AN IMPACT EVALUATION OF THE MIDA FBO TRAINING

Final Report

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by
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Acronyms and Abbreviations

AB	Afram Basin
CDFO	Commercial Development of Farmer Based Organisations
EUREPGAP	Euro- Retailer Produce Working Group Good Agriculture Practice
FBO	Farmer Based Organisation
GDP	Gross Domestic Product
GLSS5	Ghana Living Standard Survey, Round Five
GoG	Government of Ghana
GPS	Global Positioning System
HHH	Head of Household
HIV/AIDS	Human immunodeficiency virus/acquired immune deficiency syndrome
ISSER	Institute of Statistical Social and Economic Research
JSS	Junior Secondary School
MCA	Millennium Challenge Account
MCC	Millennium Challenge Corporation
MiDA	Millennium Development Authority
MoFA	Ministry of Food and Agriculture
MSLC	Middle School Leaving Certificate
NAZ	Northern Agricultural Zone
NGO	Non- governmental Organisations
RICs	Regional Implementation Consultants
SHB	Southern Horticultural Belt
USD	United States Dollar
VOC	Vocational training certificate

Executive Summary

The Institute of Statistical, Social and Economic Research (ISSER) embarked on an impact evaluation of the Farmer Based Organisations (FBOs) training and starter pack component of the MCA Ghana programme which was signed between the Government of Ghana through the Millennium Development Authority (MiDA) and the Millennium Challenge Corporation (MCC) of the United States in 2006 worth $547.

The evaluation was based on a randomised phase-in approach where farmers were put into early treatment and late treatment categories to enable for the estimation of programme impact. The surveys were conducted over a three (3) year period during the lifespan of the Compact, starting November 2008 through to January 2011. Approximately 1200 FBOs were *ex ante* designed to be interviewed as part of this evaluation. Under the evaluation design each farmer was to be interviewed twice – in rounds one (baseline) and two (follow-up).

The FBO training sessions that were undertaken by MiDA lasted for 27 contact days of three days in a week. Farmers were introduced to three thematic modules during the training; the Business Capacity Building Module, The Technical Training Module and the Sales Maximization Module. Every farmer who was trained received a starter pack to pilot the knowledge and skills acquired during the training. The content of the starter pack included; fertilizer, seeds for an acre, protective clothing and some cash amount for land preparation, all valued at US$230.

The main findings of this impact evaluation report is summarised as follows.

There is no evidence of impact of intervention on crop yields and crop incomes: The results show that there is no evidence of the programme having had an impact on yields and crop incomes overall. However there are some significant zonal differences with respect to the crop incomes. For the Afram Basin, we find no impact of the intervention on crop incomes. In the Northern Agricultural Zone for instance we do find a significant impact of the programme on crop incomes. For the Southern Horticultural Belt on the other hand we find a negative and significant impact of the intervention on crop incomes. Some of the reasons adduced from qualitative data suggest that there were possible problems of contamination; the one year over which the evaluation was done was too short; and the technical component of the training added little value mainly because these farmers had had prior technical training from MoFA extension agents. Other problems that came up included challenges with marketing.

The intervention led to an increase in the use of improved seeds and fertilizers by farmers, but that was mainly driven by the starter pack: The results show a positive impact of the intervention on the value of fertilizer and improved seeds use. However the magnitude of the impact was less than the value of the improved seeds and fertilizers in the starter pack. It is

therefore concluded that the impact on the seeds and fertilizer use is mainly due to the starter pack.

Training increases farmers' use of more formal sources for loans: The results do show that generally farmers with training were more likely to apply for loans from more formal sources. This is indeed a positive finding as it suggests that the training has equipped farmers with the confidence to engage more formal sources of finance. The results also show that the intervention impacted positively on amount of loans that households received. However further analysis suggests that the increase in loans accessed as a result of the training was mainly due to MiDA loans. In other words we do not find evidence that non-MiDA loans were impacted by the training. In addition we do find that the intervention increased non-MiDA loans accessed by farmers in the Afram Basin.

Yields of pineapple are highest: Pineapples which have the highest yields are also predominant in the Southern Horticultural Belt. Other crops with relatively high yields include cassava and yams. We note that, average yields are relatively low for crops primarily grown in the Northern Agricultural Zone.

Farmers are smallholders and mainly use local seeds: The average plot size of farms was found to be about 1.5hectares. Most of these farmers are dependent on rain for farming and use predominantly local seeds. The most common chemical used by the farmers is fertilizer.

Cash crops are prevalent in Southern Horticultural Belt - Maize is a very important crop for farmers across all the zones. However there are differences in the broad category of crops that are grown in the three zones. Pineapples, tomatoes and mangoes are relatively more important in the Southern Belt. Grains such as rice, millet, sorghum, groundnuts and soybean as well as yams are taken up relatively more in the Northern Agriculture Zone. In the Afram Basin the important crops there are plantain, cocoyam and yams.

Summary of impact variables

Impact of Training & Starter Pack on:	Measure	Expected impact	Measured impact			
			Overall	South	Afram	North
Crop yields	% change	increase	NS	NS	NS	NS
Crop Incomes of farm households	% change	increase	NS	-76.00%	NS	77.80%
Revenue	% change	increase	NS	-52.00%	NS	59%
Cost	% change	increase	NS	NS	NS	NS
Value of all loans	change in GH□/loan	increase	□440	□1,293	□449	NS
Value of non-MiDA loans	change in GH□ /loan	increase	NS	NS	□448	NS
Land under cultivation	% change	increase	NS	-54%	NS	32.00%
Chemical use	% change	increase	36.00%	42.00%	33.00%	34.00%
Value of seeds used	% change	increase	15.30%	NS	27.40%	13.30%
Labor hours for farm activities	% change	+/-increase	NS	NS	-37%	59%

NS = not significant (i.e. No impact was detected at a 95% significance level)

1. Introduction

1.1. Background to the MiDA Programme

The Government of Ghana, through the Millennium Development Authority, signed a 5-year Compact (2006-2011) worth $547 million with the Millennium Challenge Corporation (MCC) of the United States of America. The Compact was aimed at reducing poverty through economic growth and agricultural transformation. There were two main program objectives which formed the basis for the achievement of the overall program goals. These were: to increase the production and productivity of high-value cash and food crops and to enhance the competitiveness of high-value cash and food crops in local and international markets. Three projects in the area of agriculture, transportation and rural development formed the basis for the achievement of the program objectives. The projects are in 30 districts[1] in the Northern Agicultural Zone, the central Afram Basin Zone, and the Southern Horticultural Belt in the southern part of the country.

The program was anticipated to help directly alleviate poverty and enhance the livelihoods and welfare of over 1.2 million individuals. Since the Ghana programme was centred on agricultural transformation, a key objective of the modernisation programme was to improve farmer productivity and incomes. This, under the programme, was to be achieved through the training of farmers. The training of farmers were in turn organised around Farmer Based Organisations (FBOs). The FBO surveys were therefore undertaken to evaluate the impact of the training on their productivity and crop incomes. The surveys were conducted over three (3) years during the life of the Compact, starting November 2008 through to January 2011. Approximately 1200 FBOs were ex ante designed to be interviewed as part of this evaluation. Under the evaluation design each farmer was to be interviewed twice – in rounds one (baseline) and two (follow-up). This report presents the findings of this evaluation.

[1] The Districts in which MiDA operates in were 23 at the time the Compact came into force but seven of them were later split into two, to give the current number of 30.

2. Agricultural Modernization under MiDA Programme

The Agricultural Project was designed to enhance the profitability of staple food and horticulture crops and to improve delivery of business and technical services to support the expansion of commercial agriculture among farmer-based organizations (FBOs). Funds from the Compact for the Agricultural Project were intended to support the following Project Activities:

- *Farmer and Enterprise Training in Commercial Agriculture*: To accelerate the development of commercial skills and capacity among FBOs and their business partners (including service providers to FBOs and other entities adding value to agricultural crops such as processors)
- *Irrigation Development*: To establish a limited number of retention ponds and weirs requested by the FBOs and FBO partnerships for whom access to water is critical to the success of their business objectives
- *Land Tenure Facilitation*: To improve tenure security for existing land users and to facilitate access to land for commercial crops in the intervention zones
- *Improvement of Post-Harvest handling and Value Chain Services*: To facilitate strategic investments by FBOs in post-harvest infrastructure improvements and to build the capacity of the public sector to introduce and monitor compliance with international plant protection standards
- *Improvement of Credit Services for On-Farm and Value Chain Investments*: To augment the supply of, and access to, credit provided by financial institutions operating in the intervention zones
- *Rehabilitation of Feeder Roads*: To rehabilitate up to 950km of feeder roads in the intervention zones in order to reduce transportation costs and time, to increase access to major domestic and international markets, and to facilitate transportation linkages from rural areas to social service networks such as, hospitals, clinics and schools.

2.1.1. Training Package for MiDA FBOs and Starter Pack

The MiDA training programme aimed at equipping farmers technically by improving their business capacity and to be more commercially oriented so they can maximize their sales. The three stages involved in the commercialization training for farmer based organizations were as follows:

Stage 1: Business Capacity

Training to develop a business plan

This sub-section of the business capacity building focused on teaching the farmer to do more critical thinking about what to cultivate, when to cultivate it, what inputs are required, the product mix and the sources of capital for these activities. In addition, it aimed at equipping the farmer to put together a document that captures all these ideas in a coherent manner.

Introduction to value chains

Value chain is the path that a product takes as it moves from the farm to the marketplace. At each stage along the way, value is added to the product. Each vertical step in a value chain is a market for the step below. The value chain includes all the activities that it takes to bring the product to the market, including horizontal linkages to suppliers of goods and services. For farmers to get the maximum from the market price, they require knowledge of the value chains and how they function so as to participate effectively in them. This part of the training sought to equip farmers with these skills.

Access to incentives

This component sought to equip farmers with a better understanding of the dynamics of how government policy works. The aim here was to enable farmers to better position themselves to effectively influence and access government programmes.

Stage 2: Technical Training:

The technical training component involved the following:

- Access to farm management, production, and post-harvest and storage training for members.
- Support for analysis of farmers' financial situation and preparation of bankable business plans to access agricultural credit.
- Access to technical assistance for development of post-harvest facilities- with good investment backed by bankable business plans.
- Access to technical assistance and support for design of irrigation facilities. This required the development of Water Users Associations, the creation of horizontal linkages, and preparation of bankable business plans.

Stage 3: Maximizing Sales

Training to understand the requirements of the various markets

Farmers were taken through the EUREPGAP standards and certification. This is a common standard for farm management practice created in the late 1990s by several European supermarket chains and their major suppliers with the aim of bringing conformity to different retailers supplier standards which had been creating problems for farmers. This was to help them reduce the proportion of their products that are rejected and improve their ability to compete favourably with other producers around the world.

Training in use of marketing and sales techniques

This involved giving farmers some form of pseudo market research skills that informs them on what to produce and engage in sales promotion exercises. The aim of this module was to equip farmers to be able to tell what is on demand in the market.

Technical assistance to develop new linkages with buyers and negotiate new contracts

This part of the training programme was aimed at equipping the farmer with the technicalities involved in negotiation to win contracts by teaching them how to price their products based on prevailing market demands and supply side conditions.

Technical assistance to develop linkages to other FBOs in order to expand bargaining power

The idea here was to encourage farmers to appreciate that there are important gains to be made when producers of a particular line of products across different FBOs in neighbouring communities come together and agree on a price. In this way buyers will be faced with similar price regimes.

Technical assistance to support definition of packaging and presentations to expand marketability

Value addition is key to attracting more buyers and higher incomes from what the farmer sells. It is important to note that while many farmers would want to add value to what they produce, they may not know how to do so. The training was to transfer technical knowledge to the farmers in terms of how to present and package products so as to attract buyers quickly and also at a competitive price.

Duration for training MiDA FBOs

Table 2-1 presents the timing required for delivery of each module. The timing was meant to be indicative rather than prescriptive. It needs to be noted that the delivery times indicated in this table do not include time for reporting or reviewing at the beginning of each session.

Table 2-1 Suggested Timing for Course Delivery

Module	Activity	Duration
Module 1	The MCA Compact and Course Objectives (including introduction and getting started discussions)	2 hours
Module 2	FBOs, Rural Development and Commercialization	1 hours
Module 3	Value Chain Thinking	4 hours
Module 4	Business Vision through a Value Chain Lens	3 hours
Module 5	A Primer on Leadership, Governance and management	3 hours
Module 6	Developing Business Expansion Strategies	6 hours
Module 7	Developing the Action Agenda	4 hours
Module 8	Driving Organization Change	2 hours
Module 9	Completing the Actions Business Plan	5 hours

2.1.2. Priming of FBOs

The selection of FBOs for the training under the MiDA programme was done by the Ministry of Food and Agriculture (MoFA) in consultation with MiDA. MoFA, through their district directorates, had the responsibility to identify, sensitize and categorize FBOs that met the eligibility criteria for the Farmer Based-Organizations training. These FBOs were validated by the regional directorates of MoFA. The eligibility criteria for the inclusion of an FBO into the programme were as follows:

- Being part of product and trade associations;
- The FBO-average size of 50 members (minimum 15 members).
- The average farm size of each member should be dependent on the type of crop/value of crop, but in general a minimum of 2 acres.
- Objectives of the FBO must be in alignment with the goals of CDFO (product market protocols). It should have a banking/saving culture, and the length of time as an organization must be at least 6 months. There should be evidence of by-laws.
- Officers should be democratically elected, and there should be a commitment to include women in management and committees of the FBO.

- The FBO should demonstrate a history of meeting and working together and have an endorsement from the district director of agriculture, district co-operative office or banking institution.
- FBO management and membership need to understand that participation implied involvement at all stages of the commercial development process.
- The FBO should offer the development of services, through self-help activities that will benefit and strengthen the FBO.
- The FBO should have transparency of business operations and a commitment to growth.

2.1.3. FBO Training and Starter Pack

The Starter Pack was an incentive to motivate farmers to participate in all the stages of the training and also help with some of the initial investments that the training imposed. The content of the starter pack included fertilizers, seeds (for one acre), wellington boots, face masks, gloves, and the payment of GH¢30 for land clearing. This was meant to help the farmers to experiment with and demonstrate the effectiveness of the training they had received. The inputs were also to serve as a form of funding to give the individual farmers capital for their farming business.

3. Sampling and Data Collection

3.1. Introduction

This evaluation had the primary objective of measuring the impact of the FBO training programme on farmers' farm productivity and crop income. It was based on a randomized phase-in approach. It took advantage of the fact that not all FBOs' that were to be part of the programme could be trained at the same time and so implicit in the programme design itself was some degree of phasing. The study therefore took advantage of this and randomised the FBOs that were to be in the different phases of the training programme. The impact has been consequently measured as the difference-in-difference estimator which is discussed later in this report.

To enable the implementation of the difference-in-difference approach each farmer was to be interviewed twice – in rounds one (baseline) and two (follow-up).The surveys were conducted over three (3) years during the life of the Compact, starting November 2008 through to January 2011. Based on sample adequacy considerations among others, approximately 1200 FBOs were designed to be interviewed as part of this evaluation.

3.2. Sampling

A Multistage selection approach involving both stratification and clustering of the sample was used. The stratification was based on the ***three zones*** (Southern Horticultural Belt, Afram Basin and the Northern Agricultural Zone). The sample is clustered at the FBO level.

3.2.1. Stages of Sample Selection

The sample was selected in two stages. In the first stage, there was a selection of FBO's within each Zone. However the primed FBOs that MiDA made available to ISSER were just about 600. We therefore used all 600 FBOs. At this stage, we randomly selected the FBOs that were to be given early training versus those that were to get late training. This was done in a participatory manner with the executives of these FBOs. In the second stage we randomly selected 5 farmers from each of the 600 FBOs.

This approach was done for both Batch I and Batch II farmers but at different times. The Batch I FBO information was available in 2008. Consequently the two waves of the Batch I surveys were undertaken over the 2008 and 2009 periods. For the Batch II, the two waves of surveys were undertaken over the 2009 and 2010 period. For each Batch about 3000 farmers were selected to be interviewed. In total about 6000 farmers were interviewed and these formed the basis of the evaluation.

