanti		Mesuo	Humid Forest
Ashanti		Nkrama	Humid Forest
Ashanti		Nokreasa	Humid Forest
Ashanti		Nyinasei	Humid Forest
Ashanti		Samari Nkwanta	Humid Forest
Ashanti		Sunkwae	Humid Forest
Brong-Ahafo	Atebubu-Amantin	Akyeremade	Humid Forest
Brong-Ahafo		Amanfrom	Derived Savanna
Brong-Ahafo		Asanteboa	Humid Forest
Brong-Ahafo		Badukrom	Derived Savanna
Brong-Ahafo		Boniafo	Derived Savanna
Brong-Ahafo		Densi	Derived Savanna
Brong-Ahafo		Duabone 1	Derived Savanna
Brong-Ahafo		Duabone 2	Derived Savanna
Brong-Ahafo		Kafaano	Derived Savanna
Brong-Ahafo		Kumkumso	Derived Savanna
Brong-Ahafo		Lailai	Humid Forest
Brong-Ahafo		Mem	Derived Savanna
Brong-Ahafo		Morochusu	Derived Savanna
Brong-Ahafo		Nwowam	Derived Savanna
Brong-Ahafo		Old Kronkrompe	Derived Savanna
Brong-Ahafo		Patuda	Humid Forest
Brong-Ahafo		Praprabon	Humid Forest
Brong-Ahafo		Primukyea	Humid Forest
Brong-Ahafo		Sampa	Derived Savanna
Brong-Ahafo		Tintare	Derived Savanna
Brong-Ahafo		Watro	Humid Forest

YIIFSWA Project Communities Contd.

Regions	Districts	Communities	Aezs
Brong-Ahafo	Kintampo	Aduma	Derived Savanna
Brong-Ahafo		Alassankura	Derived Savanna
Brong-Ahafo		Asantekwa	Derived Savanna
Brong-Ahafo		Asuma Kura	Derived Savanna
Brong-Ahafo		Attakura	Derived Savanna
Brong-Ahafo		Bablioduo-Kokomba	Derived Savanna
Brong-Ahafo		Badu Krom (Kofi)	Derived Savanna
Brong-Ahafo		Basabasa	Derived Savanna
Brong-Ahafo		Ben Krum	Derived Savanna
Brong-Ahafo		Busuama	Derived Savanna
Brong-Ahafo		Chiranda	Derived Savanna
Brong-Ahafo		Dawadawa	Derived Savanna
Brong-Ahafo		Gulumpe	Derived Savanna
Brong-Ahafo		Kadelso	Derived Savanna
Brong-Ahafo		Kaka	Derived Savanna
Brong-Ahafo		Kandige	Humid Forest
Brong-Ahafo		Kawampe	Derived Savanna
Brong-Ahafo		Kurawura Akura	Derived Savanna
Brong-Ahafo		Mansira	Derived Savanna
Brong-Ahafo		Miawani	Derived Savanna
Brong-Ahafo		Nante Zongo	Derived Savanna
Brong-Ahafo		Nyamebekyere 1	Derived Savanna
Brong-Ahafo		Nyamebekyere 2	Derived Savanna
Brong-Ahafo		Sogliboi	Derived Savanna
Brong-Ahafo		Suronuasi	Derived Savanna
Brong-Ahafo		Taidifufuo	Derived Savanna
Brong-Ahafo		Techira 1	Derived Savanna
Brong-Ahafo		Techira 2	Derived Savanna
Brong-Ahafo		Yaara	Derived Savanna
Brong-Ahafo		Yabraso	Derived Savanna
Northern	East Gonja	Abrumase	Derived Savanna
Northern		Adamupe	Derived Savanna
Northern		Bau	Derived Savanna
Northern		Bunjai	Derived Savanna
Northern		Dagbabia	Humid Forest
Northern		Grunshie Zongo	Derived Savanna
Northern		Jemitutu	Derived Savanna
Northern		Kakoshi	Derived Savanna
Northern		Kalande	Derived Savanna
Northern		Katanga 1	Derived Savanna
Northern		Katanga 2	Derived Savanna
Northern		Kigbatito	Derived Savanna
Northern		Kijewu	Derived Savanna
Northern		Kitoe	Derived Savanna
Northern		Kpolo	Derived Savanna
Northern		Kumburupe	Derived Savanna
Northern		Latinkpa	Derived Savanna
Northern		Masaka	Derived Savanna
Northern		Mbawudo	Derived Savanna
Northern		Nakpaye	Derived Savanna
Northern		Shishipe	Derived Savanna
Northern		Talkpa	Derived Savanna
Northern		Tunga	Derived Savanna
Northern	Mion	Gunsi	Derived Savanna
Northern		Kulunkpegu	Derived Savanna
Northern		Mahakpi	Southern Guinea Savanna
Northern		Mbatinga	Southern Guinea Savanna
Northern		Ndiyuriyili	Derived Savanna
Northern		Puriya	Derived Savanna
Northern		Salankpang	Derived Savanna
Northern		Sang	Derived Savanna
Northern		Sanze	Derived Savanna
Northern		Zakpalsi	Southern Guinea Savanna

6. Localities with different production systems/environments.

Production system/Environment	Region/District
No staking system	Brong Ahafo Region (Forest savanna transition)
Staking system	Ashanti Region
Drought Low fertility	Northern Region, Guinea savanna

7. Metrics used.

Items	Average equivalents (Kg)
Yam tuber in kg	Ejura = 2.25; Atebubu = 2.25; Kintampo = 2.48; East-Gonja = 2.31; Mion = 1.98
Bundle: group of 3 tubers of yam	8.33 kg
Basket of yam (“bag”)	22.6 kg
Maxi-bag of yam	60 kg
Heap of yam	100 tubers (rarely 110 or 120)

8. Characteristictics of AEZs

Parameters	SGS	DS	HF
LGP (days)	181-210	211-270	> 270
Soil types	Luvisol, Acrisol, Vertisol	Lixisol, Leptosol, Plinthosol, Nitisol, Luvisol	Nitosol, Ferrasols, Vertisol, Fluvisol
Annual rainfall (mm)	1200-1500	1300 -2000	> 2000
Altitude (masl)	< 800	< 800	< 800
Rainy season	June-October	May-October	March-November
Solar radiation (MJ/m2/day)	15	15	12
Rainfall pattern	Bimodal	Bimodal	Bimodal
Main rainfed crop	Yam, Cowpea, Sorghum, Maize, Sweet potato, Cassava, Cocoyam	Yam, Maize, Sweet potato, Cassava, Cocoyam	Yam, Rice, Maize, Sweet potato, Cassava, Cocoyam

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest; LGP = Length of growing period.
Sources: IITA (1992); Jagtap (1995); FAO/IIASA/ISRIC/ISSCAS/JRC (2009)

9. Quantity of staple intake (kg/adult equivalent/year).

	Statistics	Sample average			
		All	SGS	DS	HF
Yam	Mean	312	138	303	360
	%	56.1	55.6	55.8	57.0
Cassava	Mean	167	667	158	158
	%	11.0	11.1	11.4	9.6
Plantain	Mean	52	5	76	19
	%	1.4	7.4	1.3	1.0
Maize	Mean	90	28	69	154
	%	23.4	18.5	23.5	23.7
Rice	Mean	89	7	97	84
	%	2.8	7.4	3.0	1.7
Sorghum	Mean	144	–	144	–
	%	0.3	0.0	0.5	0.0
Millet	Mean	78	–	21	97
	%	0.7	0.0	0.4	1.7
Cowpea	Mean	119	–	71	238
	%	1.2	0.0	1.2	1.4
Pigeon pea	Mean	13	–	13	–
	%	0.1	0.0	0.1	0.0
Groundnut	Mean	65	–	60	77
	%	1.9	0.0	1.8	2.4
Soybean	Mean	133	–	200	33
	%	0.6	0.0	0.5	1.0
Melon	Mean	95	–	95	–
	%	0.5	0.0	0.6	0.3

