

# Burkina Faso Agricultural Development Project Impact Evaluation

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## Agricultural Survey: Interim Crop Yield Data Quality Review

*September 2014*



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## 1. INTRODUCTION

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This report reviews the quality of interim crop yield data collected by the Centre d'Etudes, de Recherches et de Formation pour le Développement Economique et Social (CERFODES), the local survey firm in Burkina Faso. The data collection was contracted by the Millennium Challenge Account – Burkina Faso (MCA-BF) to evaluate the Millennium Challenge Corporation's Agricultural Development Project (ADP).

In 2008, the government of Burkina Faso and the Millennium Challenge Corporation (MCC) signed a five-year USD 480.9 million Compact for 2009–2014 to contribute to poverty reduction in the country via economic growth. The Compact consists of four distinct projects:

- Agricultural Development Project,
- Rural Land Governance Project,
- Roads Project, and
- Burkinabé Response to Improve Girls' Chances to Succeed.

The Agricultural Development Project (ADP) seeks to extend the agricultural use of land as a way to increase the quantity and value of agricultural production. This will boost income and employment in rural areas and make the rural economies more competitive. Specifically, the project targets the main constraints in rural Burkina Faso: water management, low institutional and technical capacity, as well as poor access to information, markets, inputs and credit. The expected results include growth in agricultural production, an increase in irrigated land and improved access to rural credit in the intervention areas.

The project has three main activities:

- **Water Management and Irrigation** – The goal of this activity is to promote improved water management, resulting in better access to water through increased water resource protection and more efficient irrigation, including water availability, water delivery, flood control and dam safety. This is expected to help support and protect investments (infrastructure and human/institutional capacity) in the Sourou Valley and Comoé Basin.
- **Agricultural Diversification (DA)** – This activity builds on the delivery of water resources in the project areas by supporting on-farm production and related activities throughout the agricultural value chain.
- **Access to Rural Finance (ARF)** – This activity provides access to term loans by participating financial institutions as a way to fund creditworthy borrowers in the region.

Each of the three main activities, in turn, is composed of specific sub-activities, as follows:

Water Management and Irrigation consists of the following sub-activities:

- Development of Integrated Water Resource Management (IWRM) plans,<sup>1</sup>

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<sup>1</sup> This will cover the Sourou Valley and nine villages in the Comoé Basin.

- Léry Dam Investment,
- Di Irrigation Investment, including the provision of irrigated land to Persons Affected by the Project (PAPs), five villages with traditional rights in the area and to Persons not Affected by the Project (Non-PAPs), and
- Institutional Capacity Building for Water User Associations (WUAs) and the Sourou Valley Authority (Autorité de Mise en Valeur de la Vallée du Sourou, AMVS) to provide Operation and Maintenance (O&M) to water infrastructure.

Agricultural Diversification (DA) consists of the following sub-activities:

- Technical Assistance to Farmers,
- Strengthening Animal Health Services,
- Value Chain Development, and
- Market Information System (MIS) and Rehabilitation of Rural Markets.

Access to Rural Finance (ARF) consists of the following sub-activities:

- USD 10 million loan fund toward the Establishment and Implementation of a Rural Finance Facility (RFF) that provides loans to Participating Financial Institutions (PFIs) for approved loans to rural agricultural end borrowers.
- Capacity Building support for PFIs to expand rural lending, including training in procedures and policies to evaluate applications and disburse agriculture-related loans.
- Business Development Services (BDS) to build business skills among agriculture enterprises and to assist in the development of bankable agriculture projects, reducing risk for the PFIs.

To assess the impacts of the farmer training program under ADP, MCA-BF contracted the National Opinion Research Center (NORC) at the University of Chicago and its local partner CERFODES to perform data collection. The objective was to establish a baseline for the intervention for the purpose of performance monitoring and impact evaluation. The NORC Agricultural Survey Baseline was designed to evaluate the Technical Assistance to Farmers, the Strengthening Animal Health Services and the Value Chain Development sub-activities.

In April 2011–May 2012, NORC and CERFODES conducted the following activities:

- An enumeration survey in treatment and comparison areas,
- a household survey covering the dry and rainy seasons,
- two crop yield measurement surveys (*carrés de rendement*) covering the dry and rainy seasons,
- a survey of aquaculture production (fishing), and
- an institutional community survey during dry season.

In July 2014, IMPAQ conducted a data quality review of the NORC/CERFODES survey data and found that the household baseline data could adequately serve as a baseline for measuring program impacts.

