FarmGrow: Farm Development Plans for Smallholder Cocoa Farmers in Ghana

Baseline Report

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EXECUTIVE SUMMARY

Satellite for Farming, or Sat4Farming, is a consortium of the Rainforest Alliance (lead institution), Touton, Grameen Foundation, University of Ghana, WaterWatch Projects, and Satelligence and is funded by the Geodata for Agriculture and Water (G4AW) program of the Netherlands Space Office (NSO). The Sat4Farming project is designed to assist smallholder cocoa farmers in Ghana to increase cocoa yields from 400 kg / hectare to 1500 kg / hectare (over 300%) over an 8- to 10-year period by developing a geo-data enabled precision agriculture service and technology platform known as FarmGrow. Agronomists will use FarmGrow with participating cocoa farmers to provide them with individualized support in adopting good agricultural practices (GAPs) and increasing on-farm investments to improve cocoa yields and cocoa income.

This report outlines the results for a quantitative and qualitative baseline assessment that was conducted between November and December 2018 among cocoa farmers selected by Touton to engage with the Sat4Farming project. Farmers in Sunyani and Kasapin cocoa societies are considered the treatment group and farmers in Goaso, who will not receive services under Sat4Farming until after the endline study is completed in late 2020, are considered the comparison group.

The results of the Sat4Farming baseline study indicate that there is much room for improvement in farm conditions and adoption of GAPs. There is a low use of fertilizers (less than 30 percent) but relatively high use of insecticides (about 95 percent) and fungicides (about 70 percent); however, qualitative data indicates that farmers primarily face a challenge with respect to the timing of the application of insecticides and fungicides. When households do not own their own equipment and have to rely on someone else to spray their farm, the application of the sprays are often late, reducing their effectiveness.

Almost all farmers reported pruning in the last year, with most reporting either pruning twice or more than 10 times. Approximately 85 percent of farmers reported maintaining shade trees on their cocoa farms; for those who maintain shade trees, their estimated yields are much higher than those who do not have shade trees (311 kg/hectare compared to 289 kg/hectare among those without shade trees). Most farmers (77 percent) rely on slash-and-burn to prepare their land for both cocoa farming and cash crops. Between 32 and 47 percent of farmers reported establishing a new farm in the last five years, which raises a concern about deforestation. Instead of intensifying efforts on existing cocoa farms, farmers may be using new lands to achieve the yields they need for income purposes. Fifty percent of farmers reported using soil and water conservation techniques; intercropping followed by planting of shade trees were the most reported techniques used.

Finally, a regression analysis revealed that insecticides followed by fungicides and pruning were the techniques most influential on yields. This suggests that for farmers who may have limited funds to apply all GAPs could see the most impact from applying insecticides and fungicides. Mars researchers shared that pruning may be significantly related to the other two techniques as pruning reduces the need for insecticides and fungicides when dead or disease limbs are also removed. Pruning also directs energy and nutrients into fruit-bearing branches. Therefore, farmers should consider pruning prior to insecticide and fungicide use given its double benefits to the tree.

If a typical farmer fully adopted all GAPs, Mars research estimates that a farmer might be expected to spend 4,492 GHS to simply maintain their current farm (no rehabilitation or renovation), resulting in an expected return of 400-500 kg per hectare. For rehabilitating and renovating their farm[1], a farmer would be expected to spend between 5,500 and 9,442 GHS, respectively, resulting in an expected return of 1.5 metric tons per hectare. When the current average yield of 307 kg per hectare (as measured among the farmers in this study) is compared to the targets of either 400-500 kg per hectare for basic good farm maintenance and 1.5 metric tons per hectare that would result from farm renovation, there is significant room for improvement.

If average incomes are 9,716.45 GHS for cocoa farmers and farm renovation can cost a similar amount (9,442 GHS), the investment gap is significant. However, despite the likely need for external investment, the results show there is very little use of credit among these farmers, either due to low access to credit or aversion to taking credit given real or perceived high interest rates. When credit is noted, it is often coming from informal lenders such as the local cocoa purchasing clerk and often requested for non-cocoa related expenses, such as education fees, funeral expenses, and health costs. Farmers also indicated that due to the seasonality of cocoa farming and their significant household expenditure, it is always difficult to save which affects their ability to attract credit. Most of the communities visited had no organized saving groups despite farmer interest in being part of such savings mechanisms. Farmers also felt that crop diversification and intercropping could help them have regular access to funds and facilitate their ability to save and access credit. Given women's important roles in income diversification and intercropping, this could have important implications for how Sat4Farming should engage spouses of male farmers in key farming decisions if they are not already a primary decision-maker on the cocoa farm.

In conclusion, the baseline study indicates there is much room for improvement to ensure that the current yields of 307 kg per hectare reach the desired 1.5 metric tons per hectare goal set by the Sat4Farming project. FarmGrow has been designed to address this key concern: by supporting farmers in the adoption of GAPs and supporting the farmers' understanding of the investment needs and the potential returns on investment will provide them with a clearer roadmap to improving their income and professionalizing their farms as well as providing the cocoa sector with a more reliable and sustained source of cocoa for years to come.

[1] Farm renovation entails the removal of old trees and planting new trees. Rehabilitation includes grafting or rejuvenation pruning of existing trees. Both techniques (often known as R&R) improve productivity on farms by increasing the amount of coffee produced by each tree.

ACKNOWLEDGMENTS

The authors of this baseline report would like to thank the enumerators who worked with the University of Ghana to collect data for this report. In addition, many thanks go to Touton and its agronomists who helped the research team gain entry into cocoa farming communities and assisted with locating the farmers.

We would like to thank the Sat4Farming consortium members who provided critical input into the interpretation of the data: Alfred Yeboah, Francis Arthur, Camara-Laye Ibrahim, Joseph Davis, Samuel Ntow, Mona McCord, Gigi Gatti, Julian Gomez, Hannah Rubio of Grameen Foundation; Henk van Rikxoort, Teun Smorenburg, Selasse Gidiglo of Rainforest Alliance; Frank Asiedu, Ernest Dwamena, Samuel Akoi-Wontumi of Touton; Jori Langwerden and Andre Jellema of WaterWatch Projects; Loes Masselink, Ernst Kuilder and Femke Dekker of Satelligence; and Peter van Grinsven, independent consultant.

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1. INTRODUCTION

Satellite for Farming, or Sat4Farming, is a consortium of the Rainforest Alliance (lead institution), Touton, Grameen Foundation, University of Ghana, WaterWatch, and Satelligence and is funded by the Geodata for Agriculture and Water (G4AW) program of the Netherlands Space Office (NSO). The SAT4Farming project is designed to assist smallholder cocoa farmers in Ghana to increase cocoa yields from 400 kg / hectare to 1500 kg / hectare (over 300%) over an 8- to 10-year period by developing a geo-data enabled precision agriculture service and technology platform. The major vehicle through which the overarching goal will be achieved is the deployment of a digital agriculture advisory tool, known as FarmGrow, that agronomists will use with participating cocoa farmers to assist them in adopting good agricultural practices (GAPs) and increasing on-farm investments to improve cocoa yields and cocoa income, *ceteris paribus*.

1.1 Sat4Farming Theory of Change

Sat4Farming hypothesizes that a system of effective and inclusive agricultural advisory and business services reinforced by satellite technology will lead to farmers receiving high quality services and using satellite data inputs for timely decision-making which will result in improved farming methods and adoption of GAPs, increased yields up to 1.5 ton/hectare over a 8-10 year period, and a 30-40% decrease in water/inputs use per ton of cocoa which will have the following effects:

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

If there is an increase in adoption of GAPs and timely decision-making due to use of satellite data, then there will be an increase in productivity and farmers will sell a larger quantity of cocoa; and, if there is an increase in quality or acquisition of new certification labels through adoption of GAPs then the farmers will receive higher prices and/or will reduce their costs. The increase in price realization, quantity sold, paired with the adoption of sustainable farming practices will increase farmers' income and sustainability.

The implementation of the information management system provided by FarmGrow will improve the implementing organization's (in this case, Touton) efficiency, farmer visibility, transparency/traceability and effectiveness which, combined with the increase in farmers' production and sales, will allow for an increase in the quantity and quality of the produce bought and, eventually, to the appropriation and scaling of the model.

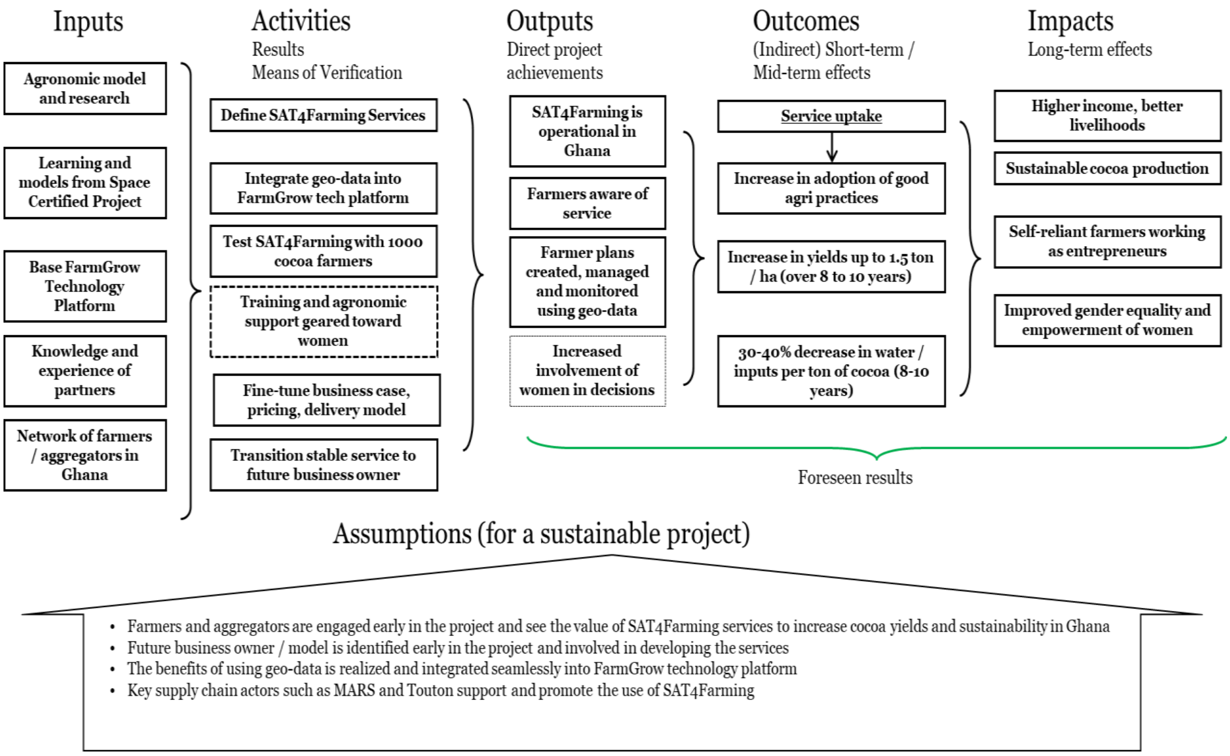
The combination of all the changes described above will ultimately lead to self-sufficient and entrepreneurial farmers and measurable improvement in the lives of poor people working in the cocoa value chain and reduce poverty among smallholder cocoa households through higher income.

For these changes to be effective there is a set of assumptions that need to be taken into account for the expected changes to be fully realized. The assumptions made are the following:

- Farmers and aggregators are engaged on the FarmGrow technology platform and farmers actively encouraged to subscribe to the platform
- Farmers have access to inputs and other business services
- Farmers have access to financing
- Household decisions are shared (enabling women's role in cocoa farming decisions)
- Farmers are visited frequently by agronomists
- The FarmGrow tool is understood by the agronomists and used for guiding interaction with farmers
- Farmers are actively trained on good agronomic and environmental practices
- The benefit of using geo-data is realised through integration into the FarmGrow technology platform
- Organization's staff will use FarmGrow data to monitor the project and take decisions based on the results found
- Key supply chain actors such as MARS and Touton will support and promote the use of FarmGrow.

This theory of change is summarized below in Figure 1.

Figure 1: Sat4Farming theory of change



1.2 Purpose of Report

As part of the Sat4Farming mandate is a research and evaluation agenda that includes quantitative and qualitative baseline, midline, and endline assessments. This report covers the results primarily from the quantitative baseline survey which was conducted between 29th November and 12th December, 2018. Some qualitative data is integrated throughout where relevant and important.

2. PROJECT METHODOLOGY

The baseline study included a random sample of 564 cocoa farming households in three cocoa districts (Kasapin, Goaso, and Sunyani) that are of relevance to Touton, a private sector business entity and a key project partner. Cocoa farmers sampled from the Sunyani and Kasapin cocoa districts were project participants ready to utilize FarmGrow (and thus served as the treatment group) while those sampled from Goaso district were non-project participants (not utilizing FarmGrow and hence served as a counterfactual group, or the comparison group). Farmers were recruited based on their status as "FarmGrow"-ready: they had achieved cocoa certification and had at least 2 hectares of cocoa.

The 10-day data collection exercise was preceded by a comprehensive two-day enumerator training workshop and a one-day baseline questionnaire pre-test that was conducted with organic cocoa farmers belonging to Yayra Glover Company located in the Suhum Municipal Assembly in the Eastern Region of Ghana. The SAT4Farming baseline survey was carried out in Sunyani, Kasapin and Goaso cocoa districts in the Brong Ahafo region of Ghana. In all, 564 cocoa farmers were sampled for the baseline survey with the anticipation that these sampled farmers are very likely to participate in the project through the use of the FarmGrow. Forty nine (49) cocoa farming households were also sampled for the project-level Women's Empowerment in Agriculture Index (pro-WEAI) assessment, which was developed by the International Food Policy Research Institute (IFPRI), the Oxford Poverty and Human Development Initiative (OPHI), and thirteen partner projects in the Gender, Agriculture, and Assets Project, Phase 2 (GAAP2) portfolio, of which Grameen Foundation is a participant.