10. Communities surveyed for the field measurement.

State/Reg	LGA/Dist	Community	Date	Latitude	Longitude	Altitude	AEZ
Ashanti	Ejura	Abrewa-Ano	12.11.13	7.50245	–1.40976	197	Humid Forest
Ashanti	Ejura	Appiadwa	11.11.13	7.31837	–1.2772	158	Humid Forest
Brong-Ahafo	Atebubu	Bachaaso	14.11.13	7.91085	–0.97033	109	Derived Savanna
Brong-Ahafo	Atebubu	Kokofu	13.11.13	7.71554	–0.88138	142	Derived Savanna
Brong-Ahafo	Kintampo	Jema	15.11.13	7.89914	–1.77121	420	Humid Forest
Brong-Ahafo	Kintampo	Kunsu	16.11.13	8.14838	–1.5082	195	Derived Savanna
Northern	East Gonja	Kuwani	20.11.13	8.44383	–0.47962	156	Derived Savanna
Northern	East Gonja	Nbawudo	20.11.13	8.550023	–0.32113	126	Derived Savanna
Northern	Mion	Dijoe	19.11.13	9.39766	–0.33555	205	Derived Savanna
Northern	Mion	Kulinkpegu	18.11.13	9.34423	–0.25553	193	Derived Savanna

11. Household questionnaire

International Institute of Tropical Agriculture (IITA)
Yam Improvement for Income and Food Security in West Africa (YIIFSWA)
BASELINE HOUSEHOLD SURVEY QUESTIONNAIRE
Nigeria and Ghana

PART A. INTERVIEW BACKGROUND

1. Respondent's name: .....

2. Mobile phone no……..…… 3. Landline phone no.....

4. State/Region..... 5. LGA/District: .....

6. Community/Community: …..…….…….....

7. Interviewed by (Enumerator's name): ….....

8. Date of interview: Day: …..……Month: .....Year: ….……

9. Checked by (Supervisor's name): .....

10. Date checked: Day: ……..…….. Month: .....Year: ……..……..

11. Entered by: ……..…….....

12. Date entered: Day: ……..……..Month: .....Year: ……..……...

13. GPS readings of homestead: a) Waypoint ID: ……b) Latitude: ……

c) Longitude: ……; d) Altitude: ……

PART B. HOUSEHOLD IDENTIFICATION

1. Name of the household head: .....

2. Religion of the household head: .....
(1. No religion/atheist/traditionalist; 2. Christian; 3. Muslim; 4. Other, specify…….....)

3. Total numbers of people in the household: .....

4. Type of toilet used: .....
(1. Flash toilet private; 2. Flash toilet shared; 3. Ordinary pit latrine private; 4. Ordinary pit latrine shared; 5. No toilet/use open air)

5. Main walling material of main residential house: ……..
(1. Burned bricks; 2. Unburned bricks; 3. Mud bricks; 4. Concrete blocks; 5. Pole and mud; 6. Timber; 7.Sticks and grass; 8. Iron sheet; 9. Other, specify…….....)

6. Main roofing material of main residential house: ……
(1. Grass thatch; 2. Iron sheet; 3. Tiles; 4. Asbestos; 5. Other, specify…….……)

7. Experience in growing yam (years) ……

8. Taking into consideration ALL food sources (own food production + food purchase + help from different sources + food hunted from forest and lakes, etc.), how would you assess your family's food consumption in the past 12 months? .....
(1. Food shortage through the year, 2. Occasional food shortage, 3. No food shortage but no surplus, 4. Food surplus)

9. In case of food shortage from 8 above, what is the most important coping strategy used? .....
1. Rely on less preferred foods; 2. Limit the variety of foods eaten; 3. Limit portion size at meal-times;
4. Reduce number of meals eaten in a day; 5. Restrict consumption by adults for small children to eat;
6. Borrow food, or rely on help from a friend or relative; 7. Have no food of any kind in your household;
8. Go to sleep at night hungry because there is not enough food; 9. Go a whole day and night without eating anything; 10. Seek jobs inside the community; 11. Migrate to urban centers in search of non-farm jobs;
12. Other, specify: ……).

10. What means of transport do you use most frequently to get to the local market? .....
(1. Walking; 2. Bicycle; 3. Motorcycle; 4. Tractor; 5. Vehicle; 6. Cart; 7. Other, specify: …….....)

11. Using the mode of transport from 10 above, what is the distance to the local market from your residence?
.....…….…..... (in minutes of walking time)

PART C. HOUSEHOLD COMPOSITION AND CHARACTERISTICS

Family code	Name of household member (start with respondent)	Sex **1 =Male;2 =Female**	Age (years) *	Marital status **Codes A**	Education (in years with 0 = None/ Illiterate)	Relation to HH head **Codes B**	Occupation **Codes C**		Own farm labor contribu-tion **Codes D**	For those under the age of 5 (see column 4)		
							Main	Secondary		Weight (kg)	Height (cm)	Any illness in the last one year? **Codes E**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
01												
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***** For those under 5 years, ask month, day and year born and then compute the age yourself (in 3 decimal places).

Codes A	**Codes B**	**Codes C**	**Codes D**	**Codes E**
1. Married living with spouse/s	1. Household head	0. None	1. 100%	0. No disease
2. Married but spouse away	2. Spouse	1. Farming (crop + livestock)	2. 75%	1. Fever/malaria
3. Divorced/separated	3. Son/daughter	2. Salaried employment	3. 50%	2. Dysentery/diarrhoea
4. Widow/widower	4. Parent	3. Self-employed off-farm	4. 25%	3. Respiratory problems
5. Never married	5. Son/daughter in-law	4. Casual laborer on-farm	5. 10%	4. Measles
6. Other, specify…….	6. Grandchild	5. Casual laborer off-farm	6. Not a worker	5. Typhoid fever
	7. Other relative	6. School/college child		6. Undernutrition
	8. Hired worker	7. Non-school child		7. Tuberculosis
	9. Other, specify…….	8. Herding		8. Lifetime disease/Disorder
		9. Household chores.		9. Other specify,
		10.Other specify,		.....

PART D. SOCIAL CAPITAL AND NETWORKING

D.1 Have you and/or your spouse been member/s of formal and informal institutions in the last 3 years?.....
(1 =Yes; 0 =No).

D.2 If **Yes** from D.1 above, please ask the following questions and if **No,** go to Section 2 below.

Section 1. Membership in formal and informal institutions <u>in the last 3 years</u> (husband and wife/wives only. One group membership per row.)

Family code	Type of group the husband/wife is/ was a member of: (**codes A**)	Three most important group functions: **(codes B)**			Year joined (YYYY)	Role in the group **(codes C)**	Still a member now? **(codes D)**
		1st	2nd	3rd			
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**

Codes A
1. Input supply/farmer coops/ union
2. Yam producer and marketing Group/coop
3. Other crop/seed producer & marketing group/coop
4. Local administration
5. Farmers' Association
6. Women's Association
7. Youth Association
8. Religious association
9. Saving & credit group
10. Funeral association
11. Government team
12. Water User's Association
13. Cooperative farming
14. Other, specify……

Codes B
1.Produce marketing
2.Input access/marketing
3.Seed production
4. Cooperative farming
5.Farmer research and training group
6.Savings and credit
7. Funeral group
8. Tree planting and nurseries
9. Soil & water conservation
10.Church group /congregation
11.Input credit
12. Other, specify: ……

Codes C
1. Official
2. Ex-officio
3. Ordinary member

Codes D
0. No
1. Yes

Section 2. Social networks

1 Number of years the respondent has been living in this community.....

2 Number of people that you can rely on for critical support in times of need <u>within this community</u>
Relatives .....Non-relatives.....

3 Number of people you can rely on for support in times of need <u>outside this community</u>
Relatives ……..……; Non-relatives .....

4 Are any of your friends or relatives in leadership positions in formal or informal institutions <u>within and outside this community?</u> ..... **(1.Yes; 0. No)**

5 Number of yam traders that you know in this community who could buy your:
Yam: ..... (Seed yams: .....; Ware yams: .....)

6 Number of yam traders that you know outside this community who could buy your:
Yam: ..... (Seed yams: .....; Ware yams: .....)

7 Do you think you can rely on Government support (subsidies, food aid etc) if your crop fails? ..... **(1.Yes; 0. No)**

8 Are you confident of the skills of Government officials including extension workers to do their job?... **(1.Yes; 0. No)**

PART E. HOUSEHOLD ASSETS

Section 1. Livestock ownership

Livestock owned			
Type	**Number owned**	**Type**	**Number owned**
1	**2**	**1**	**2**
1.Cattle		7.Poultry (Chicken, Guinea fowl, Ducks)	
2.Donkeys		8.Doves/pigeons	
3.Horses		9.Pigs	
4.Goats		10.Other (Specify1 ……)	
5.Rabbits		11. (Specify2 ……)	
6.Sheep		12. (Specify3 ……)	

Section 2. Ownership of productive and household assets

Asset	Number (if no equipment, put zero)	Estimated unit value in terms of how much you would receive from the sale. (Cedi) (if more than one item reported in column 2, take average price)
1	**2**	**3**
Cart		
Axe		
Machete/ cutlass		
Hoe		
Sprayer		
Grain mill		
Pump		
Spade or shovel		
Radio		
CD Player		
Television set		
Cell phone		
Stove		
Bicycle		
Motorbike		
Car		
Tractor		
Jewelry		
Wooden box		
Metal box		
Bed		
Chair		
Table		
Thatched house		
Corrugated iron sheet house		
Fish pond		
Sofa		
Panga knife		
Other, specify.....		

