USAID's Sustainable Intensification Program in Africa

Africa Research In Sustainable Intensification for the Next Generation (Africa RISING)

Africa RISING Baseline Evaluation Survey (ARBES) Report

Mali

Produced by International Food Policy Research Institute, Monitoring and Evaluation Team

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The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program's monitoring, evaluation and impact assessment. http://africa-rising.net/

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List of Abbreviations

Africa RISING	Research in Sustainable Intensification for the Next Generation
AMASSA	*L'Association Malienne pour la Sécurité et la Souverainete Alimentaire* *Malian Association for Food Security and Sovereignty*
AMEDD	*L'Association Malienne d'Eveil au Développement Durable* The Malian Association of Awakening to Sustainable Development
AVRDC	The World Vegetable Center
CAPI	Computer-Assisted Personal Interviewing
CMDT	*Compagnie **malienne** pour le développement du textile* Malian Corporation for Textile Development
CSPro	Census and Survey Processing System
ICRAF	International Center for Research in Agro Forestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDA	*Initiative pour le developpement de l'Afrique* Initiative for the Development of Africa
IE	Impact Evaluation
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
M&E	Monitoring and Evaluation
MARBES	Mali Africa RISING Baseline Evaluation Survey
MOBIOM	*Mouvement Biologique Malien* Malian Organic Movement
PAPI	Paper-and-Pencil Interviewing
USAID	United States Agency for International Development
WHO	World Health Organization

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Executive Summary

As part of its Feed the future Initiative, the United States Agency for International Development (USAID) supported the development of an innovative research for development project to promote the sustainable intensification of small-scale agriculture in sub-Saharan Africa. Small-scale agriculture represents the main economic activity of the majority of sub-Saharan African population. Therefore, to address global hunger and poverty, the Feed the Future initiative (FtF) developed Africa RISING (Research In Sustainable Intensification for the Next Generation). Africa RISING is an agricultural research program aiming to provide pathways out of hunger and poverty for small holder families, in particular for women and children, through the development of farming systems that can sufficiently improve nutrition and income security, while conserving or enhancing the natural resource pool.[1]

The Africa RISING program comprises three research-for-development (R4D) projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.[2] These projects are organized under four research outputs:

1) Situation Analysis and Program-wide Synthesis
2) Integrated Systems Improvement
3) Scaling and Delivery of Integrated Innovation
4) Integrated Monitoring and Evaluation

The research projects are implemented in three macro regions of Sub-Saharan Africa, namely West Africa, the Ethiopian Highlands and East and Southern Africa. The International Institute of Tropical Agriculture (IITA) leads the efforts in West Africa and East and Southern Africa, while the International Livestock Research Institute (ILRI) is responsible for the implementation in the Ethiopian Highlands. Finally, the International Food Policy Research Institute (IFPRI) leads the program's monitoring and evaluation project and partners with several scholars and M&E specialists to track, record and analyze data on the outcomes generated by the different interventions.

Figure 1 AR Countries

In West Africa, IITA works with multi-disciplinary R4D partners in selected communities located in Northern Ghana and Southern Mali. More particularly, in Southern Mali the AR-WA project focuses on sorghum-millet-legume-vegetable-livestock systems in the Bougouni, Yanfolila and Koutiala districts, which are situated in the Sikasso region. The Africa RISING partners in Mali include several international institutions: the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Livestock Research Institute (ILRI), the Asian Vegetable Research and Development Center (AVRDC), the International Center for Research in Agroforestry or World Agroforestry Center (ICRAF); as well as local partners: L'Association Malienne d'Eveil et de Développement Durable[3] (AMEDD),

[1] See also 2013 AR-WA Workplan
[2] http://africa-rising.net/about/
[3] Malien Association of Enlightenment and Sustainable Development

L'Association Malienne pour la Sécurité et la Souveraineté Alimentaires[4] (AMASSA), Mouvement Biologique du Mali[5] (MOBIOM).

This report provides a detailed report on the design, implementation and results of the AR-WA evaluation activities in Mali. Its primary focus regards those interventions that fall under the Integrated Systems Improvement research output (number two of the four research outputs listed above). Since 2012, the research and development partners of AR-Mali have implemented several activities under the ISI research paradigm including i) Programs enhancing small farmers' access to fodder and feed production to improve organic fertilizer availability, seed availability and to increase crop diversity; ii) The creation of nutrition field schools to assist mothers with meal preparation and thus improving child nutrition and health; iii) Trainings on vegetable conservation, processing and storage to improve food security.

Figure 2 Farmers in Bougouni

In accordance with the goals of Integrated Systems Improvement, these programs were designed to be enacted simultaneously in the Africa RISING villages; and participants in AR villages were encouraged, and had the opportunity to take advantage of more than one component of the program during the same planting season. Because of Africa RISING's emphasis on a comprehensive approach to research for agricultural development in the fight against hunger and poverty, the evaluation approach to such a program required multi-stakeholder involvement and innovation. Charged with the task of ensuring that AR activities remained in compliance with USAID Evaluation Policy established in 2011,[6] IFPRI, in collaboration with partners across all AR projects, developed a quasi-experimental, mixed-method impact evaluation. The impact evaluation design will aid donors and stakeholders alike to determine and isolate the effects of the USAID-funded Africa RISING ISI programmatic interventions and their inter-programmatic interactions on the intended outcomes of improving food, nutrition and income security for small holder farmers in the southern, Sikasso region of Mali.

In accordance with USAID Automated Directives System (ADS) 203, impact evaluation in this research exercise is defined as an evaluation that,

> *Measures the change in a development outcome that is attributable to a defined intervention. Impact evaluations are based on models of cause and effect and*

[4] Malien Association for Food Security and Sovereignty
[5] Bio-Organique Movement of Mali
[6] See http://www.usaid.gov/sites/default/files/documents/1868/USAIDEvaluationPolicy.pdf

require a credible and rigorously defined counterfactual to control for factors other than the intervention that might account for the observed change.[7]

The impact evaluation design for the AR-Mali programs is described in further detail in Section 2 of this report. The evaluation strategy will include propensity score matching and difference-in-differences analysis to examine the differential change in outcome between the baseline survey and the endline survey depending on whether the household lives in an Africa RISING internvetion village or not. To this end, IFPRI along with AR-Mali implementing partners, developed the Africa RISING Baseline Evaluation Survey tool, the central component in the first phase of the impact evaluation on the Africa RISING project. A variation of the ARBES tool was used across all the AR target countries.

This report on the Mali-ARBES is divided into three main sections. The first section includes an overview of the evaluation design, a description of the survey tools used in the field and a summary of the planning and implementation phases of the survey work, including any challenges met on the field in Mali. Section two presents the results emerging from the data collected from the household and community surveys. Section three concludes the report summarizing the main trends arising from the data and stating programmatic and logistic recommendations based on the experiences gained in the field.

[7] See USAID Impact Evaluation Technical Note at
http://www.usaid.gov/sites/default/files/documents/1870/IE_Technical_Note_2013_0903_Final.pdf

1 Mali Africa RISING Baseline Evaluation Survey (MARBES)

1.1 Evaluation Design

The evaluation of the USAID-funded Africa RISING program in Mali employed a mixed-method, quasi-experimental impact evaluation research design to assess the impact of the AR program on achieving the declared goals on Integrated Systems Improvement. In line with the USAID requirements and the broader international standards regarding the establishment of appropriate and reliable M&E frameworks, IFPRI worked closely with the rest of AR partners to develop and design an evaluation approach that would effectively assess the impact of the Africa RISING project on the outcomes of interest.

The final evaluation design is the result of close collaboration with the Mali-AR partners, which contributed with their local experience, and of the long-standing expertise of IFPRI in conducting large-scale, national-level studies on nutrition and agricultural policies.

As it is evident from the annual work plans presented by the AR-Mali implementation partners, each AR program is meant to work in tandem with the other ones in order to capture a multi-pronged impact on the different *farming systems.* The tree key outcomes that the AR program in Mali aims to achieve include:

I. Improving farm household nutrition
II. Sustainably managing natural resources and fodder production
III. Increasing farm and field productivity through integration of technologies and improved farming methods.

To measure program effectiveness with regard to the three key outcomes of interest, IFPRI selected twenty villages appropriate for the Africa RISING Baseline study in Mali. Ten of them received the Africa RISING program and therefore are considered *treatment villages*, while the other ten are *control villages*: villages with very similar characteristics with respect to the ten AR ones, but that were not included in the program. The comparison between these two groups through rigorous econometric methods such as propensity score matching and difference-in-differences will allow IFPRI to evaluate the impact of the Africa RISING intervention. The next section presents the selection procedure of the treatment and control villages.

AR and Control Villages Selection

The site selection process for the Africa RISING impact evaluation study in Mali is fully detailed in the Site Selection Reports that can be obtained from the AR partners at ICRISAT. [8] Here we provide a brief overview of the process.

In Koutiala, the key criteria of the selection included accessibility of the site by road (during the dry and rainy seasons),[9] the presence of key implementing partners (such as AMEDD, AMASSA), and the existence

[8] Site selection reports for the MARBES study can be obtained from AR partner, ICRISAT-Mali.

[9] Accessibility of villages is defined in two ways: 1) a village's access to market(s) and 2) distance of a village from a main/paved road.

of agricultural cooperatives and communal unions. In addition, other factors were included to verify that the different sites selected had the combination of conditions required to implement the activities of the project in the three target domains: 1) Seed Systems, 2) Livestock, Land & Fodder, and 3) Nutrition. The initial investigation reported large heterogeneity across villages, which made it difficult both to select potential intervention sites with similar initial conditions and to find control sites with comparable characteristics to the different treatment villages. As a result, the pairwise approach for site selection was recommended, since it would permit for an easier association of each intervention site to a similar potential control site. [10]

In Bougouni, potential intervention sites were selected according to their agricultural potential and access to markets; the presence of key partners for the project and the accessibility of the sites. [11] As in Koutiala, other types of information were considered to verify that the sites meet the required conditions to carry out the activities in the three target intervention domains listed above. At the initial stage of selection, the intervention sites were chosen if there was the presence of one of the partners (MOBIOM and Helvetas). When the initially selected sites did not meet the necessary criteria, the partners suggested a replacement site with similar characteristics and located in proximity. The control sites selected for Bougouni were those judged as the least accessible in the strata and where the partner organizations did not intervene, in order to insure a clean indentification strategy. They are associated with intervention sites according to their similarity in terms of population (based on data from 2005), among other characteristics. If the initially selected sites did not correspond to the action sites according to these criteria, the selection committee replaced them with a nearby site that was a better fit.

Figure 3 Map of Bougouni

At this planning stage it was also determined that the appropriate sample of households, based on population sizes reported from several sources, should be set at approximately 700. These households were to be drawn from the following villages and their respective administrative communes and cercles. During the early stages of field work preparation, a closer examination of information used to determine the villages to be in the study revealed that the village of Yeni was not an appropriate comparison village to the treatment village of Flola, because of its distance from the other AR sites, and the proximity of other villages which fit the selection criteria for control villages. In addition, there was not a comparison village in the district of Yanfolila, where the treatment village of Yorobougoula is located.

Figures 1 and 2 in Appendix 1 show the distance between Yeni and the other potential sites for the MARBES study and the location of the AR action and control sites in Koutiala. To replace Yeni, the M&E team compiled a list of potential replacement control villages using characteristics such as size of population, access to roads and markets, and environmental factors. In the end, the village of Goualala 1 was chosen by sorting the 12 qualifying villages and picking one randomly. The village of Yeni was the only village changed in the MARBES study.