3. BASELINE RESULTS

3.1 Sociodemographic Characteristics

This section provides findings on key sociodemographic and socioeconomic characteristics of all surveyed respondents (pooled) and by respective cocoa districts/societies. The distribution of sampled household heads and household demography are presented in Table 1 and Table 2, respectively.

3.1.1 Sample and population distribution

The baseline survey sampled and interviewed 564 households from 3 cocoa districts/societies. About 45% (254 respondents) were FarmGrow-ready project participants from Kasapin and Sunyani districts (see Table 1). The remaining 312 respondents (55%) came from Goaso society, which served as the counterfactual group. They also were assumed to be FarmGrow-ready farmers, but will not receive FarmGrow services until after the endline assessment has been completed.

Table 1: Distribution of sampled respondents

Society	Freq.	Percent	Society	Freq.	Percent
Kasapin	**68**	**12.06**	**Goaso**	**312**	**55.32**
Male	43	63.2	Male	206	66.0
Female	25	36.8	Female	106	34.0
Sunyani	**184**	**32.62**	**Pooled**	**564**	**100**

Male	154	83.7	Male	403	71.4
Female	30	16.3	Female	161	28.6

Source: Baseline survey, 2018

3.1.1.1 Gender

From these respondents, 492 (87%) were household heads, comprising 398 males (81%) and 94 females (19%). The majority (71%) of these sampled respondents were males 403 (71%) and this trend is reflected in all three societies. In Table 2, the baseline survey registered a total sampled household population of 3,341 individuals, with males and females each constituting 50% of the population (1,679 males and 1,662 females).

Table 2: Distribution of sampled population by gender and society

Society	Freq.	Percent	Society	Freq.	Percent
Kasapin			**Goaso**		
Male	210	51.5	Male	924	49.4
Female	198	48.5	Female	945	50.6
Total	**408**	**100**	**Total**	**1,869**	**100**
Sunyani			**Pooled**		
Male	545	51.2	Male	1,679	50.3
Female	519	48.8	Female	1,662	49.8
Total	**1,064**	**100**	**Total**	**3,341**	**100**

Source: Baseline survey, 2018

3.1.1.2 Household size

All three societies had an average household size of 6 people (Table 3). Household size ranged from 1 to 23 members, with Goaso society reporting the highest. This average household size is consistent with baseline data collected through the FarmGrow application (data not shown).

Table 3: Mean household size per society

Variable	Observation	Mean	Std. Dev.	Minimum	Maximum
Household size					
Kasapin	68	5.9	2.9	1	15
Sunyani	184	5.8	2.6	1	17
Goaso	312	6.0	3.3	1	23
Pooled	**564**	**5.9**	**3.0**	**1**	**23**

Source: Baseline survey, 2018

3.1.2 Age and marital status of respondents

3.1.2.1 Age of respondents

Table 4 indicates that the average age of sampled respondents was 53 years, with the minimum and maximum age of 19 years and 98 years, respectively.

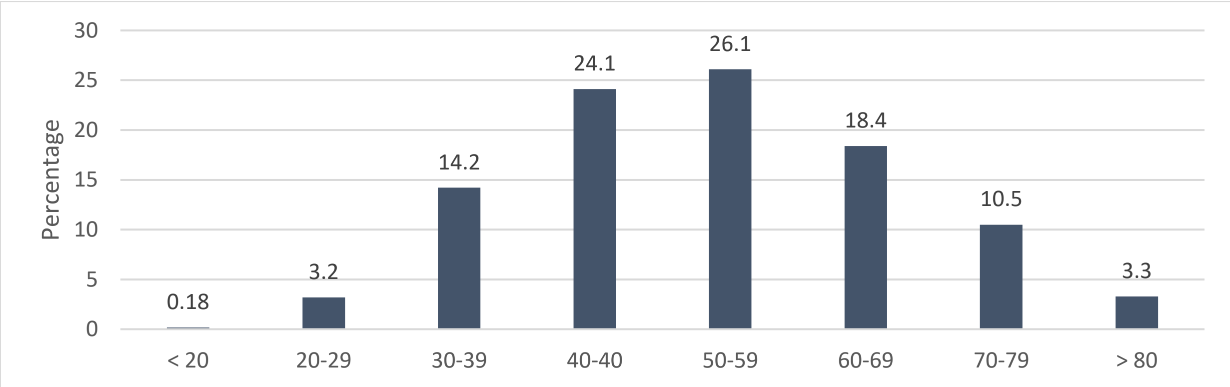
Figure 2 shows how the ages of sampled respondents are distributed; the majority (50%) of farmers identified with the 40 to 59 years range. A re-categorization of the respondents' ages into youth (15-35 years), adult (36-64 years), and elderly (65 years and more) showed that the majority (84%) comprising 472 respondents belong to the adult age group (Figure 3 and Figure 4). This is consistent with other studies conducted in Ghana with cocoa farmers where the age of the cocoa farmer was between 48 and 55 years of age. As the Royal Tropical Institute (KIT) pointed out in their study conducted in Ghana and Cote d'Ivoire with cocoa farming households, this age is more representative of the age of the male head of household, which tends to be considered as the head "farmer" and does not represent the average age of those that support the farming household.[2]

Table 4: Age of sampled respondents

Variable	Observation	Mean	Std. Dev.	Minimum	Maximum
Kasapin	68	50	11.99	26	90
Goaso	312	51	14.35	19	95
Sunyani	184	57	12.68	24	98
Pooled	**564**	**53**	**13.00**	**19**	**98**

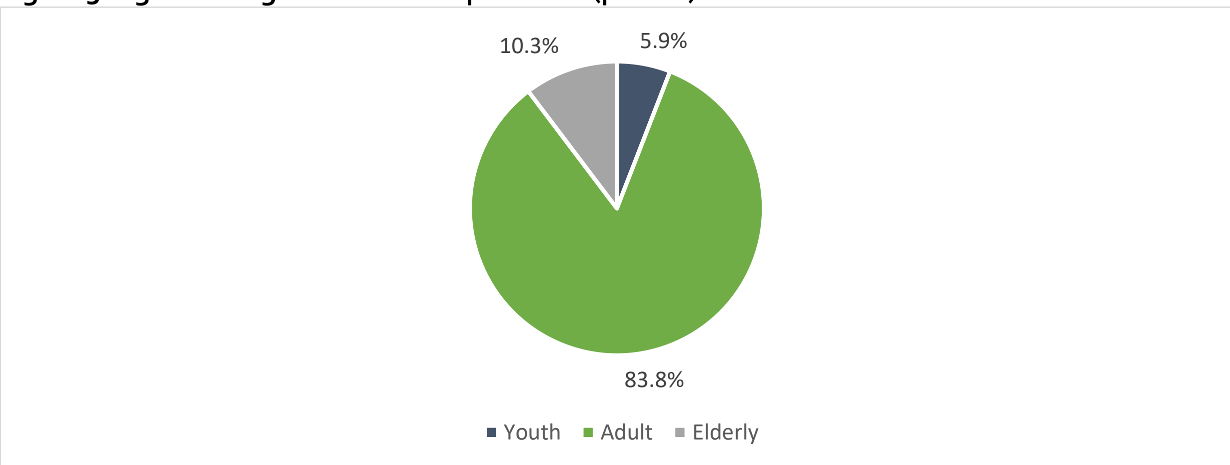
Source: Baseline survey, 2018

Figure 2: Age distribution of respondents (pooled)



Source: Baseline survey, 2018

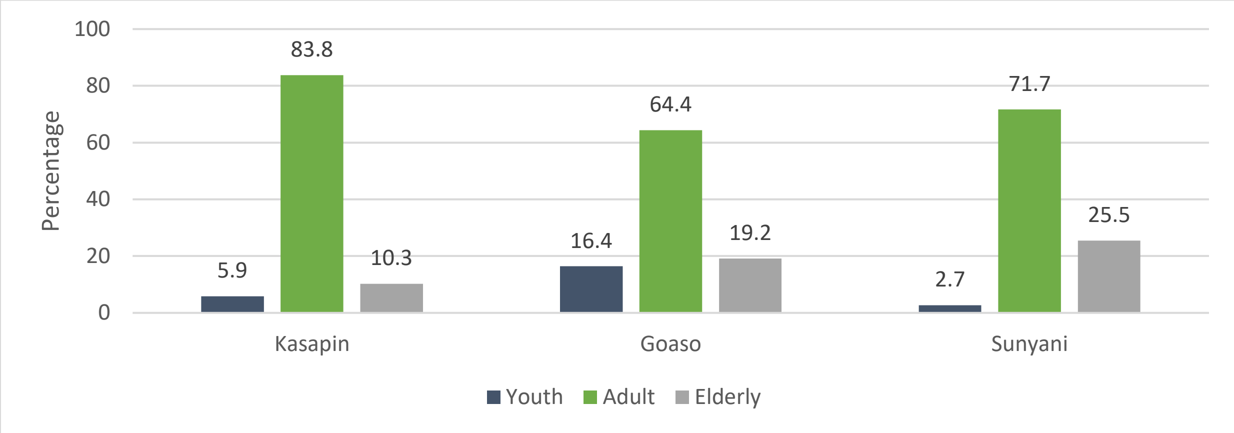
Figure 3: Age re-categorization of respondents (pooled)



Source: Baseline survey, 2018

[2] Bymolt R, Laven A, Tyszler M. 2018. "Chapter 3: Respondent and household demographics." Demystifying the cocoa sector in Ghana and Côte d'Ivoire. The Royal Tropical Institute (KIT).

Figure 4: Age category of respondents by society



Source: Baseline survey, 2018

3.1.2.2 Age dependency ratio

Ghana Statistical Service (GSS) defines the working force as Ghanaians within the ages of 15 and 64 and this age group represents the economically active population (EAP). Thus, household members above 64 years and less than 15 years are not included in the labour work force and are considered the dependent age group.

To conform to the Ghana Statistical Service (GSS) age categories/classification, the survey found that no respondent (0%) was a child (less than 15 years), 450 respondents (80%) were economically active (15-64 years), and 114 respondents (20%) were elderly/aged (+ 65 years). The age dependency ratio can be calculated as the ratio of dependents (people younger than 15 or older than 64) to the working/ economically active population. A higher dependency ratio means that employed people must support more non-working people. Due to the high dependency ratio among African countries, the quest to achieve a 50% demographic dividend[3] is paramount. According to the World Bank, Ghana has an age dependency ratio of 72%, implying that 72 Ghanaians with age less than 15 years or greater than 65 years depend on 100 Ghanaians in the 15 to 64 years age range in 2018 (www.data.worldbank.org).

An examination of the age structure of the entire household population of FarmGrow-ready cocoa farmers, as indicated in Table 5, indicates that the dependency age group constitutes approximately 41% (1,366 people) whilst the economically-active population age group make up 59% (1,975 people), resulting in an Age Dependency Ratio (ADR) of about 41%. This dependency ratio implies that for 100 household members, 41 of them depend on the remaining 59 who are economically active to take care of them. Put differently, 41% of the household population in the three cocoa societies surveyed are dependents. This gives insight into the extent of household resource allocation (especially financial resources) of the cocoa farmers and the financial burdens placed on them.

Table 5: Age structure of respondents' household population

Age category (years)	Description	Freq.	Percent
0-14	Children	1,169	35.0

[3] Demographic dividend is having the age dependency ratio being at most 50% (World Economic Forum Report, 2017).

15-64	Working age	1,975	59.1
65 and above	Elderly/aged	197	5.9
Total		**3,341**	**100**

Source: Baseline survey, 2018

3.1.2.3 Marital status

The majority (83%) of these farmers are married. Thirteen percent (13%) are divorced, separated, or widowed and very few (3%) are not yet married (Table 6).

Table 6: Marital status by society

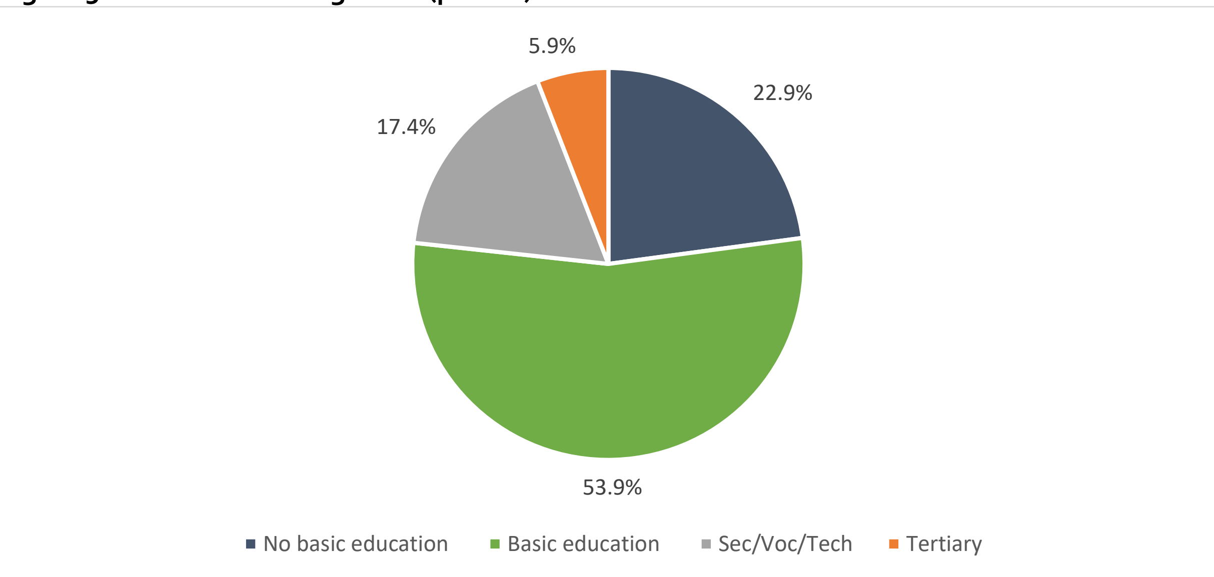
Society		Marital status						
		Single	Married	Divorced	Separated	Widowed	Cohabiting	Total
Kasapin	No.	0	61	2	1	4	0	**68**
	%	0.0	13.1	10.0	7.7	9.3	0.0	**12.1**
Sunyani	No.	3	159	6	4	12	0	**184**
	%	15.8	34.1	30.0	30.8	27.9	0.00	**32.6**
Goaso	No.	16	247	12	8	27	2	**312**
	%	84.2	52.9	60.0	61.5	62.8	100.0	**55.3**
Pooled	No.	**19**	**467**	**20**	**13**	**43**	**2**	**564**
	%	**3.4**	**82.8**	**3.6**	**2.3**	**7.6**	**0.4**	**100**

Source: Baseline survey, 2018

3.1.3 Educational level

The survey revealed that 129 farmers (23%) had no formal education while the remaining 73% had reached various levels of educational attainment, including basic, secondary, vocational, technical, and tertiary levels (see Figure 5).

