

# **AGRA BASELINE SURVEY MALI**



## **FINAL REPORT**

# Submitted to the Alliance for a Green Revolution in Africa (AGRA)

By



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## Acronyms and Abbreviations

AFC	Agricultural Finance Corporation
AGRA	Alliance for a Green Revolution in Africa
CAPI	Computer-Assisted Personal Interviews
EA	Enumeration Area
FAO	Food and Agriculture Organization
FASDEP	Food and Agriculture Sector Development Policy
FBO	Farmer Based Organization
FGD	Focus Group Discussion
GoM	Government of Mali
HDDS	Household Dietary Diversity Scale
HFIAS	Household Food Insecurity Access Scale
HHS	Household Hunger Scale
ICC	Inter-Correlation Coefficient
ISSER	Institute of Statistical Social and Economic Research
KII	Key Informant Interviews
MFI	Micro-Finance Institution
NGO	Non-Governmental Organization
SACCO	Savings And Credit Co-Operative Organization
SSA	Sub-Saharan Africa
USAID	United States Agency for International Development



## 1 Executive Summary

Though agriculture remains the mainstay of most economies in Sub-Saharan Africa (SSA), the sector is faced with structural challenges which undermine the attainment of its optimal potential. The Alliance of Green Revolution in Africa (AGRA) has advanced its operations in recent years, and aims to promote market-led agricultural transformation in the sub-region. In Mali, AGRA's objectives are to close yield gaps with the aim of doubling current yields; and also to increase the volume of crop aggregation and processing in order to boost activities in the agri-food industry and support farmers through an enabling policy environment.

In line with these objectives, the Institute of Statistical Social and Economic Research (ISSER) was contracted to conduct a baseline survey of farmer households in three (3) regions principally noted for crop production in Mali so as to generate baseline data for key indicators broadly relating to households' welfare, farming practices, crop yields, crop losses and other features of the value chain in the cultivation of four major crops, namely maize, sorghum, millet and cowpea. Overall, 2,977 farmer households were sampled and surveyed from the three (3) study regions such that, 1,056 were sampled from the Koulikoro region, 1,221 from Sikasso region, and 700 from the Segou region. The baseline survey data is intended to gather knowledge on the current state of production activities and outcomes, as well as identify key challenges confronting the production of these crops in the three (3) study regions, and to support the development and subsequent evaluation of AGRA interventions over a five-year period.

The main findings from the baseline survey are summarised as follows:

- a. The average household size reported is 16 members, and the average age of a typical household member is 22 years, with majority of household members within the 0-24 age bracket, pointing to a young and youthful household composition.
- b. More than a half of household members interviewed are in polygamous marriages.
- c. There is very high level of illiteracy in the survey regions, with less than a fifth of household members having attained at least basic education, and only a third of household members aged 15 years and above could read or write a sentence in French or Bambara.
- d. Engagement in non-farm economic activities is low in the study regions, with only 16.6% of all individuals interviewed reporting non-farm activities; and the main non-farm activity reported is wine tapping and mining. The average annual profit reported for non-farm activities is US\$283.60
- e. Only 2.4% of individuals sampled are in salary employment, and the overall average annual salary earned is US\$506.73
- f. On food security, maize, millet, sorghum, rice and cowpea (beans) are the main food staples consumed by households. Overall, a fourth of households indicated that they experienced food shortages in the last 12 months; and more than a fifth of households either experienced moderate or severe hunger in the same period.
- g. The proportion of households that sought credit during the last 12 months is 28.6%, of which 91% were successful. The main sources of credit reported by households are savings and credit cooperatives (SACCO), and neighbours; and more than a half of households mainly accessed credit to support farming activities.

- h. Less than a fifth of households sampled (19.3%) have bank accounts, of which more than a half keep their savings with Savings and Credit Cooperatives (SACCO). The distance to the nearest banking point for more than a third of households is between 5 and 15 kilometres away from their dwelling.
- i. The proportion of all households that reported having owned at least one large agricultural asset is 71.8%, those that owned at least one large household asset is 83.9%, and those that owned at least one small household asset is 68.9%.
- j. Overall, 89% of all households sampled owned their dwellings of residence, and a two-third of households had iron sheets as roofs.
- k. The average distance to the closest source of drinking water is 0.3 kilometres, and more than a half of households mentioned the Well as the main source of water for general use.
- l. Overall, 92.7% of households indicated that the main primary decision-maker in the household is the male and female adult together, and less than a tenth of households reported the main primary decision-maker being female adult only.
- m. On empowerment, males appear more empowered than women on almost all empowerment domains. Particularly, women were less empowered in economic activity. Empowerment based on dietary diversity revealed that only a little over a third of women in the study regions consume at least 50% of foods in the listed food groups.
- n. Farm households in the study region cultivate an average of two (2) farm plots, and the average size of a typical cultivated farm plot cultivated is 6.5 hectares. Almost a two-third of households ranked the soil quality on their farm plots as good.
- o. The main source of labour on farms for the average household is family labour; average total man-days per hectare of plot is 97 days.
- p. Overall, 80.5% of households reported having used chemical inputs such as fertilizers and herbicides in crop production. The mean expenditure on chemicals during the 2016 farming season is US\$168.31, expenditure on fertilizer is US\$98.61 and herbicides/weedicides is US\$98.61. The mean quantity of fertilizer used during the same season was 173.6 kilogrammes, and that for herbicides/weedicides is 43.1 litres. The main source of chemicals for farmers are the market, agro-dealers, and organisations that visit the communities.
- q. The proportion of all households that ever used improved/hybrid seeds is 71.3%, of which 58.1% planted improved/hybrid seeds in the 2016 cropping season. Improved/hybrid varieties of maize are popular among farmers in the study regions compared to the other target crops.
- r. On agricultural mechanisation, only a little over a tenth of households indicated tractor use for farming activities in the 2016 farming season, while almost all households (95%) reported using draught animals for crop cultivation. Most households (89.8%) owned the draught animals they used during farm production. The average cost of tractor services over the 2016 farming season is US\$183.98, and that for draught animals is US\$210.15. The main farming activities for which tractors and draught animals were predominantly engaged was ploughing.
- s. Less than a quarter of sampled respondents are members of FBOs, and FBOs related with activities related to crop production are the most common in the study regions.

- t. Access to agriculture extension services in the study regions is low, with only less than a fifth of households accessing extension services. Implementation of extension information by farm households is high, with 80% of households implementing the extension information received. NGOs are the most dominant providers of extension information in the study regions.
- u. On awareness and application of agronomic practices, more than two-thirds of households indicated their awareness of twenty-two (22) agronomic practices, of which a quarter of them actually applied those practices on their farms during the 2016 farming season.
- v. Overall, maize yield for the 2016 farming season is 2.2MT/Ha, sorghum yield is 1.1MT/Ha, millet yield is 0.9MT/Ha, and cowpea yield is 0.2MT/Ha. Overall, the mean pre-harvest losses reported for maize in the same season is 17.4%, sorghum is 16.4%, millet is 15.5%, and cowpea is 27.0% (the highest among the target crops).
- w. Almost all households (99.3%) stored their crops in various forms after harvest. The most common method of storage reported is storage in silos at home or farm, followed by storage in bags at home or farm.
- x. The highest quantity of crop sales reported for maize during the 2016 season is 3.4 metric tonnes, sorghum is 1.3 metric tonnes, millet is 2.1 metric tonnes, and cowpea is cowpea 0.3 metric tonnes. The major sources of market price information for farmers is market traders and colleague farmers.

## 2 Introduction

Agriculture is the mainstay for the Malian economy and remains a major sector of focus for the Government of Mali (GoM) due to its significant contributions to the economy over the years. The sector contributed 36.6% of total gross domestic product (GDP) over the period 2000-2015, with an average growth rate of 4.4% over the same period (World Bank, 2017). In 2009, the GoM invested 117.1 billion FCFA (USD 202.6 million) in the agriculture sector, accounting for 8.7% of total public expenditures<sup>1</sup>. The sector holds great potential for driving economic growth in Mali, despite the fact that only the southern part of the country is suitable for farming. Over the last five years, economic growth has been driven by the agriculture sector, which grew faster than the overall GDP.

The arable land area in Mali is estimated at 43.7 million hectares (less than 2% of the country's total land area); of this, only 7% is being cultivated. Potential irrigable land area is thought to be about 2.2 million hectares, of which only 14% is currently being used<sup>2</sup>. Mali is endowed with a diverse river system that includes the Senegal River, the Niger River, the Bani River, the Bafing River, and the Faleme River. Of these, the Niger River is the most important, as it covers significant portions of the country, starting from the southwest and flowing through the central zone plains and valleys to the northern and eastern zones.

Millet, Sorghum, Maize, Cowpea and Rice are the basic staple crops and are produced by 90% of farmers for subsistence; crop yields depend almost entirely on the weather. While Mali often has grain surplus, the country is considered food insecure because of the high levels of household poverty, particularly in the northern parts of the country<sup>3</sup>, and farmers barely meet their basic livelihood needs throughout the year. One of the prevalent challenges confronting Malian agriculture is its very low productivity. The need to increase the productivity of staple crops, in particular cereals, is therefore imperative.

AGRA's recognition of these issues has led to the development of 5-year strategy aimed at addressing productivity of Malian farmers, providing support to encourage transformation of local farming, through innovation, improved market access and partnerships. The purpose of this survey, conducted by the Institute of Statistical Social and Economic Research (ISSER) is to satisfy one of the key components of AGRA's country model for Mali. This incorporates one of its core assets: "Real time, on-the ground intelligence and insight regarding the current status of activities, farmer realities, and new opportunities to accelerate progress towards transformation". The achievement of this objective will occur through the provision of current and applicable data, detailing the demographic characteristics of target farmer households, commonly-used farming, awareness and adoption of beneficial inputs, specifically fertilizer and improved varieties of seeds, and storage and sales which determine income and returns to production. Key indicators were

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<sup>1</sup> *Améliorer la gestion des dépenses publiques au Mali*, Directeur Général du Budget, 2011

<sup>2</sup> Feed the Future Strategic Review

<sup>3</sup> ECOWAS, Agriculture and Food in West Africa: Trends, Performances and Agricultural Policies, 2015

assessed, in terms of not only the target crop, but also where these target crops are grown. This is expected to further deepen AGRA's understanding of the welfare dynamics not only in terms of the target crops the farmers grow but also the influences that the regions and more specifically the farming communities of the farmers have on the production of the target crops.

The rest of the report is structured as follows. This introductory section is followed by background information on the country of study and the programme design in Section 3. We provide detailed discussion of the Study Design in Section 4, followed by a description of the characteristics of households sampled in Section 5. Discussions on Women Empowerment is provided in Section 6, followed by Section 7 on Agricultural Production after which conclusions emerging from the study are summarised in Section 8.

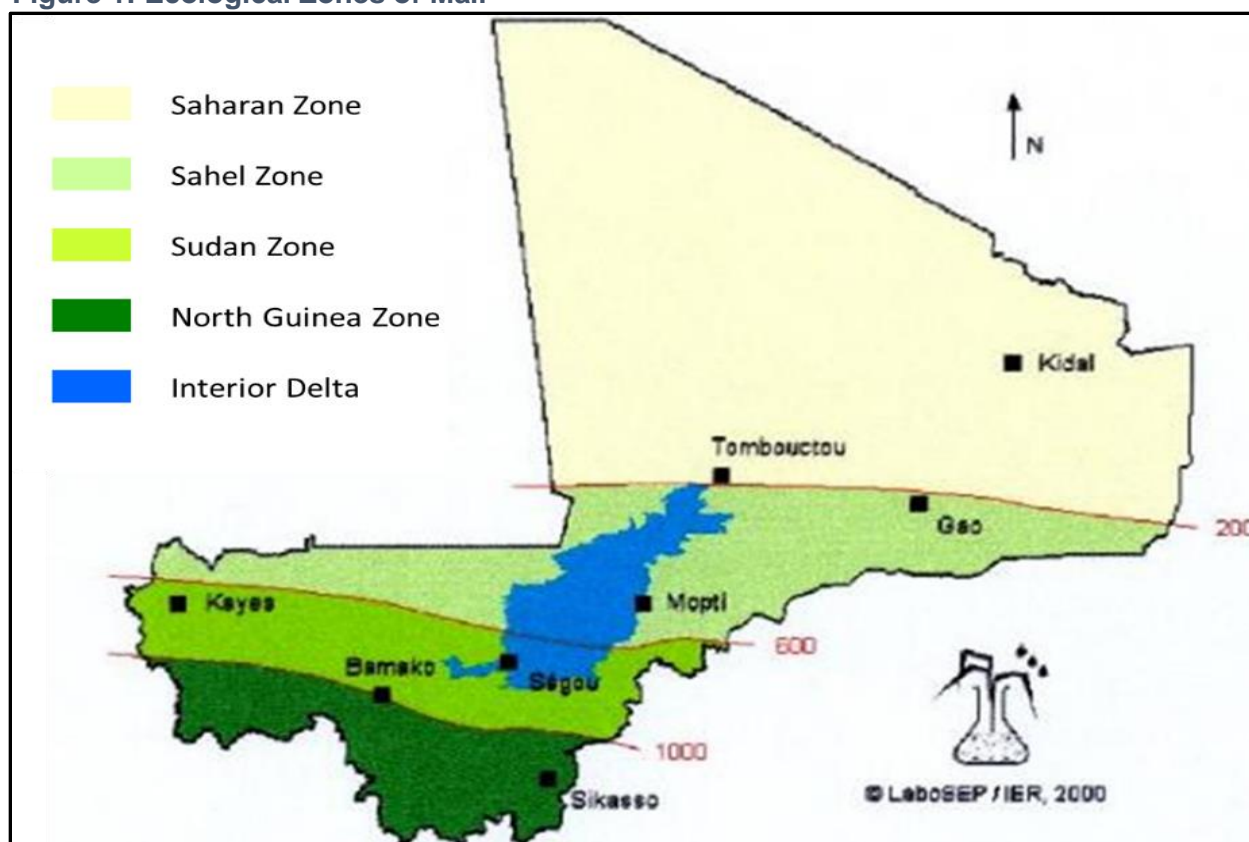
### 3 Background

#### 3.1 Country Background

The arable land area in Mali is less than 2% of the total land area of 1,241,138 km<sup>2</sup>, with the rest either desert or covered by inland water or forest. Of the estimated total arable land, only 7% is under cultivation. Most productive farming areas lie along the banks of River Niger between Bamako and Mopti, extending south to the borders of Guinea, Ivory Coast and Burkina Faso. This is a result of the rain-fed nature of agriculture in Mali, as the area along the River Niger records more frequent and reliable rains. This Potential irrigable land area is thought to be about 2.2 million hectares, of which only 14% is currently under irrigation<sup>4</sup>.

Mali has four distinct agro-ecological zones (AEZs), namely; the Saharan, the Sahel, the Sudan, and the North Guinea zones as displayed in Figure 1. Of these, the North Guinea Zone and some parts of the Sudan Zone constitute AGRA's focus areas. These areas include the entire regions of Sikasso and Segou, as well as parts of the Koulikoro region (not including Bamako).

Figure 1: Ecological Zones of Mali



Source: AGRA Business Plan for Mali

<sup>4</sup> Feed the Future Strategic Review



Agriculture sector is a major sector that sustains the Malian economy. A combination of subsistence and commercial farming provides food for over 18 million inhabitants, especially for the growing non-farming urban population, and provides employment for over 70 percent of households.

Notwithstanding the significance of agriculture to the Malian economy, the sector remained largely under-developed and its development hampered by many structural limitations over the years. Particularly, it is noted that yield gaps are still high despite the existence of improved varieties. This is exacerbated mainly by farmers' poor knowledge of input use, high input costs, and low production of certified seed. Also, despite growing market demand, only a limited volume of produce is currently commercialized. Some major crops, such as cowpeas, do not yet meet domestic demand, and a significant amount of produce does not get to market due to large post-harvest losses, limited aggregation services, and inadequate processing capacity. This is largely explained by the limited development of private sector SMEs, such as mechanization service providers, aggregators and agro-processors.

Another factor that is significantly hampering agricultural transformation is a limited capacity to implement appropriate policies and regulations. The GoM has made significant efforts to establish policies conducive to agricultural transformation, but in practice they are poorly implemented. This affects almost every stage of the agricultural value chain, especially those related to input adoption by smallholder farmers. Similarly, access to finance continues to remain an issue for nearly all SMEs and small-scale farms. Finally, greater resilience of crop varieties is critical to achieving a successful agricultural transformation in Mali, as the country is being harshly affected by climate change.

Due to the importance of the agricultural sector in the economy, there is a strong interest by the Malian government as well as local and international development-focused institutes to promote growth in the sector. In response to challenges facing the agricultural sector, the country has over the past few years embarked on a steady path towards agricultural transformation through various government interventions with the support of international organisations, particularly AGRA. The GOM together with development partners have initiated various policies which align with the Strategic Framework for Growth and Poverty Development 2012-2017 (*Cadre Stratégique pour la Croissance et la Réduction de la Pauvreté*, CSCR), the country's current national development framework. These key policies include the Agricultural Orientation Law (*Loi d'Orientation Agricole*, LOA), the Agricultural Development Policy (*Politique de Développement Agricole*, PDA), and the National Agriculture Sector Investment Plan (*Plan National Sectoriel des Investissements Agricoles*, PNSIA). On public investments, the total government expenditures to the rural and agricultural sector increased by 82% between 2004 and 2010 and the share of the total budget for agriculture is more than 10%. The government essentially provided input subsidies, which increased from USD 27.2 million (13.6 Billion FCFA) in 2009 to USD 62 million (31 Billion FCFA) in 2012, through the Rice Initiative, which eventually extended to wheat and maize, cotton, millet, sorghum, and cowpea<sup>5</sup>. For the period 2011 to 2015, the government

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<sup>5</sup> Ibid.

developed a new investment plan commonly referred to as the *Programme National d'Investissement Prioritaire dans le Secteur Agricole* (PNIP-SA) aimed at achieving 6% average agricultural growth.

With these interventions and policies by the GOM, together with various interventions from the private sector as well as international donors and NGOs, Mali is expected to overcome many of the challenges confronting the sector in order to fully attain agricultural transformation. The focus of agricultural policy and interventions are therefore aimed at increasing production volumes per household through input adoption, practice of efficient soil fertility management techniques and mechanization. Additionally, they attempt to tackle price volatility for farm produce through the introduction of irrigation options to enable year-round farming and even production volumes in and out of rain seasons, storage options for bumper seasons and ready markets for produce, to prevent post-harvest crop loss.

### 3.2 AGRA Program Objectives

AGRA's motivations for the survey are to lead transformations in Mali through interventions that tackle low yield, high post-harvest crop loss and distortions in the value chain caused by an ineffective policy environment. With a focus on Maize, Sorghum, Millet and Cowpea, the institution hopes to impact markets related to these main crops to eventually drive higher production. These markets include input and output markets, to accomplish the following:

- Close yield gaps, with the aim of doubling current yields of 50 percent of farming households in focus regions by working directly with 938,000 farmers and impacting 386,000 of them; and
- Increase the volume of crop aggregation and processing in order to boost activities in the agri-food industry.

The specific interventions to be implemented are:

- Increase the quantity and availability of high-quality seeds of improved varieties.
- Improve seed distribution capacity and expand the network to supply seed of focus varieties.
- Improve farmer's knowledge about inputs and how to use them.
- Facilitate the establishment of partnerships among SMEs operating pre-production businesses.
- Establish Private Mechanization Services Providers (PMSPs) and support their growth.
- Disseminate knowledge of best post-harvest handling practices.
- Improve aggregation capacity at the community level to link farmers to buyers.
- Strengthen processing capabilities of SMEs.
- Support the Government of Mali (GoM) in the implementation of key policies.
- Develop human and institutional capacity.

### **3.3 Survey Objectives**

This baseline survey is among a cross-section of baseline surveys conducted for four (4) countries, namely; Burkina Faso, Ghana, Mali and Mozambique in line with AGRA's overall objective to access real-time data on the activities and experiences of farmers in selected regions of the above-named countries, to inform efficient and timely interventions. As a result, the process followed as part of this survey aim to achieve the following:

- Collate farmer experiences and challenges, from interviews with farmers on farming activities related to the target crops.
- Create a baseline database and directory of farmers with which AGRA can conduct follow up surveys on selected key indicators.
- Analyse baseline quantitative data to identify key trends for the indicators of interest.

## 4 Study Design

### 4.1 Focus regions and crops

AGRA's five-year strategy covers the regions of Sikasso and Segou, as well as parts of the Koulikoro region, located in the North Guinea and some parts of the Sudan agro-ecological zones, where agricultural production mainly occurs. In addition, 80% of Mali's smallholders are located in these regions, which also have better basic infrastructure and a more organized landscape of agricultural stakeholders, such as cooperatives and private sector investors. The characteristics of these regions manifest in the soil, vegetation and climate conditions of the area. These are crucial regions, especially for the production of staple food and cash crops such as cotton, maize, millet, cowpea, and sorghum. As a result, this study samples households from districts in these regions, in line with AGRA's interests.

Though there are a variety of crops grown in these regions, the survey is narrowed down to major crops that are widely consumed nationwide and whose availability impact food security in Mali, namely Maize, Sorghum, Millet, and Cowpea.