IMPAQ also identified two significant issues that may hamper the impact evaluation:

1. **Reduced sample size:** The treatment sample includes fewer households than originally anticipated. That is, the household sample includes only 624 households that received training services, as compared to the expected sample of 1,082 households in the treatment area.<sup>2</sup>
2. **Quality of the crop yield measurement data:** IMPAQ's data quality review as well as NORC's assessment of the crop yield data suggests serious limitations in data accuracy.

Boxes 1 and 2 below summarize these two issues.

#### **Issue #1: Reduced Sample Size**

The baseline survey was collected in 2011–2012 from a random sample of households in the treatment area. The data was collected before training became available and before it was possible to identify the beneficiaries of the training program.

The training program carried out by AD10 (the training contractor) did not use the same identification code as the baseline survey. As a result, AD10 data could not be merged with the household baseline data. To overcome this problem, two options were considered: (1) match AD10 and baseline data using all the information available (e.g., name, location, gender, etc.), or (2) collect new data.

After reviewing the options, MCC decided to match the records of trainees collected by AD10 with the household baseline survey data. After several AD10 matching attempts, MCA-BF and AD10 proceeded to collect new data from all households in the intervention area. They reported that 62% of the baseline households had been matched.

With only 62% of the expected treatment household sample size, the available sample is substantially smaller than expected in the original design. IMPAQ re-estimated the statistical power calculations with this sample and determined that the reduced matched sample size will only be able to detect relatively large program effects (i.e., an impact on income of 21% or more).

#### **Issue #2: Accuracy of Crop Yields**

NORC measured crop yields using measurement squares (*carrés de rendement*). This methodology measures yields in a measurement square. The same methodology was used in two crop yield surveys:

1. survey of crop yields from sub-sample of households from the household survey, and
2. survey of crop yields from an independent sample of farmers in treatment villages.

In particular, during the data-cleaning phase, it became clear that some of the rice and maize crop yield values from the measurement squares were inaccurate (e.g., some values were too high to be plausible<sup>3</sup>). Enumerators collected crop yield weights before and after crop processing took place. It is

<sup>2</sup> *Enquête d'identification des ménages communs AD10 et Enquête globale, Synthèse des résultats*, MCA-BF.

<sup>3</sup> The detailed information for crop yields measurement in the NOCR Agricultural Survey can be found in IMPAQ (2014) NORC Agricultural Survey Data Quality Review.

difficult to compare these measures as a result of the differential moisture content in individual crops. Ideally, the extra moisture in crop harvest should be removed before reporting crop yields.

To correct the inaccuracies, the data collection firm established an upper bound for rice yields based on agriculture literature. All values that were coded higher than upper bound were reset (i.e. top-coded) to the upper bound.<sup>4</sup> In addition, maize values that were weighted and recorded before crop processing were excluded from the dataset. We believe that these issues compromise the validity of the crop yield data and that using these data could lead to biased impact estimates.

Another data limitation of both crop yield surveys is small sample sizes. In the crop yields survey that we intended to use to correct household declarations, the data was collected for approximately 300 farmers and only during the rainy season. Similarly, in the crop yields survey designed to collect information for monitoring purposes, only 85 farmers were surveyed during the dry season and 143 were surveyed during the rainy season. These small sample sizes, together with the other data limitations identified, create serious limitations for the crop yield data.

To overcome the potential problems associated with the NORC Agricultural Survey and to provide follow-up information on crop yield in both treatment and comparison areas of the ADP, MCA-BF commissioned the interim crop yield data collection activity for the ADP Agricultural Survey in 2013. From October 2013 to January 2014, CERFODES collected the ADP interim b crop yield data according to the schedule described in Exhibit 1.

#### Exhibit 1. CERFODES Data Collection Schedule

Period	Data Collection Activity
October 2–6, 2013	Interviewers' training
October 7–17, 2013	Parcel selection and installation of measurement squares
October 7–18, 2013	Supervision of data collection
October 20–December 10, 2013	Weighing of crop yields from the measurement squares
December 12–13, 2013	Data entry training
December 13–23, 2013	Data entry
December 23–28, 2013	Data clearance
December 29, 2013–January 6, 2014	Analysis and production of the draft data collection report
January 7, 2014	Filing of interim report
January 8, 2014	Restitution workshop
January 12, 2014	Production of the final data collection report

The overall objective of this data collection effort was to gather information for the monitoring of crop yields in the ADP treatment and comparison areas. Specifically, CERFODES undertook the following activities:

<sup>4</sup> NORC, *FINAL DATA COLLECTION REPORT*, MCA-Burkina Faso Agricultural survey in the Sourou Valley and Comoé Basin (2012), page 120.

- identified the plots of households in the treatment and comparison areas,
- estimated acreage and yield by crop,
- measured moisture of the crop, and
- collected household information on training and support by AD10.