Figure 5: Educational background (pooled)



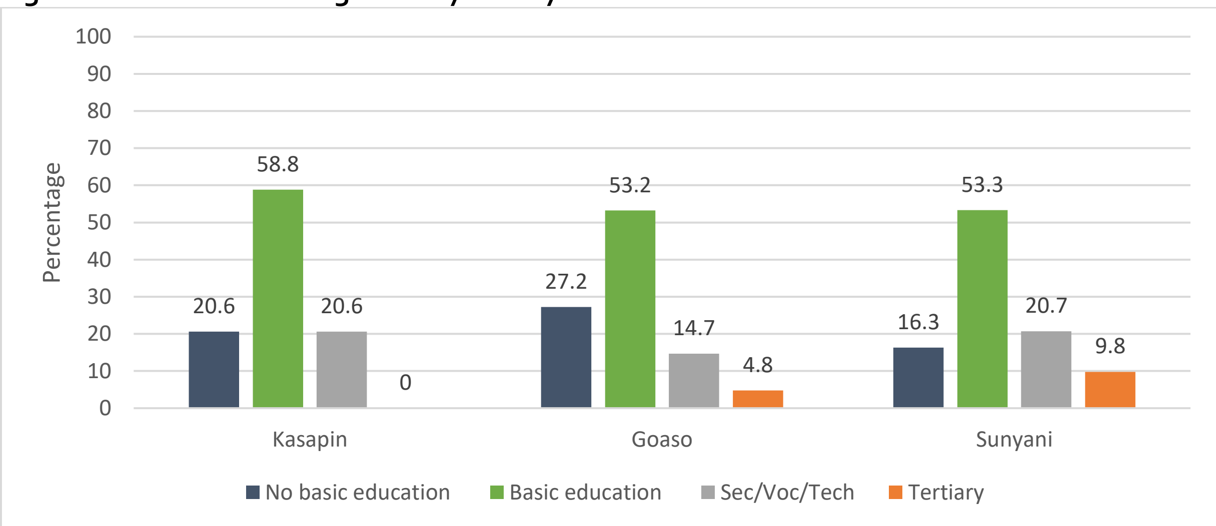
Source: Baseline survey, 2018

A disaggregation of the data indicates that the majority (54%) of the respondents had attained a basic level of education (from primary to Junior Secondary School (JSS)), only 6% had attained tertiary level of education, and 17% had reached secondary, technical, vocational levels of education. This is also what KIT found in their study: approximately 58% of farmers had attained at least a primary level of education.[4] Educational attainment level has been found to be an important determinant for cocoa income[5] and younger, more educated farmers have been found to be more productive than older farmers and more likely to adopt new farming techniques[6].

3.1.3.1 Educational level by society

In general, Goaso had the highest number of farmers (27%) with no educational background while Sunyani (a regional capital with relatively better educational facilities and resources) had the lowest (16%) (Figure 6). Moreover, comparing educational levels of farmers in the three societies, Goaso farmers had the lowest educational attainment at the secondary, vocational, and technical levels (15%) and the lowest regarding tertiary level (5%), noting that Kasapin had no farmer with a tertiary educational background.

Figure 6: Educational background by society



Source: Baseline survey, 2018

3.1.3.2 Educational level by gender

Table 7 indicates women were more likely than men to have no basic education and while men and women had similar achievements of basic education, men were much more likely to have achieved secondary or tertiary levels of education.

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4 Ibid.

5 Hiscox M & Goldstein R. 2014. Gender Inequality in the Ghanaian Cocoa Sector. Harvard University. Available at https://www.cocoalife.org/~/media/CocoaLife/News%20Articles%20PDF/Ghana%20Gender%20Assessment%20by%20Harvard%20University.pdf

6 Oomes N, Tieben B, Laven A, Ammerlaan, T, Appelman R., Biesenbeek C & Buunk E. 2016. Market concentration and price formation in the global cocoa value chain. SEO Amsterdam Economics. Available at http://www.seo.nl/en/page/article/ marktconcentratie-en-prijsvorming-in-de-mondiale-waardeketen-voor-cacao

Table 7: Educational level by gender

	Male		Female	
	No.	**%**	**No.**	**%**
No basic education	75	18.6	54	33.5
Basic education	217	53.8	87	54.0
Secondary/vocational/ technical	80	19.9	18	11.2
Tertiary	31	7.7	2	1.2
Total	**403**	**100**	**161**	**100**

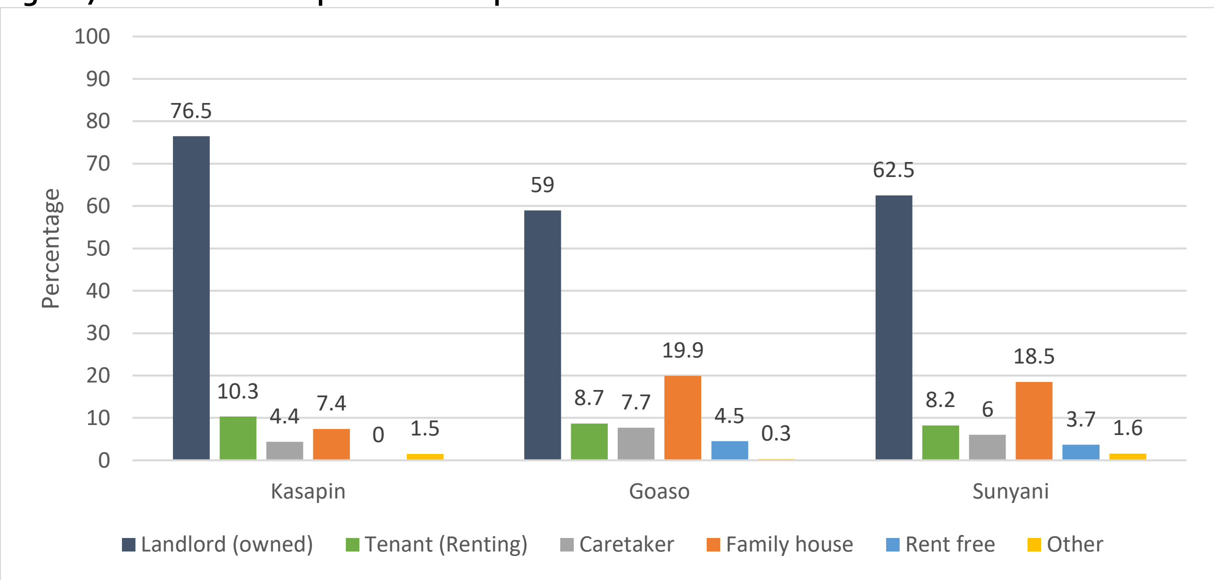
Source: Baseline survey, 2018

3.2 Residential Infrastructure

3.2.1 Ownership status

The baseline survey gathered information on respondents' residential infrastructure, including data on household ownership status and materials used for roofing and walls. The results showed that the majority (62%) of the respondents were land owners/landlords, 9% were tenants, 7% were caretakers, 18% lived in a family house, rent free, 4% lived rent free. Figure 7 presents the house ownership status by district. Of some interest is the number of respondents (18%) who are caretakers and neither rent nor own houses and yet are participating in the project which generally aims to work with landlords.

Figure 7: House ownership status of respondents

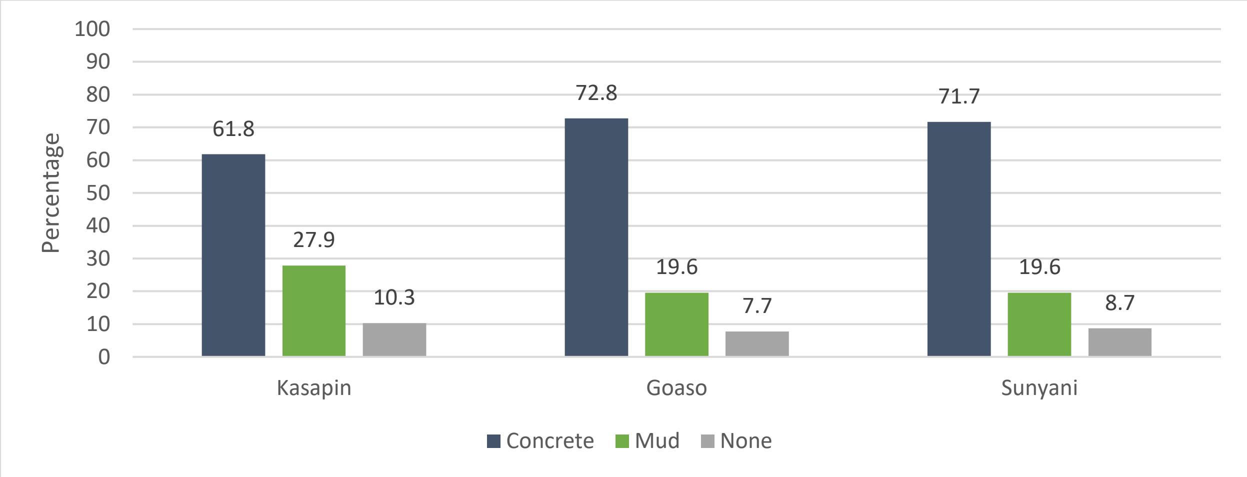


Source: Baseline survey, 2018

3.2.2 House Materials

In general, the majority (71%) of respondents used concrete as building material for walls, 21% utilized wattle and dub, commonly called mud, and 8% used other materials for this purpose. This information is presented in Figure 8 by society, where it is observed that the majority (28%) of households in Kasapin were using wattle and dub as walls, compared to the other two societies.

Figure 8: Main materials used for house walls

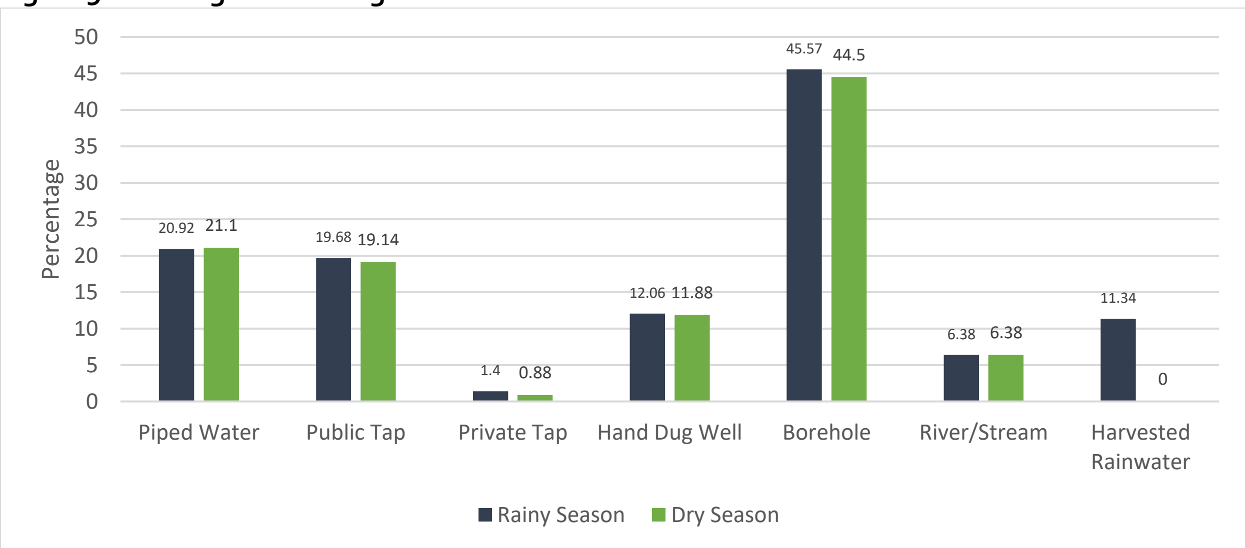


Source: Baseline survey, 2018

3.2.3 Water Sources

Almost half of households rely on boreholes for drinking and cooking water followed by piped water, public tap water and hand dug wells (Figure 9). There is very little variation between dry and rainy seasons except for use of harvested rainwater.

Figure 9: Drinking and cooking water sources



Source: Baseline survey, 2018

3.3 Household Food Security and Health Status

3.3.1 Food Security

This section describes respondents' food security status. The household food security scale was used to assess the food security status of the respondents, who were asked to describe their households' food consumption patterns from a given set of options. Their responses inferred whether they were food secured or insecure. For food insecure households, their level of food insecurity was further assessed.