[10] "AR SitesSelection_report_Koutiala_english", pp. 7-8

[11] "ENGLISH_RAPPORT DE MISSION_Bougouni", p. 4

AR Beneficiaries

Before the beginning of fieldwork, AR partners and the CMDT supplied the M&E team with lists of beneficiary and non-beneficiary households for the ten AR villages. The IFPRI M&E team received more than twenty-eight beneficiary lists from all AR partners. These lists represented both individual beneficiaries and farmers' organizations that participated in trainings, improved seed trials, nutrition classes and other activities implemented through Africa RISING between 2012 and 2014. The beneficiaries for Africa RISING are mainly self-selected and are a result of the Quick Win 2012 and AR 2013 programming activities built upon partners existing programs.[12] The non-beneficiary households lists were compiled by the CMDT and included mainly households that purchased agricultural inputs to plant cotton and households that sold cotton produce in 2013. The IFPRI M&E team received CMDT lists for seven villages included in the MARBES study.

One of the main issues encountered in the selection of households for the baseline survey on the base of these lists iregarder the definition of the household unit itself. The CMDT lists shared with the IFPRI M&E team identify an "Unité de production agricole", also called an "exploitation unit", which is often an extended family including several households farming together. As a result, the CMDT lists only included the name of the head of a concession and not the name of all the individuals that were part of it. In order to match beneficiaries with households and know really which household, or which individual within the household, has participated in the Africa RISING project, it was necessary to match individual beneficiaries listed within the 'concession' to the head of such concession. This could only be done by first, defining the household unit for the purposes of the study, and then visit each household in the field to collect a list of member's names.

Definition of a Household: Mali

In the CMDT lists, the AR survey and the national census of Mali, the household is defined in the following manner:

> *The household is an individual or a group of related individuals, living within a concession, under the authority of a person named head of household. The household is composed by the household head, his or her own wives and unmarried children, and possibly other related or unrelated people living under the authority of the head.*[13]

What is distinct about the Malian concept of the household, compared with other AR countries, is the concept of the concession. It states that the individuals or groups that make up a household live in a *concession*. Figure 4 below shows a visual representation of a concession as displayed in the national census enumerator manual from the *Bureau Central de Recensement* (B.C.R).

[12] The conflict in Mali inhibited the M&E from travelling to Mali, which made it difficult for the M&E team to participate in the planning stages of the implementation, a crucial step in the development of solid impact evaluations.

[13] Bureau Central de Recensement (B.C.R) 2008. p. 5

As can be seen from Figure 4, a concession can be comprised of one individual or several adults, living in separate structures, who share a bathroom and kitchen space. All separate structures within a concession are not considered households but homes within the household or concession. For example, in the Malian census and the small household surveys completed by the AR partners prior to program implementation, some households are listed as including as many as fifty-four people. Using Figure 4, on the right, a household, as defined by the Malian bureau of statistics, would include Mme. Kone, Mr. Traore, Mr. Coulibaly, Mr. Barry, Mr. Keita and Mr. Traore.[14] This household would also include each or all of their spouses,[15] their children and any other relatives that are living within the structures occupied by one of the persons named above.

This encompassing definition of the household translates into large household sizes, sometimes surpassing 100 individuals. Conducting a detailed household survey (which collects not only household consumption information for each meal, but also anthropometric data for all children and women in the household) using this communal, extended family concept of the household entails several complications, including the significantly larger amount of time and resources necessary to achieve a desired sample size of 700 households – the target number of households for the MARBES study. As a result, the M&E team decided to employ a more conscripted definition of the household in line with the one used for the other AR countries.

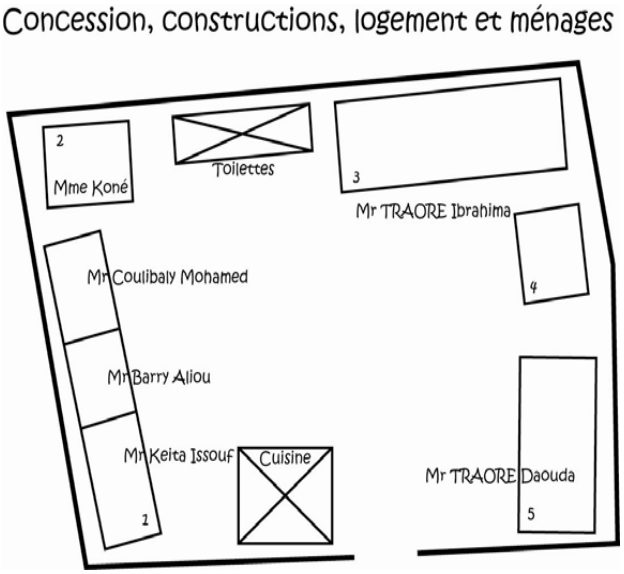

Figure 4 Concession Structure

Two main reasons motivated this choice. First, one goal of the MARBES study is to obtain micro-level data on the consumption, production and nutrition information of agricultural household in the selected regions and villages in southern Mali. While the Malian definition of the household is extended and communal; food production, consumption, conservation and transformation practices are established at the restricted household level and therefore vary within concessions. The same is valid for agricultural and non-agricultural assets ownership, which is also established at the household level. Using the concession example in Figure 4 shown above, each male listed in the compound may have two to three wives and each of those wives may receive resources from her husband to provide food, clothing and other necessary items to provide for the children they share and any other relatives. Husbands may or may not distribute resources equally among wives, and each woman may have personal assets such as a personal farm or entrepreneurial enterprise, agricultural inputs, etc... In addition, the law requires that men with multiple wives build separate living quarters for each wife and her children, making it possible for each wife to have varying levels of assets within their respective living quarters, which are not shared with other wives or children.[16] This intra-household or intra-concession variation in agricultural assets and production, food and non-food consumption and household assets and durable goods make concession-

[14] As is custom, an individual's last or family name is written first.
[15] Mali is a predominantly Muslim country where polygamy is legal.
[16] See the Family Code of Mali, Code des Personnes et de la Famille, Articles 320-322, p. 60

level analysis extremely difficult in terms of assessing the nutrition and production situation of each nuclear family unit and evaluate which interventions will be most appropriate to affect change in the intended outcomes set forth in the AR program objectives.

The second reason concerns the fact that interviewing all members of 700 households – if households had to be defined as the concession - would have been extremely complicated given the objectives of the MARBES study and the resources devoted to the impact evaluations of all AR projects located in five countries in sub-Saharan Africa. Since one of the goals of the AR evaluation activities is to perform a cross-national analysis of the relevant outcome indicators, the units of analysis have to have some level of comparability across countries. When customizing the ARBES instruments in each country, the end-level analysis was continuously taken into account even as the surveys were customized to be made appropriate for each local reality.

To reconcile the broader objectives of the AR Impact Evaluation, the resource and time constraints placed on the MARBES study, and the particular conceptualization of the meaning of a household in Mali, the M&E team resolved to conscript the definition of the household in Mali into the following:

> *The household is defined as a group of people who share expenses, live and eat together most of the time (that is, at least 3 months in the past 12 months and at least three days in a typical week). The group may also share expenses and income with other groups (of individuals) living in the concession/compound. In addition to meals shared only by group members, the group may share communal meals. A newborn less than 3 months has to be considered a household member.*

The definition above served to account for nuclear families and related or un-related individuals living together under the same roof.

Village Census

As a result of this new definition of a household, and the incompleteness of the CMDT and beneficiary lists supplied by the AR partners, the M&E team concluded that it was necessary to conduct a census of each of the twenty villages included in the MARBES study and to build beneficiary lists based on the M&E team definition of the household. Below is a brief description of the procedures followed to carry out the MARBES village census in Mali.

The listing exercise yielded a count of 3,231 treatment households and 3,305 control households, distributed across the twenty villages. Table 1 below summarizes the number of households by village.

Table 1. Households from AR M&E Village Census

Village	Number of Households per Village	Village	Number of Households per Village
Treatment		**Control**	
Dieba	135	Goualala 1	230
Flola	109	Siratogo	95
N'golonianasso	500	Sakoro	200
M'pessoba	530	Dossola	204
Madina	177	Dialakoro	264
Nampossela	260	Tiere	345
Sibirila	103	Konina	653
Sirakele	710	Konseguela	576
Yorobougoula	293	N'Togonasso	257
Zansoni	384	Bobola-zangasso	481
Total	3,231	Total	3,305

Once the listings for all twenty villages were completed, IFPRI and IDA worked together to pull a random sample of 900 households, 450 treatment and 450 control. A sample of 10 replacement households were pulled for each village, but finally only 700 households are included in the full sample.

Sampling Design

Originally, the household sample for the MARBES study was to include a set of direct treatment, indirect treatment and control households. However, because of timing and resource constraints, complications surrounding the household listing exercise and the contextual particularities of the household definition in Mali, the sample was evenly divided between 350 treatment and 350 comparison households across the 10 pre-determined treatment and 10 pre-determined comparison villages included in the AR program.

The sampling design chosen was a stratified random sample (for the control villages), and a random pick between beneficiary households (which were not chosen randomly). The methodology of extrapolation consists in estimating the parameters of a population (universe) from a sample drawn from the same population. Thus, the formulas used for this extrapolation follow from the sampling design adopted for the household survey. The drawing of the sample was done at each stratum independently, and the final full sample was obtained by aggregating the results drawn from each strata.[17]

Following the sampling plan outlined above, 45 households were sampled from each control village. This number varied in treatment villages based on the number of AR beneficiaries. In each control village, 45 households were drawn by simple random method with equal probability of being pulled -- 35 for the sample with 10 replacements at a replacement rate of 22.2%. In each treatment village, households that self-identified as beneficiaries were pulled for the sample with a replacement rate of 17.2%. The resulting ex-ante sample (excluding the replacements) is shown below.

[17] See Appendix 2 for the formulas used to draw the sample.

Table 2. Ex-Ante Sampled Households per Village

Treatment Village	Sample Size	Control Village	Sample Size
Dieba	25	Goualala 1	35
Flola	28	Siratogo	35
N'golonianasso	56	Sakoro	35
M'pessoba	47	Dossola	35
Madina	19	Dialakoro	35
Nampossela	35	Tiere	35
Sibirila	15	Konina	35
Sirakele	56	Konseguela	35
Yorobougoula	44	N'Togonasso	35
Zansoni	25	Bobola-zangasso	35
Total	350	Total	350

1.2 MARBES Tools

Based on the FtF indicators and IFPRI's experience with numerous national-level household nutrition surveys, the M&E Africa RISING team created the detailed and customized household and community questionnaires to be used for the AR baseline data collection. To assess sustainable intensification trajectories for different household typologies as they occur, and to inform the development of scaling up strategies, data were collected in all AR countries on the composition of households, crops grown at the plot level, livestock systems, farm and crop management practices, use of various agricultural inputs, and the key livelihood strategies employed by households active in agriculture.

Household survey tool

The table below summarizes the household survey tool (section by section) and the intended use of data from each module/section. In the agricultural modules (E-J) and Welfare and Consumption modules (O – R) particular emphasis is placed on the level of detail of the data. For example, section G1 contains information disaggregated at the parcel-plot-crop level and section O reports information of different demographic groups within the household, allowing the measurement of intra-household variation for access to assets and food.