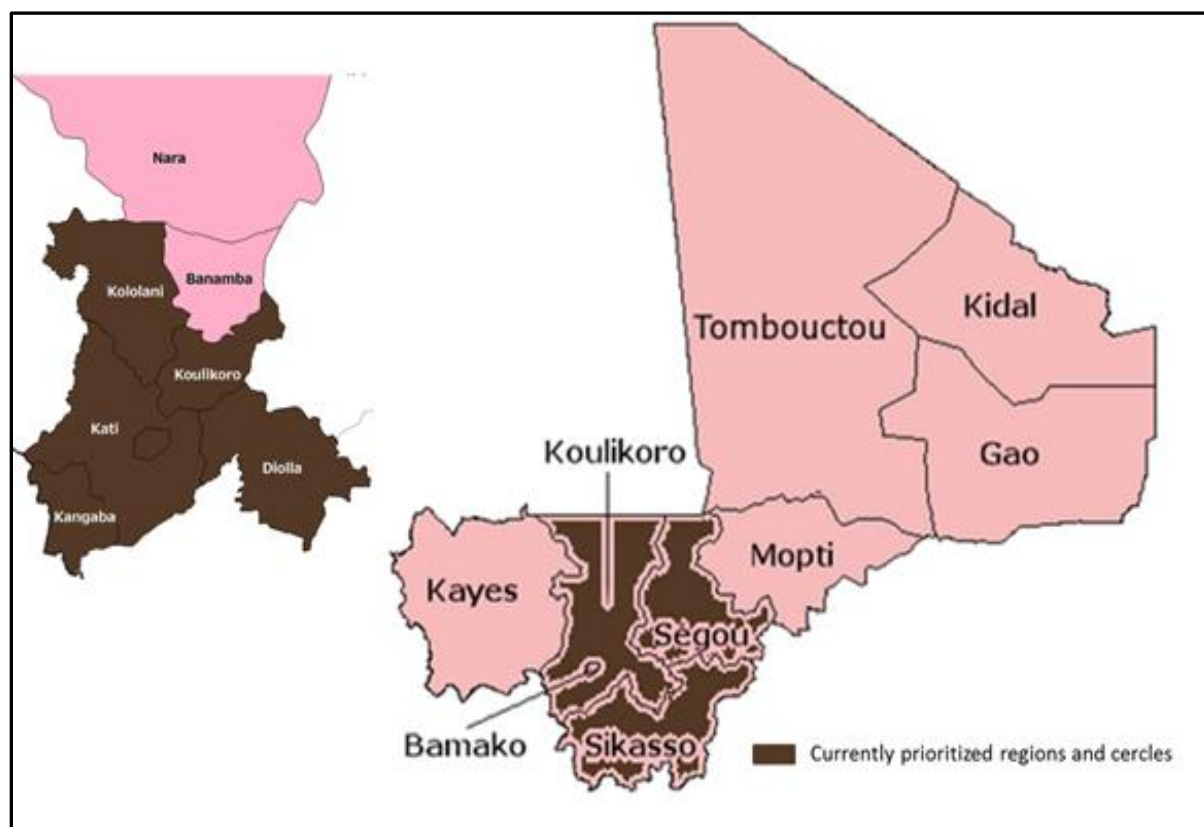
#### Focus regions

The Sikasso region is the southern-most region in Mali, covering 70,280 km<sup>2</sup>, and it hosts 665,000 economically active farmers. The vegetation is partly forest, with largely Sudanian tropical climate, combining Sudan and North Guinea agro-ecological zones. It is the most humid region of Mali, recording average rainfall of 700-1,500 mm per annum. The region has a relatively improved transport infrastructure, and that combined with its proximity to other West African countries such as Burkina Faso and Guinea, makes commercialization of crop production a viable venture. By far, the region remains the largest grain producer in Mali, with some estimated 1 million metric tonnes produced annually. The survey targets households that farm three (3) of the four (4) target crops: maize, sorghum and cowpea, since millet production is relatively low in the region.

The Ségou region is at the centre of Mali, covering 64,821 km<sup>2</sup>, and has about 642,000 economically active farmers. With its proximity to Bamako, the Region has relatively good transport infrastructure, which contributes to the commercialization of its crops. The Ségou Region is served by two important waterways, the Niger and the Bani River, which allow for irrigation and, in turn, makes it a focus area for government and development partners. The survey targets farm households cultivating three (3) out of the four (4) target crops: sorghum, millet, and cowpea, given that maize production in the region is low.

The Koulikoro region is at the western part of Mali, covering 90,120 km<sup>2</sup>, and it is home to 2,855,000 economically active farmers. The region is watered by a number of rivers, including the Niger. The southern part of the region experiences high rainfall with Sudan agro-ecological zone, while the northern part is arid with the Sahel agro-ecological zone. The region has huge commercial agricultural prospects largely due to its relatively improved transport infrastructure including an international railway and airport, as well as its proximity to Bamako, the capital of Mali. The survey targets maize and millet for the region due to their scale of production and also in line with AGRA's interests in the region.

Figure 2: Selected focus regions and selected focus cercles in Koulikoro region



Source: AGRA Business Plan for Mali

## 4.2 Sample size and power analysis

Quantitative and qualitative data collection occurred in all study regions. The enumeration areas (EAs) visited were selected using a sampling frame of EAs provided by the Statistical Service of Mali, to identify areas where rural households in the regions commonly grew the crops of interest. Based on existing and projected estimates for crop yields and crop losses in AGRA's business plan for Mali, the survey targeted a statistically acceptable sample size of 3,225 farm households.

A two stage sampling strategy was employed to ascertain the needed sample size for the survey. In the 1st Stage (Primary Sampling), power calculations determined the number of clusters or enumeration areas (EAs,) required to attain the necessary effect size for a power of at least 80%. It was determined that at least 15 farming households would be randomly selected from each of the 215 EAs to give the total sample of 3,225 households. We selected these clusters based on the distribution of the target crops across the regions and their districts, as provided by the AGRA country business plan. The result of the power calculations are shown in Table 1 for the yield and loss indicators. The results state a suitable sample size of 2,830 households, which was increased to 3,225 to account for anticipated future attrition and difficulty in accessing households or EAs during the initial baseline data collection.

**Table 1: Indicators and Parameters for Sample Size Determination**

Indicator	Parameters							
	Crop	2016	2020	Annual Average Change	Std. Dev.	ICC	Effect Size (Annual)	Sample Size per Crop
Crop Losses	Maize	30	10	-5.000	2.0	0.10	-2.50	700
	Sorghum	15	5	-2.500	2.5	0.00	-1.00	370
	Millet	15	5	-2.500	2.8	0.04	-0.89	490
	Cowpea	35	10	-6.250	2.8	0.04	-2.23	500
	Total	2,060						
	15% Attrition	309						
	Overall Sample Size	2,360						
Crop Yield	Maize	2.5	5	0.625	6.5	0.01	0.10	700
	Sorghum	0.98	2	0.255	4.7	0.00	0.05	810
	Millet	0.8	1.6	0.200	1.1	0.03	0.19	660
	Cowpea	0.5	1	0.125	1.1	0.03	0.12	660
	Total	2,830						
	15% Attrition	425						
	Overall Sample Size	3,225						
Note: The sample sizes are estimated using Optimal Design software which enabled us to do different power versus cluster size scenarios.								

Source: Authors' Computation from AGRA Breadbasket Data, 2013

In the second stage (secondary sampling), within each selected EA, households were randomly selected, following a listing process which created a master list of households that fit the required criteria; that at least one member of the household was engaged in agricultural production of the target crop linked to the EA.

### 4.3 Data Collection and Quality Control

#### Fieldwork and Data Collection

Fieldwork for the quantitative survey covered an overall period of 4 weeks, spanning 7 December 2016 to 4 January 2017. The selected period coincided with the harvest period for the target crops for most farmers. Prior to field work, enumerators for the quantitative survey were trained on the content and techniques for administering the instrument, after which they were deployed to the field.

As mentioned by the section on sampling strategy, listing data was collected on households in the chosen EAs to build a master from which households would be randomly selected. The following data was collected on each listed household; name and contact information for the household head, household size and whether they satisfied the criteria of farming at least one acre of the target crop. The field teams listed all household in each EA, after which 15 households plus additional households (as backups) were randomly selected for the quantitative interviews. The extra households sampled served as a replacement list in the case of refusals or where certain selected households were not available for the survey.



The instruments focused on farming activities of households in all regions, for all stages of production of the target crops, and household welfare, related to income, food security and housing conditions. The questions in the quantitative instrument covered land tenure and use, input adoption, agronomic practices, harvest, storage and sales, income and employment, housing conditions, food security and the *Women Empowerment in Agriculture Index*. As part of the quantitative fieldwork, data collectors measured plot sizes, using specialised logging devices, which produced satellite-generated GPS coordinates, measurement and maps of farm plots for a third of the selected households.

The qualitative fieldwork is steadily in progress. The interviews will take a different format and will consist of Key Informant Interviews with agents of stakeholder organisations such as the Ministry of Agriculture, Water and Water Resources (Ministère de l'Agriculture et des Aménagements Hydrauliques), extension officers and aggregators. Additionally, In Depth Interviews (IDIs) and Focus Group Discussions (FGDs) will also be conducted with farmers. The enumerators will be assigned based on language proficiency relevant to the areas.

Two data collection instruments will be used in collecting data for the qualitative baseline study. These are semi-structured interview and discussion guides. Both instruments are designed to address focus areas of the baseline study. Semi-structured interview guides were used as instruments to conduct in-depth interviews (IDIs) and key informant interviews (KIIs). A semi-structured discussion guide was designed and used to conduct the FGDs. They focused on the following areas for each interview:

- a. Structure, activities and sources of households' income
- b. Asset, wealth, income and food security
- c. Access and use of agricultural inputs
- d. The management and the use of agricultural output
- e. Women empowerment in agriculture
- f. Potential extraneous variables

## Quality Control

Throughout the field data collection, the research team closely monitored the data collection process to ensure that interviews were conducted ethically and that the data met the quality standards set by ISSER. This was done using the following procedures:

- Enumerators conducted interviews using a computer-assisted personal interview (CAPI) setup installed on tablets. At the end of day's work, team supervisors were required to review and upload data to be sent to the CAPI operations team in Accra. The research team reviewed the available data and, for any issue, contacted the team associated with the specific case for clarification and corrections to be made.
- Twice during the period, two teams comprising of members of the research team visited field workers to monitor the data collection process, provide necessary logistics and address any issues that came to their attention while in the field. Field teams reported their progress at each turn, so that the research team could ensure that schedules were adhered to for field work.

#### **4.4 Key Observations and Concerns**

During the listing and data collection process, field teams working in some rural settings were sometimes cut off and unreachable due to poor telephone and internet coverage. This mainly hampered the progress in field measurement data uploads using the GPS logger devices, and on a few cases delayed the transmission of data to the CAPI operations team in Accra.

During the listing and sampling process, field teams uncovered that, while some EAs are selected for certain crops, majority of households or in some cases none of the farm households were cultivating such crops. In such cases, the households were then sampled for any of the other target crops they were cultivating, thereby resulting in some reallocation of crops for certain EAs.

## 5 Descriptive Characteristics

In this section, we offer a snapshot of the households and the key characteristics that describe them on average, broken down by region and then by the main crop that they farm given the EA in which they reside.

### 5.1 Demographics

By the end of field work, household-level data had been collected for 2,977 farming households in the Koulikoro, Sikasso and Segou regions in the quantitative study. For the Koulikoro and Sikasso regions, households were sampled for all four target crops while, in the Segou region, they were sampled only for sorghum and millet, since maize and cowpea are not commonly grown in the region. The demographic characteristics of the household heads and members are presented in Table 2.

Household sizes are large on average, with approximately 16 members living in the same home, sharing farming and feeding arrangements. Overall, there are more male household members than females (50.6% for male members), with sorghum-growing homes in Koulikoro having the largest proportion of male members (56.1%). Sorghum- and cowpea-growing households in Sikasso and sorghum households in Segou, however, have majority female members. Households range between 14-16 members for all regions. At the crop level, households follow this trend on average, except for millet households in Koulikoro who have approximately 19 members on average. Households are almost entirely male-headed (99.9%). The largest proportion of female heads are recorded for millet households in Koulikoro (0.6%)

The average age of household members is approximately 22 years old, while household heads averaged about 60 years of age. Households in Maize communities in the Koulikoro region showed the lowest average age for household members (21 years), while the highest was recorded in cowpea-growing communities in the same region (24 years). Mimicking the national picture, the sample is young, with almost half of household (45.8%) of members aged 0-14 years old. This share is highest in the Sikasso region. The age and sex population distribution pyramids in Figure 2 below show the concentration of household members within the age group 0-24, for the overall sample and each region. It is also observed that, for female members, there is a larger percentage aged 25 and above than for there are for the males.

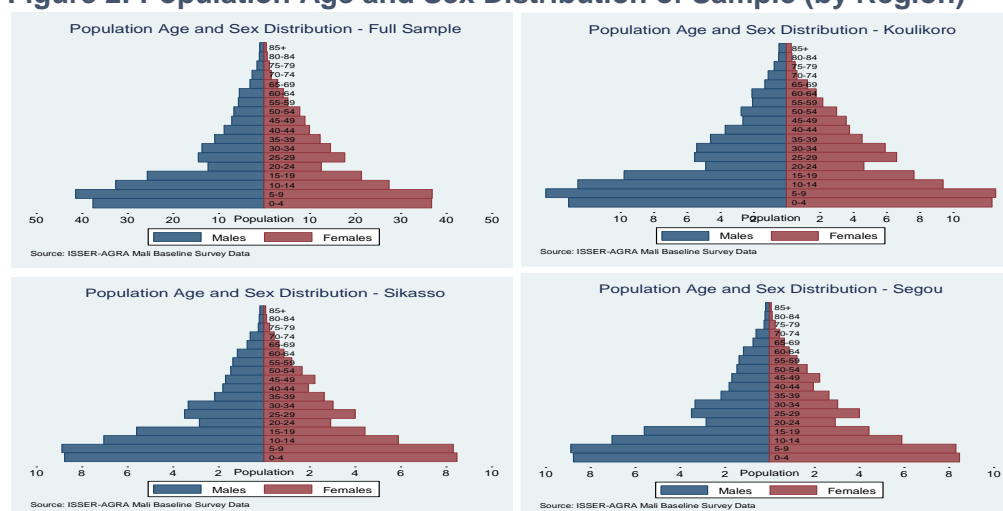
Finally, we look at the marital status of household heads. Majority of the overall sample (51.1%) are in polygamous unions. The proportion is less for Segou households, as there is a majority (57.6%) of heads in monogamous marriages. Another interesting trend shows that no heads were recorded as cohabitating in the sample.

Table 2: Demographic characteristics of sampled households (Household Composition)

Indicator	Koulikoro					Sikasso					Segou				Overall				
	Maize	Sorghum	Millet	Cowpea	Overall	Maize	Sorghum	Millet	Cowpea	Overall	Maize	Sorghum	Millet	Overall	Maize	Sorghum	Millet	Cowpea	Overall
No. of Households	355	22	344	335	1056	478	333	29	381	1221	0	362	338	701	833	717	711	716	2,977
Household Size	15.9	15.4	18.5	14.6	16.3	16.6	14.5	16.4	14.9	15.5	10.0	15.6	13.7	14.7	16.3	15.1	16.1	14.8	15.6
<b>Gender of HH Heads (%)</b>																			
Male	99.7	100.0	99.4	100.0	99.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.7	99.9	99.9	100.0	99.6	100.0	99.9
Female	0.3	0.0	0.6	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.1	0.0	0.4	0.0	0.1
<b>Gender of HH Members (%)</b>																			
Male	52.0	56.1	50.1	53.7	51.9	50.4	48.0	50.3	49.0	49.4	40.0	50.7	51.1	50.9	51.1	49.7	50.5	51.2	50.6
Female	48.0	44.0	49.9	46.3	48.1	49.6	52.0	49.7	51.0	50.7	60.0	49.4	48.9	49.2	49.0	50.4	49.5	48.9	49.4
<b>Average Age (in years)</b>																			
HH Heads	59	56	59	58	59	56	53	46	55	54	45	54	55	55	57	54	56	56	56
HH Members	24	22	22	24	23	21	21	19	21	21	23	22	22	22	22	21	22	23	22
<b>Age Breakdown (%)</b>																			
0-14	41.3	48.7	46.5	40.5	43.2	47.4	49.3	46.5	48.1	48.1	30.0	46.6	45.5	46.1	44.8	47.9	46.1	44.6	45.8
15-64	54.1	48.1	49.6	55.4	52.7	49.5	48.3	52.0	48.5	48.9	70.0	50.0	50.9	50.5	51.4	49.2	50.3	51.7	50.7
65+	4.6	3.2	3.9	4.1	4.1	3.2	2.4	1.5	3.3	3.0	0.0	3.3	3.6	3.4	3.8	2.9	3.7	3.7	3.5
HH Dependency Ratio	1.0	1.2	1.1	0.9	1.0	1.1	1.2	1.0	1.2	1.2	0.4	1.1	1.0	1.1	1.1	1.1	1.1		1.1
<b>Marital Status of HH Head (%)</b>																			
Single	0.0	0.0	0.6	0.9	0.5	1.1	0.3	0.0	0.5	0.7	0.0	1.1	1.2	1.1	0.6	0.7	0.8	0.7	0.7
Monogamous married	36.3	63.6	45.6	41.8	41.7	43.5	49.0	48.3	42.3	44.7	0.0	60.2	55.0	57.6	40.4	55.1	50.2	42.0	46.7
Polygamous Married	62.8	36.4	50.9	55.8	56.2	54.0	50.5	51.7	57.0	53.9	100.0	36.7	40.5	38.7	57.8	43.1	46.0	56.4	51.1
Divorced	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Widowed	0.9	0.0	2.9	1.5	1.7	1.3	0.3	0.0	0.3	0.7	0.0	1.7	3.0	2.3	1.1	1.0	2.8	0.8	1.4
Separated	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.0	0.1	0.1	0.0	0.1
Cohabitation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Field Data Collected by ISSER and Partners 2016

**Figure 2: Population Age and Sex Distribution of Sample (by Region)**



Source: Field Data Collected by ISSER and Partners 2016

## 5.2 Education and Literacy

In this section, the educational access and literacy of household heads and members are assessed. This characteristic is an important determinant of the success of agricultural interventions, as it influences uptake of inputs, practice of agronomic practices and understanding of extension advice. Respondents were asked to indicate whether they had ever attended school and literacy levels, defined by their ability to read or write a phrase in English.

At 18.9 percent, less than a fifth of the household heads interviewed had completed at least one level of education. We observe a difference between the focus regions for this particular indicator, although they all remain low. The proportion of educated household heads are largest in Koulikoro (20.6%), followed by 19.4 percent in Segou and 17.2 percent in Sikasso. Sorghum households in Koulikoro show a

When it comes to current enrolment, investigated for all households and a subset of members of school going age (3-25), two key trends stand out. First, the overall share of household members currently enrolled in school (18.7%) remain as low as that of household heads that have ever attended school. However, those aged 3-25 years show a higher proportion of school attendees (29.4%). (**Error! Reference source not found.**)

The sample hosts a majority illiterate adult population, with only 31.4% and 30.5% of household members, aged 15 and above, indicating that they could read or write, respectively. The share of literate household head is even smaller: 25.6% reading and 25.3% writing. Similar trends followed at the regional levels. Sorghum households in each region showed the highest literacy levels compared to the other crop categories.

**Table 3: Education and literacy of households**

Indicator	Koulikoro					Sikasso					Segou				Overall				
	Maize	Sorghum	Millet	Cowpea	Overall	Maize	Sorghum	Millet	Cowpea	Overall	Maize	Sorghum	Millet	Overall	Maize	Sorghum	Millet	Cowpea	Overall
HH Heads ever attended school (%)	17.2	36.4	22.1	21.8	20.6	14.9	22.2	6.9	16.5	17.2	0.0	18.0	21.0	19.4	15.8	20.5	21.0	19.0	18.9
Current Enrolment (all ages)(%)	25.2	20.7	17.1	21.1	21.0	17.9	16.1	13.6	19.9	17.9	11.1	16.7	15.4	16.1	21.0	16.5	16.3	20.5	18.7
Current Enrolment (3-25)(%)	42.1	32.0	26.5	34.9	33.9	27.9	23.9	19.3	31.0	27.5	0.0	26.4	24.3	25.4	33.5	25.4	25.3	32.8	29.4
Adult literacy (15+)																			
% that can read	26.6	26.5	23.7	27.7	25.9	23.9	26.0	22.7	23.3	24.2	28.6	28.8	26.1	27.6	25.1	27.5	24.6	25.5	25.6
% that can write	26.6	26.5	23.8	27.5	25.9	23.7	26.0	22.7	23.2	24.1	28.6	28.4	24.1	26.4	25.0	27.3	23.9	25.4	25.3
HH Head Literacy																			
% that can read	18.6	40.9	28.2	33.7	27.0	27.8	39.3	24.1	29.9	31.5	100.0	40.6	34.6	37.8	24.0	40.0	31.1	31.7	31.4
% that can write	17.8	36.4	28.2	32.8	26.3	27.2	40.2	24.1	29.4	31.4	100.0	39.0	31.1	35.2	23.3	39.5	29.4	31.0	30.5

Source: Field Data Collected by ISSER and Partners 2016



## 6 Household Welfare

In this AGRA baseline report we try to ascertain the welfare indicators for farmers of four (4) target crops in Mali. Welfare indicators are based on the business plans published by AGRA reports. This baseline report looks particularly at five welfare indicators; Income and Employment, Food Security, Access to Credit and Saving, Household Assets and Housing Characteristics. Welfare will not only be assessed in terms of the target crop but also where these target crops are grown. This will allow AGRA understand welfare dynamics not only for the target crops the farmers grow but also the influences that the regions have on the target crops that farmers are growing.