The results showed that 270 (48%) of sampled respondents, who described the quantity and quality of food consumed by their households as enough were considered food secure (see Table 8). The remaining food insecure respondents (52%), the majority of whom were found to be food insecure without hunger (or low severity).

Table 8: Food security status by society

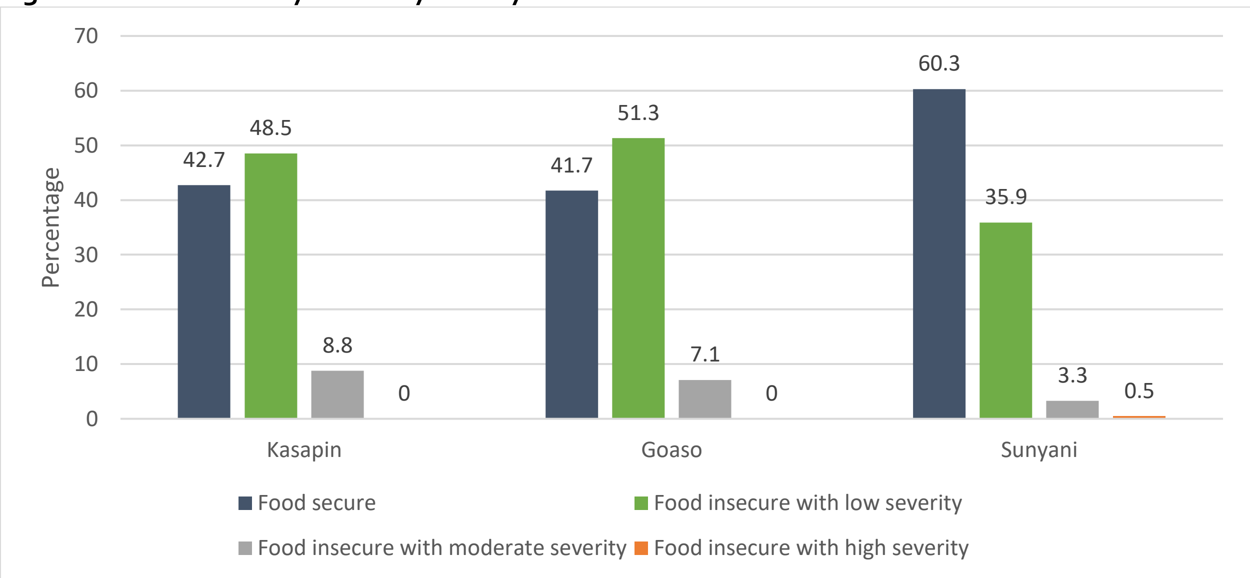
Household food access		Kasapin	Goaso	Sunyani	Total
Food secure	No.	29	130	111	270
	%	42.7	41.7	60.3	47.9
Food insecure with low severity	No.	33	160	66	259
	%	48.5	51.3	35.9	45.9
Food insecure with moderate severity	No.	6	22	6	34
	%	8.8	7.1	3.3	6.0
Food insecure with high severity	No.	0	0	1	1
	%	0.0	0.0	0.5	0.2
Total	**No.**	**68**	**312**	**184**	**564**
	%	**100**	**100**	**100**	**100**

Source: Baseline survey, 2018

Although about 46% of respondents had enough food to eat, they did not always get the kinds of food they desired, hence classified as *food insecure with low severity*. The approximate 6% of the respondents who mentioned sometimes not getting enough food to eat were classified as *food insecure with moderate severity*. Additionally, 0.2% of the respondents, who stated they often do not have enough food to eat, were categorised as *food insecure with high severity*.

At society level, the majority (60%) of respondents in Sunyani were food secure compared to Kasapin and Goaso (See Figure 10). However, the only case of food insecurity with high severity was recorded in Sunyani.

Figure 10: Food security status by society



Source: Baseline survey, 2018

3.3.2 Perception of household health conditions

The health condition of economically-active populations matters to the socioeconomic development of communities. Hence, the perceived health status of farming households were elicited, likewise their ability to afford medical treatment in cases of health emergencies. In general, about 506 respondents (90%) feel they have at least good health or better (Table 9). The situation is not significantly different in the three societies, with about 90% claiming at least good health conditions for their households.

Table 9: Respondents' perception of household health situation by society

Health situation		Kasapin	Sunyani	Goaso	Total
Excellent	No.	13	51	45	109
	%	19.1	27.7	14.4	19.3
Very Good	No.	26	57	133	216
	%	38.2	31.0	42.6	38.3
Good	No.	22	56	103	181
	%	32.4	30.4	33.0	32.1
Fair	No.	7	18	31	56
	%	10.3	9.8	9.94	9.9
Poor	No.	0	2	0	2
	%	0.0	1.1	0.0	0.4
Total	**No.**	**68**	**184**	**312**	**564**
	%	**100**	**100**	**100**	**100**

Source: Baseline survey, 2018

3.3.3 Delays in medical treatment due to cost

Respondents indicated that they are financially challenged in seeking medical care whenever any such situations arise. Approximately 10% (58 respondents) delay in seeking medical care for this reason (Table 10). When you break down the results by society, the majority of these delays due to cost can be found in Goaso.

Table 10: Delays in medical treatment due to cost

Delay In Seeking Medical Treatment		Kasapin	Goaso	Sunyani	Total
No	No.	61	268	173	502
	%	89.7	86.0	94.0	89.0
Yes	No.	6	42	10	58
	%	8.8	13.5	5.4	10.3
Don't Know	No.	1	2	1	4
	%	1.5	0.6	0.5	0.7
Total	**No.**	**68**	**312**	**184**	**564**
	%	**100**	**100**	**100**	**100**

Source: Baseline survey, 2018

3.3.4 Resilience to health shocks and sources of payment for medical treatments

About 61% (343 respondents) indicated their ability to raise the needed cash to solve emergency health challenges in the households (compared to 52% nationally[7]) (Table 11). The remaining 39% who indicated their inability to raise income for this purpose is worrying, despite the possibilities or options they could resort to, such as relatives, friends, employers, their own savings, and/or the cocoa purchasing clerks, to whom they sell their cocoa produce.

Table 11: Ability to raise funds for health emergency

		Kasapin	Goaso	Sunyani	Total
Very possible	No.	13	66	64	143
	%	19.1	21.2	34.8	25.4
Somewhat possible	No.	22	106	72	200
	%	32.4	34.0	39.1	35.5
Not very possible	No.	10	55	24	89
	%	14.7	17.6	13.0	15.8
Not at all possible	No.	23	84	24	131
	%	33.8	26.9	13.0	23.2
Don't know	No.	0	1	0	1
	%	0	0.3	0	0.2
Total	**No.**	**68**	**312**	**184**	**564**
	%	**100**	**100**	**100**	**100**

Source: Baseline survey, 2018

Table 12 indicates the various payment sources that respondents resort to in times of health emergencies. The majority (27%), representing 152 respondents, mentioned the *informal private lender or purchasing clerk* as their main source during periods of health emergency. The dependence on own savings (20%) and on family and friends (19%) are the next sources for dealing with emergency health situations. Nationally, 32% indicated they relied on savings and 34% relied on family and friends and only 1% relied on private lenders.[8] The use of cocoa purchasing clerks for access to emergency credit is noteworthy as is the low reliance on savings.

Table 12: Source of payment during health emergencies

Health emergency payment source		Kasapin	Goaso	Sunyani	Total
Savings	No.	10	43	59	**112**
	%	14.7	13.8	32.2	**19.9**
Family, relatives, or friends	No.	13	60	34	**107**
	%	19.1	19.2	18.6	**19.0**
Money from working or loan from employer	No.	5	44	14	**63**
	%	7.4	14.1	7.7	**11.2**
Borrowing from financial institution	No.	3	11	6	**20**
	%	4.4	3.5	3.3	**3.6**
An informal private lender or purchasing clerk	No.	23	86	43	**152**
	%	33.8	27.6	23.5	**27.0**
Some other source	No.	5	16	4	**25**

[7] World Bank. 2017. Global Financial Inclusion Database. https://datacatalog.worldbank.org/dataset/ghana-global-financial-inclusion-global-findex-database-2017
[8] Ibid.

	%	7.4	5.1	2.2	**4.4**
Don't know	No.	9	50	23	**82**
	%	13.2	16.0	12.6	**14.6**
Refused	No.	0	2	0	**2**
	%	0.0	0.6	0.0	**0.4**
Total	**No.**	**68**	**312**	**183**	**563**
	%	**100**	**100**	**100**	**100**

Source: Baseline survey, 2018

3.4 Household Poverty Status and Changes in Assets

3.4.1 Poverty Probability Index (PPI)

The baseline study analyzed the proportion of households living below the *USD 3.10 poverty line* using the PPI. The respondents were asked 10 verifiable household questions in relation to 10 indicators that highly correlated with poverty in Ghana. The responses were scored and converted into poverty likelihood values using the *PPI look-up table* for Ghana. The mean poverty likelihood value was computed and interpreted as the percentage of households that could not afford a daily consumption expenditure of USD 3.10 per capita.

Overall, approximately 16% of the sampled respondents, representing 88 households, were observed to be living below the USD 3.10 poverty line (Table 13). It was further observed amongst the societies, a relatively higher proportion of cocoa farming households in Kasapin (18%) were living below the poverty line than those in Goaso (16%) and Sunyani (14%). This trend suggests that poverty is basically more of a rural phenomenon, as Kasapin is a rural community compared to Sunyani which is the regional capital.

Compared to values from recent PPI studies conducted in Ghana and Cote d'Ivoire by KIT,[9] the computed PPI values for the Sat4Farming cocoa societies (both treatment and control communities) were observed to be relatively lower. In comparison, this implies that relatively fewer Sat4Farming cocoa farmers live below the assigned poverty line. Thus, cocoa farmers in these societies potentially have higher annual household income per capita than cocoa farmers in other cocoa regions.

Table 13: Comparison between Sat4Farming and KTI PPI values

Society	SAT4FARMING	KIT (Ghana)*	Deviation
Kasapin	18.1%	24.4%	-6.3%
Sunyani	13.8%	24.4%	-10.6%
Goaso	16.0%	24.4%	-8.4%
Pooled	**15.6%**	**24.4%**	**-8.8%**

Source: Baseline survey, 2018 **KIT Average is used for all societies.*

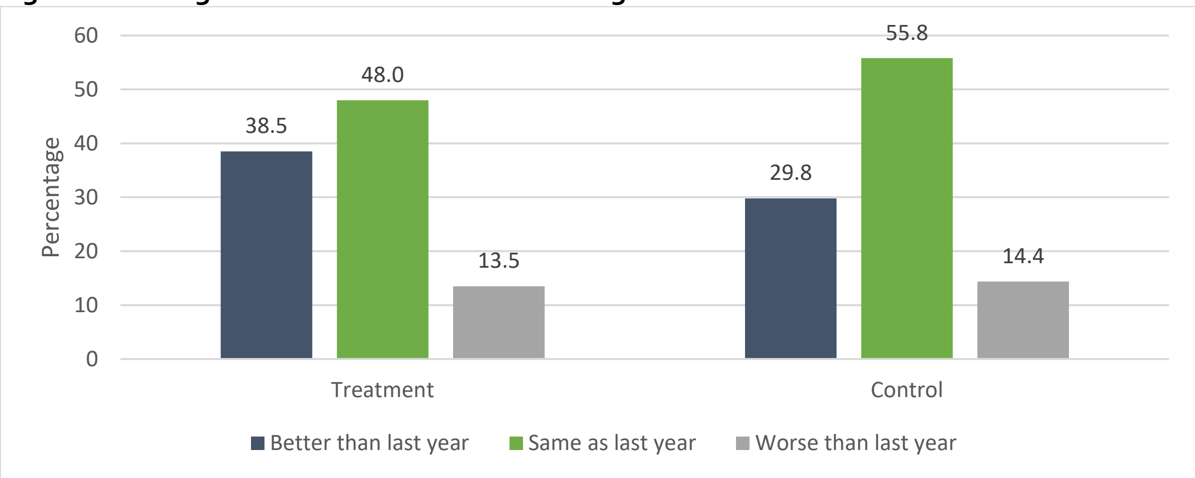
[9] Bymolt R, Laven A, Tyszler M. 2018. Demystifying the cocoa sector in Ghana and Côte d'Ivoire. The Royal Tropical Institute (KIT). https://www.kit.nl/project/demystifying-cocoa-sector/

3.4.2 Changes in household assets in past year

The study further assessed changes in respondent's household infrastructure, household appliances and livestock holdings over the past 12 months. Changes in these variables are expected to reflect respondents' welfare changes through increased household income.

Generally, most respondents did not observe any significant improvement in their household infrastructure or increase in household appliances over the past year. However, about a third of the respondents recorded an increase in their livestock holdings in 2018 (see Figure 11).

