



# Cocoa Farms in Ghana:

## An Evaluation of the Impact of UTZ Certification on the Sustainability of Smallholders Supported by the Solidaridad Cocoa Programme (2010-2012)

Report

November 27, 2013

Solidaridad

# Cocoa Farms in Ghana: An Evaluation of the Impact of UTZ Certification on the Sustainability of Smallholders Supported by the Solidaridad Cocoa Programme (2010-2012)

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and
Institute of Statistical Social and Economic Research (ISSER)
University of Ghana

November 27, 2013

**Title**: Cocoa Farms in Ghana: An Evaluation of the Impact of UTZ Certification on the Sustainability of Smallholders supported by the Solidaridad Cocoa Programme (2010-2012)

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2010 production year: September 2009 – August 2010
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**Measure and Conversion Notes for the General Reader:**
Acres are used locally as the standard measure of area in Ghana and x 2.54 is the conversion formula to Hectares (ha).

Exchange rates: from http://www.oanda.com/currency/historical-rates/ average interbank rate
Average for 2010: 0.6905
Average for 2012: 0.5187

The term “Target” is used to denote the targeted entities that were assessed while “Control” is used for those entities selected for comparison purposes and to help address the counterfactual questions.

Statistical significance used in the analysis and presentation of findings uses one to three asterisks as follows: * p<=0.10 or at least 90% level of confidence; **p<=0.05 or at least 95% level of confidence; ***p<=0.01 or at least 99% level of confidence. These are calculated using t-tests, See Appendix 2 for additional information.

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# 1. Executive Summary

This report reflects performance on key sustainability indicators in the 2010 and 2012 cocoa production years for certified farmers in the Ahafo Ano North and Ahafo Ano South districts of Ghana. The 2010 effort represents a true baseline year which created a snapshot of UTZ Certified farmers in these districts *before* they become certified. The study was commissioned by UTZ Certified and Solidaridad to learn what aspects of the implementation of UTZ certification worked effectively to improve farmer livelihoods and overall sustainability.

The COSA method compares changes in performance between a target group (that was becoming certified) and a control group. It observed the effects from a year prior to certification and again two years after the effects of certification would be expected to appear.

The results strongly suggest that some unique external influences had a very significant effect on cocoa farming between 2010 and 2012. This is evidenced by the high number of indicators with results that differed strongly for both certified and control farms between 2010 and 2012. In between these COSA assessments (2011), the Government of Ghana (GoG) embarked on a major effort to increase cocoa production that likely contributed strongly to Ghana producing a record high of more than one million metric tons. While this research focused on UTZ certification, and was not designed to ascribe results to such external interventions, the analytical methods COSA employed can effectively distinguish the effects of the UTZ certification program from such external influences and are thus essential in situations such as this.

The analysis did detect modest economic improvements that are attributable to certification although in some cases, external forces – affecting both certified and control groups – appear to be substantial enough to overshadow possible certification effects. On the economic front, in 2012 certified farmers received significantly higher prices for their cocoa. This drove a significant increase in net income for the target farms compared to controls. Total costs did not contribute substantively to the improved net income as there were no significant changes between 2010 and 2012; nor were there differences between target and control farmers within the same year to suggest a certification impact. Corroborating indicators are consistent with a picture of improved economic conditions for certified farmers: The growth of the AHANSUCOFA group from 352 certified farmers in 2010 to over 5,000 today suggests that farmers in the area believed that certified farmers were achieving desirable results.

Target farmers surveyed by ISSER (COSA's research partner) achieved higher yields between 2010 and 2012 reflecting, in part, a greater investment in fertilization (controls also invested more). Target farmers got higher yields than controls with similar fertilizer costs, reflecting the likelihood of better crop management processes. This is also evident in the target farmers' reduced application of synthetic crop protection (biocides) while achieving lower pest and disease related losses. While the yield result was true for our sample, the variation exhibited among the sample farmers means that we cannot be statistically confident that certification produced these results for the entire population of certified farmers. Workshop and qualitative or anecdotal information suggests that UTZ and Solidaridad intervention that assists farmers with more optimal fertilizer practices may have potential.

In most cases, with some exceptions, the social and environmental performance did not result in measureable differences between target and control farmers for many indicators. With the notable exceptions of children working and farming injuries, performance on social indicators declined between the baseline and follow-up years. While the target farmers outperformed the control farms in absolute terms, the target farmers' performance sometimes declined more from baseline than the control farms. Examples of this include: farms restricting vulnerable groups from biocide application and farms participating in community projects. The network of producer organizations that UTZ-Solidaridad partnership has fostered offers a vehicle for actions that would strengthen community networks, such as sponsoring community infrastructure projects that members complete.

Environmental performance followed a similar pattern to social performance. After initially strong levels of reforestation in 2010, levels tapered off by 2012 and a small percentage expanded their cocoa areas by clearing natural forest. Similarly, for soil and water resource management measures, performance declined with only a small portion of farmers using such measures. There are indications of opportunities among target farmers who are not often utilizing natural fertilizer (rather than purchased synthetics) and this is an area that might offer some paths for cost savings and environmental benefits from nutrient recycling.

Significant declines in the hours of training that target farmers reported attending suggest the possibility that for practices not reinforced by subsequent training or direct economic benefit, farmers did not retain their learning. In a stakeholder workshop held to discuss and validate the findings, representatives of Solidaridad West Africa (the local implementing partner) reported making substantial investments to bring certification to a much larger portion of the producer organization, particularly by increasing training opportunities. Nevertheless, the training reported in our survey of the first wave of certified farmers suggests that they did not take advantage of these opportunities. Another possible explanation of the unusual decline in environmental performance could be that external initiatives that led to the significant increase in cocoa production hindered environmental activities. For example, increasing cocoa planting could plausibly reduce factors such as soil cover, biodiversity, and live fences. Further investigation could offer more certainty about the reasons for this particular outcome.

# 2. About This Document: Purpose, Target, Approach

In 2009, Solidaridad began organizing and training cocoa farmers in Ghana's Ahafo Ano North and Ahafo Ano South districts. The program's main goal was to improve yields of smallholder farmers and enhance their livelihoods and overall welfare. Achieving UTZ certification was part of the strategy. The vegetation of the area is primarily moist deciduous forest, and the Ashanti region encompasses fertile lands suitable for both plantation and small-scale agriculture.

The UTZ program consists of intertwined training and certification components. UTZ governs the standard and certification, and depends on implementing partners to achieve its adoption and application on the ground. Certification is not usually a standalone intervention; UTZ Certified reports that it typically includes organizing farmers, raising awareness, training, setting up the producer group's internal control systems prior to obtaining certification. So, certification is embedded in a delivery system or larger intervention that necessarily makes it challenging to attribute impacts, or lack thereof, only to the standard or certification.

This report covers farmer performance using COSA data collected by ISSER, of the University of Ghana, during the 2009-10 production year (just before farmers received certification) and then from data collected two years later in the 2011-12 production year. This is the first COSA study of UTZ certification that has captured both a baseline year – looking at data collected before certification would be expected to have significant effects – and a post-intervention year, when sustainability effects would be expected to emerge. The study used both target and control groups of farmers, revisiting farmers from each group in the second round of data collection. This two-stage approach is considered a very reliable method for establishing relationships between specific interventions and their outcomes, especially when randomly assigning sample farmers to target or control groups is not a viable approach.

UTZ Certified together with Solidaridad initiated this impact assessment with COSA as part of its stated commitment to regularly use independent evaluations in order to:

- Prove or demonstrate if and how the program is making an impact
- Improve by learning how to specifically improve the program as farmers' situations continuously change

**Box 1: Prove and Improve**

To UTZ, it is important to continuously improve the program in order to meet the needs of various actors in the supply chain, above all those of the farmers, their workers and families. This way, UTZ ensures that the program is regularly revised and adapted to the changing context and the evolving situation of the farmers. One important function of Monitoring and Evaluation is to provide evidence of outcomes and impact ("to prove"). Another main function is to learn from our practice and improve our work ("to improve").

-from the UTZ Certified website

https://www.UTZcertified.org/en/aboutUTZcertified/monitoring-evaluation

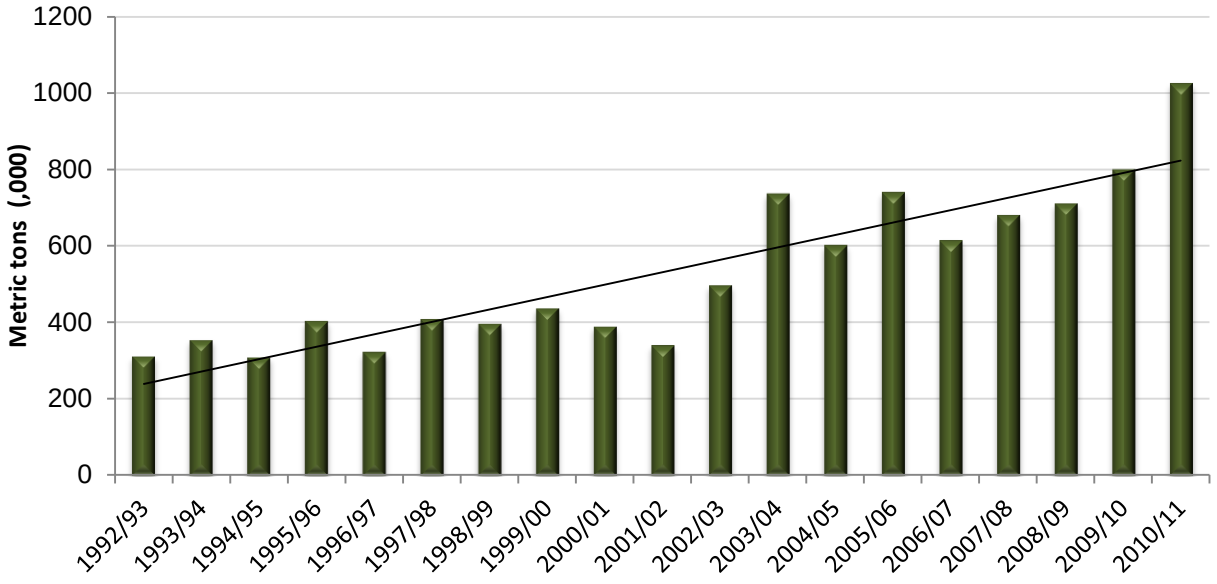
# 3. Background of Cocoa Production in Ghana

## Cocoa production - the Ghanaian context

Cocoa production in Ghana has gone through several cycles. While first cultivated in the 17th century in the Akuapim areas of the Gold Coast (the former name of Ghana), production of cocoa on a large scale only dates to the 19th century. Since then it has gone through four main cycles: introduction and exponential growth (1888 to 1937); stagnation followed by a brief but rapid growth after Ghana's independence (1938 to 1964); near collapse of the sector (1965 to 1982); and the recovery and expansion (1983 to date) starting with the introduction of the Economic Recovery Programme (Kolavalli and Vigneri, 2011).

Growth was particularly impressive in the 2000s, with total output moving from about 400 metric tons in 2004 to over one million in 2011 as shown by Figure 3.1. Though some researchers have argued that this growth has been fueled partly by the smuggling of beans from Ivory Coast due to its political instability, reported Ivorian output has not declined. A plausible argument for the high growth rate could be substantial government programs that support famers to adopt best practices that improve yields and consequently incomes. These efforts include subsidy programs for synthetic fertilizers and biocides (herbicides, fungicides, and insecticides).

**Figure 3.1: Time Profile of Cocoa Output in Ghana** (,000 Metric Tons)




Source: Agyei-Holmes and Ayerakwa's construction with data from ISSER

Cocoa is a commodity that is essential to the development of the Ghanaian economy for its contribution to employment generation and poverty reduction. Foreign exchange from cocoa amounted to about US$ 2.8 billion in 2011, translating to about 23% of total export earnings (ISSER, 2012). Small-scale farming dominates Ghana's cocoa sector with production areas averaging between 1.2 and 2.2 hectares (Barrientos et al., 2008). It is also estimated that the cocoa subsector employs over 800,000 farm households across the country, mostly in rural communities. Due to the importance of cocoa to the Ghanaian economy, the government statutorily created the Ghana Cocoa Board (COCOBOD).

**Ghana Cocoa Board**

COCOBOD has played a major role in linking small farmers to global markets – the challenge of agricultural development across Africa. In contrast to many other countries dependent on primary commodity exports, Ghana has not liberalized its cocoa sector, and the state retains a significant role in the management of the cocoa supply chain. COCOBOD manages internal prices for cocoa and provides inputs and other services to farmers. It is also charged with securing the most favorable arrangements for the purchase, grading, certification, sale and export of cocoa and cocoa products. While COCOBOD maintains a monopoly on the sale and export of cocoa beans, there has been some modest liberalization of bean procurement with the sanctioning of private sector licensed buying companies (LBCs), although prices remain tightly regulated (World Bank, 2007b, http://www.cocobod.gh/objectives.php).

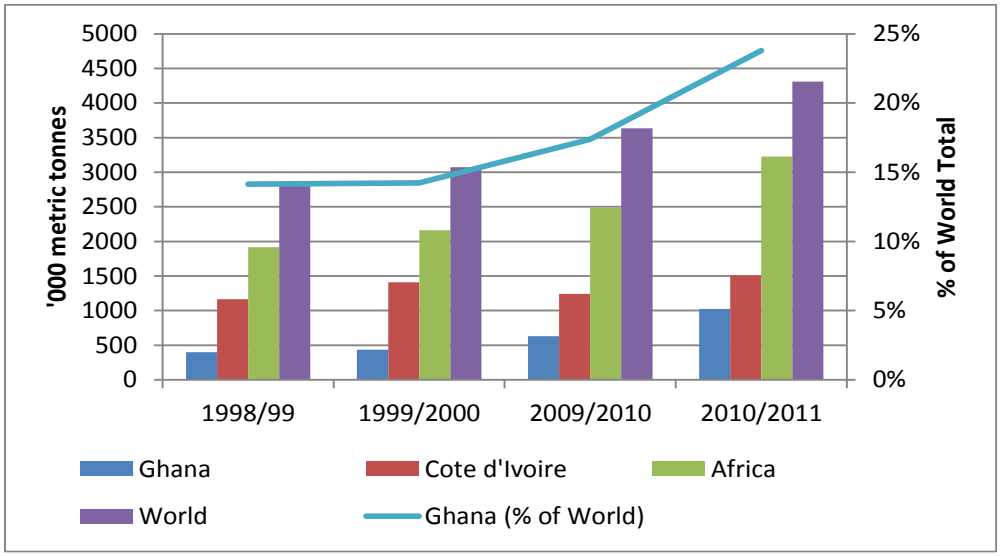
**Licensed Buying Companies**

COCOBOD authorizes Licensed Buying Companies (LBCs) to purchase cocoa on its behalf at set prices, and these companies commit to purchase a set amount of cocoa each year. The multiple buying channels were introduced to allow other private organizations to buy cocoa internally. It is thus common to find several different buyers in one community seeking to buy cocoa. This raises the level of competition among different licensed buying companies and helps ensure that no single buyer can unduly delay or manipulate the system. LBCs' ability to attract and sell to farmers depends in part on the purchasing clerk's ability to pay at the point of sale, and also upon the offer of other innovative initiatives that farmers may consider attractive. These incentives can include cash, input credit and advances, and are given in order to gain a commitment from farmers to sell to a particular LBC.

**Exports**

Ghana contributes substantially to world output with its cocoa exports comprising about 23% of world output in 2011, making it second after Ivory Coast in percent contribution to world supply (Figure 3.2). Ghana's cocoa is considered premium on the world market because of quality factors including bean size, moisture and fat content and quality of the fat. Ghana sells most of its cocoa production, over 90% of which is Grade 1, ahead of the harvest season through forward contracts (Kolavalli and Vigneri 2011). This allows COCOBOD to fix in advance the price it can offer to farmers for the entire crop year.

**Figure 3.2: Trends in Cocoa Output; 1998/1999 - 2010/2011**




Source: Graphed with data from *ICCO Quarterly Bulletin and Ghana COCOBOD*

## Challenges

Notwithstanding this success, the sector faces many difficulties. The official average cocoa yield is about 300 kg/ha, which is considered low compared to an estimated potential yield of 1.0-1.5 tons/ha (COCOBOD). Aging trees, aging farmers and poor management practices (including misuse of agrochemicals) are all seen as threats to the sustainability of cocoa production in Ghana. In 2008, it was estimated that Ghana's cocoa-producing households derive a mean per capita daily income from cocoa of US$0.42 out of a total income of only US$ 0.63 (Barrientos et al., 2008), indicating both a relatively high level of poverty and a significant dependence on cocoa.

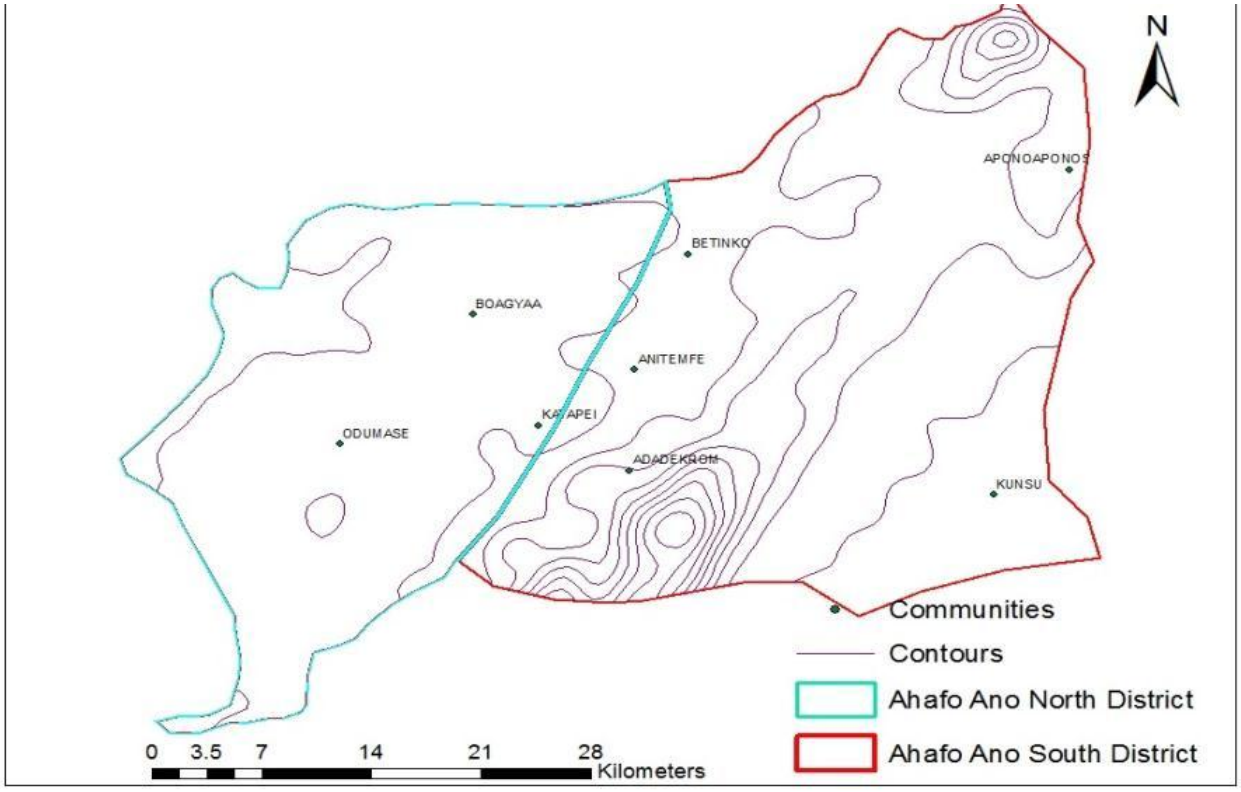
## Solidaridad's Investment in Ghanaian Cocoa Farmers

Solidaridad, an UTZ partner, began organizing cocoa farmers in Ghana's Ahafo Ano districts to attain UTZ certification in order to improve livelihoods through a focus on all three pillars of sustainability: economic, environmental, and social. The initial effort began in 2009 in ten communities with 352 farmers, all of whom had been part of a CARE/Cargill project designed to reduce child labor by educating farmers on social and community based interventions. This effort was part of the Cocoa Improvement Programme, a public, private partnership of Solidaridad, UTZ Certified, private sector partners and IDH.

Solidaridad assigned CARE representatives to engage in community level farmer mobilization and training based on UTZ Code of Conduct. Because of their familiarity with these farmers and communities, community-level farmer associations were organized for managing the group certifications. After a year, Solidaridad initiated and guided the formation of AHANSUCOFA, an umbrella producer organization for the community-level associations. This effort reflected Solidaridad's strategy to strengthen farmers through the creation of a farmer-led organization that was to become independent and sustainable. Solidaridad provided the initial funding for the umbrella organization, and the associations then contributed a portion of their certification premium to pay for the day-to-day administration and maintenance costs of co-coordinating an office. This created a structure for the umbrella organization (and, by extension for the farmer-based organization) that did not rely completely on Solidaridad funding (after their initial investment). In order to link the association to the certified market and ensure continuous funding of training of the members, in 2012 Solidaridad linked AHANSUCOFA to Noble Resources and a 3-year purchase agreement. Later, in 2012 the Bill and Melinda Gates Foundation (BMGF) and the World Cocoa Foundation (WCF) also began supporting farmer training in gender, additional livelihoods, and food security. As of November 2013, the number of associations in this producer organization had grown from 10 to 85, with membership growing over 5,000 farmers.