Table 3. Africa RISING Baseline Evaluation - Household Survey Tool

Modules – Household Survey	Objective: To gather demographic data on households, the agriculture-related activities of the households, consumption practices and participation in farmer training/education and Africa RISING.
A. Consent Form and Household Location and Contact Information	Consent from Household Head, GPS coordinates, Household Re-contact Information, date, time and status of survey
B. Household members	Information on educational attainment, marital status, and primary/secondary occupation of household members.
C. Child Anthropometry	Height, Weight and Arm circumference of children residents of the household, below age 5 yrs.
D. Woman Anthropometry	Height, Weight and Arm circumference of women residents of the household, of reproductive age (15 - 49 yrs).
E. Agricultural Land	Land ownership, participation in agricultural activities, land and soil characteristics, and water sources (at parcel-level)
F. Crop Inputs: Conservation	Farming and soil conservation practices. Data will be collected at parcel-plot level.
G1. Crop Production	Information on all different crops grown on each plot and the different varieties of the crops.
G2. Crop Inputs: Cost	Seeds, pesticides, fertilizer, and non-labour expenses incurred by the household. Data were collected at the plot-crop level.
G3. Crop Inputs: Labor	Labour input on crops grown on each plot during the planting seasons. Data were collected on how many person-days were used for different activities for each crop grown on a plot. Person days are calculated as the number of workers times the number of days they worked.
G4. Crop inputs: Seed	Seeds used for key crops grown during most recent cropping season.
H. Crop Sales: Quantities	Quantity of crops sold by the household after crop failure, and other uses
I. Crop Storage	Storage methods used by households and effectiveness of various storage methods.
J1. Livestock Ownership	Number and type of local and improved livestock owned by the household at the time of data collection and during the preceding 12 months.
J2. Livestock feed and Water Supply	Sources of food and drinking water for different livestock categories and production of organic fertilizer
K. Extension and Africa RISING	Household's interaction with agricultural extension agents and participation in Africa RISING
L. Other Income	Income earned from non-agricultural activities by the household in the past 12 months
M. Credit	Household access to and use of credit
N. Housing and Assets	Composition of household structure, facilities within the household and various household assets
O. Welfare & Food Security	Household food security and seasonality in terms of access to certain foods (at household level and selected demographic groups – men, women and children)
P. Food Consumption	Household food expenditure on various food items, including cereals, root vegetables, sugar, pulses, nuts and seeds, vegetables, fruits, meat, meat products, fish, milk and milk products, oil and fats, spices and other foods, beverages, and wild fruits.
Q1. Non-food Expenditures: Past Week and Month	Data about household's non-food expenditures on certain consumption items. Data on food and non-food expenditure will be used to construct a measure of poverty
Q2. Non-food Expenditures: Past Year	Data about household's non-food expenditures. Data on food and non-food expenditure will be used to construct a measure of poverty
R. Shocks	Types of shocks the household experienced by the household over the past five years and subsequent coping strategies.

Community Survey Tool

The table below summarizes the community survey tool (section by section) and the intended use of data from each module/section. The community questionnaire was administered to a group of notable individuals in the village, including individuals such as the chief, the president of the women's association, teachers, etc. In the services modules (C) information is collected on the availability of essential services within the community. The survey tool includes questions on access to basic services like schools, healthcare clinics and police stations, as well as services related to livestock, such as vaccination stations and livestock markets. Agriculture models (D– F) emphasize topics such as availability of technical assistance for the various stages of crop production, the major agricultural challenges faced by the community, the use and allocation of land and the distribution of land rights, and demographics and migration patterns of the community members. The data collected in the community surveys allows the measurement of inter-community variation for access to basic services, agricultural services and differences with respect to land use, land rights and commonly experienced shocks, either weather related or market related.

Table 4. AR Baseline Evaluation – Community Survey Tool

Module – Community Survey Tool	**Objective: To collect information that will be used jointly with the Household Survey tool to assist with better understanding of the situation of people living in a community.**
CA. Community Identification Information	Location information for Community including GPS coordinates
CB. Roster of Community Informants	Demographic information for community informants including age, gender and position/title in villages
CC. Basic Services	Access to, quality and availability of basic services
CD. Extension	Agricultural labor, Agricultural Extension services, and Agricultural problems
CE. Land	Land use, total land size, land used for agriculture, the allocation and transfer of land ownership, especially between men and women
CF. Demographics	Population size of community, patters of immigration and emigration, access to farmer's groups, improved seeds, and financial services
CG. Water Access, Shocks and Food Consumption	Access to water from various sources, prevalence and type of shocks experienced by community or community members, and crop-specific food production and consumption patterns
CH. Local units	Market prices for common goods and metric conversion of local measurement units

1.3 MARBES Planning, Implementation, and Challenges

After several months of vetting capable survey firms, the M&E team decided to partner with IDA (Initiative for the Development of Africa) to implement the MARBES survey. Selection of the MARBES data collection partners were based on the following criteria:

- Legal status recognized by the Government of Mali.
- Strong experience planning and executing household survey work in Mali and internationally.
- Strong network of experienced enumerators (of both genders), supervisors, IT, and research managers.
- Strong knowledge of survey-related software programs in Mali and internationally (e.g., ODK)
- High competence in electronic data collection in large surveys

As a result of IDA's experience in these areas, as well as their experience programming and implementing similar electronic household surveys on agricultural productivity, nutrition and consumption with other divisions of IFPRI and the Michigan State University, the M&E team felt confident in its selection of IDA as the survey implementation firm. IDA recruited over 40 enumerators to be trained for the MARBES implementation, as well as an additional 20 enumerators who participated in the listing exercise.

The preparation and implementation of the MARBES survey followed a detailed plan outlined by IFPRI in partnership with IDA. The IFPRI-IDA facilitation of the MARBES implementation spanned the course of four months and involved the following key elements for the various stages of the survey:

- Questionnaire Refinement and Translation
- Administrative and Government Approvals
- Recruitment and Training of Survey Personnel
- Acquisition of Survey Equipment
- Programming of Electronic Survey
- Piloting of Household and Community Surveys
- Census of Survey Villages
- Design and Rationale of Survey Sample
- Survey Implementation

Figure 4: Training of Enumerators

Because of the unique circumstances in Mali, which will be discussed in the following section, the village census, sampling design and selection, questionnaire revision, questionnaire translation and enumerator training happened almost concurrently beginning in April 2014, once a contract with IDA was finalized. A key component to questionnaire revision and enumerator training was the survey piloting activities that took place before the training, during the training and after the final enumerators had been selected.

Survey Pilot

The survey pilot was limited to the paper (PAPI) version of the household survey as the translation of the community questionnaire was not yet available at the time, and the enumerators had not yet been trained on the electronic (CAPI) version. The survey pre-test took place in two villages and tested various issues to judge their suitability to the Malian context. The first survey pre-test took place in the village of Sinsina in the *commune* of Sanakoroba. The second pre-test took place in the village of Tiele in the *commune* of Tiele.

After the pilot, several adjustments were made to the questionnaire. This helped to address important concepts such as the complexity of the definition of household in Mali; the ownership of plots within these households; the updating of the list of codes for crops; the parsing out of various educational levels; and the refinement of items related to agriculture including cropping practices and resource management, among other things. Following the pilot, the M&E team provided a second version of the questionnaire based on the findings and household definition adapted to the Malian context. This version of the questionnaire was used for the classroom enumerator training.

Enumerator Training

The training was divided into several sections covering the purpose of the MARBES study and the contents of the questionnaire, the pre-test of the survey instrument and the practical training on the electronic (CAPI) version of the questionnaire.

The CAPI version of the questionnaire was written primarily by IDA, using the CSPro software interface. The program was written to allow for efficiency and ease of implementation, permitting enumerators to input respondent answers immediately into a program that was collecting and storing the information. The advantage of CSPro is that the survey responses are easily exported into STATA, Excel or other statistical software packages.

As discussed with the M&E team, three days of survey pre-tests were organized: one day with the PAPI version of the questionnaire and two days with the CAPI version of the questionnaire. During these pretest phases, the field coordinator and research manager of IDA assisted the representatives of IFPRI to address the weaknesses of the collection device, any persistent error with the computer program and to explain the sections not fully understood by enumerators. IFPRI and IDA proceeded to make corrections to these different levels following every piloting exercise. The PAPI and CAPI versions of the MARBES questionnaire were written and conducted in French, when comfortable for the respondent. But in most cases, the survey was conducted in Bambara. Although a verified Bambara version of the questionnaire was not available for printing at the time of enumerator training, during the classroom training enumerators formulated, rehearsed and formed a consensus about how to express each survey question in Bambara.

Materials

The administration of the MARBES study involved the use of the electronic equipment to administer the questionnaire and store respondent answers, as well as the instruments and devices for the collection of the anthropometric data of women and children and the GPS coordinates of villages and households. The main inputs and materials used in administration of the MARBES included:

- Thirty-Four Samsung MiniBook Solaire Notebook Computers
- Twenty-Nine USB GPS Devices
- Eight Hanging Scales for Infant Weight
- Ten Digital Scales for Adult Weight
- Ten Height Mats for Infants/Toddlers
- Twelve Height Boards for Adults/Children

These are the main materials used in the administration of the MARBES questionnaire.

Itinerary

The survey started on May 28 and lasted 29 days in total. Activities began in the 4 control villages of Bougouni following which the teams were sent within the control and treatment villages of Koutiala. Having completed the surveys in the control and treatment villages of Koutiala, the team returned to Bougouni to conduct the surveys in the treatment and control households in Yanfolila.

The security situation in northern Mali resulted in serious delays of the ARBES study in Mali and the original time allotted for the ARBES studies in West Africa was greatly conscripted due to the halting of evaluation and other USAID and US government activities in Mali, but eventually the data collection was successfully completed. In the next section we present the main trends emerging from the data.

2 Summary of MARBES Results

2.1.1 MARBES- Household Survey Data

This section summarizes data from key sections of the MARBES survey. The analysis focuses on demographic information, such as the overall size and distribution of households in the survey; information on the agricultural attributes of the household, such as land-ownership, crops planted, crop yield and crop use and storage; livestock information; access to agricultural services; participation in the AR program or alternative farmer education/training programs; household consumption and household assets; and household experience with shocks such as drought, flooding or violence. The information is presented from the entire sample as disaggregated by cercle and/or household type (beneficiary and control). The discussion in this section highlights important trends in the data by cercle and household type, how data from the different sections reinforce (or contradict) each other and the implications, if any, on the validity of impact evaluation results.

Total Size and Distribution of Beneficiary and Control Households

Mali is divided into four distinct administrative units: the Region, Cercle, Commune and Village. As previously mentioned, the survey activities for the MARES study took place in three cercles within the Sikasso region: Bougouni, Koutiala and Yanfolila. Table 5 below indicates the number of households surveyed in each village, commune and cercle and also informs on the final list of control and treated villages.

Table 5 Distribution of MARBES Sample

Cercle	Commune	Village	Type	Total HHs
Bougouni	Keleya	Dialakoro	Control	35
Bougouni	Sido	Siratogo	Control	35
Bougouni	Sido	Sakoro	Control	37
Bougouni	Syentoula	Dossola	Control	36
Koutiala	Diouradougou-kafo	Tiere	Control	36
Koutiala	Gouadji-kao	N'Togonasso	Control	35
Koutiala	Konina	Konina	Control	35
Koutiala	Konseguela	Konseguela	Control	35
Koutiala	Zanfigue	Bobola-zangasso	Control	35
Yanfolila	Wasselou-balle	Goualala 1	Control	35
Control Total				**354**
Bougouni	Danou	Dieba	Treatment	25
Bougouni	Faradiele	Flola	Treatment	28
Bougouni	Faragouaran	Sibirila	Treatment	15
Bougouni	Kouroulamni	Madina	Treatment	19
Koutiala	N'golonianasso	N'golonianasso	Treatment	57
Koutiala	Songoua	Sirakele	Treatment	56
Koutiala	Sincina	Nampossela	Treatment	35
Koutiala	M'Pessoba	M'pessoba	Treatment	47
Koutiala	Fakolo	Zansoni	Treatment	25
Yanfolila	Gouanan	Yorobougoula	Treatment	44
Treatment Total				**351**
Total Households				705

There are a total of 705 households in the sample, 351 treatment and 354 comparison households. As is evident from Table 5 on treatment households above, the largest number of households in the sample are located within the cercle of Koutiala, which is the most populous cercle in the region of Sikasso.