Section 3. Land holding during the last cropping year

Land category	Land holding (ha)	Land holding share for yam		Land holding share for women (%)
		Seed yam (%)	Ware yam (%)	
1	**2**	**3**	**4**	**5**
1. Own land used (A)				
2. Rented in land (B)				
3. Rented out land (C)				
4. Borrowed in land (D)				
5. Borrowed out land (E)				
6. Total owned land (A+C+E)				
7. Total operated land (A+B+D)				

Section 4. Yam storage during the last cropping year

Storage duration of your yam (in weeks)	Type of storage used (**Use codes below**)	Amount in % lost at the end of storage		
		Rotting (%)	Sprouting (%)	Other:……
From …… **To** …….. weeks				

Codes: 1 =Room storage; 2 =Under trees; 3 =Raised sheds in the field; 4 =Yam barns in the compound ; 5 =Raised huts; 6 =Left in the soil after maturity; 7 = Other (specify: ……..)

PART F. IMPROVED YAM VARIETY KNOWLEDGE AND ADOPTION

Section 1. Yam variety knowledge, sources of information and seeds, adoption and disadoption

Improved crop varieties aware/ heard of **Codes from Annex 1**	If you have a local name for this variety, what is it? If no local name, put 0	Year variety known or heard of **YYYY**	Main source of variety information **Codes A**	Ever planted? **Codes B**	If **NO in Column 5,** give main reason why? **Codes C**	If **YES in column 5,** year first planted **YYYY**	**If Yes in column 5**				Planted variety this season? **Codes B**	Will plant variety in future **Codes B**	If No in Column 13, main reason why, **Codes C**
							First seed yam						
							Main source of first seeds **Codes D**	Quantity of seeds (kg)	Main means of acquiring first seeds **Codes E**	No. of years variety has been planted			
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Codes A
0. None other
1. Government extension
2. Farmers' Coop/Union
3. Farmers' group
4. NGO/CBO
5. Research center (trials/demos/days)
6. Seed/grain stockist
7. Relative/ Neighbor
8. Radio/newspaper/TV
9.Other, specify…….

Codes B
0. No
1. Yes

Codes C
0. None other
1. Seeds not available
2. Lack of cash/ credit to buy seeds
3.Susceptible to diseases/pests
4. Poor taste
5. Low yielding variety
6. Price too high
7. No market
8. Poor storability
9. Lack of enough land
10. Requires high skills
11.Content with current
12. Other, specify…….

Codes D
1. On-farm trials
2. Extension demo fields
3. Farmers' groups/ coops
4. Local seed producers
5. Seed retailers
6. Private seed suppliers
7.MOFA
8.Club/association
9. Farmer to farmer seed exchange
10. Provided free by NGOs/govt
11. Other (specify)……

Codes E
0. None other
1. Gift/free
2. Borrowed seeds
3. Bought with cash
4. Payment in kind
5. Exchange with other seeds
6. Subsidy
7. Advance pay from coop
8. Other, specify……

1. CROP VARIETY CODES

Yam – Nigeria		Yam – Ghana	General yam identification
0. Local varieties		0. Local varieties	0. Local varieties
11. TDr 89/02565	15. TDr 89/02475	21. CRI Pona	1. Agric/Improved varieties
12. TDr 89/02665	16. TDr 95/19158	22. Mankrong Pona	
13. TDr 89/02461	17. DRN 200/4/2	23. CRI Kukrupa	
14. TDr 89/02660	18. Other…….	24. Other……..	

Section 2. Yam variety characteristics [*main local variety first - use Codes A below for characterization*]

Characteristics (L =local; I =Improved)	**Yam varieties (**start with the 3 major local varieties**, variety Codes in Annex** 1**)**					
	1L……	2 L….....	3L…….	4I……..	5I……	6I……..
1	**2**	**3**	**4**	**5**	**6**	**7**
Agronomic						
1. 1. Tuber yield						
2. Drought tolerance						
3. Disease tolerance						
4. Early maturity						
5. Uniformity in maturity						
6. Tuber size						
7. Labor input requirement						
8. Stake requirement						
9. Other inputs requirement						
Market and economics						
10. Marketability (demand)						
11. Tuber flesh color						
12. Tuber price						
Cooking & utilization						
13. Storability						
14. Cooking time (boiling)						
15. Taste						
16. Nutritional value						
17. Overall variety score						

Codes A 1. Very poor, 2. Poor, 3. Average 4. Good, 5. Very Good

1. CROP VARIETY CODES

Yam – Nigeria		Yam – Ghana	Other crops
0. Local varieties		0. Local varieties	0. Local varieties
11. TDr 89/02565	15. TDr 89/02475	21. CRI Pona	1. Improved varieties
12. TDr 89/02665	16. TDr 95/19158	22. Mankrong Pona	
13. TDr 89/02461	17. DRN 200/4/2	23. CRI Kukrupa	
14. TDr 89/02660	18. Others …….	24. Others ……..	

Section 3. What is the maximum amount of money you would be willing to pay for a yam variety that has the desired qualities and is enough for planting one hectare? ..... (Naira/Cedi)
Section 4. What seedbed preparation method have you used? …….. (0 =ridges; 1 = mounds; 2 =both; 3 =other (specify…….)
Section 5. What is the number of stands planted/ha? ……

2. CROP CODES

Roots/Tubers/Banana/Plantain	Cereals	Grain legumes, oil seeds & spices	Industrial Tree crops
1 Yams	11 Maize	21 Cowpea	51 Cocoa
2 Cassava	12 Rice	22 Pigeon pea	52 Coffee
3 Cocoyam	13 Sorghum	23 Groundnut	53 Oil palm
4 Sweet potato	14 Millet	24 Bambara nut	54 Coconut
5 Irish potato	15 Wheat	25 Cotton seed	55 Rubber
6 Plantain	16 Beniseed	26 Soybean	56 Colanut
7 Cooking bananas	17 Guinea corn	27 Egusi/	57 Cashew
8 Frafra potatoes	18 Others……	28 Melon	58 Citrus
9 Others…….		29 Irvingia	59 Mango
		30 Sesame seeds	60 Other……
		31 Calabash	Other industrial crops
		32 Ginger	61 Sugarcane
		33 Green grain	62 Sisal
		39 Others ……..	63 Tobacco
		40 Vegetables	64 Kenaf
			65 Cotton
			66 Other: Shea

PART G. CROP PRODUCTION FOR ALL CROPS GROWN BY THE HOUSEHOLD DURING LAST CROPPING SEASON

Section 1. Characteristics, investment, and input use

Definitions: A field is a piece of land physically separated from others; a plot is a subunit of a field. If more than one crop is grown on a field (that is, on different plots), repeat the code in next row and use plot code. If the plot is intercropped, use same row and separate the different intercrops by commas. Consider only 3 main intercrops if you encounter more than 3 crops on a plot.