Figure 11: Changes in household livestock holdings

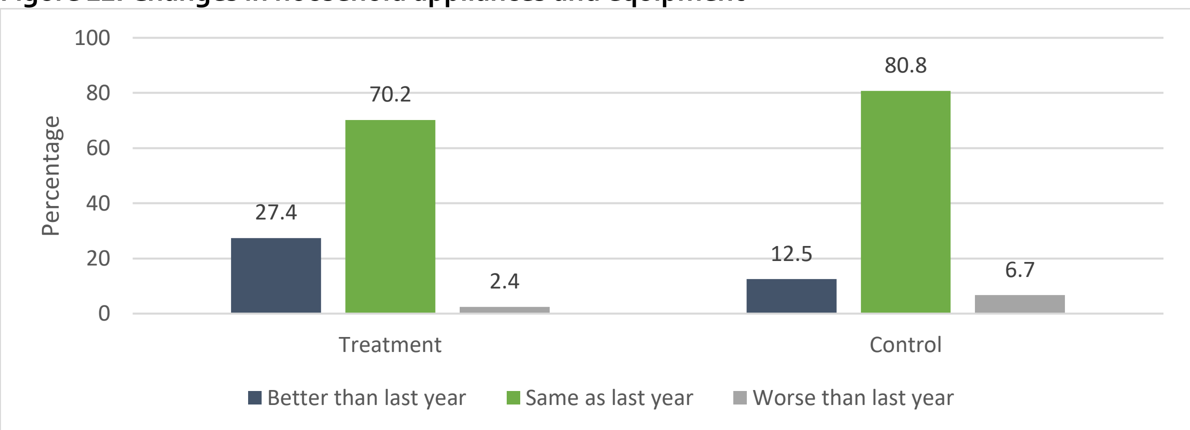


Source: Baseline survey, 2018

Although few (27% for treatment and 13% for control group) respondents mentioned adding to their household appliances and equipment, the majority (at least 70%) of sampled respondents (treatment and control groups) indicated no change in the acquisition of any such items

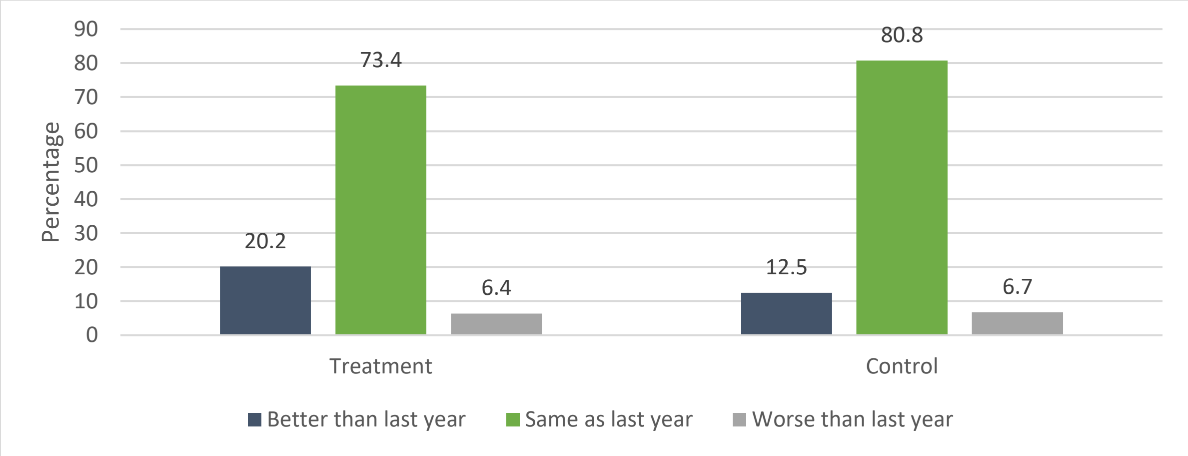
Figure 12Figure 12) whilst the majority (73% for treatment and 81% for control group) did not experience any improvements or adding onto their building structure (Figure 13).

Figure 12: Changes in household appliances and equipment



Source: Baseline survey, 2018

Figure 13: Changes in rooms and building structure



Source: Baseline survey, 2018

3.5 Household Income and Expenditure

3.5.1 Household income sources and amounts

Respondents were asked to indicate their various income sources and the frequency of earning from these sources. Data on expenditure outlays or household cost centres were generated as well. Respondents were asked to recall income or expenditure based on a daily, weekly, monthly, quarterly, semi-annual, or annual basis and this amount was annualized.

3.5.1.1 Income sources and their contributions

Crop farming (cocoa and non-cocoa) activities represent the main household income sources for FarmGrow farmers. As expected, all (100%) respondents mentioned cocoa farming as an income source, followed by the cultivation of other crops (23%) and general trading (12%) (Table 14). Based on the multiple responses of income sources, the survey revealed that cocoa farming (65%), cultivation of other crops (15%), and general trading (8%) were the top three (3) sources of income depended upon by these households.

Table 14: Annual household income sources and amounts (pooled data)

Sources	No.	% of sample	% of total responses	Total Income	Avg. Income	% (Total income)	% (Avg. income)
Artisanship	16	2.8	1.9	210,480.00	13,155.00	1.8	10.9
Bee keeping	1	0.2	0.1	1,200.00	1,200.00	0.0	1.0
Remittances	53	9.4	6.1	1,230,900.00	23,224.53	10.8	19.3
Non-cocoa farming	128	22.7	14.8	2,315,996.00	18,093.72	20.3	15.0
Cocoa farming	564	100	65.1	5,480,075.00	9,716.45	48.0	8.1
Petty trading	9	1.6	1.0	79,455.00	8,828.33	0.7	7.3
Poultry	13	2.3	1.5	45,380.00	3,490.77	0.4	2.9
Salaried work	13	2.3	1.5	216,792.00	16,676.31	1.9	13.8
General trade	70	12.4	8.1	1,834,285.00	26,204.07	16.1	21.7
Total	**867**	**564**	**100**	**11,414,563.00**	**20,238.59**	**100**	**100**

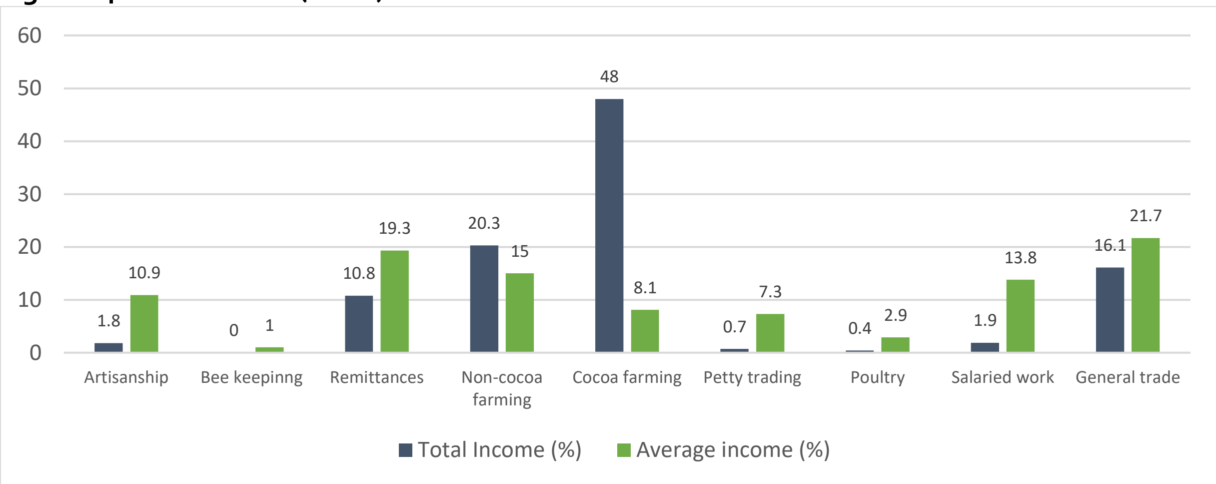
Source: Baseline survey, 2018 *Multiple response table* *Average income =Total Income/No of respondents*

3.5.1.2 Contributions to average household income

Cocoa income alone contributes almost 48% to total annual household income. More revealing from this survey, however, is that cocoa farming is the sixth important contributor (8%) to average household income, despite the engagement of all respondents in cocoa farming (refer to Table 14). Instead, the highest contributor to average household income was from small businesses/general trading activities for those reporting this as an income source (22%), bringing in an annual average cash inflow of about GHS 26,000. This is followed by remittances (19%), non-cocoa farming activities (15%), salaried work (14%), and then artisanship (11%).

For the majority of the respondents, cocoa is the primary contributor to household income. Among the 23% who note non-cocoa farming as an income source, the average amount of these other income sources is greater than the amount contributed by cocoa farming. This is similar for the amounts that remittances, artisanship, salaried work and general trading contribute among the few who note them as income sources. This suggests that cocoa is the fifth most significant income-generating activity among those who report other income sources; these other income sources are successful and significant contributors to household income. Figure 14 depicts the share of total income that each income source contributes in graphical form.

Figure 14: Contribution (share) of income sources



Source: Baseline survey, 2018

3.5.2 Household expenditures and amounts

3.5.2.1 Expenditure sources

At least twelve (12) household expenditure/cost centres were identified. Table 15 indicates that almost all households expended on food purchases. Social responsibilities (such as funerals, marriages, and child naming ceremonies), travels, and purchases of clothing were also high expenditure centres. However, when expenditures on children's school fees and the associated feeding and transportation costs are considered together, then expenditures on education represented the most mentioned expenditure source by almost 18% of respondents. Twenty-three (23) percent pay for rented homes. Also worth noting is the 231 respondents (41%) who mentioned incurring expenses on their crop production activities, suggesting that 59% do not expend on this activity.

3.5.2.2 Contributions to household average expenditure

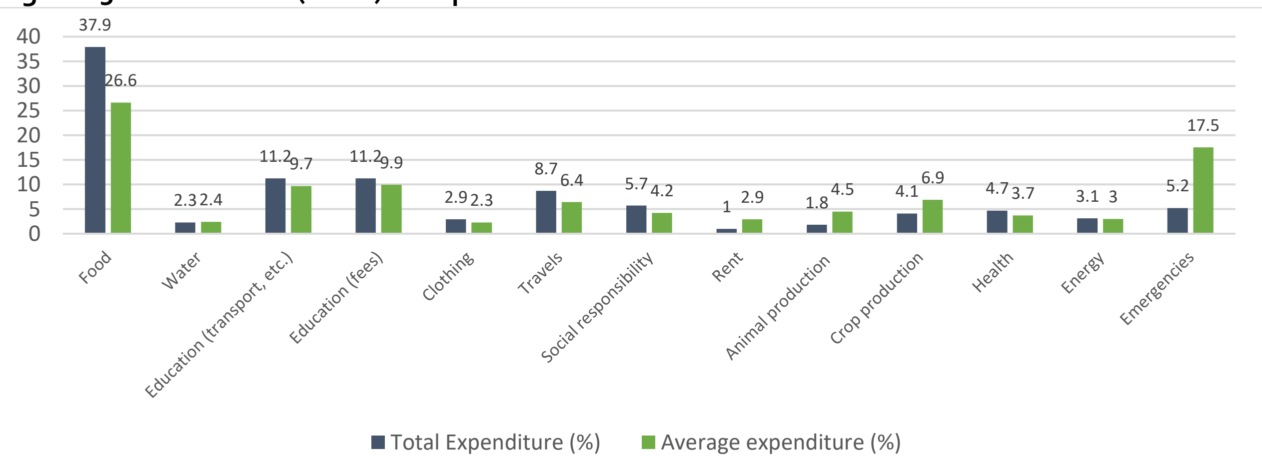
Ranking the expenditure items based on actual expenditure outlays, food expenditures contributed the highest (27%) to annual average household expenditures, spending about GHS 5,900.00 annually (Table 15). This was followed by an average annual expenditure of about GHS 4,300.00 on children's education (20%), emergency/unplanned expenditures (18%), and then expenditures associated with crop production (7%). Aside from food expenditures, the data suggest that cocoa farmers in these societies have substantial out-of-pocket expenses on education. The broad range of expenditure sources and their individual expenditure contributions is graphically presented in Figure 15.

Table 15: Household expenditure items and amounts

Expenditure items	No.	% of sample	% of total responses	Total Exp.	Avg. Exp.	% (TL Exp.)	% (Avg. Exp.)
Food (purchased)	560	99.3	11.3	3,284,236.00	5,864.71	37.9	26.6
Water	384	68.3	7.8	202,966.50	528.56	2.3	2.4
Education (Feeding, transport etc.)	456	80.9	9.2	971,849.00	2,131.25	11.2	9.7
Education (Fees)	444	78.7	9.0	973,914.00	2,193.50	11.3	9.9
Clothing	502	89.0	10.1	253,507.00	504.99	2.9	2.3
Travels	528	93.6	10.7	750,468.00	1,421.34	8.7	6.4
Social responsibility	531	94.2	10.7	495,824.52	933.76	5.73	4.2
Rent	132	23.4	2.7	83,148.00	629.91	1.0	2.9
Animal production	161	28.6	3.3	158,337.00	983.46	1.8	4.5
Crop production	231	41.0	4.7	352,788.73	1,527.22	4.1	6.9
Health	503	89.2	10.2	410,203.00	815.51	4.7	3.7
Energy	400	70.9	8.1	267,790.20	669.48	3.1	3.0
Emergency/ Unexpected	117	20.7	2.4	452,353.00	3,866.26	5.2	17.5
Total	**4949**	**564**	**100**	**8,657,384.95**	**15,349.97**	**100**	**100**

Source: Baseline survey, 2018 *Multiple response table*

Figure 15: Contribution (share) of expenditure sources



Source: Baseline survey, 2018

3.5.2.3 Income versus expenditure

A comparison of total and average annual incomes and expenditures were compared at the society level and then pooled. As shown in Table 16, respondents from Goaso had the highest average annual household income of approximately GHS 20,700.00 whilst the average annual household expenditure was the highest (GHS 17,000.00) for Sunyani society. This probably gives an indication that respondents from Goaso have more income generating opportunities available within the society compared to the other two, *ceteris paribus*. The higher expenditures registered by Sunyani respondents may be attributed to the high cost of living associated with urban communities, *ceteris paribus*, compared to Goaso (peri-urban) and Kasapin (rural). Kasapin had both the lowest average annual income and expenditures.