### 6.1 Income and Employment

This chapter presents the results of the employment and income levels of target crop farmers in the survey. Although, the sampled farmers are primarily engaged in farming, the survey tries to ascertain income that was earned from self-employment or non-farm employment which in one way or the other may supplement the income of the household. In addition to this the report also looks at how target crop farmers are able to employ other people in their households by paying these employees some wages. In terms of general welfare, the ability to take care of one's self as well as other members in a household cannot be underestimated.

As we analyse income in terms of the annual wages received from the various activities, the study also looks at the most common forms of activities that our study population is engaged in. In this way the study tries to draw some inferences from what farmers are engaged in outside their usual farming activities.

**Table 4 Farmers with Salaried Employees by target crop and region**

Indicator	Region &Target Crop																			
	Koulikoro					Sikasso					Ségou				Overall					
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total	
Salaried Employees?																				
Yes (frequency)	14	3	30	15	62	56	63	1	48	168	0	39	18	57	70	105	49	63	287	
%	4	13.6	8.7	4.5	5.9	11.7	19	3.5	12.6	13.8	0	10.8	5.3	8.1	8.4	14.7	6.9	8.8	9.7	
No (frequency)	340	19	314	320	993	422	269	28	332	1,051	1	323	320	644	763	611	662	652	2688	
%	96.1	86.4	91.3	95.5	94.1	88.3	81	96.6	87.4	86.2	100	89.2	94.7	91.9	91.6	85.3	93.1	91.2	90.4	
Total (frequency)	354	22	344	335	1,055	478	332	29	380	1,219	1	362	338	701	833	716	711	715	2975	
%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	

Source: Field Data Collected by ISSER and Partners 2016

The section starts by looking at the number of farmers who as at the time of the survey had salaried individuals working in their households. Although, among the target crop farmers there is not a significant number having salaried employees, it is worth mentioning that there are some few who fall within this category. Table 4 shows the number of people who have salaried worker as well as those farmers who do not. This is broken down at the target crop level and at the regional level.

It can be seen that a total of about 287 farmers agreed that they had some individuals who they paid at the end of each month for some services they rendered to them. In terms of regional distribution Cassava farmers in the Sikasso region had the highest number of individuals who had salaried employee's whiles in the Sikasso region Sorghum farmers recorded the highest number of people who were paying wages to individuals working in their households.

Next we look at the number of household members who are engaged in off-farm activities. It must be said that there were several off-farm activities that the study tried to assess. As a result, not all these activities could feature specifically in the analysis. For ease of expression and clarity, the top ten (10) non-farm activities are selected and categorized with the remaining activities labelled as "Other". This comprises mainly of those activities that did not have a frequency of 40 individuals. Some of these non-farm activities recorded in the "Other" category are Electricians, Plumbers, Trotro, Butchers, Hotel, Cobblers, Laundry business, Brick making, Pet breeding, Vehicle mechanic, Spraying, etc.

Table 5 shows the distribution of the number of farmers that engage in non-farm activities recorded in the survey based on the target crop and the region in which they grown. Among farmers surveyed in the study, a total of 5,908 (16.6%) agreed that they in one way or the other engaged in non-farm activities irrespective of their usual activities on their farms as compared to the total of 29,645 (83.4%) who were not engaged in other non-farm activities.

**Table 5: Distribution of Farmers Engaging in off-farm Activities by Crop and Region**

Indicator	Region & Target Crop																			
	Koulikoro					Sikasso					Ségou					Overall				
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total	
Engages in Non-farm Activities																				
Yes (frequency)	793	28	1,183	442	2,446	1,175	393	46	857	2,471	2	630	359	991	1,970	1,051	1,588	1,299	5,908	
%	17.5	10.7	24.7	11.2	18.1	19.4	10.8	13.2	20.2	17.3	28.6	14.8	10.3	12.8	18.6	12.9	18.4	15.9	16.6	
No (frequency)	3,732	233	3,607	3,505	11,077	4,897	3,233	303	3,379	11,812	5	3,623	3,128	6,756	8,634	7,089	7,038	6,884	29,645	
%	82.5	89.3	75.3	88.8	81.9	80.6	89.2	86.8	79.8	82.7	71.4	85.2	89.7	87.2	81.4	87.1	81.6	84.1	83.4	
Total (frequency)	4,525	261	4,790	3,947	13,523	6,072	3,626	349	4,236	14,283	7	4,253	3,487	7,747	10,604	8,140	8,626	8,183	35,553	
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	

Source: Field Data Collected by ISSER and Partners 2016

In the Koulikoro region, a total of 2,446 farmers (18.1%) had some non-farm activities they engaged in. In this region most Millet farmers, a total of 1,183, representing 24.7% of millet growers in the region agreed that apart from growing millet, they engaged in other activities that had nothing to do with millet cultivation. This was followed by 17.5% among Maize farmers, 11.2% among Cowpea farmers and finally 10.4% among Sorghum

Farmers. In the Sikasso region, a total of 2,471 farmers (17.3%) had some off-farm activities they engaged in. there were no cassava farmers, recording non-farm activities in this region. A total of 857 representing 20.2% of cowpea growers in the region agreed that apart from growing cowpea, they engaged in other activities that had nothing to do with cowpea cultivation. This was followed by 19.4% among maize farmers, 13.2% among millet farmers and finally 10.8% among sorghum Farmers.

As pointed out in earlier paragraphs, the study tries to ascertain the most common off-farm activities that most of the farmers were engaged in. Table 6 shows this distribution.

Table 6: Distribution of Top 10 Non-Farm Activities by Target Crop and Region

	Koulikoro					Sikasso					Ségou				Overall				
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total
<b>Top 10 Non-Farm Activities</b>																			
Agric. Trading	6	0	10	14	30	16	11	0	9	36	0	5	4	9	22	16	14	23	75
Carpentry	5.1	0	5.5	11.8	7	8.3	9.7	0	4.7	7.1	0	3.5	4.8	3.9	7.1	6	5.1	7.4	6.4
Fish Trading	2	0	4	2	8	4	2	0	6	12	0	3	4	7	6	5	8	8	27
Hiring out a bull	1.7	0	2.2	1.7	1.9	2.1	1.8	0	3.1	2.4	0	2.1	4.8	3	1.9	1.9	2.9	2.6	2.3
Income from other	0	0	0	3	3	1	1	0	0	2	0	9	1	10	1	10	1	3	15
Livestock trading	0	0	0	2.5	0.7	0.5	0.9	0	0	0.4	0	6.2	1.2	4.4	0.3	3.8	0.4	1	1.3
Masonry	0	0	1	2	3	5	6	0	6	17	0	7	4	11	5	13	5	8	31
Mining	0	0	0.6	1.7	0.7	2.6	5.3	0	3.1	3.4	0	4.8	4.8	4.8	1.6	4.9	1.8	2.6	2.7
Pet breeder	11	0	1	7	19	1	0	0	2	3	0	4	0	4	12	4	1	9	26
Wine tapper	9.4	0	0.6	5.9	4.5	0.5	0	0	1.1	0.6	0	2.8	0	1.7	3.9	1.5	0.4	2.9	2.2
Other	3	0	12	7	22	4	4	0	11	19	0	11	5	16	7	15	17	18	57
Total	2.6	0	6.6	5.9	5.2	2.1	3.5	0	5.8	3.8	0	7.6	6	7	2.2	5.6	6.2	5.8	4.9
	2	0	5	7	14	8	5	0	7	20	0	8	2	10	10	13	7	14	44
	1.7	0	2.7	5.9	3.3	4.1	4.4	0	3.7	3.9	0	5.5	2.4	4.4	3.2	4.9	2.5	4.5	3.8
	29	0	2	0	31	21	1	0	4	26	0	2	1	3	50	3	3	4	60
	24.8	0	1.1	0	7.3	10.8	0.9	0	2.1	5.1	0	1.4	1.2	1.3	16	1.1	1.1	1.3	5.2
	4	0	7	4	15	9	7	3	7	26	0	6	11	17	13	13	21	11	58
	3.4	0	3.8	3.4	3.5	4.6	6.2	33.3	3.7	5.1	0	4.1	13.1	7.4	4.2	4.9	7.6	3.6	5
	42	6	112	47	207	100	51	3	86	240	1	61	25	87	143	118	140	133	534
	35.9	75	61.2	39.5	48.5	51.6	45.1	33.3	45	47.3	100	42.1	29.8	37.8	45.8	44.4	50.7	42.9	45.9
	18	2	29	26	75	25	25	3	53	106	0	29	27	56	43	56	59	79	237
	15.4	25	15.9	21.9	17.6	12.9	22.1	33.3	27.8	20.9	0	20	32.1	24.4	13.8	21.1	21.4	25.5	20.4
	117	8	183	119	427	194	113	9	191	507	1	145	84	230	312	266	276	310	1,164
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Field Data Collected by ISSER and Partners 2016

From Table 6 it can be seen that most farmers in the survey were engaged in Wine tapping. A total of 534 farmer households (45.9%) were engaged in wine tapping. The second highest off-farm activity engaged was Agricultural trading where a total of 75 farmer households (9.0%) were engaged in. Agricultural trading includes sale of agricultural inputs, crops and other prior engagements in the agricultural sector that may not necessarily be linked to actual farming activities. This is a little surprising due to the

fact that most rural households should engage in this activity since the survey is intended for farmer household.

Next activity is mining where a total number of 60 households (5.2%) were engaged in, followed by Pet breeding with a total of 58 people (5.0%). It is not surprising that this activity features frequently due to fact that most farmer households in these region possess livestock. As a result, closely followed is Livestock trading where about 57 households (4.9) were engaged in.

The study not only looks at these work categories but now looks at the various incomes that are earned by the surveyed households undertaking these non-farm activities. First, annual average net profits that obtained by each target crop farmer is tabulated in Table 7. This was done by aggregating low earnings, average earnings, and high earnings over a one-year period for each month. This aggregation gave an idea of the annual revenue and cost figures for low, average and high earnings which was differenced to obtain mean annual earnings for the target crop farmers.

**Table 7: Mean Annual Non-farm Income by Target Crop and Region**

Region	Target Crop				
	Maize	Sorghum	Millet	Cowpea	Overall
Sikasso	(130.36)	52.86	53.61	1.38	1.02
Koulikoro	320.30	49.65	83.83	3,045.37	1.02
Ségou	(35.94)	21.33	(254.52)	-	(65.61)
Overall	181.10	31.53	(20.82)	2,161.63	393.10

Source: Field Data Collected by ISSER and Partners 2016

From the study, we see that, farmers in non-farm employment earned an average net profit of US\$471.32 in the main 2016 farming season. In terms of regional and crop breakdown cowpea farmers engaged in non-farm activities in the Koulikoro region made the most net profit earnings of US\$1,132.59 annually. This figure also doubles as the highest in the study. Maize farmers in the Sikasso regions who are engaged in non-farm activities made the huge loses US\$283.60 annually. Also maize and millet farmers in Ségou also made losses (US\$35.69).

The study also tries to ascertain the number of sampled target crop farmers engaged in salaried employment in the 2015/2016 farming season. In terms of salaried work, the study includes pensions as well as local and foreign remittances.

Table 8 shows the distribution of individuals who agree they had some kind of salaried employment.

Table 8: Distribution of Farmers with in Salaried Employment by Target Crop and Region

Indicator	Region &Target Crop																			
	Koulikoro					Sikasso					Ségou				Overall					
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total	
Salaried Employer?																				
Yes (freq.)	169	8	164	75	416	106	65	31	85	287	0	81	57	138	275	154	252	160	841	
%	3.7	3.1	3.4	1.9	3.1	1.8	1.8	8.9	2.0	2.0	0.0	1.9	1.6	1.8	2.6	1.9	2.9	2.0	2.4	
No (freq.)	4,356	253	4,626	3,872	13,107	5,966	3,561	318	4,151	13,996	7	4,172	3,430	7,609	10,329	7,986	8,374	8,023	34,712	
%	96.3	96.9	96.6	98.1	96.9	98.3	98.2	91.1	98.0	98.0	100.0	98.1	98.4	98.2	97.4	98.1	97.1	98.0	97.6	
Total (freq.)	4,525	261	4,790	3,947	13,523	6,072	3,626	349	4,236	14,283	7	4,253	3,487	7,747	10,604	8,140	8,626	8,183	35,553	
%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	

Source: Field Data Collected by ISSER and Partners 2016



In

Table 8 a total of 841 (2.4%) individuals agreed to the fact that they were engaged in some sort of salaried employment. In the Koulikoro region, a total of 416 farmers (3.1%) had some salaried employment they engaged in. In this region most maize farmers, a total of 169 representing 3.7% of cassava growers in the region agreed that apart from growing maize, they engaged in other wage related activities that had nothing to do with maize cultivation. In the Sikasso region, a total of 287 farmers (2.0%) had some salary related activities they engaged in. A total of 106 representing 1.8% of maize growers in the region agreed that apart from growing maize, they engaged salaried employment that had nothing to do with cassava cultivation. In the Ségou region, a total of 138 farmers (1.8%) had some salary related activities they engaged in.

In addition to this, efforts were made to calculate the average earnings that target crop farmers made from these salaried engagements. Aggregation for annual incomes obtained from salaried employment was done in two ways. First, if the respondent confirmed that monthly income never changed in the course of the year, a sum over the 12 months gave annual salaried employment income. However, in cases where the respondent confirmed that payments were uneven over the course of the year, efforts were made to aggregate the different amounts obtained each month over the course of the year. Table 9 shows the distribution of average annual income earned from salaried employment.

**Table 9: Mean Annual Salaried Employment Income by Target Crop and Region**

Region	Target Crop				
	Maize	Sorghum	Millet	Cowpea	Total
Sikasso	1,054.14	1,227.06	561.71	718.99	631.04
Koulikoro	440.65	267.95	242.34	512.69	345.59
Ségou	-	500.14	439.82	-	454.36
Overall	817.46	421.96	496.10	610.11	506.73

Source: Field Data Collected by ISSER and Partners 2016

From the study, we see that, farmers engaged in salaried employment earned an average income of US\$506.73 in the main 2016 farming season. In terms of regional and crop breakdown sorghum farmers engaged in salary related activities in the Sikasso region earned the highest salaries of US\$631.04 annually. This figure also doubles as the highest in the study. Millet farmers in the Koulikoro region who are engaged salaried employment made the least earnings (US\$345.59 annually).

## 6.2 Food Security

Despite long-standing efforts to improve the food security situation of populations globally, food deprivation and its physical consequences remain a continuing problem in resource-poor areas throughout the world. The Food and Agriculture Organization of the United Nations (FAO) estimated that, in 2010 alone, 925 million people worldwide did not have access to sufficient food to meet their dietary energy requirements (Coates, Swindale, & Bilinsky, 2007).

Household food access is defined as the ability to acquire sufficient quality and quantity of food to meet all household members' nutritional requirements for productive lives. Given the variety of activities implemented by AGRA to improve household food access and the significant challenges most surveys face in measuring household food access for reporting purposes, there is a need to build consensus on appropriate household food access impact indicators. This section provides an approach to ascertain household dietary diversity as well as some measures of household food access. This is done in terms target crops and region.

The first step is to ascertain the types of food available and commonly consumed by households. This will inform the study on how food secure households are. USAID defines food security as, "when all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life." Three distinct variables are essential to the attainment of food security: 1) Food Availability: sufficient quantities of appropriate, necessary types of food from domestic production, commercial imports or donors other than USAID are consistently available to the individuals or are within reasonable proximity to them or are within their reach; 2) Food Access: individuals have adequate incomes or other resources to purchase or barter to obtain levels of appropriate food needed to maintain consumption of an adequate diet/nutrition level; 3) Food Utilization: food is properly used, proper food processing and storage techniques are employed, adequate knowledge of nutrition and child care techniques exist and is applied, and adequate health and sanitation services exist (USAID, 1992).

Since availability of food is the first key to food security the survey investigates the availability of some food crop in the household which indicates some kind of household food security.

Table 10 shows the distribution of the five most commonly consumed foods in the surveyed household.

The study revealed that Maize, Millet, Sorghum, Rice and Beans were the five most commonly consumed food. However, among these food crops, maize was most available in the surveyed households. A total of 1,874 households representing 62.1% agreed that they had maize stocks for their food needs. The next most common food crop consumed was millet where a total of 752 households representing 25.3% confirmed that they had millet in stock for consumption. Third most consumed food crop is sorghum and 299 households (10.1%) had this crop in stock. Fourth food crop recorded is Rice where a total of 55 households (1.9%) agreed to the fact that they had this food crop in stock. Last is beans where a total of 20 households (0.7%) had this food crop in stock.

In discussing food security, the survey also tries to investigate the number of households that are currently experiencing or have experienced food shortages in the last 12 months. This food shortage experience is compared at the regional and the target crop level. Table 11 shows this distribution. From the surveyed sample of 2,974 households, a total 762 households (25.6%) agreed that they experienced food shortages in the course of the year. The reverse was 2,212 households (74.4%) who admitted that they experienced no food shortages in the course of the year.

Table 10: Commonly Consumed Food Crops (Top 5)

Indicator	Region & Target Crop																			
	Koulikoro					Sikasso					Ségou				Overall					
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total	
Commonly consumed Food																				
.Maize	331	21	110	290	752	471	220	27	336	1,054	0	39	2	41	802	280	139	626	1,847	
	93.5	100.0	32.0	86.6	71.4	98.5	66.3	93.1	88.7	86.5	0.0	10.8	0.6	5.9	96.3	39.2	19.6	87.7	62.1	
Millet	11	0	179	12	202	2	52	2	14	70	0	162	318	480	13	214	499	26	752	
	3.1	0.0	52.0	3.6	19.2	0.4	15.7	6.9	3.7	5.8	0.0	44.8	94.1	68.5	1.6	29.9	70.2	3.6	25.3	
Sorghum	7	0	54	25	86	4	53	0	15	72	1	129	11	141	12	182	65	40	299	
	2.0	0.0	15.7	7.5	8.2	0.8	16.0	0.0	4.0	5.9	100.0	35.6	3.3	20.1	1.4	25.5	9.1	5.6	10.1	
Rice	5	0	1	1	7	1	5	0	6	12	0	32	4	36	6	37	5	7	55	
	1.4	0.0	0.3	0.3	0.7	0.2	1.5	0.0	1.6	1.0	0.0	8.8	1.2	5.1	0.7	5.2	0.7	1.0	1.9	
Beans	0	0	0	7	7	0	2	0	8	10	0	0	3	3	0	2	3	15	20	
	0.0	0.0	0.0	2.1	0.7	0.0	0.6	0.0	2.1	0.8	0.0	0.0	0.9	0.4	0.0	0.3	0.4	2.1	0.7	
Total	354	21	344	335	1054	478	332	29	379	1,218	1	362	338	701	833	715	711	714	2,973	
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	

Note: The target crop groups at the column refer to the dominant crops grown by farmers.

Source: Field Data Collected by ISSER and Partners 2016

Table 11: Distribution of Households that Experienced Food Shortages

Indicator	Region & Target Crop																		
	Koulikoro					Sikasso					Ségou				Overall				
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total
Did household experience food shortage																			
Yes (freq.)	65	6	126	60	257	76	155	7	55	293	0	124	88	212	141	285	221	115	762
%	18.4	28.6	36.6	17.9	24.4	15.9	46.7	24.1	14.5	24.0	0.0	34.3	26.0	30.2	16.9	39.9	31.1	16.1	25.6
No (freq.)	289	15	218	275	797	402	177	22	325	926	1	238	250	489	692	430	490	600	2,212
%	81.6	71.4	63.4	82.1	75.6	84.1	53.3	75.9	85.5	76.0	100.0	65.8	74.0	69.8	83.1	60.1	68.9	83.9	74.4
Total (freq.)	354	21	344	335	1,054	478	332	29	380	1,219	1	362	338	701	833	715	711	715	2,974
%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Field Data Collected by ISSER and Partners 2016

In terms of regional distribution of food shortage Table 11 shows that they were more people in the Sikasso region 293 households (24%) as compared to 257 households (24.4%) in the Koulikoro region and 212 households (30.2%) in the Ségou region admitted to experiencing food shortages in the course of the year.

Subsequently the survey weigh households on a hunger scale to know target farmer households that are more or less prone to hunger. Arguably, one of the first steps to effectively addressing food insecurity is to establish reliable methods for measuring it. In the absence of reliable measurement, it is not possible to target interventions appropriately, to monitor and evaluate programs and policies, or to generate lessons learned to improve the effectiveness of these efforts in the future.

This study uses the Household Hunger Scale (HHS) to measure household hunger in food secure areas. The HHS is different from other household food insecurity indicators in that it has been specifically developed and validated for cross-cultural use. This means that the HHS produces valid and comparable results across cultures and settings so that the status of different population groups can be described in a meaningful and comparable way. The HHS is a household food deprivation scale, derived from research to adapt the United States (U.S.) household food security survey module for use in a developing country context and from research to assess the validity of the Household Food Insecurity Access Scale (HFIAS) for cross-cultural use. Table 12 shows the distribution of household susceptibility to hunger by target crops and region.

Table 12 shows that out of the total sample of 2,977 households, about 78.6% of this number were found to be experiencing little or no hunger at all when placed on the hunger scale. A total of 2,342 households made this tally whereas 597 households (20.1%) when assessed on the hunger scale were found to moderately hungry. In terms of households experiencing severe hunger, a total of 39 households (1.3%) through the hunger scale were assessed to be experiencing severe hunger. In terms of regional assessment target crop farmers in the Koulikoro and Sikasso region (18 households representing 1.7 and 1.5% respectively) had the same number of households found to be experiencing severe hunger as compared to that of households in the Ségou region (3 households).