Serial number	Field code (start with one next to residence)	Field location name (as called by farmer)	Plot code	Plot size (hectares)	Intercrop? **(0 =No; 1 =Yes)**	Crop(s) grown **(Use Annex 2 codes)**	Crop variety **(Use Annex 1codes)** (e.g. 0, 1)	Percent of area under each intercrop (e.g. 50,50)	Transport used from residence to field **Codes A**	Field distance from residence **(walking minutes)**	Plot ownership **Codes B**	Plot manager **Codes C**	Soil fertility **Codes D**	Soil slope **Codes E**	Soil depth **Codes F**	Soil type/colour **Codes G**	Soil & water conservation method **Codes H**	Crop residue left on plot **1 =Yes; 0 =No**	Purely irrigated **(0 =No; 1 =Yes)**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**

Codes A	**Codes B**	**Codes C**	**Codes D**	**Codes E**	**Codes F**	**Codes G**	**Codes H**
1. Walking 5. Other	1. Owned 4. Borrowed in	0. Women	1. Good	1. Gente slope (flat)	1. Shallow	1. Black 4.Grey	0. None 3. Grass strips 6.Minimum till
2. Bicycle	2. Rented in 5.Borrowed out	1. Men	2. Medium	2. Medium slope	2. Medium	2. Brown 5. Other, specify…	1. Terraces 4. Trees on boundaries 7.Soil bunds
3. Motorcycle	3. Rented out 6. Other, specify…	2. Both equally	3. Poor	3. Steep slope	3. Deep	3. Red	2. Mulching 5. No tillage 8.Stone bunds 9. Box ridges 10.Other, specify…
4. Vehicle/ tractor							

Section 2. Input use for <u>all crops</u> grown by the household during the last cropping season

(<u>Serial number, field code, plot code, crop(s) and variety grown</u> in this Section should be in <u>exactly the same order as in Section 1</u> above) ---- N/C =Naira/Cedis

Serial number	Field code	Plot code	Crop(s) grown **(As in Section 1 above)**	Crop variety **(As in Section 1 above)**	Crop rotation **(0 =No; 1 =Yes)**	Previous season **<u>main</u>** crop grown **(Annex 2 codes)**	Fertilizer (If not used, put Zero)					Seed use (if intercropped, <u>separate by comma</u>)					Manure (dry equivalent)			Herbicides used	
							Basal fertilizer		Top dressing fertilizer- urea, etc		<u>Main</u> method of payment for fertilizer used (**Codes A**)	Non-bought seeds (own saved, farmer- to-farmer exchange, etc. (**kg or no.**)	No. of seasons own saved seed <u>recycled</u>	Bought seeds (including using credit & voucher)		<u>Main</u> method of payment for seeds used (**Codes A**)	own	Bought		Amount **(Litres/kg)**	Total cost **(N/C)**
							Amount **(Kg/ Lt)**	Total cost **(N/C)**	Amount **(Kg/Lt)**	Total cost **(N/C)**				Amount **(kg)**	Total cost **(N/C)**		Amount **(kg)**	Amount **(kg)**	Total cost **(N/C)**		
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**

Codes A

1.Own cash; 2. Government subsidy; 3. donor supported vouchers; 4. Money got as gift from relative & non-relatives; 5. Credit from savings and credit organizations; 6. Credit form bank;

7. Credit money lender; 8. Credit from relative/neighbor/friend; 9. Credit micro-finance; 10. Credit from NGO; 11. Own saved seeds; 12. Other, specify.....

Section 3. When was the last time seed yam was obtained from other sources? …… From where …….. And whom …… did you get it?
What was the quantity acquired/obtained compared to your own? …… (1 =Total; 2 =More than half; 3 =Half; 4 =Less than half; 5 =little; 6 =Nothing)

Section 3: Input use and crop harvested

(Serial number, field code, plot code, crop(s) and variety grown in this Section should be in exactly the same order as in Section A and Section B above)

Serial number	Field code	Plot code	Crops grown **(as in section 2 above)**	Pesticides used		Total labor (family and hired) used in person-days Intercrops: record harvesting and threshing/shelling separately (by comma) FAMILY LABOR: PEOPLE (AE) ×EFFECTIVE DAYS × EFFECTIVE HOURS AE = Adult Equivalents (1 Adult = A person of 15 and above years of age; A child of 10- 14 years of age will be equated to 0.5 of an adult equivalent)											Total cost of oxen/ tractor hire **(Naira/ Cedi)**	Total cost of hired labor **(Naira/ Cedi)**	Stress incidence on field **Codes A**	Perceived level of stress severity **0 =Not a problem 1 =Less severe 2 =Severe 3 =Highly severe**	Total harvested per plot Intercrops: separate by comma	
				Amount **(Litres/ kg)**	Total cost **(Naira/ Cedi)**	Land preparation & planting		Staking & roping		Weed control			Harvesting & transportation		Threshing or shelling							Fresh or green **(kg)**	Dry **(kg)**
						Male	Female	Male	Female	Weeding freq	Male	Female	Male	Female	Male	Female							
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

Codes A: 0. No stress; 1. Insect pests; 2. Diseases; 3. Water logging; 4. Drought; 5. Rodents; 6. Low soil fertility; 7. Shortage of staking material; 8. Inadequate input supply; 9. Inadequate storage facilities; 10. Land shortage; 11. High cost of labor; 12. Lack of improved varieties; 13. Other, specify……

Section 4. Utilization of crop produced and household food security
Different from Sections 1, 2 and 3 above: i.e. record <u>one row per crop</u> (e.g. ,add production from all yam fields together)

Crop **(from Section 3 above)**	Form **Codes A**	Carryover stock from previous harvest **(kg)**	Production of last season (last columns of Section 3) **(kg)**	Total available stock for this season **(kg)**	From the total available stock (**Column 5**)…					Amount left in store before next harvest **(kg)**
					Quantity sold **(kg)**	In-kind payments (labor, land and others) paid during last cropping season **(kg)**	Seeds used during last cropping season **(kg)**	Gifts, donations given out during last cropping season **(kg)**	Consumption during last cropping season **(kg)**	
1	**2**	**3**	**4**	**5 =3+4**	**6**	**7**	**8**	**9**	**10**	**11 =5-6-7-8-9-10**

Codes A: 1. Fresh/green; 2. Dry

Section 5. Marketing of crops

Use one row for each transaction involving different buyers by crop (i.e. different from Sections 1, 2, 3 and 4)

Crop **(Column 1 of Section 4 above)**	Market type **Codes A**	Month sold **Codes B**	Quantity sold **(kg)** (sum should be equal to Column 6 of Section 4)	Who sold? **Codes C**	Price (Naira/Cedi/kg)	Buyer **Codes D**	Relation to buyer **Codes E**	Mode of transport **Codes F**	Time taken to get to the market **(minutes)**	Actual transport cost **(Naira/Cedi)**
1	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**

Codes A	**Codes B**		**Codes C**	**Codes D**		**Codes E**	**Codes F**
1. Farmgate	1. January	7. July	0. Female	1. Farmers' group/union /coop/ club	6. Urban grain trader/ wholesaler	1. No relation but not a long-time buyer	1. Bicycle
2. Community market	2. February	8. August	1. Male	2. Consumer or other farmer	7. Exporter	2. No relation but a long time buyer	2. Hired vehicle
3. Main/district market	3. March	9. September	2. Both	3. Rural assembler	8. Millers	3. Relative	3. Public transport
	4. April	10. October		4. Broker/middlemen	9. FRA	4. Friend	4. Donkey
	5. May	11. November		5. Rural grain trader/wholesaler	10. Other, specify……..	5. Money lender	5. Oxen/horse cart
	6. June	12. December				6. Other, specify……	6. Back/head load
							7. Other, specify……..

PART H. TRANSFER AND OTHER SOURCES OF INCOME LAST YEAR

Who earned/received? **Use family code from Part C: Household composition and characteristics**	Sources of income **Use Codes A**	Total income (cash & in-kind)		Total income **(Naira/Cedi)**
		Cash **(Naira/Cedi)**	Payment in kind **Cash equivalent**	
1	**2**	**3**	**4**	**5 = 3+4**

Codes A

1. Rented/sharecropped out land
2. Rented out oxen for plowing
3. Salaried employment
4. Farm labor wages
5. Non-farm labor wages
6. Non-farm agribusiness income (e.g. grain milling/trading)
7. Other business NET income (shops, trade, tailor, sales of beverages, etc.)
8. Pension income
9. Drought/flood relief
10. Safety net or food for work
11. Remittances (sent from non-resident family and relatives living elsewhere)
12. Marriage gifts
13. Sales of firewood/charcoal
14. Brick making
15. Poles from own and communal forests
16. Sale of crop residues
17. Quarrying stones
18. Rental property (other than land and oxen)
19. Interest from deposits
20. Social cash transfer
21. Other, specify ……..……...