Table 16: Summary of annual household income and expenditure by society

	Household income (GHS)			Household expenditure (GHS)			Difference (GHS)	
	N	Total (T_1)	Average (A_1)	N	Total (T_2)	Average (A_2)	Total (T_1-T_2)	Average (A_1-A_2)
Kasapin	68	1,281,157.50	18,840.55	68	645,693.50	9,495.49	635,464.00	9,345.06
Goaso	312	6,454,635.00	20,687.93	312	4,879,918.35	15,640.76	1,574,716.65	5,047.17
Sunyani	184	3,678,771.00	20,687.93	184	3,131,773.10	17,020.51	546,997.90	2,972.81
TOTAL	**564**	**11,414,563.50**	**20,238.59**	**564**	**8,657,384.95**	**15,349.97**	**2,757,178.55**	**4,888.62**

Source: Baseline survey, 2018

In general, respondents in all three societies showed positive average annual net cash inflows, with Kasapin and Sunyani recording the highest (GHS 9,345.06) and lowest (GHS 2,972.81) net cash flows, respectively. On a per capita basis, Kasapin respondents had the highest and lowest per capita income and expenditure respectively, as shown in Table 17. Given the standard deviation for Sunyani, it is very likely that there is an outlier that is heavily skewing the income results overall.

Table 17: Per capita income and expenditure comparisons by society

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Per capita income					
Total income per capita (Kasapin)	68	5,049.26	9,859.53	211.11	75,175.00
Total income per capita (Goaso)	312	4,589.08	8,171.84	95.00	89,041.66
Total income per capita (Sunyani)	184	4,606.16	20,583.87	200.00	262,137.50
Total income per capita (Total)	**564**	**4,650.13**	**13,645.47**	**95.00**	**262,137.50**
Expenditure per capita					
Total expenditure per capita (Kasapin)	68	3,049.61	1,935.42	563.25	11,015.00
Total expenditure per capita (Goaso)	312	3,661.41	3,881.74	470.20	36,580.00
Total expenditure per capita (Sunyani)	184	4,976.89	6,911.82	519.20	50,570.00
Total expenditure per capita (Total)	**564**	**4,016.81**	**4,978.15**	**470.20**	**50,570.00**

Source: Baseline survey, 2018

Table 18: Significance of average annual household income and expenditure by society

Society	Obs.	Mean	T-stat	p-value	Decision
Avg. Income					
Kasapin	68	18,840.55	-0.2118	0.8325	No significant difference
Sunyani	184	20,210.74			

Kasapin Goaso	68 312	18,840.55 20,687.93	-0.5750	0.5661	No significant difference
Goaso Sunyani	312 184	20,687.93 20,210.74	0.0765	0.9391	No significant difference
Avg. Expenditure					
Kasapin Sunyani	68 184	9,495.49 17,020.51	-4.9740	0.0000	Significant difference
Kasapin Goaso	68 312	9,495.49 15,640.76	-4.8883	0.0000	Significant difference
Goaso Sunyani	312 184	15,640.76 17,020.51	-1.0372	0.3004	No significant difference

Source: Baseline survey, 2018

Are the differences in incomes and expenditures per society statistically significant or different from each other? In other words, do these differences matter? Table 18 indicates that the differences in average annual household income in the three societies are not statistically significant from each other. Put differently, cocoa farmers in these societies have similar levels of income. However, expenditure levels differ between respondent farmers in Kasapin and Sunyani and also between Kasapin and Goaso, implying that Kasapin has the least expenditure levels, again likely due to Kasapin's more rural location compared to the other two societies.

3.6 Cocoa Production Activities

This section presents information on respondents' cocoa farming activities and farm profile. This section also highlights the perceptions of these farmers on aspects of their farm business. Farmers' access to various institutional arrangements and their intensification/extensification (expansion of cocoa farming to new lands) behaviors are also analyzed and presented.

3.6.1 Basic farm characteristics

3.6.1.1 Cocoa farm characteristics and farm income

The average size of cocoa farm cultivated by the 564 respondents was 5.11 ha, with Kasapin cultivating the lowest (3.90 ha) and the highest being Sunyani (5.31 ha). The minimum cultivated was 0.4 ha (Goaso) and maximum was 48 ha (Sunyani) (see Table 19).

Average cocoa output (in 64.5kg bags) was approximately 21 bags, with the corresponding cocoa output (in kgs) of 1,319.4 kgs. Again, Kasapin recorded the lowest on these indicators. Average yield recorded was 307.6 kg/ha, with Kasapin recording the highest yield (380.15 kg/ha) and the lowest being Goaso (295.1 kg/ha). Translating these yield figures into cocoa income, respondents received an average income of GHS 9,716 for the 2017/2018 cocoa season, and an average income per capita of GHS 2,142.

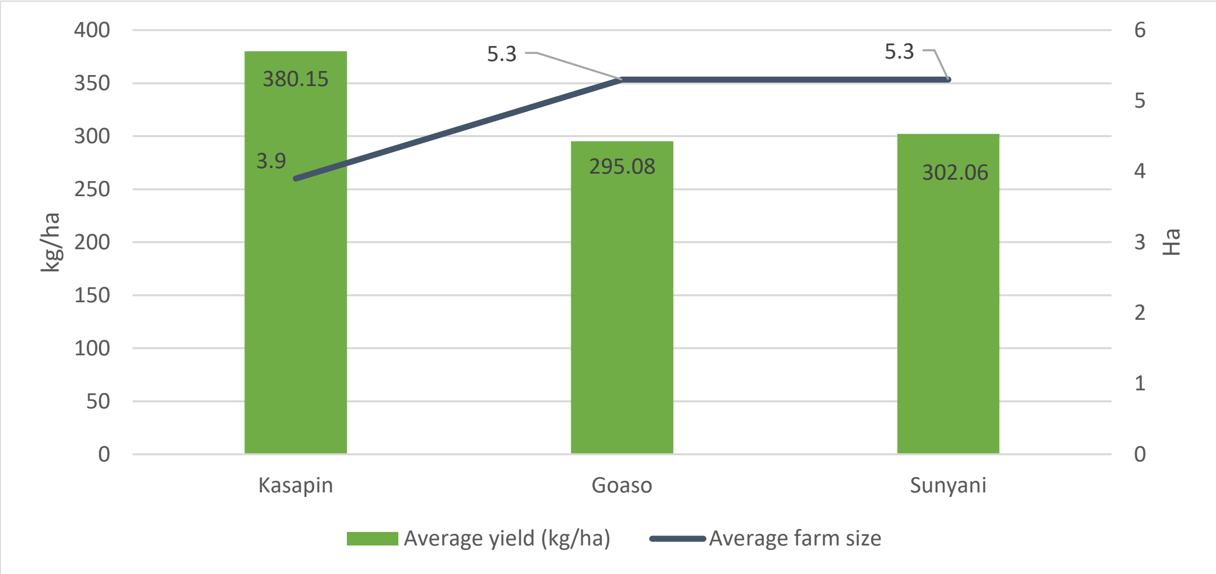
On the average, Kasapin had the lowest farm size but recorded the highest average yield whilst the Goaso, which had a bigger farm size, recorded the lowest average yield (Figure 16). This suggests that cocoa farmers in Kasapin may be more efficient and productive than their colleagues in Goaso society.

Table 19: Respondents' farm characteristics and farm income by society

Characteristics	Obs.	Mean	Standard deviation	Min.	Max.	Total
Farm size (Ha)						
Kasapin	68	3.90	3.13	0.6	18	264.47
Goaso	312	5.26	5.91	0.4	42.5	1,641.64
Sunyani	184	5.31	5.29	0.6	48	978.46
Pooled	**564**	**5.11**	**5.46**	**0.4**	**48**	**2,884.57**
Output in bags (64.5Kg)						
Kasapin	68	18.18	15.24	3	87	1,236.50
Goaso	312	20.94	24.90	1	210	6,534.50
Sunyani	184	20.47	21.76	1	150	3,766.00
Pooled	**564**	**20.46**	**22.91**	**1**	**210**	**11,537.00**
Output in kilograms (Kg)						
Kasapin	68	1,172.86	983.13	193.5	5,611.5	79,754.28
Goaso	312	1,350.88	1,606.05	64.5	13,545	421,475.18
Sunyani	184	1,320.15	1,403.59	64.5	9,675	242,907.05
Pooled	**564**	**1,319.39**	**1477.62**	**64.5**	**13,545**	**744,136.51**
Yield (kg/ha)						
Kasapin	68	380.15	297.05	52.16	1,404.08	-
Goaso	312	295.08	212.56	16.12	1,346.91	-
Sunyani	184	302.06	225.00	4.83	1,693.13	-
Pooled	**564**	**307.62**	**229.45**	**4.83**	**1,693.13**	**-**
Farm income (GHS)						
Kasapin	68	8,637.32	7,240.09	1,425	41,325.00	587,337.50
Goaso	312	9,948.36	11,827.47	475	99,750.00	3,103,887.00
Sunyani	184	9,722.01	10,336.52	475	71,250.00	1,788,850.00
Pooled	**564**	**9,716.45**	**10,881.73**	**475**	**99750.00**	**5,480,074.50**
Farm income per capita						
Kasapin	68	1,966.94	2,416.04	203.57	13,775.00	
Goaso	312	2,200.44	3,054.78	95.00	21,375.00	
Sunyani	184	2,107.97	2,487.58	105.56	14,250.00	
Pooled	**564**	**2142.12**	**2804.79**	**95.00**	**21,375.00**	

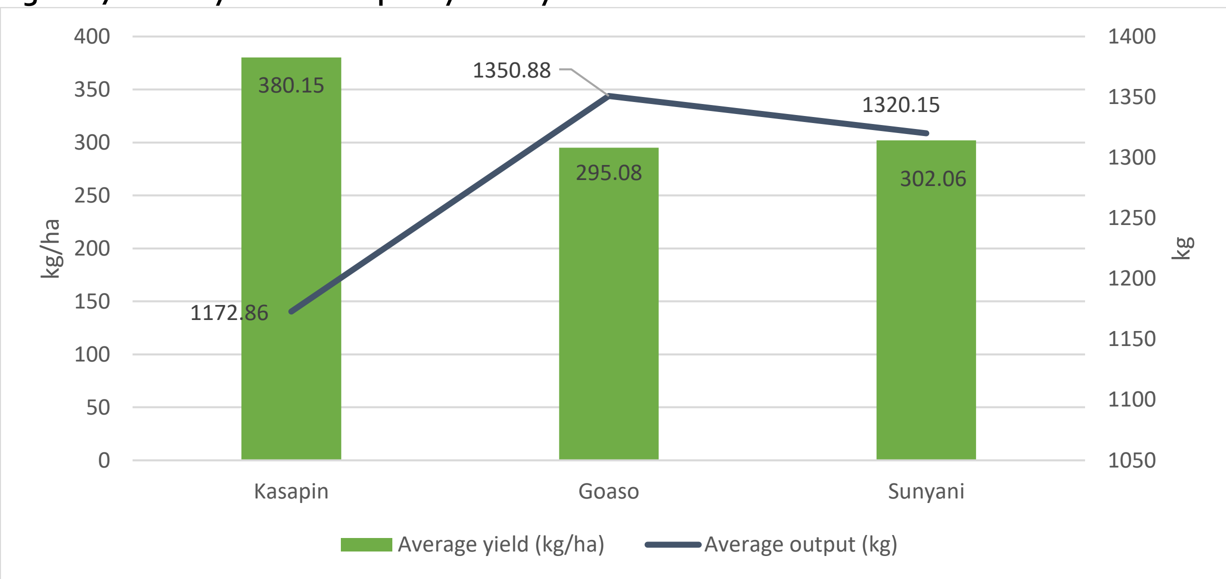
Source: Baseline survey, 2018

Figure 16: Cocoa yield and farm size by society



Source: Baseline survey, 2018

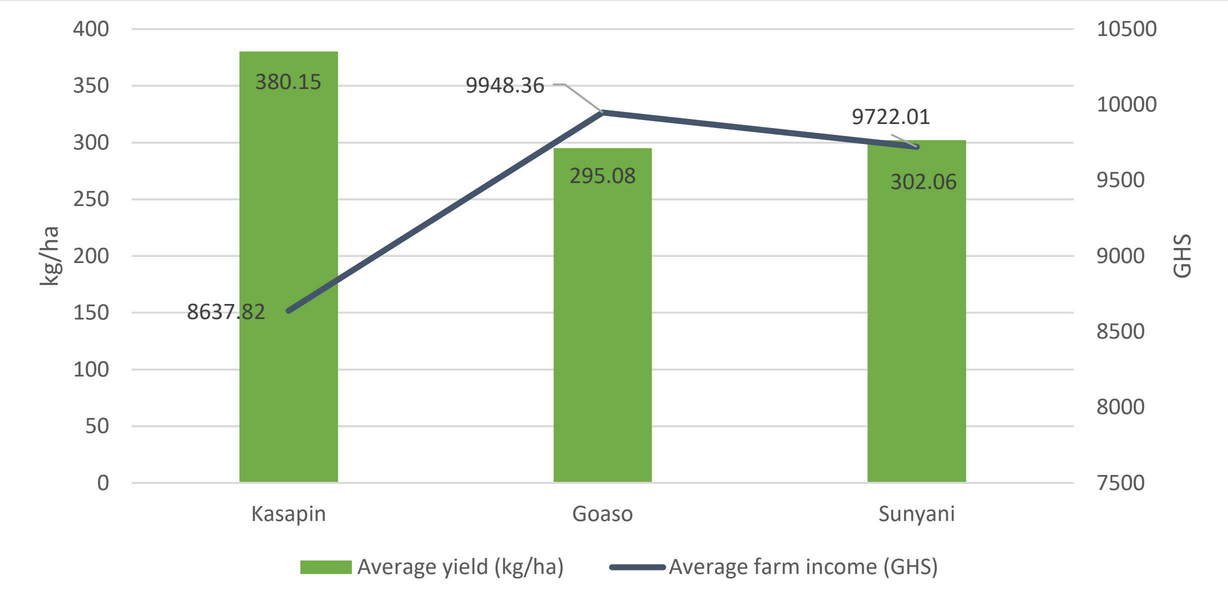
Figure 17: Cocoa yield and output by society



Source: Baseline survey, 2018

Figure 17 also reveals that on average, Kasapin with the lowest cocoa output produced the highest yield whilst Goaso, producing the highest cocoa output, recorded the lowest yield. Interestingly, Kasapin with the highest average yield received the lowest average income of GHS 8,637 compared with Goaso that recorded the highest average annual income of GHS 9,948 but produced the lowest average yield (Figure 18).