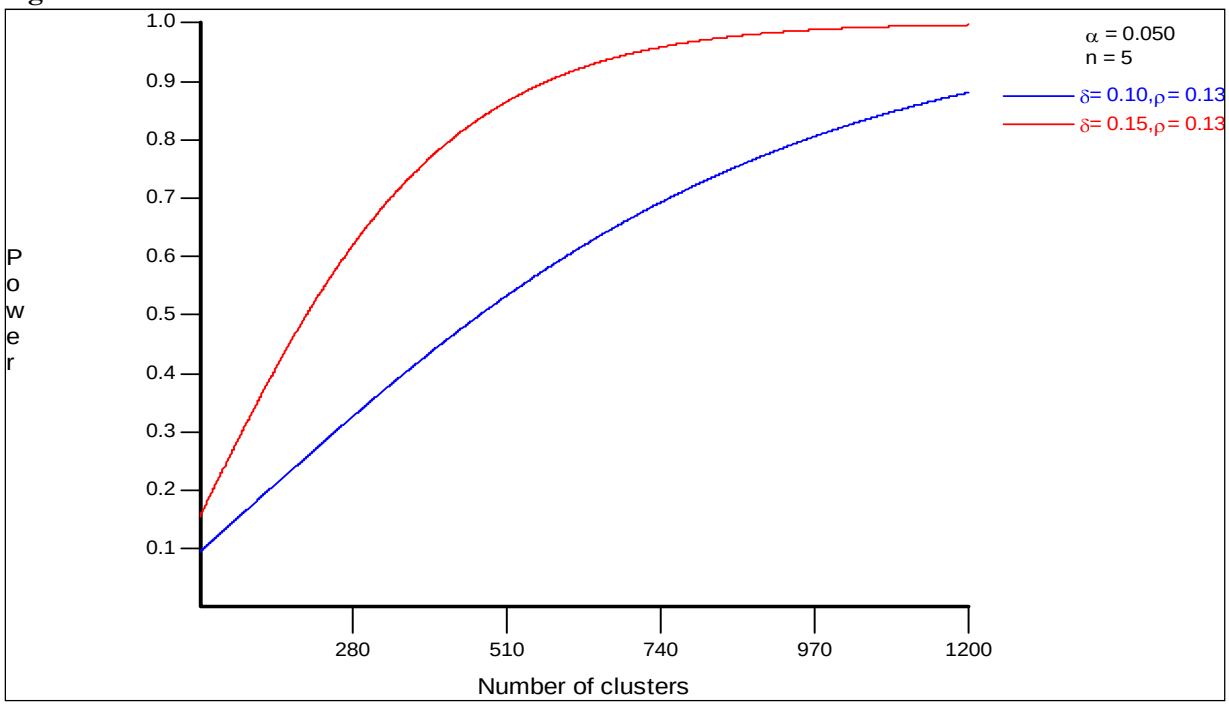
3.2.2. ADEQUACY OF THE SAMPLE SIZE

To ensure that statistical tests which forms the basis of testing the hypotheses have adequate power, we performed power calculations to enable us assess the adequacy of our sample size. The power calculations were based on the following assumptions:

- The agriculture outcomes (of profits and crop productivity) were expected to have an effect size of between 10% and 15%.
- We assume an intra-class correlation (fraction of the variance between FBOs (cluster) to the total variability) to be about 0.13. This was based on other studies that have been undertaken in Ghana
- The number of farmers per FBO was 5
- The total number of FBOs was 1200

Based on these parameters we note that to get a power of about 80%, the effect size should be 10% or more. In other words, for the given parameters (1200 FBOs with 5 farmers per FBO), 10% effect size is the minimum that will yield power of about 80%. See figure 3-1 below.

Figure 3-1 Power of estimations for different number of FBOs



3.3. Implementing Surveys

For practical purposes, and because not all the potential FBOs were available at the start of the programme, the evaluation design was revised so that we would have two independent Batches of FBOs – a Batch I and II. In total about 1200 FBOs were used for the purposes of the evaluation. For each batch, two rounds of data were collected – a round one and two. A number of farmers in each of the FBOs were selected for interviews. Two distinct set of farmers constitute this sample – those who received early training (treatment group) and those who received late training (control group). Five farmers were randomly picked from each FBO to participate in the survey. In addition we included 3 replacement farmers for each FBO. The distribution of farmers across the MiDA zones is shown in Table 3-1. The distribution of the sampled farmers (*ex ante*) across the three zones was respectively 27 per cent, 39 per cent and 34 per cent for the Southern Horticultural Belt, Afram Basin and Northern Agricultural Zone overall. The realised distribution across the two batches however differed slightly. For instance, in the batch one the distribution was about 26 per cent, 41 per cent and 33 per cent respectively for Southern Horticultural Belt, Afram Basin and Northern Agricultural Zone. In the case of the batch two, the realised distribution of sample was respectively 27 per cent, 38 per cent, and 35 per cent. We obtain an overall attrition of about 10 per cent over the baseline and follow-up. However most of this attrition is recorded for the batch one sample – the batch one sample has an attrition of about 18 per cent compared to about 2 per cent for the batch two.

Table 3-1 Distribution of Farmers across the MiDA zones

	Batch 1			Batch 2			Overall		
	Treatment	Control	Total	Treatment	Control	Total	Treatment	Control	Total
Horticulture	25.9	26.1	26.0	27.8	26.4	27.1	26.8	26.3	26.6
Afram Basin	41.6	40.8	41.2	37.3	38.1	37.7	39.4	39.4	39.4
Agriculture	32.6	33.1	32.8	35.0	35.6	35.3	33.8	34.4	34.1
Total	100	100	100	100	100	100	100	100	100
Attrition	17.8%			2.2%			10.0%		
Chi-2 Test	P-value=0.85			P-value=0.49			P-value=0.71		

3.4. Time Lag for the Evaluation of the Programme

We define the time-lag for the evaluation as the period that spans the time when the intervention starts and the final period when we measure the outcome indicators of interest. The period over which an evaluation is undertaken is important for the outcome of any given study. This is

because it will usually take some time before one begins to see the outcome of any given intervention. Too short a period will mean a lower effect size and consequently one will have to compensate for this by increasing the sample size for the possibility of a significant effect to be captured. Indeed whether the time lag allowed for the evaluation is adequate or otherwise depends on the type and nature of the intervention. We therefore scanned the literature to get a sense of the appropriate time lag over which the evaluation had to be undertaken. The matrix in Appendix 3 provides a summary of some of the relevant literature on impact studies related to farmer training. Generally what the literature suggests that the evaluation be undertaken over a 2-year period for training-related interventions. Unfortunately a two-year period has important ethical implications. In a randomised phasing-in trail such as done in this study the control group would have had to wait for two years before getting the treatment. Earlier indications from the agriculture extension agents as well as the Regional Implementation Consultants (RICs) suggested a two-year wait for the control group would pose implementation challenges. We therefore, in consultation with MiDA agreed to undertake the evaluation over a one year period.

4. Descriptive Statistics of Key Indicators

4.1. Characteristics of MiDA FBO Farmers

4.1.1. Introduction

This section presents the demographic characteristics of the MiDA FBO members and the other non-farm employment activities. Demographic characteristics presented include sex, age, educational attainment, religious affiliation, marital status and the relationship to the household head. Household characteristics such as age-sex composition, household sizes, sex of household head, and household dependency ratios are also presented. The tables are generated based on FBO members who completed the two rounds of surveys.

4.1.2. Demographic characteristics of MiDA FBO members and their households

Table 4-1shows the percentage distribution of the demographic characteristics of the selected MiDA FBO members who took part in the two surveys, by batch and MiDA zone. About 60 per cent of the farmers in Batch I and 57 per cent of the farmers in Batch II were males. For each Batch, there was a higher proportion of females in the NAZ than in the two other zones, especially in the SHB where the ratio of male to female farmers was about 2:1 compared to a corresponding ratio of almost 1:1 in the NAZ.

In terms of age, the age group 40-49 years emerges as modal age group of the farmers in both Batches, accounting for 30 and 29 per cent respectively of Batch I and Batch II. Less than 1 in 6 of the farmers (about 13%) were aged 60 years or over and the overall mean age of the farmers was about 45 years for both batches. The age pattern and resultant mean ages is similar across the three MiDA zones although the farmers in the NAZ are slightly younger on average.

About 7 in 10 of the farmers were the heads of their household and the rest were mainly the spouses of the heads of household. We note some differences across the MiDA zones. In the NAZ, the percentage of the farmers who were the heads of their household was lower compared to the other two Zones. In Batch I, about 83 per cent of the farmers in the SHB indicated they were the heads of their household as compared to about 56 per cent of the farmers in the NAZ. Also in Batch II, 81 per cent of the farmers in the SHB indicated they were the heads of their household as compared to 52 per cent of the farmers in the NAZ. This observation could be explained by the fact that the proportion of female farmers was higher in the NAZ and females are usually not heads of their household, especially in the NAZ.

Table 4-1 Distribution of the background characteristics of MiDA FBO farmers by batch and MiDA Zone

Background characteristics	Batch I				Batch II			
	SHB	AFB	NAZ	Total	SHB	AFB	NAZ	Total
Sex								
Male	65.9	62.9	51.0	59.8	64.3	58.1	49.3	56.7
Female	34.1	37.1	49.0	40.2	35.7	41.9	50.7	43.3
Age group (years)								
Less than 20	0.2	0.2	1.0	0.5	0.0	0.1	0.2	0.1
20-29	4.6	5.9	11.7	7.4	5.7	9.2	13.6	9.8
30-39	21.9	26.2	28.5	25.8	24	28.5	30	27.8
40-49	33.4	31.0	26.8	30.3	34.5	26.6	26.3	28.6
50-59	23.7	23.9	18.8	22.2	23.2	22.2	16.3	20.4
60 and over	16.2	12.8	13.1	13.8	12.6	13.4	13.7	13.3
Mean age	**47.5**	**45.6**	**43.4**	**45.4**	**45.8**	**45.1**	**42.9**	**44.5**
Relationship to HH								
Head of household	82.7	75.9	56.4	71.4	80.7	72.0	51.9	67.3
Spouse of head	15.8	23.7	39.6	26.8	18.7	27.3	42.7	30.4
Other	1.4	0.4	4.0	1.8	0.6	0.7	5.4	2.4
Highest Education								
None	16.7	27.8	81.8	42.4	18.2	23.6	82.8	42.9
Primary	17.8	18.3	9.6	15.3	21.6	17.9	7.2	15.2
Middle/JHS	44.3	43.6	3.6	30.8	45.3	46.0	5.0	31.4
Secondary+	21.2	10.3	5.0	11.4	15.0	12.5	4.9	10.5

In terms of the religions to which households belong to, we find about 58 per cent of the farmers in the Batch I professing to be Christians while 35 per cent profess the Islam religion and the remaining 7 per cent were either Traditionalist (3%), have no religion (3%) or belong to other unspecified religions (1%). A sharp contrast exists in the religious affiliations between the farmers from the NAZ and their counterparts in the other two MiDA zones. Nearly 9 in 10 of the farmers in the NAZ are Moslems compared to an average of about 2 in 10 for their counterparts from the other two zones.

Concerning marital status, about 83 per cent of farmers in the Batch I were married with a further 4 per cent in a consensual union. About 1 in 10 of them were divorced, separated or widowed and only 2 per cent were never married. A higher proportion of the farmers in the Northern Agricultural Zone were married as compared to the other two zones (90% for NAZ, 81% for Southern Horticultural Belt and 79% for Afram Basin).

The educational levels of the farmers were generally found to below. For both batches, about 4 in 10 of the farmers have never been to school and only 1 in 10 has secondary or higher education. The lack of education was more pervasive among farmers from the northern zone with about 8 out of 10 of them not having any formal education. Despite these educational limitations, literacy and numeracy levels were quite encouraging. As shown in Table 4-2, about 50 per cent of the farmers in each Batch were able to read simple sentences proficiently and about 70 per cent were able to do a written calculation proficiently.

Table 4-2 Literacy and Numeracy among FBO members

	Batch 1				Batch 2			
	SHB	AFB	NAZ	Total	SHB	AFB	NAZ	Total
Literacy								
Able to read proficiently	55.4	50.9	38.0	51.3	49.5	44.7	51.5	47.3
Able to read but not proficiently	20.2	16.7	12.7	17.6	22.7	21.3	9.9	20.6
Not able to read at all	24.4	32.4	49.3	31.1	27.8	34.0	38.6	32.1
Numeracy								
Able to do written calculation proficiently	79.7	75.7	60.0	75.6	75.6	71.5	62.6	72.2
Able to do written calculation but not proficiently	12.4	10.3	10.7	11.1	16.3	16.9	11.1	16.1
Not able to do written calculation	7.9	14.0	29.3	13.3	8.1	11.5	26.3	11.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

4.1.3. Profile of households of MIDA FBO farmers

The demographic characteristics of the household members of the selected FBO members are shown in

Table 4-3. The distribution of the household members by sex shows near gender parity with either sex constituting approximately 50 per cent of the number of household members. However, the same representation is not reflected on the sex of the head of household. The males dominating with about 87 per cent and about 88 per cent for the Batch I and Batch II respectively. Male dominance as household heads is more pronounced in the NAZ with more than 9 in 10 of all household heads being males.

Distribution of the household members by age shows a heavy representation at the base with more than 20 per cent of the household members being age less than 10 years. The age group 10-19 accounts for the largest percentage of the household members across all the MIDA zones, accounting for about 26 per cent of Batch I farmer households and about 25 per cent of Batch II farmer households. Combining these two age groups shows that more than 50 per cent of the

household members are less than 20 years of age. On the upper end of the distribution, 0.7 per cent are 80 years or older and less than 6 per cent of them are 60 years of age or older. The

Table 4-3 Household characteristics of FBO farmers

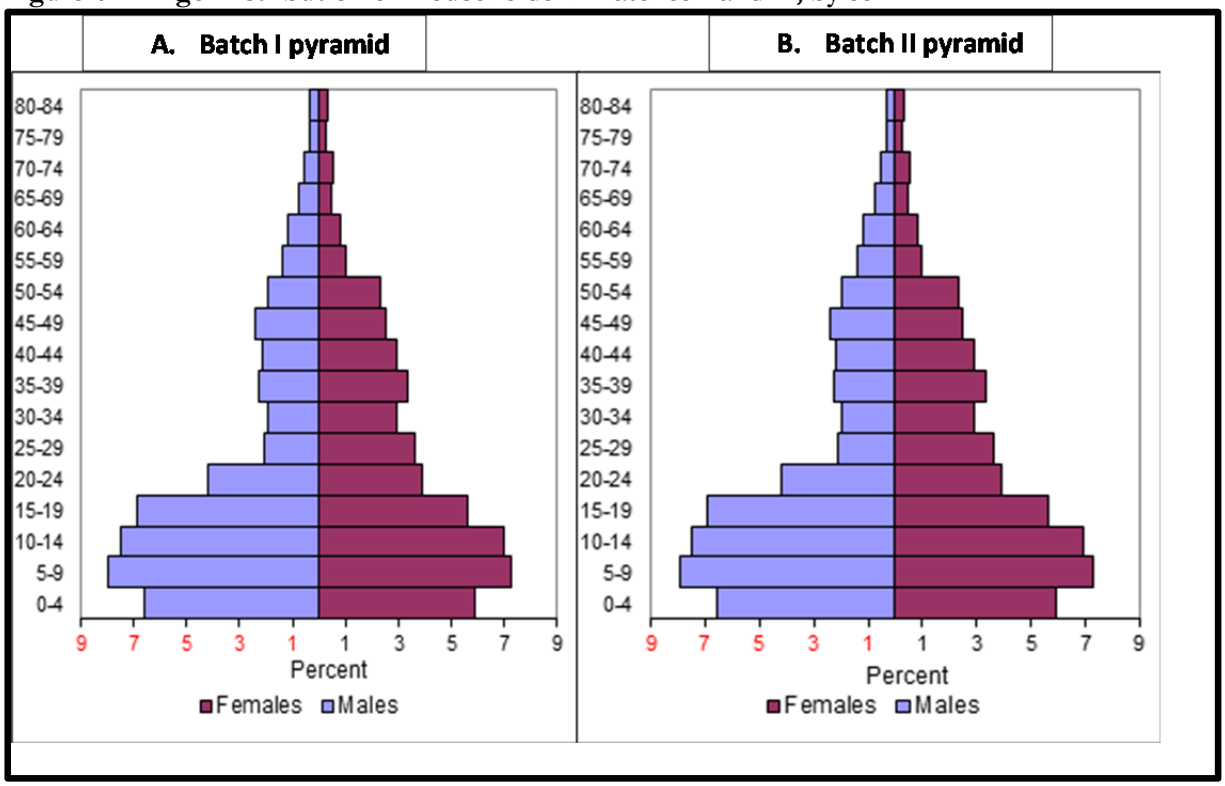
Variables	Batch 1				Batch 2			
	SHB	AFB	NAZ	Total	SHB	AFB	NAZ	SHB
Sex of Members								
Male	48.9	50.7	49.9	49.9	49.1	50.8	50.1	50.1
Female	51.1	49.3	50.1	50.1	50.9	49.2	49.9	49.9
Sex of household head								
Male	81.4	86.5	91.0	86.6	83.4	85.3	93.4	87.6
Female	18.6	13.5	9.0	13.4	16.6	14.7	6.6	12.4
10-year age groups								
0-9	22.2	26.4	31.4	27.4	24.8	28.2	33.1	29.6
10-19	28.4	28.5	23.9	26.6	28.3	26.1	23.3	25.4
20-29	14.7	11.2	15.2	13.7	11.9	10.8	13.5	12.3
30-39	10.3	10.8	10.1	10.4	11.0	11.4	10.5	10.9
40-49	11.0	11.0	8.2	9.9	11.9	10.7	8.8	10.2
50-59	7.4	7.4	5.2	6.5	7.3	7.2	5.3	6.4
60-69	3.2	2.8	3.5	3.2	3.0	3.6	3.3	3.3
70-79	1.8	1.3	1.9	1.7	1.2	1.3	1.6	1.4
80+	1.0	0.4	0.6	0.7	0.7	0.7	0.6	0.7
Dependency age groups								
0-14	37.2	42.1	44.0	41.7	39.8	42.6	45.7	43.3
15-60	56.8	53.3	50.0	52.8	55.4	51.9	48.8	51.3
60+	6.0	4.6	6.0	5.5	4.8	5.5	5.5	5.4
Mean dependency ratio	**0.9984**	**1.1094**	**1.2453**	**1.1377**	**1.0532**	**1.2035**	**1.2880**	**1.2051**
Household size								
1	17.7	19.2	13.2	16.4	19.6	20.4	13.8	17.3
2-3	33.5	34.7	26.0	30.9	35.8	36.2	26.8	31.9
4-5	26.5	26.4	23.1	25.1	27.1	26.0	23.6	25.2
6-7	13.9	13.4	17.0	15.0	12.7	12.0	16.7	14.2
8-9	5.0	4.5	10.2	6.9	3.9	3.8	9.6	6.4
10+	3.4	1.7	10.5	5.7	.8	1.5	9.5	4.9
Mean household size	**3.90**	**3.66**	**5.05**	**4.28**	**3.51**	**3.52**	**4.91**	**4.13**

median age is 18 years for Batch I and 17 years for Batch 2 with no much difference across zones. A pyramid of the age-sex distribution is shown in Figure4-1(a) and 4-1(b).