PART I. HOUSEHOLD EXPENDITURE
(*Here, the person involved in purchases should be the principal respondent/s)*

Section 1. Food consumption

No.	Item	**Unit** (e.g. kg, liter, packet, bundle, number)	**Bought in the last 12 months**				
			Frequency of buying (e.g., once/year twice/year etc.)	Average quantity each time (e.g. 2 kg; 4 bundles etc.)	Total quantity / year	Average price/ unit **(Naira/ Cedi)**	Total cost of purchase **(Naira/Cedi)**
1	**2**	**3**	**4**	**5**	**6 =4x5**	**7**	**8 =6x7**
	Staple foods						
1	Seed yam						
2	Ware yam						
3	Dried yam products						
4	Maize						
5	Wheat						
6	Barley						
7	Rice						
8	Sorghum						
9	Millet						
10	Cassava						
11	Potatoes						
12	Sweet potato						
13	Beans						
14	Cowpea						
15	Groundnut						
16	Soybean						
17	Pigeon pea						
18	Banana						
19	Plantain						
20	Egusi/Melon						
21	Other, specify.....						
	Beverages and drinks						
22	Tea (leaves)						
23	Tea (liquid)						
24	Coffee (powder)						
25	Coffee (liquid)						
26	Soft drinks						
27	Juices						
28	Local beer						
29	Bottled/clear beer						
30	Wine						
31	Drinking water						
32	Coffee beans						
33	Opaque beer (*chibuku*)						

Section 1. Food consumption (cont'd)

No.	Item	Unit (e.g. kg, liter, packet, bundle, number)	Bought in the last 12 months				
			Frequency of buying (e.g., once/year twice/year	Average quantity each time	Total quantity/ year	Average price/ unit **(Naira/Cedi)**	Total cost of purchase **(Naira/Cedi)**
1	**2**	**3**	**4**	**5**	**6 =4x5**	**7**	**8 =6x7**
	Fruits						
34	Oranges						
35	Mango						
36	Pawpaw						
37	Pineapple						
38	Banana (ripe)						
39	Apple						
40	Guava						
41	Coconut						
42	Sugar cane						
43	Other.						
	Meat &other products						
44	Beef						
45	Goat meat						
46	Mutton						
47	Pork						
48	Chicken						
49	Turkey						
50	Duck						
51	Bush meat						
52	Fish						
53	Eggs						
54	Milk						
55	Cheese/Ghee						
56	Butter						
57	Yoghurt						
58	Honey						
59	Other.						
	Vegetables						
60	Tomato						
61	Onion						
62	Cabbage						
63	Spinach						
64	Kale						
65	Carrot						
66	Okra						
67	Pumpkin						
68	Egg plant						
69	Cucumber						
70	Pepper						
71	Garlic						
	Fats, oils, sweeteners, snacks and others						
72	Cooking fat						
73	Margarine						
74	Groundnut oil						
75	Coconut oil						
76	Bread						
77	Biscuits						
78	Popcorn						
79	Cashew nuts						
80	Sugar						
81	Salt						
82	Chocolate						
83	Curry						
84	Ginger						
85	Macadamia nuts						

Section 2. Expenditure on non-food items in the last 12 months

No.	Expense Item	Unit (e.g. kg, liter, packet, bundle, number)	Frequency of purchase (e.g., once/ year twice/ year,	Average quantity each time	Total quantity year	Average price/ unit **(Naira/Cedi)**	Total cost of purchase **(Naira/ Cedi)**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8 =6x7**
1	Clothing						
2	Shoes						
3	Blankets						
4	Bed sheets						
5	Soap/washing products						
6	Electricity						
7	Fuelwood						
8	Charcoal						
9	Kerosene						
10	Batteries						
11	School fees						
12	School books and supplies						
13	Health care						
14	Grain milling						
15	Land tax						
16	Church contributions						
17	Dowry						
18	Membership fees						
19	House building/construction						
20	Guard/security						
21	Newspapers, magazines, etc.						
22	Travel expenses						
23	Mobile phone air time (voucher)						
24	Radio/TV service charge						
25	Payment for extension services						
26	Kitchen utensils						
27	Personal care (toothpaste, nail, etc)						
28	Furniture (tables, chairs, beds, etc)						
29	Home repairs						
30	Purchase of bicycle, motorcycle, etc						
31	Repairs for vehicles, bicycles, etc						
32	Petrol and engine oils for cars						
33	House rent						
34	Utility bills (water, telephone, etc)						
35	Cigarettes, tobacco, etc						
36	Remittances paid						
37	Boxes of matches						
38	Debt payments						
39	Payment for land rent in cash						
40	Other, specify.....						

PART J. ACCESS TO CAPITAL AND SUPPORT SERVICES

Section 1. Household credit need and sources during last cropping season. If the credit is in non-cash form, indicate the cash equivalent or value.

Activity	Needed credit? **Codes A**	If **No** in column 2, then Why? **Codes B**	If **Yes** in column 2, then did you get it? **Codes A**	If **NO in column 4**, then what was the main reason? **(codes C)**	If **Yes in column 4**		
					Source of credit, **Codes D**	How much did you get? **(Naira/Cedi)**	Have you repaid the loan? **Codes A**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1.Buying local seeds							
2. Buying improved seeds							
3. Buying fertilizer							
4. Buying herbicide/pesticides							
5. Buying farm implements							
6. Buyinglivestock							
7. Investing in irrigation system							
8. Non-farm business or trade							
9. Buying food							
10. Medical expenses							
11. School fees							

Codes A
0. No
1. Yes

Codes B
1. Not cash constrained
2. Activity is not profitable
3. Never thought of this investment
4. Other, specify.....

Codes C
0. No reason
1. Borrowing is risky
2. Interest rate is high
3. Too much paper work/ procedures
4. Expected to be rejected, so did not try it
5. I have no asset for collateral
6. No money lenders in this area for this purpose
7. Lenders don't provide the amount needed
8. No credit association available
9. Not available on time
10. Other, specify……

Codes D
1. Money lender
2. Farmer group/ coop
3. Merry go round (chilimba)
4. Microfinance
5. Bank
6. Savings and Credit
7. Relative/ friend /neighbor
8. Other, specify……..

Section 2. Access to extension/information services

Type of service	Did you receive training or information on [……] during the last cropping season? (**Codes A**)	If Yes in column 2, main source of information/ training, **(Codes B)**	If Yes in column 2, number of contacts during the season **(days/year)**
1	**2**	**3**	**4**
1. New varieties of yam			
2. New varieties of other crops			
3. Pest and disease control - yam			
4. Pest and disease control – other crops			
5. Soil and water management			
6. Crop rotation			
7. Output markets and prices			
8. Input markets and prices			
9. Livestock production			
10. Family health/planning			
11. Sanitation			
12. Food processing			

Codes A
0. No
1. Yes

Codes B
1. Government'sextension service
2. Farmers' coops or groups
3. Neighbor/relative farmers
4. NGOs
5. Private company
6. Research center
7. Farmers' field school
8. Radio/TV
9. Newspaper
10. Mobile phone
11. Town hall meetings
12. Farmers' training centere
13.Traders/Agro-dealers
14. Other specify.....

12. Community Profile Form

YIIFSWA PROJECT: Community Profile Form

Community Interview Background & Identification

LGA Name:	Community:	Population	Number of households	Number of men	Number of women
		Discussion attendance			
GPS Readings					
Name and address of the head of the community					
Name and address of discussion leader					

1. Characteristics of the community

1.1 Description of the community and existing main crops (activities; production trends, constraints, gender, etc)

1.2 Community relationship with neighboring communities and markets

2. Basic public services

2.1 Distance to the nearest main (district) market from residence .....…….… minutes of walking time

2.2 Number of months the road to main (district) market is passable for vehicles in a year.....

2.3 Quality of road to the main market (district) … **(1. Very poor; 2. Poor; 3. Average; 4. Good; 5. Very good)**

2.4 Average one-way transport cost (/person) to the main market using a car (Naira/Cedi/ person).....

2.5 Distance to the nearest seed dealer from residence .....minutes of walking time

2.6 Distance to the nearest fertilizer dealer from residence ..... minutes of walking time

2.7 Distance to nearest herbicides/pesticides dealer from residence ……minutes of walking time

2.8 Distance to the nearest farmers' cooperative from residence ……..minutes of walking time

2.9 Distance to the nearest farmers' group/club from residence ……....minutes of walking time

2.10 Distance to the nearest agricultural extension office from residence .....minutes of walking time

2.11 Distance to the nearest health center from residence ……minutes of walking time

2.12 Main source of drinking water…….....(**Codes A**)

***Codes A*:** 1. Piped/tap; 2. Deep well protected and covered; 3. Deep well unprotected & uncovered; 4. Stream; 5. River; 6. Dams; 7. Ponds or floods; 8. Borehole

Note: protected refers to water sources internally plastered and covered with a cap of wood, stone or concrete)

2.13 Do you boil water for drinking?.....(**1 =Yes; 2 =No**)

2.14 Do you treat water (chemical treatment) for drinking?..... **(1 =Yes; 2 =No**)

2.15 Distance to main water source for drinking ……..…minutes of walking time

2.16 What are the three common types of diseases experienced in the last six months?

2.17 Are there any projects that are starting in the community? If yes, what kind of projects are they:

a. Agriculture extension services

b. Microcredit

c. Community Health Volunteer Training

d. Water supply

e. NGO (Non-overnmental Organization) starting new activities

f. Other projects, which _____

2.18 Is there an elementary school in the community? Y N _____ hours, min.

2.19 Is there a primary school in the community? Y N _____hours, min.

2.20 Number of teachers? _____

2.21 How many students in your community attend school? % girls _____ % boys_____

2.22 Where is the nearest secondary school? Place_____ Distance_____

3. Yam production and marketing

3.1 Importance of yam in the community (fresh and dried form, ware and seed, etc.)

3.2 Yam varieties existing (traditional, improved, demand, etc.)

3.3 Yam transport to market and cost of transporting

3.4 Yam cropping calendar and commercial flows (fluctuations in quantities traded and prices during different seasons, etc.)