Table 12: Hunger Scale by Target crop and Region

Indicator	Region & Target Crop																		
	Koulikoro					Sikasso					Ségou				Overall				
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total
Hunger Scale																			
Little/No hunger (freq.)	327	8	185	231	751	390	234	28	320	972	1	318	300	619	718	560	513	551	2,342
%	92.1	36.4	53.8	69.0	71.1	81.6	70.3	96.6	84.0	79.6	100.0	87.9	88.8	88.3	86.1	78.1	72.2	77.0	78.6
Moderate Hunger (freq.)	23	14	148	102	287	88	86	1	56	231	0	44	35	79	111	144	184	158	597
%	6.5	63.6	43.0	30.4	27.2	18.4	25.8	3.4	14.7	18.9	0.0	12.2	10.4	11.3	13.3	20.1	25.9	22.1	20.1
Severe hunger (freq.)	5	0	11	2	18	0	13	0	5	18	0	0	3	3	5	13	14	7	39
%	1.4	0.0	3.2	0.6	1.7	0.0	3.9	0.0	1.3	1.5	0.0	0.0	0.9	0.4	0.6	1.8	2.0	1.0	1.3
Total (freq.)	355	22	344	335	1,056	478	333	29	381	1,221	0	362	338	701	833	717	711	716	2,977
%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Field Data Collected by ISSER and Partners 2016

**Table 13: Average Number of Months of Adequate Food Supply**

Indicator and Region	Target Crop				
	Maize	Sorghum	Millet	Cowpea	Overall
Average Number of Months of Adequate Food					
Koulikoro	9	9	11	10	10
Sikasso	11	10	11	11	11
Segou	10	12	11	10	11
Overall	10	11	11	10	11

Source: Field Data Collected by ISSER and Partners 2016

On a whole, a vast majority of households have adequate food for most months of the year. We observed that overall, households in the Koulikoro region reported the lowest number of months of adequate food supply. Also, the lowest average number of months of food adequacy is recorded for Maize and Sorghum farmers in Koulikoro (see Table 13).

### 6.3 Access to Credit and Savings

#### Access to Credit and Savings

Agricultural credit access has particular salience in the context of Malian rural development. Improving local agricultural production and exports is a government policy objective. Recent structural adjustment loans to Mali from the World Bank (World Bank, 2015) have pushed the Malian government to reduce agricultural subsidies and price interventions and let the private control the marketing of the agricultural products. It is therefore important to know the current situation concerning how farmer households obtain credit to run their day to day activities. This section tries to investigate if the first place farmers tried to get credit? Moreover, if they did, where was this credit sought? Also, was this credit request granted? Lastly, if granted what was the credit used for? This section also looks at the saving attitudes of farmers surveyed. The study seeks to understand if savings exist in the first place as well as the channels through which savings are done.

In trying to ascertain whether or not farmers tried to obtain credit the study uses a time period of 12 months to probe into the household if within this period any household member tried to get credit in cash or in kind for any purpose. Table 14 shows the distribution among households in our two study regions who tried to obtain a loan taking into consideration the target crop they cultivated.

Table 14: Distribution of Households that tried to get Credit

	Region & Target Crop																			
Indicator	Koulikoro					Sikasso					Ségou				Overall					
	M a i	S o r	M i l l e	C o	T o t	M a i	S o r	M i l l e	C o	T o t	M a i	S o r	M i l l e	T o t	M a i	S o r	M i l l e	C o	T o t	
Did Household seek Credit																				
Yes	40	6	69	66	181	144	196	17	145	502	0	97	69	166	184	299	155	211	849	
	11.3	28.6	20.1	19.7	17.2	30.1	59.0	58.6	38.2	41.2	0.0	26.8	20.4	23.7	22.1	41.8	21.8	29.5	28.6	
No	314	15	275	269	873	334	136	12	235	717	1	265	269	535	649	416	556	504	2,125	
	88.7	71.4	79.9	80.3	82.8	69.9	41.0	41.4	61.9	58.8	100	73.2	79.6	76.3	77.9	58.2	78.2	70.5	71.5	
Total	354	21	344	335	1054	478	332	29	380	1,219	1	362	338	701	833	715	711	715	2,974	
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	

Source: Field Data Collected by ISSER and Partners 2016

In the next paragraphs the study looks at where the credit was sought. In this case we look at the main channels through which households get credit. For the purposes of this baseline study ten (10) main channels we selected and probed. These are: neighbours, Farmer groups, savings and credit cooperatives (SACCO), commercial banks, and relatives/friends, non-governmental organizations (NGO's) and Micro-Finance Institutions (MFI), agricultural finance corporation (AFC), rural banks, informal money lenders and traders. By anecdotal evidence, these are the main channels where most usually go when seeking credit. Table 15 shows this distribution by region and target crop.

It is seen that among farmers who sought credit most households went to Savings and Credit cooperatives (SACCO) (24.1%) as well as Neighbours (15.4%) when they were in need of some credit. This is not unusual due to the nature of households in the survey. Being small scale farmers they might not usually require huge sums of credit for investments into their agricultural and off-farm activities. In the localities studied, there is a huge presence of farmer group activities so it also not surprising that Farmer groups were the next option where some households (12.5%) sought for credit when the need arose.

The last four options where respondents sought credit are Rural banks and Informal money lenders (1.8%), followed by commercial banks (2.5%) and finally by Traders (3.7%).

Table 16 presents the results on the number of households that got the credit they sought taking into consideration the region and the target crop the household cultivated. Out of the 885 households that sought for loans, about 91% representing about 805 households actually obtained the credit requested. This is not surprising due to the fact that in the Table 15 above we realize that most loans are sought from savings and credit cooperatives (SACCO). Although rare, about 80 (9%) households had their credit applications turned down.

The study goes ahead to ascertain the uses of the credit that was obtained. There were six (6) categories of uses considered; school fees, medical, household consumption, building a house, farming and other purposes. Table 17 shows the distribution of these uses by the region as well as the target crop.



Table 15: Sources of Household Credit by Target Crop and Region

	Region & Target Crop																			
Indicator	Koulikoro					Sikasso					Ségou				Overall					
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total	
Where did household try to get credit																				
Neighbour (freq.)	19	2	7	15	43	11	17	1	25	54	0	20	19	39	30	39	27	40	136	
%	45.2	33.3	9.1	22.4	22.4	7.3	8.4	5.9	16.0	10.3	0	20.6	27.1	23.4	15.5	12.8	16.5	17.9	15.4	
Farmer group (freq.)	2	0	5	1	8	11	36	1	4	52	0	38	13	51	13	74	19	5	111	
%	4.8	0.0	6.5	1.5	4.2	7.3	17.8	5.9	2.6	9.9	0	39.2	18.6	30.5	6.7	24.3	11.6	2.2	12.5	
SACCO (freq.)	13	1	17	22	53	38	64	7	34	143	0	12	5	17	51	77	29	56	21	
%	31.0	16.7	22.1	32.8	27.6	25.2	31.7	41.2	21.8	27.2	0	12.4	7.1	10.2	26.4	25.3	17.7	25.1	24.1	
Commercial bank (freq.)	2	0	1	2	5	6	1	0	7	14	0	3	0	3	8	4	1	9	22	
%	4.8	0.0	1.3	3.0	2.6	4.0	0.5	0.0	4.5	2.7	0	3.1	0.0	1.8	4.2	1.3	0.6	4.0	2.5	
Relative/friend (freq.)	1	0	16	11	28	19	6	2	15	42	0	10	4	14	20	16	22	26	84	
%	2.4	0.0	20.8	16.4	14.6	12.6	3.0	11.8	9.6	8.0	0	10.3	5.7	8.4	10.4	5.3	13.4	11.7	9.5	
NGO/MFI (freq.)	0	0	19	1	20	6	25	0	18	49	0	3	8	11	6	28	27	19	80	
%	0.0	0.0	24.7	1.5	10.4	4.0	12.4	0.0	11.5	9.3	0	3.1	11.4	6.6	3.1	9.2	16.5	8.5	9.0	
AFC (freq.)	0	2	10	1	13	29	28	0	32	89	0	5	6	11	29	35	16	33	113	
%	0.0	33.3	13.0	1.5	6.8	19.2	13.9	0.0	20.5	16.9	0	5.2	8.6	6.6	15.0	11.5	9.8	14.8	12.8	
Rural bank (freq.)	2	1	0	1	4	0	0	0	2	2	0	1	9	10	2	2	9	3	16	
%	4.8	16.7	0.0	1.5	2.1	0	0.0	0.0	1.3	0.4	0	1.0	12.9	6.0	1.0	0.7	5.5	1.4	1.8	
Informal money lender (freq.)	0	0	0	1	1	8	2	4	0	14	0	1	0	1	8	3	4	1	16	
%	0.0	0.0	0.0	1.5	0.5	5.3	1.0	23.5	0.0	2.7	0	1.0	0.0	0.6	4.2	1.0	2.4	0.5	1.8	
Trader (freq.)	2	0	1	8	11	6	4	2	2	14	0	4	4	8	8	8	7	10	33	
%	4.8	0.0	1.3	11.9	5.7	4.0	2.0	11.8	1.3	2.7	0	4.1	5.7	4.8	4.2	2.6	4.3	4.5	3.7	
Other(specify)(freq.)	1	0	1	4	6	17	19	0	17	53	0	0	2	2	18	19	3	21	61	
%	2.4	0.0	1.3	6.0	3.1	11.3	9.4	0	10.9	10.1	0	0.0	2.9	1.2	9.3	6.2	1.8	9.4	6.9	
Total (freq.)	42	6	77	67	192	151	202	17	156	526	0	97	70	167	193	305	164	223	885	
%	100	100	100	100	100	100	100	100	100	100	0	100	100	100	100	100	100	100	100	

Source: Field Data Collected by ISSER and Partners 2016

Table 16: Distribution of Household that obtained Credit requested

	Region & Target Crop																			
Indicator	Koulikoro					Sikasso					Ségou				Overall					
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total	
Did household get credit																				
Yes (freq.)	30	5	74	58	167	137	197	14	147	495	0	82	61	143	167	284	149	205	805	
%	71.4	83.3	96.1	86.6	87.0	90.7	97.5	82.4	94.2	94.1	0.0	84.5	87.1	85.6	86.5	93.1	90.9	91.9	91.0	
No (freq.)	12	1	3	9	25	14	5	3	9	31	0	15	9	24	26	21	15	18	80	
%	28.6	16.7	3.9	13.4	13.0	9.3	2.5	17.7	5.8	5.9	0.0	15.5	12.9	14.4	13.5	6.9	9.2	8.1	9.0	
Total (freq.)	42	6	77	67	192	151	202	17	156	526	0	97	70	167	193	305	164	223	885	
%	100	100	100	100	100	100	100	100	100	100	0	100	100	100	100	100	100	100	100	

Source: Field Data Collected by ISSER and Partners 2016



Table 17: Uses of credit obtained

Indicator	Region & Target Crop																			
	Koulikoro					Sikasso					Ségou				Overall					
	Maiz e	Sorg hum	Millet	Cow pea	Total	Maiz e	Sorg hum	Millet	Cow pea	Total	Maiz e	Sorg hum	Millet	Total	Maiz e	Sorg hum	Millet	Cow pea	Total	
Credit obtained is used for:																				
School fees (freq.)	0	0	0	1	1	3	2	0	2	7	0	0	1	1	3	2	1	3	9	
%	0.0	0.0	0.0	1.6	0.5	2.0	0.9	0.0	1.3	1.3	0.0	0.0	1.6	0.7	1.7	0.7	0.6	1.4	1.0	
Medical (freq.)	3	1	12	15	31	15	16	3	23	57	0	5	5	10	18	22	20	38	98	
%	8.8	20.0	13.6	23.8	16.3	10.1	7.4	21.4	14.7	10.7	0.0	6.0	8.1	6.9	9.9	7.2	12.2	17.4	11.3	
Business (freq.)	5	0	9	7	21	14	5	2	13	34	0	5	5	10	19	10	16	20	65	
%	14.7	0.0	10.2	11.1	11.1	9.5	2.3	14.3	8.3	6.4	0.0	6.0	8.1	6.9	10.4	3.3	9.8	9.1	7.5	
Household consumption (freq.)	4	2	24	15	45	8	37	1	11	57	0	13	22	35	12	52	47	26	137	
%	11.8	40.0	27.3	23.8	23.7	5.4	17.1	7.1	7.1	10.7	0.0	15.7	35.5	24.1	6.6	17.1	28.7	11.9	15.8	
Build a house (freq.)	1	0	1	2	4	0	0	0	0	0	0	0	0	1	1	0	1	2	4	
%	2.9	0.0	1.1	3.2	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.6	0.9	0.5	
Farming (freq.)	16	1	37	14	68	101	136	7	97	341	0	54	20	74	117	191	64	111	483	
%	47.1	20.0	42.1	22.2	35.8	68.2	62.7	50.0	62.2	63.7	0.0	65.1	32.3	51.0	64.3	62.6	39.0	50.7	55.5	
Other (freq.)	5	1	5	9	20	7	21	1	10	39	0	6	9	15	12	28	15	19	74	
%	14.7	20.0	5.7	14.3	10.5	4.7	9.7	7.1	6.4	7.3	0.0	7.2	14.5	10.3	6.6	9.2	9.2	8.7	8.5	
Total (freq.)	34	5	88	63	190	148	217	14	156	535	0	83	62	145	182	305	164	219	870	
%	100	100	100	100	100	100	100	100	100	100	0	100	100	100	100	100	100	100	100	

Source: Field Data Collected by ISSER and Partners 2016

Table 18: Distribution of Households that have Bank Accounts

Indicator	Region & Target Crop																		
	Koulikoro					Sikasso					Ségou				Overall				
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total
Do you have a bank account?																			
Yes (freq.)	17	12	73	62	164	89	144	11	102	346	0	35	29	64	106	191	113	164	574
%	4.8	57.1	21.2	18.5	15.6	18.6	43.4	37.9	26.8	28.4	0.0	9.7	8.6	9.1	12.7	26.7	15.9	22.9	19.3
No (freq.)	337	9	271	273	890	389	188	18	278	873	1	327	309	637	727	524	598	551	2,400
%	95.2	42.9	78.8	81.5	84.4	81.4	56.6	62.1	73.2	71.6	100.0	90.3	91.4	90.9	87.3	73.3	84.1	77.1	80.7
Total (freq.)	354	21	344	335	1,054	478	332	29	380	1,219	1	362	338	701	833	715	711	715	2,974
%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Field Data Collected by ISSER and Partners 2016

Table 19: Distribution of Account locations by Region and Target crop

Indicator	Region & Target Crop																		
	Koulikoro					Sikasso					Ségou				Overall				
Location of Bank Account																			
Commercial bank (freq.)	5	0	3	9	17	11	5	0	5	21	0	7	3	10	16	12	6	14	48
%	25.0	0.0	2.5	12.2	7.5	10.7	3.1	0.0	3.6	5.1	0.0	16.3	10.0	13.7	13.0	5.6	3.7	6.6	6.7
SACCO (freq.)	0	11	34	52	97	64	115	10	54	243	0	19	13	32	64	145	57	106	372
%	0.0	91.7	27.9	70.3	42.5	62.1	71.9	90.9	39.1	59.0	0.0	44.2	43.3	43.8	52.0	67.4	35.0	50.0	52.2
MFI (freq.)	3	0	9	0	12	15	19	0	9	43	0	9	7	16	18	28	16	9	71
%	15.0	0.0	7.4	0.0	5.3	14.6	11.9	0.0	6.5	10.4	0.0	20.9	23.3	21.9	14.6	13.0	9.8	4.3	10.0
Groups (ROSCAs) (freq.)	0	0	13	1	14	2	5	0	7	14	0	1	0	1	2	6	13	8	29
%	0.0	0.0	10.7	1.4	6.1	1.9	3.1	0.0	5.1	3.4	0.0	2.3	0.0	1.4	1.6	2.8	8.0	3.8	4.1
Village bank/Rural (freq.)	0	1	9	1	11	0	4	0	9	13	0	0	0	0	0	5	9	10	24
%	0.0	8.3	7.4	1.4	4.8	0.0	2.5	0.0	6.5	3.2	0.0	0.0	0.0	0.0	0.0	2.3	5.5	4.7	3.4
Phone banking/mobile money (freq.)	12	0	54	11	77	11	12	1	54	78	0	7	7	14	23	19	62	65	169
%	60.0	0.0	44.3	14.9	33.8	10.7	7.5	9.1	39.1	18.9	0.0	16.3	23.3	19.2	18.7	8.8	38.0	30.7	23.7
Total (freq.)	20	12	122	74	228	103	160	11	138	412	0	43	30	73	123	215	163	212	713
%	100	100	100	100	100	100	100	100	100	100	0	100	100	100	100	100	100	100	100

Source: Field Data Collected by ISSER and Partners 2016

Since the study concerned small scale farmers, it is not surprising that the use of credit obtained for farming purposes topped the list of uses. More than half of the households surveyed (459 households) confirmed that the credit they obtained was injected into their farming activities. This was followed by Household consumption (15.8%), Medical (10.9%), Other purposes (8%), Business (4.3%), School fees (0.9%) and finally Building a house (0.5%).

The study now looks at the saving behaviour of the surveyed households in terms of their location and the target crop they cultivated. First, the study tried to investigate the number of households whose members had a bank account. For the purposes of this study a bank account could be held in a corporative. Table 18 shows this distribution of households with bank accounts.

About 574 households representing 19.3% of the survey household population confirmed that they had bank accounts. Although majority of the households (80.7%) do not have bank accounts, this is not unusual due to the localities that were chosen for the survey. Levels of formal education as well as annual income prevent such individuals from using formal financial saving instruments.

Table 19 shows the various locations where the bank accounts are held. Savings and Credit Cooperatives are the most common locations in the survey where farmer households kept their savings. More than half of the respondents, 372 individuals representing 52.2% of people in this category saved with rural banks. Most of these cooperatives due to proximity and security make them the best places to save money.

The second most common place that savings accounts were held was in Mobile money wallets where a total 169 individuals (23.7%) used this channel to keep their savings. It is obvious how this channel is gaining so much grounds as reflected in the number of people using this channel. The last know channel was Village or rural banks (3.4%).

Table 20 shows the distances that individuals have to travel to their various banking points. More often than not a study would be interested in how close or how far individuals have to travel to cash some money from their savings. Usually distance to banking point is a strong incentive for individuals to hold savings accounts in the first place hence the importance of this variable in this study.

Table 20: Distance to Nearest Banking Point

Indicator	Region & Target Crop																			
	Koulikoro					Sikasso					Ségou				Overall					
	Maize	Sorghu m	Millet	Cowpea	Total	Maize	Sorghu m	Millet	Cowpea	Total	Maize	Sorghu m	Millet	Total	Maize	Sorghu m	Millet	Cowpea	Total	
Distance (KM)																				
Less than 5km (freq.)	8	7	76	40	131	19	51	1	43	114	0	21	14	35	27	79	91	83	280	
%	40.0	58.3	62.3	54.1	57.5	18.5	31.9	9.1	31.2	27.7	0.0	48.8	46.7	48.0	22.0	36.7	55.8	39.2	39.3	
5-15km (freq.)	5	0	34	17	56	45	59	5	51	160	0	11	8	19	50	70	47	68	235	
%	25.0	0.0	27.9	23.0	24.6	43.7	36.9	45.5	37.0	38.8	0.0	25.6	26.7	26.0	40.7	32.6	28.8	32.1	33.0	
15-30km (freq.)	2	5	8	12	27	22	36	4	28	90	0	6	3	9	24	47	15	40	126	
%	10.0	41.7	6.6	16.2	11.8	21.4	22.5	36.4	20.3	21.8	0.0	14.0	10.0	12.3	19.5	21.9	9.2	18.9	17.7	
30-50km (freq.)	3	0	3	3	9	13	13	1	11	38	0	3	4	7	16	16	8	14	54	
%	15.0	0.0	2.5	4.1	4.0	12.6	8.1	9.1	8.0	9.2	0.0	7.0	13.3	9.6	13.0	7.4	4.9	6.6	7.6	
Above 50km (freq.)	2	0	1	2	5	4	1	0	5	10	0	2	1	3	6	3	2	7	18	
%	10.0	0.0	0.8	2.7	2.2	3.9	0.6	0.0	3.6	2.4	0.0	4.7	3.3	4.1	4.9	1.4	1.2	3.3	2.5	
Total (freq.)	20	12	122	74	228	103	160	11	138	412	0	43	30	73	123	215	163	212	713	
%	100	100	100	100	100	100	100	100	100	100	0	100	100	100	100	100	100	100	100	

Source: Field Data Collected by ISSER and Partners 2016

Table 21: Large Agricultural Asset Ownership by Region and Crop

Indicator	Region & Target Crop																		
	Koulikoro					Sikasso					Ségou				Overall				
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total
Number of Large Agric. Assets owned																			
None (freq.)	100	3	93	64	260	121	74	5	58	258	0	137	185	322	221	214	283	122	840
%	28.3	14.3	27.0	19.1	24.7	25.3	22.3	17.2	15.3	21.2	0.0	37.9	54.7	45.9	26.5	29.9	39.8	17.1	28.2
At least One (freq.)	254	18	251	271	794	357	258	24	322	961	1	225	153	379	612	501	428	593	2,134
%	71.8	85.7	73.0	80.9	75.3	74.7	77.7	82.8	84.7	78.8	100.0	62.2	45.3	54.1	73.5	70.1	60.2	82.9	71.8
Total (freq.)	354	21	344	335	1,054	478	332	29	380	1,219	1	362	338	701	833	715	711	715	2,974
%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Field Data Collected by ISSER and Partners 2016

More than a third of the surveyed farmers for this category (38.8%) have their saving accounts located between 5 and 15 kilometres from where they live. This is followed by those who have theirs located less than 5 kilometres from their residence which makes up about 27.7% of the individual possessing savings accounts. Individuals who had saving accounts located between 30 and 50 kilometres made up 21.8% and last was those who had their savings institutions located 50 kilometres or more away from their homes (9.2%).

