FarmGrow Midline Survey Report

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EXECUTIVE SUMMARY

Satellite for Farming (Sat4Farming) is a Netherland Space Office (NSO) three-year funded project which seeks to triple productivity of smallholder cocoa farmers over a decade using geo-data enabled precision agriculture. The project is implemented by a consortium led by Rainforest Alliance (RA), that includes Touton S.A, Grameen Foundation, University of Ghana, WaterWatch (now AuxFin), and Satelligence. This midline survey tracked progress made by project beneficiaries on some key process/output and outcome indicators, such as farm size, output, yield, farm income, input use, access to farm credit, and record keeping after one year of implementation. Respondents, consisting of project beneficiaries and non-beneficiaries, were randomly sampled and relevant information analyzed. Respondents for the midline survey constituted 47.2% of the baseline respondents.

The midline assessment found the following as key: very few youths (10.53%) are engaged in cocoa farming; average cocoa farm sizes significantly declined for both project participants and nonparticipants during the second year of the Sat4Farming project implementation; average cocoa output per person generally increased over the period but not significantly, with nonparticipating farmers rather recording marginally higher average cocoa output than participating farmers; cocoa yield (kg/ha) significantly increased over the period and as at midline, nonparticipating farmers observed marginally higher yields than project participants although yield differences were statistically insignificant between participating and nonparticipating farmers; average cocoa farm income increased over the period but not significantly, whilst participating farmers recorded higher average farm incomes than nonparticipating farmers but with no significant differences. In real terms, real farm income and real farm income per hectare significantly increased over the two time periods for both respondent groups. However, the midline data showed no significant differences between participating and nonparticipating farmers in these two indicators.

Access to farm credit generally declined significantly over the period. The midline assessment also found that whilst use of granular fertilizers significantly increased for participating farmers, the use of insecticides significantly declined by this same farmer group. Additionally, the proportion of beneficiaries keeping records on their farm enterprises continue to be significantly higher for Sat4Farming beneficiaries compared to the control.

Based on these findings, it is recommended that the project should endeavor to investigate the actual reasons for acreage declines for both project beneficiaries and non-beneficiaries. This step is required to fully understand the implications for attaining productivity increases envisaged under the project. Project implementers need to understand the financial needs of participating farmers so that workable strategies could be provided to help ease access to farm credit to ensure the implementation of all recommendations emerging from the AOs. Continuous monitoring of project beneficiaries should be maintained to further consolidate the gains made so far in achieving the project's target of substantially increasing cocoa productivity.

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ACKNOWLEDGEMENT

We express our gratitude to the midline survey enumeration team, Touton's officers in Kasapin and Sunyani, and their Sustainability officer in Goaso for their immense support throughout the data collection exercise. We also thank the Touton's 266 farmers who took valuable time off their busy schedule to participate in this survey round.

1.0 Introduction

Satellite for Farming (Sat4Farming) is a project designed to help smallholder cocoa farmers increase productivity from 400 kg / hectare to 1500 kg / hectare over an 8- to 10-year period via the use of a geo-data enabled precision agriculture service and technology platform known as FarmGrow. Sat4Farming is a 3-year project implemented by a consortium comprising Rainforest Alliance (lead institution), Touton S.A, Grameen Foundation, University of Ghana, WaterWatch (now known as AuxFin), and Satelligence and is funded by the Geodata for Agriculture and Water (G4AW) program of the Netherlands Space Office (NSO). The 3-year project hopes to achieve the following results:

- Higher income and better livelihoods of cocoa farming households
- Sustainable cocoa production
- Self-reliant farmers working as entrepreneurs
- Improved gender equality and women's empowerment.

The project hypothesises that if cocoa farmers increase their adoption of Good Agricultural Practices (GAPs), implement recommendations proposed from farm Adoption Observations (AOs), and effectively use satellite data to make timely farm management decisions, cocoa farmers will triple their farm yields and increase cocoa farm profitability from their existing farms whiles protecting the environment.

A baseline survey was undertaken in 2018. To track progress made in the identified process indicators because of project interventions, a quantitative midline survey was carried out (in January 2020) in the second year 2019 of project implementation. This midline survey report provides update on the project's key progress in the process indicators after 2 years of the project's implementation.

2.0 Methodology

During the baseline survey, respondents from 23 communities in 3 Societies were enumerated involving a total of 564 respondents, of which 252 were Sat4Farming project participants (treatment group) and 312 categorised as nonparticipants (control group). However, due to the need for a reduced midline sample size (i.e., for a low-key midline survey) and the fact that Touton/Eliho operations were no longer existent in some communities, 14 of the 23 baseline communities were randomly sampled for the midline assessment.