The dependency age groups and implied mean dependency ratios are also given in Table 4-3. About 4 in 10 of the household members are child dependants (age 0-14 years) and about 6 per cent are adult dependants (age 60 years or older). These give average household dependency ratio of about 1.14 for the Batch I sample and 1.21 for the Batch II sample with some differentials across MiDA zone. For both Batches, the dependency ratio is higher for households in the NAZ than for the two other zones.

The distribution of the household size shows that more than 50 per cent of the households consist of more than 3 members and about 10 per cent of the households consist of 8 or more members. Farmers in the NAZ tended to have larger household sizes with mean household size of 5.05 members for the Batch I farmers compared to 3.90 and 3.66 for the corresponding farmers in the SHB and AFB zones respectively. Average household size for the entire Batch I farmers is 4.28 persons. This pattern of the household size across the MiDA zones and the implied overall average household size is similar to the Batch II intake of farmers.

Figure 4-1 Age Distribution of Households in Batches I and II, by sex



4.2. Agricultural Related Activities

4.2.1. Land Information

Introduction

This section of the report discuses land sizes, total land holdings, irrigation and the major crops that farmers in the FBOs cultivated.

4.2.2. Plot Sizes and total land holdings

The average plot size of the farms cultivated by the sample farmers is between one hectare and one and a half hectares (
Table 4-4). For the first batch, the average plot size reduced from 1.39 to 1.15 for the treatment group between the baseline and the follow-up. During the same period that of the control group fell also marginally from about 1.6 to 1.2 hectares. The pattern is similar also for the batch two.

Table 4-4 Average Plot Size by MiDA Zone, Treatment, Round and Batch (Hectares)

	Batch 1			
	Round 1		Round 2	
MiDA Zone	Treatment	Control	Treatment	Control
Southern Horticultural Belt	0.90	1.00	1.09	1.24
Afram Basin	1.52	1.62	1.24	1.33
Northern Agriculture Zone	1.17	1.24	1.11	1.08
All	1.39	1.55	1.15	1.20
	Batch 2			
	Round 1		Round 2	
MiDA Zone	Treatment	Control	Treatment	Control
Southern Horticultural Belt	1.39	1.20	1.36	1.65
Afram Basin	1.07	1.16	1.05	1.21
Northern Agriculture Zone	1.06	1.22	0.99	1.13
All	1.14	1.20	1.09	1.27

The total land holdings controlled by a household is directly related to how much land they can allocate to the cultivation of crops or used for share cropping arrangements. Across the MiDA Zones and over the different waves most households average land holdings range between 1.3 hectare and 4.1 hectares, a characteristic of small holder agriculture in Ghana. Between the treatment and control groups, little or no differences are observed. The average total household land holding is about 3 hectares. For the first batch, the average for the treatment group fell between the rounds from 2.7 to 2.6 whilst that of the control group increased from about 2.7 to 3 hectares. For the second batch, no change was observed on average between the rounds for the land holdings of the treatment group whiles that of the control group fell marginally from 3.3 to 3 hectares

Table 4-5 Average Total Land Holdings of Households by MiDA Zone, Treatment, Round and Batch of FBO Survey

	Batch 1			
	Round 1		Round 2	
MiDA Zone	**Treatment**	**Control**	**Treatment**	Control
Southern Horticultural Belt	1.6	1.3	1.9	2.3
Afram Basin	2.9	2.7	2.7	3.3
Northern Agriculture Zone	3.6	4.1	3.4	3.4
Total	2.7	2.7	2.6	3
MiDA Zone	**Batch 2**			
	Round 1		**Round 2**	
	Treatment	**Control**	**Treatment**	**Control**
Southern Horticultural Belt	1.8	2.6	2.1	1.7
Afram Basin	2.5	2.9	2.3	3.4
Northern Agriculture Zone	3.3	4.5	3	3.9
Total	2.5	3.3	2.5	3

Table 4-6 Proportion of Plots Watered From a Source other than Rain (%)

	Batch 1			
	Round 1		Round 2	
MiDA Zone	**Treatment**	**Control**	**Treatment**	**Control**
Southern Horticultural Belt	0.28	0.25	0.21	0.23
Afram Basin	0.08	0.07	0.06	0.07
Northern Agriculture Zone	0.04	0.03	0.02	0.02
Total	0.11	0.09	0.08	0.09
	Batch 1			
	Round 1		**Round 2**	
MiDA Zone	**Treatment**	**Control**	**Treatment**	**Control**
Southern Horticultural Belt	0.11	0.12	0.11	0.11
Afram Basin	0.05	0.06	0.03	0.04
Northern Agriculture Zone	0.01	0	0.01	0.01
Total	0.05	0.05	0.04	0.04

The majority of plots of the farmers in the MiDA FBOs rely on rain for agriculture production. However there remain a number of farmers that water their farms using other sources of water. We note that the proportion of farmers that use irrigation water is higher for the Southern Horticultural Belt than it is for the two other zones. The proportions of plots that use other sources of water other than rain water, in the Southern Horticultural Belt is between 10 and 20 per cent. For the Northern and Afram zones the recorded proportions are below 10 per cent on average (Table 4-6). We also note that the between the two rounds the proportions reduced marginally.

4.2.3. Major Crops grown by Farmers

The main crops grown by the FBO farmers are cereals (maize, rice, millet, and sorghum), root crops (yam, cassava, and cocoyam), and vegetables (tomatoes, pepper, okro and garden eggs). Farmers also grow legumes (beans/peas and groundnuts), plantain, and fruits such as orange, mangoes, pineapple and pawpaw.

The crop that is planted by most of the households is maize, planted by about 75 per cent of the farmers in the baseline survey and for the Batch 1. This increased to about 87% in the follow-up period (Table 4-7). The proportions are even higher for the second batch (86% for round one and 92% for the follow-up). The increase in the proportion of that plant maize between the rounds of the survey may be partly due to the starter pack which included maize seeds.

The distribution of the various crops grown by the MiDA zone and the different waves are reported in Table 4-7. We note that crops such as rice, millet, sorghum, groundnuts and soybean are predominantly cultivated in the Northern Agricultural Zone. Pineapple, tomatoes and mango are predominant in the Southern Horticultural Belt. For the Afram Basin we find that plantain and cocoyam are relatively important. For yam cultivation, we find it to be important in the Northern Agricultural Zone and the Afram Basin, whiles cassava and pepper are important in the Afram Basin and the Southern Horticultural Belt. Okro cultivation is mainly in the Northern Agricultural Zone and Southern Horticultural Belt. The reported distribution in Table 4-7 shows no significant switching of crops.

Table 4-7 Major crops grown and the proportion of households that grows them

	Batch 1 Round 1			Batch 1 Round 2			Batch 2 Round 1			Batch 2 Round 2		
Maize												
MiDA Zone	Treat	Control	Total	Treat	Control	Total	Treat	Control	Total	Treat	Control	Total
SHB	69.1	67.8	68.5	82.7	81.1	81.9	88.0	80.4	84.3	94.1	85.3	89.7
AFB	78.5	82.7	80.4	85.6	85.9	85.7	89.8	79.8	84.8	95.2	83.5	89.2
NAZ	73.3	69.3	71.4	95.5	90.1	92.9	88.5	89.8	89.2	98.0	95.3	96.6
Total	74.4	74.7	74.5	88.0	86.0	87.1	88.8	83.5	86.2	95.9	88.1	91.9
P-value	0.881			0.137			0.000			0.000		
Beans/Peas												
SHB	3.5	3.6	3.5	2.5	5.3	3.8	4.3	8.2	6.2	7.9	5.3	6.6
AFB	13.7	17.5	15.5	14.6	16.3	15.4	15.2	12.3	13.7	15.2	14.7	15.0
NAZ	17.2	12.0	14.7	10.2	11.8	11.0	12.3	16.4	14.3	12.4	15.1	13.8
Total	11.8	12.1	11.9	10.1	11.9	10.9	11.2	12.7	11.9	12.2	12.3	12.3
P-value	0.827			0.151			0.225			0.948		
Cassava												
SHB	29.3	34.0	31.5	56.5	60.1	58.2	64.7	67.7	66.1	64.4	68.9	66.6
AFB	45.3	44.5	44.9	56.3	53.4	54.9	57.4	64.1	60.7	55.9	63.0	59.5
NAZ	5.4	11.1	8.2	11.9	12.3	12.1	10.9	12.6	11.7	6.9	10.0	8.5
Total	29.8	32.1	30.9	42.2	41.7	41.9	43.1	46.6	44.8	41.1	46.0	43.6
P-value	0.215			0.812			0.065			0.008		
Yam												
SHB	3.7	9.1	6.2	7.7	8.6	8.2	5.4	7.3	6.3	9.2	10.4	9.8
AFB	34.1	34.4	34.2	37.4	34.3	35.9	26.5	29.3	27.9	28.7	32.3	30.6
NAZ	28.9	31.3	30.0	30.0	32.4	31.2	30.4	36.1	33.3	31.6	40.4	36.1
Total	24.1	26.4	25.2	27.4	26.9	27.2	22.0	26.0	24.0	24.3	29.2	26.8
P-value	0.176			0.765			0.015			0.003		
Groundnut												
SHB	2.7	5.8	4.1	3.4	4.0	3.7	3.8	4.1	4.0	2.1	4.6	3.3
AFB	18.8	22.6	20.6	16.8	17.8	17.3	20.5	19.7	20.1	15.4	14.3	14.9
NAZ	71.9	73.5	72.7	58.6	67.0	62.6	63.3	75.8	69.6	58.7	70.0	64.4
Total	28.9	32.3	30.5	26.7	30.3	28.4	30.9	35.7	33.3	26.9	31.2	29.1
P-value	0.061			0.051			0.007			0.011		

4.3. Households Input Use

4.3.1. Chemical Use by Farmers

Types of Chemical Used

The various forms of chemicals applied by farmers in agriculture production are shown in Table 4-8. Overall we do find that inorganic fertilizers are the most used chemicals on farms in the sample. This is followed by the use of herbicides, insecticides and organic fertilizers in that order. Across the different zones however one notes some differences. For instance in the Afram Basin, herbicides seem to be the most important chemical used on farms, followed by

inorganic fertilizers. One also observes some differences in the importance of the different chemicals use across the two batches.

Three key features can be discerned from Table 4-8. First we note that inorganic fertilizer and herbicides are the most used forms of chemicals on farms. Second, there seems to be an increase in importance of inorganic fertilizer and herbicides use over the two periods. This change in the relative importance of these two types of chemicals seems to vary across the three zones. Finally we note that there is little difference between the treatment and control groups in terms of the relative importance of the use of these two chemicals.

Table 4-8 Type of Chemical used by farmers, by MiDA Zone as well as Treatment and Control groups

	Batch 1 Round 1						**Batch 1 Round 2**					
	Treat	**Control**	**Treat**	**Control**	**Treat**	**Control**	**Treat**	**Control**	**Treat**	**Control**	**Treat**	**Control**
Type of Chemical	SHB		AFB		NAZ		SHB		AFB		NAZ	
Fertilizer (organic)	8.0	10.5	5.5	3.1	1.8	2.0	9.9	8.7	3.3	2.7	1.8	2.3
Fertilizer (inorganic)	50.0	46.6	18.7	22.4	54.4	49.3	50.5	44.2	37.4	27.1	58.1	53.0
Herbicide	23.5	32.2	58.0	58.2	42.4	46.4	22.4	23.4	43.0	53.2	37.7	40.9
Insecticide	14.8	8.4	15.7	13.5	1.2	2.3	10.0	14.3	13.5	13.9	2.3	3.5
Fungicide	1.8	2.1	0.8	1.1	0.0	0.0	5.6	7.1	2.7	3.0	0.1	0.1
Other	2.0	0.3	1.4	1.6	0.3	0.0	1.6	2.3	0.1	0.1	0.0	0.1
Total	100	100	100	100	100	100	100	100	100	100	100	100
	Batch 2 Round 1						**Batch 2 Round 2**					
	Treat	**Control**	**Treat**	**Control**	**Treat**	**Control**	**Treat**	**Control**	**Treat**	**Control**	**Treat**	**Control**
Type of Chemical	SHB		AFB		NAZ		SHB		AFB		NAZ	
Fertilizer (organic)	6.8	5.5	2.8	1.6	2.0	1.4	4.9	5.6	1.2	0.8	4.6	6.9
Fertilizer (inorganic)	38.7	37.7	24.2	26.6	50.2	49.0	46.5	38.1	39.2	27.2	45.0	38.0
Herbicide	40.0	38.4	55.9	56.2	43.5	46.9	37.0	44.2	48.1	59.9	47.7	52.4
Insecticide	10.4	12.2	14.4	13.4	4.2	2.7	8.6	10.0	9.7	9.7	2.1	2.4
Fungicide	3.2	2.9	2.3	1.7	0.1	0.1	2.8	1.9	1.5	2.0	0.5	0.4
Other	0.8	3.4	0.4	0.5	0.1	0.0	0.1	0.2	0.3	0.4	0.1	0.0
Total	100	100	100	100	100	100	100	100	100	100	100	100

Chemical Use Value

For the Batch 1 data, the average value of chemicals used by farmers in all intervention zones increased over the two rounds for both the treatment and control farmers. The average chemical use values for the treatment group are higher than that of the control group. For the Batch 2 data, we note that the chemical use value for the treatment group increased while that of the control group declined (Table 4-9).

Table 4-9 Average chemical use value, by MiDA Zone, Batch and Round

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Batch11_T[2]	Batch11_C	Batch12_T	Batch12_C	Batch_21_T	Batch_21_C	Batch_22_T	Batch_22_C
SHB	159.1	156.8	412.3	326.7	224.5	273.5	303.3	222.5
AFB	109.7	91.5	343.6	237.6	200.0	217.1	279.7	216.9
NAZ	100.6	100.4	272.0	217.1	215.7	231.2	261.1	221.2
Observations	911	773	1,230	1,114	1,352	1,400	1,352	1,400

4.3.2. Type of seed/seedlings

Farmers use either improved seeds, which they mostly buy from the market, or local seeds from their own farm or from friends and relatives. Generally one expects that the yield from the improved seeds will be higher than that of local seeds. However the costs of procuring the improved seeds are also higher. It is therefore a case of investing more to elicit even more returns.

Our data shows that generally the FBO farmers in our sample use local seeds. However there are important zonal differences. Generally the probability is much higher that a farmer from the southern part of the country (SHB) will use improved seeds compared to their counterparts from the Northern Zone. For instance, for the first batch, we note some differences in the proportion of improved seeds used across the zones. Farmers in the South (57% for the treatment and 42% for the control) used more improved seeds than those in the Afram Basin (31% for both groups), and those in the North used even less improved seeds (9.6% for the treatment and 15% for the control) in the baseline. We do not see much change in the pattern in the follow-up. However we do note that for the treatment group in the Southern Horticultural Belt, the use of improved seeds reduced from 57 to 47 per cent. For the farmers in the control group, we observe a reduction in the use of improved seeds across all the zones.

[2] **Batch11_T** stands for Treatment group of Batch one round one; **Batch 11_C** stands for Control group of Batch one round one;**Batch12_T** stands for Treatment group of Batch one round two; **Batch12_C** stands for Control group of Batch one round two; **Batch21_T** stands for Treatment group of Batch two round one; **Batch21_C** stands for Control group of Batch two round one;**Batch22_T** stands for Treatment group of Batch two round two;**Batch22_C** stands for Control group of Batch two round two.