#### **6.4 Household Assets**

Assets are key determinants of household welfare. Ownership or access to a range of assets determines to a large extent the livelihood strategies of poor rural households and whether they manage to stay or get out of poverty. In agriculture, the combination of assets endowments and access to agrarian institutions is crucial in forming the incentives faced by agricultural households and their ability to respond to changes in markets and policy. This is why a sizeable share of the agricultural economics literature, particularly of that concerned with developing regions, is devoted to the study of issues in wealth and asset creation for farmer households (Zezza, et al., 2007).

For the purposes of this study we group assets into four (4) main categories namely; Large Mechanized Agricultural Assets, Small Agricultural Assets, Large Household Assets and Small Household items. Large Agricultural Assets comprise items such as Animal traction, Harrows, Planters, power saws, etc. whereas Small household assets are made up of Chaff cutters, hammers, wheel barrow etc. On the other hand large household assets comprise Bicycles/Motorcycles, Computers, Houses etc. Table 21 to Table 23 below show the distribution ownership of household assets by region and target crop.

For Large agricultural assets close to a third of the households surveyed made up of about 840 households (28%) had none of these assets in their households as compared to 2,134 households who confirmed that they had at least one of such items in their household. Table 21 shows this ownership distribution by target crop and region.

Table 22 on the other hand shows the distribution of the number of households who own Large Household Assets and those who do not. About 16% of the households surveyed had large household asset in their homes. On the other hand, majority 83.9% of households had no Large household asset in their possession.

Table 22: Large Household Asset Ownership by Region and Crop

Indicator	Region & Target Crop																		
	Koulikoro					Sikasso					Ségou					Overall			
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total
No of Large HH Assets owned																			
None (freq.)	57	3	41	47	148	81	40	6	52	179	0	65	86	151	138	108	133	99	478
%	16.1	14.3	11.9	14.0	14.0	17.0	12.1	20.7	13.7	14.7	0.0	18.0	25.4	21.5	16.6	15.1	18.7	13.9	16.1
At least One (freq.)	297	18	303	288	906	397	292	23	328	1,040	1	297	252	550	695	607	578	616	2,496
%	83.9	85.7	88.1	86.0	86.0	83.1	88.0	79.3	86.3	85.3	100.0	82.0	74.6	78.5	83.4	84.9	81.3	86.2	83.9
Total (freq.)	354	21	344	335	1,054	478	332	29	380	1,219	1	362	338	701	833	715	711	715	2,974
%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Field Data Collected by ISSER and Partners 2016

Table 23: Small household Asset Ownership by Region and Crop

Indicator	Region & Target Crop																		
	Koulikoro					Sikasso					Ségou				Overall				
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total
No of Small HH Assets owned																			
None (freq.)	69	1	101	56	227	177	94	4	87	362	0	149	186	335	246	244	291	143	924
%	19.5	4.8	29.4	16.7	21.5	37.0	28.3	13.8	22.9	29.7	0.0	41.2	55.0	47.8	29.5	34.1	40.9	20.0	31.1
At least One (freq.)	285	20	243	279	827	301	238	25	293	857	1	213	152	366	587	471	420	572	2,050
%	80.5	95.2	70.6	83.3	78.5	63.0	71.7	86.2	77.1	70.3	100.0	58.8	45.0	52.2	70.5	65.9	59.1	80.0	68.9
Total (freq.)	354	21	344	335	1,054	478	332	29	380	1,219	1	362	338	701	833	715	711	715	2,974
%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Field Data Collected by ISSER and Partners 2016

Lastly for Small household assets about a third of the households surveyed made up of about 924 households (31.1%) had none of such assets in their households as compared to 2,050 households (68.9%) who confirmed that they had at least one of such items in their household. Table 23 shows this ownership distribution by target crop and region.

## 6.5 Housing Characteristics

In this section we discuss the household features encountered during the baseline study. This will enable readers appreciate the nature of the localities visited during the survey. One of the three basic needs of humanity aside food and clothing is shelter. A great deal of the household activities takes place in the home. The household structure serves as a place of sleeping for household members, receiving visitors, resting, cooking and as a shelter for farm animals where applicable. For households with sizeable compounds it also serves as playground for children. Other sub-structures such as toilet facilities are also essential for the comfort and sanitary conditions of the home. This section discusses rents and rental arrangements of the households, dwelling structure and amenities and utilities.

For the purposes of this study there are four main occupancy statuses that a household may possess in relation the dwelling in which they live. The household may own, rent, ownership by relative or some other type of ownership. Across the Koulikoro, Sikasso and Segou localities most of the households own the dwelling in which they live, a total of 89%. However, slightly more Sikasso households (1,094) as compared to the Koulikoro households (915) and Segou households (635) own the dwelling in which they live. Other occupancy status was on the low side and accounted for about 0.7% of the sample (See Table 24).



Table 24: Distribution of Ownership Status by Region and Target Crop

Indicator	Region & Target Crop																		
	Koulikoro					Sikasso					Ségou				Overall				
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total
<b>Ownership Arrangements</b>																			
Owned (freq.)	313	17	316	269	915	441	275	21	357	1094	1	318	316	635	755	610	653	626	2644
%	88.4	81.0	91.9	80.3	86.8	92.3	82.8	72.4	94.0	89.8	100.0	87.9	93.5	90.6	90.6	85.3	91.8	87.6	88.9
Rented (freq.)	0	0	1	7	8	2	6	0	3	11	0	1	0	1	2	7	1	10	20
%	0.0	0.0	0.3	2.1	0.8	0.4	1.8	0.0	0.8	0.9	0.0	0.3	0.0	0.1	0.2	1.0	0.1	1.4	0.7
Owned by relative (freq.)	38	4	21	59	122	33	49	8	18	108	0	39	18	57	71	92	47	77	287
%	10.7	19.1	6.1	17.6	11.6	6.9	14.8	27.6	4.7	8.9	0.0	10.8	5.3	8.1	8.5	12.9	6.6	10.8	9.7
Other(specify)(freq.)	3	0	6	0	9	2	2	0	2	6	0	4	4	8	5	6	10	2	23
%	0.9	0.0	1.7	0.0	0.9	0.4	0.6	0.0	0.5	0.5	0.0	1.1	1.2	1.1	0.6	0.8	1.4	0.3	0.8
Total (freq.)	354	21	344	335	1054	478	332	29	380	1219	1	362	338	701	833	715	711	715	2974
%	100	100	100	100	100	100	100	100	100	100	100	100.0	100	100	100	100	100	100	100

Source: Field Data Collected by ISSER and Partners 2016

Table 25: Distribution of roofing types by region and target crop

Indicator	Region & Target Crop																		
	Koulikoro					Sikasso					Ségou				Overall				
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total
<b>Type of Roofing</b>																			
Grass/thatch	15	7	133	27	182	66	45	8	27	146	0	66	127	193	81	118	268	54	521
%	4.2	33.3	38.7	8.1	17.3	13.8	13.6	27.6	7.1	12.0	0.0	18.2	37.6	27.5	9.7	16.5	37.7	7.6	17.5
Iron sheet	320	11	182	282	795	407	212	21	344	984	1	155	83	239	728	378	286	626	2018
%	90.4	52.4	52.9	84.2	75.4	85.2	63.9	72.4	90.5	80.7	100.0	42.8	24.6	34.1	87.4	52.9	40.2	87.6	67.9
Tiles	5	3	8	13	29	3	0	0	0	3	0	2	14	16	8	5	22	13	48
%	1.4	14.3	2.3	3.9	2.8	0.6	0.0	0.0	0.0	0.3	0.0	0.6	4.1	2.3	1.0	0.7	3.1	1.8	1.6
Other	14	0	21	13	48	2	75	0	9	86	0	139	114	253	16	214	135	22	387
%	4.0	0.0	6.1	3.9	4.6	0.4	22.6	0.0	2.4	7.1	0.0	38.4	33.7	36.1	1.9	29.9	19.0	3.1	13.0
Total	354	21	344	335	1054	478	332	29	380	1219	1	362	338	701	833	715	711	715	2974
%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Field Data Collected by ISSER and Partners 2016

The roofing materials in a household also talks about an individual's standard of living. In this study we categorize the type of roofing into grass or thatch, Iron sheets and tiles. In the study more than about 67% of the households surveyed were roofed with iron sheets. Although quite outmoded, 17.5% of households surveyed were roofed with grass or thatch. Roofing tiles are much more exquisite and expensive for the households surveyed. This is reflective on the number of people who are using this roofing type. Only 48 households confirmed that they used this kind of roof (1.6%).

The situation and distance of sources of water for household consumption is a crucial factor in determining how much time households can allocate to other household chores especially when it comes to fetching water for drinking and for general use in the dry season. The average distance in kilometres to the source of water from household dwelling is consistently lower in the Segou localities than the Koulikoro and Sikasso localities for both drinking and general use water. Koulikoro and Sikasso dwellers on average must in the dry season travel 0.33 km and 0.30 km to get to their drinking water and general use water respectively. In terms of target crop farmers in the Sikasso region, maize farmers travel the most, about 0.38 km in search of water in the dry season whereas in the Koulikoro region millet farmers travel the most, about 1.33 km in the dry season in search of water. Table 26 below shows this distribution.

**Table 26: Average distance in KM to water source in the Dry season by Target Crop and Region**

Region	Target Crops				
	Maize	Sorghum	Millet	Cowpea	Total
Sikasso	0.4	0.1	0.2	0.3	0.3
Koulikoro	0.4	0.1	1.3	0.4	0.3
Ségou	-	0.2	0.1	-	0.2
Overall	0.4	0.1	0.2	0.4	0.3

Source: Field Data Collected by ISSER and Partners 2016

One other important element for a complete household is water for drinking and for general use. Different households used different sources as their main source of water supply. In the dry seasons Wells as a source of domestic water is used in general by about 60% of households and based on the regional divide serves an average of 62.4% of dwellers in the Koulikoro region, 57.8% in the Sikasso region and 51.6% of Segou folks in Mali (see Table 27).

Table 27: Distribution of water sources during the Dry Season

Indicator	Koulikoro					Sikasso					Ségou					Overall				
	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Cowpea	Total	Maize	Sorghum	Millet	Total	Maize	Sorghum	Millet	Cowpea	Total	
Water Sources																				
Pond (freq.)	0	0	3	0	3	2	0	0	4	6	0	1	1	2	2	1	4	4	11	
%	0.0	0.0	0.9	0.0	0.3	0.4	0.0	0.0	1.1	0.5	0.0	0.3	0.3	0.3	0.2	0.1	0.6	0.6	0.4	
Dam/sand dam (freq.)	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2	0	2	
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.3	0.0	0.0	0.3	0.0	0.1	
Stream/river (freq.)	0	0	16	1	17	2	0	0	0	2	0	0	1	1	2	0	17	1	20	
%	0.0	0.0	4.7	0.3	1.6	0.4	0.0	0.0	0.0	0.2	0.0	0.0	0.3	0.1	0.2	0.0	2.4	0.1	0.7	
Unprotected spring (freq.)	1	0	2	1	4	1	0	0	1	2	0	15	16	31	2	15	18	2	37	
%	0.3	0.0	0.6	0.3	0.4	0.2	0.0	0.0	0.3	0.2	0.0	4.1	4.7	4.4	0.2	2.1	2.5	0.3	1.2	
Protected spring (freq.)	3	0	13	3	19	25	3	12	21	61	0	27	30	57	28	30	55	24	137	
%	0.9	0.0	3.8	0.9	1.8	5.2	0.9	41.4	5.5	5.0	0.0	7.5	8.9	8.1	3.4	4.2	7.7	3.4	4.6	
Well (freq.)	218	17	187	236	658	211	269	16	209	705	1	215	200	416	430	501	403	445	1779	
%	61.6	81.0	54.4	70.5	62.4	44.1	81.0	55.2	55.0	57.8	100.0	59.4	59.2	59.3	51.6	70.1	56.7	62.2	59.8	
Borehole (freq.)	91	1	39	43	174	169	44	1	90	304	0	82	60	142	260	127	100	133	620	
%	25.7	4.8	11.3	12.8	16.5	35.4	13.3	3.5	23.7	24.9	0.0	22.7	17.8	20.3	31.2	17.8	14.1	18.6	20.9	
Piped into compound(freq.)	0	0	0	0	0	1	2	0	0	3	0	7	6	13	1	9	6	0	16	
%	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.0	0.0	0.3	0.0	1.9	1.8	1.9	0.1	1.3	0.8	0.0	0.5	
Piped outside com(freq.)	15	3	83	37	138	28	13	0	14	55	0	12	16	28	43	28	99	51	221	
%	4.2	14.3	24.1	11.0	13.1	5.9	3.9	0.0	3.7	4.5	0.0	3.3	4.7	4.0	5.2	3.9	13.9	7.1	7.4	
Other(specify)(freq.)	26	0	1	14	41	39	1	0	41	81	0	3	6	9	65	4	7	55	131	
%	7.3	0.0	0.3	4.2	3.9	8.2	0.3	0.0	10.8	6.6	0.0	0.8	1.8	1.3	7.8	0.6	1.0	7.7	4.4	
Total (freq.)	354	21	344	335	1054	478	332	29	380	1219	1	362	338	701	833	715	711	715	2974	
%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	

Source: Field Data Collected by ISSER and Partners 2016

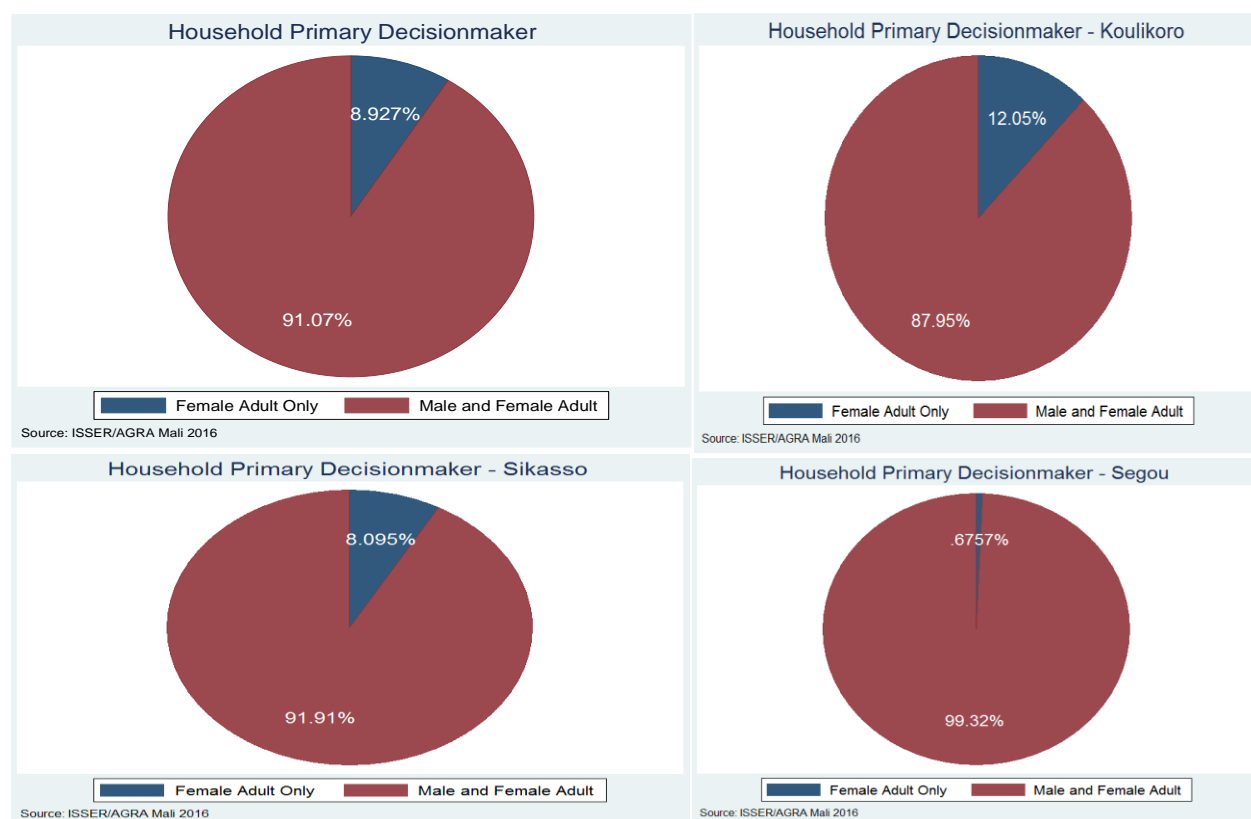
## 7 Women Empowerment in Agriculture Index

This section assesses the welfare of women in terms of empowerment in household production and decision-making, as well as their food security as defined by meal diversity.

### 7.1 Decision-making and Empowerment

This analysis of women empowerment in the household is adapted from the Women Empowerment in Agriculture Index, initially developed by the USAID 'Feed the Future' initiative (2012). The original WEAI looks at five domains, namely: production, income, resources, leadership and time use (or workload). In this survey, the WEAI is adapted to consider production, income and leadership quantitatively and examine time use qualitatively. For the resource domain, both household asset ownership and credit use were originally combined to rate resource use, but in this survey, we were only interested in asset use and ownership. In keeping with the proposed analysis of the indices, the section will look at the overall state of empowerment along gender lines for self-identified primary and secondary respondents in a household, as defined by adults involved in decision-making. Majority of the households have both male and female as decision-makers, accounting for 92.7% overall, 88.0% for Koulikoro, 91.9% for Sikasso and 99.3% for Segou (see Figure 3).

**Figure 3: Household Decision-Making Structure**



An individual's adequacy for each domain is weighted to create an ad-hoc empowerment index. Adequacy is defined in the following ways:

- Production decisions: Individual is adequate if they gave some input into at least 2 particular farm production activity that they and the household were involved in or felt to a medium extent that they could make decisions if they wanted to, over the past twelve months. Farm production refers to food crop farming, cash crop farming, livestock raising and fishing or fishpond culture.
- Income decisions: Individual is adequate if they gave some input into the decision regarding use of income generated from at least one of both farm and non-farm activities.
- Resource decisions: Individual is adequate if they felt they had sole or joint ownership of at least one household asset that was not a minor asset such as fowls, non-mechanized farm equipment and small consumer durables.
- Leadership: Individual is adequate if they felt that they were comfortable speaking in public in at least one setting within the community.
- Time use (workload): This dimension concerns the allocation of time to productive and domestic tasks and satisfaction with available time for leisure activities

In Table 28, the level of individual empowerment is highlighted for each of the domains for men and women in each region. It is observed that for all domains, men are more empowered than women are. The smallest gap is recorded for the resource decision domain in all regions, while the largest gap is recorded for empowerment in production decisions. Koulikoro recorded the largest empowerment gap for leadership (30.8%). For production decision-making, Sikasso recorded the largest gender empowerment gap (55.5%). Segou recorded the largest gaps in two domains; income and resource ownership and decisions, 37.7% and 21.1% respectively.

**Table 28: Individual empowerment for each domain**

Indicator & Region	Target Crop & Sex									
	Maize		Sorghum		Millet		Cowpea		Overall	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
<b>Koulikoro (%)</b>										
Production	42.3	3.2	52.6	14.3	60.7	7.6	46.8	2.3	49.8	5.2
Income	93.1	54.0	100.0	85.7	97.0	69.3	96.4	65.2	95.5	64.7
Resources	99.7	100.0	100.0	100.0	100.0	100.0	100.0	97.6	99.9	98.6
Leadership	80.8	40.0	84.2	0.0	91.5	40.0	84.4	53.7	85.4	46.6
<b>Sikasso (%)</b>										
Production	70.5	27.0	75.5	1.8	85.7	25.0	78.5	24.3	74.7	19.2
Income	93.2	77.8	97.3	54.0	100.0	25.0	97.6	76.8	95.8	70.6
Resources	100.0	100.0	99.7	100.0	100.0	100.0	100.0	100.0	99.9	100.0
Leadership	86.5	54.6	87.9	100.0	89.3	100.0	90.0	70.0	88.0	65.2
<b>Segou (%)</b>										
Production	-	-	60.4	7.0	54.7	4.9	-	-	57.7	6.0
Income	-	-	88.4	56.8	90.9	46.1	-	-	89.6	51.9
Resources	-	-	100.0	83.3	100.0	100.0	-	-	100.0	88.9
Leadership	-	-	82.6	66.7	89.0	66.7	-	-	85.7	66.7

Source: Field Data Collected by ISSER and Partners 2016

An Empowerment index was designed as an average of adequacy in the four selected domains, with a minimum of zero for no empowerment and one for complete empowerment.

In Table 29 below, we observe that more men than women are recorded as primary or secondary household members in terms of decision-making Sikasso records the highest number of male respondents (1,213), while Segou records the lowest (714). In the case of female respondents, who identify as primary or secondary decision makers, Koulikoro recorded the largest number (501), while Segou recorded the lowest (428).

Overall, empowerment index values are about 20% higher for men than for women in all three regions. The highest average empowerment index was recorded by males in Sikasso (0.9). Respondents are further defined as empowered with two key cut-off points.

- (1) An empowerment index of at least .75, indicating empowerment in three domains or more.
- (2) Empowerment in at least production and income decisions.

The gender empowerment gap for (1) is lower than that of (2), indicating that the difference between percentage of men and women satisfying criteria (1) is less than that of criteria (2). Women are less empowered in economic activity, namely production and income use in the household, even though more women satisfied (1). Similar trends are observed at crop level for each region, except for overall empowerment in sorghum and millet households in Koulikoro.