Solidaridad's activities have coincided with a major effort by the Government of Ghana through the COCOBOD to improve support to the cocoa sector. Government programs were aimed at multiple goals such as improved pest and disease control; improved fertilizer application; improved agronomic protocols; higher cocoa prices; replanting of old farms; improved varieties; and road system improvements to cocoa growing areas. Combined with good weather conditions, these efforts may have contributed to national production of 1 million metric tons of cocoa in 2011-12, the first time annual cocoa production reached the million ton threshold. (Ashitey 2012).

**Figure 3.3: Map of the Ahafo Ano North and Ahafo Ano South Districts**



# 4. Methods

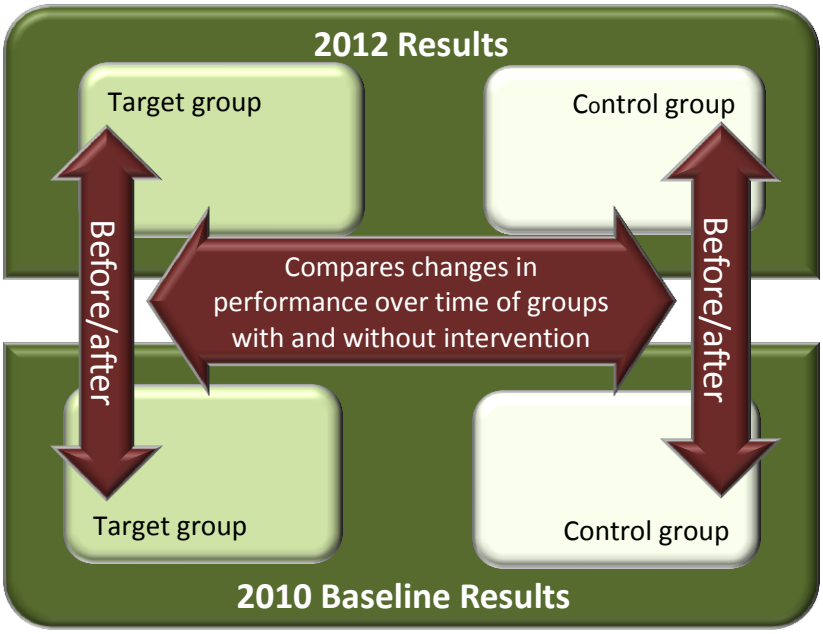
## General Approach

For each impact assessment, COSA tailors the analytic approach that will yield the most valid, reliable information for providing insight into the effectiveness of an intervention and for identifying which strategies are working and which are not. COSA initiated this study just as Solidaridad began its implementation for the certification. Randomly assigning farmers to interventions (randomized control trial) was not feasible in this case and we employed an analytic approach called Difference-in-Differences (DID) that was augmented by Propensity Score Matching analysis (PSM).

### Difference in Differences

A DID approach compares the results for a "target" group - before and after an intervention - to results for a group with no intervention (the "control" group) for the same timeframe. The target and control groups are selected to be as similar as possible in agro-ecological and socio-demographic characteristics. Then, with careful analysis, changes in performance of both the target and control groups over time reveal which changes may be due to the intervention. To use a very simple example, if at baseline a target group had a value of 7 and the control had 5 (a difference of 2), we would expect to see a difference of 2 between the control and target in the final measurement if we can ascertain that each is fundamentally similar and faced similar conditions in the ensuing time. If the final measurement for the control was 10, we would expect that the value of the target would be 12, and any deviation from this estimated value would be what is called the "treatment effect." The research design with the control group allows control for factors that are common to all farmers (and so not affected by project intervention). Such design is especially needed in agriculture where results (such as yields) can be significantly affected by local phenomena (such as weather, government policy, political events, and market prices) that might vary substantially from year to year. A more detailed discussion of the DID model is provided in the appendix.

**Figure 4.1: Difference in Differences Illustrated**




**Difference in Differences Presentation**

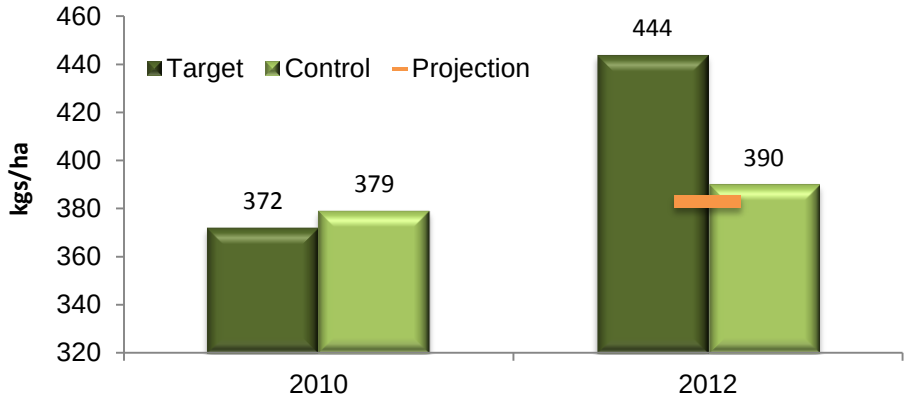
Difference in differences (DID) results are complex to interpret, as the reader must take into account the differences *between years* for both targets and controls as well as the differences *within years* between the target and controls. We primarily use graphs to present this multiplicity of measurements because they seem to be most intuitively interpretable by readers.

When a single indicator is used to measure a dimension of sustainability, graphs like Figure 4.2 present the information. The figure shows the difference between target and controls with each year. When such differences within a year are significant, we mark the year with asterisks according to the code shown in the second page of this report. The graph also shows visually the difference between years for both target and controls and the narrative also cites any such significance. This between-year significance is a key part of the DID analysis. Differences between years for target and controls alike indicate that factors other than certification most likely caused the change. Only when the difference for the target between in the first and second years exceeds the difference between the first and second years for the controls is there potential of program-related impact, assuming other factors are accounted for.

The projection line in the graphs shows the expected results for the certified group if it changed from the first year to the second year at the same rate as the control changed (assuming no unique effect on either). The distance between the top of the target column and the projection line is the estimate of program impact. The hypothetical example in Figure 4.2 deliberately shows a situation where a large difference for the target versus the control in the second year cannot be interpreted as significant for the population. This happens when there is great variation (range) in individual farmer results. In such cases, the *sample* results are just what the graph depicts. However, the chances are significant that by random chance, the farmers in the sample are not representative of the variation in the population so we cannot say with confidence that the result is true for the entire population of farmers that the sample represents. We indicate in the text when the program impact is significant for the population.

In many cases, multiple indicators measure a dimension of sustainability. Such instances appear throughout the report and we use a variety of ways to indicate significant differences between target and controls and the narrative covers the "between year" and program impact significance in these cases.

**Figure 4.2: Example of DID Projection**



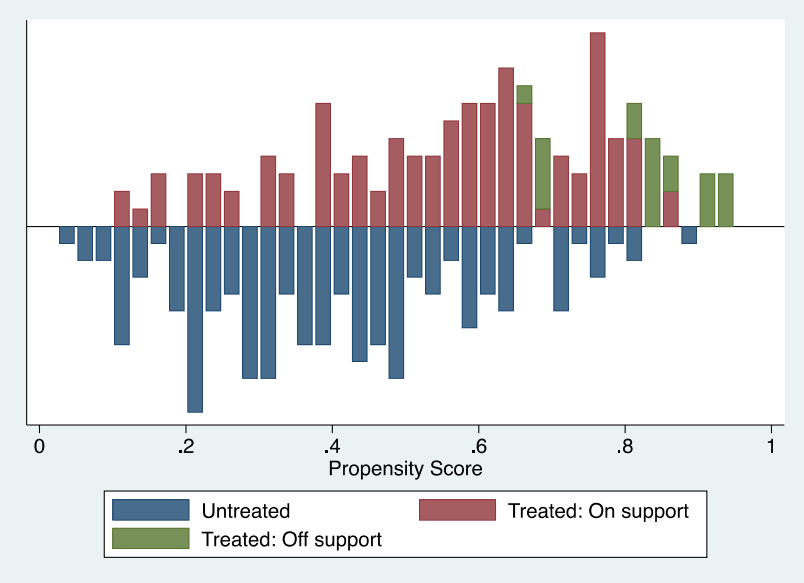

## Propensity Score Matching

A complication for the DID approach is that farmers who elect to participate in a sustainability initiative may, by virtue of their choice, reveal that they are different from other farmers. This possibility for 'self-selection bias' presents a problem because differences in performance between target and control groups could stem from these underlying differences between farmers, rather than from the sustainability initiative. Propensity score matching (PSM) matches target and control farmers on all observable factors, and can then control for differences in results due to differences in the participating farmers, thus better isolating the true impact of the initiative.

One tradeoff of using PSM is that we can only use observations for which we have a suitable match, and must drop those that remain unmatched. As Figure 4.3 illustrates, we drop observations that are off the "common support" (green bars), which is comprise of areas where propensity scores overlap between target and control observations. As depicted here, the dropped observations are around propensity scores that have few to no controls with similar scores. This means that the analysis drops those target farmers who are not comparable based on household and farm demographics. However, because samples in this study were sufficiently large in both years of data collection, we retained a substantially adequate sample after matching. We provide further discussion of this matching process in the appendix. [1]

[1] The combination of PSM and DID yields an accurate, statistically rigorous framework for identifying causality within this context. Using these techniques provides unbiased estimates of the average treatment effect. However, a consistent challenge in impact evaluation is accounting for inefficient estimates of standard errors. This is caused by serial correlation, which is the idea that random errors from one period in the study carry over to the next period for each observation (non-randomly). While this type of error does not impact the "unbiasedness" of our results, it does impact their standard errors, which could impact conclusions regarding significance. This error is difficult to account for in the difference-in-difference framework. While there are suggestions in the current literature of how to deal with serial correlation in a DID model, there is no clear or overwhelming consensus.

**Figure 4.3: Propensity Score Matching**




In this way, PSM analysis is data intensive. Table 5.3 shows us the final count of observations we work with for the analysis. While this lowers our sample size, it increases the reliability of our results, and offers more confidence that the results are unbiased and consistent.

**Table 4.1: Final Sample**

| | Off Support | On Support | Total |
|---|---|---|---|
| Control | 0 | 143 | 143 |
| Target | 20 | 117 | 137 |
| **Total** | **20** | **260** | **280** |

## Sample Selection

The overall approach was to randomly select target and control farms within the target population consisting of farms which were slated for certification but not yet certified and farmers with similar characteristics but not participating or slated for certification. We then interviewed representatives of the same farms in both first (2010) and second (2012) rounds of data collection.

**Target (certified) group selection - 2010 (first round)**
The sampling universe consisted of 352 farmers across 10 communities initially selected to obtain UTZ certification. These 10 communities were all part of the initial formation of the AHANSUCOFA producer organization as well as part of a larger project initiated earlier by CARE/Cargill.

**Control group selection – 2010**
The manager of the CARE project identified nine communities that were 1) part of the original CARE project, 2) not a part of the Solidaridad certification project, and 3) the most similar to the

target communities of all the 'not certified' communities. The factors most important for similarity among the target and control communities included agro-ecological zones, demographics, farm size, and proximity to markets. COSA randomly selected 192 farmers from the initial CARE project's list of participating farms. Using these farms for the control group was intended to reduce bias in the following ways:

- CARE farms might have performed better on some measures due to training they received from CARE, having nothing to do with UTZ certification. Selecting all CARE farm eliminated this potential 'noise' in the data.
- Spill-over bias could otherwise occur. Spill-over occurs when farmers *not* part of an intervention adopt intervention practices because they observe counterparts who *were* part of the intervention. This can make the intervention appear less effective by reducing performance differences between target and controls.

**Sample for second round data collection - 2012**

In the second round of data collection, surveyors interviewed all available farmers from the initial sample. In cases where they could not locate the farmer originally interviewed, they interviewed a person knowledgeable about the farm, if one could be found. Surveyors were able to gather survey data for 300 farms in both the first and second rounds of data collection, but 68 farms from the first round did not have second round surveys. These 68 farms were evenly split between target and control groups. Also they were not concentrated in any particular communities.

## Data Collection

The Institute for Statistical, Social and Economic Research (ISSER) of the University of Ghana managed and conducted the field work for both rounds of data collection, under the supervision of Andrew Agyei-Holmes in 2010 and Hayford Ayerakwa in 2012. These supervisors organized and trained the surveyors and reviewed their work as they collected data in the field. The 2010 field work occurred in August and September and focused on the farmer's previous 12 months which also coincided generally with the 2009-2010 production year for that area. The 2012 field work occurred in February and March of 2012 and focused on the 2011-2012 production year.

As a preliminary to analysis, the ISSER supervisors working with COSA analysts reviewed the data to identify data entry errors as well as implausible data possibly arising from farmer misunderstandings of questions. This process brought to light concerns with some specific data for 2010, in particular farm and cocoa growing area. For 2012 field work, COSA and ISSER revised some questions for more accurate responses and provided enhanced training and review for surveyors. Nonetheless, the data still showed evidence of potential 'measurement error' defined in survey literature as "the difference between the recorded or observed value and the true value of the variable." Therefore, ISSER returned to the field in August 2013 to follow up on farm and crop areas, production and labor data. Before re-interviewing farmers, the field staff held focus groups with 'model farmers' and other area technical experts to develop interview protocols and follow-up question techniques to best elicit correct information (see Box 2). Surveyors then held additional sessions with supervisors to further develop interviewing technique - including how to politely and effectively probe when farms provided seemingly unrealistic data. When farmers maintained that implausible answers were correct, the surveyor asked questions to determine if factors existed to cause significant deviations from normal in that farmer's results. The findings presented below use the data from this final set of interviews.

Following the analysis of the data, ISSER convened a stakeholder workshop to gain insights from people with local knowledge regarding the reasonableness and interpretation of the data. Relevant input from workshop is interspersed within this report.

**Box 2: Challenge: Accurately Estimating the Size of a Cocoa Farm in Ghana**

**Problem:**
After COSA's first round of data collection in 2010, researchers and agricultural agencies began to identify a recurring tendency for Ghanaian farmers to overstate the size of their farms. Incorrect information on size or area is a difficult hurdle for research since comparing performance usually requires standardizing economic data such as costs and revenue on a common area basis i.e. per acre or per hectare.

**Reason:**
Many farmers did not know their areas, in part, because they held multiple traditional parcels (in some cases more than 10) under different tenure or ownership arrangements thus making a precise statement difficult. For example, a farmer may technically own the land but allow its harvest to be taken by other family members or may technically not own some of the parcels farmed while nevertheless providing all the inputs and labor for those. The inconsistent shapes of parcels and lack of formal titling details also contribute to not knowing the precise size of landholdings. The possible combinations are manifold.

**Investigation:**
Attempts to resolve the challenge were particularly costly in terms of time and effort. Applying GIS is not the obvious solution because of complications due to considerable tree cover, steep slopes, and complex shapes in addition to multiple non-contiguous plots. A review of the literature by credible researchers and discussions with experienced institutions and researchers in Ghana did not reveal a solution. The error appears to be an accepted condition and stated common practice is the general acceptance, within reason, of what is stated by the farmer as true. Testing for this revealed errors that could range to 40% and are mostly evident when comparing year to year (estimates are often not consistent) and using known data to counter-check.

**Solution:**
COSA and the University of Ghana team convened a focus group to explore how to obtain accurate farm size information. Model farmers and experts confirmed that farmers gave the wrong area because they did not know the measurements of their farms. Further, the convened group noted that government guidelines to aid in measurement had been commonly misinterpreted at the local level to result in estimations that are larger than actual size. The model farmers recommended an elegantly simple solution for at least having a reasonable approximation. They suggested that it worked to have the farmers visualize their farms in terms of comparison to standard football fields – a well-known area. In local testing, this simple approach has so far produced the most plausible data.

# 5. Key Findings

## Core Demographic and Farm Characteristics

Tables 5.1 and 5.2 below present household and farm data from the farms we surveyed. This data is employed in our PSM analysis, which uses an array of household and farm level characteristics to ensure that each target producer is compared to a similar control producer.

**Table 5.1: Household characteristics of surveyed farms**

| Indicator | Group | Value |
|---|---|---|
| Producer's age | Control | 53 |
| | Target | 51 |
| Producer's experience | Control | 21 |
| | Target | 16 |
| Gender (% female) | Control | 31% |
| | Target | 27% |
| Years in school | Control | 7 |
| | Target | 6 |
| Household members | Control | 5 |
| | Target | 5 |
| Household assets (value in Cedis) | Control | 61 |
| | Target | 82 |

**Table 5.2: Characteristics of surveyed farms**

| Indicator | Group | Value |
|---|---|---|
| Cocoa area (ha) | Control | 3 |
| | Target | 2 |
| Total area (ha) | Control | 4 |
| | Target | 4 |
| Owns the land | Control | 65% |
| | Target | 68% |
| Distance in minutes from a commercial center | Control | 49 |
| | Target | 53 |

## Training

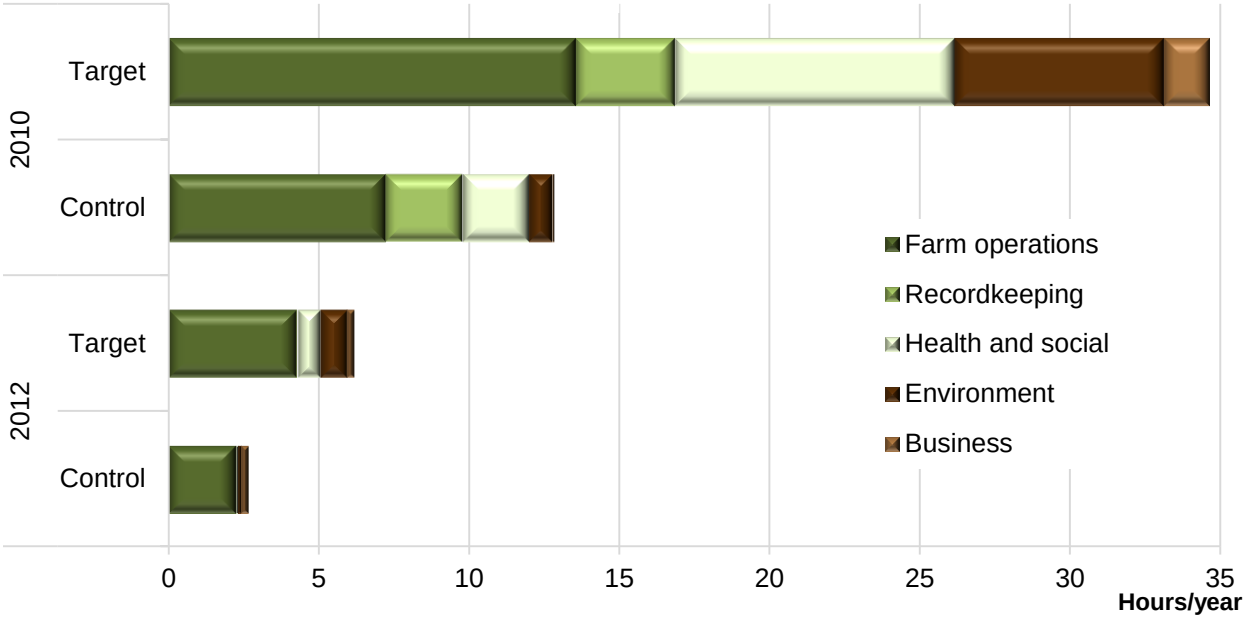
Figure 5.1 presents the average number of hours that sample producers attended in 2010 and 2012 for a range of training types. In 2010, the target group undertook a substantial amount of training in meeting standards for subsequent certification from UTZ. In 2012, the training attendance declined for these already certified farmers and also declined for control farmers.

**Box 3: Training as a Channel for Change**

Training is a key element of the UTZ Certified theory of change toward greater sustainability. It is a primary channel that transforms standards into actions. Establishing attribution between an intervention and a result is stronger when such a channel for achieving change is apparent and can be well-measured.

An interesting aspect to this is that during field work, surveyors talked with older farmers who could no longer keep up the physical labor required for cocoa productions and so they hired others to do much of the work. In many cases, these farmers still attended the trainings offered rather than the hired workers, meaning that those receiving the training were not necessarily in the best position to put what they learned into practice.

**Figure 5.1: Average Hours Training in Last Production Year**




Note: For both 2010 and 2012, the difference between target and control groups for total training hours attended is significant to more than the 99% level of confidence with varying levels for specific training categories. For 2010, difference between target and controls for individual training topics were significant with more than 99% confidence for operations, health and social, environmental, and business. For 2012, differences for individual topics were significant with more than 95% confidence for farm operations. Differences in environmental training were significant with 90% confidence. There were no hours for marketing support or adult literacy in either year.

## ECONOMIC SUSTAINABILITY

The economic picture emerging from analysis of the two years of data collection is one of modest impacts from UTZ certification. This may provide a foundation for expanded improvements, if UTZ and Solidaridad can build on the successes the sample achieved. Economic results benefitted substantially from factors external to certification that raised incomes significantly for 2012 compared to 2010 for both target and control farmers. Beyond the general increase, evidence suggests that the UTZ-Solidaridad partnership contributed to even greater increases for target farms. The primary driver of increased revenue was significantly higher prices paid for certified cocoa. There were no effects on costs either by external factors or by certification that were significant for the population. However, the *sample* target farmers achieved higher yields while spending less on synthetic fertilizers and biocides than did the *sample* control farmers. The reason these results are not significant for the population of UTZ certified farms is that the sample showed such a high range of variation in yields and spending. If the UTZ program could determine how to train farmers to use inputs to more consistently gain the efficiencies that the sample target farmers did, then not only would incomes increase more for all certified farmers, but environmental results could be enhanced through equivalent yields with less consumption of synthetic fertilizers and biocides. Further increasing incomes is an important goal since although cocoa incomes improved in 2012, they averaged only USD 653 per ha which translates to just over USD 1300 per year for the target farms in the sample with average cocoa plots of two hectares.