4. Food security

4.1 Food shortage (when, how, why, etc.)

4.2 Coping strategies existing (by gender, socio-economic class)

5. Access to resources in your community

6. Access to media

Sources of information	**Do you use these sources of information?** 1 =Yes; 0 =No	**Do you trust the information you get from the following sources?** 1 =Yes; 0 =No	**Rank them by importance** (from 1 =the most important,……, 9 =the least important)	**Time spent daily in getting information from different sources** (in minutes/day)	**What type of information do you expect to get from different sources?** 1 = news; 2 =Health & nutrition; 3 = Community; 4 = Agricultural info; 5 = Other (specify: ……..….)
1.Town criers					
2.Community head secretaries					
3.Religious leaders					
4.Town hall meetings					
5. Radio					
6. TV					
7. Newspaper					
8. Mobile phone					
9. Other (specify: ……)					

7. Recommendations

13. Complementary Community Level Questionnaire.

International Institute of Tropical Agriculture (IITA)

Yam Improvement for Income and Food Security in West Africa (YIIFSWA)

COMMUNITY LEVEL QUESTIONNAIRE
Nigeria and Ghana

PART A. INTERVIEW BACKGROUND

1. Country No. _____ (*1 = Nigeria ; 2 =Ghana*)
2. State/Region: _____
3. LGA/District: _____
4. Community/village No _____ Name _____
   (*Community/village code: 01 = 1st village visited, ... , 10 =10th village visited*)
5. Survey date: Day _____; Mth _____ ; 20 _____
6. State of road from main city to community: _____ (Use Roads status codes below)

1 Tarmac, easily motorable in all seasons;	*4 Path, easily passable in all seasons;*	*7 Dirt road, easily motorable, all seasons;*
2 Tarmac, poorly motorable in all seasons;	*5 Path, barely passable in all seasons;*	*8 Dirt road, barely motorable in all seasons;*
3 Tarmac, not motorable in all seasons;	*6 Path, not passable in all seasons;*	*9 Dirt road, not motorable;*
		10 River or stream.

7. No of people: _____ interviewed, comprising of _____ men and _____women
8. GPS readings of the Community: a) Waypoint ID: _____ b) Latitude: _____
   c) Longitude: _____; d) Altitude: _____

PART B. CROPS GROWN

1. What are the main crops grown in this community? *(Rank 1st = most important)*

Crop* ranked by Overall importance	Rank by land area	Rank by sales	Rank by quantity consumed
1 ……	1 …….	1 . ……..	1……
2 ……	2 …….	2 …….	2 ……
3 ……	3 …….	3 …….	3 ……

* ***Roots tubers and plantain***
1 Yam; 2 Cassava; 3 Cocoyams; 4 Sweet Potato; 5 Irish potato; 6 Plantain; 7 Cooking Banana; 8 Other roots/tubers

Cereals
11 Maize; 12 Rice; 13 Sorghum; 14 Millet; 15 Wheat; 16 Finger millet; 17 Other Cereals

Grain legumes, oil seeds and vegetables
21 Cowpea; 22 Pigeon pea; 23 Groundnut; 24 Bambara nut; 25 Cotton seeds; 26 Other Beans/peas; 27Egusi/melon; 29 Sesame seeds; 30 Calabash; 31 Ginger; 32 Sunflower; 33 Beniseed; 34 Tea; 35 Other legumes/Oils; 40 Vegetables

2. Do you know anyone producing only seed yam? ___ *(1 = Yes; 2 = No)*

   2.a If YES, Are they many in this community? ___ *(1 = Yes; 2 = No)*
   Number? ____men & ___ women

3. Any special way of producing yam in this community? _____

_____

4. Do you have in this village any variety with extraordinary qualities? ___ *(1 = Yes; 2 = No)*

4.a If Yes, what are they?

Variety1 Name _____; Qualities _____

Variety1 Name _____; Qualities _____

Variety1 Name _____; Qualities _____

6. What has been the trend in yam production in the last 20 years? ___ *(1 = Decreasing? 2 = No change? 3 = Increasing?)*

Why? Explain _____

7. Yam production objectives. What is the most important objective for growing yam in this community? ___ *(1 = Sale; 2 = Food; 3 = Other, specify: _____)*

8. Source of hired labor: Where do the hired labor in this community come mostly from? ___ *(1 =Within the community; 2 =Neighboring community in the area; 3 =Community far away (in other regions); 4 =Nearest town; 5 = Neighboring countries; 6 =Not known?)*

PART C. RISK SOURCES & INFRASTRUCTURE

1. What are the major problems in the production of yam?
   1. _____
   2. _____
   3. _____

2. Distance to: Kilometres, Walking distance in Minutes

Kilometres	***Minutes by foot***	
Health clinic	DIST_____	TIME_____
Hospital	DIST_____	TIME_____
Primary school	DIST_____	TIME_____
Secondary school	DIST_____	TIME_____
Farmers'cooperative/club	DIST_____	TIME_____
Agro-chemicals dealer	DIST_____	TIME_____
Agric extension office	DIST_____	TIME_____
Seed yam dealer	DIST_____	TIME_____

[IF FACILITY IS NOT IN COMMUNITY, MARK 0 Kilometre; 0 Minute]

3. Where do farmers sale yam mostly? ___ *(1 = Farm-gate; 2 = Village market; 3 = Other market, specify: _____)*

4. By what is (most common means) do you carry yam to market? ____ *(1 = Head load; 2 = Bicycle; 3 = Barrow/Cart, 4 =Lorry/Pickup/tractor/trailer; 5 = Animal; 6 = Motorcycle; 7 = Other, specify: _____)*

5. What is the frequency of market days in this village? Every _____ days?

5.1 Rank by volume traded, the people who buy ware yam in this market.

People who buy (Rank 1 =highest)

Consumers from this or nearby community? ___

Consumers from far away? ___

Small traders from this and nearby villages? ___

Small traders from far away? ___

Big traders from far with lorries? ___

5.2 Rank by volume traded, the people who buy seed yam in this market.

People who buy (1 =highest)

Consumers from this or nearby community? ___

Consumers from far away? ___

Small traders from this and nearby villages ___

Small traders from far away? ___

Big traders from far with lorries ___

5.3 Rank by volume traded, the people who sell ware yam in this market.

People who sell (Rank 1 =highest)

Farmers themselves? ___

Traders from this and nearby community? ___

Traders from far away? ___

5.4 Rank by volume traded, the people who sell seed yam in this market.

People who sell (Rank 1 =highest)

Farmers themselves? ___

Traders from this and nearby community? ___

Traders from far away? ___

6. How many vehicles (lorries) come into this community per market day? _____

14. Complementary Household Level Questionnaire.

International Institute of Tropical Agriculture (IITA)
Yam Improvement for Income and Food Security in West Africa (YIIFSWA)
HOUSEHOLD LEVEL QUESTIONNAIRE

Nigeria and Ghana

PART A. INTERVIEW BACKGROUND

1. Household No _____

2. Respondent's name: _____

3. Mobile phone No _____

4. Country No. ____ (*1 = Nigeria; 2 =Ghana*)

5. State/Region Name _____

6. LGA/District:_____

7. Community/village No _____
(*Community/village code: 01 = 1st village visited, ... , 10 =10th village visited*)

8. Date of interview: Day _____Month _____Year 20____

9. GPS readings of homestead: a) Waypoint ID _____ b) Latitude _____

c) Longitude _____d) Altitude _____

PART B. HOUSEHOLD HEAD INFORMATION

1 Age of the household head: _____

2 Sex of the household head _____ *(1 =Male; 2 =Female)*

3 Marital status of the household head _____ (*1. Married living with spouse/s; 2. Married but spouse away; 3. Divorced/ separated; 4. Widow/widower; 5. Never married; 6. Other, specify_____)*