Four questionnaires were developed and fielded to achieve the four specific goals. These questionnaires include the following:

- Census of household plots questionnaire was designed to identify all parcels exploited by the household during 2013–2014, regardless of the crop.
- Measurement squares questionnaire concerned the extent of the areas, the laying-out and the weighing of the performance squares on the plots of crops (maize, sorghum, millet, rice, cowpea, sesame, peanut and groundnut).
- A supplementary household questionnaire was developed to provide information on AD10 training-related information.
- As part of the crop yield survey, a humidity questionnaire was developed for the measurement of crop humidity content during the weighing of the performance squares.

In this report, we review each component of the interim crop yield survey sequentially<sup>5</sup>. For each component, we present the sampling frame, data collection, descriptive statistics of key variables and the data issues encountered. The rest of the report is structured as follows: 2) Study Zones 3) Census of Household Plots 4) Crop Yield Measurement Squares Survey 5) Supplemental Household Survey, and 6) Conclusion.

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<sup>5</sup> The Interim Crop Yield Survey is using NORC Agricultural Survey sample with 2,164 households in treatment and comparison zones. Thus, typically topics included in the Data Quality Reviews (DQR) such as sampling correction/substitution problems and data management/orphan problem are identical to those presented in IMPAQ (2014), *NORC Agricultural Survey Data Quality Review*.





### 3. CENSUS OF HOUSEHOLD PLOTS

#### 3.1 Sampling Frame

The census of household plots (*Recensement des Parcelles des Ménages*) provides information on exploited parcels of all the households in the 2012 NORC Agricultural Survey. The total number of households in the NORC Agricultural Survey was 1,082 matched pairs, i.e. 2,164 households from 88 villages (30 villages in treatment areas and 58 in comparison areas) across 19 provinces. The census of household plots covers all these households, including those common to the AD10 and NORC Agricultural Survey (624 households).

**Exhibit 3. Distribution of Households in the Census of Household Plots**

	Number of Households Planned	Number of Household with Plots	Realization Rate
<b>Treatment</b>	1,082	972	89.8%
<b>Comparison</b>	1,082	795	73.5%
<b>Total</b>	2,164	1,767	81.7%

As described in Exhibit 3, of the 2,164 households in the NORC Baseline Agricultural Survey, 1,767 (81.7%) have plots that could potentially be included in the crop yield survey. We observe a slightly higher proportion of households with plots in the treatment areas (89.8%) compared to the households located in the comparison areas (73.5%). Appendix 2 lists the households in the census of household plots by village and treatment status (the green shaded portion refers to treatment areas).

A total of 7,241 parcels were recorded in the census of household plots. Exhibit 4 describes the distribution of these parcels by treatment status and for parcels in the treatment area, by province.

**Exhibit 4. Distribution of Parcels in the Census of Household Plots**

	Comoé	Sourou	Total
<b>Treatment</b>	539	1,327	1,866
<b>Comparison</b>			5,375

There are 1,866 parcels (25.8%) in the treatment area and 5,375 parcels (74.2%) in the comparison area. Within the treatment area, 539 parcels are recorded in Comoé (28.9%) and 1,327 are recorded in Sourou (71.1%).

#### 3.2 Key Variable Distributions

The census of household plots also provides limited information on the characteristics of the parcels, the methods of plot acquisition, the types of crops planted and the growing methods (single crop or intercrop). Exhibit 5 tabulates the distribution of characteristics of the parcels by treatment status. Given the geographic location of Sourou and Comoé, it is not surprising that the fraction of parcels that are in irrigated lowlands is higher in the treatment areas.

**Exhibit 5. Distribution of Parcel Characteristics in the Census of Household Plots**

	Plain/Plateau	Irrigated Lowland	Non-irrigated Lowland	Terraces
<b>Treatment</b>	67.9%	24.3%	7.7%	0.1%
<b>Comparison</b>	80.9%	7.8%	8.1%	3.2%

Source: *Recensement des Parcelles des Ménages* of the Interim Crop Yield Data.

**Exhibit 6. Distribution of Parcel Acquisition Methods in the Census of Household Plots**

	Purchased	Borrowed	Rented	Donated	Inherited	Other
<b>Treatment</b>	3.2%	33.2%	13.9%	11.0%	38.4%	0.3%
<b>Comparison</b>	0.5%	32.9%	0.7%	19.1%	46.0%	0.8%

Source: *Recensement des Parcelles des Ménages* of the Interim Crop Yield Data.

Exhibit 6 presents the methods of parcel acquisition by treatment status. It is clear from the Exhibit that the dominant way of acquiring plots in Burkina Faso is through inheritance. The distribution of plot acquisition methods, as presented in Exhibit 6, is quite similar between treatment and comparison areas.