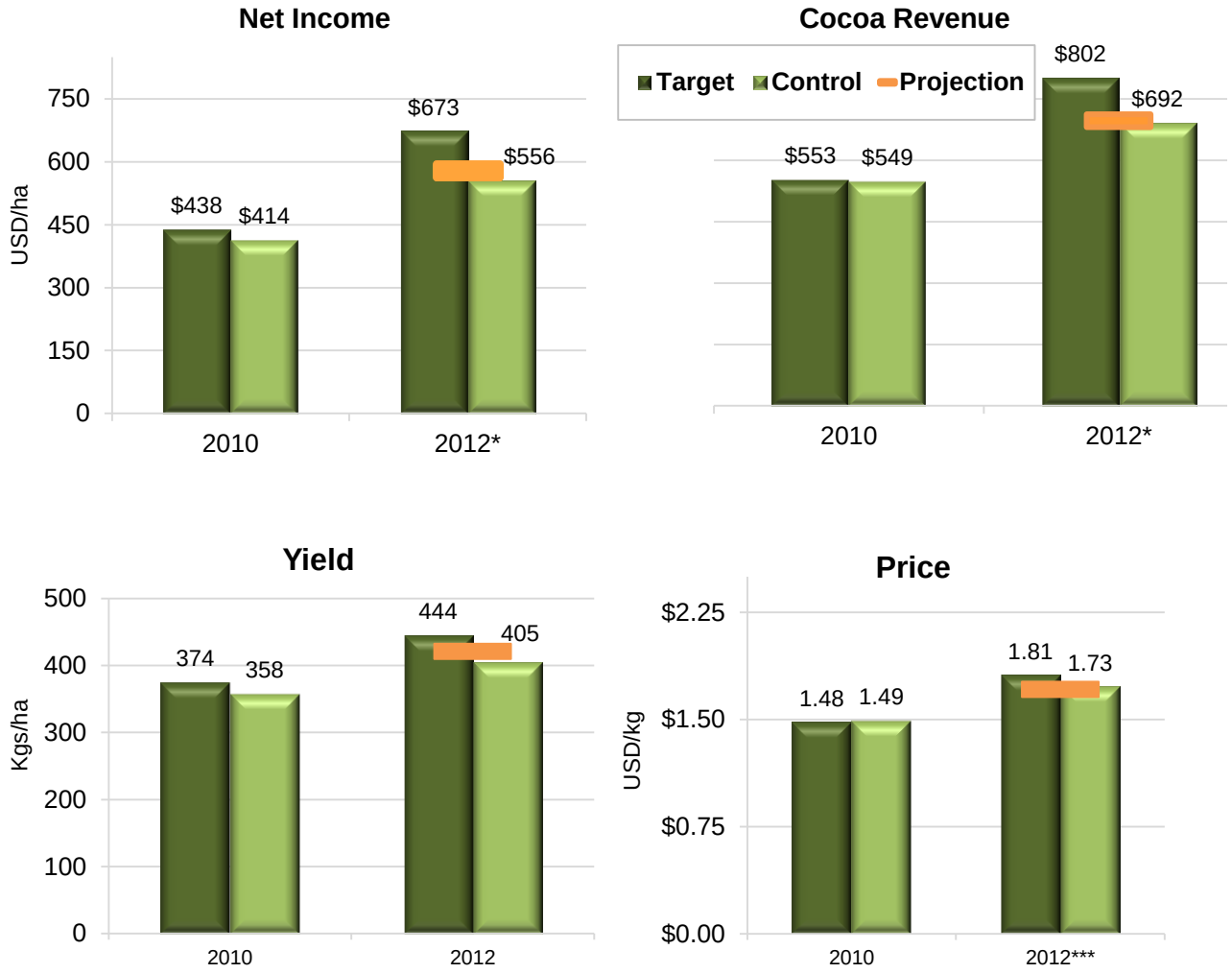
## Yield, Price and Income

*Yield: Total amount of cocoa produced per hectare*
*Price: Amount received per kilogram for cocoa sold*
*Revenue from focus crop: Revenue from all sales of cocoa including any premiums*

Results for cocoa net income, revenue, price and yield shows significant impacts on farmer performance from influences external to the certification program since results for both target and control groups were significantly higher in 2012 than in 2010. Beyond this general increase, however, in 2012 the target group showed significantly higher net income than the control, driven by significantly higher prices and revenue, suggesting a possible positive impact from certification[2].

[2] Yields were also higher for the target *sample* group in 2012; however, among individual farmers the variation (range) in the yields was great enough within the *sample* that we cannot be confident that this result is true for the *population* of UTZ certified farmers (the earliest wave of UTZ certified farmers in Ghana). This variation carried over the assessment of impact of the program. Because target farmers had higher income and revenue before certification, they would be expected to have higher income in 2012, even without certification. Sample farmers had Income and even higher than would be expected from past results as indicated by the height of the target column above the orange projection line. However, the variation in the sample was great enough that we cannot be confident that the program had a similar degree of impact on the whole population of UTZ certified farmers. The situation is different for price where not only was price lower for target farmers pre-certification, but the variation among farmers was very low. As a result, we have high confidence that UTZ certification had similar impact on the population of UTZ certified farmers. All monetary values were collected in GHS, but converted to USD using the average historical exchange rates for the period. This conversion

**Figure 5.2: Net Income (USD/ha), Revenue (USD/ha), Yield (kgs/ha) and Price**




Note: Program impact significant with 90% confidence

Although COCOBOD sets a single price for all cocoa in Ghana, provisions have been made to convey premiums to farmers for certified cocoa. According to Solidaridad, buyers wanting certified cocoa arrange in advance with COCOBOD. Involved licensed buying companies and COCOBOD then segregate and track such purchases to deliver the certified product to the buyer. COCOBOD then disburses the certified premium to AHANSUCOFA which then disburses appropriate amounts to farmers as a 'second payment' beyond the national price they received when they first sold their cocoa. For our sample, no farmers received a certification payment in 2010 because there wasn't yet any certified cocoa. For the 2011-12 production year cocoa, certification payments of USD 0.16/kg were earmarked for farmers. Fifty percent of this payment went to the producer organization managing the certification, and as such is considered a "cost of certification" to the farmer. The other 50% is scheduled to be paid directly to the farmers. Technically, the portion of the price that goes to the producer organization counts first as a revenue of certification, then as a cost that is subtracted from net income. Revenue is presented above with the portion that goes to the producer organization already deducted, as the farmers never actually received it. Since no cost is subtracted either, the effect on net income is the same either way. Still, it is very important to note that if the producer

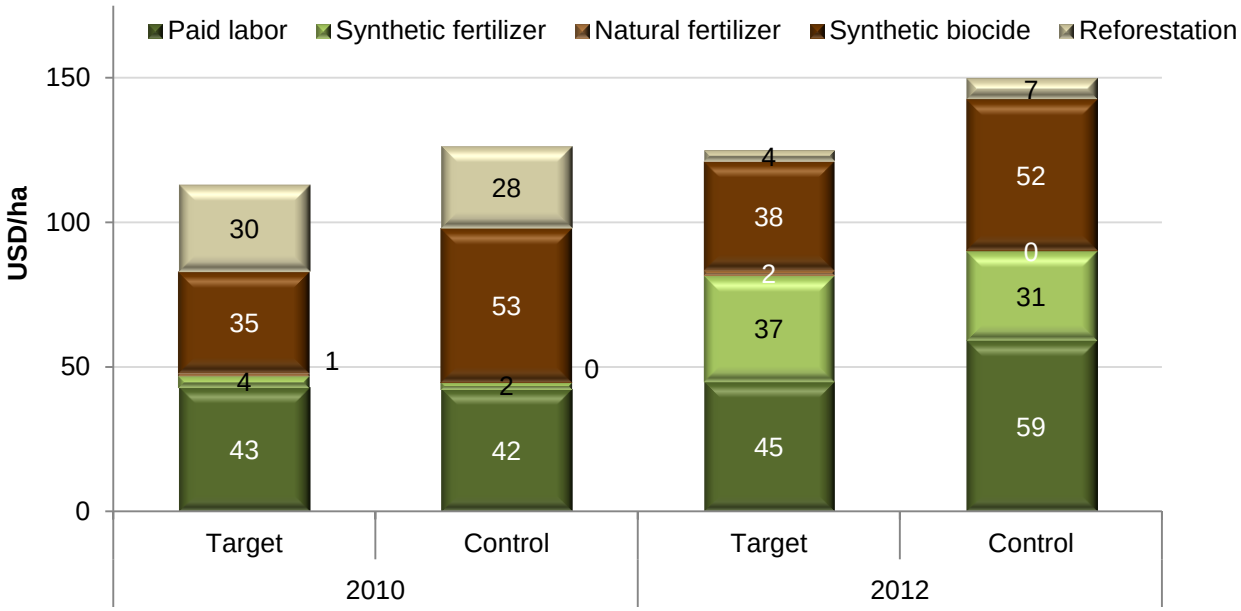
organization retained less of the price premium, revenue would be higher for the farmers and net income therefore even more clearly higher than net income for the control farmers. Although certified farmers selling through buyers other than their producer organization would not receive the certification payment, certified farmers nevertheless chose to sell 11% of their production through other channels in 2012.

### Costs

*Main production costs include costs of labor (paid and unpaid), inputs and record keeping*

Certification had little significant impact on costs for the overall population of UTZ Certified farmers. Unlike cocoa revenue, cocoa production total costs did not vary significantly between 2010 and 2012, nor were there significant differences between target and control farms within years. However, the components of total costs did show interesting differences, particularly fertilizer and reforestation costs. Reforestation costs declined for both target and controls in 2012, but fertilizer costs increased significantly. Increased fertilizer costs should not automatically be interpreted as a negative, since the increase could have contributed to the higher yields

**Figure 5.3: Total Costs per Ha (USD)**




### Labor

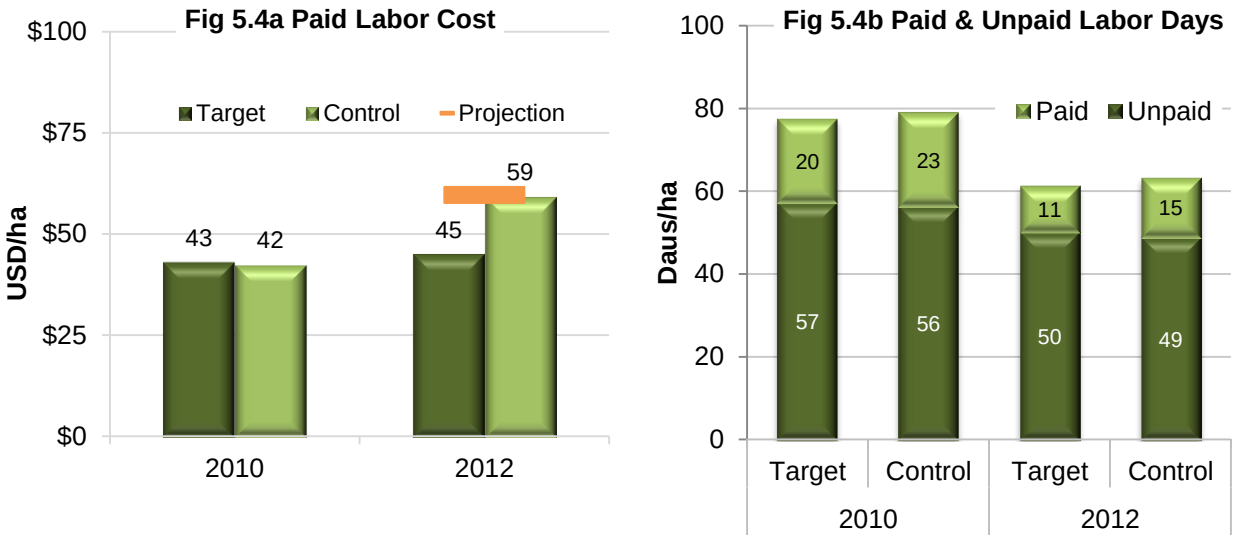
*Cost per ha of workers paid to do jobs on the farm*

*Days spent by paid and unpaid workers to do jobs on the farm*

As cocoa prices paid to farmers increased from 2010 to 2012, so too did the prices farmers paid for labor, with the daily agricultural wage rate increasing by more than 50% in our sample villages for 2012. As could be expected, both target and control farms showed a significant, concurrent reduction in paid labor days used in 2012. This reduction in *days* resulted in paid labor *costs* staying about the same between years for both target and control farms, and there were not significant differences in paid labor costs between target and control groups within years.

To calculate net income, COSA accounts for paid labor because it is an out-of-pocket cash expense; however, it is also important to recognize the impact of sustainability initiatives on farmers' time or unpaid labor. As shown in figure 5.4b, in spite of using significantly fewer *paid* labor days, both target and control farms at least maintained yields without increasing *unpaid* labor days between 2010 and 2012. One viable interpretation is that farmers achieved greater labor efficiency in 2012 (although, because both the target and control groups show this effect, it may not be an effect of certification). This increase in labor efficiency would most likely have been gained from the increased use of fertilizer (discussed below) to increase yields even as labor use went down.

**Figure 5.4: Paid and Unpaid Labor**

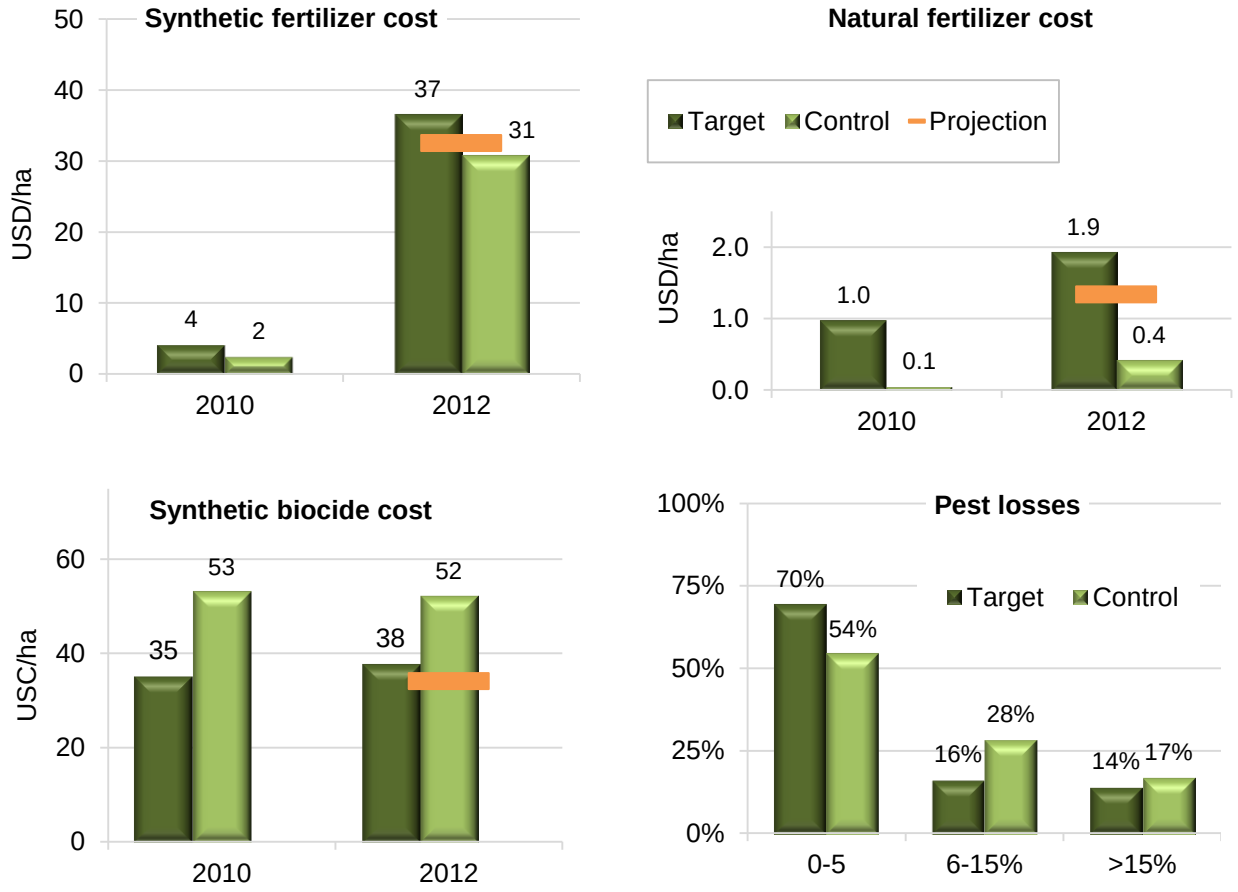



**Fertilizers and Biocides**

Both target and control farmers spent significantly more on fertilizers in 2012 over 2010, once again attesting to factors other than certification having an effect on cocoa production. Further, there are no significant differences between target and control farmers within years, suggesting no effect of certification on fertilizer costs. As for synthetic biocides (comprised of insecticides, herbicides and fungicides), the amount farmers spent did not change significantly between 2010 and 2012 for either the target or the control populations. However, target farmers in the *sample* spent less on biocides than control farmers in 2012 and yet had fewer losses from pests. While these results do not have the statistical significance needed to extrapolate to the population of certified farmers, Solidaridad and UTZ may want to investigate what program elements contribute to some farmers more effectively using agrochemicals. Discoveries in this area can then become a base for achieving stronger results.

Furthermore, the current rates for using integrated pest management (IPM) methods and natural fertilizers were below 10% for target farmers. With very low levels of adoption of environmentally benign approaches such as IPM and natural fertilizers (especially recycling of organic farm wastes) there may be opportunities for improving this and having more closed resource loops wherein producers use more of the inexpensive and locally available materials (compost, green manure, etc.) and knowledge (IPM). The use of natural fertilizer could also prevent degradation in soil fertility which could be a wise investment, contributing positively to future yields.

**Figure 5.5: Fertilizers and Biocides**




## Capacity for Competitiveness

While net income is a snapshot of farmers' immediate economic conditions, competitiveness offers a picture of farmers' capacity to maintain economic outcomes in the future as they encounter changing market, environmental, and social landscapes. The COSA collection of competitiveness indicators includes:

- **Quality**– the ability of farmers to be aware of market place demands for quality, and the practices put in place to meet those demands
- **Credit** – an indication of farmers' ability to obtain the resources they need to take advantage of opportunities or to withstand shocks
- **Knowledge** of market factors - specifically knowing the various prices that are available for their product at different locations in the value chain, and knowing how the price they receive is set

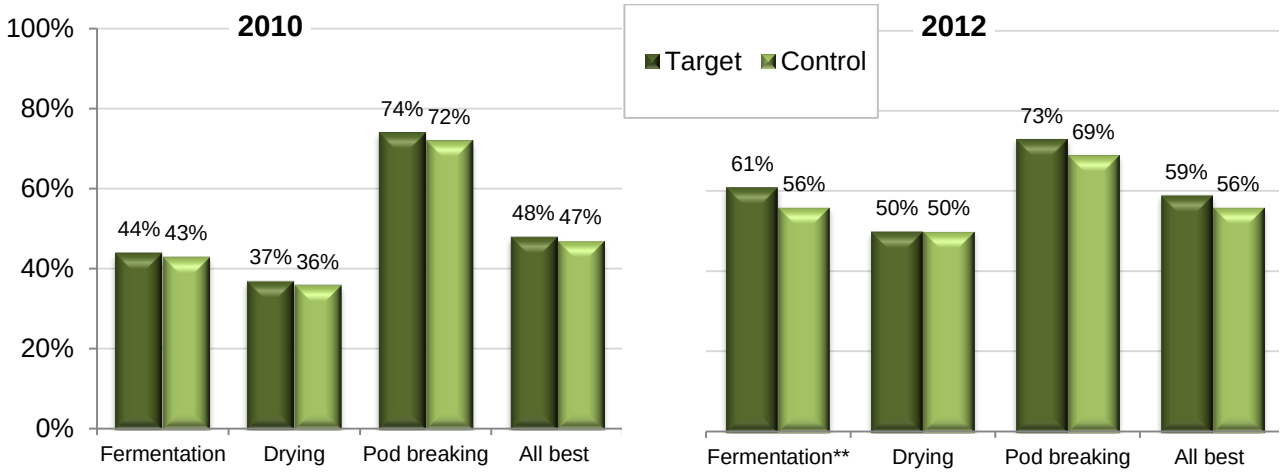
Target farmers had better quality performance; beyond this, they did not show more competitive capacity than control farmers.

## Quality Practices

*Average number of best practices employed in fermentation, drying, and pod breaking*

As Figure 5.6 shows, the average percent of best quality practices that farmers used increased significantly in 2012 for both target and control farms suggesting the influence of factors external to certification. Over and above this general increase, target farms averaged a slightly higher percent using best fermenting practices. Target farmers also averaged a higher percent of pod breaking and overall quality practices, but this was not significant for the population.