Demographic Attributes of Households

Table 6 presents household-level demographic information for households in the treatment and comparison groups including the average household size, education level, and primary economic activity of the household head. The analyses of each variable are discussed in separate sections below, but Table 6 provides a snapshot view of the significant baseline differences between treatment and comparison households in the sample.

Table 6 Demographic Attributes of Households in MARBES Study

	Household Characteristics			***Attributes of Household Head[18]***				
Group	**Household size**	**Dependency ratio**	**Max education**	**Age**	**Max Education**	**Male (%)**	**Married (%)**	**Primary Activity Agriculture (%)**
Treatment	4.77***	0.81	4.87	45.97***	2.1	98	98	97***
Control	4.29***	0.74	5.27	43.35***	2.66	97	96	89***
Total	4.53	0.77	5.07	44.66	2.38	97	97	93
Treatment								
Bougouni	5.33***	1.13***	4.8	47.47	1.7	100	100	99
Koutiala	4.43***	0.62***	4.73	45.4	2.08	100*	98	95
Yanfolila	5.34*	1.18***	5.68	45.8	3.02*	83***	98	98
Total	4.77	0.81	4.87	45.97	2.1	98	98	97
Control								
Bougouni	4.28	0.73	5.43	45.14**	2.5	96	96	87
Koutiala	4.12	0.63***	5.19	41.55**	2.89	98	97	90
Yanfolila	5.23***	1.28***	5.09	45.24	2.12	100	97	91
Total	4.29	0.74	5.27	43.35	2.66	97	96	89

* significant at 10%; ** significant at 5%; *** significant at 1%

As pointed out in the previous section on the planning and implementation of the MARBES study, the issue of defining the household in Mali proved to be very complex. Because of the need of uniform units across countries, and resource management for the study, the definition of the household was restricted to that of a household head, the spouse, the children and any other person – children or elderly adults - that are under the head's direct care. Because Mali is a polygamous society, not unlike other West Africa nations, this often involved asking a man to choose among one of his wives to be interviewed and to

[18] Those variables marked with the † symbol represent percentages or shares of households in the study that exhibit a certain trait, such as male-headed household.

respond to questions only in relation to the selected wife and the children they share. Accordingly, the household demographics presented below are based on this restricted definition of the household.

The average size of the household interviewed in the AR baseline survey in Mali is 4.5 persons, ranging from a household with one person to a household with thirteen persons. As depicted in the table above, the difference in means for household size is statistically significant and households in the treatment villages are slightly larger than those in the comparison villages.

When disaggregated by cercle and type, we see that the differences in means for household size are also significant among the cercles with AR beneficiaries. As seen from Table 6 above, the treatment households in the cercles of Bougouni and Yanfolila have close to one additional member than in Koutiala, which subsequently affects the dependency ratio statistics. This trend also holds true for the control households in Yanfolila. The difference in means for household size is more statistically significant in the cercle of Bougouni than in Koutiala, but there is no statistically significant difference for household sizes between the treatment village and control village within Yanfolila.

As defined by the World Health Organization (WHO), the age dependency ratio represents the ratio of dependents to the number of working–age persons in the population. In this definition, dependents are persons younger than fifteen years and older than sixty-four years old; and the working–age population are those persons between the ages of fifteen and sixty-four.[19] For this report, the dependency ratio is restricted to the ages of the household members included in the MARBES study, unlike the WHO figures which reports age dependency ratio using ages for the entire population of the country. The overall average dependency in the MARBES study is .77, which is lower than the national rate as reported by the World Bank for 2013 (1.01). Like household size, the dependency ratio changes based on treatment type and geographic location - treatment households have an average age dependency ratio of .81 compared to a ratio of .74 for comparison households but this difference is not statistically significant. When disaggregated by cercle, the difference in means for the dependency ratio becomes significant, with treatment households in Bougouni and Yanfolila having a higher share of dependents compared to treatment households in Koutiala. The same trend holds for the control households in Yanfolila and Koutiala; control households in Yanfolila have more dependents than those in Koutiala and the difference is statistically significant.

The maximum education levels attained by household members aged 15 years or older in the MARBES study is of about 5 years of school, which falls between the 4th and the 5th grade of primary school. Interestingly, from Table 6 above, it appears that the average level of education among treatment households is lower than those of the control households, 4.87 against 5.27 respectively, but this difference is not significant. Geographically, AR beneficiaries in Yanfolila have on average an additional level of education (5.68) compared with their counterparts in Koutiala (4.73) and Bougouni (4.80). Again this difference is not statistically significant.

Table 6 above also summarizes key characteristics of the primary decision makers, or heads of the households included in this study. Heads of households are almost exclusively married men, who possess, on average, between the 1st and 2nd grade of educational attainment. This indicates that household heads are often not the most educated people in the family, which implies that resources for education are more likely directed towards children or persons other than the household head. The heads of households

[19] See http://data.worldbank.org/indicator/SP.POP.DPND for more information on country-level age-dependency ratios in Mali and other countries.

belonging to the AR treatment villages are slightly older and slightly more likely to be involved with agriculture as primary economic activity. An interesting finding from Table 6 above is that households in the treatment village of Yanfolila are more likely than others to have households headed by women. Four of the eleven female-headed households in the study reside in Yorobougoula, the treatment village for Yanfolila.

Agricultural attributes of households

Table 7, below reports the information pertaining to the agricultural attributes of households in the MARBES study. These include the amount of land cultivated for each household, the number and type of crops grown by the household, farming techniques like irrigation, information on the use of inputs –both customary and encouraged by the AR program- and the average household expenditure on those inputs, (labor, fertilizer, etc…). Mali has mainly one planting season, which occurs from May through December. May is the month in which land is prepared and seeds are planted, with some seeds being planted as late as June. All of the data reported below pertain to the 2013 agricultural planting season (May-Dec 2013).

The average cultivated area per household in the 20 villages included in the MARBES study is 8.63 hectares. AR participating households cultivate, on average, about 1.2 additional hectares than their counterparts: Treatment households cultivate, on average 9.21 hectares of land, compared to the 8.04 hectares of land cultivated by control households. The differences between the total are of cultivated land is statistically significant at the 1% level. The difference in land size, however, disappears completely if we look at the per capita statistics.

The average household in the areas covered by the MARBES study own multiple farms or parcels, 4.17 on average. Treatment households own slightly more than this, averaging 4.71 farms per household, and control households have smaller holding at 3.63 farms per household. The differences between the total number of parcels between treatment and control households is also statistically significant.

Table 7 Agricultural Attributes of Households: LAND

	Treatment	Control	Total	Obs
Size of operated land(ha)	9.21***	8.04***	8.63	705
Size of operated land per capita(ha)	2.38	2.38	2.38	705
Total # of parcels	4.71***	3.63***	4.17	705
Intercropped plots at hh(ha)	0.02	0.05	0.04	684
Legumes intercropped plots at hh(ha)	0.01	0.01	0.01	684
Does Household Own Land (%)	99	99	99	697
No of Crops/ HH	6.23***	4.68***	5.45	705

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8 Agricultural Attributes of Household: Crop Area, Production and Yield

	Share of HHH Growing Crop (%)			Average area of Crop (ha)/hh			Yield of Crop (kg/ha)		
Crop Name/Group	Treat	Control	Total	Treat	Control	Total	Treat	Control	Total
maize	90**	84**	87	2.02	2.05	2.03	1895.67	1823.46	1860.52
groundnut	81***	64***	72	1.06**	0.78**	0.92	1415.24	1384.37	1401.58
sorghum	73	70	71	2.3	2.55	2.42	883.09	796.29	841.02
cotton	77***	59***	68	2.41***	1.94***	2.17	963.27**	1230.99**	1076.18
millet	59***	40***	49	1.83***	1.16***	1.49	940.97**	768.81**	871
rice	53***	40***	46	0.44	0.47	0.45	1164.85	1374.74	1255.75
beans	53***	29***	41	1.05***	0.50***	0.77	423.58	429.69	425.72
okra	37***	22***	29	0.18	0.12	0.15	2608.59	2728.39	2651.69
Bambara nuts	24***	8***	16	0.13***	0.04***	0.08	640.24	1162.67	774.58
mango	10***	4***	7	0.15***	0.04***	0.1	1780.61	1906.17	1812
Soya bean	3	5	4	0.01**	0.03**	0.02	699.58	373.37	486.29
cereals	98	97	97	6.51	6.48	6.49	1234.60***	1056.52***	1145.82
legumes	89***	74***	82	2.32***	1.45***	1.88	1010.46	955.65	985.35

** significant at 10%; ** significant at 5%; *** significant at 1%*

Area, Production and Yield of the Main Crops Cultivated in the Households

As shown in Table 7, the average number of crops cultivated per household is 5.45, that figure is slightly higher for treatment households (6.23) and lower for comparison households (4.68).
Of the crops produced by households included in the MARBES study, seven are grown by at least forty percent of households, including maize, groundnut, sorghum, cotton, millet and rice, as displayed in Table 8 in order of their popularity. Cereals and legumes make up the majority of crops cultivated by MARBES households and households. On average, each household dedicates 1.88 hectares to legumes such as beans and groundnuts and 6.49 hectares to cereal crops such as millet, rice and sorghum. We can observe some statistically significant differences between treatment and control groups. For example, AR participating households dedicate almost one additional hectare to legume crops as do comparison households. This difference is not surprising, since one of the Africa RISING objectives is the one of increasing the production of legumes.

For each of the seven most common crops listed above, a larger share of AR participating households cultivate these crops than do households in comparison groups. For example, 77% of AR households grow cotton, a major cash crop in Mali, compared to 59% of comparison households. This difference holds true for less widespread crops, such as perennials and tubers like mangos and onions. Roselle (hibiscus) is the only crop for which a greater share of the comparison households grows than that of AR participating households.

For most of the main crops – groundnut, cotton, millet, beans, Bambara nuts and mango – we observe that the treatment villages allocate a larger portion of land for their cultivation. On the other hand, treatment households' productivity (as measured by yield) is not necessarily greater than the one of control households for the majority of the crops, even though we observe a significant difference when we look at productivity of all the cereals combined.

Of the seven crops identified as the most common (i.e. crops grown by more than forty percent of households in the sample) the difference in yields is statistically significant only for cotton and millet. Treatment households produce more kilograms of millet per hectare than control households but produce less cotton for the same area. More analysis is needed to see whether some of these differences can be explained by the AR program.

Household Agricultural Inputs

This section presents the share of households using key agricultural inputs such as improved seeds, fertilizers and various tilling and irrigation techniques. It also discusses the mean expenditure on these inputs, disaggregating by treatment and control.

The majority of households in the MARBES study did not employ improved seeds for the crops planted in the May-December 2013 planting season. According to the data 73% of households did not use improved seeds for any of the crops planted in May-December 2013 cropping season. Only 10 of the 31 crops reported in the study were planted using improved seeds in some cases. Among the 7 main crops in the study, 4 were planted using improved seeds in some cases – maize, sorghum, beans and groundnut. There is no statistically significant difference between the share of treatment households and the share of control households that used improved seeds for the main crops, except in the case of sorghum where

one percent of households in the treatment group reported having used improved seeds for that crop. However, when the entire group of cereals and legumes are considered, we can see that household in the treatment group make significantly more use of improved varieties.