Table 4-10 Type of Seed used by farmers, by MiDA Zone as well as Treatment and Control groups

	Batch 1											
	Round 1						Round 2					
	Treat	Control	Treat	Control	Treat	Control	Treat	Control	Treat	Control	Treat	Control
Type of Seed	SHB		AFB		NAZ		SHB		AFB		NAZ	
Improved[1]	57.4	42.1	30.9	30.9	9.6	15.1	47	37.5	37.5	24.2	25.7	10.6
Local	42.5	57.2	68.9	69.1	89.5	84.8	50.7	60.3	61.4	73.6	72.6	88.8
Don't Know	0.2	0.7	0.2	0	0.9	0.2	2.3	2.1	1	2.3	1.7	0.7
	Batch 2											
	Round 1						**Round 2**					
	Treat	Control	Treat	Control	Treat	Control	Treat	Control	Treat	Control	Treat	Control
Type of Seed	SHB		AFB		NAZ		SHB		AFB		NAZ	
Improved	34.3	31	22.4	21.9	10.7	9	51.9	33.2	39.3	22.1	18.5	9.5
Local	62.4	65	76.2	78	89.2	90.9	45.6	65.4	59.9	77.6	78.7	86.8
Don't Know	3.3	4	1.4	0.2	0.1	0.1	2.5	1.4	0.8	0.4	2.9	3.7

4.3.3. Labour use on Household Farms

Agriculture in Ghana still remains not mechanized and this is reflected, particularly for rural farmers, in the use of labour intensive system of farming. Training farmers may affect the average and relative amount of hours they devote to the various aspects of farm work. There results presented in Table 4-11shows that the total labour hours used for farm work reduced between the baseline and the follow-up for both batches and across the treatment and control groups. For the first batch, the average amount of total labour hours for the treatment group reduced from about 1,065 to 790 hours for the treatment group and that of the control group reduced from 1029 to 657 hours. Similar reductions are also noted for the Batch 2. Generally the data shows little difference between the total labour hours used by the treatment and the control group.

In the same table we are able to tell whether the relative importance of the application of labour to the different stages of production changed over the two periods. For both the treatment and the control groups in the first round of the Batch 1, we note that land preparation did take up the most of the labour hours. This was followed by harvesting, farm management and post-harvest activities in that order. In the second round however, the order of importance changed to become harvesting, farm management, land preparation and post-harvest activities.

With respect to farmers in the second batch, the order of importance was harvesting, farm management, land preparation and post-harvest activities. Only minor changes in the order are observed for this batch.

Table 4-11 Average man-hours spent by farm activity

Farm Activity	Batch 1				Batch 2			
	Round 1		Round 2		Round 1		Round 2	
	Treat	Control	Treat	Control	Treat	Control	Treat	Control
Land Preparation	613.7	598.8	157.4	126.5	132.8	176.4	83.1	83.1
Field Management	129.3	145.6	239.1	207.3	228.9	405.9	196.4	233.7
Harvesting	280.2	250.2	267.2	228.8	233.8	275.3	123.2	125.1
Post Harvest	41.7	34.1	126.6	94.2	127.1	136.6	82.9	73.3
Total	1,064.80	1,028.70	790.3	656.8	722.5	994.2	485.6	515.2

4.4. ACCESS TO CREDIT

4.4.1. Introduction

Productive agriculture requires different important inputs, among which is credit. This section provides information on household access to loans, the sources of household loans and the amounts households received as loans. The information is organized by batch, round, MiDA zones and treatment/control.

4.4.2. Source and Amounts of Credit

Table 4-12 shows the proportion of household members who attempted to contract loans in the 12 months preceding the survey by batch, MiDA zone, round of interview and whether these individuals are in the treated or control group. For the first batch, an average of 3.7 per cent of household members attempted to contract loans at baseline (round one). For the follow-up period, the average proportion of household members who attempted to contract loans increased to 10.9 per cent for the total sample. The increment was true for both the treated and control groups, and in two of the three zones, with the exception being the control group in the Northern Agriculture Zone.

For the second batch, one notes that the proportion of household members who attempted to contract loans increased from 6.8 per cent to 8.7 per cent over the two periods. The proportions increased for both treated and control groups in the three zones except for the control group in the Afram Basin who recorded a slight decrease (0.7%).

Table 4-12 Proportion of Household members who attempted to contract loans (%)

Batch 1						
	Round 1			Round 2		
MiDA Zones	Treated	Control	Total	Treated	Control	Total
Southern Horticultural Belt	3.7	4.3	4.0	12.3	8.6	10.5
Afram Basin	3.5	3.9	3.7	16.7	13.1	15.1
Northern Agriculture Zone	3.1	3.9	3.5	11.5	2.8	7.3
Total	3.4	4.0	3.7	13.7	7.8	10.9
P-value	0.082			0		
Batch 2						
	Round 1			Round 2		
MiDA Zones	Treated	Control	Total	Treated	Control	Total
Southern Horticultural Belt	7.8	7.3	7.6	11.9	11.6	11.8
Afram Basin	10.9	10.6	10.8	10.9	9.9	10.4
Northern Agriculture Zone	4.1	3.0	3.5	6.9	4.8	5.8
Total	7.2	6.4	6.8	9.4	8.0	8.7
P-value	0.063			0.002		

Table 4-13shows the sources from which loans are contracted among the various groups. At the baseline for the first batch, *relative/neighbour/friend* was identified as the primary source of household loans, with no significant difference in the responses of the treated and control groups. It is evident that in the follow up MiDA was the primary source of loan for both treated and control groups (64.8% and 53.5% respectively). The statistics for the second batch also show that both groups benefitted by borrowing from MiDA (from 39.8% in the baseline to 65% in the follow-up). There seem to be no significant difference in the source of loans between the treated and control groups for both the baseline and follow-up survey.

Table 4-13 Proportional Distribution of where loans were sought by Batch and Round

Batch 1						
	Round 1			Round 2		
Source	Treated	Control	Total	Treated	Control	Total
Relative/neighbour/friend	63.1	68.0	65.6	17.4	19.9	18.2
MiDA loan				64.8	55.5	61.7
Other Institutions	36.9	32.0	34.4	17.8	24.6	20.1
Total	100	100	100	100	100	100
P-value	0.3191			0.0994		
Batch 2						
	Round 1			Round 2		
Source	Treated	Control	Total	Treated	Control	Total
Relative/neighbour/friend	29.2	34.9	31.9	12.4	17.6	14.8
MiDA loan	44.1	35.1	39.8	65.7	64.2	65.0
Other Institutions	26.8	29.9	28.3	21.9	18.3	20.3
Total	100	100	100	100	100	100
P-value	0.2401			0.3634		

We present the average amounts of loans received by household members, by the source of the loan in Table 4-14.The amounts for the first batch shows, household members received an average of aboutGH¢400.00 as loans. We find no statistically significant difference in the sources of loans for both treated and control groups for the baseline survey.

For the follow-up the loan amounts for Batch 1 shows an increase to over GHC1, 000.00. We also find that there are significant differences in the loan amount received from the various sources. While the treated group received an average amount of GH¢1,232.44 as MiDA loans, the control group received an average of GH¢458.92 from the same source.

In Batch 2, there are no statistically significant differences in the loan amounts received by both the treated and control groups. Average loan amounts for the total sample increased from GH¢746.52 to GH¢1029.08. On the whole, the amount of loans received from all sources increased except for that from *relative/neighbour/friend* by the treated group which decreased by GH¢268.45.

Table 4-14 Mean Loan Amounts by Source, Treatment and Control

Batch 1						
	Round 1			**Round 2**		
Source	Treated	Control	Total	Treated	Control	Total
Relative/neighbour/friend	242.64	234.88	238.52	653.18	554.70	615.42
MiDA loan				1232.44	458.92	1204.35
Other Institutions	517.04	921.86	710.07	1008.85	1059.88	1028.68
Total	343.47	453.74	399.98	1067.56	792.45	1006.54
P-value	0.3191			0.0994		
Batch 2						
	Round 1			**Round 2**		
Source	Treated	Control	Total	Treated	Control	Total
Relative/neighbour/friend	571.10	414.10	482.49	302.65	504.89	415.70
MiDA loan	384.57	495.56	428.00	1439.67	857.06	1324.50
Other Institutions	801.88	1423.49	1151.94	1261.36	1834.24	1508.49
Total	649.13	824.43	746.52	1015.70	1046.65	1029.08
P-value	0.2401			0.3634		

4.4.3. Crop Incomes

A key indicator required for assessing the overall programme objective of MiDA is the incomes from crops. We discuss the baseline annual crop incomes that farmers derived from selected crops in the different batches, by rounds and by the treatment group. The results are presented in Table 4-15.

We note that pineapples have the highest crop incomes/profits. In the baseline for Batch 1 the average annual crop income for a household from pineapple was about GH¢1,318. This is

followed by pepper which gave the average annual household income of about GH¢988. The importance of pineapple also shows up in the Batch 2 data. However in this second batch two, other important crops, in terms of incomes, were yams (GH¢1,453) and cassava (GH¢843). The high income from pineapple is consistent with prior expectations. Indeed, pineapple is one of the very important non-traditional exports for Ghana. The crop incomes are lowest for crops that thrive relatively more in the Northern Agricultural Zone – soya, sorghum and millet. In the baseline for Batch 1, the average household income from soybean, sorghum and millet were respectively GH¢154, GH¢131 and GH¢153.

Generally, at the baseline the data is balanced in terms of crop incomes. This means that the crop incomes were not significantly different for a household in the treatment relative to the control group. The only exception for the Batch 1 is millet. In the case of the Batch 2, it is only sorghum that we find a significant difference between the treatment and the control groups, at a 5 per cent significance level. A slightly different result is obtained when one considers the average total crop income for households. In that case, we note that in the baseline for Batch 1, the average total crop income is significantly higher for the treatment group than it is for the control. However for the Batch 2, there is no statistically significant difference between the treatment and the control.

For almost all crops, we observe an increase in the incomes over the two periods. Probably the largest increase (in percentage terms) is that for yams in batch one – and this is true across the treatment groups. Other marked increases over the rounds (i.e. change between baseline and follow-up) include those for maize, rice, and mangoes in Batch 1and rice and groundnuts in Batch 2. At the household level, we observe an increase in the average total crop income over the two periods.

4.4.4. Farm Yields

Table 4-16shows the average yields for selected crops for each batch and over the two waves (baseline and follow-up) of the data. We note that pineapple yields are the highest amongst the selected crops. This is true for all the batches and over all the rounds – the exception being the yields for mangoes in Batch Two[3]. Other crops with relatively high yields include cassava and yams, but their relative importance differs by batch and round. Again, we note that average yields are relatively low for crops grown in the Northern Agriculture Zone[4]. For instance, for crops such as sorghum, millet and soybean, all crops grown predominantly in the NAZ, the average yields are respectively about 0.5-1.3tonnes/ha, 0.9-1.2tonnes/ha, and 0.8tonnes/ha for the Batch 1 baseline.

[3]It is important to note that mangoes have low degrees of freedom in the yields sample. The loss in the degrees of freedom in some of the data is mainly because some of the households could not supply all the relevant information for the calculation of the yields

[4]We need to mention here that we are merely comparing the yields across the selected crops and not necessarily benchmarking these yields by their potential

We observe from the yields table that in the baseline for Batch 1, all the crops are balanced in the sense that the average yield is statistically not different for the treatment and control at 5 per cent significance level. We also note that in the baseline for Batch 2, the treatment and control are not statistically different for all the crops except rice at a 5 per cent significance level.

These recorded yields in the MiDA zones are comparable to some of the reported statistics on crop yields. For instance, ISSER (2010)[5] reports maize yields as ranging from about 1.2 tonnes/ha to 1.6 tonnes/ha over the period 2004 to 2009. In fact the reported maize yield of about 1.6 tonnes/ha in 2009 in the ISSER (2010) report is not too different from the yields reported here of about 1.5 tonnes/ha. For yam, the reported yield in the ISSER (2010) report is about 5.8 tonnes/ha in 2009. In Table 4-16 the yields for all the batches and rounds, except for Batch 1Round 1, was between 5.6 tonnes/ha and 6.9 tonnes/ha for yam. For cereals such as millet, sorghum and rice, the yields obtained in our sample is higher than that reported in ISSER (2010). For cassava, the reported yield in ISSER (2010) is higher than that reported in Table 4-16. For instance in ISSER (2010) the reported yield for cassava in 2009 was 12.3 tonnes/ha as against the highest of 4.7 tonnes/ha recorded in the baseline for batch one.

[5]ISSER, (2010) 'The State of the Ghanaian Economy in 2009)', *Institute of Statistical Social and Economic Research*, University of Ghana, Legon, Accra

Table 4-15 Average Crop Income for selected crops by Batch and Round

	Batch 1						Batch 2					
	Round1			Round 2			Round 1			Round 2		
	Treatment	Control		Treatment	Control		Treatment	Control		Treatment	Control	
VARIABLES	Mean	Mean	P-value	Mean	Mean	P-value	Mean	Mean	P-value	Mean	Mean	P-value
Maize	543.0	344.9	0.1278	760.7	712.5	0.5747	625.1	636.9	0.869	786.1	748.1	0.572
Cassava	473.0	196.8	0.2885	270.7	684.4	0.1104	843.3	1,790.8	0.2422	491.6	415.3	0.6941
Soya	153.8	92.8	0.1675	161.1	97.8	0.2955	187.7	118.7	0.0837	185.0	303.8	0.2089
Yams	497.0	360.3	0.4029	1,568.3	957.3	0.1523	1,453.2	1,504.5	0.9132	1,239.1	1,366.2	0.7681
Sorghum	131.3	126.8	0.9541	193.3	365.7		208.3	1,118.7	0.04	450.6	718.2	0.5106
Rice	278.6	403.1	0.2372	887.4	788.0	0.6958	604.1	502.8	0.2297	1,125.0	974.5	0.4524
Millet	153.0	49.6	0.0097	180.2	75.5	0.3475	295.2	300.8	0.9569	462.7	550.3	0.7801
Groundnuts	299.0	244.3	0.5365	378.6	370.7	0.9154	264.7	283.5	0.7111	495.0	612.6	0.2088
Pineapples	1,318.4	769.1	0.2952	1,531.2	3,920.3	0.2412	1,733.8	3,901.3	0.4366	2,340.2	3,225.9	0.6583
Mangoes	783.8	231.5		3,179.9	1,299.8	0.6866						
Pepper	988.4	321.7	0.2251	1,012.1	396.6	0.069	571.9	607.5	0.9087	466.6	248.7	0.1317
Average Total	617.5	395.6	0.0104	847.8	800.1	0.6311	692.4	802.6	0.2037	855.2	911.8	0.4545

Table 4-16 Average Yield for selected crops by Batch and Round

	Batch1						Batch2					
	Round 1			Round 2			Round 1			Round 2		
	Treatment	Control		Treatment	Control		Treatment	Control		Treatment	Control	
VARIABLES	Mean	Mean	P-value	Mean	Mean	P=value	Mean	Mean	p-value	Mean	Mean	p-value
Cassava	4.7	3.6	0.2158	3.5	3.5	0.9875	4.4	3.3	0.067	2.7	2.6	0.7836
Groundnut/Peanut	0.7	0.8	0.3954	0.9	1.0	0.1357	1.0	1.1	0.7899	1.3	1.4	0.886
Sorghum	0.5	1.3	0.0861	0.6	1.0	0.2123	1.1	0.7	0.4025	0.8	0.9	0.3772
Maize	1.5	1.5	0.9415	1.6	1.6	0.9925	1.6	1.5	0.2237	1.2	1.2	0.4565
Mango	0.1			2.9	1.4	0.5609		29.6		2.5	3.7	
Millet	0.9	1.2	0.1646	0.9	1.0	0.6996	0.7	0.9	0.5301	0.6	0.6	0.3753
Pepper	1.7	1.4	0.6487	2.4	0.9	0.1394	1.5	0.9	0.4735	0.7	1.1	0.4969
Pineapple	22.6	23.9	0.7973	18.4	9.5	0.2456	15.1	4.1	0.1863	31.3	9.6	0.0074
Rice	0.8	0.9	0.4745	1.5	1.6	0.8862	1.6	1.3	0.0438	1.6	1.4	0.1413
Soybean	0.8	0.8	0.7699	0.6	0.6	0.6691	0.7	0.6	0.6277	0.8	0.6	0.0841
Yam	2.6	3.2	0.0858	5.6	6.3	0.2818	6.9	6.2	0.4465	5.7	5.8	0.9489
Observations	1,199	1,113		1,529	1,455		2,479	2,718		2,305	2,489	

5. Analytical Technique

The general analytical framework is based on a difference-in-difference approach. Following Kremer and Miguel (2003) we specify a model which captures the difference in project impact (outcome) across treatment and comparison FBOs 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 FBOs assigned in the first and second phases of the treatment groups, respectively;
- X_{ijt} is a vector of variables capturing information of the surveyed FBO members, at the level of both the farmer and the FBO s/he belongs to;
- $_{i, j}$and $_t$ refers to the FBO, the farmer and the time over which data is captured;
- and ε are the disturbance terms, with the former capturing the effect at the FBO level.