**Figure 5.6: Quality Practices: Average Number of Total Quality Practices Farmers Use**



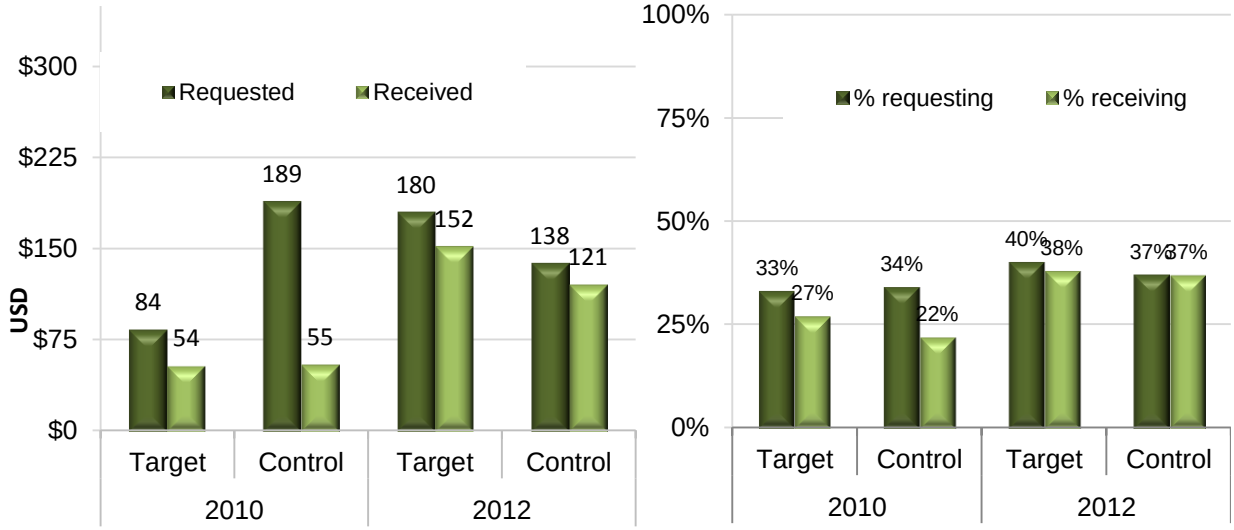

## Credit Access

*Percentage of farmers who requested loans*

*Percentage of farmers who received loans*

*Percentage of loan amounts received of amounts requested*

**Figure 5.7: Credit Requested and Received: Amounts and Percentages of Farmers**




Note: Program impact significant with 95% confidence for credit requested.

The availability of credit in the labor- and input-intensive cocoa production system can be very important. The need for credit by cocoa farms goes beyond a need to purchase farming inputs to in some cases meeting basic household needs. Formal commercial lenders will give loans to farmers using their expected income from cocoa as security, and some buyers give loans during the season in order to secure commitment for a later sale. Government credits are also targeted to farm improvement and are given as subsidized inputs such as fertilizers and biocides.

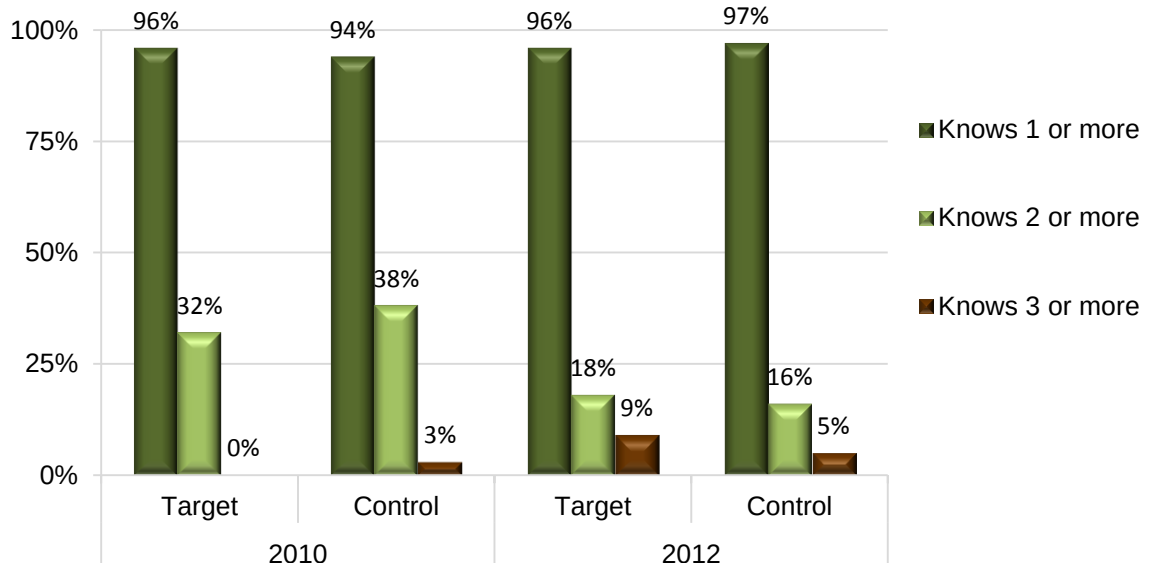
Certification appears to have made an impact in the amount of credit that farmers requested, as control farmers did not request significantly more credit in 2012 compared to 2010, but target farmers did. Interestingly, the percent of both target and control farmers requesting credit did not change significantly between 2010 and 2012, suggesting that the amount requested per farmer drove the increase in average amount requested by the target group, not an increase in the number of farmers requesting credit. The *percent* of farmers *receiving* credit did not change significantly for either target or control farmers between years, indicating that certification did not impact if farmers were approved for credit.

**Price Knowledge (Available Prices)**

*Percentage of farmers with awareness of prices by number of price sources known. Price options were: The price paid by the producer group for both CERTIFIED and NON-CERTIFIED cocoa, prices paid by different buyers throughout the region for the cocoa, price announced by government, price paid by local buying station, The price the farmer's buyer received for the cocoa, Price paid by local exporter, Other .*

From this study we did not see a significant overall impact on price awareness due to certification (Fig. 5.8). The percent of farmers with awareness of at least one price was virtually the same for targets and controls in both 2010 and 2012. In 2012 the percent of farmers with awareness of at least two prices declined, but there was a compensating increase in the percent of farmers knowing three or more prices, especially among those with UTZ certification.

**Figure 5.8: Farmer's Awareness of Different Market Prices (% by Number Known)**

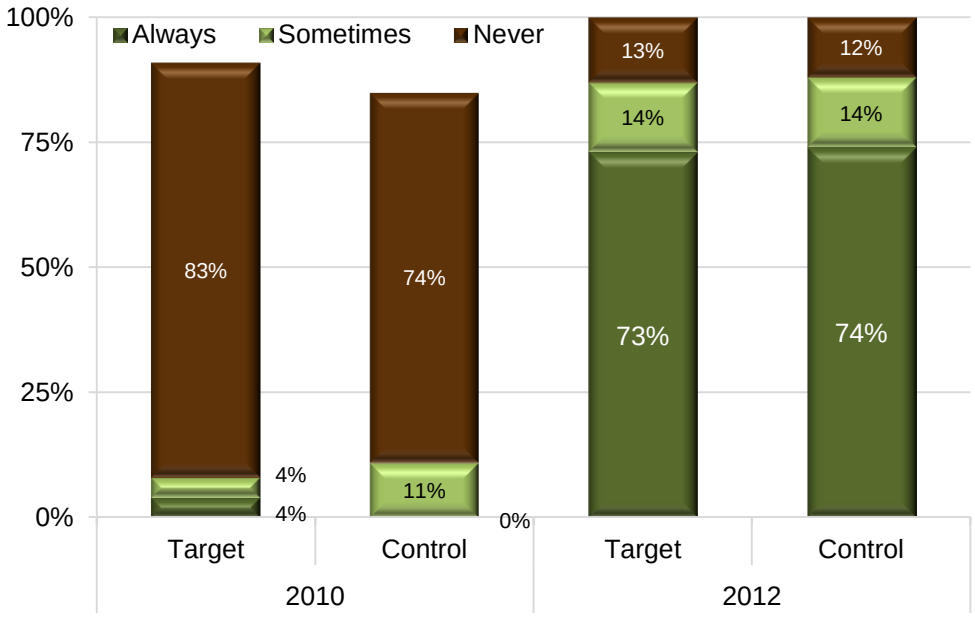


### Price Knowledge

*Percentage of farmers with awareness of how prices are set*

Understanding how prices are set helps farmers make informed decisions regarding marketing and investments. As shown in Figure 5.9, a significantly higher percentage of both target and control farmers had an understanding how prices are set in 2012 than in 2010. In 2010, 83% of target and 74% of control farmers "never" understood how prices were set, while in 2012 only 13% of target and 12% of control farms were still in this category. On the other hand, in 2012 a large majority of both target and control farms "always" knew how prices were set. This increase however was virtually the same for both target and control farmers, suggesting the change was not a result of certification. Given the dominance of the COCOBOD in establishing prices, its effort to stimulate cocoa production (including raising prices to farmers) may have had more of an influence on this result than other factors.

**Figure 5.9: Percentage Farmers Who Understand How Prices Are Set**



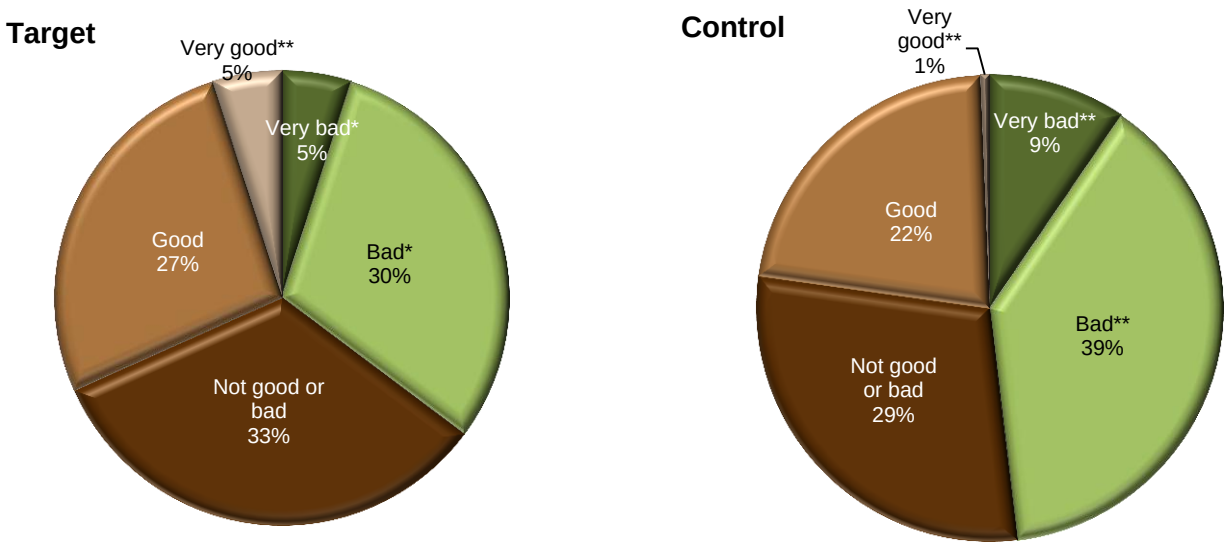

Note: For 2010, the difference between target and control for "sometimes understand" were significant with 90% confidence and for "never" at 95% confidence.

### Economic Satisfaction

*Farmer's perception of farm's economic circumstances in the past production year*

For 2012, target farmers perceived their economic situation more favorably than did control farmers. Significantly fewer target farmers viewed their situation as "bad" or "very bad" and significantly more saw it as "very good." These results coupled with the positive results on net income as well as other economic factors and the fact that participation in certification grew from 352 farms in 2009 to more than 5,000 today suggests that farmers in the region do perceive participants to have favorable conditions.

**Figure 5.10: Economic Perception (2012)**




## COSA with GIS: A Tool for Discovering Impact Pathways

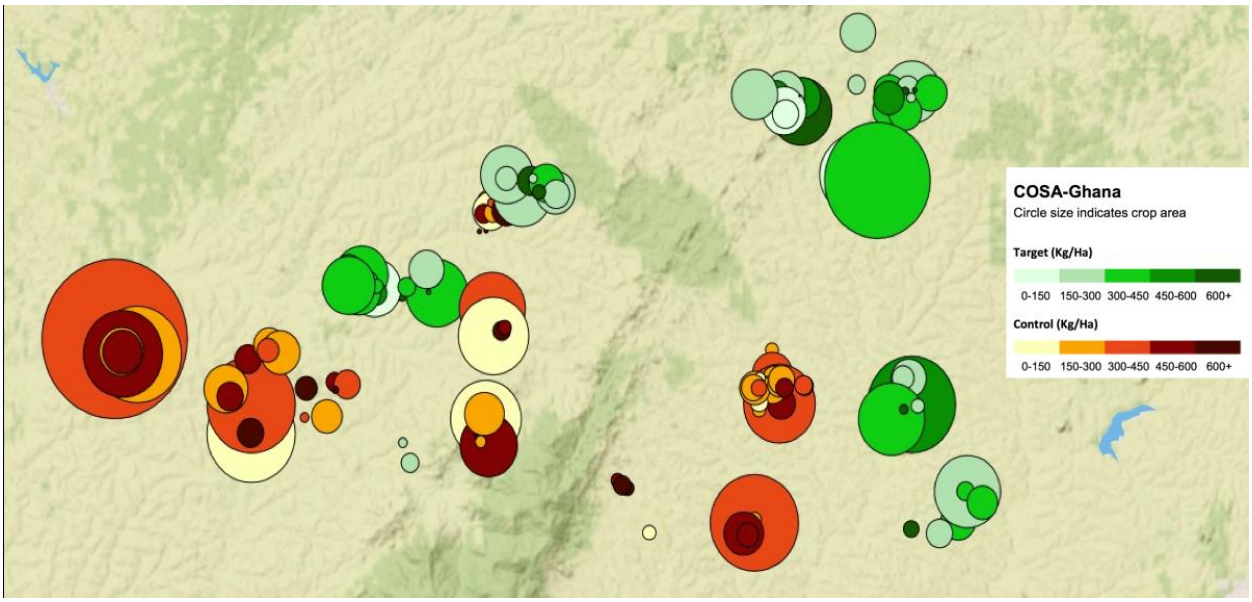
Using the GIS coordinates that COSA collects to visually depict various relationships at the individual farm level can offer deeper insights than numerical averages alone. Locating farms on maps shows patterns that suggest impact pathways for sustainability initiatives to improve their results based on geography. Maps can also be used to depict the interactions between other factors other than geography. The maps below give examples of impact pathways that specific inquiries suggest. These examples show

- Productivity in relation to size of cocoa areas and to spending on inputs
- Gender in relation to size of cocoa areas and to credit

These examples do not have statistical significance; they are intended to stimulate more ideas for using maps. COSA can assist in creating maps based on other data. The static screen shots here give a flavor of what you can see in dynamic views. Access the dynamic views by clicking on the links shown.

## Productivity

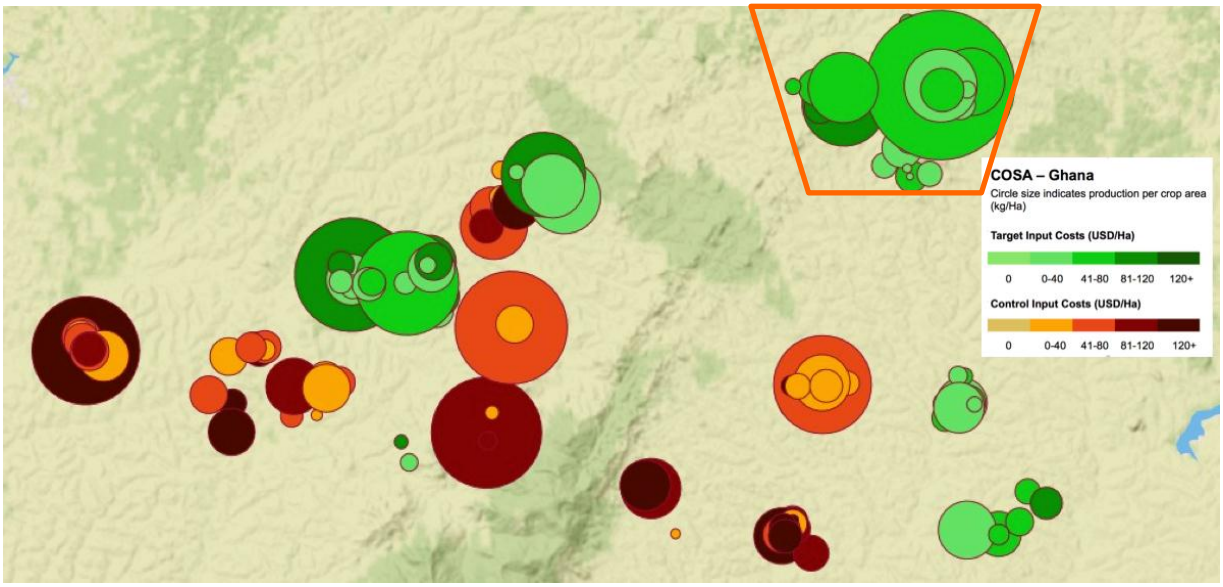
**Figure 5.11a Productivity and Size of Cocoa Area**




https://a.tiles.mapbox.com/v3/arimarose.map-x4nvtwyg/page.html?secure=1#3/0/0

The size of a farm's cocoa growing area, more than location, appears to influence yield. The preponderance of dark circles that are small show that smaller farms produced more kilograms per hectare than larger farms since dark color indicates the highest productivity. On the other hand, each community cluster has a range of sizes of cocoa areas with productivity generally appearing to correspond to the cocoa area size.

**Figure 5.11b Productivity and Inputs**

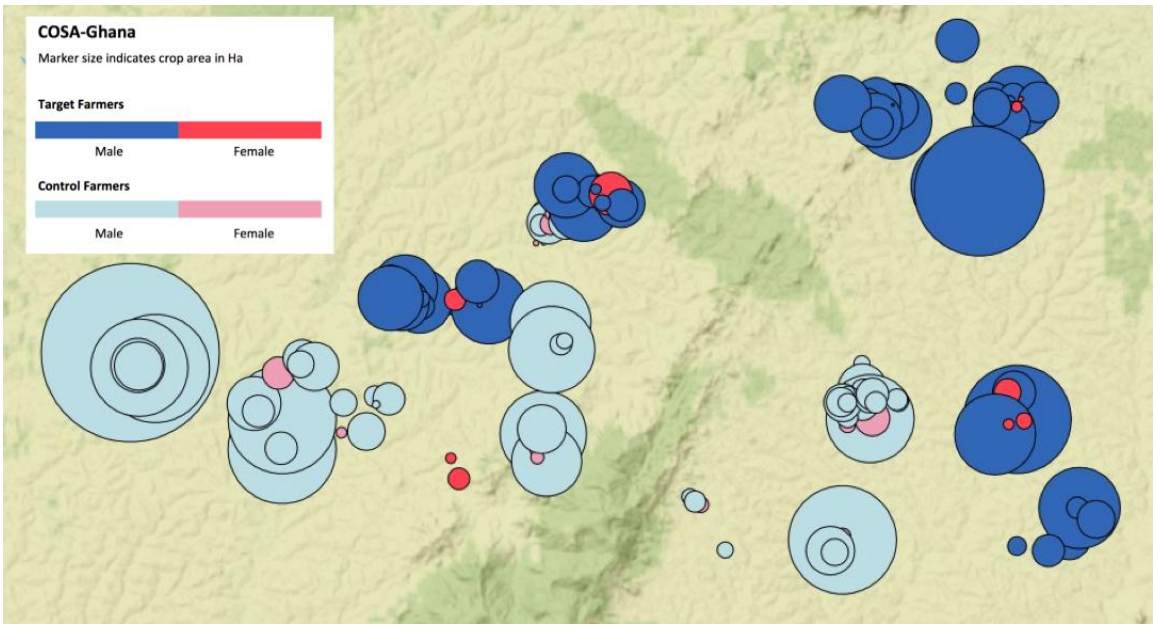



http://a.tiles.mapbox.com/v3/arimarose.map-zmc23rkg/page.html

The relationship between productivity and inputs appears to be not as strong as might be expected. Note that for both target and control, the darker circles (where darker indicates more spent on inputs per hectare) are not always the largest circles (where size indicates kilograms per hectare). For example, the largest farms in the orange trapezoid are not the darkest, so these high producing farms did not spend as much per hectare on inputs as some of the smaller producing farms. This suggests that an intervention might want to focus on the proper use of inputs, rather than strictly in increasing use of inputs, to be sure farmers apply them to get the most predictable, consistent benefits.