Use of improved seeds for the cotton crop is much more widespread, as seen from table 9 below. 22% of farmers in the sample use improved seeds for cotton cultivation. This is likely the result of farmers' engagement with the CMDT, which provides seeds and other agricultural inputs to support the production of Mali's most important export – cotton and textiles. That being said, however, a greater share of households with exposure to AR program interventions used improved seeds for cotton than households in the control group. 24% percent of treatment households used improved seeds for cotton, compared with 11% of households in the control group, the difference in means is statistically significant at the $p < .01$ level.

Given what the data show about the use of improved seeds for certain crops, it is not surprising that households in the MARBES study spent more on traditional seeds than improved seeds as shown in Table 9, below. There are statistically significant differences between households in the treatment group and households in the control group for the mean value of seeds purchased. Treatment households spent more, on average, on both traditional and improved seeds compared to control households. The difference in means is greatest for the value of traditional seeds purchased by treatment households.

Table 9 Household Agricultural Inputs: Improved Seeds

Share of Households Using Improved Seeds by Crop

Crop Name/Group	Treatment	Control	Total	Obs
Maize (%)	3	1	2	684
Millet (%)	0	0	0	684
Sorghum (%)	1*	0*	1	684
Rice (%)	0	0	0	684
Beans (%)	2	1	1	684
Soybean (%)	0	0	0	684
Cow peas (%)	0	0	0	684
Groundnut (%)	1	1	1	684
Bambara nuts (%)	0	0	0	684
Cabbage (%)	1	0	0	684
Tomatoes (%)	1	0	1	684
Okra (%)	1	0	0	684
Red paper (%)	2	1	1	684
Green paper (%)	0	0	0	684
Bitter leaves (%)	2*	0*	1	684
Cotton (%)	34*	11*	22	684
Roselle (%)	0	0	0	684
Legumes (%)	3*	1*	2	684
Cereals (%)	4*	1*	3	684
Value of traditional seeds[20]	4465**	3095**	3778	705
Value of improved seeds	3062***	1149***	2102	705

** significant at 10%; ** significant at 5%; *** significant at 1%*

Agricultural Practices

In contrast to the number of households using improved seeds, nearly all households included in the MARBES study indicated that they use some form of fertilizer, chemical or organic, on the crops grown in the May-December 2013 cropping season (95% of the sample). Significantly more households in the treatment group used chemical and mixed fertilizer than the ones in the control group; the opposite is true for organic fertilizer. Chemical fertilizer is the most commonly used (67% of the households). Treatment households, on average, also used greater quantities fertilizer than control households and spent more on it. Households that purchased fertilizers spent an average of 225,632 CFA[21](roughly $474 USD), $532 USD by the treatment group and $417 USD by the control group.

[20] The final two variables, *value of traditional seeds* and *value of improved seeds* are reported in the national currency of Mali, which is the CFA Franc (XOF). At the time of the survey, the exchange rate of 1 CFA Franc to 1 US Dollar was 0.0021.

[21] XOF is the ISAO currency code for the West African CFA franc, which is the national currency of Mali. Figures here are reported using CFA, to maintain consistency with the response options in the MARBES questionnaire.

Most agricultural practices inquired in the survey, with the exception of crop rotation, are not widely used among the MARBES respondents, although more than thirty percent of household farms report to be negatively affected by soil erosion. As Table 10 shows, only 10% of MARBES respondents employ irrigation and fallowing, and even less households practiced certain tillage techniques on the parcels that they farm. However, even among the households in the sample that do employ irrigation and fallowing techniques on their farms, statistically significant differences are observed between households in the treatment and control groups. A larger share of treatment households reported using irrigation to supply water to their crops in the May-December 2013 planting season (12% of treatment households compared to 8% of control households); where a larger share of control households reported using alternative tillage methods and land fallowing compared to treatment households. Alternative Tillage (tillage techniques used to prevent soil erosion) was practiced by 6% of control households, compared to just 3% of treatment households, and 12% of control households practiced land fallowing compared to 8% of treatment households. A larger share of control households reported being negatively affected by soil erosion than did treatment households, which may explain why more control households are more likely to reported using fallowing and alternative tillage methods.

Table 10 Agricultural Inputs and Practices

Share of Households Using Inputs and Practices

	Treatment	Control	Total	Obs
Chemical Fertilizer (%)	71**	63**	67	692
Organic Fertilizer (%)	8***	17***	12	692
Mixed Fertilizer (%)	53***	36***	45	692
Total value Of Fertilizer Used(CFA)	252746***	198673***	225632	692
Total amount Of Fertilizer Used(Kg)	983.67***	811.17***	897.17	692
Irrigation: Last Season (%)	12*	8*	10	692
Practicing Rotation: Last 5 years (%)	96***	85***	91	692
Practicing Fallowing: Last 5 years (%)	7**	12**	10	692
Practicing Alternative Tillage: Last Season (%)	3*	6*	5	692
Practicing Zero/Minimum Tillage: Last Season (%)	3	5	4	692
Affected By Soil Erosion (%)	24***	37***	31	692
W/ Soil Erosion But No Erosion Control Measure (%)	6	9	8	692

** significant at 10%; ** significant at 5%; *** significant at 1%*

Crop rotation is a widely used practice among all households in the study. 91% of households reported having rotated crops on the plots and parcels that they farm over the past 5 years. A statistically significant larger share of treatment households (96%) practice crop rotation compared to control households (85%).

Labor use in Agriculture

Table 11 Household Agricultural Inputs: Labor

Agricultural Labor Inputs

	Treatment	Control	Total	Obs
% of hh using hired labor	39*	32*	36	682
% of hh using communal labor	45	45	45	682
Total person-days of hired labor used	38***	19***	28	682
Total person-days of communal labor used	58	53	55	682
Total person-days used, male	398	366	382	682
Total person-days used, female	257***	143***	200	682
Total person-days used	654**	509**	581	682

** significant at 10%; ** significant at 5%; *** significant at 1%*

Households in the twenty villages included in this study, and likely throughout all of Mali, predominantly rely on familial labor for crop cultivation. If there is a need of supplemental labor for a particular crop, households are more likely to utilize communal resources than hiring individuals to complete the tasks involved in cultivating crops, which include land preparation, planting, fertilizing, weeding, harvesting, etc. 36% of households in the study indicated that they had relied on hired labor for some of the above listed tasks (39% of AR households and 32% of control households). Overall, 45% of households replied that they relied on communal labor for key agricultural tasks. Treatment households report to use significantly more hired labor than control households. Finally, treatment households, have more total person days used than do households in comparison villages and the difference is particularly important for female labor.

Allocation of Harvest/ Harvest Use

The portfolio and resource management of crops, not only for production and sale, but also for household consumption, animal feed and sustainable farming are central components of the AR program. Table 12 below displays the share of households that reserved some portion of the total harvest for different uses. The data presented in Table 12 below is disaggregated by crop and household type (cereal and legumes crops and treatment and control crops).

As is evident from Table 12 below, households in the MARBES study allocate harvested crops for various uses. For legumes crops, including beans and nuts, households identified own consumption, seeds and animal feed as the most common uses of the crops.[22] For cereal crops, such as sorghum and millet, the most common uses are also own consumption and seeds but here a larger share of households (81%) also identified "other" uses.[23] The treatment group is significantly more involved in all the types of harvest usage for both types of crops.

[22] Seventy-nine percent of households in the sample (556) reported allocation uses for legumes crops; this excludes cash crops such as cotton and tobacco as well as roots and tubers.

[23] Eighty-eight percent of households in the sample (624) reported allocation uses for cereal crops; this excludes cash crops such as cotton and tobacco as well as roots and tubers.

Table 12 Harvest Use By Crop and Household Type

Allocation of Harvest				
Share of HHs	Treatment (%)	Control (%)	Total (%)	Obs
legumes - animal feed	82***	70***	77	549
legumes - crop residue	33***	23***	29	549
legumes - seeds	94***	61***	79	549
legumes - own consumption	93***	77***	85	549
legumes - sales	65***	40***	54	549
legumes - other uses	56**	47**	52	549
cereals - animal feed	68**	60**	64	664
cereals - crop residue	70***	52***	61	664
cereals - seeds	97***	68***	83	664
cereals - own consumption	99***	78***	89	664
cereals - sales	38***	25***	32	664
cereals - other uses	79	83	81	664

** significant at 10%; ** significant at 5%; *** significant at 1%*

Crop Storage

Table 13 below displays the share of households cultivating a certain crop that still had some in storage one month after harvest. Crops defined as cereals and legumes were the most common crops stored by households in the sample, with the addition of cotton. As Table 13 demonstrates, 92% of households in the sample reported having stored maize crops that they harvested in the May-Dec 2013 cropping season. The share of treatment households that had maize crops in storage one month after the harvest (97%) is significantly greater than the share of control households which reported having maize in storage one month after the harvest (87%).[24] Generally, a higher percentage of treatment households practiced crops storage than control households, with the exception of onion and green pepper storage, which were stored more frequently by controls households (80% versus 53% and 74% versus 40% respectively).

[24] Recall from Table 8 that the treatment households reported higher production (kg) of maize than the control households, which, as is also evident in Table 8, may not be attributable to higher yields, but greater landholdings on the part of treatment households, from Table 7.

Table 13 Crop Storage

Share of HHS with produced crops in storage 30 DAYS after Harvest

Crop	Treatment (%)	Control (%)	Total (%)	Obs.
Maize	97***	87***	92	693
Millet	95	90	93	693
Sorghum	97***	84***	90	693
Rice	85***	65***	76	693
Groundnut	88***	76***	83	693
Red pepper	40***	74***	54	693
Tomato	27	19	24	693
Okra	51	62	55	693
Onion	53**	80**	62	693
Cotton	64	58	61	693

** significant at 10%; ** significant at 5%; *** significant at 1%*

Households were also sked about which types of facilities they used to store crops. Table 14 indicate that granaries are the most popular storage facility among households (79% of them use it), followed by sacks (100-200 kilo sacks), which are used by 73% of them. A greater proportion of treatment households are using granaries and sacks to store their month-old harvests than control households, which is consistent with the finding that treatment households store more crops than control households.

Table 14: Crop Storage Facility[25]

Share of Households using Storage Type

Crop_Type	Treatment (%)	Control (%)	Total	Obs.
Granary	80	78	79	694
Sack/Bag	80***	64***	73	694
Open ground covered	20***	11***	15	694
Raised open platforms	16***	8***	12	694
Raised roofed platforms	6	7	7	694
Roof	4	3	4	694
Open ground uncovered	2	3	2	694
Commercial storage	0**	2**	1	694
Multiple methods	2	2	2	694
Other	14	13	13	694

** significant at 10%; ** significant at 5%; *** significant at 1%*

Only a few households that had crops in storage one month after the 2013 harvest experienced crop loss due to various reasons. Table 15 below displays the share of household that experienced crop loss, disaggregated by crop and treatment type. Tomato is the most common crop lost, which is probably due to its perishable nature. All the main crops cultivated in the region - maize, groundnut, sorghum, rice and millet - are lost in a share between 16% and 19% due to various reasons such as insects, rodents or multiple reasons.

[25] Crops with no observations for a type of storage facility have been removed from the table for efficiency of reporting.

Table 15 Loss of Stored Crops

Share of HHs that Loss Stored Crops

Crop	Treatment (%)	Control (%)	Total (%)	Obs.
Tomato	22	33	25	694
Maize	21	21	21	694
Groundnut	20	17	19	694
Millet	18	16	18	694
Sorghum	13**	20**	16	694
Rice	13*	21*	16	694
Onion	26**	00**	15	694
Okra	13	10	12	694
Cabbage	.	0	0	694

** significant at 10%; ** significant at 5%; *** significant at 1%*

Livestock

Cattle, small ruminants, and poultry are the predominant forms of livestock owned by treatment and control households in the sample, with ownership of chicken livestock being the most widespread among treatment and control households. 77% of households in the sample own poultry; 71% of households in the sample own cattle. As Table 16 below shows, there are few statistically significant differences between treatment and control households regarding different types of cattle ownership. However, for calves, goats and pigs, a greater share of treatment households own these types of livestock than do control households. The statistical significance for the difference of means is, as Table 16 demonstrates, stronger for goats and pigs than for calves. This relationship also holds true for the number of animals own per household. On average, treatment households own more goats, pigs and chicken than control households.