Figure 18: Cocoa yield and farm income by society



Source: Baseline survey, 2018

What is deduced from these comparisons is that high cocoa output is what matters in generating increased cocoa farm income (with cocoa price remaining fixed) and secondly, with a given farm size, increased cocoa yields increases farm income. With respect to cocoa incomes, farmers in Goaso earn 2.28% more than their Sunyani counterparts and 13.18% more than their Kasapin counterparts. These income differences may be attributed to differences in productivity (yield), output, and farm size and how these variables interact.

A further analysis suggests that average cocoa yields and average farm sizes, respectively, registered statistically significant differences between farmers in Kasapin and Sunyani and then between Kasapin and Goaso (Table 20). This implies that land productivity of cocoa farmers in Kasapin is significantly higher than the other two societies. However, the study found no statistically significant differences in average annual farm incomes among the three societies.

Table 20: Significant differences in key variables by societies

Variable	Obs.	Mean	T-Stat.	p-value	Decision
Cocoa Farm Income (GHS)					
Kasapin	68	8,637.32	-0.7957	0.4269	No Significant difference
Sunyani	184	9,722.01			
Kasapin	68	8,637.32	-0.8784	0.3803	No Significant difference
Goaso	312	9,948.36			
Sunyani	184	9,722.01	0.2155	0.8294	No Significant difference
Goaso	312	9,948.36			
Yield (Kg/ha)					
Kasapin	68	380.16	2.2333	0.0264	Significant difference
Sunyani	184	302.07			
Kasapin	68	380.16	2.7660	0.0060	Significant difference
Goaso	312	295.08			
Sunyani	184	302.07	-0.3458	0.7297	No Significant difference
Goaso	312	295.08			

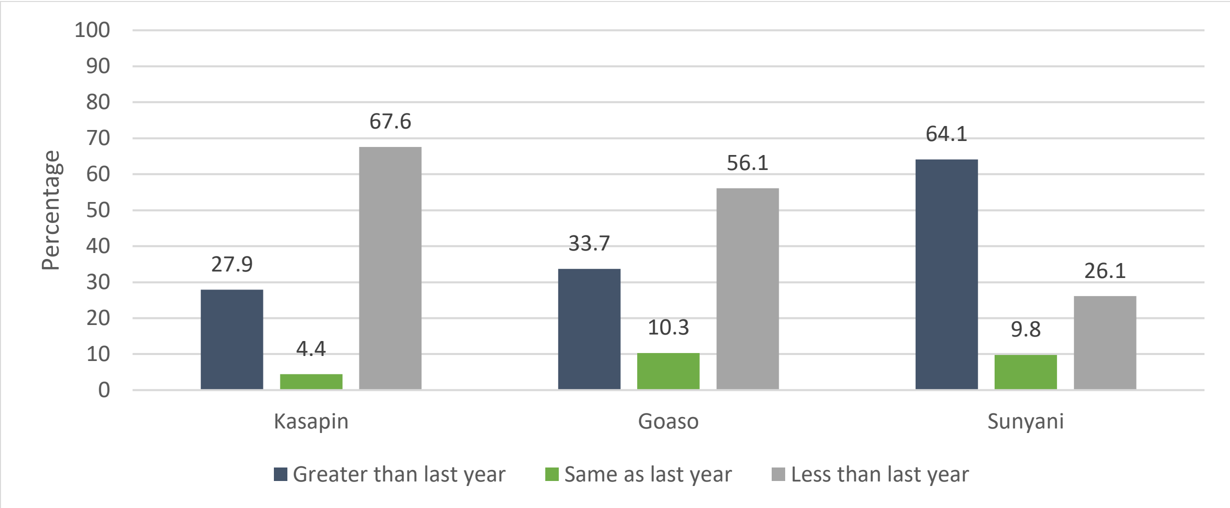
Farm size (ha)					
Kasapin	68	3.90	-2.0940	0.0373	Significant difference
Sunyani	184	5.32			
Kasapin	68	3.88	-1.8556	0.0643	Significant difference
Goaso	312	5.26			
Sunyani	184	5.26	-0.1059	0.9157	No Significant difference
Goaso	312	5.32			

Source: Baseline survey, 2018

3.6.1.2 Perception of current yield levels

The perceptions of respondents on current farm productivity levels, in comparison to previous years' yields, were solicited. As depicted in Figure 19, most of the respondents in Kasapin (68%) and Goaso (56%) perceived their current yields to be lower than the previous years' yields. However, at least 64% of the respondents in Sunyani society instead perceived their current yields to be higher than previous years' cocoa yields. What accounts for these perceived yield levels is not exactly known, but may be confirmed with available data for previous cocoa yields.

Figure 19: Perception of farm productivity levels by society



Source: Baseline survey, 2018

3.6.2 Cocoa farm ownership

3.6.2.1 Farm ownership

Cocoa farm ownership comes through various types of land acquisition. As shown in Table 21, the majority (43%) mainly acquired land through inheritance, followed by sharecropping (23%).

Table 21: Means of land acquisition

Means of land acquisition		Kasapin	Goaso	Sunyani	Total
Purchased	No.	5	46	15	66
	%	7.4	14.7	8.2	11.7
Leased/rented	No.	1	2	0	3
	%	1.4	0.6	0.0	0.5
Sharecropping	No.	16	63	52	131
	%	23.5	20.2	28.3	23.2
Family land	No.	9	58	29	96

	%	13.2	18.6	15.8	17.0
Inheritance	No.	34	126	80	240
	%	50.0	40.4	43.5	42.6
Other	No.	3	17	8	28
	%	4.4	5.5	4.4	5.0
Total	**No.**	**68**	**312**	**184**	**564**
	%	**100**	**100**	**100**	**100**

Source: Baseline survey, 2018

Only 12% of respondents acquired lands through purchasing. It is known that land acquisition through inheritance subsequently results in more fragmented and smaller land holdings, which has the potential of negatively impacting on cocoa output if yields are compromised.

Table 22: Cocoa land ownership by gender

Land Ownership	Male		Female		Total	
	No.	%	No.	%	No.	%
Purchased	56	13.90	10	6.21	66	11.70
Leased/Rented	2	0.50	1	0.62	3	0.53
Share Cropping	108	26.80	23	14.29	131	23.23
Family Land	64	15.88	32	19.88	96	17.02
Inheritance	152	37.72	88	54.66	240	42.55
Other	21	5.21	7	4.35	28	4.96
Total	**403**	**100.00**	**161**	**100.00**	**564**	**100.00**

Source: Baseline survey, 2018

A breakdown of cocoa land ownership into gender, as shown in Table 22, suggests that both men and women are likely to inherit land as the means to acquiring it than any other category, but men appear more likely to purchase land than women and become sharecroppers.

3.6.2.2 Number of farms cultivated

The number of farms cultivated does not necessarily mean ownership of land. The number of cocoa farms cultivated ranged from one (1) to six (6) farms, with five respondents (1%) cultivating this maximum number (Table 23). The majority (58%) cultivated only one (1) farm, followed by 157 respondents (28%) cultivating 2 separate cocoa farms. Generally, the majority (484 respondents, 86%) of sampled respondents produce cocoa from 1-2 farms.

Table 23: Distribution of number of cocoa farms by society

No of farms		Kasapin	Goaso	Sunyani	Total
1	No.	31	167	129	**327**
	%	45.6	53.5	70.1	**58.0**
2	No.	25	94	38	**157**
	%	36.8	30.1	20.7	**27.8**
3	No.	7	30	8	**45**
	%	10.3	9.6	4.4	**8.0**
4	No.	2	11	5	**18**
	%	2.9	3.5	2.7	**3.2**
5	No.	2	6	4	**12**
	%	2.9	1.9	2.2	**2.1**
6	No.	1	4	0	**5**

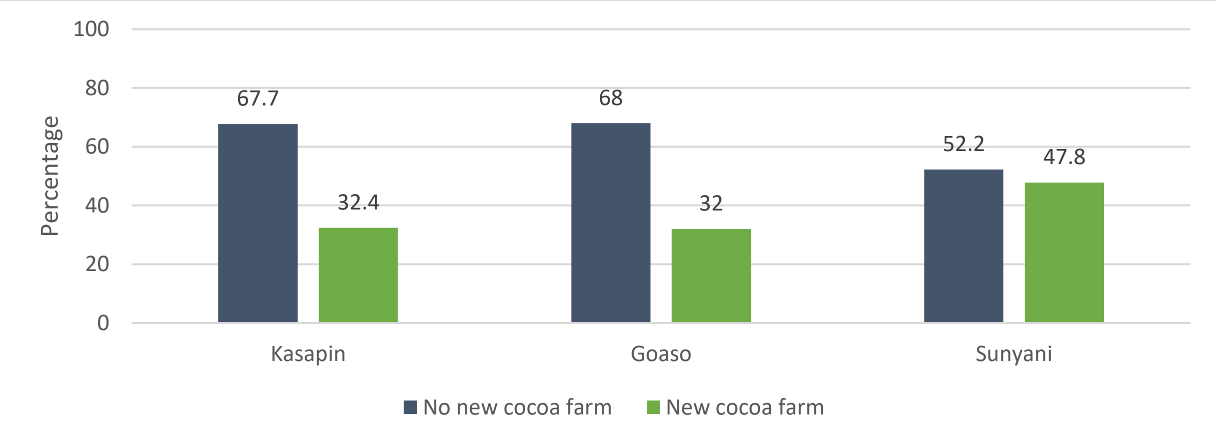
	%	1.5	1.3	0.0	**0.9**
Total	**No.**	**68**	**312**	**184**	**564**
	%	**100**	**100**	**100**	**100**

Source: Baseline survey, 2018

3.6.2.3 New farm establishment (expansion)

Respondents expanded their cocoa farming activities by establishing new cocoa farms, probably with the aim of increasing output. The baseline survey revealed that within the past five (5) years, no fewer than 32% of respondents in each society established new cocoa farms (Figure 20). This observation may suggest that increases in cocoa output may be attributed, not only to yield improvements, but also to deforestation or forest degradation as additional lands are cultivated. This should continue to be explored.

Figure 20: New cocoa farm establishment



Source: Baseline survey, 2018

3.6.3 Farm input access and usage

3.6.3.1 Access to agricultural extension services

Having access to agricultural-related services (technology and good agronomic and cultural practices) by cocoa farmers is a relevant input for sustained output. Most (79%) of these farmers mentioned having access to agricultural extension services (Table 24). The lack of accessibility to these services is more prominent in Goaso society, compared to Sunyani (9%), as a larger proportion of these farmers (about 30%) did not report receiving these advisory services.

Table 24: Access to agricultural extension services by society

District	Do not Access		Access		Total	
	Freq.	%	Freq.	%	Freq.	%
Kasapin	8	11.8	60	88.2	68	100.00
Goaso	95	30.4	217	69.6	312	100.00
Sunyani	16	8.7	168	91.3	184	100.00
Total	**119**	**21.1**	**445**	**78.9**	**564**	**100.00**

Source: Baseline survey, 2018

The providers of these agricultural extension/advisory services are several, as indicated by the respondents in Table 25. Two dominant players emerged, namely, the Ministry of Food and Agriculture (MoFA)/COCOBOD and Touton, a private sector business entity involved in the purchase and sale of cocoa beans. The majority (47%) of respondents receive advisory services from MoFA/COCOBOD, followed by Touton (39%). It is interesting to note that friends and family members constituted the third significant provider of agricultural extension information (5%).

Table 25: Source of agricultural extension service or advice by society

District		MoFA/ COCOBOD	Touton	Other LBC	NGO	Friends & Family	Private Extension	Other	TOTAL
Kasapin	No.	28	45	1	1	5	0	3	**83**
	%	9.8	19.0	6.7	7.1	15.2	0.0	13.0	
Goaso	No.	164	55	9	8	20	6	20	**282**
	%	57.5	23.2	60.0	57.1	60.6	100	87.0	
Sunyani	No.	93	137	5	5	8	0	0	**248**
	%	32.6	57.8	33.3	35.7	24.2	0.0	0.0	
Total	**No.**	**285**	**237**	**15**	**14**	**33**	**6**	**23**	**613**
	%	**46.5**	**38.7**	**2.5**	**2.3**	**5.4**	**1.0**	**3.8**	**100**

Source: Baseline survey, 2018 *Multiple response table*

Table 26: Types of agricultural extension service or advice received by society

District	Kasapin		Goaso		Sunyani		Total	
	No.	%	No.	%	No.	%	No.	%
Advisory	45	66.2	No.	52.9	150	81.5	360	63.8
Spraying	31	45.6	165	38.8	73	39.7	225	39.9
Pruning	22	32.4	121	36.5	58	31.5	194	34.4
Harvest	8	11.8	114	14.4	13	7.1	66	11.7
Planting Material	2	2.9	45	3.2	12	6.5	24	4.3
Rehabilitation	5	7.4	10	1.9	21	11.4	32	5.7
Intensification	5	7.4	6	0.0	27	14.7	32	5.7
Financial Literacy	9	13.2	0	0.6	7	3.8	18	3.2
Access to Finance	2	2.9	2	1.0	3	1.6	8	1.4
Additional Income	0	0.0	3	0.6	0	0.0	2	0.4
Other	2	2.9	2	3.2	7	3.8	19	3.4
Total	**68**		**312**		**184**		**564**	

Source: Baseline survey, 2018 *Note: Multiple response table*

What types of agricultural extension advice/service did the respondents benefit from these providers? Table 26 indicates that cocoa farmers received at least eleven (11) extension advice services from various service providers. The top three (3) information/advisory services received by farmers are general advice on farm practices (64%), spraying (40%), and pruning (34%). Very few mentioned receiving advisory services on additional income sources, access to finance, or financial literacy.