For the midline survey, as shown in Table 1, 266 respondents participated, constituting about 47.2% of baseline respondents. Farmers in the treatment group were those who have been enrolled on the FarmGrow plan. It is worth noting that in all, five (5) additional communities were included in the midline survey: two (2) communities comprising 11 farmers from the Kasapin Society (treatment group), and three (3) communities comprising 93 farmers in the Goaso Society (control group). Oseikwesikrom and Suntreso communities in Kasapin served as replacements for farmers in Wam B community who were no longer engaged on the FarmGrow plan.

Table 1. Communities selected for the midline survey by district

	Sunyani District (Treatment Group)				Kasapin District (Treatment Group)			Total (Treatment)	
Key	Community	Baseline	Midline	Key	Community	Baseline	Midline	Baseline	Midline
A	Antwikrom	18	18	A	Abidjan	11	7		
A	Dwenase	20	24	A	Adiemera	15	9		

A	Mangoase	29	31	A	Mansrokwa	2	2		
A	Nsoatre	20	22	A	Oppong Kwasi	31	17		
B	Chiraa	13	0	B	Wam B	9	0		
B	Daadom	29	0	D	Oseikwasikrom	0	7		
B	Yamfo	8	0	D	Suntreso	0	4		
B	Sunyani 1	16	0						
B	Duayaw Nkwanta	31	0						
	Total	**184**	**95**		**Total**	**68**	**46**	**252**	**141**
	Goaso District (Control Group)								
Key	**Community**	**Baseline**	**Midline**						
C	Apotoyiwa	30	0						
C	Owusukrom	23	0						
C	Ampabame	31	0						
C	Akrodie	55	0						
C	Community 3	4	0						
C	Kwamedonkokrom	52	0						
C	Morta	10	0						
C	Oseiyawkrom	18	0						
A	Fawohoyeden	89	32						
D	Tenewohoye	0	37						
D	Kumaho	0	18						
D	Manhyia	0	38						
	TOTAL (Control)	**312**	**125**						
	GRAND TOTAL	**564**	**266**						

Source: Midline survey, 2020

Legend:

KEY	DESCRIPTION
A	Baseline communities that were randomly selected for further engagement during midline
B	Baseline communities that were not randomly selected during midline due to need for reduced sample size and resource constraint.
C	Baseline communities (in control group) that were not selected during midline either because Touton/Eliho is no longer operational in such communities or there is difficulty in engaging purchasing clerks and farmers in those communities that are no longer dedicated to Touton/Eliho.
D	Communities that were not either sampled for baseline (Oseikwasikro and Suntreso) or were not part of Tuoton/Eliho operations during 2018 (baseline period).

In the Goaso control group, only one (1) community, namely, Fawohoyeden (see Table 1) amongst the baseline communities was followed up during the midline for two main reasons. The first and most important reason is that Touton/Eliho no longer operates in those communities and hence those farmers are no longer dedicated to or considered as Touton farmers to continue with the project. Secondly, it was difficult engaging with the purchasing clerks and farmers in some of those communities since Touton is no longer operational there.

A revised version of the baseline questionnaire was programmed on an Open Data Kit (ODK) mobile application for enumeration. The midline questionnaire was structured to capture data on variables that are strongly linked to the project's measurement indicators. These include variables on demographic characteristics, farm income, sustainable cocoa production, and access to quality and affordable financial services. The Slovin's formula was used to estimate the minimum sample size required to make statistical inferences of the survey results. The midline survey data was jointly analysed with SPSS 20, STATA 14, and MS EXCEL software.

The midline survey results provide descriptive statistics on key output and outcome indicators such as farm size, output, yield, farm income, input use, access to farm credit, and record keeping. The analysis disaggregates information per respondent category (treatment and control). Owing to the differences in time of enrolment onto FarmGrow plan, a further disaggregation of farmers in the treatment group have been highlighted in the analysis. Hence, for this report, respondents in the Kasapin and Sunyani districts (FarmGrow participants) are referred as the ***pooled treatment group*** whiles those in Goaso district (nonparticipants) are referred to as the ***control group***. Moreover, farmers in the pooled treatment group who were enrolled in year 1 and continued in year 2 of the project are referred to as **treatment 1** whiles those enrolled only in year 2 are referred to as **treatment 2.** In this regard, **treatment 1** comprises 130 respondents in 8 communities and **treatment 2** consists of 11 respondents in 2 communities. The 125 respondents in the control group were sampled from 4 communities.