The main crops that have been planted during the survey duration are:

- Maize
- Sorghum
- Peanut
- Rice
- Millet
- Cowpea
- Sesame
- Groundnut

Exhibit 7 presents the distribution of primary and secondary crops in the census of household plots. More than a quarter of the plots in the census were planted with maize as a primary crop. Sorghum is the second most common crop in the treatment and comparison areas. As for secondary crops, more than 70% of the parcels with secondary crops were planted with cowpeas.

**Exhibit 7. Primary and Secondary Crops Planted in the Census of Household Plots**

<b>Crops</b>	<b>Primary</b>	<b>Secondary</b>
Maize	25.9%	3.2%
Sorghum (white)	15.1%	7.6%
Sorghum (Red)	4.0%	1.4%
Peanut	12.8%	2.4%
Rice	13.1%	0.3%
Millet	9.2%	5.9%
Cowpea	8.1%	71.9%
Sesame	5.4%	3.1%
Groundnut	3.9%	3.2%
Other Crops	2.5%	1.0%

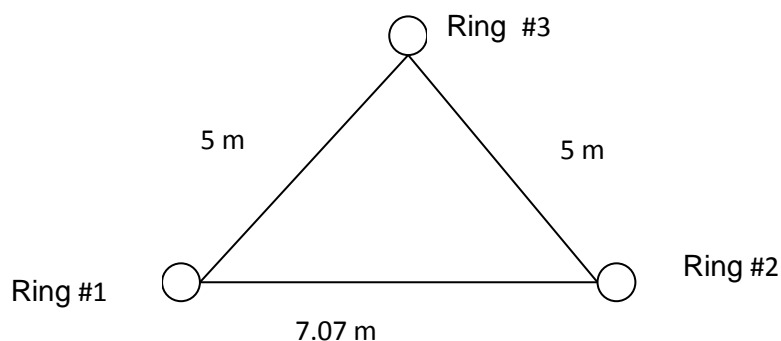
Source: *Recensement des Parcelles des Ménages* of the Interim Crop Yield Data.

## 4. CROP YIELD MEASUREMENT SQUARES SURVEY

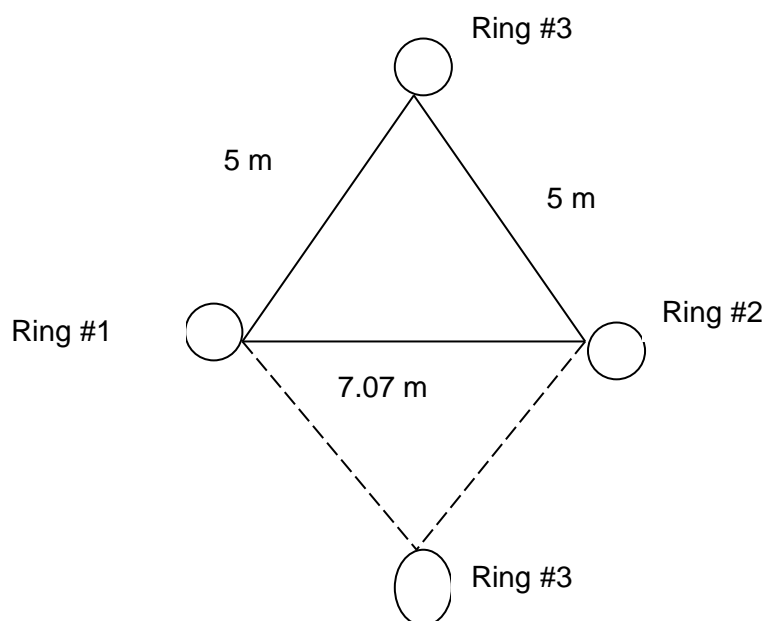
The methods of measuring area and crop yield are those specifically adopted by the *Direction Générale des Etudes et des Statistiques Sectorielles* (DGESS) of the Ministry of Agriculture and food security (MAH). It is a method recognized by the *Comité permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel* (CILSS) and has been used in the production of food and agricultural statistics in Burkina Faso. Field interviewers were instructed on the correct methodology to ensure the reliability of measurements. Once a household/parcel has been identified, field agents are required to:

- Notify the selected household,
- Measure the areas of all of the target crops,
- Install the measurement squares using the proper method (the one used by the *Direction Générale pour la Promotion de l'Economie Rurale*, DGPER, in the *Enquête Permanente Agricole*, EPA, survey) to measure production, and
- Collect and weigh the produce.