## Women in Cocoa

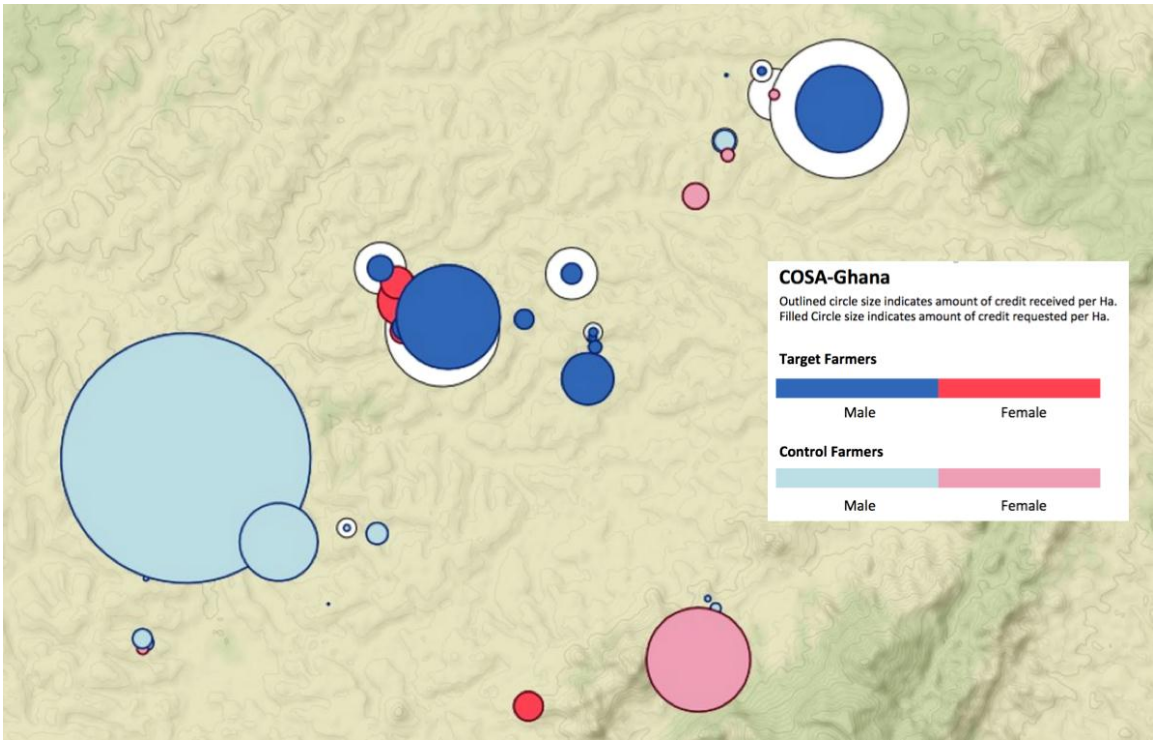
**Figure 5.12a Gender and Size of Cocoa Area**




https://a.tiles.mapbox.com/v3/arimarose.gclfb369/page.html?secure=1#5/38/-97

Women in both the target and control groups have smaller farms than men as indicated by the size of the red/pink circles compared to the light/dark blue circles. Of further interest, the women-led farms tend to be in the center of their communities, indicated by their location in the community clusters. If the UTZ-Solidaridad partnership is interested in bringing more women into certification and in what actions may make certification more valuable to women, they could further investigate some of the conclusions this information suggests. For example, it makes sense that women might engage in cocoa production only when the farm is close to their house in the village so they can farm and manage responsibilities toward children and the home. The additional implications of this for the sustainability of female-led farms could provide useful information about effective intervention pathways.

**Figure 5.12b Gender and Credit**




https://a.tiles.mapbox.com/v3/arimarose.gc87oeg4/page.html?secure=1#3/0/-0.087890625

Women requested less credit per ha than men, but more often received all the credit they requested. This suggests that assisting women with more credit opportunities and advice on how much credit to request could make a positive impact with women.

The circles control for the effect of women's smaller crop areas on credit requested because the size indicates the credit requested per hectare. With one exception, the pink/red circles representing women are much smaller than the light/dark blue circles for men. However, no women's circles have white outlines which show the difference between amounts requested versus received per hectare. Many of the men's circles do have white outlines. This is an additional indication that women could be obtaining more credit that could possibly boost their production.

## SOCIAL SUSTAINABILITY

This study did not reveal many substantial outcomes in the area of social sustainability. We did find that significantly fewer children were working on certified farms, and certified farmers had lower injury rates – both bright spots in the social landscape. Otherwise, certified farmers' performance on social indicators generally declined from 2010 to 2012. Some of this could be explained by the significantly reduced training that farmers attended in 2012 compared to 2010. While certification program implementers noted that more training was *offered* in 2012 than in 2010, our study focused on training actually *attended* by the earliest certified farmers. While it is

possible that farmers misreported their training, these results are a call to further investigate the potential attrition in participation that may take place the longer that farmers are certified.

## Basic Rights

### Food Security

*Number of days that household members did not have enough to eat and percent of households in each category of hunger frequency*

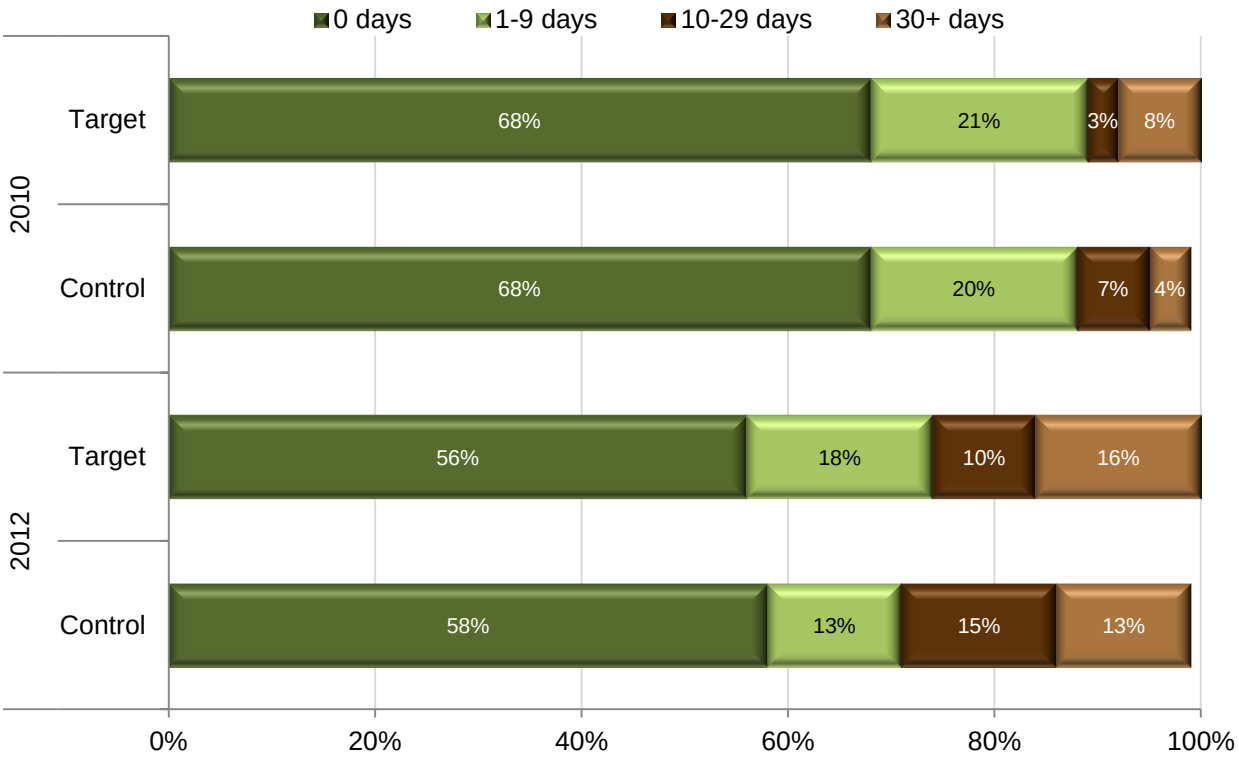
Food security is one of the most important indicators for understanding overall socio-economic conditions of producers. Under-nutrition can have deep impacts on both short- and long-term wellbeing, especially for children. Food insecurity in a household frequently results in childhood malnutrition, which can lead to stunting, causing life-long effects. Stunting that reduces a child's height by only 1 percent, translates to a 1.4 percent reduction in future productivity (Behrman and Rosenzweig, 2001). The World Bank demonstrated that simply increasing agricultural production and household income does not always reduce under-nutrition, and both IFPRI and FAO concur (World Bank, 2007; IFPRI, 2011; FAO, 2012). While Ghana has one of the lowest percentages of stunting in West Africa, 28% of children in Ghana are stunted (UNICEF 2011).

As seen in Figure 5.13, farmers reported periods of food insecurity in both 2010 and 2012 with significantly higher percentages of both target and control farms experiencing lack of food in 2012[3]. Thirty two percent of target households reported some days in 2010 with not enough food; this increased to 44% in 2012 with control farms virtually the same. Further, 16% of target farmers in 2012 reported extreme food insecurity (over thirty days without sufficient food) compared to 13% of control producers. While these differences were not statistically significant, it is still an indication that food insecurity is a serious challenge faced by producers in the region.

The decrease in food security in 2012 may seem to conflict with the higher incomes reported in the economic section of this report. However, stakeholders from the area suggested that this was possible due to rains in 2012 that affected local food crops more than cocoa crops. Also, while inflation was not excessive during this time, there were some reports that prices went up significantly for foods the poor consume. According to Solidaridad, they initiated a program in 2012 with two other partners – WCF and BMGF – to address food insecurity. The program is still underway and is targeting the first wave of certified farmers from which our sample comes.

[3] This is true except for food insecurity for 1 to 9 days which was not significantly different between years for target or controls.

**Figure 5.13: Food Security (% of Farms by Days without Enough Food)**



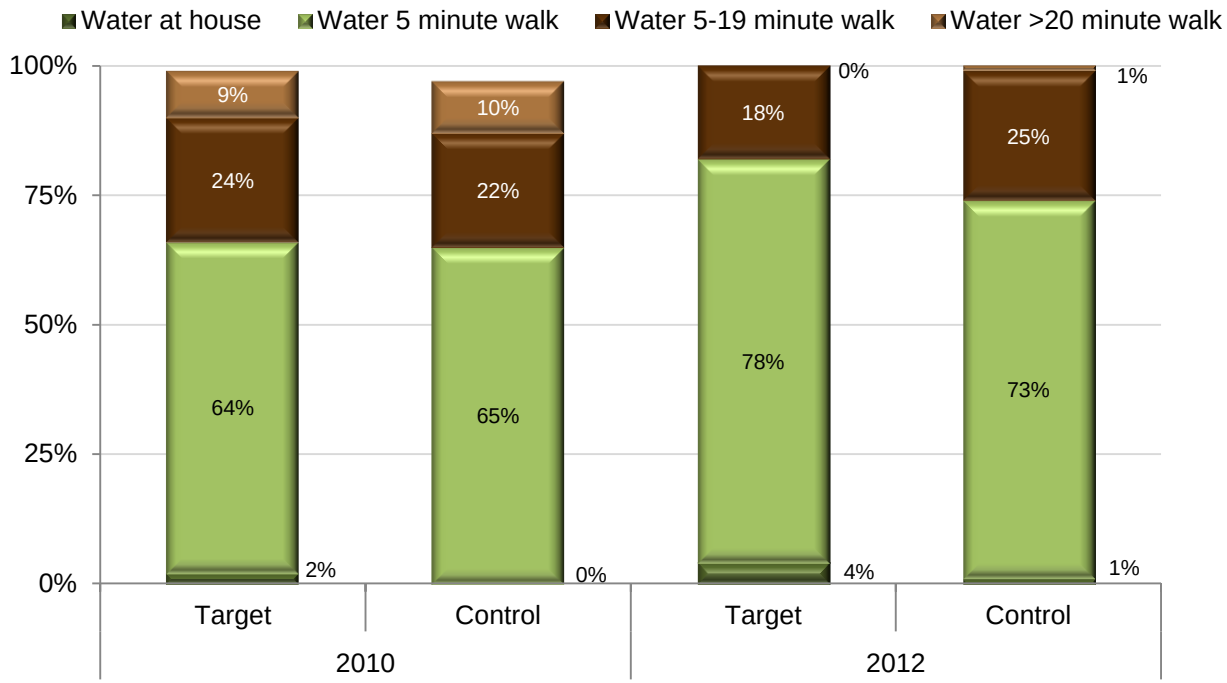

**Farm Households with Safe Drinking Water**

*Percentage of farmers with access to potable water:*
** in the house*
** less than 5 minutes walking distance from house*
** between 5 - 20 minutes walking distance from house*
** more than 20 minutes walking distance from house*

UNICEF and WHO report that millions of African women and children travel long distances daily to fetch water. On average, a member of the household (commonly a woman or a child) takes almost half an hour to walk to the water source, fetch water and return. Ghana's average is a bit better than the African average, ranging from 10 to 19 minutes.

Access to safe water is one of the bright spots for 2012 for the entire sample. The percentage of farms more than 20 minutes from safe water fell significantly in 2012 for both target and control groups. However, the differences between target and controls within the same year are slight. Therefore, the changes reflect an influence external to certification.

**Figure 5.14: Minutes Walking from Household to Drinking Water**




Note: Differences between years were significant for the *target* for "5 minutes" and "more than 20 minutes." They were significant for the *control* for "at house" and "more than 20 minutes."

### Child Education

*Children in household are at the school grade appropriate for their age*

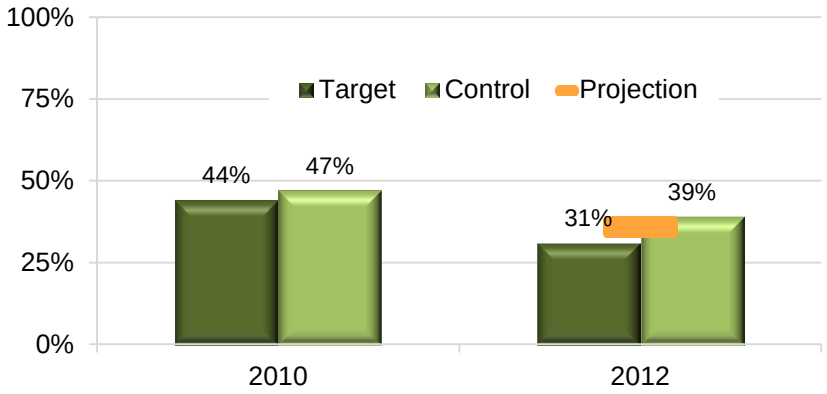
Measuring education is an important part of measuring sustainability. Basic education is essential for developing the ability to adjust to changing environments, as well as gaining self-determination over one's future. Unfortunately, attending school regularly can be difficult for poor children. Global concern has arisen over children in cocoa-producing areas missing school because they work in the fields. However, lack of funds for school fees, books, decent clothing and adequate nutrition can also prevent regular attendance, as can the lack of schools within walking distance.

Although the percent of children in the sample at grade level declined in 2012 over 2010, these differences were not significant enough to extrapolate to the population level. Further, the differences between target and control farms were not significant at the population level within years. The salient conclusion from the results, therefore, is the low percentage of children at grade level for either group, rather than any differences between groups. Participants in the Stakeholder Workshop found these statistics puzzling, since the government and other agencies had been vigorously promoting the importance of child education.

It may be worth noting that once anything stalls a child's education (or many children's education in one area - such as a teacher's strike or large fee increase), from that point on a child's (or an area's children's) education will always be reported as "behind appropriate grade level." Though it is correct that the child is behind, the indicator does not differentiate between children who make sustained progress after one problem year and children who continue to fall behind. In this study, however, stakeholders were unaware of any such widespread

occurrences. These results indicate that school attendance is a very intractable problem that will require continuing action to change. UTZ and partners Solidaridad should stay alert to any factors that might be preventing children from attending school.

**Figure 5.15: Child Education (Percent of Children at Grade Level)**




### Child Labor

*Percentage of school age children working on cocoa*

The data gathered on child labor suggest the cause of delayed education is *not* that children are working on the farm. Figure 5.16 shows the percent children doing *any* work on cocoa. Even as the percentage of children at grade level declined for the target group in 2012 (as shown in figure above), the children working *also declined* while the percent from control households increased. This result is significant and indicates that UTZ certification may have had a positive impact on reducing child labor, though this did not translate into improved school attendance.

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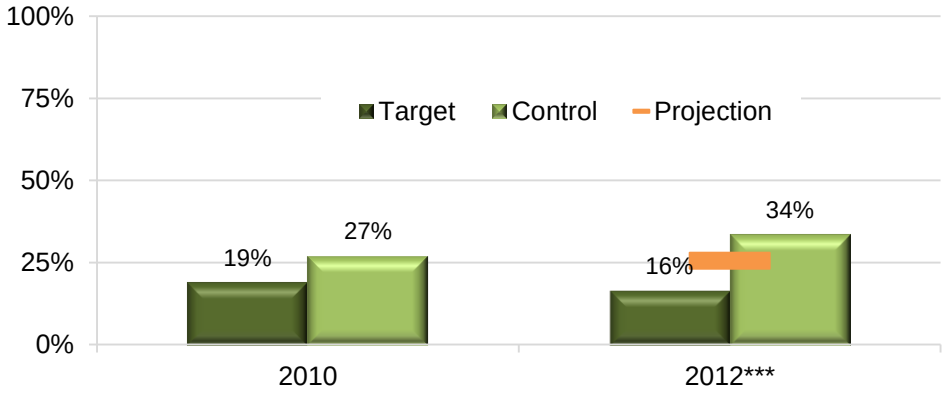
**Figure 5.16: Percentage of Children Working in Cocoa**




### Safe Work Environment

*Number of vulnerable groups restricted from biocide use*

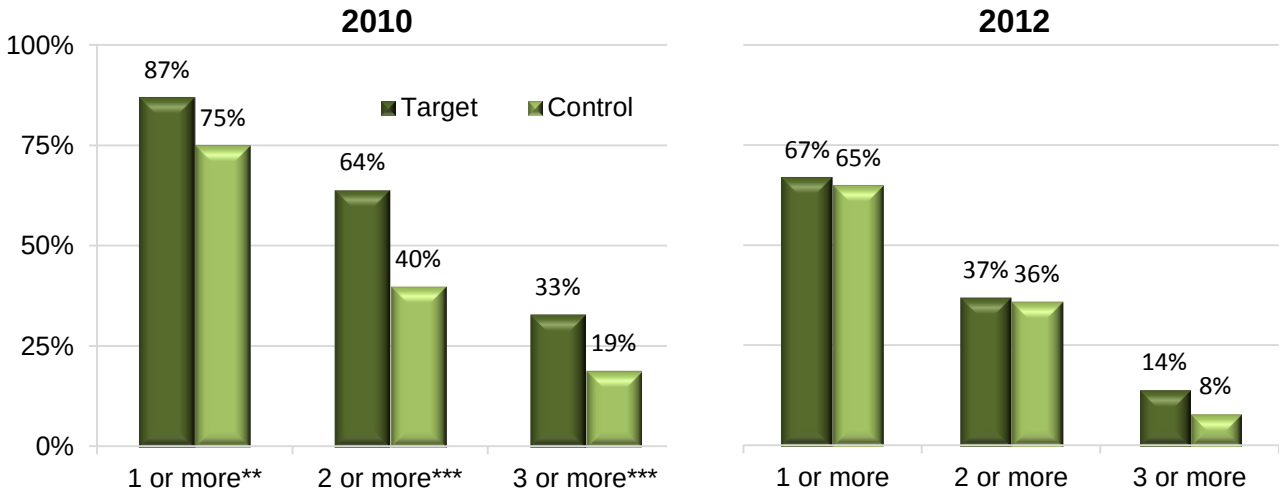
Restricting groups vulnerable to negative consequences from applying biocides (children, pregnant women and people untrained in applying biocides) indicates a safe work environment. COSA measures the percent of farmers restricting at least one, two and three groups. The results suggest influences at work external to certification, since 2012 results declined significantly from high rates in 2010 for both target and control groups for all indicators. While the 2010 results suggest that UTZ certification may have had an influence that increased the percent

of farmers restricting members of vulnerable groups from applying biocides, by 2012, target farms showed no differences from controls.

**Box 4: Question Design for Moral Hazards**

It is important to note that to reduce the "moral hazard" of farmers reporting what they believe to be the correct answer, surveyors do not read from a list of restricted groups. Rather, farmers must mention them on their own accord, though surveyors will give guidance to farmers not understanding the question. A farmer who can name restrictions will be more likely to practice the restriction than a farmer who is not aware of it.

**Figure 5.17: Percent of Farms Restricting Vulnerable Groups by Number Restricted**

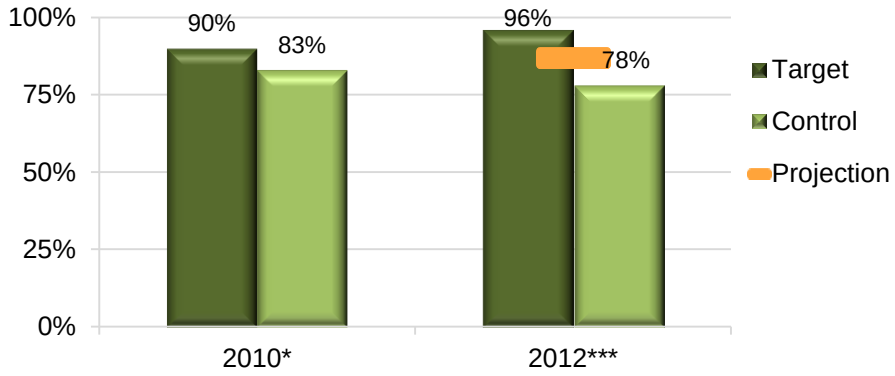



## Injuries

*Number of farm injuries in last production year requiring medical treatment*

Along with restricting agrochemical use for vulnerable groups, we look at injuries as another indicator of safe work environments. Overall we found that more certified producers maintained a safe work environment with significantly more farms having no injuries in 2012. This difference widened in 2012, implying that UTZ certification encourages safer working conditions. Figure 5.18 depicts this finding, where we find 96 percent of target producers without injuries, outperforming the projection of 87%. This is a significant result.