Across the FBOs however, both terms are independent but clustered within FBOs; the panel structure of the data will permit more general error structures. Most importantly,β_1 and $\beta_2$are the coefficients measuring the difference-in-difference estimate of the project impact (in respect of the outcome for the FBOs 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 of such an econometric method is 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 behavioural characteristics (including gender, marital status, age categories, etc.) and other dummy variables for the different cohorts in the model 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 training) group and 1 if in the treatment (early training) 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. Let us call this 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 easily 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 can be summarised as follows:

Table 5-1 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	$Y^*_{D1} - Y^*_{C1} = \beta_1$	$Y^*_{D2} - Y^*_{C2} = \beta_1 + \beta_3$	$\Delta\Delta Y^* = \beta_3$

The list of variables used in the tables presented in the next section (impact evaluation regressions) are defined as follows:

Time 2	Categorical variable which takes the value of 1 in period 2; 0 otherwise
Treatdum	Categorical variable which takes the value of 1 if in treatment group and 0 if in control group
Treattime	Impact variable which measures the impact of the training on variables of interest. (difference-in-difference estimator)
Batchdum/Batch_two	Categorical variable which takes the value of 1 if Batch is two and 0 if batch is one
mean_rainfall	Averages of rainfall for the three zones to control for rainfall in regression
Treattime_South	Interaction of Treattime with Southern Horticultural Belt
Treattime_Afram	Interaction of Treatime with the Afram Basin
Treattime_North	Interaction of Treattime with the Northern Agriculture Zone

6. Impact of MiDA Training and Starter Pack on Key Outcomes

6.1. Impact Estimates on Crop Yields, Incomes, Revenues and Costs

Our results show that training does not affect crop yields. This result relates to the aggregate for all the three zones (Table 6-1). We however do find differential impact at the zonal level as shown in column 5 in the table. We also test for the effects on the yields for maize and find no significant effect of the training and starter pack. In other words, in spite of the maize seeds given to farmers (as part of the starter pack) in the treatment group, we do not find any significant increases in yields over and above those in the control group.

Discussions with some of the farmers across the three zones give some pointers as to possible reasons why the programme may not have impacted on yields as expected. Some of these factors are outlined as follows. First, there seem to have been some level of contamination of the control group. This was a problem that the farmers in the southern zone particularly raised strongly. There were two sources of this contamination. One was from the control farmers attending training sessions meant for the treatment group. The other source was engendered by the situation where farmers who got the training went around to their colleagues in the control group (who may have been part of some 'original' groupings) and taught them what they had learnt. Whereas the first was an implementation challenge, the second reflects positive spillovers of the training[6]. Our discussion with MiDA and also what we learned from the validation workshops suggests that both sources of contamination were limited[7]. Consequently instrumenting for actual treatment should have enabled us to pick impacts, if there was any.

A second possible reason for the statistical results obtained and inferred from the discussions with the farmers may be related to rainfall patterns plus the use of the improved seeds. Some of the farmers in the southern zone, for instance, made the point that the rains failed in the follow-up year (this was raised mostly by Batch II farmers). This factor coupled with the use of improved seeds could have accounted for the marginal decline in yields for the treatment farmers in this zone. Our discussions with MoFA extension officers revealed that the improved maize seeds are very sensitive to rainfall variability and also to the timing of the harvest. Farmers for instance mentioned that some of their maize got rotten on their farms. The MoFA technical officers explained that this was because for the improved maize varieties farmers had to harvest them earlier than what they normally would have done with their 'traditional' seeds. Of course farmers did not plant only maize, but because maize dominates in terms of coverage, it may be

[6]We did try different specifications but it did not change the main results. For instance we did include covariates and also tried to remove the effects of the contamination by instrumenting for the intention to treat using actual treatment (i.e. those who said they had had treatment).

[7] We calculate the proportion of the sample that were contaminated as about 4.5%. This is calculated as the proportion of control farmers that got training in Round I.

part of the reason why the marginal impacts for the southern zone were not significant. Indeed, this would support the argument that one year was too short a period to begin to see significant changes in some of these outcome indicators.

Another reason for the no impact on yields result may be that the technical training offered to farmers in the treatment group did not give them an advantage over their colleagues in the control group with respect to the technical training. Over the years, MoFA has provided farmers with requisite technical knowledge needed for their farm activities. Our discussions with farmers in the intervention zones revealed that, technical training provided them were not significantly different from what MoFA had given them in the past except that the MiDA training placed emphasis on producing for sale and not just for domestic consumption. In such a case, changes in yields may not differ significantly among the two groups.

Different model specifications (see Appendix) also show that, training and starter pack did not impact on crop yields. With the exception of the Afram Basin, which shows a positive effect attributable to the intervention, no impact is found in the SHB and NAZ.

A major component of the MiDA FBO training was the commercialization of farming activities which included sales and marketing of output. The training provided farmers, was among other things, expected to help farmers improve on their marketing prowess, leading to increased sales of farm produce. Our results for crop incomes takes into account the total value of output produced. The results for household crop incomes follow a similar pattern as that of crop yields. We find no impact of the training on the overall crop incomes. However, we do find differential impacts for the different zones. The results show a positive impact of the intervention on crop incomes among farm households in the Northern Agricultural Zone but negative for the Southern Horticultural Belt. We find from our results that the programme impacted positively on crop incomes in the Northern Agricultural Zone – it increased by about 77.8 per cent. For the Southern Horticultural Belt however crop incomes decreased by about 76.6 per cent as a result of the intervention. No impact on crop income is found for the Afram Basin (column 5 in Table 6-2). The negative and positive impacts at the Southern Horticultural Belt and the Northern Agricultural Zone respectively have similar magnitudes and so cancel each other out resulting in a zero net effect.

We also go behind the data to try and understand possible reasons for the results obtained. Our interaction with some of the farmers revealed that, it was difficult getting good prices for their produce. This, the farmers indicated remains a major challenge to increasing their incomes from agriculture. In other words demand side problems still persist and so one would expect limited supply response with the interventions. Some of the demand side interventions, such as the feeder roads had not fully been completed at the time of undertaking the follow-up survey. Indeed, farmers mentioned the challenge of transportation in certain parts of the country. In some

instances, the problem had to do with carting farm produce to the house or the market. They were therefore forced to pay higher fares which impacts negatively on their profits. In addition other important variables which tilt market power in favour of farmers, such as the storage facilities were not fully in place for these farmers.

Our results for revenue in Table 6-3 show that training and starter pack did not impact on revenues. Again, we test for differential impacts and find a positive and significant impact for the Northern Agricultural Zone but negative for the Southern Horticultural Belt. In other words, we find that, as a result of the intervention, the revenues accruing from farm business were significantly higher for farmers in the northern zone compared to the other zones. On the other hand, the results show a decrease in the impact on revenue for the southern zone compared to the other zones. For the Afram zone the marginal impact due to the intervention was not significant. Here also the alternative specifications do not change the results (See Appendix).

In Table 6-4, we estimate the impact of the intervention on the farmers costs. Ex ante, one could expect to find either a positive or negative impact. For the positive impact on cost the argument will be that farmers increase their farm investments as a result of the training, translating into increased cost. The other argument with respect to a negative impact on costs could be that, farmers become more efficient as a result of the training and that translates to decreased costs. MiDA's *ex ante* expectation was for the costs to increase, to reflect increased farm investments by households. The results show that farmer investments, and therefore their costs, were not impacted by the programme. In addition, there were no significant differential impacts with respect to the different zones. Our alternative specifications also show that there is no impact on costs.

Table 6-1 Estimates of Impact of training on farm Yields of households

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Batch_One	Batch_Two	Yield_ALL1	Yield_ALL2	Yield_ALL3	Yield_ALL4	Yield_ALL5	Yield_ALL6	Yield_ALL7
VARIABLES	Lyield	Lyield	Lyield	Lyield	Lyield	Lyield	Lyield	lyield	lyield
Period2			0.186***	0.186***	0.181***	0.184***	0.186***	0.186***	0.186***
Period3			0.057	0.057	0.055	0.056	0.057	0.057	0.057
Treatdum	-0.069	0.084**	0.028	0.028	0.028	0.028	0.028	0.028	0.028
Treattime	-0.016	-0.072	-0.05	-0.038	-0.082*	-0.024	-0.064	0.03	-0.041
Batchdum			-0.179***	-0.179***	-0.176***	-0.178***	-0.179***	-0.178***	-0.178***
mean_rainfall	0.003***	0.009***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***	0.006***
Time2	0.135***	-0.138***							
Treattime_South				-0.072					
Treattime_Afram					0.108**				
Treattime_North						-0.049			
Treattime_maize							0.025		
Treattime_maizeP								-0.139***	
Treattime_maizePR									-0.013
Constant	-0.263***	-0.991***	-0.674***	-0.666***	-0.641***	-0.665***	-0.674***	-0.676***	-0.674***
Observations	3,348	7,344	10,692	10,692	10,692	10,692	10,692	10,692	10,692
R-squared	0.007	0.02	0.018	0.019	0.019	0.019	0.018	0.019	0.018
					Impact at zonal and crop level				
			Overall	South	Afram	North			
			-5%	-11%	26%	-7%	-4%	-11%	-5%

Notes: *** p<0.01, ** p<0.05, * p<0.1

Table 6-2 Estimates of Impact of training on Income of farm households

	(1)	(2)	(3)	(4)	(5)	(6)
	Batch_One	Batch_Two	INCOME_ALL1	INCOME_ALL2	INCOME_ALL3	INCOME_ALL4
VARIABLES	lincome	lincome	Lincome	lincome	lincome	lincome
Time2	0.378	0.557***	0.449***	0.450***	0.450***	0.436***
Treatdum	0.071	-0.065	-0.02	-0.022	-0.02	-0.021
Treattime	0.328	-0.073	0.096	0.429**	0.086	-0.268
Batchdum			0.055	0.048	0.058	-0.058
mean_rainfall	0.008**	0.005	0.007***	0.005**	0.006***	0.007***
Treattime_South				-1.195***		
Treattime_Afram					0.027	
Treattime_North						1.046***
Constant	3.633***	4.197***	3.910***	4.115***	3.915***	3.899***
Observations	585	1,171	1,756	1,756	1,756	1,756
R-squared	0.028	0.021	0.021	0.042	0.021	0.039
				Impact at the zonal level		
			Overall	South	Afram	North
			10%	-76%***	11%	77.8%***

Notes: *** p<0.01, ** p<0.05, * p<0.1

Table 6-3 Estimates of Impact of training on Revenue

	(1)	(2)	(3)	(4)	(5)	(6)
	Batch_One	Batch_Two	REV_ALL1	REV_ALL2	REV_ALL3	REV_ALL4
VARIABLES	lrev	Lrev	Lrev	Lrev	lrev	lrev
Time2	-0.136	0.379***	0.182*	0.182*	0.183*	0.172*
Treatdum	-0.043	-0.035	-0.033	-0.035	-0.033	-0.034
Treattime	0.424*	-0.084	0.114	0.360***	0.088	-0.139
Batchdum			-0.059	-0.065	-0.052	-0.138**
mean_rainfall	0.007***	0.007***	0.008***	0.007***	0.008***	0.009***
Treattime_South				-0.885***		
Treattime_Afram					0.069	
Treattime_North						0.727***
Constant	5.224***	5.029***	5.010***	5.162***	5.023***	5.003***
Observations	585	1,171	1,756	1,756	1,756	1,756
R-squared	0.029	0.029	0.024	0.049	0.025	0.043
				Impact at the zonal level		
			Overall	South	Afram	North
			14%	-0.52%***	16%	59%***

Notes: *** p<0.01, ** p<0.05, * p<0.1

Table 6-4 Estimates of Impact of training on Cost

	(1)	(2)	(3)	(4)	(5)	(6)
	Batch_One	Batch_Two	COST_ALL1	COST_ALL2	COST_ALL3	COST_ALL4
VARIABLES	lcost2	lcost2	lcost2	lcost2	lcost2	lcost2
Time2	-0.937***	-0.116	-0.383***	-0.383***	-0.384***	-0.384***
Treatdum	-0.036	-0.014	-0.014	-0.014	-0.014	-0.014
Treattime	0.235	0.012	0.095	0.079	0.119	0.092
Batchdum			-0.237***	-0.237***	-0.244***	-0.238***
mean_rainfall	0.004*	0.008***	0.009***	0.009***	0.009***	0.009***
Treattime_South				0.06		
Treattime_Afram					-0.063	
Treattime_North						0.008
Constant	5.426***	4.301***	4.604***	4.594***	4.593***	4.604***
Observations	585	1,171	1,756	1,756	1,756	1,756
R-squared	0.118	0.011	0.039	0.039	0.039	0.039
				Impact at the zonal level		
			Overall	South	Afram	North
			10%	14%	6%	10%

Notes: *** p<0.01, ** p<0.05, * p<0.1

6.2. Impact of Training on Loan Accessed

6.2.1. Impact on Loan Amount

On the whole, we find an impact of the training and starter park on loan amounts received by selected FBO members. The results show that training increased loan amounts received by farmers by about GH¢440. We also note some differential impact of the training on loan amounts for the three different zones. We find that the impact of the training on loan amounts received by farmers in the Southern Horticultural Belt was an increase of about GH¢1,292. For the Afram Basin also loans amounts increased by about GH¢449. However for the Northern Agriculture Zone the intervention did not impact on the loan amount that the farmers got (Table 5-5). Controlling for rainfall and trying different specifications did not change the main findings here.

Table 6-5 Impact of Training on all Loan Amounts Accessed By Selected FBO Members

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Batch1	Batch2	Loans	Loans_1	Loans_2	Loans_3
Time2	237.98	174.44	206.63	206.04	206.63	206.1
Treatment	-180.38	-134.28	-160.43	-160.12	-160.43	-160.15
Treattime	531.06**	281.75	440.32**	225.34	435.44**	754.74***
Batch_two			216.61**	227.07**	216.66**	225.99**
Treattime_South				1,067.26***		
Treattime_Afram					13.55	
Treattime_North						-717.73***
Constant	503.18***	818.37***	554.89***	549.41***	554.87***	549.97***
Observations	932	727	1,659	1,659	1,659	1,659
R-squared	0.03	0.01	0.02	0.05	0.02	0.04
			Impact at the zonal level			
			Overall	South	Afram	North
Impact of the training			440.32GHC***	1,292GHC***	449GHC**	37GHC

Notes: *** p<0.01, ** p<0.05, * p<0.1

The commercial component of the training was supposed to build the capacity of farmers to acquire loans on their own merit and from various other non-MiDA sources. We therefore test for whether the intervention resulted in the ability of farmers to acquire loans outside of MiDA. The results show that generally there was no significant impact of the training on the non-MiDA loan amounts received by farmers. We do find differential impacts of the training on loan amounts for the three different zones. We note that the training increased non-MiDA loan amounts for farmers in the Afram Basin by about GH¢448. However for the Northern Agricultural Zone and the Southern Horticultural Belt the intervention did not impact on the non-MIDA loan amounts (Table 6-6).

Table 6-6 Impact of Training on Amounts Accessed By Selected FBO Members (all Non- MiDA loans)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Batch1	Batch2	Loans	Loans_1	Loans_2	Loans_3
Follow up	264.98	169.34	214.26	214.23	214.24	214.1
Treatment	-180.38	-134.51	-161.13	-161.11	-161.12	-161.04
Treattime	290.51	91.68	211.59	179.18	53.96	397.65**
Batch_two			260.66***	261.19***	261.01***	263.18***
Treattime_South				134.78		
Treattime_Afram					393.59**	
Treattime_North						-518.22***
Constant	503.18***	835.23***	539.91***	539.64***	539.73***	538.62***
Observations	650	631	1,281	1,281	1,281	1,281
R-squared	0.02	0	0.02	0.02	0.02	0.02
			Impact at the zonal level			
			Overall	South	Afram	North
			212GHC	314GHC	448GHC**	-120.57

Notes: *** p<0.01, ** p<0.05, * p<0.1

6.2.2. Impact on Source of Loan

We consequently examined whether the chances of farmers switching to more formal sources improved with the training. Our results show that, the likelihood of a farmer obtaining a non-MiDA loan from a formal source increases by about 8 per cent with the training. Higher and positive marginal propensities are found for the Afram Basin (13%) over and above their counterparts in the other zones but negative for the Northern Agricultural Zone. In other words, FBOs in the Afram Basin had a 13 per cent higher probability of accessing non-MiDA credit from formal institutions such as the state banks, rural banks, private banks, government agencies, cooperatives, and business firms. Conversely, farmers in the NAZ were found to have less likelihood (17%) of obtaining a non-MiDA credit from a formal bank and non-bank financial institutions.