**Table 29: Gender differences in Empowerment Index**

Indicator & Region	Target Crop & Sex									
	Maize		Sorghum		Millet		Cowpea		Overall	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
<b>Average Empowerment Index</b>										
Koulikoro	0.8	0.6	0.8	0.6	0.9	0.6	0.8	0.6	0.8	0.6
Sikasso	0.9	0.5	0.9	0.8	0.9	1.0	0.9	0.8	0.9	0.7
Segou	-	-	0.8	0.5	0.8	0.7	-	-	0.8	0.6
<b>Number of observations</b>										
Koulikoro	364	124	19	7	328	238	301	132	1012	501
Sikasso	482	126	331	113	28	4	372	185	1213	428
Segou	-	-	371	199	342	165	-	-	714	364
<b>% empowered</b>										
Koulikoro	84.1	96.8	89.5	85.7	94.2	92.9	87.4	84.1	88.4	91.4
Sikasso	89.4	95.2	94.9	100.0	96.4	100.0	96.5	99.5	93.2	98.4
Segou	-	-	85.2	97.0	88.3	99.4	-	-	86.7	98.1
<b>% empowered in production and income</b>										
Koulikoro	42.3	3.2	52.6	14.3	60.7	7.6	46.8	2.3	49.8	5.2
Sikasso	70.5	27.0	75.2	1.8	85.7	25.0	78.0	24.3	74.4	19.2
Segou	-	-	60.4	7.0	54.7	4.9	-	-	57.7	6.0

Source: Field Data Collected by ISSER and Partners 2016

## 7.2 Women's Dietary Diversity

Another indicator used to assess women empowerment in households is their dietary diversity score. In many homes, dietary diversity is influenced by age and sex of household members, as these are traditionally indicators of economic contribution to the household, as such, determinants of nutritional requirement. Women in the households, aged 15 and above, were asked to identify the food groups that each had consumed in the past 24 hours. The dietary diversity measure, modelled after the USAID Household Dietary Diversity Score (HDDS)<sup>6</sup>, looks at a sum of the number of food groups consumed by each individual, categorised as:

- |                        |                          |
|------------------------|--------------------------|
| - Cereals              | - Fish and seafood       |
| - Root and tubers      | - Pulses/legumes/nuts    |
| - Vegetables           | - Milk and milk products |
| - Fruits               | - Oil/fats               |
| - Meat, poultry, offal | - Sugar/honey            |
| - Eggs                 | - Miscellaneous          |

In this case, the score recorded by each female adult member was averaged for the household. In Table 30 below, we observe that on average, women consume a little less than half of the listed food groups (5.0 groups). This score is only slightly higher for households sampled from Sikasso at 5.1 and lowest for households sampled from Koulikoro (4.8). Millet-growing households record the highest score in Sikasso (6.6).

The table also shows the share of households in which women on average consume at least six of the twelve food categories daily. Overall, 35.6 percent of households have a women's dietary diversity score of six and above. This share is largest for Sikasso households (37.8%) and lowest for Segou households (31.1%). When investigated by target crops, we find the largest share of households with women's dietary diversity score over six in millet-growing households in Sikasso.

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<sup>6</sup> Swindale, A., Bilinsky, P., Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access: Indicator Guide VERSION 2, September 2006, Food and Nutrition Technical Assistance III Project (FANTA), USAID

Table 30: Household women's dietary diversity score, distributed by region and target crop

Region & Target Crop	Indicator		
	Dietary Diversity Score(from 0-12)	% of HHs with women consuming at least 50% of food groups	Number of Observations
<b>Koulikoro</b>			
Maize	4.8	39.4	338
Sorghum	5.1	38.1	21
Millet	4.7	33.5	337
Cowpea	4.9	34.8	325
Total	4.8	36.0	1021
<b>Sikasso</b>			
Maize	5.3	42.5	468
Sorghum	4.8	29.0	321
Millet	6.6	75.9	29
Cowpea	5.1	36.4	371
Total	5.1	37.8	1189
<b>Segou</b>			
Sorghum	5.1	35.3	354
Millet	4.7	26.6	323
Total	4.9	31.1	678
<b>Overall</b>			
Maize	5.1	41.1	807
Sorghum	5.0	32.5	696
Millet	4.8	32.1	689
Cowpea	5.0	35.6	696
Total	5.0	35.6	2,888

Source: Field Data Collected by ISSER and Partners 2016



## 8 Agricultural Production and Input Access

Agricultural production remains the major economic activity for households in the study regions. In this section, we provide a discussion of the baseline characteristics of households on various farm production activities and outcomes. The figures for the key indicators reported in this section generally relate to the main 2016 farming season.

### 8.1 Plot Characteristics and Soil Quality

We find that a relatively higher proportion of households (31.9%) cultivated 2 farm plots in the main 2016 farming season. Overall, only 13.1% of households were cultivating more than 3 plots. Comparing the number of plots cultivated by households across the study regions, we find that households in the Segou and Sikasso regions generally cultivated a relatively higher number of plots compared to their counterparts in the Koulikoro region.

Plot measurements were recorded in two main ways. First, farmers reported the area covered by each piece of cultivated land. The second method was a satellite-recorded area, using the Milano Innovancy's logging devices to measure the main plot of a third of the sampled households (about 1,000 households). The aim of this activity was to compare and observe the differences between farmers' reported and actual plot sizes. In the case for Mali, the ratio (correction factor) of the farmer-reported to actual plot sizes was 1.5, implying that actual plot sizes were smaller than those reported by farmers. As such, an adjusted plot size was computed for each plot by dividing the farmer-reported areas by the correction factor of 1.5.

On the mean cultivated area per target crop, we reported the farmer reported mean cultivated areas (unadjusted) and the logger-corrected mean cultivated areas (adjusted). As indicated earlier, the logger-corrected mean cultivated areas were computed from a correction factor generated comparing logger-measured and farmer reported farm sizes. The unadjusted mean cultivated plot size for all crops combined is 6.5 hectares, with Maize and Sorghum recording the largest (5.9 Ha) and the smallest (1.9 Ha) mean cultivated plot sizes respectively. We observed that the logger-corrected plot sizes are relatively smaller compared to the farmer reported (unadjusted) plot sizes. This means that farmers generally over-estimate their farm sizes. The study also sought to gather information on farmer's perception of the quality of soil on farm plots they currently cultivate. We find that more than a half of households rated the soil quality as at least good. Comparing farmers' perception of their soil quality across region, it is evident that a greater proportion of households in the Sikasso region pointed more to a generally good soil quality compared to those in the other 2 regions (See Table 31).

Table 31: Plot Characteristics and Soil Quality by Region

Indicator	Region				
	Koulikoro	Sikasso	Segou	Overall	N
<b>% of households cultivating:</b>					
1 plot	31.6	37.9	17.7	30.9	2,977
2 plots	37.8	22.4	39.5	31.9	2,977
3 plots	21.6	26.7	23.1	24.1	2,977
4+ plots	9.0	12.9	19.7	13.1	2,977
Mean number of plots	2	2	2	2	2,977
<b>Mean cultivated area by crop (Ha):</b>					
Maize	11.3(7.3)	2.9(2.0)	1.7(1.1)	5.9(3.9)	1,885
Sorghum	2.9(1.9)	2.1(1.4)	2.5(1.7)	2.5(1.6)	1,316
Millet	7.2(4.3)	2.2(1.5)	4.0(2.7)	4.6(3.0)	1,536
Cowpea	5.1(3.3)	2.1(1.3)	1.3(0.7)	3.1(1.9)	1,090
Mean total plot size (Ha)	10.2(5.5)	4.7(3.3)	3.9(2.4)	6.5(3.8)	2,960
<b>% of households indicating soil quality is:</b>					
Very Good	12.9	11.6	5.9	10.5	2,977
Good	45.4	52.5	49.0	49.2	2,977
Average	27.3	24.5	28.9	26.6	2,977
Poor	12.0	10.4	15.0	12.2	2,977
Very Poor	2.4	1.0	1.2	1.5	2,977

Note: Values in parenthesis are the logger-adjusted mean cultivated plot sizes.

Source: Field Data Collected by ISSER and Partners 2016

We find that a higher proportion of households selected for Sorghum generally reported a relatively higher number of cultivated plots (3 and more plots) compared to their counterparts selected for the other target crop groups. It is observed that households selected for Maize reported a comparatively larger cultivated area for all crops (11.2 Ha) compared to their counterparts selected for the other target crops. On a scale, we find that a relatively higher proportion of households selected for Maize reported a generally good soil quality compared to their cohorts selected for the other target crops (see Table 32).

Table 32 Plot Characteristics and Soil Quality by Target Crop Groups

Indicator	Target Crop Group					N
	Maize	Sorghum	Millet	Cowpea	Overall	
% of households cultivating:						
1 plot	53.4	6.1	29.3	31.2	30.9	2,977
2 plots	34.3	28.6	40.4	24.0	31.9	2,977
3 plots	8.2	41.4	18.1	31.0	24.1	2,977
4+ plots	4.1	23.9	12.2	13.8	13.1	2,977
Mean number of plots	2	3	2	2	2	2,977
Mean cultivated area by crop (Ha):						
Maize	8.8(5.5)	1.9(1.3)	2.7(1.8)	6.2(4.1)	5.9(3.9)	1,885
Sorghum	2.3(1.5)	2.4(1.6)	2.3(1.6)	2.7(1.8)	2.5(1.6)	1,316
Millet	15.0(9.6)	2.8(1.9)	3.8(2.5)	3.7(2.4)	4.6(3.0)	1,536
Cowpea	2.8(1.7)	1.1(0.6)	1.3(0.8)	4.1(2.6)	3.1(1.9)	1,090
Mean total plot size (Ha)	11.2(6.5)	3.7(2.4)	4.0(2.6)	6.2(4.3)	6.5(3.8)	2,960
% of households indicating soil quality is:						
Very Good	20.5	4.8	7.2	12.6	10.5	2,977
Good	52.7	48.0	49.7	47.5	49.2	2,977
Average	20.2	29.8	29.0	25.6	26.6	2,977
Poor	5.6	15.8	12.3	12.9	12.2	2,977
Very Poor	0.9	1.6	1.8	1.6	1.5	2,977

Note: Values in parenthesis are the logger-adjusted mean cultivated plot sizes. The target crop groups at the column refer to the dominant crops grown by farmers.

Source: Field Data Collected by ISSER and Partners 2016

## 8.2 Farm Labour

Table 33 shows the man-days and well as relative proportions of various categories of labour used during the main 2016 farming season. We find that overall, the mean total man-days used per hectare is 97 man-days. Among the three (3) labour categories, family labour provided the highest man-days per hectare (89 man-days) whilst hired and communal labour provided the least man-days per hectare (4 man-days each). Except for communal labour, we observed that households in the Segou region generally reported higher man-days per hectare for all the categories of labour compared to their counterparts in the other study regions. We make a similar observation for the man-days per hectare of the various categories of labour with exception to hired labour. Overall, the share of family labour in total farm labour is 81.3%, followed by hired labour (9.6%), and communal labour (9.1%). Also, the share of female labour in total family labour is 16.2%, with households in the Segou region reporting a relatively higher share of female labour in total family labour (16.0%).

Further, we observe in Table 34 that households selected for Sorghum reported higher total man-days used on plot per hectare (122 man-days) compared to those selected for the other target crops. This observation holds for the various categories of labour, except for communal labour.

**Table 33: Farm Labour by Region**

Indicator	Region				
	Koulikoro	Sikasso	Segou	Overall	N
Per hectare total man-days used on the farm	105	74	127	97	2,977
Per hectare family man-days used on the farm	98	70	109	89	2,977
Per hectare hired man-days used on the farm	1	2	14	4	2,977
Per hectare communal man-days used on the farm	6	2	3	4	2,977
Share of family labour in total farm labour (%)	84.7	79.2	79.9	81.3	2,977
Share of hired labour in total farm labour (%)	4.6	10.8	14.9	9.6	2,977
Share of communal labour in total farm labour (%)	10.7	9.9	5.3	9.1	2,977
Share of female labour in total family farm labour (%)	11.0	20.9	16.0	16.2	2,977

Source: Field Data Collected by ISSER and Partners 2016

**Table 34 Farm Labour by Target Crop Group**

Indicator	Target Crop Group				
	Maize	Sorghum	Millet	Cowpea	Overall
Per hectare total man-days used on the farm	83	122	95	92	97
Per hectare family man-days used on the farm	78	106	89	85	89
Per hectare hired man-days used on the farm	1	13	3	1	4
Per hectare communal man-days used on the farm	4	3	3	6	4
Share of family labour in total farm labour (%)	80.3	80.7	79.6	84.9	81.3
Share of hired labour in total farm labour (%)	8.3	12.1	12.7	5.5	9.6
Share of communal labour in total farm labour (%)	11.4	7.3	7.8	9.6	9.1
Share of female labour in total family farm labour (%)	14.5	20.7	13.1	16.8	16.2

Source: Field Data Collected by ISSER and Partners 2016

### 8.3 Chemical Use

The use of agro-chemicals in crop production are becoming increasingly crucial, given the growing incidence of pest and disease infestations in farm production. Measuring households' access to, and use of chemicals in crop production, we observed from Table 35 that overall, a considerably high proportion of households (80.5%) used chemical inputs (in the form of fertilizers and herbicides) in the main 2016 farming season. We particularly note that a relatively higher proportion of households in the Sikasso region (94.1%) reported chemical use compared to those in the other regions. Overall, 50.4% of farm households in the study regions used inorganic fertilizers in the main 2016 farming season. Across region, we find that a relatively higher proportion of households (52.6%) in the Segou region used inorganic fertilizers relative to households in the other 2 study regions. We find that the mean expenditure on all chemicals was US\$168.31, fertilizer is US\$98.61 and herbicides/weedicides is US\$98.61. Overall, households in the Sikasso region reported a comparatively higher expenditure on chemicals.

The mean quantity of fertilizer used by the average household was 173.6Kg, that for herbicides/weedicides was 43.1 litres. Overall, the unadjusted mean quantity of fertilizer used per a hectare of farm is 13.4 Kg/Ha, and herbicides used per hectare is 3.3 litres per hectare. Using the logger-corrected plot sizes computed using a correction factor of 1.5, we report the adjusted mean fertilizer used per hectare and adjusted mean herbicides used per hectare in parenthesis in the table that follows. We observed that the adjusted mean fertilizer used per hectare and the adjusted mean herbicide used per hectare are generally higher than their unadjusted values. We identify that the most common source of chemicals for households in the sample is the Market (38.9%). A significant proportion of households also sourced chemicals from Agro-dealers (25.9%) and Organisations (24.4%).

Table 35 Chemicals Use by Region

Indicators	Region				
	Koulikoro	Sikasso	Segou	Overall	N
% of households using chemicals (i.e. fertilizers, weedicides, pesticides)	76.1	94.1	63.5	80.5	2,977
% of households using inorganic fertilizer	48.1	51.1	52.6	50.4	2,977
Mean expenditure on chemicals (US\$)	160.62	198.71	80.80	168.31	6611
Mean expenditure on inorganic fertilizers (US\$)	153.76	82.66	50.31	98.61	3614
Mean expenditure on herbicides/weedicides (US\$)	57.80	91.40	17.12	77.29	2208
Mean quantity of fertilizer used (Kg)	165.0	214.8	117.1	173.6	1466
Mean quantity of fertilizer used per hectare (Kg/Ha)	8.1(15.0)	22.9(33.0)	15.0(24.0)	13.4(23.0)	1466
Mean quantity of herbicides/weedicides used (Litre)	116.2	12.7	0.4	43.1	6611
Mean quantity of herbicides/weedicides used per hectare (Litre/Ha)	5.7(10.6)	1.4(2.0)	0.1(0.3)	3.3(5.7)	6611
% of households that acquired chemicals from:					
Agro-dealers	33.1	17.4	35.1	25.9	2,977
Market	41.9	41.4	26.7	38.9	2,977
Organisation	15.0	31.0	24.3	24.4	2,977
Borrowed	7.46	9.4	10.6	9.0	2,977
Other sources (such as gifts, exchanged, etc.)	2.4	0.8	3.37	1.8	2,977

Note: Values in parenthesis are the mean quantities adjusted for logger-corrected plot sizes.

Source: Field Data Collected by ISSER and Partners 2016

We find in Table 36 that households selected for Maize reported the highest proportion of households using agro-chemicals among the 4 target crop groups (98.0%). Compared to the other target crop groups, a relatively higher proportion of households selected for Sorghum (63.0%) reported that they used inorganic fertilizers during the main 2016 farming season. The mean expenditure on chemicals and inorganic fertilizers are highest (US\$150.87 and US\$124.90 respectively) for households selected for Maize. A similar observation holds for the mean expenditure on herbicides/weedicides. Also on chemical quantities, households selected for Maize generally reported relatively higher quantities of fertilizer and weedicides/herbicides used (199.4Kg and 112.0 Litres respectively) during the main 2016 farming season.

An interviewed key informant indicated that generally, farmers accessed chemical inputs from two (2) main sources, these were state subsidized chemical outlets and the general markets without any subsidies. From the listed crops that were targeted under subsidized outlets, it was realized that maize was the only target crop that could access subsidized chemical outlets. Comparing that information with Table 36 below revealed maize as the target crop with the highest percentage (98.0%) of chemical use among all focus crops. The key informant interviewee gave the following quote:

*“...we have two main sources of agricultural inputs, the state subsidy and the markets. Subsidized fertilizer is intended primarily for cotton, maize and rice...”* A key informant interviewee from the Agricultural Ministry in Mali.

Table 36 Chemical Use by Target Crop Group

Indicator	Target Crop Group					
	Maize	Sorghum	Millet	Cowpea	Overall	N
% of households using chemicals (i.e. fertilizers, weedicides, pesticides)	98.0	85.2	50.6	85.2	80.5	2,977
% of households using inorganic fertilizer	56.0	63.0	39.0	43.9	50.7	2,977
Mean expenditure on chemicals (US\$)	293.51	80.52	52.81	138.52	168.31	6611
Mean expenditure on inorganic fertilizers (US\$)	150.87	36.93	41.48	126.87	98.61	3614
Mean expenditure on herbicides/weedicides (US\$)	124.90	25.05	33.10	40.55	77.29	2208
Mean quantity of fertilizer used (Kg)	199.4	154.9	80.9	195.3	173.6	1466
Mean quantity of fertilizer used per hectare (Kg/Ha)	8.9(18.1)	14.0(15.9)	10.1(16.6)	15.8(25.8)	13.4(23.0)	1466
Mean quantity of herbicides/weedicides used (Litre)	112.0	0.9	0.8	8.4	43.1	6611
Mean quantity of herbicides/weedicides used per hectare (Litre/Ha)	5.0(10.2)	0.1(0.1)	0.1(0.2)	0.7(1.1)	3.3(5.7)	6611
% of households that acquired chemicals from:						
Agro-dealers	21.4	25.0	38.1	24.8	25.7	2,977
Market	55.7	19.2	30.8	44.8	39.9	2,977
Organisation	17.6	36.5	20.8	21.2	23.8	2,977
Borrowed	4.4	18.5	6.9	6.7	9.0	2,977
Other sources (such as gifts, exchanged, etc.)	0.9	0.8	3.3	2.6	1.7	2,977

Note: Values in parenthesis are the mean quantities adjusted for logger-corrected plot sizes.

Source: Field Data Collected by ISSER and Partners 2016

Table 37: Awareness and cultivation of hybrid/improved varieties by region

Indicator	Regions				
	Koulikoro	Sikasso	Ségou	Overall	N
% households aware of hybrid/improved seed varieties of their target crops	13.7	25.0	15.0	18.6	2977
% households aware of hybrid/improved seed variety of their target crop that they do not currently produce	18.2	17.6	8	15.6	2977
% households that used hybrid/improved seed variety before	84.5	57.8	81.8	71.3	442
% households that planted improved variety in the past cropping season	72.1	40.7	60	58.1	315
% awareness of improved seed varieties currently not cultivated:					
Maize	65.5	66.2	16.4	59.7	442
Sorghum	12.6	9.4	50.9	15.8	442
Millet	35.6	2.8	45.5	21.0	442
Cowpea	22.4	29.1	14.6	24.7	442

Source: Field Data Collected by ISSER and Partners 2016

#### 8.4 Awareness of hybrid/improved seed varieties and usage

The results of awareness and use of hybrid/improved seed varieties by region are presented in Table 37. The results indicate that few households are aware of hybrid/improved seed varieties that they do not currently cultivate. Out of a sample of 2977, only 18.6 percent of farmers are aware of hybrid/improved seed varieties of target crops they currently cultivate, and 15.6 percent of respondents are aware of hybrid/improved seed varieties of target crops that they currently do not cultivate. However, 71.3 percent of these households indicated that they have used the hybrid/improved varieties in the past. Furthermore, of the 71.3 percent of households that have cultivated these varieties in the past, 58.1 percent of them indicated that they did so in the last cropping season.

The regional analysis show that the greatest percentage of households who are aware of hybrid/improved seed varieties of their target crop are found in the Sikasso region with a value of 25.0 percent. This is followed by Ségou and Koulikoro with percentages 15.0 and 13.7 respectively. Also, respondents in Koulikoro region (84.5%) have the highest percentage of respondents who have used these hybrid/improved seed varieties in the past. In Ségou, 81.8 percent of respondents have used these varieties in the past compared to 57.8 percent of respondents in Sikasso. A similar trend is observed when analysing the percentage of respondents who cultivated these varieties in the last cropping season.