3.0 Results and Discussions

This section presents findings from the midline survey results. It highlights progress made on key project process indicators at the end of the second year of the project's implementation. The indicators discussed include farm size, cocoa output and yield, farm income, perception on farm yield, access to farm credit, input use and farm record keeping. The results of the various statistical tests of significance (t-test and z-test) are presented in Tables A2 to A5 in the annexes.

The midline survey sample comprised 266 respondents, made up of 171 (64%) males and 95 (36%) females (Table 2), suggesting that males dominate in cocoa farming activities and not necessarily with other associated activities. Respondents in Sunyani and Kasapin represent the treatment (project intervention) group whiles those in Goaso represent the control (counterfactual) group.

Table 2. Distribution of sampled respondents

District	Male		Female		Pooled	
	Freq	%	Freq	%	Freq	%
Kasapin	29	63.04	17	39.96	46	17.29
Sunyani	65	68.42	30	31.58	95	35.71
Goaso	77	61.60	48	38.40	125	46.99
Pooled	**171**	**64.29**	**95**	**35.71**	**266**	**100.00**

Source: Midline survey, 2020

The majority (89%) of respondents are adults, suggesting that the involvement of the youth (less than 35 years) in cocoa farming is low (see Table 3).

Table 3. Distribution in respondent's age category

	Pooled treatment		Control		Pooled	
Age category	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**
Youth (<35 yrs)	5	3.55	23	18.4	28	10.53
Adult (Above 35 yrs)	136	96.45	102	81.6	238	89.47
Pooled	**141**	**100.00**	**125**	**100.00**	**266**	**100.00**

Source: Midline survey, 2020

3.1 Farm characteristics (Farm size, output, and yield)

Data on respondents' farm size was reported in acres and converted to hectares for the estimation of farm yield. Table 4 indicates that the average size of farmlands cultivated by respondents significantly reduced from 5.11 ha at baseline to 4.31 ha at midline. This decline was observed for both project participants (pooled treatment group) and nonparticipants (control group). The difference in average farm sizes between baseline and midline periods is statistically significant (see Table A2 in Annex). This observation for the project participants may be attributed to one key reason. In view of the acceptance of implementing the recommendations of the projects Adoption Observations (AOs) by rehabilitating some cocoa farms, farmers may not have counted such plots/farms as part of their active/current farms contributing to cocoa outputs during the midline survey. For project nonparticipants, this observation is quite difficult to explain except to also infer that probably yields from some plots/farms were low (likely due to disease and pest infestations) and hence were not included as contributing to cocoa outputs during the midline survey. These observations and suggested explanations require further investigations to ascertain the actual reasons behind the observations.

At levels, farm sizes recorded at midline was nominally higher (but not statistically significant) for nonparticipating farmers (4.53 ha) than for project participants (4.11 ha)[1]. Also, respondents in the ***treatment 1*** group (participating farmers in their second year with FarmGrow plan) recorded nominally higher (4.17 ha) average farm sizes than those in ***treatment 2*** (3.46 ha). A comparison of the average farm sizes cultivated at both baseline and midline are presented in Table 4.

Table 4. Comparison of respondent's farm size (Ha)

Farm size (Ha)	**Baseline**	**Midline**
Pooled treatment	4.61	4.11
Treatment 1		4.17
Treatment 2		3.46
Control	5.26	4.53

[1] A similar trend was observed in the baseline data (see Table A6 in Annex)

Pooled	**5.11**	**4.31**

Source: Midline survey, 2020

Cocoa output per person as at midline was higher than previous baseline figures (Table 5), although there is no statistically significant difference between them (see Table A2 in Annex). Though not statistically significantly different, nonparticipating farmers in the FarmGrow plan recorded a slightly higher average output per person (1,433.65 Kg) than participating farmers (1,313.66 Kg) (Table 5). This observation could be linked to the higher average farm sizes of nonparticipant farmers compared to that of participating farmers, *ceteris paribus*. For participating farmers, it was observed that those enrolled only in the second year of the programme (***treatment 2*****)** observed a significantly higher average output (1,675.64 Kg) than those currently in the second year of the FarmGrow plan (***treatment 1***) (1,281.55 Kg). It is likely that treatment 2 farmers that are newly introduced into FarmGrow are more productive (with smaller acreages and higher outputs) than treatment 1 farmers. Baseline and midline values for average farm output are compared in Table 5.