**Figure 5.18: Percentage of Farms with No Injuries**




**Community Strength**

Communities offer their participants a wide variety of benefits. Of particular interest for measuring sustainability is how the strength of a community can help producers with risk mitigation by facilitating collective action, and increasing the exchange of social and knowledge capital. COSA uses two measures to evaluate initiatives' contribution to building stronger community. The first uses participation in producer organizations (including governance and voting) as a proxy for community involvement, and the second measures farmers' participation community projects

*Level of participation in producer organizations*

When the UTZ certification project began, no producer organizations existed in the Ahafo Ano districts to manage the group certification process. Therefore, Solidaridad began the certification project by forming farmers into ten cooperative groups with 352 members. Figure 5.20 shows that nearly every target farmer surveyed engaged with a group in at least one way, while no control farmers did. We've also learned (from other information sources) that there are now 85 associations with more than 5,000 members, evidence that farmers find group membership valuable. At the same time, there are signs of a small decline in involvement by the earliest-certified farmers which comprise our sample. Given the strong initial participation, perhaps it was inevitable that such a high level of enthusiasm would not be sustained. Still, UTZ and Solidaridad may want to be aware of this phenomenon and find ways to encourage producer interest and maintain benefits over time. Interestingly, the slight decline in participation by target farms has been matched in a slight increase in participation by control groups. The percent of farmers participating in democratic process in their group (as indicated by voting) has shown the same general pattern as participation overall.

**Figure 5.19: Participation in Producer Organizations (% Farmers Active in Number of Ways)**

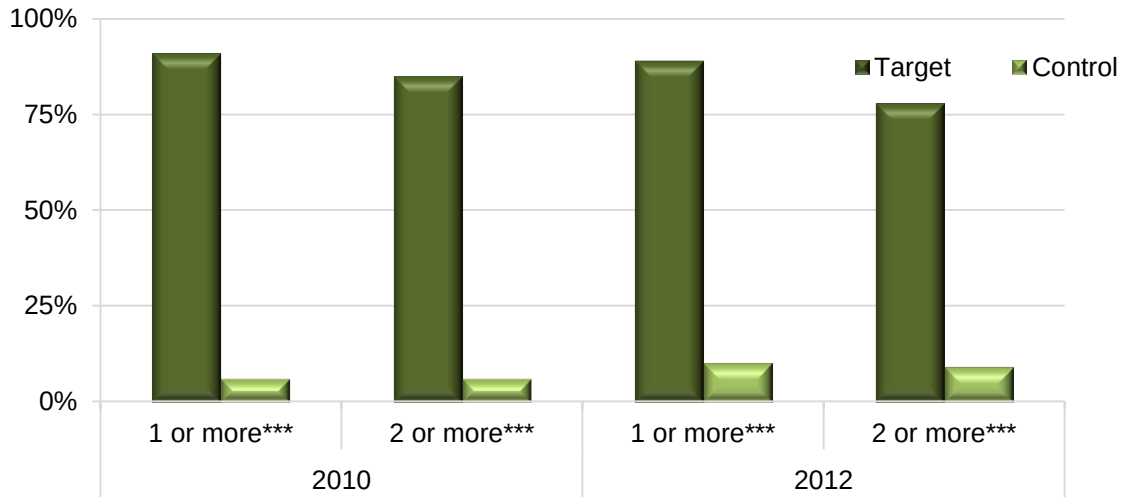
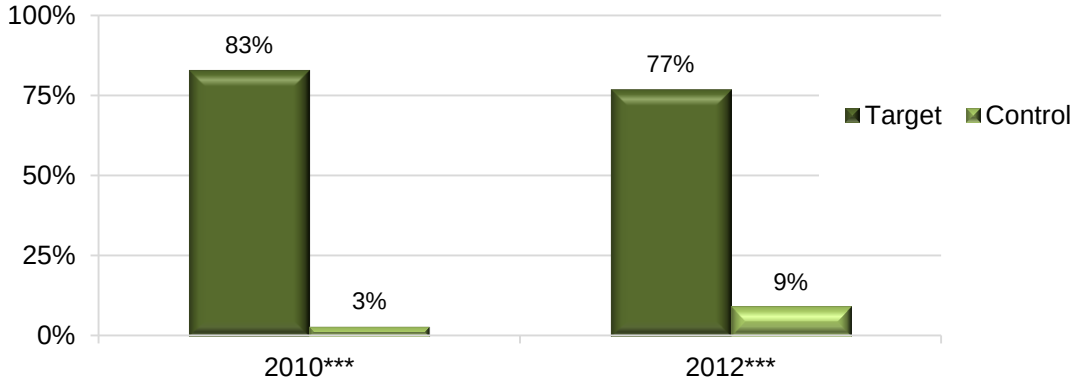


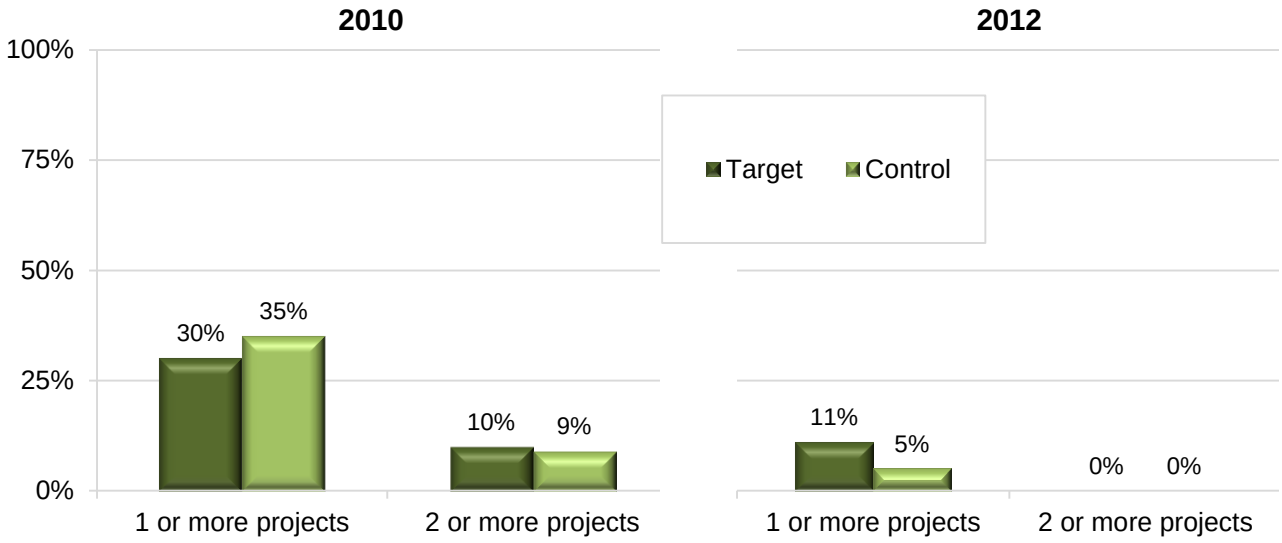

**Figure 5.20: Participation in Producer Organizations (% Farmers Voting in their Groups)**




*Level of participation in community infrastructure projects*

Participation in community projects fell sharply and significantly for both target and control farmers in 2012. The strong participation in 2010 may show the same external factors at work as many of the other indicators, and opportunities for participation may have dwindled since then. Interestingly, while the none of the differences are significant between target and control groups within years, the DID analysis shows very nearly significant confidence that there was a program impact at the population level on this indicator – inviting UTZ and Solidaridad to capitalize on this result. Producer organizations (with quickly growing memberships) may be well situated to initiate infrastructure projects in their communities. Undertakings such as building a processing or storage facility benefit the individual farmers as well as other members, enhancing the value of their membership in the process while strengthening community bonds.

**Figure 5.21: Percent Farms Participating in Community Projects**




## ENVIRONMENTAL SUSTAINABILITY

The overall story for environmental performance parallels the social one: promising results in 2010 give way to disappointing results in 2012. Low rates of training attendance among sample farmers could be a factor in this decline, in both environmental and social performance. There are some exceptions to this overall decline: more target farmers use natural fertilizers than control farmers, and fewer target farmers expanded their cocoa areas by clearing natural areas. As it happens, these exceptions may provide promising guidelines for how to improve farmers' environmental performance, as we discuss later in this section.

## Resource Sustainability and Management

### Soil and Water Conservation

*Percentage of producers using practices to increase water percolation (water efficiency) and to keep soil from eroding by number of practices used.*

*Practices include use of soil cover, live fences, drainage ditches, and prohibiting grazing*

The percent of farmers employing soil conservation and water-use improvement practices in 2010, while low, was still encouraging. At that time, farmers had completed some training, but were not yet certified. However, Figure 5.22 shows that rather than the use of these practices increasing, their use dropped markedly. This decline is surprising, especially when some semi-permanent practices such as live fences disappeared altogether. That the decline is significant between years for both target and control farms suggests that influences other than certification caused performance to drop. It is possible that the same influences that led to the significant increase cocoa production between 2010 and 2012 were incompatible with these conservation practices. As figure 5.4 shows, reforestation costs were much higher for 2010 than 2012. These costs reflect that 78% of the control and 63% of the target sample replanted cocoa trees. However, if soil conservation measures are sacrificed to increase yields in the shorter-term, long-term production can be compromised due to soil degradation.

On the bright side, the performance of the target farmers did not decline as much as that of the control farmers, suggesting the program helped to limit the decline. When spending time in cocoa production communities, UTZ and Solidaridad should be aware that soil and water conservation continues to be a serious challenge that its producers face. It will be important to find out what makes farmers respond to lessons on soil conservation and what they say works in their setting. UTZ and Solidaridad could then evaluate what they learn for inclusion in working with farmers toward more sustainable production. (Read more about moral hazards in Box 4 above. The issues discussed there could be relevant here also.)

**Figure 5.22: Soil Conservation and Water Use Improvement Measures Used**

**Fig 5.22a: % farms by number of practices**

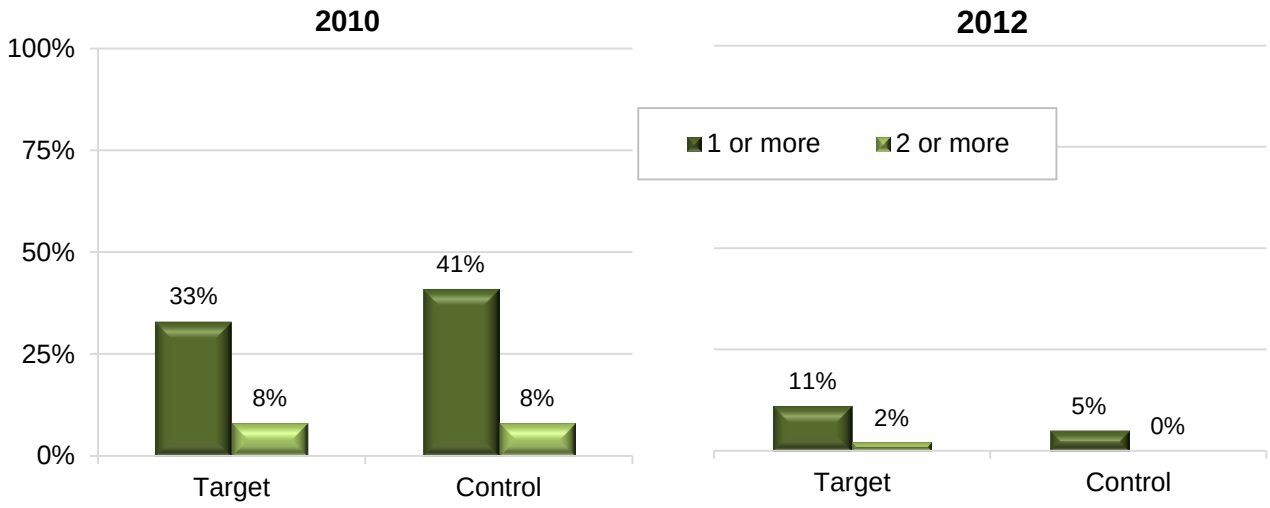
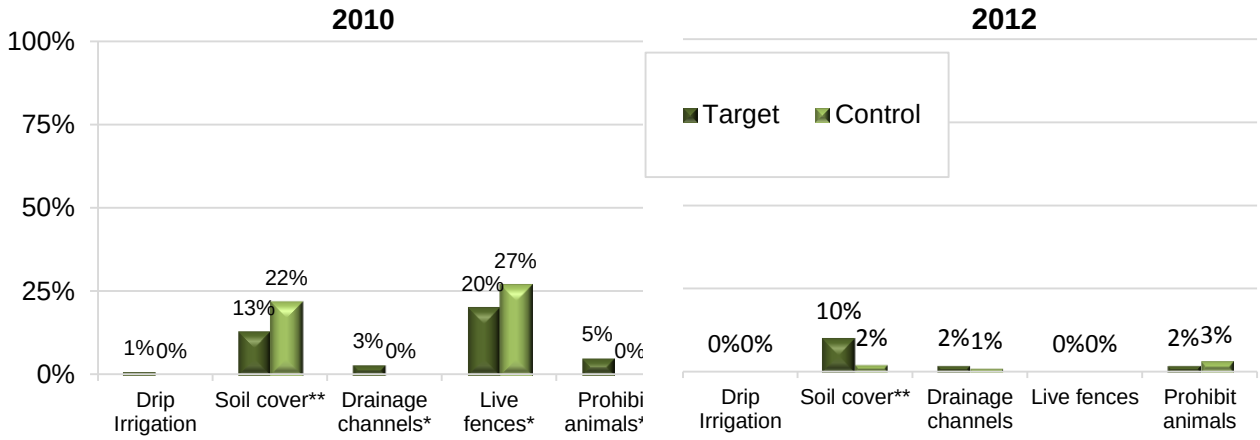



**Fig 5.22b: % farmers using specific practices**




**Synthetic and Natural Fertilizer Use**

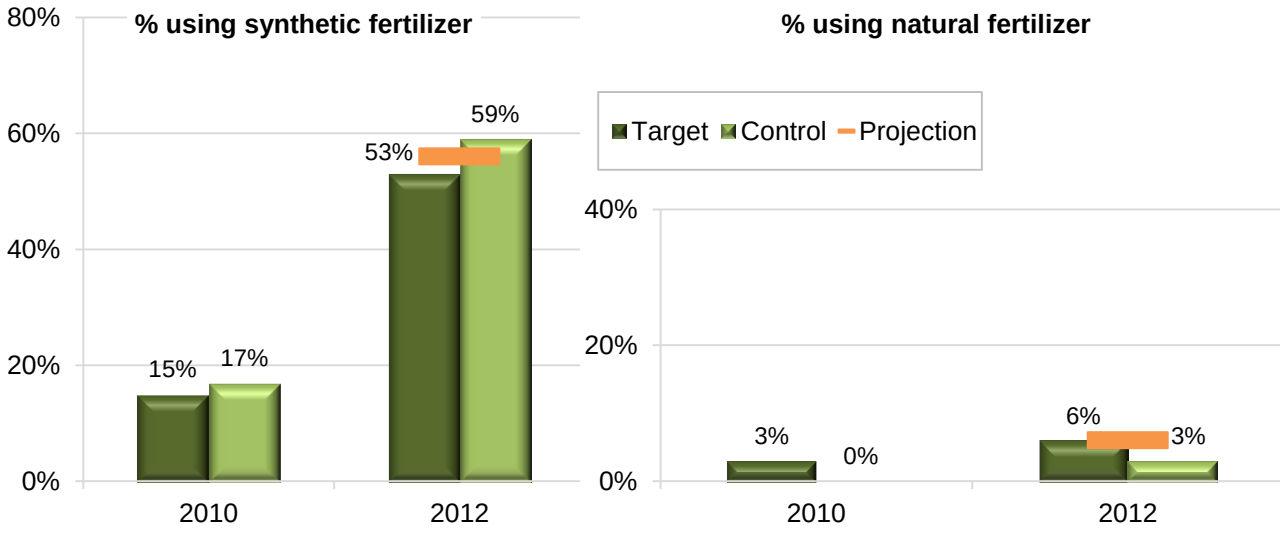
Contrary to most indicators in this study where performance declined from 2010 to 2012, the portion of both target and control farms using synthetic fertilizer increased significantly. Since the increase affected both target and control groups to a similar degree, it likely resulted from factors independent of certification. In some places the overuse of fertilizers has negative

environmental consequences, but this is rarely the case in Africa where access to synthetic fertilizers is often limited. With fewer than 20 percent of farmers using synthetic fertilizers in 2010, the 2012 increase depicted in Figure 5.23 to more than 50% of farms represents a positive trend. That the sample target farmers on average spent less on fertilizer than the control farmers while obtaining higher yields suggests they achieved greater cost efficiency with their fertilizer, however, the variability among the sample farmers was great enough that we cannot say with confidence that the entire population of UTZ certified farmers obtained the same results. Training where all certified farmers could learn to achieve more consistent results could have very positive effects.

The results on fertilizer use also give a small indication that natural fertilizers could be a complementary part of this effort, as they are in some other locations. The percentage of target farms using natural fertilizers increased a bit and this was not significant. Nonetheless, as part of an effort to improve overall fertilizer use, natural fertilizers are often a good option for farmers, as they can be cheaper and more readily available. The organic matter in the natural fertilizers also can improve soil structure and nutrient and water holding capacity. Using local materials closes nutrient and energy loops, thus increasing efficiency. Further, their creation and delivery have few negative carbon impacts.

UTZ and Solidaridad could inquire of those farmers who have increased their use natural fertilizers to gain valuable insight into the factors that caused them to adopt the practice and what could be emphasized to encourage improved fertilization in the programs they deliver. Combining any such lessons with those learned from farmers retaining soil conservation practices could pay multiple benefits for increasing productivity without increasing monetary costs.

**Figure 5.23: Fertilizer Use (Percent Farmers Using Fertilizer)**




### Recycling Organic Farm Materials

The final missing piece of the soil protection puzzle is the serious decline in recycling crop and farm wastes between 2010 and 2012, with the decline for both target and controls once again suggesting an impact of factors external to certification. As natural substances, crop and other organic farm wastes have the benefits of natural fertilizers. Inquiry into why most farmers abandoned these recycling practices (and why some did not) could illuminate the kinds of

training and education that is needed in these areas. (See Table 5.3 and, again Box 4 above on challenges of interpreting moral hazard questions.)

**Table 5.3: Percent Farms Recycling Organic Farm Waste**

| | 2010 | | 2012 | | |
|---|---|---|---|---|---|
| | **Target** | **Control** | **Target** | **Control** | **Program impact** |
| Crop waste | 59% | 66% | 21% | 18% | 9% |
| Other organic farm waste | 23% | 15%* | 5% | 2% | -4% |

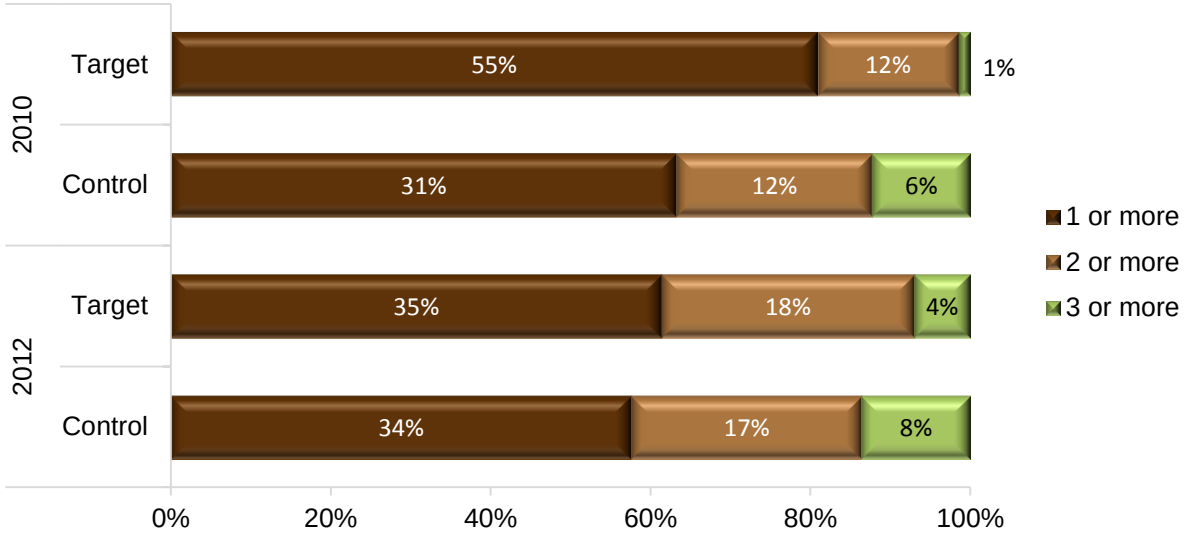
**Water Protection**

*Number of water protections measures used*
*Specific measures are protecting waterways from run-off from*
**domestic uses*
**cocoa-processing*
**cleaning agrochemical equipment*
**animal confinement*

Water protection measures help maintain short- and long-term ecological health, as well as protect the community from contaminated drinking and washing water, so a focus on protecting water benefits multiple dimensions of sustainability.

Performance on this indicator breaks with the pattern of both target and control farms showing significant difference between 2010 and 2012. Instead, the target group showed a significantly higher percentage of farms using water protection measures than control farms in 2010; however, the percent of target farms using measures fell significantly in 2012 to levels similar to the control performance. Even though the farmers practicing “at least one” measure declined in 2012, the farmers using and “3 or more” measures actually showed a significant increased, even among control farmers. While the change is significant, these percentages are very low and leave much room for improvement. However, farmers using multiple measures may offer good insights into what training and messages used by UTZ and Solidaridad could further farmers’ application of environmental protection.