Overall, 59.7 percent of households indicated that they are aware of hybrid/improved maize varieties that they do not currently cultivate. This is followed by cowpea respondents (24.7%), millet respondents (21.0%) and sorghum respondents (15.8%). On the regional level, out of the four target crops, improved maize varieties currently not cultivated by households is highest in Koulikoro, and Sikasso. While in Ségou, improved sorghum varieties are the crops with the highest percentage of households currently not cultivating them.

From Table 38, the awareness and cultivation of hybrid/improved seed varieties based on target crop is presented. The highest percentage of respondents who are aware of hybrid/improved seed varieties of target crops they currently cultivate are cowpea farmers (28.2%). This is followed by sorghum farmers (18.7%), maize farmers (16.7%) and millet farmers (11.1%). Sorghum farmers have the highest percentage (82.3%) of farmers who have used hybrid/improved seed varieties in the past. While maize (68.5%) and cowpea (68.2%) farmers have the least percentage of farmers who have planted hybrid/improved seed varieties in the past.

A substantial proportion of maize farmers (96.2%) are aware of improved maize varieties that they do not currently cultivate. For sorghum, 58.1 percent of sorghum farmers are aware of improved sorghum varieties that they do not currently cultivate. The percentage of millet and cowpea farmers who are aware of improved varieties of their respective crops that they do not currently cultivate are 81.3 percent and 68.4 percent respectively.



Table 38: Awareness and cultivation of hybrid/improved seed varieties by target crop

Indicator	Target Crop Group					
	Maize	Sorghum	Millet	Cowpea	Overall	N
% households aware of hybrid/improved seed varieties of their target crops	16.7	18.7	11.1	28.2	18.6	2977
% households aware of hybrid/improved seed variety of their target crop that they do not currently produce	23.1	8.8	9.3	19.8	15.6	2976
% households that used hybrid/improved seed variety before	68.5	82.3	75.0	68.2	71.3	442
o/w						
% households that planted improved variety in the past cropping season	55.6	54.9	58.3	63.3	58.1	315
% awareness of improved seed varieties currently not cultivated						
Maize	96.2	43.6	6.3	42.4	59.7	442
Sorghum	2.2	58.1	15.6	15.2	15.8	442
Millet	8.2	21	81.3	9.9	21	442
Cowpea	3.8	11.3	6.3	68.9	24.7	442

Note: The target crop group at the column refers to the dominant crops grown by farmers.

Source: Field Data Collected by ISSER and Partners 2016

## 8.5 Agricultural mechanisation

This sub-section covers the use and ownership of tractor and animal draught services in agricultural activities of households. Also, the average household cost of tractor and animal draught services are presented.

### 8.5.1 Machinery

Mali's agricultural sector is dominated by smallholder farmers. The use of machinery in production has been limited in scope. The results of tractor and animal draught services are presented in Table 39. The results indicate that more households use animal draught services compared to tractor services. Every household engaged in the survey engaged in some form of cropping activity in the cropping season under study.

The use of tractor services by households in the survey is low. Only 12.4 percent of respondents said they used tractor services on their farms. The region with the most usage of tractor services is Sikasso with 16.7 percent of respondents using tractor services. The region with the least usage of tractor services is Ségou with a percentage of 3.4. The overall proportion of households that own tractors to those who use tractor services is 24.7 percent. Although the percentage of households using tractor services is lowest in Ségou, they recorded the highest percentage of tractor owners with a percentage of 29.2 percent. The average cost of tractor services is US\$183.98. Tractor services are most expensive in Koulikoro (US\$138.85) and least expensive in Ségou (US\$39.08).

Use of animal draught services is very prevalent in the sample regions. About 95 percent of all households indicated they use animal draught services. Use of animal draught services ranges from 98 percent of respondents in Ségou to 91 percent of all households in Koulikoro. A similar trend is observed in terms of ownership of animal draughts. Percentage of ownership is highest in Ségou and lowest in Koulikoro. In terms of cost of services, the average cost of animal draught services is US\$210.15. For the regional analysis, animal draught is most expensive in Sikasso (US\$212.44) followed by Koulikoro (US\$210.24) and then finally Ségou (US\$206.13).

**Table 39: Tractor and animal draught services**

Indicator	Region				
	Koulikoro	Sikasso	Ségou	Overall	N
% households engaged in cropping activities	100	100	100	100	2977
o/w					
% households using tractors	13.3	16.7	3.4	12.4	2977
o/w					
% households own a tractor	25	24	29.2	24.7	368
Cost of tractor services (US\$)	138.85	230.20	39.08	182.98	368
% household using animal draught	90.7	95.5	98.4	94.5	2977
o/w					
% households own animal draught	88.2	89	93.5	89.8	2813
Cost of animal draught services (US\$)	210.24	212.44	206.13	210.15	2813

Source: Field Data Collected by ISSER and Partners 2016

The use of machinery by households for farming activities by target crop is presented in **Table 40**. The use of tractor service is most dominant among maize farmers. About 21 percent maize farmers use tractor services in their cropping activities. The proportion of households using tractor services is least among millet farmers with a percentage of about 4.9 percent. Usage of tractor services among sorghum and cowpea farmers are 7.5 percent and 14.1 percent respectively.

Tractor ownership is highest among sorghum farmers. About 30 percent of sorghum farmers who use tractor services also own the tractors. Maize, millet and cowpea farmers' percentage of tractor ownership are 21.9, 20.0 and 28.7 percent respectively. Cowpea farmers pay the most for tractor services while millet farmers pay the least for tractor services. Average cost of tractor services range from US\$96.96 to US\$248.72.

Animal draught usage is relatively high among all target crop farmers. About 98 percent of Sorghum and millet farmers use animal draught services. Maize farmers use animal draught services the least with a percentage of 88.0. The usage of animal draught services is reflected in the ownership among farmers. Sorghum and maize farmers own their animal draughts the most and least respectively. Cost of draught services is also highest among sorghum farmers (US\$219.27) while least among cowpea farmers (US\$195.86).

**Table 40: Tractor and animal draught services by target crop**

Indicator	Target Crop Group					
	Maize	Sorghum	Millet	Cowpea	Overall	N
% households engaged in cropping activities	100	100	100	100	100	2977
o/w						
% households using tractors	21.4	7.5	4.9	14.1	12.4	2977
o/w						
% households own a tractor	21.9	29.6	20	28.7	24.7	368
Cost of tractor services (US\$)	169.4	160.55	96.96	248.72	182.98	368
% household using animal draught	88	98.1	98.2	94.8	94.5	2977
o/w						
% households own animal draught	85	94.9	91.1	88.5	89.8	2813
Cost of animal draught services (US\$)	217.30	219.27	207.34	195.86	210.15	2813

Source: Field Data Collected by ISSER and Partners 2016

### Use of machinery in cropping activities

The results of the cropping activities in which tractor and animal draught services are used are presented in Table 41. The findings show that majority of households only engage tractor services to plough their farms. About 88 percent of households engage tractor services for ploughing their farms. The second most popular activity for which tractor services are used is clearing the farm with about 7.1 percent of households indicating that they use tractor services to clear their farms. The least activity for which tractors are used is chemical application. Less than 2 percent of households use tractor services for chemical application.

Table 41: Use of tractor and animal services in cropping activities by region

Cropping activities	Usage of tractor					Use of draught animal				
	Region					Region				
	Koulikoro	Sikasso	Ségou	Overall	N	Koulikoro	Sikasso	Ségou	Overall	N
	%	%	%	%		%	%	%	%	
Clearing	15.7	1	8.3	7.1	368	5.8	8	2	5.8	2813
Ploughing	87.1	95.1	37.5	88.3	368	94.4	95.2	98.3	95.7	2813
Planting	2.1	2.5	4.2	2.5	368	46.5	53.5	22.5	43.5	2813
Chemical application	2.1	1	0	1.4	368	2.9	8.2	2.5	5	2813
Weeding	3.6	3.4	4.2	3.5	368	65.2	49.3	55.7	56.3	2813
Harvesting	2.9	3.4	50	6.3	368	4.5	17.5	1.2	9.1	2813

Source: Field Data Collected by ISSER and Partners 2016

Table 42: Use of tractor and animal services in cropping activities by target crop

Cropping activities	Usage of tractor						Use of draught animal					
	Target Crop Group						Target Crop Group					
	Maize	Sorghum	Millet	Cowpea	Overall	N	Maize	Sorghum	Millet	Cowpea	Overall	N
	(%)	(%)	(%)	(%)	(%)		(%)	(%)	(%)	(%)	(%)	
Clearing	10.1	1.9	14.3	2	7.1	368	10.2	3.6	4.7	4.3	5.8	2813
Ploughing	91	90.7	54.3	94.1	88.3	368	94.1	97.3	95.7	95.6	95.7	2813
Planting	3.4	3.7	0	1	2.5	368	41.1	54.2	27.9	51.1	43.5	2813
Chemical application	1.7	0	0	2	1.4	368	5.6	5.4	1.6	7.4	5	2813
Weeding	2.8	5.6	2.9	4	3.5	368	55	60.6	59.5	49.9	56.3	2813
Harvesting	2.3	1.9	37.1	5	6.3	368	7.4	10	7.9	11.2	9.1	2813

Source: Field Data Collected by ISSER and Partners 2016

The use of animal draught services is more spread across different cropping activities compared to tractor services. Contrary to the situation where tractor services are chiefly used for ploughing, animal draught services are used mainly for ploughing, planting and weeding. About 96, 56 and 44 percent of respondents said they use draught animals for ploughing, weeding and planting respectively. Animal draught services are least used during chemical application with only 5.0 percent of households indicating they use it for this purpose.

Table 42 presents the results of tractor and animal draught services in cropping activities by target crop. Tractor services are used primarily for ploughing while animal draught services are used mainly for ploughing, planting and weeding. About 91 percent each of maize and sorghum farmers who use tractor service, use it to plough. Millet and cowpea farmers have the least and most percentages of farmers who use tractor services for ploughing respectively. The percentages are 54 and 94 percent respectively. Sorghum farmers use animal draught services the most in ploughing, planting and weeding activities with values of 97, 54 and 61 percent respectively. Maize, millet and cowpea farmers use draught services the least in ploughing, planting and weeding respectively.

## **8.6 Households' Membership of Farmer Based Organisations (FBOs)**

The results of membership of Farmer Based Organisations (FBOs) by region are presented in Table 43. Less than a quarter of sampled respondents belong to FBOs. A total of 24 percent of respondents belong to FBOs. The region with the highest percentage of households belonging to FBOs is Sikasso with a membership of 33 percent of total respondents in the region. The region with the least percentage of FBO membership is Ségou (18.5%). Koulikoro region has an FBO membership of 18.6 percent. Crop production FBOs are the most common among households with 74 percent of households belonging to them. Membership of the remaining FBOs are very low. Seed production and multiplication FBOs account for just 3.7 percent of total FBO membership. About 66.7 percent of households in the seed production and multiplication FBO are producing their target crops. Also, about 63 percent of households belonging to the seed production and multiplication FBO have received training on seed production and marketing.

Table 44 presents the results of household membership of FBOs by target crop. About 19, 37, 20 and 23 percent of maize, sorghum, millet and cowpea households belong to FBOs respectively. Majority of households belonging to FBOs, belong to crop production FBOs. About 51, 83, 79 and 79 percent of maize, sorghum, millet and cowpea households respectively belong to crop production FBOs. Seed production and multiplication FBOs account for approximately 6, 2, 4 and 5 percent of maize, sorghum, millet and cowpea households respectively.

**Table 43: Household membership of Farmer Based Organisations (FBOs)**

Indicator	Region				
	Koulikoro	Sikasso	Ségou	Overall	N
	(%)	(%)	(%)	(%)	
% households members of FBOs	18.6	32.7	18.5	24.4	2974
Type of FBOs					
Seed production and multiplication	6.1	3	2.3	3.7	725
Livestock production	0	1	0	0.6	725
Value addition	1	3	0.8	2.1	725
Aquaculture	0	0.8	0.8	0.6	725
Beekeeping	1.5	7.8	0	4.7	725
Crops production	84.7	66.9	82.3	74.5	725
Others	14.8	20.6	15.4	18.1	725
Membership of seed production and multiplication FBO					
% households producing target crop seeds	100	41.7	33.3	66.7	27
% households trained in seed production and marketing	66.7	66.7	33.3	63.0	27

Source: Field Data Collected by ISSER and Partners 2016

Out of the membership of seed production and multiplication FBOs, 44 percent of maize farmers are producing maize seeds, 50 percent of sorghum farmers are producing sorghum seeds, 83 percent of millet farmers are producing millet seeds and 67 percent of cowpea farmers are producing cowpea seeds. In terms of training in seed production and marketing, 44 percent of maize farmers have been trained in maize production and marketing. About half of sorghum farmers, 67 percent of millet farmers and 88 percent of cowpea farmers have received some form of training in sorghum, millet and cowpea seed production and marketing respectively.

**Table 44: Household membership of Farmer Based Organisations (FBOs) by target crop**

Indicator	Target Crop Group					
	Maize	Sorghum	Millet	Cowpea	Overall	N
	(%)	(%)	(%)	(%)	(%)	
% households members of FBOs	19	36.8	19.8	22.8	24.4	2974
<b>Type of FBOs</b>						
Seed production and multiplication	5.7	1.5	4.3	4.9	3.7	725
Livestock production	0	1.1	0	0.6	0.6	725
Value addition	5.1	0.8	2.1	1.2	2.1	725
Aquaculture	1.9	0	0.7	0	0.6	725
Beekeeping	15.8	1.9	0.7	1.8	4.7	725
Crops production	51.3	83.3	79.4	78.5	74.5	725
Others	26.6	12.6	21.3	16	18.1	725
<b>Membership of seed production and multiplication FBO</b>						
% households producing target crop seeds	44.4	50	83.3	87.5	66.6	27
% households trained in seed production and marketing	44.4	50	66.7	87.5	63	27

Source: Field Data Collected by ISSER and Partners 2016

## 8.7 Awareness and use of extension services

The awareness and use of extension services is provided in Table 45. Households that received extension services in the sample area is very low. Less than 15 percent of respondents said they received extension services. Households in the Sikasso region received more (16.7%) extension services than households in the Koulikoro region (13.0%) and Ségou region (5.3%). Out of households that received the services, 38 percent actively sought those services. Majority of households that received extension services, implemented whatever advice they received. About 80 percent of receipts of extension services implemented the advice they received. Most households in Koulikoro (81%) implemented the advice they received while respondents in Ségou region (76%) implemented extension service advice the least. The extension services received by households were not always free. About 2 percent of respondents had to pay for the services they received. No respondent in Ségou paid for extension services. However, respondents in Koulikoro (3%) and Sikasso (2%) paid for extension services.

All households indicated that they received extension services on seed multiplication. The next most provided extension service was related to crop production (fertiliser and seed use). About 40 percent of households received advice on crop production specifically on fertilizer application and seed use. Livestock production (18%), and soil fertility testing and management (17%) were also significantly addressed by extension service providers. Livestock marketing (3.7%) was the least provided service by extension officers.

Non-governmental organisations (NGOs) are the most dominant extension service providers. Out of the 378 households that received extension services, NGOs accounted for 36 percent. Government agents provided 32 percent of the services while farmer organisations provided 5 percent of the extension services. The least providers of extension services are farmer training centres and local leaders. These group of service providers accounted for 0.3 percent each of the households that received extension services.

From Table 46, about 9, 16, 11 and 16 percent of maize, sorghum, millet and cowpea producing households received extension services respectively. Out of this percentages, 34, 29, 39 and 50 percent of maize, sorghum, millet and cowpea producing households respectively sought these services. Millet producing households (84%) implemented extension services received the most while the target crop group that implemented extension advice the least is maize producing households (78%). Payment for extension services was dominated by maize (6%) producing households. No sorghum producing household paid for extension services. Less than 3 percent each of millet and cowpea producing households paid for extension services.

Furthermore, all respondents received seed multiplication extension services. The percentage of maize households that received crop production (fertiliser and seed use) extension services is about 38 percent. Sorghum, millet and cowpea producing households constitute 29, 43 and 52 percent of households that also received crop production extension services respectively.

Table 45: Awareness and use of extension services by region

Indicator	Region				
	Koulikoro	Sikasso	Ségou	Overall	N
	(%)	(%)	(%)	(%)	
<b>Use of various extension services by households</b>					
Seed multiplication	100	100	100	100	378
Crop production (fertiliser and seed use)	52.6	34.8	27	40.5	378
Insurance advice	18.3	13.2	8.1	14.6	378
Crop marketing	7.3	20.1	24.3	15.9	378
Postharvest handling and storage	12.4	11.3	5.4	11.1	378
Soil fertility testing and management	19.7	16.2	10.8	16.9	378
Livestock production	11	21.6	21.6	17.7	378
Livestock marketing	3.7	3.4	5.4	3.7	378
% household received extension service	13	16.7	5.3	12.7	2974
% household that actively sought extension service	40.2	37.8	35.1	38.4	378
% household implemented advice	81	80.4	75.7	80.2	378
% household paid for extension service	2.9	2.0	0.0	2.1	378
<b>Main extension service providers by number of activities</b>					
Government agent	25.6	35.8	35.1	32	378
NGOs	50.4	30.9	10.8	36	378
Farmers organisation	2.9	6.4	8.1	5.3	378
Community based organisations (CBOs)	1.5	2.9	0	2.1	378
Input dealer	0	1	2.7	0.8	378
Processing and marketing enterprise	4.4	0	0	1.6	378
Research organisation	0.7	0	2.7	0.5	378
Other farmer(s)	0	3.9	2.7	2.4	378
Baraza	0.7	2	2.7	1.6	378
Farmer training centre	0	0.5	0	0.3	378
Local leaders	0	0.5	0	0.3	378
Radio	0.7	5.4	8.1	4	378
Others	5.8	9.8	13.5	8.7	378

Source: Field Data Collected by ISSER and Partners 2016

NGOs and government agents are the major providers of extension services. NGOs provided services to about 31, 28, 53 and 36 percent of maize, sorghum, millet and cowpea households respectively. Government agents provided extension services to about 40, 27, 33 and 31 percent of maize, sorghum, millet and cowpea producing households respectively.

Table 46: Awareness and use of extension services by region



Indicator	Target Crop Group					
	Maize (%)	Sorghum (%)	Millet (%)	Cowpea (%)	Overall (%)	N
<b>Use of extension services by households</b>						
Seed multiplication	100	100	100	100	100	378
Crop production (fertiliser and seed use)	37.7	29.5	42.7	51.8	40.5	378
Insurance advice	10.4	19.6	16	11.4	14.6	378
Crop marketing	26	10.7	22.7	9.7	15.9	378
Postharvest handling and storage	18.2	5.4	10.7	12.3	11.1	378
Soil fertility testing and management	14.3	17	14.6	20.2	16.9	378
Livestock production	27.3	17	22.7	8.8	17.7	378
Livestock marketing	2.6	2.7	9.3	1.8	3.7	378
% household received extension service	9.2	15.7	10.6	15.9	12.7	2974
% household that actively sought extension service	33.8	29.5	38.7	50	38.4	378
% household implemented advice	77.9	79.5	84	79.8	80.2	378
% household paid for extension service	6.5	0	2.7	0.9	2.1	378
<b>Main extension service providers by number of activities</b>						
Government agent	40.3	26.8	33.3	30.7	32	378
NGOs	31.2	27.7	53.3	36	36	378
Farmers organisation	9.1	7.1	2.7	2.6	5.3	378
Community based organisations (CBOs)	1.3	3.6	0	2.6	2.1	378
Input dealer	0	1.8	1.3	0	0.8	378
Processing and marketing enterprise	0	0	2.7	3.5	1.6	378
Research organisation	0	0.9	0	0.9	0.5	378
Other farmer(s)	2.6	3.6	0	2.6	2.4	378
Baraza	0	4.5	1.3	0	1.6	378
Farmer training centre	0	0.9	0	0	0.3	378
Local leaders	0	0	0	0.9	0.3	378
Radio	7.8	3.6	2.7	2.6	4	378
Others	11.7	7.1	1.3	13.2	8.7	378

Source: Field Data Collected by ISSER and Partners 2016

## 8.8 Awareness and application of agronomic practices

Farmers' awareness and application of agronomic practices by region is presented in Table 47. The results show that although more than half of farmers in our sample are aware of the agronomic practices presented to them, few of them are actually applying these practices.

More specifically, an average of 69 percent of our sample are aware of the twenty-two (22) agronomic practices presented. The three regions all have awareness levels above 50 percent. The regional breakdown indicates that farmers in the Sikasso region (75%) are most aware of the presented agronomic practices compared to their counterparts in the other regions. The region with the lowest awareness of agronomic practices is Ségou with a percentage of 60 percent. The three most popular agronomic practice are crop rotation, use of farm yard manure and composting. The least known agronomic practice is use of inoculum.

The application of these agronomic practices is low among farmers. On average, 25 percent of farmers said they applied the presented agronomic practices on their farms. The application of agronomic practices ranges from 22 percent in Koulikoro to 28 percent in Ségou. The three most applied agronomic practices are use of farm yard manure, use of inorganic fertilisers and minimum tillage. The least applied agronomic practice is water pans/planting basins.