Table 5. Baseline and midline comparisons respondent's average farm output (Kg)

Output (Kg)	**Baseline**	**Midline**
Pooled treatment	1,246.51	1,313.66
Treatment 1		1,281.55
Treatment 2		1,675.64
Control	1,350.88	1,433.65
Pooled	**1,319.39**	**1,370.38**

Source: Midline survey, 2020

Overall, respondents' land productivity (yield) significantly increased by almost 17%, from baseline figure of 307.62 kg/ha to an estimated 359.77 Kg/ha for midline (Table 6). This midline yield data is still lower than the national average of 423 kg/ha[2].

Table 6. Comparison of respondent's farm yield (Kg/Ha) at baseline and midline

Yield (Kg/Ha)	**Baseline**	**Midline**
Pooled treatment	341.11	359.00
Treatment 1		346.39
Treatment 2		501.06
Control	295.08	360.63
Pooled	**307.62**	**359.77**

Source: Midline survey, 2020

The midline data further suggest no statistically significant yield differences (see Table A3 in Annex) between participating farmers (359.00 kg/ha) and nonparticipating farmers (360.63 kg/ha), although cocoa yield in the former was marginally lower than the latter group. Moreover, farmers in the ***treatment 2***

[2] Bymolt, R., Laven, A., & Tyzler, M. (2018). Demystifying the cocoa sector in Ghana and Côte d'Ivoire. *The Royal Tropical Institute (KIT): Amsterdam, The Netherlands*.

category observed significantly higher yields (501.06 Kg/ha) than those in the ***treatment 1*** category (346.39 Kg/ha) (see Table A8 in Annex), which may be expected due to their higher productivity levels (higher cocoa output and reduced farm sizes) for treatment 2 participants (second year entrants onto the programme). Moreover, over the past year, land productivity (yield) increased despite the decrease in hectares cultivated. The average area of land cultivated by farmers on FarmGrow reduced by 11.89% (4.61 ha to 4.11 ha) whiles their yield increased by 5.24% (341.11 Kg/ha to 359.00 Kg/ha). Similarly, whiles the area of land cultivated by the control group decreased by 13.87% (5.26 ha to 4.53 ha), their yield levels increased by 22.21% (295.08 to 360.63 Kg/ha). A breakdown of farmer's yield at baseline and midline is presented in Table 6. In general, as at midline, both FarmGrow participants and nonparticipants experienced significant farm size declines, marginal output increases, and significant yield increases.

3.2 Farmers' perception of changes in farm yield

The midline study assessed farmer's perception on their cocoa yields over the past year. As shown in Table 7, the majority (52%) of respondents generally perceive that their cocoa yields have increased over the past year. This perception corresponds to the actual yield increases observed amongst respondents. About two-thirds (67.65%), representing the majority of participating farmers, perceived increases in farm yields in the 2018/2019 production season compared to the previous (baseline) season. For the nonparticipating farmers, the majority (47.93%) rather perceived a decline in their yields, which stand at odds with the slight increase in outputs they experienced over the period. Nevertheless, about 34% rather perceived current yield increases compared to the previous year. Although early days yet, this perception of relative increase in yield may reflect the confidence that participating farmers have in FarmGrow, through the implementation of the Adoption Observations, and therefore the view by the majority that yields have improved compared to last year.

Table 7. Respondent's perception of changes in farm yield

Perception of yield	Pooled treatment (%)	Control (%)	Pooled (%)
Same as last year	5.88	18.18	11.67
Greater than last year	67.65	33.88	51.75
Less than last year	26.47	47.93	36.58
Total	**100.00**	**100.00**	**100.00**

Source: Midline survey, 2020

3.3 Farm income

The survey found 19 respondents (7%) not earning income from cocoa farming in the 2018/2019 production season and hence were not included in the computations of average farm incomes. As indicated in Table 8, the average nominal farm income earned at midline for all respondents (based on average outputs estimated) is GHS 10,132, higher than the baseline figure of GHS 9,716.45, with no statistically significant difference (see Table A2 in Annex) in the two estimates. Again, when the effect of inflation is considered, there is also no statistically significant difference in the real farm income between the two (2) periods (see Table A2 in Annex). Additionally, respondents in the ***treatment 2*** group realized a higher average nominal farm income (GHS 14,190.50) than their ***treatment 1*** counterparts (GHS 10,193.26).