Table 6-7 Marginal effects of formal verses informal sources of loans

Loansource	Eqn(1)	Eqn(2)	Eqn(3)	Eqn(4)
Follow_Up	0.07***	0.09***	0.09***	0.09***
Batch_Two	-0.02	-0.03*	-0.03**	-0.03*
Treatment	0.02	0.03	0.09***	0.00
Treattime	0.08***	0.06**	0.05*	0.05
Treattime_South		0.00		
Treattime_Afram			0.13***	
Treattime_North				-0.17***
Observations	4,854	4,854	4,854	4,854

Notes: *** p<0.01, ** p<0.05, * p<0.1

6.3. Impact Estimates on Behavioural Variables

6.3.1. Cultivated Land Size

The prior expectation under the MiDA programme was for diversification in the Northern Agricultural Zone, extensification in the Afram Basin and, intensification in the Southern Horticultural Belt. This suggests that generally the programme expected to increase land under cultivation, but mainly from the Afram Basin. However discussions with MiDA does not say whether the expected extensification was to be driven by increasing number of households farming or the existing farmers increasing the average land size cultivated.

Table 6-8 Estimates of Impact of MiDA Training on land size under cultivation

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Batch1	Batch2	SIZE_ALL1	SIZE_ALL2	SIZE_ALL3	SIZE_ALL4
Time2	-0.005	-0.032	-0.025	-0.026	-0.025	-0.032
Treatdum	-0.197	-0.175**	-0.180***	-0.181***	-0.181***	-0.181***
Treattime	-0.017	-0.044	-0.038	0.139	-0.032	-0.270***
Batchdum			-0.044	-0.060	-0.046	-0.114**
Treattime_South				-0.695***		
Treattime_Afram					-0.016	
Treattime_North						0.580***
Constant	0.755***	0.724***	0.765***	0.777***	0.766***	0.819***
Observations	415	1,095	1,510	1,510	1,510	1,510
R-squared	0.015	0.016	0.016	0.055	0.016	0.050
				Impact at the zonal level		
			Overall	South	Afram	North
			NS	-60%	NS	12.00%
			-4%	-54%***	-11%	32%***

Notes: *** p<0.01, ** p<0.05, * p<0.1

Table 6-8 gives the results of the difference-in-difference analyses done on the land size under cultivation. It can be seen from equation six (Treattime in Eqn 6) that the combined impact of the training on land sizes in Southern Horticultural belt and Afram Basin together was a decrease in land sizes by 27 per cent. The marginal impact in the Northern Agricultural Zone was an increase of about 58 per cent (Treattime North in Eqn 6), suggesting that in the Northern Agricultural Zone, extensification did happen with the average land size of farmers increasing by about 32 per cent. However in the Southern Horticultural Belt, the average land sizes decreased by about 54 per cent as a result of the intevention.

6.3.2. Impact on Chemical Use and Value

With the back drop of farmers being given starter packs which included chemicals for an acre of land, we do expect that once MiDA training went well and farmers understood the right ways of applying them as well as the importance of chemical use on their farms, they would increase their usage over time. Again one could think of this as part of the behavioural change that one expects to see if farmers embraced the tenets of the training.

The results show that overall the intervention impacted positively on the value of chemicals used. More specifically, we note that the value of chemicals used increased by about 35.6 per cent. Even in the presence of inflation which over the survey period averaged about 10 per cent per annum, the real values of chemicals used was still positive. However given that the value of chemical use at baseline was about US$120, the 35.6 per cent increase translates to an impact magnitude of about US$84. This is lower than the value of chemicals in the starter pack estimated at about US$152[8]. In other words, the impact found here can be explained by the starter pack.

The results show that for each zone the intervention did impact on the value of chemical use. For the three zones, Northern Agricultural Zone, Afram Basin and the Southern Horticultural Belt, the respective impacts were 34 per cent, 32.3 per cent and 42 per cent. Information from farmers at the validation workshops suggest that some farmers, in addition to chemicals from the starter pack which was for an acre of land, bought more chemicals for use on farms for pests and insects control. However this is not consistent with the quantitative results as we have noted that on average the increase in value of chemical use was less than what MiDA gave the farmers as part of their starter pack.

[8] This is based on estimates received from MiDA

Table 6-9 Impact of programme on chemical use value

VARIABLES	(1) Batch_One	(2) Batch_Two	(3) CHEM_ALL1	(4) CHEM_ALL2	(5) CHEM_ALL3	(6) CHEM_ALL4
Time2	0.619***	-0.059	0.152***	0.152***	0.152***	0.152***
Treatment	0.064	-0.128**	-0.087**	-0.087**	-0.087**	-0.087**
Treattime	0.191*	0.383***	0.356***	0.331***	0.378***	0.364***
Batchd_Two			0.106***	0.106***	0.104***	0.107***
Treattime_South				0.093		
Treattime_Afram					-0.052	
Treattime_North						-0.026
Constant	4.425***	4.963***	4.729***	4.730***	4.731***	4.729***
Observations	2,468	4,540	7,008	7,008	7,008	7,008
R-squared	0.087	0.011	0.028	0.028	0.028	0.028
				Impact at the zonal level		
			Overall	South	Afram	North
			35.60%***	42%***	32.3%***	34%***

Notes: *** p<0.01, ** p<0.05, * p<0.1

6.3.3. Impact on Labour Hours

We investigate whether the MiDA training and starter pack affected households labour use on farms. This is done for total household labour use on farms as well as labour use at the different stages of production.

Table 6-10 Impact of Training on Labour use, by Farming activities

VARIABLES	Total lTLab	Land Prep llabLP	Field Mgt llabFM	Harvest llabH	P_Harvest llabPH
Time2	0.011	-0.132*	-0.246**	0.131*	-0.119
Treatdum	-0.039	-0.049	-0.204*	-0.046	0.077
Treattime	-0.001	0.042	-0.079	0.065	0.01
Batchdum	0.218***	-0.042	0.021	0.346***	0.186***
mean_rainfall	-0.001	-0.001	-0.005**	0	-0.001
Constant	6.354***	5.967***	7.131***	5.392***	5.258***
Observations	4,349	3,006	1,305	2,788	1,709
R-squared	0.007	0.003	0.021	0.022	0.009
Impact for Southern Horticultural Belt	-22%				
Impact for Afram Basin	-37.5%**				
Impact for Northern Agricultural Zone	59%***				

Notes: *** p<0.01, ** p<0.05, * p<0.1

The results presented in Table 6-10 shows that generally the intervention did not have any impact on labour use on farms. This finding holds for total labour use as well as labour use at the different stages of production – land preparations, field management, harvesting and post-harvest. For the total labour use, we test for zonal impacts and find some differences. For the Northern Agricultural Zone we find that the training impacted positively on labour use. In the case of the Afram Basin, labour use decreased as a result of the intervention and we do not find any impact for the Southern Horticultural Belt.

6.3.4. Impact on Seed use

Impact on Value of Seeds used

One expected a priori, that the training and starter pact will lead to an increase in the value of seeds used by farmers. This was to come from two sources; first if farmers responded to the intervention by increasing their land sizes, then their seed use value would also increase. A second source was to be from the use of more improved seeds. Indeed the starter pack that farmers received included improved seeds for one acre of land. We therefore test for the impact of the intervention of seed use value.

Table 6-11 Estimation results on the value of seeds used

	(1)	(2)	(3)	(4)	(5)	(6)
	Batch1	Batch2	SEED_ALL1	SEED_ALL2	SEED_ALL3	SEED_ALL4
VARIABLES	lseed	lseed	lseed	lseed	lseed	lseed
Time2	0.258***	-0.021	0.066*	0.066*	0.066*	0.066*
Treatdum	-0.017	-0.278***	-0.198***	-0.198***	-0.198***	-0.198***
Treattime	0.174*	0.104	0.153***	0.213***	0.067	0.163***
Batchdum			0.099***	0.100***	0.106***	0.100***
Treattime_Z1				-0.222***		
Treattime_Z2					0.207***	
Treattime_Z3						-0.030
Constant	4.175***	4.579***	4.384***	4.383***	4.379***	4.383***
Observations	2,874	5,192	8,066	8,066	8,066	8,066
R-squared	0.019	0.010	0.008	0.010	0.010	0.008
			Impact at the zonal level			
			Overall	South	Afram	North
			15.3%***	0.008	27%***	13%**

Notes: *** p<0.01, ** p<0.05, * p<0.1

Our results show that overall the intervention impacted positively on the value of seeds used by the farmers (Table 6-11). The value of seeds used by farmers increased by about 15% per cent. With a baseline seed use value of between US$100 and US$120, the magnitude of this impact will be between US$15 and US$18. This is lower than the value of the seeds given to the farmers9. We can therefore assert that the impact found here is mainly due to the starter pack. We also note differential impacts with respect to the zones. In particular whereas the value of seeds used by farmers in the Afram Basin and the Northern Agricultural Zone increased by about 27 per cent and 13 per cent respectively, there was no impact found for the Southern Horticultural Belt.

Impact on Type of Seeds used

We further tests whether farmers as a result of the intervention are switching to the use of more improved seeds. Our results show the intervention has not impacted on farmers' behaviour in terms of using relatively more improved seeds (Table 6-12). We however observe some differential zonal impacts. The programme seem to have increased the probability of farmers in the Southern and Afram Basin zones to use more improved seeds whilst for those in the Northern Zone it seemed to have changed their probability in the other direction.

Table 6-12 Marginal effects of type of seeds used by farmers

Seedtype	(1)	(2)	(3)	(4)
Follow_Up	-0.09***	-0.07***	-0.07***	-0.04***
Treatment	-0.08***	-0.12***	-0.09***	-0.03***
Treattime	0.00	-0.01	-0.02	-0.03**
Treattime_South		-0.13***		
Treattime_Afram			-0.03***	
Treattime_North				0.15***
Observations	28,109	26,606	26,606	26,606
Pseudo R2	0.0149	0.0521	0.018	0.0635
*** p<0.01, ** p<0.05, * p<0.1				

[9] Information from MiDA suggests that the value of seeds in the Starter Pack was about US$28

7. Conclusions and Recommendations

This study provides an analysis of the impact of the MiDA intervention of providing farmers with technical training plus 'starter packs' on key programme outcomes. The programme outcomes that form the basis of the evaluation include crop yields, crops incomes, size of household farms, value of seeds and chemical used, and access to credit. The design is such that we are only able to examine the impact on these outcomes over a one year period. The study employs the use of the difference-in-difference approach. The data used is based on surveys conducted over three (3) years during the life of the Compact, starting November 2008 through to January 2011. In all, about 5 farmers each from the 1200 FBOs formed the basis of the data used for this evaluation. We summarise the main characteristics of data used for the analysis as follows.

First, from over forty crops that were identified as being grown by farmers in the MiDA intervention zones, we identify maize as the most common crop. Crops like rice, millet, sorghum, groundnuts and soybean were predominantly cultivated in the Northern Agricultural Zone. Pineapple, Tomatoes and Mango were predominant in the Southern Horticultural Belt whiles plantain and cocoyam were in the Afram Basin. Yam cultivation was mostly found in the Northern Agricultural Zone and the Afram Basin with cassava and pepper being the cultivated in the Afram Basin and the Southern Horticultural Belt. Okro cultivation was more popular in the Northern Agricultural Zone and Southern Horticultural Belt.

Second, we note that pineapple yields are the highest of all the crops that feature in the farmers' lists. The other crops with relatively high yields include cassava and yams. We note that average yields are relatively low for crops primarily grown in the Northern Agricultural Zone. The yields in the MiDA zones were generally found to be comparable with some of the official GoG statistics. For crop incomes we note that almost all crops recorded an increase in incomes over the two periods with pineapples having the highest increase.

Third, the most common chemicals used by farmers in the MiDA districts were inorganic fertilizers followed by herbicides. This is particularly true for the Southern Horticultural Beltand Northern Agricultural Zone. However in Afram Basin, herbicides were the most commonly used.

Fourth, we note that farmers generally tend to use local seeds. However, we note quite stark differences across zones. Whereas more than half of the farmers in the South used improved seeds, the proportions were about 30 and 20 per cent for the Afram Basin and the Northern zones respectively.

Fifth, we find that the average plot size of the farms was about 1.5 hectares, whiles the average total household land holdings was about 3 hectares. Most of the farms rely on rain with very little irrigation.

The impact of the programme on key outcome indicators forms the key hypotheses that this study seeks to test. The main findings with respect to the impact analysisare summarised as follows:

First the estimates show that the intervention did not have any impact on the overall crop yields and incomes. We do observe differential impacts at the zonal levels. For the Southern Horticulture Zone the impact of the intervention on crop incomes was negative. In the case of the Northern Agricultural Zone however the training and starter pack impacted positively on crop incomes. However the magnitudes were about the same so that the net effect was zero. Some of the possible reasons assigned for these results include problems of contamination, a lower than anticipated value addition to the technical component of the training and differences in effectiveness of the RICs who oversaw the different zones. In addition, for the crop incomes the lack of evidence of impact may have been due to challenges with respect to the marketing of farm produce which is in turn related to transportation problems. Indeed, the MiDA programme *ex ante* recognises this problem and has interventions targeted at overcoming this challenge. However, most of these interventions with respect to transportation had not been finished when the data was collected. We further examined the impact of the intervention on the two main components of crop incomes, namely costs and revenue. Here also we do not find any impact at the aggregate level for both these indicators.

Second, we find evidence of the training impacting positively on amount of loans that households received. However, this seems to be driven (whether by design or otherwise) by the MiDA loans. Estimates using only loans from non-MiDA sources show no impact. We find generally that the impact on loans differ by zone. In particular we do find that for the Afram Basin, the intervention did impact positively on the amount of non-MiDA loans that farmers were able to access. We also find that the intervention increased the probability of a farmer getting loans from more formal sources by about 8%. This is certainly positive for the programme and it would be interesting to see how these farmers fare after a few more years.

Third, we do find that MiDA training impacted positively on the value of chemicals used by the farmers. The estimates show a 35.6 per cent increase in the chemical use value of the farmers. However this translates to a value that is significantly lower than what the farmers were given as part of the starter pack. It suggests that the impact found here is purely due to the starter pack. This result is also true for the impact on the value of seeds used. Although we find an impact of about 15%, it translates into a magnitude that is lower than the value of seeds given to the farmers as part of the starter pack.

To conclude, we note that although overall, and for most outcome indicators, we do not find any significant effect, there are signs albeit limited, of differential impacts with respect to the zones. The qualitative information gathered from farmers also point to some success and as some of the farmers from the Afram basin noted, 'with the improved maize seeds we have been able to increase our yields from about 8 maxi bags per acre to about 14 maxi bags per acre'[10]. Indeed it could also be the case that the one-year lag over which this evaluation was undertaken may have been too short.

[10] A maxi bag is about 100kg. This quote is paraphrased.