Table 47: Awareness and application of agronomic practices by region

Indicator	Awareness of agronomic practices					Application of agronomic practices				
	Region					Region				
	Koulikoro	Sikasso	Ségou	Overall	N	Koulikoro	Sikasso	Ségou	Overall	N
	(%)	(%)	(%)	(%)		(%)	(%)	(%)	(%)	
Terracing	78.7	69.0	69.0	72.4	2977	38.7	19.8	34.3	30.3	2156
Mulching/cover cropping	50.5	61.8	48.8	54.8	2977	9.4	6.9	14.6	9.3	1630
Minimum tillage	77.4	85.9	79.5	81.4	2977	58.8	50.4	65.4	56.7	2422
Wind breaks	45.7	64.2	33.7	50.5	2977	10.4	12.0	13.1	11.7	1502
Contour farming	78.2	90.7	73.2	82.1	2977	7.5	12.3	9.4	10.1	2445
Crop rotation	95.4	98.0	89.4	95.0	2977	35.0	71.8	45.1	52.8	2829
Water pans/planting basins	42.8	43.3	28.4	39.6	2977	2.2	4.4	5.0	3.6	1180
Grass strips	42.8	46.1	37.4	42.9	2977	7.3	5.7	12.6	7.7	1276
Afforestation	89.0	95.3	75.9	88.5	2977	9.3	22.3	9.2	15.0	2634
Agro forestry (legumes trees)	60.8	79.9	49.2	65.9	2977	5.9	12.8	6.7	9.5	1961
Agro forestry (other trees)	59.9	75.9	45.2	63.0	2977	8.9	9.3	2.5	8.0	1876
Gabions/storm bands	59.2	84.9	64.3	71.0	2977	10.7	25.1	16.4	19.0	2113
Cut-off drains/soil bounding	59.9	68.4	57.4	62.8	2977	35.8	45.2	51.7	43.4	1869
Fallow	92.2	92.6	87.0	91.1	2977	12.3	18.8	13.8	15.3	2713
Composting	91.2	95.2	92.3	93.1	2977	47.1	46.1	56.4	48.8	2770
Use of inorganic fertilisers	81.5	88.6	77.0	83.4	2977	50.8	71.9	57.8	61.5	2481
Use of green manure fertilisers	66.5	69.9	58.2	65.9	2977	38.0	39.9	39.0	39.0	1962
Use of farm yard manure	96.7	92.3	93.3	94.1	2977	61.7	52.5	87.0	63.9	2800
Slash and burn	80.4	82.4	56.1	75.5	2977	22.9	11.8	41.0	21.1	2245
Growing legume crops	58.0	80.1	59.9	67.5	2977	2.3	12.0	2.4	7.0	2008
Use of inoculum	34.5	30.0	17.1	28.6	2977	5.5	9.3	15.0	8.5	850
Use of lime	42.2	56.3	28.8	44.8	2977	4.9	7.4	10.4	7.1	1333
Average percentage	78.7	69.0	69.0	72.4	2977	38.7	19.8	34.3	30.3	2156

Source: Field Data Collected by ISSER and Partners 2016

The awareness and application of agronomic practices by target crop is presented in Table 48. From the results, cowpea cultivating households have the highest percentage of awareness of the twenty-two (22) agronomic practices presented. The average awareness of agronomic practices by cowpea farmers is 74 percent. This is closely followed by maize farmers (73%). The third and fourth are sorghum (66%) and millet (62%) farmers respectively. Maize (95%) and cowpea (98%) farmers are most aware of crop rotation as an agronomic practice. For sorghum and millet farmers, they are most aware of composting (94%) and use of farm yard manure (95%) respectively.

Sorghum cultivating households (30%) apply the agronomic practices they are aware of the most while maize cultivating households (22%) apply the practices they are aware of the least. Among maize and sorghum cultivating households, they apply inorganic fertilisers the most. For millet and cowpea cultivating households, they apply farm yard manure and crop rotation respectively the most.

Table 48: Awareness and application of agronomic practices by target crop

Indicator	Awareness of agronomic practices						Application of agronomic practices					
	Target Crop Group						Target Crop Group					
	Maize	Sorghum	Millet	Cowpea	Overall	N	Maize	Sorghum	Millet	Cowpea	Overall	N
	(%)	(%)	(%)	(%)	(%)		(%)	(%)	(%)	(%)	(%)	
Terracing	74.31	63.32	72.71	79.05	72.42	2977	23.1	26.43	41.2	31.45	30.33	2156
Mulching/cover cropping	64.95	50.77	45.01	56.56	54.75	2977	7.95	9.34	14.37	7.16	9.33	1630
Minimum tillage	82.47	83.54	79.47	79.75	81.36	2977	45.12	65.44	57.17	60.95	56.69	2422
Wind breaks	64.35	46.72	37.55	50.84	50.45	2977	9.51	13.13	18.73	8.24	11.65	1502
Contour farming	88.12	80.06	73	86.31	82.13	2977	10.35	10.8	6.74	11.81	10.06	2445
Crop rotation	95.92	93.31	92.69	98.04	95.03	2977	39.8	76.38	31.71	64.96	52.81	2829
Water pans/planting basins	46.7	31.38	36.85	42.46	39.64	2977	3.08	4	4.2	3.62	3.64	1180
Grass strips	46.82	43.93	34.04	45.95	42.86	2977	5.38	9.52	9.09	7.6	7.68	1276
Afforestation	94.12	83.68	80.73	94.41	88.48	2977	24.36	13.17	6.45	13.02	15	2634
Agro forestry (legumes trees)	72.15	62.34	47.4	80.45	65.87	2977	9.32	11.19	3.56	11.81	9.48	1961
Agro forestry (other trees)	70.83	56.49	45.99	77.37	63.02	2977	12.03	2.72	2.45	10.83	8	1876
Gabions/storm bands	72.15	75.17	58.23	78.07	70.98	2977	20.3	21.71	10.14	21.47	18.98	2113
Cut-off drains/soil bounding	61.46	60.11	63.99	65.78	62.78	2977	38.67	53.13	43.52	39.49	43.39	1869
Fallow	89.32	88.28	92.12	95.11	91.13	2977	20.16	14.06	10.84	15.57	15.33	2713
Composting	89.8	94.42	93.25	95.38	93.08	2977	33.29	64.4	51.28	48.09	48.84	2770
Use of inorganic fertilisers	83.43	83.54	76.37	90.07	83.37	2977	60.86	77.13	41.44	64.6	61.51	2481
Use of green manure fertilisers	75.27	57.74	57.67	71.47	65.93	2977	33.49	54.59	27.56	42.27	38.99	1962
Use of farm yard manure	95.2	89.96	94.94	96.08	94.09	2977	51.45	76.9	76	54.15	63.89	2800
Slash and burn	84.03	65.5	69.06	81.82	75.46	2977	12.43	26.23	31.36	18.63	21.07	2245
Growing legume crops	70.95	67.6	59.21	71.61	67.5	2977	7.45	5.58	0.71	13.09	7.02	2008
Use of inoculum	36.25	21.37	17.86	37.48	28.57	2977	6.95	15.69	5.51	7.46	8.47	850
Use of lime	50.3	49.72	25.18	53.01	44.81	2977	4.3	7.58	8.94	8.71	7.05	1333
Average percentage	73.13	65.86	61.51	73.96	68.81	2977	21.79	29.96	22.86	25.68	24.96	2047.95

Source: Field Data Collected by ISSER and Partners 2016

## 8.9 Crop Yields

We report crop yields computed as total output on plot as a ratio of cultivated size of plot, and measured in metric tonnes per hectare (MT/Ha) in Table 49. The figures in parenthesis are the yields adjusted for logger-measured cultivated plot sizes. Overall, the unadjusted yield for Maize yield for the 2016 farming season was 2.2MT/Ha, Sorghum yield was 1.1MT/Ha, Millet yield is 0.9MT/Ha, and Cowpea yield was 0.2MT/Ha. Comparing unadjusted crop yields across regions, we find that overall, households in the Sikasso region generally reported relatively higher yields for all crops, except for Cowpea for which households in the Sikasso and Segou regions reported 0.3MT/Ha each. We find that crop yields adjusted for logger-measured plot sizes are generally higher compared to the unadjusted, implying that self-reported plot sizes by farmers are generally overestimated. Comparing the current yield figures reported for the 3 regions to nation-wide yield figures reported by the Malian Ministry of Rural Development for the period 2008-2014, we find that the unadjusted yields reported for millet and sorghum are compatible with the average reported over the 2008-2014 period (see Table 50).

**Table 49 Crop Yields by Region**

Indicator	Region				
	Koulikoro	Sikasso	Segou	Overall	N
Maize Yield (MT/Ha)	1.5(2.0)	2.8(2.9)	1.5(1.9)	2.2(2.3)	1828
Sorghum Yield (MT/Ha)	0.8(1.1)	1.6(1.4)	0.6(0.9)	1.1(1.3)	1273
Millet Yield (MT/Ha)	0.8(1.1)	1.4(2.4)	0.8(1.0)	0.9(1.3)	1421
Cowpea Yield (MT/Ha)	0.2(0.4)	0.3(1.9)	0.3(0.5)	0.2(0.9)	500

Note: Values in parenthesis are the logger-adjusted mean crop yields.

Source: Field Data Collected by ISSER and Partners 2016

A key informant interviewee added that consistently Sikasso was the rainiest and most productive in terms of yields his quote below:

*“.... the hypothesis was well thought because the Sikasso region until proven otherwise is the rainiest with more farmland...”* « A key informant from Agric. Ministry in Mali.

**Table 50 Crop Yields for Mali, 2008-2014**

Yield (MT/Ha)	Cropping Year						
	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2008-2014 Average
Millet	0.9	1.0	1.1	0.8	0.9	0.8	0.9
Sorghum	1.0	1.6	1.0	1.4	1.0	0.9	1.2
Maize	2.0	3.9	3.9	2.6	3.0	2.3	3.0
Cowpea	-	-	-	-	-	0.7	0.7

Source: Ministry of Rural Development (MoRD), 2014.

Disaggregating crop yields into target crop groups in Table 51 shows that households selected for Sorghum reported comparatively higher yields for Maize (2.7MT/Ha), Millet (1.2MT/Ha) and

Cowpea (0.4MT/Ha) among the target crop groups. Also, households selected for Cowpea reported relatively higher yields for Sorghum (2.3MT/Ha), compared to the other 3 target crop groups.

**Table 51 Crop Yields by Target Crop Groups**

Indicators	Target Crop Group					N
	Maize	Sorghum	Millet	Cowpea	Overall	
Maize Yield (MT/Ha)	1.7	2.7	1.3	2.9	2.2	1828
Sorghum Yield (MT/Ha)	0.9	0.8	0.6	2.3	1.1	1273
Millet Yield (MT/Ha)	1.0	1.2	0.7	0.9	0.9	1421
Cowpea Yield (MT/Ha)	0.2	0.4	0.1	0.2	0.2	500

Note: Values in parenthesis are the logger-adjusted mean crop yields. The target crop group at the column refers to the dominant crops grown by farmers.

Source: Field Data Collected by ISSER and Partners 2016

## 8.10 Pre-harvest Crop Losses

Table 52 displays the distribution of pre-harvest crop losses by region. Overall, the mean pre-harvest losses reported for Maize in the 2016 farming season was 17.4%, Sorghum was 16.4%, Millet was 15.5%, and Cowpea is 27.0% (the highest among the target crops). We observed that except for Maize, households in the Koulikoro region generally reported higher pre-harvest crop losses for all the other crops compared to those in the other study regions.

**Table 52: Pre-Harvest Crop Losses by Region**

	Region				
Indicator	Koulikoro	Sikasso	Segou	Overall	N
Maize Loss (%)	16.3	19.4	11.5	17.4	980
Sorghum Loss (%)	26.3	22.9	8.4	16.4	743
Millet Loss (%)	22.5	17.5	10.2	15.5	908
Cowpea Loss (%)	38.3	25.8	8.0	27.0	781

Source: Field Data Collected by ISSER and Partners 2016

Showing the distribution of pre-harvest crop losses at the target crop level, losses in his quote:

*“...pre-harvest losses mean losses on field before crops are harvested, one can note the losses from birds, insects, termites, wind, especially late rains, theft...”* Key informant from the Agriculture ministry in Mali.

Table 53 reveals that households selected for Cowpea reported relatively higher average pre-harvest crop losses for all the target crops compared to their counterparts selected for the other target crops. A Key informant interviewee who works with focus crop farmers mentioned the following causes of pre-harvest losses in his quote:

“...pre-harvest losses mean losses on field before crops are harvested, one can note the losses from birds, insects, termites, wind, especially late rains, theft...” Key informant from the Agriculture ministry in Mali.

Table 53: Pre-Harvest Crop Losses by Target Crop Group

Indicator	Target Crop Group					
	Maize	Sorghum	Millet	Cowpea	Overall	N
Maize Loss (%)	16.4	14.9	16.8	22.3	17.4	980
Sorghum Loss (%)	9.8	12.6	12.2	33.4	16.4	743
Millet Loss (%)	15.7	10.6	17.1	25.8	15.5	908
Cowpea Loss (%)	16.6	9.1	19.4	34.1	27.0	781

Note: The target crop group at the column refers to the dominant crops grown by farmers.

Source: Field Data Collected by ISSER and Partners 2016

## 8.11 Post-Harvest Storage, Crop Sales, Processing and Market Price Information

### Post-Harvest Crop Storage

We find from Table 54 that overall, almost all households (99.3%) stored their crops in various forms after harvest. Comparing crop storage across the study regions, we observed that the proportion of households reporting post-harvest crop storage does not differ significantly across the study regions. We further observed that overall, a comparatively higher proportion of households (73.5%) stored their crops in Silos at home/farm, followed by storage in Bags at home/farm (38.5%). Additionally, we find that overall, 48.7% of households use chemicals for storage; and a relatively higher proportion of households (59.2%) in the Sikasso region reported having used chemicals for storage compared to households in the other study regions.

Table 54 Post-Harvest Crop Storage by Region

Indicators	Region				
	Koulikoro	Sikasso	Segou	Overall	N
% of households that stored crop after harvest	99.5	99.2	99.3	99.3	2977
% of households that stored crop in:					
Silos at home/farm	71.1	82.4	61.0	73.5	2977
Bags at home/farm	43.2	26.9	52.5	38.5	2977
Other storage	3.7	4.0	6.6	4.5	2977
% of households that store crops with chemicals	44.6	59.2	35.7	48.7	2977

Source: Field Data Collected by ISSER and Partners 2016

Across target crop groups, we observed that the proportion of households that reported having stored their crops after harvest does not significantly vary across the target crop groups. We find that a comparatively higher proportion of households in the Maize group reported having stored their crops in Silos at home/farm, whilst a relatively higher proportion of households in the Cowpea group reported having stored their crops in Bags at home/farm compared to their counterparts in

the other target crop groups. In addition, compared to households selected for the other target crops, a relatively higher proportion of households selected for Maize (62.6%) reported having stored crops with chemicals, followed by households in Cowpea group (56.5%)(see Table 55).

**Table 55 Crop Storage by Target Crop Group**

Indicators	Target Crop Group					
	Maize	Sorghum	Millet	Cowpea	Overall	N
% of households that stored crop after harvest	98.8	99.6	99.7	99.3	99.3	2977
% of households that stored crop in:						
Silos at home/farm	75.3	78.9	75.4	62.5	73.5	2977
Bags at home/farm	28.1	38.4	36.4	53.3	38.5	2977
Other storage	1.9	6.3	3.4	6.6	4.5	2977
% of households that store crops with chemicals	62.6	45.2	30.2	56.5	48.7	2977

Source: Field Data Collected by ISSER and Partners 2016

## Crop Sales

Overall, the highest quantity of crop sales was reported for Maize (3.4 MT), followed by Millet (2.1 MT); while the lowest quantity was reported for Cowpea (0.3 MT). Comparing the volumes of crop sales across the study regions, we observed that households in the Sikasso region reported a relatively higher sales volume for Maize (4.0 MT), households in Koulikoro reported comparatively higher sales for Sorghum (1.7MT), and households in the Segou region reported relatively higher volumes of sales for Millet (2.5MT) and Cowpea (0.4MT) (see Table 56).

**Table 56: Quantity of Crop Sold by Region**

Indicator	Region				
	Koulikoro	Sikasso	Segou	Overall	N
Mean quantity sold of:					
Maize (MT)	3.1	4.0	1.1	3.4	1467
Sorghum (MT)	1.7	1.3	1.1	1.3	1054
Millet (MT)	2.0	1.8	2.5	2.1	1179
Cowpea (MT)	0.3	0.2	0.4	0.3	470

Source: Field Data Collected by ISSER and Partners 2016

At the target crop group level, Table 57 shows that households selected for Maize reported relatively higher quantities of sales for Maize (4.2MT), households selected for Cowpea reported higher sales volumes for Sorghum (1.6MT) and Millet (3.1 MT), and households selected for Sorghum reported comparatively higher sales volumes for Cowpea (0.4 MT).

**Table 57: Quantity of Crop Sold by Target Crop Group**

Indicator	Target Crop Group					
	Maize	Sorghum	Millet	Cowpea	Overall	N
Mean quantity sold of:						
Maize (MT)	4.2	2.0	3.1	3.8	3.4	1467



Sorghum (MT)	1.3	1.3	0.9	1.6	1.3	1054
Millet (MT)	2.0	1.8	2.2	3.1	2.1	1179
Cowpea (MT)	0.2	0.4	0.2	0.3	0.3	470

Source: Field Data Collected by ISSER and Partners 2016

## 8.12 Sources of Market Price Information

Market price information is crucial for household welfare as it enables farmers to negotiate with traders from a well-informed position to obtain higher prices for their farm products. Households in the sample revealed having obtained market price information from various sources. The main source of market price information reported by the majority of households is Market traders (74.3%), followed by market price information from Other farmers. We find in Table 58 that across the study regions, a relatively higher proportion of households in the Segou region (83.9%) reported having received market price information from Market traders compared to their cohorts in the other study regions.

**Table 58 Source of market price Information by Region**

Indicator	Region				
	Koulikoro	Sikasso	Segou	Overall	N
% of households that received market price information from:					
Market traders	82.1	62.8	83.9	74.3	2977
Other farmers	20.6	25.1	18.9	22.1	2977
Other sources	2.5	1.5	1.0	1.7	2977

Source: Field Data Collected by ISSER and Partners 2016

We find in Table 59 that compared to households selected for the other target crops, a higher proportion of households selected for Millet (88.3%) reported having received market price information from Market traders.

**Table 59 Source of Market Price Information by Target Crop Group**

	Target Crop Group					
Indicators	Maize	Sorghum	Millet	Cowpea	Overall	N
% of households that received market price information from:						
Market traders	65.6	66.3	88.3	79.2	74.3	2977
Other farmers	23.9	29.5	12.6	21.3	22.1	2977
Other sources	2.2	0.6	2.0	2.2	1.7	2977

Source: Field Data Collected by ISSER and Partners 2016

## 9 Conclusion

After a successful baseline survey in three (3) agricultural production regions of Mali, the report provides a discussion of some household characteristics in relation to a number of key indicators based on baseline data collected on farmer households in the Koulikoro, Sikasso, and Segou regions. We broadly provide a discussion of the Background to the Study, the Study Design, Demographic Characteristics, Household Welfare, Women Empowerment in Agriculture, and Agricultural Production and Input Use. The key findings based on the baseline indicators are as follows:

- ◆ Household sizes reported were fairly large, most households were male-headed, and household compositions were generally young members, with most marital relationships being polygamous marriages.
- ◆ The levels of illiteracy were generally high among households sampled across the three (3) study regions, with only a third of households reported being able to read or write a sentence in French or Bambara.
- ◆ In line with *a priori* expectations, farming is the predominant economic activity for households sampled, with only a handful engaged in non-farm income activities and salary employment.
- ◆ There are food security challenges in the study regions. Though most households depend heavily on the consumption of own grown staple foods for sustenance, significant proportion of households sampled reported having experienced food shortages, and also moderate and severe hunger during the last 12 months preceding the survey.
- ◆ Credit access is low for households in the study regions and still very informal. Majority source loans from neighbours, local collaborative funding sources and moneylenders within the community. Very few use financial institutions such as commercial banks. Financial intermediation is therefore generally low among the sampled population, with a few households reported having owned a bank account and banking points far from households.
- ◆ Most households owned the dwellings in which they reside. This is partly a great source of socio-economic security to the households.
- ◆ There were yawning gender gaps in household empowerment with regards to production and income use.
- ◆ Household plots are large in all regions, with majority owning at 2 farm plots, and farmers generally considered the soil quality on their farm plots as good for crop cultivation.
- ◆ Farming activities were labour-intensive, with minimal farm mechanisation. The use of draught animals for ploughing is high, and family labour is the predominant source of farm labour in the study regions.

- ◆ Use of chemicals in the crop production process was high among farmers sampled, and the main source of chemicals were the market, agro-dealers, and organisations that went to the communities.
- ◆ A slight majority of farmers used improved seeds during the 2016 farming season, though more than two-thirds of households were aware of improved/hybrid seeds.
- ◆ A few households belonged to FBOs, and FBOs related with activities related to crop production were the most common in the study regions.
- ◆ Access to agriculture extension services in the study regions is low, with only less than a fifth of households accessing extension services. Implementation of extension information by farm households was high, and NGOs were the most dominant providers of extension information in the study regions.
- ◆ Households demonstrated very high awareness of various agronomic practices, but a handful of them applied those practices during the 2016 farming season.
- ◆ Except for cowpea, yields for the various target crops were fairly moderate, and crop losses were less than 20%, except for cowpea which recorded almost twice the losses for the other target crops.
- ◆ After harvest, crops were often stored in silos or in bags at home or farm. The major providers of market price information for farmer households in the study regions are market traders and colleague farmers.

We intimate that these findings have implications for households' welfare in the study region. We therefore recommend that AGRA consider these key observations in the course of developing programs and policies aimed at increasing farmer productivity and welfare in Mali. It is especially important to understand how these household level indicators affect the adoption of certain farm inputs, technologies and innovations in the study regions.

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