**Figure 5.24: Percent Farmers Using Water Protection Measures by Numbers Of Measures**



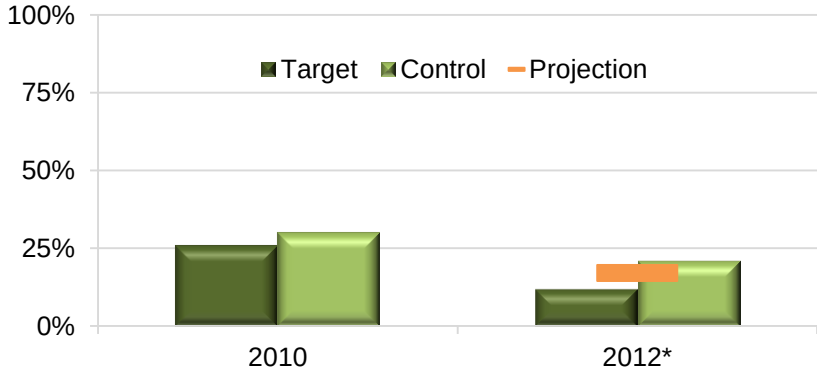

Note: For 2010 differences between target and control for "1 or more uses" was significant with 99% confidence and for "3 or more" with 90% confidence.

### Biodiversity protection – clearing natural areas

*Number of farmers who expanded their farms by clearing natural areas*

Information on farmers expanding their cocoa production by clearing natural areas gives insight into their investment in natural floral and faunal resources.[4] A significantly lower percentage of both target and control farmers cleared natural areas to expand their cocoa in 2012 compared to 2010, implying that factors external to certification influenced this result. However, in 2012 a significantly smaller percentage of target farmers cleared natural areas than control farmers suggesting some impact of certification.

**Figure 5.25: Percent Farmers Clearing Natural Area (of those expanding cocoa)**



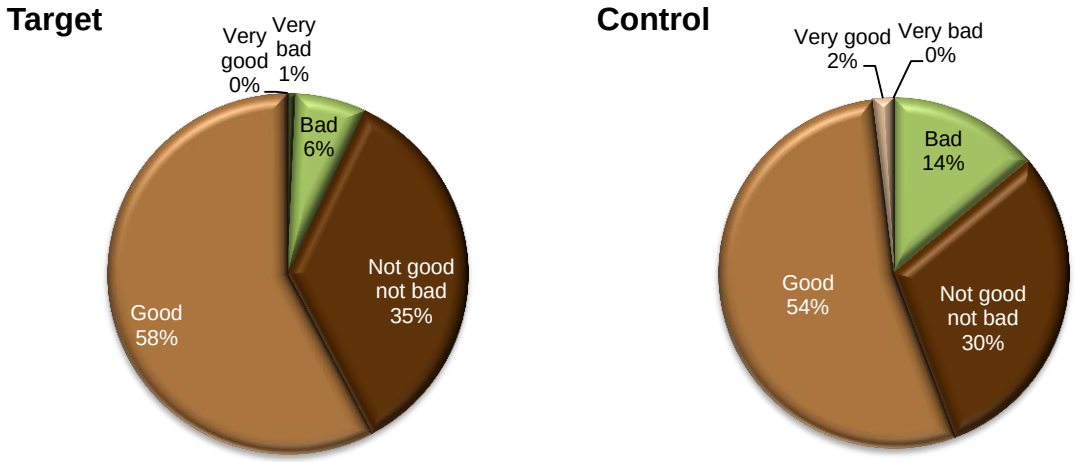

[4] ''This question refers to any area of natural biodiversity not only to protected national forest

**Environmental Care (2012)**

*Farmer's perception of farm's environmental circumstances during past production year*

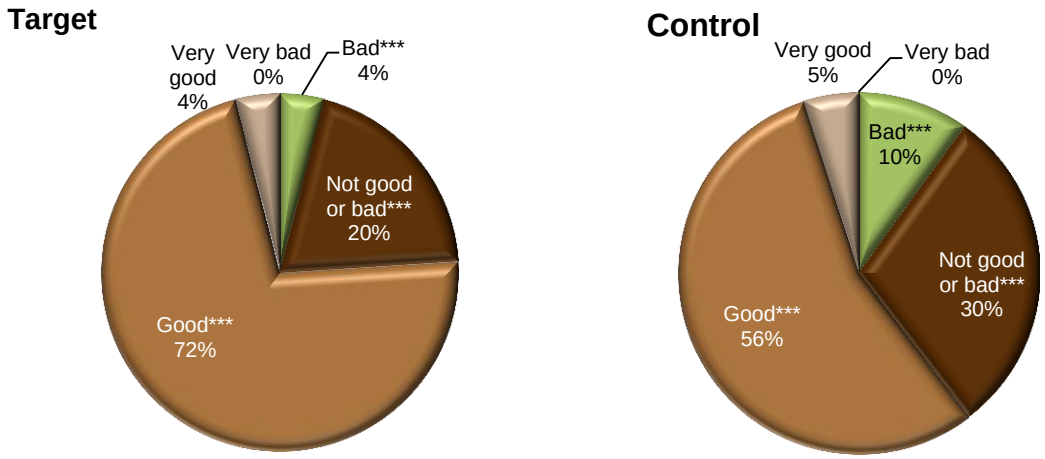
Gauging perception is a way of detecting aspects that may be important but do not come out in the "observable" data. In spite of the few favorable outcomes for environmental indicators, a majority of both target and control farmers say that both their farms' and their communities' care of the environment is "good" or "very good." Target farmers, however, are significantly more likely than control farmers to say their care of their farms' environment is "good," while significantly more control farmers say their care of their farms' environment is "bad." UTZ and Solidaridad should take steps to understand what factors these farmers value in environmental care as it appears they form their judgments on factors different than the environmental indicators COSA has assembled. Hearing farmers' perspectives is an important validation that no key indicators have been missed in establishing the environmental ones. UTZ and Solidaridad could also investigate why certified farmers say their care of the environment is good when performance on more objective environmental indicators do not back up this perception. This position could be the certified equivalent of a little knowledge being a dangerous thing – that is, if farmers believe that being certified means they are caring well for their environment when they are not, they may not be sufficiently open to learning how to actually improve.

**Figure 5.26: Farmer Perception - Community Care of the Environment (2012)**




Note: differences between target and control are significant for "bad" and "very good" with at least 95% confidence.

**Figure 5.27: Farmer Perception - Farm's Care of the Environment (2012)**

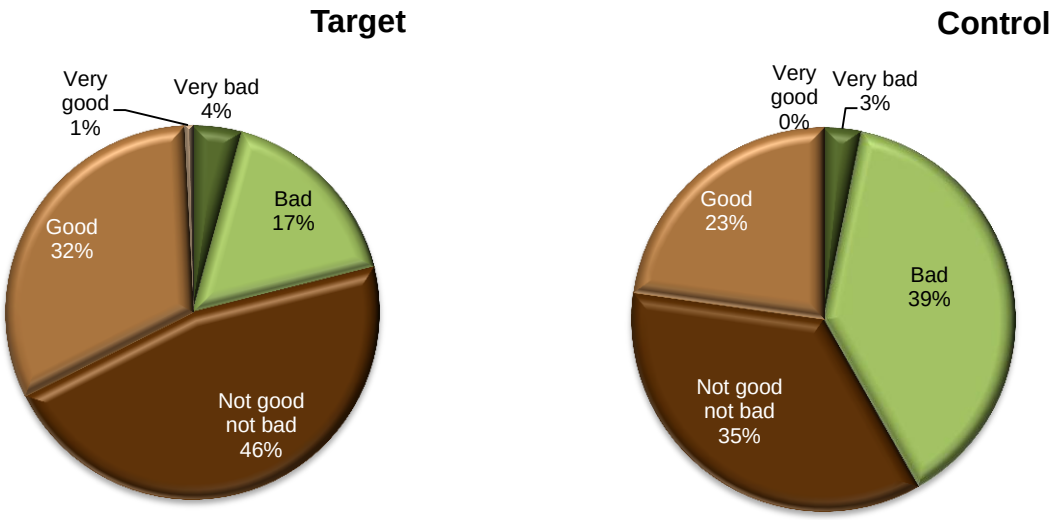



## Quality of Life (2012)

*Farmer's perception of farm's quality of life during past production year*

COSA deliberately allows farmers to apply their own standards to their assessment of their quality of life, so that this indicator can capture their sense of their wellbeing according to how they judge it. For some farmers economic circumstances may have the strongest influence on this measure, while for others family health might, and others may not have any reason more specific than a general sense. Because of this, parsing out exactly how sustainability initiatives influence farmers' perception of quality of life, and thereby determining specific activities to affect such perceptions, may not be possible. Still, tracking this integrated measure can show the relationship between sustainability interventions and farmers' sense of wellbeing over time. The results from the earliest UTZ certified farmers in Ghana seem to echo and corroborate the economic results and perceptions. However, the target farmers were even more likely than controls to say their "quality of life" was good than to say their "economic circumstances" were good. This result occurred even though the target and control farmers performed the same on the majority of indicators – suggesting that the significantly better performance on a smaller number of indicators had more influence on the farmers' perceptions than the greater number of indicators where no difference was detected. (There were very few indicators where targets performed significantly worse than controls).

**Figure 5.28: Perceptions of Quality of Life (2012)**



# 6. Conclusions and Lessons Learned

This report offers some positive feedback on the economic impacts of the UTZ and Solidaridad certification support program in Ghana, particularly the statistically significant difference in income between the controls and certified targets for 2012. For the social and environmental indicators the results are more sobering, showing declines in performance on many indicators between 2010 and 2012. The report provides a number of areas for learning and identifies opportunities that can guide UTZ Certified and Solidaridad in their goal to improve the program and its impacts. Specific guidelines from this report include the following.

**Economic**

- The target farmers in the sample achieved higher incomes than control farmers driven by their higher yields while maintaining similar costs. However, the sample farmers displayed so much variation in yields and costs that we cannot state confidently that the same patterns exist across the population.
- Workshop and qualitative or anecdotal field reports suggest that farmers cannot always afford fertilizers and biocides or labor when most needed, so they may acquire them but too late or at inefficient times. Understanding this shortcoming in production practices, UTZ and Solidaridad can inquire more deeply into what practices farmers have difficulty implementing such that appropriate solutions can be identified (in the case of this project, possibly credit or timely group purchases of fertilizers).

**Social**

- The current sample suggests that hunger levels increased somewhat but the incidence of very low rains affecting food crops and increased food prices may have also influenced food security to the extent that a small increase in income could not avert. It is not clear why data shows that fewer children progressed through school at normal rates after the certification than before. The conventional wisdom is that work in the field interferes with school attendance, however, in our sample the percentage of children working in fields actually declined thus calling into question whether there may be other factors affecting the schooling or whether it may have been an anomaly in the data. The implementing partner is well placed to learn more details of why this may be the case.
- The UTZ-Solidaridad partnership has led to the establishment of a large producer organization with active members. Yet there are signs of slight deterioration in participation from the first members that may signal deeper issues. The program could consider ensuring that the services and activities of these organizations still meet farmer needs. Complementary factors such as assisting with risk mitigation, collective action, and increasing the exchange of social and knowledge capital may further strengthen producer participation. Community projects could also be an effective vehicle toward strengthening community networks and their effectiveness.

**Environmental**

Maintaining environmental balance is important for protecting the productive capacity of farmers' natural capital, but performance on environmental indicators declined between the two rounds of data collection. Since, for each of the environmental indicators, there

are a number of individual farmers who exhibit strong performance, they can be the key toward improving the program's effectiveness. If field workers remain sensitive to which farmers do use sound environmental practices, they can learn from them the messages and methods that could encourage other farmers to adapt them. The certified farmers' perception of environmental care by their farms and communities does not illuminate why there was a decline and instead suggests that, in their opinion, things are predominantly okay. It is possible that there may not be adequate appreciation among some farmers of the relationship between environmental conditions and long-term productivity, or of the inherent benefits of caring for their soils, water resources, and environment.

On methodological issues, some important lessons were learned. The major changes that occurred in the cocoa sector that affected both target and control farmers validated the target-control, difference-in-difference method that attributes impact by comparing the change for a target and a control group over the same time period. The big challenge in the Ghana context was measurement error (especially farm size) – with farmers reporting different information than what we would regard as the true value. This was a demonstrable issue in the measurement of crop area where our independent measurement with the ISSER team showed very different values. COSA corroborated that this problem was endemic and experienced by other experienced researchers and COCOBOD. The best solution proved to be conducting local focus groups with 'model farmers' to enquire about the best way to ask local farmers about area so as to elicit the most correct information. We will consider further integrating such focus groups into COSA processes.

The commission of this study by UTZ Certified and Solidaridad reflects this commitment to understanding the effects of certification, improving farmer livelihoods, and playing a role in our planet's overall sustainability. COSA also had the opportunity in this project to learn more about the many inherent challenges as well as the many opportunities that lie within the undertaking of measuring sustainability in a scientific and comparable way. For all this, we at COSA would like to thank you.

** ** **

**Thank you for the opportunity to learn together with you.**

*The COSA team*

# 7. Annexes

## Annex 1. Propensity Score Matching

Table A.1 presents the first stage of our PSM, whereby household and farm-level characteristics are regressed against certification status using a Probit model. The variables capture farm and organizational characteristics that affect program participation. For example, farm location was an important control variable to include because control groups were generally more remote than target groups.

**Table A.1 Propensity Score Matching Output**

| Probit regression | | N | 280 |
|---|---|---|---|
| | | LR chi2(19) | 58.87 |
| | | Prob > chi2 | 0 |
| Log likelihood = -164.58335 | | Pseudo R2 | 0.1517 |

| | Coefficient | Std Error | |
|---|---|---|---|
| Share cropper | -0.44 | 0.42 | |
| Crop area (ha) | 0.02 | 0.05 | |
| Farm area (ha) | 0.00 | 0.03 | |
| Owns land | -0.18 | 0.41 | |
| Producer age | 0.00 | 0.01 | |
| Producer gender | -0.34 | 0.20 | |
| Years of schooling | -0.05 | 0.02 | ** |
| Years of experience | -0.03 | 0.01 | *** |
| HH Members | -0.02 | 0.05 | |
| HH Average age | -0.01 | 0.01 | |
| HH Literate members (%) | 0.60 | 0.29 | ** |
| HH Assets (Cedis) | 0.00 | 0.00 | * |
| Village reputation for cocoa (1-5) | -0.30 | 0.09 | *** |
| Distance to market (10-30 mins) | 0.14 | 0.37 | |
| Distance to market (30-60 mins) | 0.58 | 0.31 | *** |
| Distance to market (60-120 mins) | 0.38 | 0.31 | |
| Distance to market (>120 mins) | 0.08 | 0.47 | |
| Access to water (<5 mins) | 0.00 | 0.17 | |
| Access to hospital (<60 mins) | -0.55 | 0.17 | *** |
| Constant | 1.97 | 0.80 | |

We overspecify the first-stage Probit regression in order to include all the relevant household and farm level demographic variables that could have played a role in the selection into the treatment.

## Annex 2. Difference in Difference

For the purposes of our evaluation, we employ the general analytical framework based on a difference on difference approach. Following Kremer and Miguel (2003) we specify a model which captures the difference in project impact (outcome) across treatment and comparison farmers associations as follows:

$$Y_{ijt} = \alpha + \beta_1 T_{1it} + \beta_2 T_{2it} + X'_{ijt}\delta + \upsilon_i + \varepsilon_{ijt} \quad (1)$$

Where;

- $Y_{ijt}$ is the individual outcome of the variable of interest (the outcome variable);
- $T_{1it}$ and $T_{2it}$ are the dummies for farmer-members of farmers associations assigned in the first and second rounds of the treatment groups, respectively;
- $X_{ijt}$ is a vector of variables capturing information of the surveyed farmers association members, at the level of both the farmer and the farmer association s/he belongs to;
- $_{i,\ j}$ and $_{t}$ refers to the farmers associations, the farmer and the time over which data is captured;
- $\upsilon$ and ε are the disturbance terms, with the former capturing the effect at the farmers associations level.

$\beta_1$ and $\beta_2$ are the coefficients measuring the difference-in-difference estimate of the project impact (in respect of the outcome for the farmers associations treated in the first and second cycles, respectively). Since our dependent variables are continuous we base our estimates on Ordinary Least Squares.

An important merit in the use of such econometric analytical method is the fact that it allows us to include control factors in the estimation (both time-variant and time-invariant factors within the treatment and control groups). The opportunity to employ different individual and group behavioral characteristics (including gender, age categories, etc.) and other dummy variables for the different cohorts in the model also permits the evaluation of the differential impact of the interventions on these groups.

We therefore estimate the following equation:

$$Y_{it} = \alpha + \beta_1 T_t + \beta_2 D_i + \beta_3 DT + X_{it}\delta + \upsilon_i + \varepsilon_{it} \quad (2)$$

Where

- $Y_{it}$ is our variable of interest (yield, crop income etc.) for household *i* at time t (t=1, 2),
- $T_t$ is a binary variable which takes the value of 0 in the base year and 1 in the follow-up period
- $D_i$ is a binary variable which takes the value of 0 if individual is in the control (late certification) group and 1 if in the treatment (early certification) group
- $X_{it}$ is a vector containing covariates which may influence our variable of interest.
- *TD* is an interactive variable. The coefficient of this interactive variable provides a measure of effect of the intervention which is referred to as the difference in difference estimator

The difference in difference estimator is obtained in two steps. First, one takes the difference in the outcome indicator of interest, between the treatment and control farmers. This we call the first difference. In the second stage one takes the difference of the first difference over time; hence the name 'difference-in-difference'. This can be expressed as follows:

$$\beta_3 = (Y^*_{D2} - Y^*_{C2}) - (Y^*_{D1} - Y^*_{C1}) \quad (3)$$

Where $Y_{D2}^{*}$ and $Y_{C2}^{*}$ are the respective averages of the outcome indicator in the treatment (*D*) and control (*C*) groups in the follow-up period (*t=2*) and, $Y_{D1}^{*}$ and $Y_{C1}^{*}$ are the corresponding averages for the base period (*t=1*).
This can be illustrated using Equation 2 as follows.
If the "X" covariates are assumed away in Equation 2, then the difference in the outcome indicator between the treatment and the control in period 1 will be;

$$Y_{D1}^{*} - Y_{C1}^{*} = (\alpha + \beta_1) - \alpha = \beta_1 \quad (4$$

In period 2 the difference between the treatment and control groups can be expressed as

$$Y_{D2}^{*} - Y_{C2}^{*} = (\alpha + \beta_1 + \beta_2 + \beta_3) - (\alpha + \beta_2) = \beta_1 + \beta_3 \quad (5)$$

The difference in difference obtained as Equation 5 minus Equation 4 is therefore given by:

$$(Y_{D2}^{*} - Y_{C2}^{*}) - (Y_{D1}^{*} - Y_{C1}^{*}) = (\beta_1 + \beta_3) - \beta_1 = \beta_3 \quad (6)$$

The estimators obtained in Equations 3-6 is summarized in Table A.2.