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Appendices

Appendix 1 Estimates for alternative specifications for Impact Regressions

Table_A 1 Alternative Specifications of the Estimates of Impact of training on farm Yields of households

	(1)	(2)	(3)	(4)	(5)	(6)
	ALL	Batch	South	Afram	North	Maize
VARIABLES	yeild_follow	yeild_follow	yeild_follow	yeild_follow	yeild_follow	yeild_follow
yeild_baseline	0.103***	0.102***	0.104***	0.101***	0.101***	0.103***
Treatdum	-0.018	0.195***	-0.009	-0.050*	0.011	-0.005
Treatdum_Batch_Two		-0.363***				
mean_rainfall	0.004***	0.005***	0.004***	0.003***	0.004***	0.004***
TreatSouth			-0.056			
TreatAfram				0.105**		
TreatNorth					-0.054	
Treat_maize						-0.030
Constant	-0.460***	-0.527***	-0.444***	-0.386***	-0.437***	-0.461***
Observations	7,748	7,748	7,748	7,748	7,748	7,748
R-squared	0.039	0.050	0.039	0.039	0.039	0.039

*** p<0.01, ** p<0.05, * p<0.1

Table_A 2 Alternative Specifications of the Estimates of Impact of training on Income of farm households

	(1)	(2)	(3)	(4)	(5)
	ALL	Batch	South	Afram	North
VARIABLES	income_follow	income_follow	income_follow	income_follow	income_follow
income_baseline	0.070***	0.072***	0.065***	0.070***	0.061***
Treatdum	-0.041	0.017	0.161*	-0.053	-0.303***
Treatdum_Batch_Two		-0.100			
mean_rainfall	0.012***	0.012***	0.010***	0.012***	0.013***
TreatSouth			-0.874***		
TreatAfram				0.042	
TreatNorth					0.552***
Constant	2.842***	2.842***	3.122***	2.861***	2.764***
Observations	4,644	4,644	4,644	4,644	4,644
R-squared	0.020	0.021	0.027	0.020	0.025

*** p<0.01, ** p<0.05, * p<0.1

Table_A 3 Alternative Specifications of the Estimates of Impact of training on Cost

	(1)	(2)	(3)	(4)	(5)
	ALL	Batch	South	Afram	North
VARIABLES	cost2_follow	cost2_follow	cost2_follow	cost2_follow	cost2_follow
cost2_baseline	0.047***	0.046***	0.046***	0.047***	0.046***
Treatdum	0.001	0.105	0.094*	0.005	-0.107*
Treatdum_Batch_Two		-0.177**			
mean_rainfall	0.001	0.001	-0.000	0.001	0.002
TreatSouth			-0.340***		
TreatAfram				-0.013	
TreatNorth					0.277***
Constant	4.840***	4.833***	4.962***	4.833***	4.799***
Observations	3,053	3,053	3,053	3,053	3,053
R-squared	0.011	0.013	0.016	0.011	0.015

*** p<0.01, ** p<0.05, * p<0.1

Table_A 4 Alternative Specifications of the Estimates of Impact of training on Revenue

	(1)	(2)	(3)	(4)	(5)
	ALL	Batch	South	Afram	North
VARIABLES	rev_follow	rev_follow	rev_follow	rev_follow	rev_follow
rev_baseline	0.072***	0.072***	0.068***	0.071***	0.064***
Treatdum	-0.061	-0.011	0.200***	-0.028	-0.385***
Treatdum_Batch_Two		-0.086			
mean_rainfall	0.006***	0.006***	0.003*	0.006***	0.007***
TreatSouth			-0.951***		
TreatAfram				-0.099	
TreatNorth					0.836***
Constant	5.326***	5.321***	5.670***	5.277***	5.212***
Observations	3,053	3,053	3,053	3,053	3,053
R-squared	0.032	0.033	0.071	0.033	0.070

*** p<0.01, ** p<0.05, * p<0.1

Table_A 5 Estimates of Impact of Training on all Loan Amounts Accessed By Selected FBO Members with weight and means of rainfall

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Batch1	Batch2	Loans	Loan_1	Loan_2	Loan_3
Time2	272.8	82.5	193.9	193.8	194.0	192.0
Treatdum	-224.7	-135.7	-182.1	-183.2	-182.4	-178.2
TreatTime	572.0**	297.7	485.5***	266.9	501.6***	773.5***
Mean_rainfall	4.4*	9.0**	4.9**	5.3***	5.0**	3.6*
Batchdum			237.6***	246.0***	237.5***	245.2***
Treattime_South				1,057.3***		
Treattime_Afram					-43.0	
Treattime_North						-689.5***
Constant	5.5	-117.3	10.4	-34.4	0.1	146.1
Observations	932	727	1,659	1,659	1,659	1,659
R-squared	0.0	0.0	0.0	0.0	0.0	0.0

*** p<0.01, ** p<0.05, * p<0.1

Table_A 6 Estimates of Impact of Training on Amounts Accessed By Selected FBO Members from Non MiDA Sources with weights and means of rainfall

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Batch1	Batch2	Loans	Loan_1	Loan_2	Loan_3
Time2	258.7	65.5	198.8	198.8	198.2	198.1
Treatdum	-201.5	-138.1	-177.7	-177.8	-176.0	-175.9
TreatTime	319.0	126.0	254.0	226.2	95.5	425.5**
Mean_rainfall	0.4	9.5**	2.3	2.4	1.8	1.7
Batchdum			279.8***	279.9***	280.7***	281.4***
Treattime_South				115.0		
Treattime_Afram					380.6**	
Treattime_North						-501.8**
Constant	467.0*	-142.6	282.9	279.8	343.0	348.4
Observations	650	631	1,281	1,281	1,281	1,281
R-squared	0.0	0.0	0.0	0.0	0.0	0.0

*** p<0.01, ** p<0.05, * p<0.1

Table_A 7 Estimates of Impact of MiDA Training on land size under cultivation with household weights and average rainfall

VARIABLES	(1) Batch_One	(2) Batch_Two	(3) SIZE_ALL1	(4) SIZE_ALL2	(5) SIZE_ALL3	(6) SIZE_ALL4
Time2	0.125	-0.082	-0.025	-0.023	-0.026	-0.034
Treatdum	-0.209	-0.192**	-0.198***	-0.198***	-0.198***	-0.199***
Treattime	-0.089	-0.024	-0.047	0.119	-0.014	-0.285***
mean_rainfall	0.005**	0.004**	0.004***	0.002**	0.004***	0.004***
Batchdum			-0.051	-0.066	-0.059	-0.119**
Treattime_South				-0.663***		
Treattime_Afram					-0.093	
Treattime_North						0.609***
Constant	0.184	0.374**	0.402***	0.552***	0.379***	0.388***
Observations	414	1,095	1,509	1,509	1,509	1,509
R-squared	0.034	0.023	0.026	0.059	0.027	0.062

*** p<0.01, ** p<0.05, * p<0.1

Table_A 8 Alternative specification of Impact of MiDA Training on land size under cultivation

VARIABLES	(1) ALL Size_follow up	(2) Batch Size_follow up	(3) South Size_follow up	(4) Afram Size_follow up	(5) North Size_follow up
Size_baseline	0.509***	0.510***	0.480***	0.507***	0.472***
Treatment	-0.100***	-0.082**	-0.009	-0.076***	-0.242***
Treatdum_Batch_Two		-0.031			
TreatSouth			-0.359***		
TreatAfram				-0.067*	
TreatNorth					0.360***
Constant	0.381***	0.380***	0.394***	0.381***	0.398***
Observations	3,053	3,053	3,053	3,053	3,053
R-squared	0.242	0.242	0.259	0.242	0.263

*** p<0.01, ** p<0.05, * p<0.1

Table_A 9 Alternative specification of Impact of MiDA Training on land size under cultivation with household weights and average rainfall

	(1) ALL	(2) Batch	(3) South	(4) Afram	(5) North
VARIABLES	Size_follow up	Size_follow up	Size_follow up	Size_follow up	Size_follow up
Size_baseline	0.515***	0.516***	0.488***	0.513***	0.479***
Treatment	-0.101***	-0.081**	0.000	-0.076***	-0.247***
Treatdum_Batch_Two		-0.033			
mean_rainfall	-0.001	-0.001	-0.002**	-0.000	0.000
TreatSouth			-0.374***		
TreatAfram				-0.074*	
TreatNorth					0.367***
Constant	0.433***	0.431***	0.568***	0.395***	0.378***
Observations	3,053	3,053	3,053	3,053	3,053
R-squared	0.245	0.245	0.263	0.246	0.267

*** p<0.01, ** p<0.05, * p<0.1

Table_A 10 Impact of programme on chemical use value with household weights and average rainfall

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Batch_One	Batch_Two	CHEM_ALL1	CHEM_ALL2	CHEM_ALL3	CHEM_ALL4
Follow up	0.541***	-0.023	0.172***	0.172***	0.172***	0.172***
Treatdum	0.034	-0.116**	-0.081*	-0.081*	-0.080*	-0.080*
Treattime	0.236**	0.347***	0.338***	0.333***	0.324***	0.354***
mean_rainfall	-0.002**	-0.001	-0.003***	-0.003***	-0.003***	-0.003***
Batchdum			0.124***	0.124***	0.126***	0.126***
Treattime_South				0.020		
Treattime_Afram					0.032	
Treattime_North						-0.055
Constant	4.714***	5.102***	5.061***	5.058***	5.070***	5.067***
Observations	2,454	4,540	6,994	6,994	6,994	6,994
R-squared	0.084	0.010	0.032	0.032	0.032	0.032

*** p<0.01, ** p<0.05, * p<0.1

Table_A 11 Alternative specification of the Impact of programme on chemical use value

VARIABLES	(1) ALL Chem_follow up	(2) Batch Chem_follow up	(3) South Chem_follow up	(4) Afram Chem_follow up	(5) North Chem_follow up
Chemical_baseline	0.142***	0.195***	0.142***	0.141***	0.142***
Treatment	0.775***	1.187***	0.764***	0.803***	0.769***
Treatdum_Batch_Two		-0.787***			
TreatSouth			0.044		
TreatAfram				-0.070	
TreatNorth					0.020
Constant	3.866***	3.772***	3.866***	3.867***	3.866***
Observations	5,580	5,580	5,580	5,580	5,580
R-squared	0.072	0.086	0.072	0.072	0.072

*** p<0.01, ** p<0.05, * p<0.1

Table_A 12 Alternative specification of the Impact of programme on chemical use value with household weights and average rainfall

VARIABLES	(1) ALL Chem_follow up	(2) Batch Chem_follow up	(3) South Chem_follow up	(4) Afram Chem_follow up	(5) North Chem_follow up
Chemical_baseline	0.151***	0.201***	0.151***	0.151***	0.151***
Treatdum	0.766***	1.143***	0.774***	0.746***	0.781***
Treatdum_Batch_Two		-0.744***			
mean_rainfall	-0.005***	-0.004***	-0.005***	-0.005***	-0.005***
TreatSouth			-0.029		
TreatAfram				0.051	
TreatNorth					-0.046
Constant	4.395***	4.246***	4.404***	4.426***	4.410***
Observations	5,578	5,578	5,578	5,578	5,578
R-squared	0.074	0.086	0.074	0.074	0.074

*** p<0.01, ** p<0.05, * p<0.1

Table_A 13 Estimates of the Impact of training on Labour Hours for Land Preparation with weight and rainfall

	(1)	(2)	(3)	(4)	(5)	(6)
	Batch21	Batch22	LABLP_ALL1	LABLP_ALL2	LABLP_ALL3	LABLP_ALL4
VARIABLES	llabLP	llabLP	llabLP	llabLP	llabLP	llabLP
Time2	-0.060	-0.285***	-0.132*	-0.133*	-0.129*	-0.128*
Treatdum	0.000	-0.195*	-0.049	-0.048	-0.050	-0.050
Treattime	0.014	0.169	0.042	0.152	0.215*	-0.318***
Batchdum			-0.042	-0.041	-0.044	-0.044
mean_rainfall	-0.002*	0.001	-0.001	-0.001*	-0.001	-0.001
Treattime_South				-0.590***		
Treattime_Afram					-0.472***	
Treattime_North						0.807***
Constant	5.966***	5.794***	5.967***	5.977***	5.931***	5.918***
Observations	1,989	1,017	3,006	3,006	3,006	3,006
R-squared	0.002	0.011	0.003	0.008	0.007	0.017

*** p<0.01, ** p<0.05, * p<0.1

Table_A 14 Estimates of the Impact of training on Labour Hours for Farm Management with weight and rainfall

	(1)	(2)	(3)	(4)	(5)	(6)
	Batch31	Batch32	LABFM_ALL1	LABFM_ALL2	LABFM_ALL3	LABFM_ALL4
VARIABLES	llabFM	llabFM	llabFM	llabFM	llabFM	llabFM
Time2	0.054	-0.332**	-0.246**	-0.255**	-0.239**	-0.242**
Treatdum	0.267	-0.425***	-0.204*	-0.201*	-0.209*	-0.210*
Treattime	-0.512**	0.094	-0.079	0.140	0.260	-0.657***
Batchdum			0.021	0.005	0.013	-0.017
mean_rainfall	-0.002	-0.008**	-0.005**	-0.007***	-0.003	-0.003
Treattime_South				-1.178***		
Treattime_Afram					-0.767***	
Treattime_North						1.554***
Constant	6.411***	7.511***	7.131***	7.329***	6.882***	6.887***
Observations	515	790	1,305	1,305	1,305	1,305
R-squared	0.013	0.034	0.021	0.048	0.039	0.091

*** p<0.01, ** p<0.05, * p<0.1

Table_A 15 Estimates of the Impact of training on Labour Hours for Harvesting with weight and rainfall

	(1)	(2)	(3)	(4)	(5)	(6)
	Batch41	Batch42	LABH_ALL1	LABH_ALL2	LABH_ALL3	LABH_ALL4
VARIABLES	llabH	llabH	llabH	llabH	llabH	llabH
Time2	0.580***	-0.352***	0.131*	0.129*	0.135*	0.137*
Treatdum	0.050	-0.148	-0.046	-0.045	-0.047	-0.048
Treattime	-0.009	0.086	0.065	0.203*	0.240**	-0.286**
Batchdum			0.346***	0.340***	0.340***	0.327***
mean_rainfall	0.002	0.003*	0.000	0.000	0.001	0.001
Treattime_South				-0.747***		
Treattime_Afram					-0.414***	
Treattime_North						0.894***
Constant	5.032***	5.682***	5.392***	5.435***	5.338***	5.326***
Observations	1,534	1,254	2,788	2,788	2,788	2,788
R-squared	0.039	0.016	0.022	0.031	0.027	0.042

*** p<0.01, ** p<0.05, * p<0.1

Table_A 16 Estimates of the Impact of training on Labour Hours for Post-Harvest Activities with weight and rainfall

	(1)	(2)	(3)	(4)	(5)	(6)
	Batch51	Batch52	LABPH_ALL1	LABPH_ALL2	LABPH_ALL3	LABPH_ALL4
VARIABLES	llabPH	llabPH	llabPH	llabPH	llabPH	llabPH
Time2	0.544***	-0.291***	-0.119	-0.120	-0.129	-0.135
Treatdum	0.399*	0.011	0.077	0.076	0.078	0.077
Treattime	-0.363	0.081	0.010	0.076	0.278**	-0.319**
Batchdum			0.186***	0.185***	0.142**	0.121*
mean_rainfall	0.006*	-0.001	-0.001	-0.001	0.001	0.001
Treattime_South				-0.295**		
Treattime_Afram					-0.653***	
Treattime_North						0.904***
Constant	4.053***	5.551***	5.258***	5.294***	5.098***	5.145***
Observations	574	1,135	1,709	1,709	1,709	1,709
R-squared	0.016	0.010	0.009	0.011	0.024	0.038

*** p<0.01, ** p<0.05, * p<0.1

Table_A 17 Estimates of the Impact of training on Labour Hours for All Farming Activities with weight and rainfall

	(1)	(2)	(3)	(4)	(5)	(6)
	Batch_One	Batch_Two	TLAB_ALL1	TLAB_ALL2	TLAB_ALL3	TLAB_ALL4
VARIABLES	lTLab	lTLab	lTLab	lTLab	lTLab	lTLab
Time2	0.412***	-0.415***	0.011	0.010	0.015	0.020
Treatdum	0.030	-0.155	-0.039	-0.039	-0.041	-0.042
Treattime	-0.144	0.123	-0.001	0.155	0.182*	-0.367***
Batchdum			0.218***	0.213***	0.208***	0.189***
mean_rainfall	0.000	-0.000	-0.001	-0.001*	-0.001	-0.001
Treattime_South				-0.726***		
Treattime_Afram					-0.441***	
Treattime_North						0.984***
Constant	6.065***	6.706***	6.354***	6.392***	6.303***	6.292***
Observations	2,497	1,852	4,349	4,349	4,349	4,349
R-squared	0.012	0.015	0.007	0.014	0.011	0.026

*** p<0.01, ** p<0.05, * p<0.1

Table_A 18 Estimates of the alternative specifications of the Impact of training on Labour Hours for Land Preparation

	(1)	(2)	(3)	(4)	(5)
	ALL	Batch	South	Afram	North
VARIABLES	TLabLP_follow	TLabLP_follow	TLabLP_follow	TLabLP_follow	TLabLP_follow
TLabLP_base2	0.085***	0.095***	0.082***	0.087***	0.086***
Treatdum	-0.172***	-0.300***	-0.029	-0.010	-0.459***
Treatdum_Batch_Two		0.201*			
TreatSouth			-0.505***		
TreatAfram				-0.397***	
TreatNorth					0.932***
Constant	0.932***	0.913***	0.936***	0.927***	0.929***
Observations	5,509	5,509	5,509	5,509	5,509
R-squared	0.012	0.013	0.017	0.015	0.028

*** p<0.01, ** p<0.05, * p<0.1

Table_A 19 Estimates of the alternative specifications of the Impact of training on Labour Hours for Farm Management

	(1) ALL	(2) Batch	(3) South	(4) Afram	(5) North
VARIABLES	TLabFM_follow	TLabFM_follow	TLabFM_follow	TLabFM_follow	TLabFM_follow
TLabFM_base2	0.112***	0.115***	0.108***	0.112***	0.107***
Treatdum	-0.025	0.210**	0.112	0.040	-0.222***
Treatdum_Batch_Two		-0.399***			
TreatSouth			-0.489***		
TreatAfram				-0.158	
TreatNorth					0.645***
Constant	0.874***	0.872***	0.877***	0.874***	0.877***
Observations	5,509	5,509	5,509	5,509	5,509
R-squared	0.010	0.014	0.014	0.011	0.017

*** p<0.01, ** p<0.05, * p<0.1

Table_A 20 Estimates of the alternative specifications of the Impact of training on Labour Hours for Harvesting

	(1) ALL	(2) Batch	(3) South	(4) Afram	(5) North
VARIABLES	TLabH_follow	TLabH_follow	TLabH_follow	TLabH_follow	TLabH_follow
TLabH_base2	0.098***	0.091***	0.093***	0.099***	0.096***
Treatdum	-0.150**	0.040	0.050	-0.051	-0.436***
Treatdum_Batch_Two		-0.313***			
TreatSouth			-0.700***		
TreatAfram				-0.242**	
TreatNorth					0.938***
Constant	1.238***	1.249***	1.245***	1.236***	1.241***
Observations	5,509	5,509	5,509	5,509	5,509
R-squared	0.011	0.013	0.018	0.012	0.024