4 Education of the household head _____ *(in years with 0 = None/Illiterate)*

5 Experience in growing yams _____ *(in years)*

6 Main Occupation of the household head _____ *(0. None; 1. Farming (crop + livestock); 2. Salaried employment; 3. Self-employed off-farm; 4. Casual labourer on-farm; 5. Casual labourer off-farm; 6. School/college child; 7. Non-school child ; 8. Herding; 9. Household chores.; 10.Other, specify, _____)*

7 Secondary occupation of the household head _____ *(0. None; 1. Farming (crop + livestock); 2. Salaried employment; 3. Self-employed off-farm; 4. Casual labourer on-farm; 5. Casual labourer off-farm; 6. School/college child; 7. Non-school child ; 8. Herding; 9. Household chores.; 10.Other specify, _____)*

8 Religion of the household head: ____ *(1. No religion/atheist/traditionalist; 2. Christian; 3. Muslim; 4. Other, specify_____)*

PART C. HOUSEHOLD IDENTIFICATION
1 Total number of people in the household:_____

2 Type of toilet used: _____ *(1. Flash toilet private; 2. Flash toilet shared; 3. Ordinary pit latrine private; 4. Ordinary pit latrine shared; 5. No toilet/use open air)*

3 Main walling material of main residential house: _____ *(1. Burned bricks; 2. Unburned bricks; 3. Mud bricks; 4. Concrete block; 5. Pole & mud; 6. Timber; 7.Stick and grass; 8. Iron sheet; 9. Other, specify……..)*

4 Main roofing material of main residential house ____ *(1. Grass thatch; 2. Iron sheet; 3. Tiles; 4. Asbestos; 5. Other, specify_____)*

5 Where and how do you store yam? _____

6 How long did you store yam last year? _____ months

7 What is the most important objective for growing yam for your household_*(1 = Sale;2 =Food; 3 = Other, specify: _____)*

8 For household owned yam, who takes the decisions to do the following?

8.1 To plant____ *(1 =Man; 2 =Woman; 3 =Equally both)*

8.2 To harvest____ *(1 =Man; 2 =Woman; 3 =Equally both)*

8.3 To use____ *(1 =Man; 2 =Woman; 3 =Equally both)*

8.4 To market____ *(1 =Man; 2 =Woman; 3 =Equally both)*

8.5 Crops at home ____ *(1 =Man; 2 =Woman; 3 =Equally both)*

PART D. LAND TENURE & CROPS GROWN

1. What are the main crops grown by your household?
(Rank 1st = most important and fill using the codes mentioned below)

Crop* ranked by Overall importance	Rank by land area	Rank by sales	Rank by quantity consumed
1 ……	1 ……	1 ……	1……
2 ……	2 ……	2 ……	2 ……
3 ……	3 ……	3 ……	3 ……

* ***Roots tubers and plantain***

1 Yam; 2 Cassava; 3 Cocoyams; 4 Sweet Potato; 5 Irish potato; 6 Plantain; 7 Cooking Banana; 8 Other roots/tubers

Cereals

11 Maize; 12 Rice; 13 Sorghum; 14 Millet; 15 Wheat; 16 Finger millet; 17 Other Cereals

Grain legumes, oil seeds and vegetables

21 Cowpea; 22 Pigeon pea; 23 Groundnut; 24 Bambara nut; 25 Cotton seeds; 26 Other Beans/peas; 27Egusi/melon; 29 Sesame seeds; 30 Calabash; 31 Ginger; 32 Sunflower; 33 Beniseed; 34 Tea; 35 Other legumes/Oils; 40 Vegetables

2. For each crop ranked by overall importance above, how much did you earn last year?

2.a Crop 1, Amount earned last year: _____ Naira/Cedis

2.b Crop 2, Amount earned last year: _____ Naira/Cedis

2.c Crop 3, Amount earned last year: _____ Naira/Cedis

3. (a) Where did (would) you carry the yam harvested? ___ *(1 = Home; 2 = Market; 3 =Store in the field; 4 = Other, specify: _____)*

(b) What was the distance? _____ Km

PART E. HOUSEHOLD AND MARKET

1 Do you take your yam to the market for sale? ___ *(1 = Yes; 2 = No)*

1.a. If Yes, Is the market located in your village? ___ *(1 = Yes; 2 = No)*

2 Do traders come to you to buy your yam? ___ *(1 = Yes; 2 = No)*

3 If you divide the entire yam you harvest into 10 parts, how many parts do you sell at harvest and and how many parts do you store?

Sell at harvest _____ Parts out of 10

Store _____ Parts out of 10; How long do you store? _____ months

_____

Total 10

4 If you divide yam you sell into 10 parts, how many parts will you take to market and how many parts will traders come to you and buy?

To market _____ Parts out of 10

Traders come for _____ Parts out of 10

_____

Total 10

5 What means of transport do you use most frequently to get to the village market? ____ *(1. Walking; 2. Bicycle; 3. Motocycle; 4. Tractor; 5. Vehicle; 6. Cart; 7. Others, specify:_____)*

6 What is the distance to the village market from your residence? _____*(in minutes/hours' time)*

7 What means of transport do you use most frequently to get to the urban market? ____ *(1. Walking; 2. Bicycle; 3. Motocycle; 4. Tractor; 5. Vehicle; 6. Cart; 7. Others, specify:_____)*

8 What is the distance to the urban market from your residence? _____ (in minutes/hours' time)

15. Complementary Field Level Questionnaire.

International Institute of Tropical Agriculture (IITA)

Yam Improvement for Income and Food Security in West Africa (YIIFSWA)

FIELD LEVEL QUESTIONNAIRE
Nigeria and Ghana

(Complete one copy of this questionnaire per field)

PART A. INTERVIEW BACKGROUND

1. Country No. ____ (*1 = Nigeria ; 2 =Ghana*)

2. Community/village No _____
(*Community/village code: 01 = 1st village visited, ... , 10 =10th village visited*)
3. Household questionnaire No. _____ *(1 = largest farmer; 2 = Medium; 3 =Smallest)*
4. Field No. _____*(1 = First visited)*

5. Survey date: Day ____ ; Mth _____ ; 20_____

6. Field Location distance from residence: _____

7. GPS readings of field: a) Waypoint ID: _____ b) Latitude: _____

c) Longitude: _____; d) Altitude: _____

PART B. YAM & OTHER CROPS GROWN

1 Three most important yam varietal identification & source

Yam identification/type		**1**	**2**	**3**
Variety Name				
Month Planted				
1st Harvesting Month				
Type of seed yam used: *(1 =Whole tuber; 2 =Sliced tuber; 3 =Milked tuber)*				
Origin of the Variety*				
Seed yam Source	% Own produced			
	% Purchased			
	% Gift			
2nd Harvesting Month				

** 1 =The village; 2 =Neighboring village in the area; 3 =Village far away (in other regions); 4 =Nearest town; 5 =Town farther away; 6 = Neighboring countries; 7 =Min of Agric; 9 =Not known.*

2 How much did you spend on seed yam you purchased? _____ Naira/Cedis

3 How much would you sell the own produced seed yam? _____ Naira/Cedis

4 Other major crops in the field:

4.1 _____

4.2 _____

4.3 _____

PART C. LABOR INPUT USE FOR YAM GROWN

1 Land clearing

1.1 Who did most of the land clearing in this field? ___ *(M =Men mostly; W =Women mostly; B =Both equally; C =Children < 15; O =Other, specify: _____)*

1.2 If mostly by men:
1.2a How many men working full time would clear the entire field in one day? _____ men
1.2b What was the Wage rate/man/day for the land clearing? _____ Naira/Cedis

1.3 If mostly by women:
1.3a How many women working full time would clear the entire field in one day? ____women
1.3b What was the Wage rate/woman/day for the land clearing? _____ Naira/Cedis

1.4 If mostly by children < 15 years:
1.4a How many <15 working full time would clear the entire field in one day? _____children
1.4b What was the Wage rate/child/day for the land clearing? _____ Naira/Cedis

1.5 How much of the entire land clearing labor for this field was hired and how much was family? _____ *(AF = All family; MF = Mostly family; HF = Hired/family equally; MH = Mostly hired; AH = All hired)*

1.6 Was any of the land in this field mechanized? ___ *(1 = Yes; 2 = No)*

1.6a If mechanized, in full or in part: ____ *(F = Mechanized fully; P = Mechanized partly)*
Type of mechanization: _____

1.6b How much was paid for the mechanization? _____ Naira/Cedis

1.7 Did you apply herbicide? ___ *(1 = Yes; 2 = No)*; If Yes, Cost _____ Naira/Cedis

2 Seedbed Preparation

2.1 Who did most of the seedbed preparation in this field? ___ *(M =Men mostly; W =Women mostly; B =Both equally; C =Children < 15; O =Other, specify: _____)*