Table 16 Livestock Ownership

Livestock Ownership

Group	Treatment	Control	Total	Obs.
Share of HH that own livestock				
Draught animals (%)	73	69	71	705
Bull-local (%)	8	9	9	705
Cow-local (%)	46	45	46	705
Heifer-local (%)	3	3	3	705
Calves-local (%)	34*	28*	31	705
Horse/Donkey/Mule (%)	68	65	66	705
Goat-local (%)	66***	52***	59	705
Sheep (%)	54	52	53	705
Pig-local (%)	3***	0***	2	705
Poultry (%)	79	75	77	705
Other livestock (%)	0	1	1	705
Bees (%)	1	1	1	705

Total number of livestock owned				
N. of draught animals (Tot)	2.44	2.17	2.31	705
N. of Bull-local (Tot)	0.24	0.32	0.28	705
N. of Cow-local (Tot)	3.72	4.25	3.99	705
N. of Heifer-local (Tot)	0.09	0.14	0.11	705
N. of Calves-local (Tot)	1.23	1.25	1.24	705
N. of Horse/Donkey/Mule (Tot)	1.3	1.21	1.25	705
N. of Goat-local (Tot)	4.65***	3.42***	4.03	705
N. of Sheep (Tot)	3.2	3.65	3.42	705
N. of Pig-local (Tot)	0.19**	0.01**	0.1	705
N. of Poultry (Tot)	14.83**	11.79**	13.3	705
N. of Other livestock (Tot)	0.05	0.16	0.1	705
N. of Bee hives (Tot)	0.17	3.39	1.79	705

** significant at 10%; ** significant at 5%; *** significant at 1%*

Table 17 below displays the main sources of feed for each type of livestock, disaggregated by treatment and control. As is shown below, most households use a combination of different food sources for their livestock. Crop residue, however, is the predominant source of feed for all livestock types. Grazing in open air and green foragers are the other common types of feed used by households in the sample. The t-tests for the differences in means of livestock feed for animals by treatment type shows that the trends are fairly balanced between the two groups. There is some evidence that the control group uses more often crop residue and legume/fodder and shrubs to feed his animals where the treatment group tend to use more forage, at least for cattle.

For the most part, households in the survey do not have widespread experience with water shortages for their animals. As outlined in Table 17 below, less than 20% of households, whether treatment or control, have had any experience with water shortages for any type of animal. For small ruminants (goats) and pigs, the control group reports higher frequencies of water shortage with respect to the treatment group. This indicates that with regard to the necessary resources to maintain small ruminants, which are both important agricultural and consumption inputs, (unlike equines, which are not used for nutrition, but for transport and labor almost exclusively) there is a difference in the resources available to the treatment households compared to control households.

Table 17 Livestock Feed and Water

	Cattle				Equines				Small Ruminants				Pigs			
Animal Feed	**Treat**	**Control**	**Tot**	**Obs**	**Treat**	**Control**	**Total**	**Obs**	**Treat**	**Control**	**Total**	**Obs**	**Treat**	**Control**	**Total**	**Obs**
Crop Residue	68*	75*	71	686	75*	82*	79	686	64**	72**	68	686	44	41	42	686
Forage	42*	35*	39	686	50	51	51	686	45	41	43	686	13	13	13	686
Grazing	56	54	55	686	61	55	58	686	58	56	57	686	39	42	41	686
Concentrate	0	1	1	686	10	14	12	686	5	8	6	686	9	7	8	686
Legumes/Fodder/Shrubs	9***	18***	14	686	7***	15***	11	686	9**	16**	13	686	4	3	4	686
Multiple	19	18	19	686	16	17	17	686	24**	16**	20	686	49	44	47	686
Other	6	9	7	686	4*	7*	6	686	5**	10**	8	686	25	30	27	686
Water Shortages																
Always	7	5	6	686	4	5	5	686	6	5	6	686	8	6	7	686
Often	5	8	6	686	11	15	13	686	5***	12***	9	686	2**	5**	4	686
Sometimes	8	8	8	686	12	9	10	686	12	8	11	686	2	3	3	686
Rarely	10	12	11	686	9*	15*	12	686	9	11	10	686	7	5	6	686
Never	69	68	69	686	64	57	60	686	67	63	66	686	81	81	81	686

** significant at 10%; ** significant at 5%; *** significant at 1%*

Agriculture-Related Shocks

Because agriculture is the main economic activity for not only those households included the MARBES study, but also households throughout the country of Mali, any shocks, whether negative or positive, can have serious implications for household consumption and well-being. Here we discuss the main shocks experienced by the households as well as their severity. As the Table 19 shows, the majority of households in the MARBES study experienced some form of agriculture-related shock over the last five-year period (72% percent of households experienced a drought or flood). Households experienced, on average, one or more agriculture-related shock within the past five years.

A greater share of treatment households reported experiencing drought or flood in the past five years (75% of treatment compared to 69% of control). This is interesting considering the information presented above, where treatment households consistently had an advantage over control households with respect to land holding, number of crops planted, crop production and ownership of certain types of livestock. However, a higher share of control households reported to be affected by high food and input prices. Overall the three most common agricultural-related shocks reported are drought or flood, loss of livestock, and high winds or storms. A large share of households report that the drought or flood they experienced was severe.

Table 19 Agriculture Related Shocks

Share of HHs that Experienced Shocks				
Shock	Treatment	Control	Total	Obs.
Sh. HH that experienced it				
Drought/Flood	75*	69*	72	700
Livestock Loss	48	52	50	700
Wind/Storm	25	20	23	700
Crop disease	15	17	16	700
Water shortage	11	11	11	700
Rise in food prices	5*	8*	7	700
Fall in crop prices	4	3	4	700
Rise in input prices	2**	6**	4	700
Loss of land	1	3	2	700
Sh. HH that experienced the shock in a severe form				
Severe Drought/Flood	51	50	50	700
Severe Livestock Loss	10	12	11	700
Severe Wind/Storm	3	3	3	700
Severe Crop disease	2	3	2	700
Severe Water shortage	0	1	1	700
Severe Rise in food prices	0	0	0	700
Severe Fall in crop prices	1	0	0	700
Severe Rise in input prices	0	0	0	700
Severe Loss of land	0	0	0	700

** significant at 10%; ** significant at 5%; *** significant at 1%*

Housing

Table 20 below describes the conditions of housing structures for MARBES survey respondents. It demonstrates that the majority of household structures in the survey are composed of dirt or mud floors and extract most of their drinking water from public taps or boreholes and wells. The majority of homes also have shared, open toilets and rely on natural lighting for the house at all hours of the day. In terms of the material used for roofs however, the majority of households in the survey have roofs that are made of stable and protective material such as wood, tin, concrete or plastic sheeting. In addition, close to 50% of households in the sample have advanced lighting.

Table 20 Housing Condition

Share of HHs with quality Housing Materials				
Materials	Treatment (%)	Control (%)	Total (%)	Obs.
Good walls	13	11	12	700
Good floor	14	13	14	700
Good roof	73	72	73	700
Good source of drinking water	4	2	3	700
Good toilet	4	6	5	700
Good lighting system	55*	49*	52	700

** significant at 10%; ** significant at 5%; *** significant at 1%*

Nutrition Status

Table 21 displays the share of children ages 0-59 months in the treatment and control groups, who could be categorized as stunted, wasted or underweight at the time of the survey. Anthropometric measurements including height, weight and arm circumference were taken three times in order to confirm the accuracy the measurement.

Table 21 Childhood Nutrition Status

	Treatment (%)	**Control (%)**	**Total (%)**	**Obs**
Moderately stunted	42**	33**	38	709
Severely stunted	25***	16***	20	709
Moderately underweight	32*	25*	28	709
Severely underweight	15	13	14	709
Moderately wasted	15	14	14	709
Severely wasted	9*	6*	7	709

The table above indicates that anthropometric outcomes are consistently and significantly worst among the treated group than among the controls. This observation is in contrast with what observed in terms of household production and access to technology and thus calls for further analysis. 38% of the children

in the sample present some level of stunting and 28% of them some level of underweight, about half of which in a severe form. Although in smaller proportions, wasting is also a problem among roughly 15% of both treatment and control communities. The WHO declares than incidences of wasting greater than 15% percent is considered critical.[26] In general, all of the figures for levels of stunting, wasting and underweight would be categorized as serious according to the z scores based on WHO Child Growth standards.

BMI for Adult Women

Below, in Table 23 we see the BMI values for not-pregnant females aged between 15 and 49 years in the sample. The information indicates that the majority of women in the sample, in both treatment and control groups, are in the normal weight range for their height. Relating this to the z-scores for wasting, stunting and underweight measurements in children, it can be interpreted that as girls in the sample grow older, they experience less evidence of malnutrition than they did as children. A significantly higher proportion of women in the treatment group fall into a normal range of BMI with respect to the control group. On the other hand, the findings show that women in the control group are twice as much likely to be overweight than in the treatment group; and the difference is statistically significant.

Table 22: BMI for Women

	Treatment	Control	Total	Obs
BMI (Ave.)	21.49*	22.16*	21.76	399
Underweight (%)	14	15	14	399
Normal (%)	77**	67**	73	399
Overweight (%)	9***	18***	13	399
Obese (%)	3	6	4	399

** significant at 10%; ** significant at 5%; *** significant at 1%*

[26] See http://www.who.int/nutgrowthdb/about/introduction/en/index2.html

2.1.2 MARBES- Community Data

This section summarizes community data for all twenty villages included in the study, and for action and control villages separately.

Availability and Travel Time to Community Services

Community members were asked about the access to twenty key services including school facilities, healthcare facilities, markets, police stations and agriculture extension offices. Results of analysis of the community data show that there are six key services for which less than forty percent of households had access. Daily Markets, Police Stations, Post Offices, Slaughter Houses, Dip Tanks and Milk Collection Centers are not widely acceptable to the communities included in the MARBES study. In the analysis of the household data, certain agricultural inputs and practices, such as fertilizer and irrigation, were more widely used among households with participants in the AR program. However, Table 21 below shows that a greater share of control communities have access to Agricultural Extension Services than do treatment villages. Other services, such as access to bus transport and livestock markets is more widespread among control communities than villages in the AR catchment areas. Walking is the most common means of accessing available services, and the average time (in minutes) to access each services is outlined in Table 21 below.