**Exhibit 8. Half-Squared Instrument for Measurement Squares**



**Exhibit 9. Installation of Measurement Squares**



Every field agent had to assess the crop yields of eight households, on average. Measurement squares were placed randomly within each of these plots. The measurement squares were installed at the beginning of October 2013.. They became yield measurement squares if they were still present at harvest. To install the measurement squares, field agents were given a half-squared instrument (See Exhibit 8) that consisted of a rope measuring 7.07 meters in length. The rope was divided into three sections linked by three rings to form the shape of a half-square.

This rope is used for laying the squares with 5 m on each side. With a half-squared instrument, the installation of the square is done as follows:

- Hang Ring #1 to a pole in the parcel.
- Stretch the longer section of the rope and hook Ring #2 to a pole.
- Tighten the rope by pulling on Ring #3 and fastening the picket line.
- Move Ring #3 in the opposite direction to get a complete square (See Exhibit 9).

If the size of the parcel is less than 25 m<sup>2</sup>, field agents should consider the whole parcel as a measurement square.

The density measurement squares were kept in place until harvest. Farmers were asked to treat the portion of the field with the square exactly the same as the rest of their farm. They were also asked not to partially harvest that part of the field until the arrival of the field agent. Production weighing proceeded as follows:

- When crops were ripe for harvest, the output of the plants remaining in the square was weighted. The output of maize, pod plants, tubers and root plants was weighed. Roots and tubers were directly weighed. Cereals and pulses were shelled or milled before weighing. Grain crops were dried to a constant weight to ensure reliable measurement. In these cases, field agents weighed the harvest, then deducted and dried a sample of the production and weighed it again. The actual production quantity was calculated as if the entire harvest had been dried.
- For crops in which harvesting is not done all at once (certain kinds of peas and leaf vegetables), the production was weighed at each harvest until the end of the harvest period. Production was calculated as the sum of these weights.

## **4.1 Sampling Frame**

There are 5,833 parcels with main crops listed in Section 3.2 (1,545 in treatment areas and 4,288 in comparison areas). Measurement squares were not laid in some plots since the harvest season for some crops had passed at the time of the survey. A total of 1,201 measurement squares were laid in the treatment plots and 3,438 in the comparison area, about 80% of the laying plan. Exhibit 10 illustrates the distribution of measurement squares across treatment and comparison areas.

### Exhibit 10. Distribution of Measurement Squares

	Small Parcel (<25 m <sup>2</sup> )		Squares Installed		No Squares		Total	
	N	%	N	%	N	%	N	%
<b>Treatment</b>	1	0.1%	1,200	77.7%	344	22.2%	1,545	100%
<b>Comparison</b>	10	0.3%	3,428	79.9%	850	19.8%	4,288	100%
<b>Total</b>	11	0.2%	4,628	79.3%	1,194	20.5%	5,833	100%

## 4.2 Key Variable Distributions

For measurement squares that were actually laid, average crop yields were calculated by crop and type of cropping methods (single cropping vs. intercropping with primary and secondary crops) in each parcel. For quality control, prior to the calculation of these yields, a top-coding procedure was used on the yields obtained by the field agents. CERFODES used the following thresholds set by the DGESS/MASA to top-code crop yields:

- Millet < 2000 Kg/Ha
- Maize < 4500 Kg/Ha
- Sorghum < 2500 Kg/Ha
- Rice yield < 5000 Kg/Ha
- Cowpea < 2000 Kg/Ha
- Peanut < 1500 Kg/Ha
- Sesame < 1200 Kg/Ha

In the treatment area, 5% of the parcels had crop yields greater than the thresholds, compared to 1% in the comparison area. For these parcels, crop yields have been top-coded for yield thresholds. If the crop yields are zero or very low (lower than 100 Kg/Ha) and if there are no loss factors, then the crop yield was coded as missing. This situation represents less than 2% of all parcels.

Moreover, to accurately capture the crop yields in the survey, crop moisture content was tested in two ways. First, 20 electronic grain moisture testers were randomly distributed (stratified by province) among 20 survey controllers and the moisture content was measured when the measurement squares were weighted. Secondly, one-tenth or 10% of the production of the measurement squares was packaged and sent to the laboratory of the *Société Nationale de Gestion du Stock de Sécurité Alimentaire* (SONAGESS) for moisture testing. Exhibit 11 presents the geographical distribution of samples tested in the SONAGESS lab. All the testing results showed that the moisture content of the crops fall within the reference range recommended by FAO, as described in Exhibit 12.