2.2a How much of the entire seedbed preparation labor for this field was hired and how much was family? _____ *(AF = All family; MF = Mostly family; HF = Hired/family equally; MH = Mostly hired; AH = All hired)*

2.2b Was any of the seedbed preparation in this field mechanized? ___ *(1 = Yes; 2 = No)*
2.2c If mechanized, in full or in part: ____ *(F = Mechanized fully; P = Mechanized partly)*
Type of mechanization: _____

2.3 If mostly by men:
2.3a How many men working full time would prep. the seedbed in the entire field in one day? _____ men
2.3b What was the Wage rate/man/day for the seedbed preparation? _____ Naira/Cedis

2.4 If mostly by women:
2.4a How many women working full time would prep. the seedbed in the entire field in one day? ____women
2.4b What was the Wage rate/woman/day for the seedbed preparation? _____ Naira/Cedis

2.5 If mostly by children < 15 years:
2.5a How many <15 working full time would the prep. the seedbed in the entire field in one day? _____children
2.5b What was the Wage rate/child/day for the seedbed preparation? _____ Naira/Cedis

2.6 If mechanized, in full or in part:
2.6a How much was paid? _____ Naira/Cedis

3 Planting

3.1 Who did most of the planting in this field? ___ *(M =Men mostly; W =Women mostly; B =Both equally; C =Children < 15; O =Other, specify: _____)*

3.2a How much of the entire planting labor for this field was hired and how much was family? _____ *(AF = All family; MF = Mostly family; HF = Hired/family equally; MH = Mostly hired; AH = All hired)*

3.3 If mostly by men:
3.3a How many men working full time would plant yam in the entire field in one day? _____ men
3.3bWhat was the Wage rate/man/day for the planting? _____ Naira/Cedis

3.4 If mostly by women:
3.4a How many women working full time would plant yam in the entire field in one day? ____women
3.4bWhat was the Wage rate/woman/day for the planting? _____ Naira/Cedis

3.5 If mostly by children < 15 years:
3.5a How many <15 working full time would plant yam in the entire field in one day? _____children
3.5b What was the Wage rate/child/day for the planting? _____ Naira/Cedis

4 Weeding

4.1 Who did most of the different weedings done in this field?

4.1a For Weeding 1: ___ *(M =Men mostly; W =Women mostly; B =Both equally; C =Children < 15; O =Other, specify: _____)*

4.1b For Weeding 2: ___ *(M =Men mostly; W =Women mostly; B =Both equally; C =Children < 15; O =Other, specify: _____)*

4.1c For Weeding 3: ___ *(M =Men mostly; W =Women mostly; B =Both equally; C =Children < 15; O =Other, specify: _____)*

4.2 How much of the entire weeding labor for this field for each weeding was hired and how much was family?

4.2a For Weeding 1: _____ *(AF = All family; MF = Mostly family; HF = Hired/family equally; MH = Mostly hired; AH = All hired)*

4.2b For Weeding 2: _____ *(AF = All family; MF = Mostly family; HF = Hired/family equally; MH = Mostly hired; AH = All hired)*

4.2c For Weeding 3: _____ *(AF = All family; MF = Mostly family; HF = Hired/family equally; MH = Mostly hired; AH = All hired)*

4.3 Did you weed with herbicide? ___ *(1 = Yes; 2 = No); If Yes,* Cost _____ Naira/Cedis

4.4 For the weedings done mostly by men:
4.4a How many men working full time would weed the entire field in one day?
Weeding 1 Weeding 2 Weeding 3
_____ men _____ men _____ men

4.4b What was the wage rate/man/day for weeding?

Weeding 1 Weeding 2 Weeding 3
_____ Naira/Cedis _____ Naira/Cedis _____ Naira/Cedis

4.5 For the weedings done mostly by women:
4.5a How many women working full time would weed the entire field in one day?
Weeding 1 Weeding 2 Weeding 3
_____ women _____ women _____ women

4.5b What was the wage rate/woman/day for weeding?

Weeding 1 Weeding 2 Weeding 3
_____ Naira/Cedis _____ Naira/Cedis _____

4.6 For the weedings done mostly by children:
4.6a How many children working full time would weed the entire field in one day?
Weeding 1 Weeding 2 Weeding 3
_____ children _____ children _____ children

4.6b What was the wage rate/child/day for weeding?

Weeding 1 Weeding 2 Weeding 3
_____ Naira/Cedis _____ Naira/Cedis _____

5 Harvesting

5.1 Who did (would do) most of the harvesting in this field? ___ *(M =Men mostly; W =Women mostly; B =Both equally; C =Children < 15; O =Other, specify: _____)*

5.2 How much of the entire harvesting labor for this field was hired and how much was family? _____ *(AF = All family; MF = Mostly family; HF = Hired/family equally; MH = Mostly hired; AH = All hired)*

_____

5.3 If mostly by men:
5.3a How many men working full time would harvest yam in the entire field in one day? _____ men
5.3b What was the Wage rate/man/day for the harvesting? _____ Naira/Cedis

5.4 If mostly by women:
5.4a How many women working full time would harvest yam in the entire field in one day? ____women
5.4b What was the Wage rate/woman/day for the harvesting? _____ Naira/Cedis

5.5 If mostly by children < 15 years:
5.5a How many <15 working full time would harvest yam in the entire field in one day? _____children
5.5b What was the Wage rate/child/day for the harvesting? _____ Naira/Cedis

6 Transportation

6.1 Where did (would) you carry most of the yam harvested? ___ *(1 = Home; 2 = Market; 3 = Other, specify: _____)*
6.1a What was the distance? _____ Km

6.2 By what most common means did (would) you carry the yam harvested? ____ *(1 = Head load; 2 = Bicycle; 3 = Barrow/Cart, 4 =Lorry/Pickup/tractor/trailer; 5 = Animal; 6 =Motorcycle; 7 = Other, specify: _____)*

6.3 If mostly by head load (H)
6.3(a) Who did most of the carrying for the yam harvested? ___ *(M =Men mostly; W =Women mostly; B =Both equally; C =Children < 15; O =Other, specify: _____)*
6.3(b) How many of the most people would carry the whole yam in one day? _____ people.

PART D. NON-LABOR INPUT USE FOR YAM GROWN

1 Have you used stakes? ___ *(1 = Yes; 2 = No). If Yes* How much did you spend on stakes?

_____ Naira/Cedis

2 Have you used chemical fertilizer? ___ *(1 = Yes; 2 = No). If Yes* How much did you spend on

it? _____ Naira/Cedis

3 Have you used other chemical 1 (specify: _____)? ___ *(1 = Yes; 2 = No).*

If Yes How much did you spend on it? _____ Naira/Cedis

4 Have you used other chemical 2 (specify: _____)? ___ *(1 = Yes; 2 = No).*

If Yes How much did you spend on it? _____ Naira/Cedis

PART E. TENURIAL ARRANGEMENTS

1 Who owns the yam in this field? ___ *(F = Whole family; M = Man or husband; W = Woman or wife; S = Son; D = Daughter; O =Other, specify: _____)*

2 How was this land acquired for use in producing yam? ___ *(I = Inherited; L* = Loaned or Rented; B = Borrowed; P = Purchased; A = Allocated by; O =Other, specify: _____)*

* if L, circle mode of payment: ___ (1 =Cash; 2 =Kind; 3 =Sharecrop; 4 =Other _____)

1 If this field or land was inherited, from whom was it inherited? ___ *(F = Father's (Husband's) family; M = Mother's (wife's) family)*

PART F. HARVESTS & **USES OF YAM OUTPUT**

1 Total field area _____ sqm.

2 Yam yield sample plot: Size _____ sqm.

3 Number of stands/plot _____stands

4 Yield, Number of tubers _____ ; and weigh: _____total kgs

5 Is the field milked? ___ *(1 = Yes; 2 = No)*

6 If you divide expected yam output from this field into 10 parts, how many parts will you sell and how many parts will you use at home?

Sell _____ Parts out of 10
Home use _____ Parts out of 10
Seed yam _____ Parts out of 10

_____
Total 10

7 If you divide yam to sell from this field into 10 parts, how many parts will you sell now and how many parts will you store and sell later?

Sell now _____ Parts out of 10
Store to sell later _____ Parts out of 10; Store for how long? _____ months

_____

Total 10

Weighing records in Kg

							Total
Total							

8. Observation, if any special way of producing yam from this field_____

_____