Table 23 Availability of Community Services

	Service Access (%)			Travel Time (min)		
	Treat. site	Cont.o	Totall	Treat. site	Cont.	Tot
Region HQ	100	100	100	221.43	191.00	203.53
District HQ	100	100	100	55.00*	96.00*	79.41
Nursery Edu.	100	100	100	8.33	15.00	10.00
Primary Edu.	100	100	100	5.71	7.00	6.47
Secondary Edu.	90	100	95	107.50	78.50	89.38
Health Ctr.	100	90	95	10.00	14.78	12.69
Day Mkt.	20	30	25	32.50	17.33	23.40
Week Mkt.	90	1	95	12.86	37.00	27.06
Milling	90	90	90	4.33	6.11	5.40
Finance Svc.	80	100	90	5.33**	45.20**	30.25
Ag. Ext. Svc.	70*	100*	85	9.57	54.80	36.18
Police	40	30	35	60.00	105.00	79.29
Post	0	10	5	0.00	0.20	0.10
Water Tap	90	90	90	7.86	6.89	7.31
Bus Stop	70*	100*	85	33.29	38.00	35.94
Slaughter	20	10	15	8.50**	180.00**	65.67
Vet. Clinic	50	70	60	13.40	56.43	38.50
Dip Tank	10*	50*	30	15.00	19.00	18.33
Animal Mkt.	40**	90**	65	5.75*	73.56*	52.69
Milk Ctr.	20	20	20	4.00	110.00	57.00

** significant at 10%; ** significant at 5%; *** significant at 1%*

Availability of agricultural extension services, by activity

Table 22 displays the portion of villages in the sample having access to agricultural extension services for various tasks associated with agricultural activities. The findings below show that for preparation activities such as clearing the land, plowing, and irrigation, which are foundational to crop production and resource conservation, even direct beneficiaries of AR did not have widespread access to extension support. However, it is clear that for the planting stage of crop production, there is a very large and statistically significant difference between the access to extension services in AR action communities and comparison communities.

The activity for which there is widespread access to extension support is fertilizers, which farmers have to purchase. This is consistent with the household data above, where Table 10 showed that more than ninety percent of households interviewed for the MARBES study use fertilizer. This finding may suggest two possible relationships, the first being that if extension service support were made available for techniques on land preparation and water resource management, the household would adopt new techniques. It could also suggest that the new techniques on water resource management and soil conservation may not directly impact production and yield, and are therefore, difficult to convince farmers to adopt, and difficult to maintain as an extension service. Nevertheless, access to extension support for land preparation is limited, based on the data presented below.

Table 24: Agricultural Extension Services Available for [ACTIVITY]

	Treatment (%)	Control (%)	Total (%)	Obs
Clearing	29	33	31	20
Plowing	29	33	31	20
Planting	86*	33*	62	20
Composting	43	33	38	20
Fertilizer	71	67	69	20
Pesticides	57	67	62	20
Weeding	43	17	31	20
Irrigation	14	17	15	20
Harvest	71	50	62	20
Animal Management	57	33	46	20

* significant at 10%; ** significant at 5%; *** significant at 1%

Top three agricultural problems and solutions

Both treatment and control villages cited the same items as the greatest agricultural related problems they face: a shortage of agricultural inputs, drought and high input prices are the most common. However, while representatives from treatment and control communities may have converged on the main impediments that they face, they diverge on the approaches taken to mitigate the issues. Table 23 below demonstrates how these communities differ with respect to their coping strategies.

Table 25: Agricultural Problems and Solution Experienced by Community

	Treat (%)	Control (%)	Total (%)		Treat (%)	Control (%)	Total (%)
1st Problem				**1st Solution**			
Few Inputs	60	60	60	More HH Labor	10	20	15
Low Soil Fertility	0	20	10	Labor Exchange	0	10	5
Drought	0	10	5	Adjust Inputs	40	10	25
Bad Weather	40	10	25	Rent/Hire/Share Land	10	0	5
				Loan/Rent/Hire Equip.	30	40	35
				None	10	20	15
2nd Problem				**2nd Solution**			
Few Inputs	30	30	30	More HH Labor	0	10	5
High In. Price	20	20	20	Labor Exchange	20	0	10
Low Soil Fertility	20	10	15	Adjust Inputs	0	10	5
Poor Seed quality	10	0	5	Rent/Hire/Share Land	0	10	5
Drought	0	20	10	Loan/Rent/Hire Equip	30*	0*	15
Bad Weather	10	10	10	Conserve Soil	10	0	5
				Migration	0	10	5
				Rent Graze Land	0	10	5
				Join Farm Group	10	0	5
				None	10	30	20
3rd Problem				**3rd Solution**			
High In. Price	10	10	10	Labor Exchange	10	0	5
Low Soil Fertility	10	0	5	Adjust Inputs	0	10	5
Land Access	10	10	10	Irrigation	0	10	5
Poor Seed quality	0	10	5	None	50	30	40
Pest/Disease	10	0	5				
Drought	20	40	30				
Little Info	10	0	5				
Other	10	10	10				

* significant at 10%; ** significant at 5%; *** significant at 1%

Gendered land ownership: Inheritance and incidence of re-allocation

The majority of land held by households is either passed down within the family, or allocated to the household by the chief of the village, likely related to members of the community. As Table 24 shows, here is no statistically significant difference between treatment and control communities with respect to land acquisition. However, the results of the community survey show that there is a discrepancy between AR treatment and control villages with respect to land ownership among males and females. Fifty percent of control villages reported that both men and women are allowed to own land in their communities: the villages of Siratogo, Dossola, Konina, N'Togonasso and Bobola-Zangasso. In the AR treatment villages however, land is held exclusively by men.

One interesting discrepancy in the reporting about gender and land ownership is that fifty percent of the villages report that a wife can inherit her husband's land upon his passing, although some of these are the same villages that reported that a woman couldn't own land.

Table 26: Land Ownership, Inheritance and Gender

	Treatment (%)	Control (%)	Total (%)
How families Acquire Land			
Family Inherited	50	30	40
Allocated by Chief	30	50	40
Sale	10	0	5
Other	10	20	15
Land Ownership			
Men	100***	50***	75
Men and Women	0***	50***	25
Land Inheritance			
Husband Inherits if wife dies	0	40**	20
Wife Inherits if husband dies	40	60	50

* significant at 10%; ** significant at 5%; *** significant at 1%

As the table above indicates, 40% of treatment communities affirmed that a woman could inherit her deceased husband's land, compared to 60% of control villages. It is unclear then, what the rules are, especially in the AR treatment villages, regarding land ownership by women.

Farmer cooperatives

Both treatment and control villages have farmer's cooperatives and groups present in the community and while AR treatment villages have, on average, more farmers' groups compared to control villages; the difference is not statistically significant. This is also true for the number of participants in the farmers' groups.

Table 27: Farmer Groups, Participation and Activities

	Treatment	Control	Total
Farmer's Groups			
Farmers Groups (%)	100	90	95
No. of Groups	6	4.33	5.21
Participants	187.70	348.22	263.74
Primary Activity (%)			
Knowledge Share	20	33	26
Buy Inputs	50	33	42
Farm Activity	10	22	16
Group Credit	20	11	16
Secondary Activity (%)			
Knowledge Share	30	33	32
Buy Inputs	10	22	16
Equipment Share	30*	0*	16
Farm Activity	10	22	16
Group Credit	10	11	11
Store Crops	10	11	11
Third Activity (%)			
Knowledge Share	20	11	16
Buy Inputs	40**	0**	21
Equipment Share	0	11	5
Farm Activity	0	22	11
Group Credit	30	11	21
Output Sell	0	11	5

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 25 also details the primary, secondary and third most important activities undertaken by the farmers' groups. Collective purchasing of agricultural supplies and inputs, knowledge sharing and credit groups are the most popular activities undertaken by the farmers' groups. As the table shows, however, there is a very significant difference between treatment and control communities with regard to secondary and third most important farmer group activities. 30% and 40% percent of treatment communities reported that sharing equipment and buying inputs and supplies were the second and third most important activities, respectively. No control communities listed sharing equipment and buying supplies and inputs as secondary or third activities of farmer groups.

Main Community Crops

Table 26 displays the crops that are identified as the most popular crops for cultivation within a community. Maize, sorghum, cotton and groundnut are the four most common crops grown by the communities in the sample. There is a statistically significant difference between the treatment and control communities for the cotton crop. 80% percent of treatment communities reported that cotton was among the most common crops grown, compared to only 40% percent of the control communities.

Table 28: Main Community Crops

Crop	Treatment	Control	Total
Maize	100	100	100
Sorghum	60	90	75
Cotton	80*	40*	60
Groundnut	50	50	50
Rice	30	60	45
Millet	30	30	30
Wheat	40	10	25
Green Beans	0	20	10

* significant at 10%; ** significant at 5%; *** significant at 1%

Prevalence of Migration

In the 20 villages included in this study, the prevalence of *permanent* emigration is quite low. Only four villages reported that individuals permanently migrated out of the community over the last 12-month period. Two treatment villages reported that one percent of residents migrated out of the community (Nampossela and Sirakele); and two control villages reported that 2 percent of community members emigrated to other areas over the past 12 months (N'Togonasso and Bobola-Zagasso).

Table 29: Share of Communities with [MIGRATION]

Migration	Treatment (%)	Control (%)	Total (%)
Emigrate Permanently	20	20	20
Immigrate Permanently	50	70	60
Migrate Temporarily	90	100	95

* significant at 10%; ** significant at 5%; *** significant at 1%

While permanent emigration is low, migration for temporary periods is very common. All but one village – Sirakele – reported that residents emigrate for parts of the year. Most communities also reported that some people immigrated to the community in the twelve months prior to the survey.

Availability of Water Sources

While most communities in the sample reported having access to multiple sources of water, including piped water, boreholes, lakes, reservoirs, rivers, tank and or streams, one control community reported having no access to the referenced water sources: Dialakoro. In both treatment and control communities, rain is the most available and frequently used source of water, followed by boreholes or wells and by lakes, ponds and rivers. Piped water is publicly available in roughly half of the communities but few households (less than 20%) primarily rely on this source.

Table 30: Share of Communities Relying on [WATER SOURCE]

Water Sources	Treatment (%)	Control (%)	Total (%)
Available			
Piped Water	40	50	45
Borehole or Well	100	90	95
Lake/River/Etc…	80	50	65
Other source	20	0	10
Available for private use			
Piped Water	37.5	55.56	47.06
Borehole or Well	100	100	100
Other source	12.5	0	5.88
Share of HH relying on source			
Rain	77	53.4	65.2
Piped Water	15.5	17.4	16.45
Borehole or Well	65	55.8	60.4
Lake/River/Etc…	36	18.6	27.3
Other source	0.5	0	0.25

* significant at 10%; ** significant at 5%; *** significant at 1%

Prevalence of Shocks

The following tables represent the share of communities that experienced the different shocks in the MARBES study, and the share of households affected within each one of the community concerned. The most common shocks affecting communities is similar to those identified by households, namely drought, strong winds and livestock diseases. Drought, Food Prices and Incidence of Fire were the three shocks for which there is a statistically significant between the treatment and control groups. All treatment communities reported experiencing Drought, compared to 70% of control communities. More Control communities however, reported experiencing a rise in Food Prices and incidents of Fire.

Table 31: Prevalence of Shocks

	Treatment	Control	Total		Treatment	Control	Total
Communities affected by Shock				**Share of HH affected in each comm.**			
Drought	100*	70*	85	Drought	76	82	78
Flood	0	20	10	Flood	0	18	18
Strong Winds	30	60	45	Strong Winds	44	27	32
Crop Disease	20	50	35	Crop Disease	55	41	45
Livestock Disease	50	50	50	Livestock Disease	82	84	83
Fall in Crop Price	30	30	30	Fall in Crop Price	80	83	82
Rise in Food Price	0*	30*	15	Rise in Food Price	0	68	68
Rise in Ag. Input Price	30	20	25	Rise in Ag. Input Price	57	75	64
Land Loss	10	0	5	Land Loss	100	0	100
Conflict	20	40	30	Conflict	4	22	16
Theft	30	50	40	Theft	8	41	29
Fire	10*	50*	30	Fire	1	23	20
Lack of Animal Feed	20	0	10	Lack of Animal Feed	100	0	100
Other	40	50	45	Other	28	50.2	40.33

* significant at 10%; ** significant at 5%; *** significant at 1%

3 Conclusion

The MARBES study provides baseline data on the key characteristics of the AR target communities and households and on the expected outcomes of the Africa RISING program. The data analyzed in this report delineates the overall trends and their observed differences between the households chosen to take part in the AR program interventions and those serving as comparison.