**Table A.2 Summary of Estimators in the Difference-in-difference Approach**

| Group | Before Change | After Change | Difference |
|---|---|---|---|
| Treatment Group | $Y_{D1}^{*} = \alpha + \beta_1$ | $Y_{D2}^{*} = \alpha + \beta_1 + \beta_2 + \beta_3$ | $Y_{D2}^{*} - Y_{D1}^{*} = \beta_2 + \beta_3$ |
| Control Group | $Y_{C1}^{*} = \alpha$ | $Y_{C2}^{*} = \alpha_1 + \beta_2$ | $Y_{C2}^{*} - Y_{C1}^{*} = \beta_2$ |
| Difference | $Y_{D1}^{*} - Y_{C1}^{*} = \beta_1$ | $Y_{D2}^{*} - Y_{C2}^{*} = \beta_1 + \beta_3$ | $\Delta\Delta Y^{*} = \beta_3$ |

## Annex 3. Data

| | 2010 | | | | | 2012 | | | | | Program Impact | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MEAN (control) | MEAN (target) | DIFF | STD ERR of diff | p>t | MEAN (control) | MEAN (target) | DIFF | STD ERR of diff | p>t | Program Impact (DID) | STD ERR of diff | p>t |
| **ECONOMIC SUSTAINABILITY** | | | | | | | | | | | | | |
| **Income** | | | | | | | | | | | | | |
| *All in USD/ha except where noted* | | | | | | | | | | | | | |
| Income calculated without reflecting the opportunity cost of unpaid labor | 414 | 438 | 25 | 65 | 0.7 | 556 | 673 | 118 | 65.3 | 0.07 | 93 | 92 | 0.31 |
| Cost - natural fertilizers | 0.1 | 1.0 | 1 | 1 | 0.34 | 0.4 | 1.9 | 2 | 0.97 | 0.12 | 1 | 1 | 0.67 |
| Cost – synthetic fertilizers | 2 | 4 | 2 | 7 | 0.81 | 31 | 37 | 6 | 7.17 | 0.42 | 4 | 10 | 0.69 |
| Cost – natural biocides | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cost – synthetic biocides | 53 | 35 | -18 | 16 | 0.26 | 52 | 38 | -14 | 16.06 | 0.37 | 4 | 23 | 0.88 |
| Cost - paid labor | 42 | 43 | 1 | 12 | 0.96 | 59 | 45 | -14 | 11.68 | 0.23 | -15 | 17 | 0.37 |
| Cost - total labor (including opportunity cost of unpaid labor) | 118 | 129 | 11 | 50 | 0.83 | 343 | 336 | -7 | 50.58 | 0.88 | -18 | 71 | 0.8 |
| Yield (Kgs. /ha) | 358 | 374 | 16 | 40 | 0.68 | 405 | 444 | 40 | 39.93 | 0.32 | 23 | 56 | 0.68 |
| Price (USD/kg) | 1.49 | 1.48 | -0.02 | 0.02 | 0.39 | 1.73 | 1.81 | 0.09 | 0.02 | 0.00 | 0.10 | 0.02 | 0.00 |
| Revenue | 549 | 553 | 5 | 62 | 0.94 | 692 | 802 | 110 | 62.67 | 0.08 | 105 | 88 | 0.23 |
| Unpaid labor (Days/ha) | 56 | 56 | 0 | 13 | 0.97 | 48 | 49 | 1 | 12.88 | 0.93 | 1 | 18 | 0.97 |
| Paid labor (Days/ha | 23 | 21 | -2 | 4 | 0.66 | 14 | 12 | -3 | 4.46 | 0.53 | -1 | 6 | 0.9 |
| **Access to Credit** | | | | | | | | | | | | | |
| Credit requested | 55 | 54 | -1 | 34 | 0.98 | 121 | 152 | 32 | 34 | 0.35 | 33 | 48 | 0.5 |
| Credit received | 189 | 84 | -105 | 52 | 0.05 | 138 | 180 | 42 | 52 | 0.42 | 147 | 74 | 0.05 |
| % Requested Credit | 34% | 33% | -1% | 6% | 0.81 | 37% | 40% | 3% | 0.06 | 0.65 | 0 | 0 | 0.62 |
| % Received Credit | 22% | 27% | 5% | 6% | 0.44 | 37% | 38% | 1% | 0.06 | 0.86 | 0 | 0 | 0.67 |
| **Food Security** | | | | | | | | | | | | | |

| | 2010 | | | | | 2012 | | | | | Program Impact | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MEAN (control) | MEAN (target) | DIFF | STD ERR of diff | p>t | MEAN (control) | MEAN (target) | DIFF | STD ERR of diff | p>t | Program Impact (DID) | STD ERR of diff | p>t |
| *% farms where any family member did not have enough to eat during the last production year for ranges of days shown* | | | | | | | | | | | | | |
| 0 day | 68% | 68% | -1% | 6% | 0.92 | 58% | 56% | 2% | 6% | 0.73 | -0.01 | 0.09 | 0.86 |
| 1-9 days | 20% | 21% | 0% | 5% | 0.92 | 13% | 18% | 5% | 5% | 0.29 | 0.05 | 0.07 | 0.5 |
| 10-29 days | 7% | 3% | 3% | 4% | 0.33 | 15% | 10% | -5% | 4% | 0.13 | -0.02 | 0.05 | 0.71 |
| 30 or more days | 4% | 8% | 4% | 4% | 0.27 | 13% | 16% | 2% | 4% | 0.54 | -0.02 | 0.05 | 0.72 |
| **Price Transparency & Access to Market Information** | | | | | | | | | | | | | |
| *Price information that farmers have access to: immediate buyer/producer group; different buyers throughout region; government; global reference price; the price the farmer's buyer received for the crop.* | | | | | | | | | | | | | |
| % Price Transparency – Always | 0% | 4% | 4% | 4% | 0.30 | 74% | 73% | -1% | 4% | 0.85 | -0.05 | 0.06 | 0.38 |
| % Price Transparency – Sometimes | 11% | 4% | -7% | 4% | 0.10 | 14% | 14% | 0% | 4% | 0.97 | 0.06 | 0.06 | 0.25 |
| % Price Transparency - Never | 74% | 83% | 10% | 5% | 0.04 | 12% | 13% | 1% | 5% | 0.84 | -0.09 | 0.07 | 0.18 |
| Know 0 market price | 6% | 4% | -3% | 3% | 0.29 | 3% | 4% | 0% | 3% | 0.96 | 0 | 0 | 0.43 |
| Knows 1+ market prices | 94% | 96% | 3% | 3% | 0.29 | 97% | 96% | 0% | 3% | 0.96 | 0 | 0 | 0.43 |
| Knows 2+ market prices | 38% | 32% | -6% | 5% | 0.3 | 16% | 18% | 2% | 5% | 0.71 | 0 | 0 | 0.32 |
| Knows 3+ market prices | 3% | 0% | -3% | 3% | 0.23 | 5% | 9% | 4% | 3% | 0.12 | 7% | 4% | 0.05 |
| **Quality Practices in Cultivation and Processing** | | | | | | | | | | | | | |
| *Practices farmers used for treating coffee cherries before and after pulping and used for post-harvest processing or drying the coffee.* | | | | | | | | | | | | | |
| % used of best drying practices | *36%* | *37%* | *1%* | *2%* | *0.6* | *50%* | *50%* | *1%* | *2%* | *0.78* | *-0.01* | 0.03 | 087 |
| % used of best pod breaking practices | 72% | 74% | 2% | 3% | 0.51 | 69% | 73% | 4% | 3% | 0.16 | 0.02 | 0.04 | 0.61 |
| % used of best fermentation practices | 43% | 44% | 1% | 3% | 0.73 | 56% | 61% | 5% | 3% | 0.05 | 0.04 | 0.04 | 0.26 |
| % used of all cocoa processing best practices | 47% | 48% | 1% | 2% | 0.58 | 56% | 59% | 3% | 2% | 0.20 | 0.02 | 0.03 | 0.61 |
| **Farmer Participation Levels in Groups** | | | | | | | | | | | | | |
| 0 Membership Participation | *94%* | *9%* | *-85%* | *4%* | *0* | *10%* | *89%* | *80%* | *4%* | *0* | *0.06* | *0.05* | *0.26* |
| Membership Participation Level 1 | *6%* | *91%* | *85%* | *4%* | *0* | *10%* | *89%* | *80%* | *4%* | *0* | *-0.06* | *0.05* | *0.26* |
| Membership Participation Level 2 | *6%* | *85%* | *80%* | *5%* | *0* | *9%* | *78%* | *69%* | *4%* | *0* | *-0.10* | *0.06* | *0.08* |
| Vote in Producer Organization | *3%* | *83%* | *79%* | *4%* | *0* | *9%* | *77%* | *68%* | *4%* | *0* | *-0.11* | *0.06* | *0.06* |

| | 2010 | | | | | 2012 | | | | | Program Impact | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MEAN (control) | MEAN (target) | DIFF | STD ERR of diff | p>t | MEAN (control) | MEAN (target) | DIFF | STD ERR of diff | p>t | Program Impact (DID) | STD ERR of diff | p>t |
| **Farmer Perceptions - Economic** | | | | | | | | | | | | | |
| *Percent farmers whose quality of life worsened, unchanged, or improved since the prior year* | | | | | | | | | | | | | |
| Very bad | | | | | | *9%* | *5%* | 5% | 0.03 | *0.06* | | | |
| Bad | | | | | | 39% | 30% | 8% | 0.05 | 0.07 | | | |
| Not good or bad | | | | | | 29% | 33% | -4% | 0.05 | 0.23 | | | |
| Good | | | | | | 22% | 27% | -5% | 0.05 | 0.18 | | | |
| Very good | | | | | | 1% | 5% | -4% | 0.02 | 0.01 | | | |
| **SOCIAL SUSTAINABILITY** | | | | | | | | | | | | | |
| **Farm Injuries** | | | | | | | | | | | | | |
| *Percent of farms witout injuries serious enough to require treatment from a medical practitioner* | | | | | | | | | | | | | |
| | 83% | 90% | 8% | 4% | 0.06 | 78% | 96% | 17% | 4% | 0 | 9% | 6% | 0.12 |
| **Farms with Agrochemical Restrictions** | | | | | | | | | | | | | |
| *Farms that apply restrictions as to who applies any agrochemicals (including fertilizers)* | | | | | | | | | | | | | |
| % With no restrictions | 30% | 18% | -13% | 6% | 0.03 | 41% | 35% | -7% | 6% | 0.26 | 0.06 | 0.08 | 0.45 |
| % restricting 1 or more groups | 70% | 82% | 13% | 6% | 0.03 | 59% | 65% | 7% | 6% | 0.26 | -0.06 | 0.08 | 0.45 |
| % restricting 2 or more groups | 36% | 57% | 21% | 6% | 0 | 25% | 37% | 12% | 6% | 0.04 | -0.08 | 0.09 | 0.33 |
| % restricting 3 or more groups | 15% | 27% | 12% | 5% | 0.01 | 6% | 14% | 8% | 5% | 0.08 | -0.04 | 0.06 | 0.54 |
| Restricts Women | 28% | 42% | 13% | 5% | 0.01 | 11% | 25% | 15% | 5% | 0.01 | 0.01 | 0.08 | 0.85 |
| Restricts Children | 37% | 60% | 23% | 6% | 0 | 31% | 45% | 14% | 6% | 0.03 | -0.09 | 0.09 | 0.31 |
| Restricts Untrained Workers | 55% | 66% | 12% | 6% | 0.07 | 49% | 46% | -2% | 6% | 0.73 | -0.14 | 0.09 | 0.12 |
| Restricts Other | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Restricts None | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Children's Education** | | | | | | | | | | | | | |
| *Percent of children at appropriate grade level for their age (ratio to total n. of children in household)* | | | | | | | | | | | | | |
| % Children At Grade Level | 47% | 44% | -3% | 6% | 0.66 | 39% | 31% | -8% | 7% | 0.29 | -0.05 | 0.09 | 0.60 |
| % Children Working | 27% | 19% | -8% | 5% | 0.14 | 34% | 16% | -17% | 6% | 0 | -0.09 | 0.08 | 0.24 |

| | 2010 | | | | | 2012 | | | | | Program Impact | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MEAN (control) | MEAN (target) | DIFF | STD ERR of diff | p>t | MEAN (control) | MEAN (target) | DIFF | STD ERR of diff | p>t | Program Impact (DID) | STD ERR of diff | p>t |
| **Community Projects** | | | | | | | | | | | | | |
| % Participating in 0 Projects | 65% | 70% | 4% | 5% | 0.39 | 95% | 89% | -7% | 5% | 0.16 | -0.11 | 0.07 | 0.11 |
| % Participating in 1+ Projects | 35% | 30% | -4% | 5% | 0.39 | 5% | 11% | 7% | 5% | 0.16 | 0.11 | 0.07 | 0.11 |
| % Participating in 2+ Projects | 9% | 10% | 2% | 3% | 0.53 | 0% | 0% | 0% | 3% | 1 | -0.02 | 0.04 | 0.65 |
| | | | | | | | | | | | | | |
| **Potable Water** | | | | | | | | | | | | | |
| Water at house | 0% | 2% | 2% | 2% | 0.28 | 1% | 4% | 2% | 2% | 0.20 | 0 | 0.02 | 0.88 |
| Water 0-5 Mins Away | 65% | 64% | -1% | 6% | 0.88 | 73% | 78% | 5% | 6% | 0.37 | 0.06 | 0.08 | 0.46 |
| Water 5-19 Mins Away | 22% | 24% | 2% | 5% | 0.69 | 25% | 18% | -6% | 5% | 0.25 | -0.08 | 0.07 | 0.27 |
| Water 20+ Mins Away | 10% | 9% | -1% | 3% | 0.60 | 1% | 0% | -1% | 3% | 0.69 | 0 | 0.04 | 0.93 |
| **Soil Conservation and Water Use Improvement Practices** | | | | | | | | | | | | | |
| *Percentage of farmers using specific practices for conserving soil and improving water use and percentage by number of practices used* | | | | | | | | | | | | | |
| Drip Irrigation | 0% | 1% | 1% | 1% | 0.14 | 0% | 0% | 0% | 1% | 1 | -0.01 | 0.01 | 0.30 |
| Soil Coverage | 22% | 13% | -9% | 4% | 0.03 | 2% | 10% | 8% | 4% | 0.05 | 0.17 | 0.06 | 0 |
| Check Dams | 0% | 0% | 0% | 0% | 0 | 0% | 0% | 0% | 0% | 0 | 0 | 0 | 0 |
| Drainage Channels | 0% | 3% | 3% | 1% | 0.07 | 1% | 2% | 1% | 1% | 0.49 | -0.02 | 0.02 | 0.42 |
| Soil Ridges | 0% | 0% | 0% | 0% | 0 | 0% | 0% | 0% | 0% | 0 | 0 | 0 | 0 |
| Terracing | 0% | 0% | 0% | 0% | 0 | 0% | 0% | 0% | 0% | 0 | 0 | 0 | 0 |
| Contour Planting | 0% | 0% | 0% | 0% | 0 | 0% | 0% | 0% | 0% | 0 | 0 | 0 | 0 |
| Live Fences | 27% | 20% | -7% | 4% | 0.06 | 0% | 0% | 0% | 4% | 1 | 0.07 | 0.05 | 0.18 |
| Prohibit Animal Grazing | 0% | 5% | 5% | 2% | 0.01 | 3% | 2% | -1% | 2% | 0.63 | -0.06 | 0.03 | 0.03 |
| No Conservation Practices | 59% | 67% | 8% | 5% | 0.11 | 95% | 89% | -5% | 5% | 0.28 | -0.13 | 0.07 | 0.06 |
| 1+ Conservation Practices | 41% | 33% | -8% | 5% | 0.11 | 5% | 11% | 5% | 5% | 0.29 | 0.13 | 0.07 | 0.06 |
| 2+ Conservation Practices | 8% | 8% | 0% | 3% | 0.95 | 0% | 2% | 2% | 3% | 0.50 | 0.02 | 0.04 | 0.60 |
| **Water Contamination Protection Measures** | | | | | | | | | | | | | |

| | 2010 | | | | | 2012 | | | | | Program Impact | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MEAN (control) | MEAN (target) | DIFF | STD ERR of diff | p>t | MEAN (control) | MEAN (target) | DIFF | STD ERR of diff | p>t | Program Impact (DID) | STD ERR of diff | p>t |
| *Percentage of farmers using water safety measures* | | | | | | | | | | | | | |
| No Protection Measures | 69% | 45% | -24% | 6% | 0 | 66% | 65% | -2% | 6% | 0.76 | 0.22 | 0.09 | 0.01 |
| 1+ Protection Measures | 31% | 55% | 24% | 6% | 0 | 34% | 35% | 2% | 6% | 0.76 | -0.22 | 0.09 | 0.01 |
| 2+ Protection Measures | 12% | 12% | 1% | 5% | 0.91 | 17% | 18% | 0% | 5% | 0.95 | 0 | 0.06 | 0.97 |
| 3+ Protection Measures | 6% | 1% | -5% | 3% | 0.07 | 8% | 4% | -3% | 3% | 0.20 | 0.02 | 0.04 | 0.69 |
| **Farms Recycling - Reusing Waste** | | | | | | | | | | | | | |
| *Average number of different waste materials farms recycled or reused* | | | | | | | | | | | | | |
| % with 0 types of materials | 31% | 36% | 5% | 6% | 0.37 | 78% | 74% | -4% | 6% | 0.44 | -0.10 | 0.08 | 0.24 |
| % with 1 or more types of materials | 69% | 64% | -5% | 6% | 0.37 | 22% | 26% | 4% | 6% | 0.44 | 0.10 | 0.08 | 0.24 |
| % with 2 or more types of materials | 12% | 18% | 7% | 3% | 0.06 | 3% | 2% | -1% | 3% | 0.76 | -0.08 | 0.05 | 0.12 |
| Crop waste | 66% | 59% | -7% | 6% | 0.24 | 18% | 21% | 3% | 6% | 0.63 | 9% | 8% | 0.24 |
| Plastic | 0 | 1% | 1% | 1% | 0.55 | 4% | 1% | -3% | 1% | 0.07 | -4% | 2% | 0.08 |
| Other organic farm wastes | 15% | 23% | 7% | 4% | 0.07 | 2% | 5% | 3% | 4% | 0.48 | -4% | 6% | 0.43 |
| Paper | 0 | 0% | 0% | 1% | 1 | 0% | 1% | 1% | 1% | 0.47 | 1% | 1% | 0.61 |
| Metal | 0 | 0% | 0% | | . | 0% | 0% | 0% | . | | 0% | . | . |
| **Use Levels of Synthetic and Natural Fertilizers** | | | | | | | | | | | | | |
| % of group using natural fertilizer | 0% | 3% | 3% | 2% | 0.16 | 3% | 6% | 3% | 2% | 0.19 | 0 | 0.03 | 0.94 |
| % of group using synthetic fertilizer | 17% | 15% | -3% | 6% | 0.63 | 59% | 53% | -6% | 6% | 0.27 | -0.03 | 0.08 | 0.66 |
| **Cocoa Planting** | | | | | | | | | | | | | |
| *Percent of farmers expanding the area for growing the focus crop and of those, the percentage that cleared a natural area to do so* | | | | | | | | | | | | | |
| % Expanded crop area | 78% | 68% | -10% | 6% | 0.09 | 59% | 51% | -8% | 6% | 0.16 | 0.02 | 0.08 | 0.83 |
| %Cleared Natural Area | 30% | 26% | -4% | 5% | 0.47 | 21% | 12% | -9% | 5% | 0.10 | -0.05 | 0.07 | 0.51 |
| **Pest losses** | | | | | | | | | | | | | |
| *Percentage of Farmers who lost a certain amount of their crop due to pests* | | | | | | | | | | | | | |
| Lost 1-5% | | | | | | 13% | 24% | -11% | 13% | 0.24 | | | |
| Lost 6-15% | | | | | | 28% | 16% | 12% | 28% | 0.16 | | | |
| Lost 16-25% | | | | | | 11% | 5% | 6% | 11% | 0.05 | | | |

| | 2010 | | | | | 2012 | | | | | Program Impact | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MEAN (control) | MEAN (target) | DIFF | STD ERR of diff | p>t | MEAN (control) | MEAN (target) | DIFF | STD ERR of diff | p>t | Program Impact (DID) | STD ERR of diff | p>t |
| Lost 26%+ | | | | | | 6% | 9% | -3% | 6% | 0.09 | | | |
| Lost None | | | | | | 42% | 45% | -4% | 42% | 0.45 | | | |
| **Farmer's Perception** | | | | | | | | | | | | | |
| *Percentage of farmers indicating that their care of the environment is better, same or worse compared to prior year.* | | | | | | | | | | | | | |
| Very bad | | | | | | 0% | 0% | 0% | 0% | 0 | | | |
| Bad | | | | | | 10% | 3% | 6% | 3% | 0.02 | | | |
| Not good or bad | | | | | | 29% | 19% | 9% | 5% | 0.03 | | | |
| Good | | | | | | 59% | 73% | -14% | 5% | 0.01 | | | |
| Very good | | | | | | 3% | 4% | -1% | 2% | 0.31 | | | |
| *Percentage of farmers indicating that their community's care of the environment is better, same or worse compared to prior year.* | | | | | | | | | | | | | |
| Very Bad | | | | | | 0% | 1% | -1% | 1% | 0.16 | | | |
| Bad | | | | | | 14% | 6% | 8% | 3% | 0.01 | | | |
| Not Good or Bad | | | | | | 30% | 35% | -5% | 5% | 0.19 | | | |
| Good | | | | | | 54% | 58% | -4% | 6% | 0.25 | | | |
| Very Good | | | | | | 2% | 0% | 2% | 1% | 0.04 | | | |
| *Percentage of farmers indicating that their overall Quality of Life is better, same, or worse compared to prior year* | | | | | | | | | | | | | |
| Very Bad | | | | | | 3% | 4% | -1% | 2% | 0.31 | | | |
| Bad | | | | | | 39% | 17% | 22% | 5% | 0 | | | |
| Not Good or Bad | | | | | | 35% | 46% | -11% | 6% | 0.03 | | | |
| Good | | | | | | 23% | 32% | -9% | 5% | 0.04 | | | |
| Very Good | | | | | | 0% | 1% | -1% | 1% | 0.16 | | | |
| **Training** | | | | | | | | | | | | | |
| *Hours of different types of training sessions attended and total training hours attended* | | | | | | | | | | | | | |
| Farm Operations Training | 7 | 14 | 6.31 | 0.85 | 0.00 | 2 | 4 | 2.02 | 0.85 | 0.02 | -4.28 | 1.20 | 0.00 |
| Record Keeping Training | 3 | 3 | 0.73 | 0.74 | 0.22 | 0 | 0 | 0.04 | 0.74 | 0.95 | -0.68 | 1.05 | 0.51 |
| Marketing Training | 0 | 0 | 0.28 | 0.15 | 0.05 | 0 | 0 | 0.04 | 0.15 | 0.80 | -0.25 | 0.21 | 0.24 |
| Health and Social Training | 2 | 9 | 7.10 | 0.60 | 0.00 | 0 | 1 | 0.68 | 0.60 | 0.25 | -6.42 | 0.84 | 0.00 |
| Environmental Training | 1 | 7 | 6.21 | 0.48 | 0.00 | 0 | 1 | 0.79 | 0.48 | 0.10 | -5.42 | 0.68 | 0.00 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Adult Literacy Training | 0 | 0 | 0 | 0.02 | 1.00 | 0 | 0 | 0.04 | 0.02 | 0.14 | 0.04 | 0.03 | 0.29 |
| Business Training | 1 | 2 | 1.45 | 0.30 | 0.00 | 0.26 | 0.25 | -0.11 | 0.30 | 0.97 | -1/46 | 0.42 | 0.00 |
| Other Training | 0 | 0 | 0 | 0.05 | 1.00 | 0 | 0 | 0.11 | 0.05 | 0.04 | 0.11 | 0.07 | 0.14 |
| Total Training Hours | 13 | 35 | 22.07 | 1.95 | 0.00 | 3 | 7 | 3.71 | 1.95 | 0.06 | -18.37 | 2.75 | 0.00 |

| **Labor Days** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Day of paid and unpaid labor per Ha* | | | | | | | | | | | | | |
| Paid Labor Days per Ha | 23 | 21 | -1.99 | 4.45 | 0.66 | 14 | 12 | -2.77 | 4.46 | 0.53 | -0.78 | 6.30 | 0.90 |
| Unpaid Labor Days per Ha | 56 | 56 | 0.46 | 12.85 | 0.97 | 48 | 49 | 1.18 | 12.88 | 0.93 | 0.72 | 18.19 | 0.97 |