**Exhibit 11. Geographical Distribution of Samples Tested in SONAGESS**

Region	Number of Samples	Proportion
Hauts-Bassins	44	5.95%
Cascades	328	44.38%
Centre Nord	168	22.76%
Boucle du Mouhoun	24	3.24%
Centre-ouest	32	4.33%
Plateau Central	114	15.42%
Centre Est	29	3.92%
<b>Total</b>	<b>739</b>	<b>100%</b>

**Exhibit 12. Crop Average Moisture Content and FAO Reference Values**

Crop	Mean Moisture Content	FAO Reference Value
Millet	8.74%	13.0%
Maize	11.06%	13.0%
Rice	10.03%	13.0%
Sorghum	9.73%	12.5%
Peanut	4.14%	7.0%
Sesame	4.33%	6.0%
Cowpea	11.22%	15.0%

Exhibit 13 describes the summary of statistics for crop yields (in Kg/Ha) in single crop parcels. Exhibits 14 and 15 present the summary statistics for crop yields (in Kg/Ha) in intercrop parcels.

**Exhibit 13. Single Crop Parcel Yield by Treatment Status (Kg/Ha)**

Crop	Treatment		Comparison	
	Mean	S.D.	Mean	S.D.
Millet	1,459.8	783.9	776.4	403.2
Maize (Irrigated)	2,804.1	1,366.1	1,939.6	842.6
Maize (Non-Irrigated)	2,324.0	941.9	1,829.9	870.9
Rice (Irrigated)	3,685.1	1,725.3	2,743.7	1,730.3
Rice (Non-Irrigated)	1,493.2	877.8	1,464.5	868.0
Sorghum (White)	1,381.2	505.4	1,002.5	479.4
Sorghum (Red)	890.0	479.3	1,101.2	446.8
Peanut	1,129.2	718.7	729.9	562.8
Sesame	470.0	203.3	-	-
Cowpea	1,101.9	729.7	699.6	498.1
Groundnut	947.4	952.7	719.5	540.0



**Exhibit 14. Intercrop Parcel Yield of Primary Crop by Treatment Status  
(Kg/Ha)**

Crop	Treatment		Comparison	
	Mean	S.D.	Mean	S.D.
Millet	1,572.1	871.1	720.4	387.5
Maize (Irrigated)	1,746.7	283.8	660.0	367.7
Maize (Non-Irrigated)	2,076.7	1,485.8	1,395.2	684.5
Rice (Irrigated)	-	-	2,600.0	-
Rice (Non-Irrigated)	2,000.0	-	-	-
Sorghum (White)	1,338.4	571.1	810.6	420.5
Sorghum (Red)	1,040.0	-	951.0	595.1
Peanut	949.6	648.5	649.4	373.5
Sesame	2,040.0	-	480.4	358.8
Cowpea	736.0	171.1	648.0	378.6
Groundnut	1,430.0	651.6	957.8	549.2

**Exhibit 15. Intercrop Parcel Yield of Secondary Crop by Treatment Status  
(kg/Ha)**

Crop	Treatment		Comparison	
	Mean	S.D.	Mean	S.D.
Millet	854.3	501.5	378.6	234.1
Maize (Irrigated)	-	-	-	-
Maize (Non-Irrigated)	1,053.3	541.8	670.0	430.7
Rice (Irrigated)	-	-	-	-
Rice (Non-Irrigated)	-	-	340.0	141.4
Sorghum (White)	488.0	320.5	512.6	481.2
Sorghum (Red)	-	-	280.6	109.6
Peanut	904.0	651.1	435.0	208.9
Sesame	640.0	-	157.9	142.2
Cowpea	454.1	365.9	326.0	696.8
Groundnut	662.2	472.1	391.6	338.8

The crop yield measurement squares survey also provides information on production losses and their associated causes. Exhibit 16 describes the distribution of causes for crop production loss in treatment and comparison areas. About 10% of all the parcels in the treatment area experienced production loss, while over 21% of the parcels in the comparison area recorded a production loss. The most common cause of crop production loss is drought, as shown in the exhibit.

**Exhibit 16. Distribution of Causes for Crop Production Loss by Treatment Status**

<b>Causes for Crop Production Loss</b>	<b>Treatment</b>	<b>Comparison</b>
No loss	90.7%	78.3%
Flood	0.3%	1.3%
Fire	0.0%	0.3%
Animals	0.8%	1.0%
Parasites	0.0%	0.2%
Pest	0.1%	0.1%
Drought	3.7%	16.2%
Parcel untended	0.7%	0.4%
Loss after harvest	2.8%	0.7%
Other causes	0.9%	1.5%

## 5. SUPPLEMENTAL HOUSEHOLD SURVEY

The supplemental household survey provides information related to the training and the support farmers received from AD10. The main focus of this survey is the farmer’s training experience. The data was only collected in the treatment area.