Table 8. Average farm income at baseline and midline compared

Nominal farm income (GHS)	Baseline	Midline
Pooled treatment	9,179.66	10,513.04
Treatment 1		10,193.26
Treatment 2		14,190.50
Control	9,948.36	9,742.19
Pooled	**9,716.45**	**10,132.30**

Source: Midline survey, 2020

However, when farm income per hectare (ha) cultivated is considered, there is a statistically significant increase in this indicator at midline (GHS 2,723.32) compared to baseline value of GHS 2,265.41 (see Table A2 in Annex). This result may be driven by some productivity gains between the two time periods. Programme participants in the pooled treatment group recorded a nominally higher average cocoa farm income (GHS 10,513.04) compared with nonparticipants (GHS 9,742.19) (although the difference between them is not statistically significant) (see Table A3 in Annex). Taking cocoa price as given, increased cocoa farm income is however expected when yields increase, ceteris paribus.

In real terms, as shown in Table 9, real farm income increased between the two periods but not statistically significant (Table A3 in Annex). However, there is a significant increase in real farm income per ha from baseline figure of GHS 1,980.42 to GHS 2,380.73 (Table A3 in Annex).

Table 9. Average real farm income at baseline and midline

Pooled (all respondents)	Baseline	Midline
Real farm income (GHS)	8,494.14	8,857.68
Real farm income per ha (GHS)	1,980.42	2,380.73
Pooled treatment (project participants)		
Real farm income (GHS)		9,190.52
Real farm income per ha (GHS)		2,532.59
Control (nonparticipants)		
Real farm income (GHS)		8,516.65
Real farm income per ha (GHS)		2,225.14

Source: Midline survey, 2020

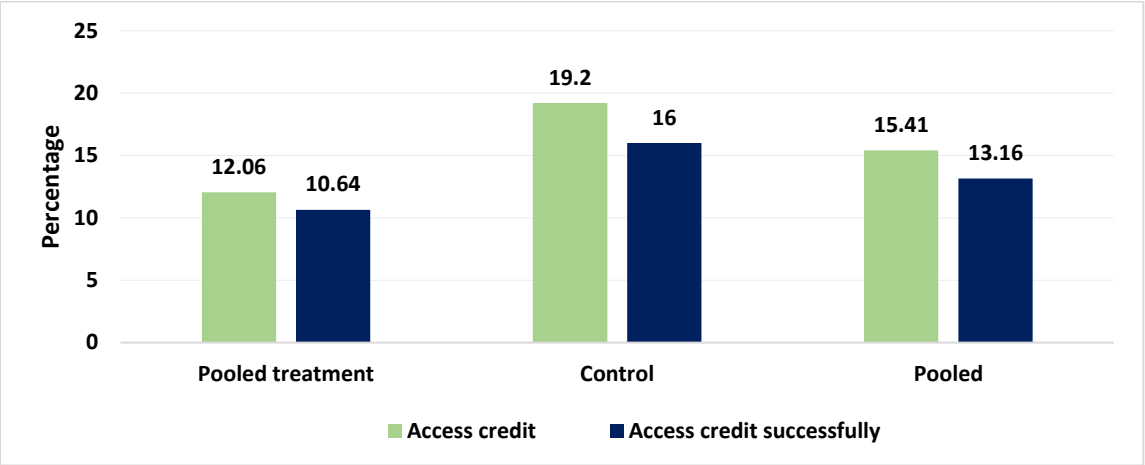
With regards to how project participants performed compared to nonparticipants at midline, Table 9 shows that project participants recorded higher real farm income and also on per hectare basis than nonparticipants. However, there was no statistically significant differences in these metrics for these groups (see Table A3 in Annex).

3.4 Access to credit

The proportion of FarmGrow beneficiaries who claim they successfully accessed credit for crop farm operations nominally reduced from 23.01% (at baseline) to 12.06% as at midline (Figure 1) and this decline was statistically significant (See Table A4 in Annex). Similarly, the proportion of control group farmers who accessed credit reduced from 23.72% at baseline to 19.20% at midline. More farmers in the ***treatment***

2 group (18.18%) indicated they successfully accessed farm credit than their ***treatment 1*** counterparts (11.54%). In comparison with the pooled treatment group, a relatively higher proportion of respondents in the control group successfully accessed cocoa farming credit in the 2018/2019 season. However, this difference was not statistically significant (See Table A5 in Annex). The distribution in farm credit access is presented in Figure 1.

Figure 1. Distribution in credit access by respondents



Source: Midline survey, 2020

3.5 Farm input use

All respondents utilized agrochemicals for pest and disease control as well as the use of fertilizers for increased cocoa yields. However, insecticides and fungicides are the most used farm inputs by respondents.