*** p<0.01, ** p<0.05, * p<0.1

Table_A 21 Estimates of the alternative specifications of the Impact of training on Labour Hours for Post-Harvest Activities

	(1) ALL	(2) Batch	(3) South	(4) Afram	(5) North
VARIABLES	TLabPH_follow	TLabPH_follow	TLabPH_follow	TLabPH_follow	TLabPH_follow
TLabPH_base2	0.141***	0.150***	0.139***	0.141***	0.136***
Treatdum	-0.044	0.183**	0.035	0.064	-0.216***
Treatdum_Batch_Two		-0.389***			
TreatSouth			-0.280***		
TreatAfram				-0.262***	
TreatNorth					0.567***
Constant	1.001***	0.995***	1.003***	1.002***	1.005***
Observations	5,509	5,509	5,509	5,509	5,509
R-squared	0.016	0.019	0.017	0.017	0.021

*** p<0.01, ** p<0.05, * p<0.1

Table_A 22 Estimates of the alternative specifications of the Impact of training on Labour Hours for All Farming Activities

	(1)	(2)	(3)	(4)	(5)
	ALL	Batch	South	Afram	North
VARIABLES	TLab_follow	TLab_follow	TLab_follow	TLab_follow	TLab_follow
TLab_base2	0.171***	0.176***	0.168***	0.172***	0.170***
Treatdum	-0.335***	-0.416***	-0.104	-0.148	-0.729***
Treatdum_Batch_Two		0.128			
TreatSouth			-0.812***		
TreatAfram				-0.456***	
TreatNorth					1.291***
Constant	1.829***	1.817***	1.838***	1.826***	1.833***
Observations	5,509	5,509	5,509	5,509	5,509
R-squared	0.031	0.031	0.037	0.033	0.046

*** p<0.01, ** p<0.05, * p<0.1

Table_A 23 Estimates of the alternative specifications of the Impact of training on Labour Hours for Land Preparation with weights and rainfall

	(1)	(2)	(3)	(4)	(5)
	ALL	Batch	South	Afram	North
VARIABLES	TLabLP_follow	TLabLP_follow	TLabLP_follow	TLabLP_follow	TLabLP_follow
TLabLP_base2	0.080***	0.090***	0.076***	0.083***	0.083***
Treatdum	-0.173***	-0.298***	-0.015	-0.029	-0.447***
Treatdum_Batch_Two		0.203*			
mean_rainfall	-0.003	-0.003*	-0.004**	-0.001	-0.001
TreatSouth			-0.540***		
TreatAfram				-0.357***	
TreatNorth					0.898***
Constant	1.221***	1.222***	1.401***	1.013***	1.000***
Observations	5,507	5,507	5,507	5,507	5,507
R-squared	0.012	0.013	0.017	0.014	0.026

*** p<0.01, ** p<0.05, * p<0.1

Table_A 24 Estimates of the alternative specifications of the Impact of training on Labour Hours for Farm Management with weights and rainfall

	(1)	(2)	(3)	(4)	(5)
	ALL	Batch	South	Afram	North
VARIABLES	TLabFM_follow	TLabFM_follow	TLabFM_follow	TLabFM_follow	TLabFM_follow
TLabFM_base2	0.112***	0.115***	0.108***	0.112***	0.108***
Treatdum	-0.042	0.201**	0.110	-0.005	-0.221***
Treatdum_Batch_Two		-0.429***			
mean_rainfall	-0.000	0.001	-0.002	0.000	0.001
TreatSouth			-0.527***		
TreatAfram				-0.089	
TreatNorth					0.598***
Constant	0.920***	0.840***	1.084***	0.871***	0.781***
Observations	5,507	5,507	5,507	5,507	5,507
R-squared	0.010	0.014	0.014	0.010	0.016

*** p<0.01, ** p<0.05, * p<0.1

Table_A 25 Estimates of the alternative specifications of the Impact of training on Labour Hours for Harvesting with weights and rainfall

	(1)	(2)	(3)	(4)	(5)
	ALL	Batch	South	Afram	North
VARIABLES	TLabH_follow	TLabH_follow	TLabH_follow	TLabH_follow	TLabH_follow
TLabH_base2	0.092***	0.084***	0.087***	0.093***	0.092***
Treatdum	-0.142**	0.049	0.073	-0.073	-0.409***
Treatdum_Batch_Two		-0.327***			
mean_rainfall	-0.002	-0.002	-0.004**	-0.001	-0.000
TreatSouth			-0.740***		
TreatAfram				-0.170	
TreatNorth					0.886***
Constant	1.495***	1.447***	1.731***	1.401***	1.289***
Observations	5,507	5,507	5,507	5,507	5,507
R-squared	0.010	0.012	0.017	0.011	0.021

*** p<0.01, ** p<0.05, * p<0.1

Table_A 26 Estimates of the alternative specifications of the Impact of training on Labour Hours for Post-Harvest Activities with weights and rainfall

	(1)	(2)	(3)	(4)	(5)
	ALL	Batch	South	Afram	North
VARIABLES	TLabPH_follow	TLabPH_follow	TLabPH_follow	TLabPH_follow	TLabPH_follow
TLabPH_base2	0.129***	0.138***	0.127***	0.129***	0.124***
Treatdum	-0.033	0.178**	0.089	-0.007	-0.173**
Treatdum_Batch_Two		-0.374***			
mean_rainfall	-0.007***	-0.006***	-0.008***	-0.007***	-0.006***
TreatSouth			-0.421***		
TreatAfram				-0.063	
TreatNorth					0.471***
Constant	1.788***	1.719***	1.919***	1.754***	1.679***
Observations	5,507	5,507	5,507	5,507	5,507
R-squared	0.016	0.018	0.019	0.016	0.019

*** p<0.01, ** p<0.05, * p<0.1

Table_A 27 Estimates of the alternative specifications of the Impact of training on Labour Hours for All Farming Activities with weights and rainfall

	(1)	(2)	(3)	(4)	(5)
	ALL	Batch	South	Afram	North
VARIABLES	TLab_follow	TLab_follow	TLab_follow	TLab_follow	TLab_follow
TLab_base2	0.163***	0.166***	0.158***	0.165***	0.163***
Treatdum	-0.328***	-0.377***	-0.068	-0.197*	-0.687***
Treatdum_Batch_Two		0.081			
mean_rainfall	-0.004*	-0.004*	-0.007***	-0.003	-0.002
TreatSouth			-0.885***		
TreatAfram				-0.323**	
TreatNorth					1.190***
Constant	2.323***	2.327***	2.614***	2.142***	2.045***
Observations	5,507	5,507	5,507	5,507	5,507
R-squared	0.029	0.029	0.036	0.030	0.042

*** p<0.01, ** p<0.05, * p<0.1

Table_A 28 Estimates of the Impact of training on the value of seeds planted with weights and average rainfall

	(1)	(2)	(3)	(4)	(5)	(6)
	Batch_One	Batch_Two	SEED_ALL1	SEED_ALL2	SEED_ALL3	SEED_ALL4
VARIABLES	lseed	Lseed	Lseed	lseed	lseed	Lseed
Time2	0.251***	-0.028	0.075*	0.076*	0.077*	0.075*
Treatdum	-0.047	-0.267***	-0.198***	-0.197***	-0.197***	-0.198***
Treattime	0.223**	0.090	0.164***	0.228***	0.067	0.173***
Batchdum			0.103***	0.104***	0.110***	0.103***
mean_rainfall	0.001	0.003***	0.001	0.001	0.000	0.001
Treattime_South				-0.239***		
Treattime_Afram					0.224***	
Treattime_North						-0.029
Constant	4.082***	4.289***	4.277***	4.312***	4.328***	4.279***
Observations	2,858	5,192	8,050	8,050	8,050	8,050
R-squared	0.021	0.011	0.009	0.011	0.011	0.009

*** p<0.01, ** p<0.05, * p<0.1

Table_A 29 Estimates of an alternative specification of the Impact of training on the value of seeds planted

	-1	-2	-3	-4	-5
	ALL	Batch	South	Afram	North
VARIABLES	seed_follow	seed_follow	seed_follow	seed_follow	seed_follow
seed_base2	0.079***	0.119***	0.079***	0.081***	0.079***
Treatdum	0.037	0.356***	0.088**	-0.023	0.033
Treatdum_Batch_Two		-0.559***			
TreatSouth			-0.198***		
TreatAfram				0.145**	
TreatNorth					0.013
Constant	4.144***	4.072***	4.143***	4.141***	4.145***
Observations	5,509	5,509	5,509	5,509	5,509
R-squared	0.017	0.027	0.018	0.018	0.017

*** p<0.01, ** p<0.05, * p<0.1

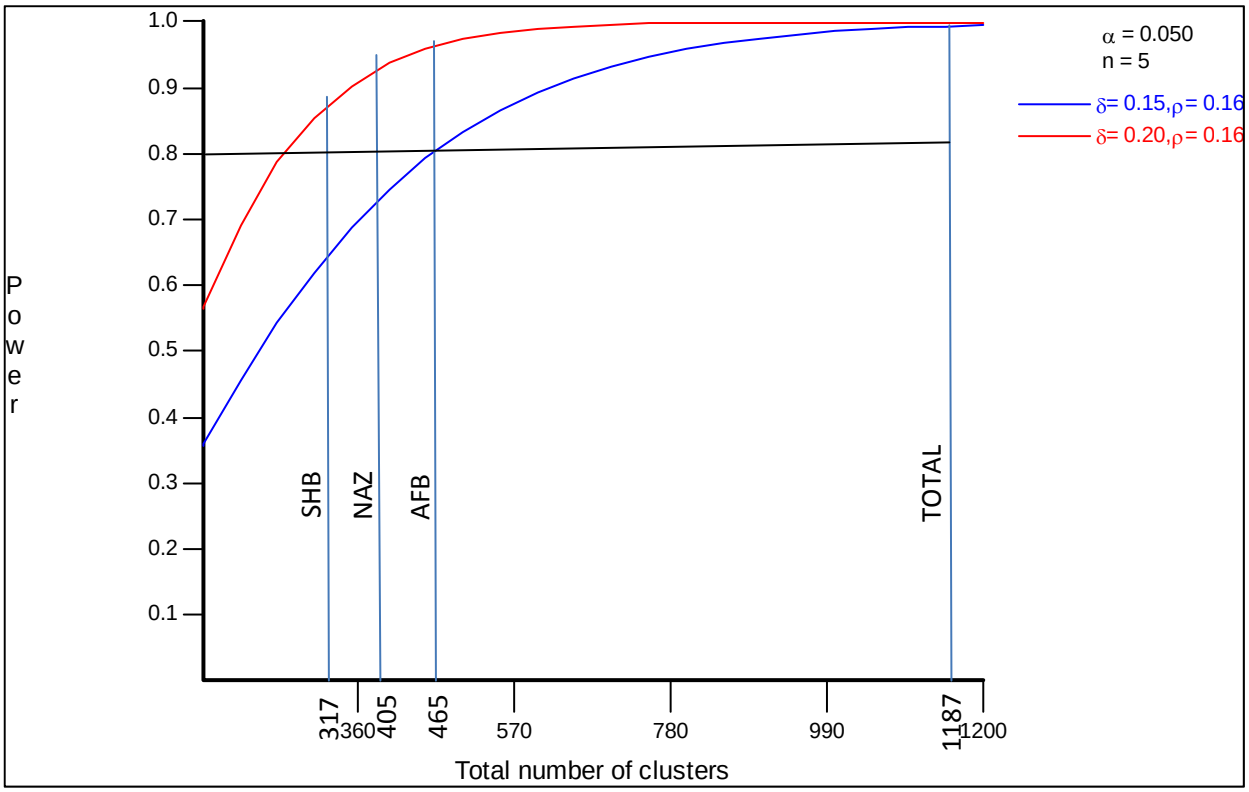
Table_A 30 Estimates of an alternative specification of the Impact of training on the value of seeds planted with weights and average rainfall

	(1)	(2)	(3)	(4)	(5)
	ALL	Batch	South	Afram	North
VARIABLES	seed_follow	seed_follow	seed_follow	seed_follow	seed_follow
seed_base2	0.074***	0.115***	0.075***	0.075***	0.073***
Treatdum	0.043	0.363***	0.091**	0.003	0.029
Treatdum_Batch_Two		-0.577***			
mean_rainfall	0.005***	0.005***	0.004***	0.004***	0.005***
TreatSouth			-0.178**		
TreatAfram				0.099	
TreatNorth					0.050
Constant	3.664***	3.584***	3.718***	3.713***	3.654***
Observations	5,507	5,507	5,507	5,507	5,507
R-squared	0.021	0.032	0.022	0.021	0.021

*** p<0.01, ** p<0.05, * p<0.1

Appendix 2 Ex Post Power Analysis

The ex-ante power analysis showed that the sample of 6000 farmers drawn from 1200 FBOs with 5 members from each FBO would result in a power of 0.98 or 0.85 to detect effect sizes of at least 0.10 and 0.15 respectively, using an expected intra-class correlation coefficient of 0.13 for the key outcome of crop productivity (based on previous studies with similar design). Ex-post, the actual number of farmers who completed the two rounds of each batch was found to be 5,241 from 1187 different FBOs with an average of 4.4 farmers per FBO. Nonetheless, more than 90% of the FBOs still had all 5 selected members completing the panel. The observed intra-class correlation coefficient for crop productivity is found to be 0.16, slightly higher than the ex-ante estimate of 0.13. Based on these realizations, the revised power by number of clusters chart is as shown in Figure 1. The total sample gives a power of more than 98% to detect an effect size of at least 0.20. A breakdown of the realized sample sizes by the zones gives sample sizes of 317, 465 and 405 for the SHB, AFB and NAZ respectively, and the vertical lines drawn from the horizontal axis to the power curve shows that we can conduct the zonal level analysis with sufficient power to detect effect size of 0.20 or more



Appendix 3: Summary of Literature on Time lag for Evaluation of Training on Farmer Behaviour

Study	Period	Time lag	Objective	Methodology	Nature of training	Impact variables	Main Findings
Evaluating Training Projects On Low External Input Agriculture: Lessons From Guatemala – By Jos Vaessen and Jan de Groot	1999-2000	One year	The main objective of the study was to assess the outcome and impact of the project by showing the presence or absence of plausible effects of the project on participants and an indication of the magnitude of these effects.	mixed method evaluation: simplified quasi-experimental design plus information from field visits and semi-structured stakeholder interviews	Soil conservation measures. Cultivation practices. Organic fertilizers. Organic pesticides. Crop diversification. Farm infrastructure. Family nutrition. Rural organisation.	Soil quality. Yields. % of harvest sold. Farm Income. Nutritional and health status. Organizational and managerial capacities.	In the case of yields, a slight increase over time (though not statistically significant) in maize yields was recorded. Different sources of information permitted some conclusions to be drawn in this regard. First of all, weather conditions, if anything, were worse in 2001 than in 1998. Hence, in a normal situation one would have expected a decline in yields.
Agricultural Innovation Support, Dominican Republic	2011-2014	Four years	Accelerate the process of technological diffusion and adoption in the rural areas	Randomise control trials	Extension services and technology transfer	Agricultural incomes, total factor productivity, yield or production per hectare.	Yet to come out with findings

Study	Period	Time lag	Objective	Methodology	Nature of training	Impact variables	Main Findings
7.1.1. APAGRO Nicaragua 7.1.2. Agro-food Support Program	2009	Two years	Help farmers adopt technological improvements. Improve the managerial capacity of beneficiaries	Randomised order of phase-in. Baseline survey in Year 1. Treatment of the 1st cohort begins in Year 1, 2nd Cohort in Year 2 and 3rd Cohort in Year 3. Year 4-follow up	Help farmers adopt technological improvements. Improve the managerial capacity of beneficiaries	Internal Rate of return (IRR)	IRR of at least 12% for at least 80% of beneficiaries
Agricultural Financial Survey, by Kilpatrick S.	1993-1994	One Year	Access impact of education and training on farm management practices in Australia	Crossectional household survey	Farm management and best practices on the farm	Farm profits	Those trained and made changes made 64% more profit
Harvesting Health: Fertilizer, Nutrition and AIDS Treatment in Kenya by S. Chakravarty, 2009	2006-2008	Three years	Identify the economic and health impacts of free fertilizer provision on patients and their families	Randomized control trials	Fertilizer application training and giving fertilizer worth US$90 to the treated	Maize output and incomes	70% more income from maize by the treatment group
Impacts of Agricultural Training on	2002 to 2006	From one to four years	Assess the effectiveness (relevance, impact and value for money) of the DATIC's	Crossectional analysis-trained vrs the untrained farmer	Training by the District Agricultural Training and	Farm incomes	18.5% increase in farm incomes for the trained

Study	Period	Time lag	Objective	Methodology	Nature of training	Impact variables	Main Findings
Young Farmers in Uganda. Mugisha et al, 2008			supported activities		Information Centres (DATIC)		