### 5.1 Sampling Frame

The sampling frame for the supplemental household survey is the treatment household sample in the NORC Agricultural Survey, i.e. the 1,082 households from 30 villages in Comoé and Sourou provinces. Exhibit 17 describes the sample composition of the supplemental household survey. There are 949 respondent households in the sample, representing a response rate of nearly 90%. Within the 949 households in the sample, 290 (30.6%) are from Comoé and 659 (69.4%) are from Sourou.

**Exhibit 17. Distribution of Households in the Supplemental Household Survey**

Number of Households Planned	Number of Households in Sample		Response Rate
	Comoé	Sourou	
1,082	290	659	89.8%

### 5.2 Key Variable Distributions

The household survey supplements the crop yield data with farmer training-related information, which includes training status, type of training and the AD10 incentive kit status. Exhibit 18 describes the training status and the application of training knowledge in household plots. Almost 50% of the households in the sample reported that they received AD10 training and 40.3% of the households reported that they received the incentive kit. The proportion of training participating households that reported applying training knowledge in their plots is almost 95%. We observed an imbalance between Comoé (61.3%) and Sourou (44%) in the proportion of households that received training. Exhibit 19 presents the types of agricultural training received by participating households. Exhibit 20 presents the percentages of training participating households reporting that they are applying trained and new practices in their plots. Among training participants, majority of households (nearly 95%) have utilized the practices they received trainings in their plots. About 85% of the training participants have applied new practices in their household plots. Exhibit 21 shows that more than 40% of the training participants have applied new practices in all of their plots, while about 30% only applied the new practices in a small portion of their plots.

**Exhibit 18. Distribution of Training Status and the Utilization of Training Knowledge**

	Training Participation	Application of Training Knowledge	Received Incentive Kit
Comoé	61.3%	97.7%	52.9%
Sourou	44.0%	92.9%	34.6%
Total	49.4%	94.8%	40.3%

**Exhibit 19. Distribution of Types of Training Received**

Training Module	Comoé	Sourou	Total
Use of compost	71.8%	83.3%	78.9%
Crop Rotation	36.7%	51.4%	45.8%
Cultivation method	73.4%	72.3%	72.8%
Rice planting	16.4%	31.9%	25.9%
Rice harvesting	12.4%	24.5%	19.8%
Maize harvesting	54.2%	48.2%	50.5%
Production of onions and tomatoes in dry season	24.9%	36.5%	32.0%
Pesticide	18.1%	35.8%	29.0%
Irrigation	11.3%	44.3%	31.6%
Weeding	39.0%	51.8%	46.8%

**Exhibit 20. Distribution of Households Who Utilized Trained Practice and New Practice**

	Applying Training Practice in Household Plots	Applying New Practice in Household Plots
Comoé	97.74%	87.28%
Sourou	92.91%	84.35%
Total	94.77%	85.52%

**Exhibit 21. Distribution of Households Who Utilized New Practice by Plot Portions**

	Small Portion of Plot	Half of Plot	Most of Plot	All of Plot
Comoé	32.45%	17.88%	9.27%	40.40%
Sourou	27.27%	26.36%	6.36%	40.00%
Total	29.38%	22.91%	7.55%	40.16%

## 6. CONCLUSION

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Based on our review of the interim crop yield data, we have found that the overall quality is better than the crop yield section of the NORC Baseline Agricultural Survey. The clear documentation of measurement square installation methods and weighing procedures has provided us with very useful background information to detect data quality issues. The scientific analysis of moisture content has also greatly increased our confidence in the accuracy of the yields data. Overall, the interim crop yield data is of high quality and can be used in the ADP impact analysis.

Although the quality of the crop yield data in the NORC Baseline Agricultural Survey is problematic based on our data quality review, the interim crop yield data provided an alternative way of examining baseline agricultural productivity of the ADP treatment and comparison areas given that the benefits of farmer training program usually takes longer to realize. Moreover, the wealth of baseline household information in the NORC survey could be merged with the interim crop yield data to track households and their agricultural activity. We have conducted an initial consistency check of the unique household identifier across the two sets of files and we believe that the interim crop yield data merges reasonably well with the NORC baseline data. This merging of data will also allow us to investigate the NORC baseline household training/incentive kit status from the household supplemental data of the crop yield data.