Compared to baseline conditions, midline data (see Table 10) suggest that programme participants (pooled treatment) significantly increased the use of granular fertilizers from 21.51% to 34.04% for FarmGrow beneficiaries (see Table A4 in Annex) and fungicides (from 67.57% to 69.50%) whilst there was a decline in the use of liquid fertilizers and a significant decline in the use of insecticides from 95.24% to 90.07%. The decline in insecticides use may be attributable to less insect infestation on cocoa farms as a result of implementing the Adoption Observations (AOs). Again, the increase in use of granular fertilizers may be as a result of complying with recommendations of the use of recommended granular fertilizers to increase cocoa yields. Possible increase in fungicide infestation on cocoa farms could likely explain the significant increase in the use of fungicides by programme participants.

Unlike farmers in treatment 1, all (100%) the farmers in ***treatment 2*** indicated the use of insecticides in controlling insect pests on their farms. Also, a higher proportion (45.45%) of ***treatment 2*** respondents indicated the use of liquid fertilizer and granular fertilizer (63.64%). Just 36.92% and 31.54% of ***treatment 1*** group used liquid and granular fertilizer, respectively. However, a higher proportion of farmers in ***treatment 1*** (70.00%) applied fungicides than those in ***treatment 2*** (63.64%). In general, the use of agrochemicals, i.e., fertilizers, insecticides, and fungicides, was observed to be nominally higher amongst participating farmers than in the control group at midline with no statistically significant difference between the two groups.

Table 10. Farm input use by respondents at baseline and midline compared

	Baseline		Midline	
Farm input use (%)	**Pooled treatment**	**Control**	**Pooled treatment**	**Control**
Liquid fertilizer	54.15	32.69	37.59	24.80
Granular fertilizer	21.51	12.82	34.04	25.60
Insecticides	95.24	92.63	90.07	89.60
Fungicides	67.57	73.72	69.50	64.00

Source: Midline survey, 2020

3.6 Water use

It was observed that 7 out of the 35 farmers (20%) who nurse their own seedlings do not irrigate them. Overall, just about a tenth (10.15%) of the respondent's demanded water for irrigating their nurseries, and this is done either daily (6.77%), every 2 days (1.13%) or twice a week (2.26%). The frequency of water use for nursery irrigation purposes was nominally higher for participating farmers in the pooled treatment group than for those in both the control group and the pooled.

3.7 Farm record keeping

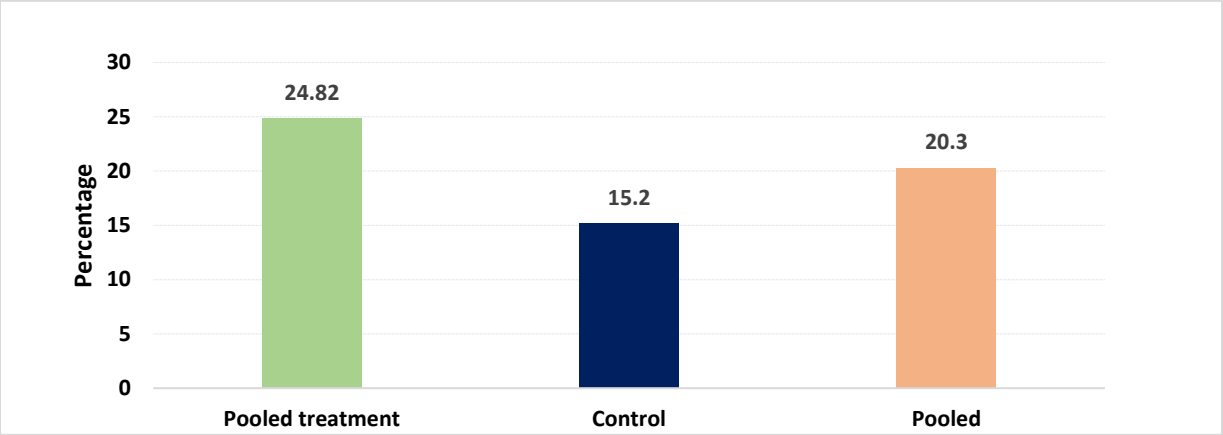
About a fifth (20.30%) of respondents indicated keeping farm records, as presented in Figure 2. A significantly higher proportion (54.55%) of the respondents in ***treatment 2*** indicated they kept farm records in the 2018/2019 season than those in ***treatment 1*** (22.31%). Additionally, more farmers in the pooled treatment category (24.82%) indicated keeping records on farm expenditure and operations than their colleagues in the control group (15.20%). This difference is statistically significant and is consistent with estimates at the baseline. Moreover, though not statistically significant, a similar trend is observed from the respondents in the control group, suggesting that interventions aimed at promoting enhanced farm record keeping among cocoa farmers may not be entirely exclusive to FarmGrow beneficiaries. Table 11 provides a breakdown.