As detailed in the opening sections of this report, the implementation of the MARBES study involved not only years of planning, but months of vetting viable survey partner firms to implement the complicated survey as well as the time taken to proceed through the subsequent enumerator training, survey translation and testing, government authorizations, villages censuses and electronic programming that needed to be put in place before survey implementation could begin.

That being said, the survey was implemented successfully, and the data analyzed and discussed in this report provides an overview of the current status of households and communities in the treatment and comparison areas for the impending evaluation of the AR program efforts. Beginning with the discussion of the demographic attributes of treatment and comparison households in Section 1, clear differences between the treatment and control households began to emerge that persisted into the analysis of community data.

In general, households pre-identified by AR partners and in the village census as direct beneficiaries, had different resource endowments than their counterparts in the comparison villages. Direct beneficiary households had household heads that were more educated, more likely to be married and older than comparison households. The average size of direct beneficiary households was also larger than control households, which proved to be an important factor when shortage of agricultural inputs (such as labor) was shown to be a persistent challenge for the comparison group – at both the household and community level. However comparison households have, on average higher education levels than their AR counterparts and although only very slight, they are more likely to be headed by females, and the role and autonomy of women with regard to land rights proved to be more favorable in comparison households and communities than in the AR catchment areas.

While AR treatment households are less likely to own land than households in comparison villages, their land holdings are greater than their counterparts and AR direct beneficiary households plant a more diverse set of crops than households in comparison villages. In addition, households identified as AR direct beneficiaries devoted a greater share of land to the planting of AR-targeted crops and saw greater levels of productions from their planting than did those in comparison villages. If any of these differences are a result of the AR quick-win activities, then expanding the program into comparison could have the possibility of resulting very real improvements for households that the program has yet to reach. However the AR program may be inadvertently selecting or attracting households that are better off**.** In addition, the evidence in terms of yields difference is much more mixed and in some cases shows that control plots were more productive on average.

Households in the comparison villages use and spend considerably less on inputs such as improved seeds, chemical and organic fertilizer, pesticides and irrigation. In addition AR treatment households are more likely to store surplus crops (likely because they produce more on average) than the comparison households.

Households in the control sites own, on average, slightly less livestock than to the treatment households, and are more likely to rely on crop residue for animal feed. AR treatment households rely, more often than comparison households, on a mixture of crop residue and open air grazing. This may also be attributable to the initial differentials in resource endowments between treatment and control households. Because treatment households have more land holdings, on average, it is possible that they have less pressure or competition for land from other community members and can leave their animals free to graze on fallow land.

Comparison and AR households experience about an equal number of shocks. The predominant shocks are droughts and floods, which affect everyone living in a particular region at the same time. Treatment households however, are more able to cope with shocks than are the comparison households, either by adjusting inputs or by annexing land to compensate for previous losses.

While AR households may have greater household-level resources than comparison households, control villages have more access to basic services than treatment villages. Control villages have on average, more access to schools and markets, agriculture extension services and financial organizations than their AR counterparts.[27]

An important distinction between AR communities and comparison communities is the ability of women to own and inherit land. In control villages both men and women own land, but feedback from the community surveys in AR treatment villages, suggest there is perhaps a soft restriction on women's ability to be land holders.

As previously mentioned, the MARBES study was conducted to obtain baseline data on the universe of factors that affect the key inputs, outcome indicators and intended impact of the Africa RISING program intervention. Toward that end, data was collected on a sample of treatment and comparison households in communities that were pre-selected based on criteria related to the AR objectives (climate for key cereal and vegetable crops, conditions for livestock and access to markets, etc..). The data resulting from the households and community MARBES study demonstrates that there are key initial differences between treatment and control households and communities with regard to resource endowments such as land, agricultural inputs and practice, production and yields and access to basic and agricultural extension services. A rigorous analysis of these features will allow to proper estimate and identify the current impact of AR on livelihoods and to compute prediction on the evolution of such outcomes in the future.

[27] This may explain why comparison households have, on average, higher education levels than do treatment households.

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APPENDICES

Appendix 1 : AR Village Maps

Figure A1.1

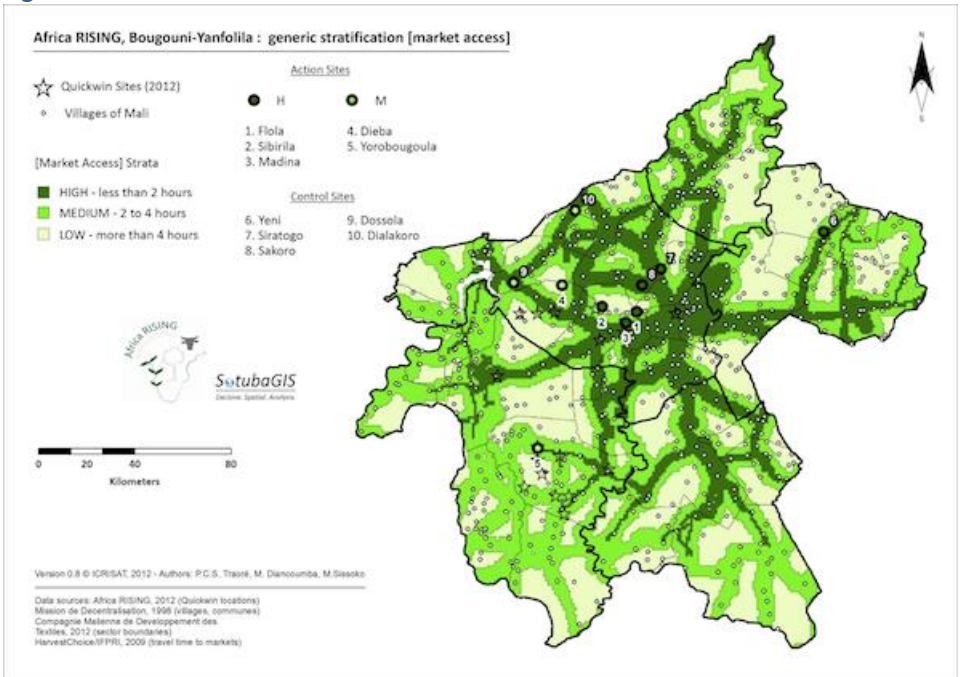
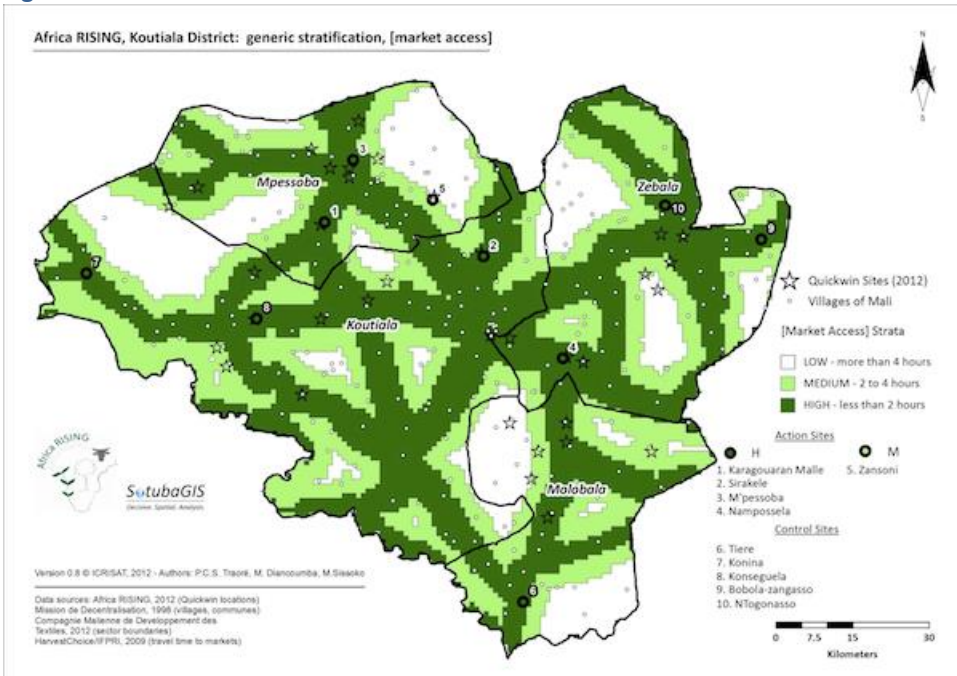


Figure A1.2



Appendix 2 : Sampling Formulas

Notations

N: The number of villages in each strata

Nh: The number of sampled villages per strata h,h=1,2 ,3

Ei: The total number (the number of beneficifiaries in each treatment villages)[28] of households per village i, i=1,2……,20

ei: The number of sampled households per village i, i=1,2……,20

The probability of drawing sample (Ai) from a village is the ratio of the number of villages sampled to the total population of households in the village:

$$A_i = \frac{n_h}{N}$$

By definition, we deduce the following sampling weights: $C'_i = \frac{1}{A_i} \Rightarrow C'_i = \frac{N}{n_h}$

The probability of drawing (Aj) household from a village is:

$$A_j = \frac{e_i}{E_i}$$

The corresponding sampling weight is: $C'_j = \frac{1}{A_j} \Rightarrow C'_j = \frac{E_i}{e_i}$

Thus the probability of a household being drawn in a stratum is:

$$= A_{ij} = A_i \times A_j = \frac{n_h}{N} \times \frac{e_i}{E_i} = \frac{n_h e_i}{N E_i}$$

The extrapolation coefficient is the inverse of the probability of an agricultural household from a stratum will be part of the sample of households.

$$\frac{1}{A_{ij}} = \frac{1}{\frac{n_h ei}{NEi}} = \frac{NEi}{n_h ei}$$

[28] In effect, in the treatment villages, *Ei* is limited to the number of AR program beneficiaries in the village, contrary to the control villages where *Ei* includes all of the census households.

The extrapolation coefficient is therefore: $C_i = \frac{NE_i}{n_h e_i}$ or $C_i = \frac{N}{n_h} \times \frac{E_i}{e_i} \Leftrightarrow$

$C_i = C'_i \times C'_j$

Appendix 3: Conversion of units of measurement

The survey questionnaire allowed the respondents to express quantities such as the output for each crop in local measurement units. In order to convert all the information into kilograms we applied a two steps procedure. First we converted the measures that were directly transformable into Kg through one unique coefficient (see table). Secondly, we used information collected at the community level to convert the measures that required a crop-location specific conversion.

Table A5.1: Conversion table

Unit	Conversion coefficient to KG
Kilogram	1
Gram	0.001
Liter	Crop – location specific
Unit of piece	Crop – location specific
Cane/basket	Crop – location specific
Bucket	Crop – location specific
120 Kg maxibag	120
100 Kg maxibag	100
50 Kg minibag	50
Ox-cart	Crop – location specific
Trailer	Crop – location specific
Lorry	Crop – location specific
Headload	Crop – location specific
Bunch	Crop – location specific
Bale	Crop – location specific
Sachet/tube	Crop – location specific
Plate	Crop – location specific
Cup	Crop – location specific
Heap	Crop – location specific
Bowl	Crop – location specific

To construct the crop-location specific coefficients we took the median of the conversion factors by crop, unit and location reported by the community leaders. When possible, we attributed crop-district specific coefficients of conversion. If this information was not available at the district level, we moved one level up and attributed crop-region specific coefficients. Finally, when regional information was also not available, we used crop-specific coefficients for the entire sample. As a final refinement, we replaced all the coefficients that differed more than 2 standard deviations from the unit-crop specific mean with the mean itself.