## APPENDIX 1. LIST OF STUDY VILLAGES AND PROVINCES

Treatment		Comparison	
Provinces	Villages	Villages	Provinces
Sourou	Benkadi Bosse Bouna Débé Di Gouran Guiedougou Kourani Lanfiera Lo Niassan Nion Oué Poro Pourra Querin Tani Toma-Ile Toma-Koura Tourou Yaran		
Comoé	Diarabakoko Kossara Marebama Nékanklou Niarebama Siniéna Sitiéna Tangrela Tiekouna	Berega Deregoue Diongolo Kouere Nafona Sakora Soubagagnedougou Takaledougou Tiefora Toumousseni	Comoé
		Bam village Kondibto Kora Kourpelle Loulouka Saint Paul Secteur 2 Secteur 3 Secteur 4 Tangaye	Bam
		Savili	Boulkiemdé

Treatment		Comparison	
Provinces	Villages	Villages	Provinces
		Dawaka Mogtedo Talembika Zoungou-Nord	Ganzourgou
		Thion	Gnagna
		Leguema Nasso	Houet
		Kieryaoghin	Kadiogo
		Sourou	KénéDougou
		Soro	Kossi
		Gorgo Itengue Kuilmoko Tensobtenga	Kouritenga
		Sandogo	Kourwéogo
		Dakoro Douna Moadougou Nofila	Léraba
		Bolomakote Bona Kouama Lan Souri/Badala Zanzaka	Mouhoun
		Bousance Zeguedeguin	Namentenga
		Kosse	Nayala
		Dablo Dem Louda Louda II Sian Korsimoro	Sanmantenga
		Benaverou Boura	Sissili
		Lago	Zondoma

Source: Authors' calculations.

## APPENDIX 2. CENSUS OF HOUSEHOLD PLOTS BY VILLAGE

Provinces	Villages	Number of Households Planned	Number of Households with Plots
Sourou	Benkadi	14	15
	Bosse	19	16
	Bouna	21	19
	Débé	63	60
	Di	101	95
	Gouran	74	72
	Guiedougou	130	113
	Kourani	7	7
	Lanfiera	13	11
	Lo	6	0
	Niassan	61	56
	Nion	15	15
	Oué	63	61
	Poro	21	21
	Pourra	17	17
	Querin	16	3
	Tani	10	9
	Toma-Ile	20	20
	Toma-Koura	10	10
	Tourou	13	13
Yaran	48	47	
Comoé	Diarabakoko	54	14
	Kossara	27	25
	Marebama	1	1
	Nékanklou	23	18
	Niarebama	13	0
	Siniéna	78	1
	Sitiéna	43	28
	Tangrela	65	1
	Tiekouna	28	27
Comoé	Berega	17	17
	Deregoue	21	20
	Diongolo	31	25
	Kouere	16	13
	Nafona	7	5
	Sakora	1	1
	Soubagagnedougou	10	0



Provinces	Villages	Number of Households Planned	Number of Households with Plots
	Takaledougou	16	11
	Tiefora	6	7
	Toumousseni	26	18
Bam	Bam village	32	33
	Kondibto	1	1
	Kora	20	20
	Kourpelle	8	8
	Loulouka	24	23
	Saint Paul	2	1
	Secteur 2	11	6
	Secteur 3	6	6
	Secteur 4	12	5
	Tangaye	8	8
Boulkiemdé	Savili	24	23
Ganzourgou	Dawaka	9	7
	Mogtedo	65	57
	Talembika	21	19
	Zoungou-Nord	9	9
Gnagna	Thion	2	0
Houet	Leguema	94	89
	Nasso	43	40
Kadiogo	Kieryaoghin	10	10
Kéné Dougou	Sourou	46	50
Kossi	Soro	2	2
Kouritenga	Gorgo	9	8
	Itengue	6	6
	Kuilwoko	2	2
	Tensobtenga	13	13
Kourwéogo	Sandogo	10	10
Léraba	Dakoro	34	31
	Douna	32	25
	Moadougou	14	15
	Nofila	25	20
Mouhoun	Bolomakote	7	6
	Bona	4	4
	Kouama	32	24
	Lan	18	13
	Souri/Badala	19	18
	Zanzaka	1	1

<b>Provinces</b>	<b>Villages</b>	<b>Number of Households Planned</b>	<b>Number of Households with Plots</b>
<b>Namentenga</b>	<b>Bousance</b>	18	18
	<b>Zeguedeguin</b>	22	22
<b>Nayala</b>	<b>Kosse</b>	27	27
<b>Sanmantenga</b>	<b>Dablo</b>	32	25
	<b>Dem</b>	19	16
	<b>Louda</b>	27	24
	<b>Louda II</b>	3	1
	<b>Sian</b>	3	3
	<b>Korsimoro</b>	53	48
<b>Sissili</b>	<b>Benaverou</b>	3	3
	<b>Boura</b>	43	41
<b>Zondoma</b>	<b>Lago</b>	14	14
<b>Total</b>		<b>2,164</b>	<b>1,767</b>

Source: Authors' calculations.