Table 11. Farm record keeping by respondents at baseline and midline compared

Record keeping (%)	**Baseline**	**Midline**
Pooled treatment	22.30	24.82
Treatment 1		22.31
Treatment 2		54.55
Control	12.00	15.00
Pooled		**20.30**

Source: Midline survey, 2020

Figure 2. Distribution in farm record keeping by respondents.



Source: Midline survey, 2020

4.0 Conclusions

The following conclusions are derived from the midline assessment:

- Respondents for the midline survey constituted 47.2% of the baseline respondents.
- Very few youths (10.53%) are engaged in cocoa farming.
- Average cocoa farm sizes significantly declined for both project participants and nonparticipants during the second year of FarmGrow project implementation.
- Average cocoa output generally increased over the period but not significantly and nonparticipating farmers observed an insignificantly higher average cocoa output than participating farmers.
- Cocoa productivity or yield significantly increased over the period. However, there is no significant midline yield differences between participating and nonparticipating farmers with the latter group observing marginally higher yields than the former.
- The observed yield increases are predominantly influenced by significant declines in average farm sizes and marginal increases in cocoa output.
- Average cocoa farm income increased over the period but not significantly. Participating farmers recorded higher average farm incomes than nonparticipating farmers but with no significant differences.
- Considering the effects of inflation, real farm income and real farm income per hectare significantly increased over the two time periods for both respondent groups. However, as at midline, these two indicators showed no significant differences between participating and nonparticipating farmers.
- Newly introduced participating farmers (treatment 2 group) in Kasapin Community recorded significant average cocoa output, yields, and farm incomes than participating farmers in their second year of FarmGrow implementation.
- Access to credit for farm operations generally declined significantly over the period.
- Insecticides and fungicides are the most used farm inputs by all respondents. Whilst the use of fungicides marginally increased and that of granular fertilizers significantly increased for participating farmers, the use of insecticides by participating farmers significantly declined.
- A significantly higher proportion of FarmGrow beneficiaries keep farm records than the non-beneficiaries.

5.0 Recommendations

From the above conclusions, the following recommendations have been suggested to the project's management team:

- The project should endeavor to investigate the actual reasons for observing average declines in acreages put under cocoa production for both FarmGrow beneficiaries and nonbeneficiaries. This step is required to fully understand the implications for attaining productivity increases envisaged under this project.
- The project management team needs to understand the financial needs of participating farmers so that workable strategies could be provided to help ease access to farm credit as this has the potential to enhance the implementation of all recommendations emerging from the AOs.
- Project participants should be continually monitored for proffered sustainability and productivity enhancing solutions to yield desired results.
- Further learning studies should be commissioned to see if the gains made with respect to reduced land use, increased yield, farm record keeping and enhanced fertilizer use can be attributed to the project's intervention.
- The project should consider including gender, youth, and adult analysis in the endline project report.

Annexes

Table A1: Comparison of sample size by Society and survey type

No.	District	Baseline	Midline
1	Sunyani (Treatment)	184	95
2	Kasapin (Treatment)	68	46
	TOTAL	**252**	**141**
3	Goaso (Control)	312	125
	GRAND TOTAL	**564**	**266**

Source: Midline survey, 2020

Table A2: Mean comparison test of baseline and midline estimates on farm characteristics

Variable	Baseline	Midline	Mean difference	t-stat	p-value	Statistical Significance
Farm size (Ha)	5.11	4.30	0.81	2.49	0.01**	Significant
Output (Kg)	1,319.39	1,370.38	-50.98	-0.41	0.68	Not significant
Yield (Kg/ha)	307.62	359.78	-52.15	-2.45	0.01**	Significant
Farm income (GHS)	9,716.44	10,132.30	-415.85	-0.49	0.62	Not significant
Real Farm income (GHS)	8,494.14	8,857.68	-363.54	-0.49	0.62	Not significant
Farm income per ha (GHS)	2,265.41	2,723.32	2,404.87	-2.80	0.00	Significant
Real Farm income per ha (GHS)	1,980.42	2,380.73	-400.30	-2.79	0.00	Significant

**Real farm income adjusted for inflation using CPI for Brong Ahafo (114.39) using 2018 as the base (2018=100)*

Table A3: Mean comparison test for farm characteristics group at midline (Treatment vs. Control)

Variable	Treatment	Control	Mean difference	t-stat	p-value	Statistical Significance
Farm size (Ha)	4.11	4.53	0.41	0.90	0.37	Not significant
Output (Kg)	1,313.66	1,433.65	120.00	0.29	0.58	Not significant
Yield (Kg/ha)	359.00	360.63	1.63	0.04	0.97	Not significant
Farm income (GHS)	10,513.04	9,742.19	-770.85	-0.54	0.58	Not significant
Real Farm income (GHS)	9,190.52	8,516.65	-673.88	-0.54	0.59	Not significant
Farm income per ha (GHS)	2,897.02	2,545.33	2,723.32	-1.19	0.23	Not significant
Real Farm income per ha (GHS)	2,532.59	2,225.14	-307.4471	-1.20	0.23	Not significant

**Real farm income adjusted for inflation using CPI for Brong Ahafo (114.39%) using 2018 as the base (2018=100)*

Table A4. Mean comparison test of baseline and midline estimates on input use

Variable	Baseline	Midline	Mean difference	z-test	p-value	Statistical Significance
Record keeping (%)	0.16	0.20	-0.04	-1.43	0.15	Not significant
Credit access (%)	0.60	0.85	-0.25	-3.51	0.00***	Significant
Solid fertilizer (%)	0.13	0.30	-0.17	-5.30	0.00***	Significant
Liquid fertilizer (%)	0.34	0.32	0.02	0.65	0.51	Not significant
Insecticide (%)	0.94	0.90	0.04	2.15	0.03**	Significant
Fungicide (%)	0.72	0.67	0.05	1.52	0.13	Not significant

Source: Midline survey, 2020

Table A5. Mean comparison test for farm input use at midline (Treatment vs. Control)

Variable	Treatment	Control	Mean difference	z-test	p-value	Statistical Significance
Record keeping (%)	0.25	0.15	-0.10	-1.99	0.05	Significant
Credit access (%)	0.88	0.83	-0.05	-0.47	0.64	Not significant

Solid fertilizer (%)	0.34	0.26	-0.08	-1.49	0.14	Not significant
Liquid fertilizer (%)	0.34	0.26	-0.08	-1.5	0.14	Not significant
Insecticide (%)	0.90	0.90	0.00	-0.10	0.92	Not significant
Fungicide (%)	0.70	0.64	-0.05	-0.95	0.34	Not significant

Source: Midline survey, 2020

Table A6: Mean comparison test for farm characteristics group at baseline (Treatment vs. Control)

Variable	Treatment	Control	Mean difference	t-stat	p-value	Statistical Significance
Farm size (Ha)	5.00	5.21	0.22	0.47	0.64	Not significant
Output (Kg)	1,280.40	1,350.88	70.48	0.58	0.57	Not significant
Yield (Kg/ha)	302.11	312.07	9.95	0.52	0.60	Not significant
Farm income (GHS)	9,429.32	9,948.36	519.04	0.58	0.57	Not significant

Source: Midline survey, 2020

Table A7. Mean comparison test for farm input use at baseline (Treatment vs. Control)

Variable	Treatment	Control	Mean difference	z-test	p-value	Statistical Significance
Record keeping (%)	0.22	0.12	-0.10	-3.26	0.00	Significant
Credit access (%)	0.64	0.58	-0.06	-0.72	0.47	Not significant
Solid fertilizer (%)	0.14	0.13	-0.02	-0.62	0.54	Not significant
Liquid fertilizer (%)	0.35	0.33	-0.01	-0.30	0.77	Not significant
Insecticide (%)	0.95	0.94	-0.02	-0.85	0.39	Not significant
Fungicide (%)	0.68	0.75	0.07	1.84	0.07	Significant

Source: Midline survey, 2020

Table A8. Mean comparison test for farm characteristics at midline (Treatment 1 vs. Treatment 2)

Variable	Treatment 1	Treatment 2	Mean difference	t-stat	p-value	Statistical Significance
Farm size (Ha)	4.18	3.46	0.72	1.61	0.11	Not significant
Output (Kg)	1,281.54	1,675.64	-394.09	-1.45	0.17	Not significant
Yield (Kg/ha)	346.34	501.06	-154.66	-2.17	0.05	Significant
Farm income (GHS)	10,193.26	14,190.5	-3997.24	-1.64	0.12	Not significant
Farm income per hectare (GHS)	2,779.66	4,246.74	-1,467.08	-2.20	0.04	Significant

Source: Midline survey, 2020