3.6.3.2 Access to credit

Only 132 (23%) of the respondents requested credit for cocoa farming activities during the 2017/2018 season (see Table 27). Of those who requested farm credit (132 respondents), only 80 (61%) were successful in receiving credit. At the society level, more farmers in Kasapi requested credit with approximately half of them being successful in acquiring it. Overall, a little over half of all societies were successful in receiving credit if they requested it.

Table 27: Access to and receipt of credit by society

Credit access		Kasapin	Goaso	Sunyani	Total
Did not request credit	No.	43	238	151	432
	%	63.2	76.3	82.1	76.6
Requested credit	No.	25	74	33	132
	%	36.8	23.7	17.93	23.4
Total	**No.**	**68**	**312**	**184**	**564**
	%	100	100	100	100
Success of credit access					
Unsuccessful	No.	11	25	16	52
	%	44	33.8	48.5	39.4
Successful	No.	14	49	17	80
	%	56	66.2	51.5	60.6
Total	**No.**	**25**	**74**	**33**	**132**
	%	100	100	100	100

Source: Baseline survey, 2018

An examination of the sources of farm credit revealed the cocoa purchasing clerks (CPCs) as key players in credit supply to cocoa farmers (Table 28), reported by approximately 48% of the 80 respondents who received credit. This observation may indicate the cordial business relationship that exists between these CPCs and the cocoa farmer. The next source of credit was non-family members (40%) whilst very few (6%) opted to access credit from bank/non-bank financial institutions and 2 respondents (3%) utilized their personal savings for this purpose. Kasapin and Goaso farmers relied primarily on non-family members and CPCs while those in Sunyani relied primarily on CPCs.

Table 28: Institutions where farmers received credit by society

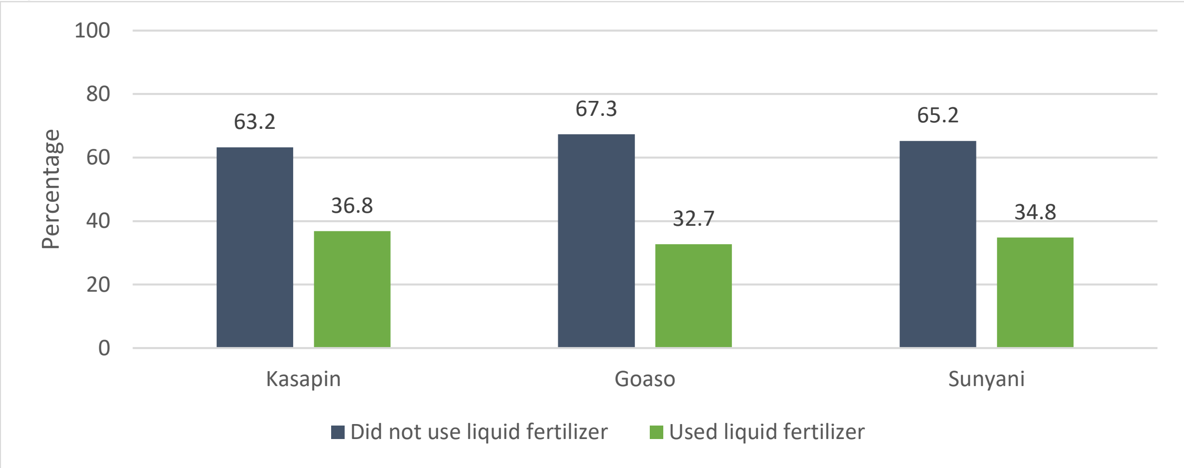
District		Bank/Financial institutions	Family members	Non family	CPCs	Savings	Total
Kasapin	No.	0	2	7	5	0	14
	%	0.0	14.3	50	35.7	0.0	17.5
Goaso	No.	4	0	23	21	1	49
	%	8.2	0.0	46.9	42.9	2.0	61.3
Sunyani	No.	1	1	2	12	1	17
	%	5.9	5.9	11.8	70.6	5.9	21.3
Total	**No.**	**5**	**3**	**32**	**38**	**2**	**80**
	%	**6.3**	**3.8**	**40.0**	**47.5**	**2.5**	**100**

Source: Baseline survey, 2018

3.6.3.3 Input Use

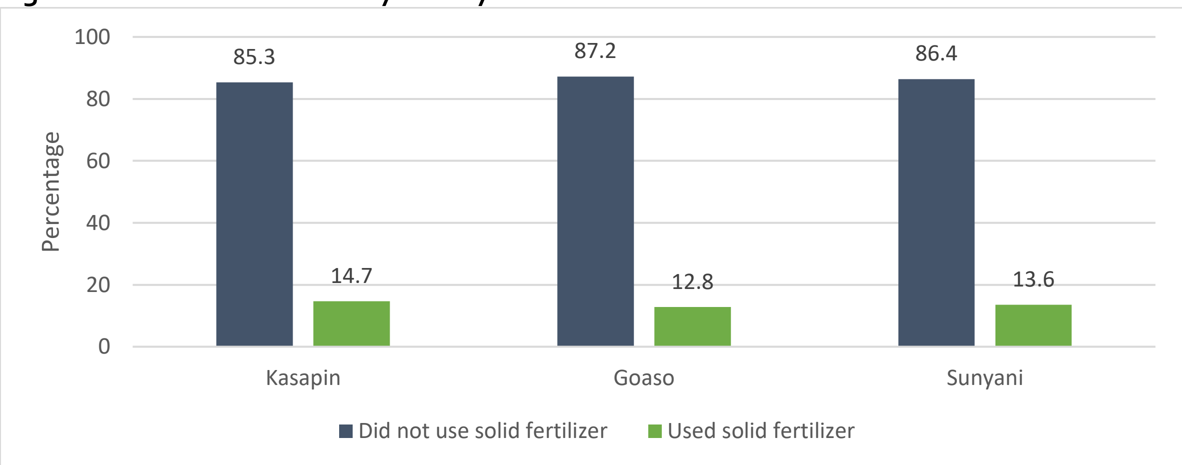
The use of other farm inputs by respondents in the 2017/2018 cocoa season is also presented. These inputs include chemical fertilizers, insecticides, fungicides, and weedicides. The data shows low fertilizer usage among the respondents. Only 191 (34%) cocoa farmers used liquid fertilizers whilst only 75 (13%) used solid fertilizers. The use of weedicides also recorded very low numbers, which is expected, with only 68 (12%) of farmers using it. Figure 21, Figure 22, and Figure 23 show the use of fertilizer and weedicide use by society; the rates of usage is similar across the three societies.

Figure 21: Liquid fertilizer use by society



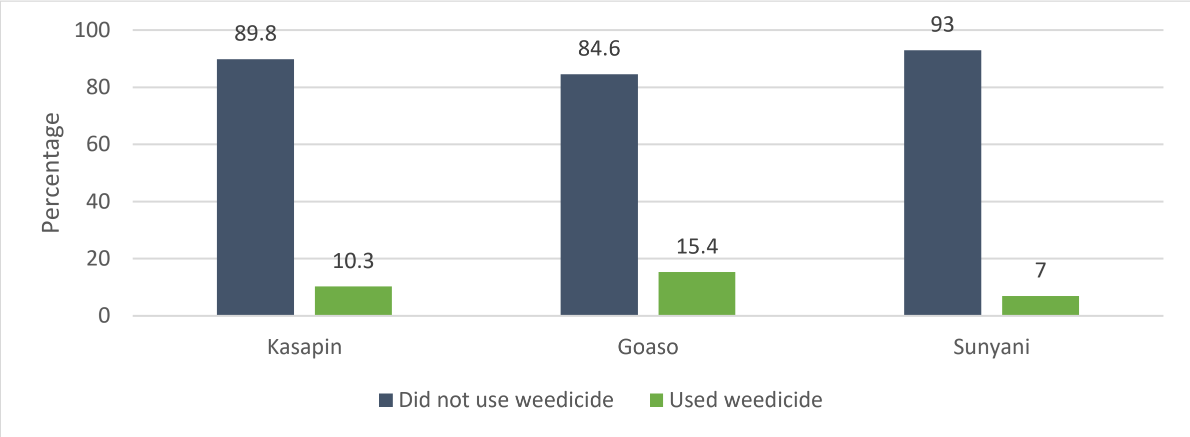
Source: Baseline survey, 2018

Figure 22: Solid fertilizer use by society



Source: Baseline survey, 2018

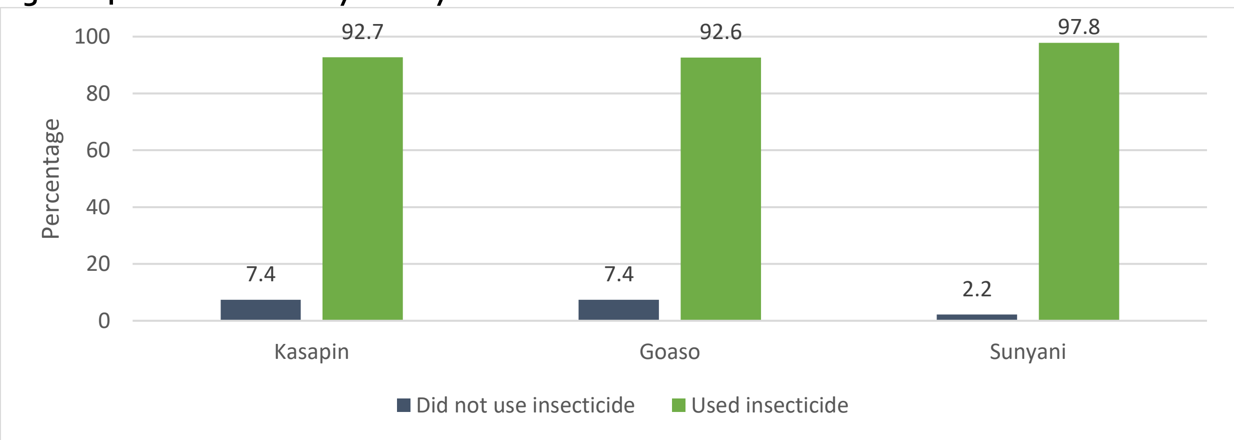
Figure 23: Weedicide use by society



Source: Baseline survey, 2018

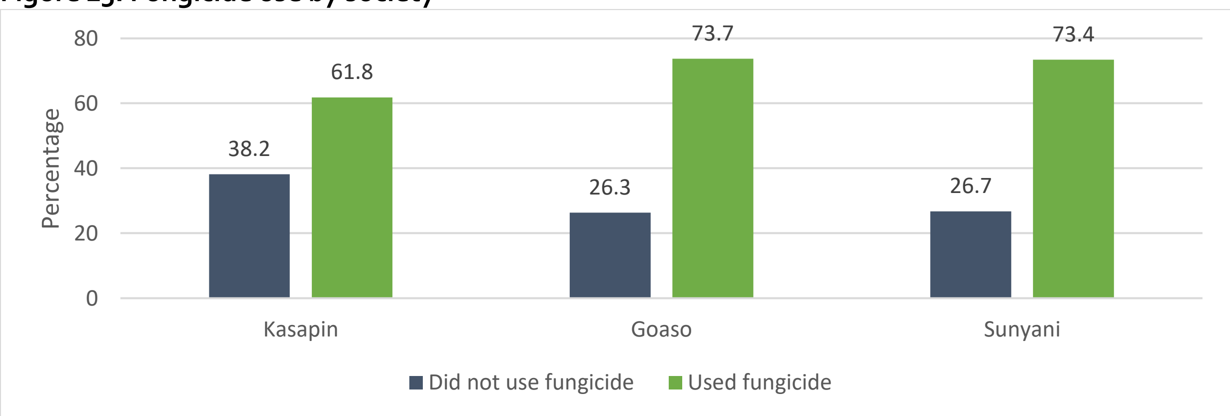
On the contrary, there was high use of insecticides and fungicides across all three societies. The survey indicated that 530 (94%) and 399 (69%) of the sampled respondents, respectively, used insecticides and fungicides in their farming operations to control for capsids and black pod disease. Figure 24 and Figure 25 illustrate the use of insecticides and fungicides by society. While Kasapin had similar use of insecticides as the other two societies, it had slightly lower use of fungicide.

Figure 24: Insecticide use by society



Source: Baseline survey, 2018

Figure 25: Fungicide use by society



Source: Baseline survey, 2018

3.6.3.4 Input application rates

It was observed that most of respondents applied insecticides and fungicides between 1-5 times annually. As shown in Table 29 and Table 30, 508 (95.8%) and 382 (95.7%) of sampled respondents applied insecticides and fungicides 1-5 times per season. However, with respect to insecticide application, the majority (43%) applied it 3 times per season whilst for fungicides, the majority (61%) applied it two to three times per season.

Table 29: Frequency of insecticide use by society: 2017/2018 season

No. of times used	Kasapin		Goaso		Sunyani		Total	
	No.	%	No.	%	No.	%	No.	%
Once	5	8.1	21	7.3	3	1.7	29	5.5
Twice	12	19.4	58	20.1	30	16.7	100	18.9
3 times	30	48.4	126	43.8	73	40.6	229	43.2
4 times	10	16.1	57	19.8	48	26.7	115	21.7
5 times	3	4.8	13	4.5	19	10.6	35	6.6
6 times	1	1.6	9	3.1	4	2.2	14	2.6
7 times	0	0.0	1	0.4	0	0.0	1	0.2
8 times	0	0.0	0	0.0	1	0.6	1	0.2
10 times	1	1.6	1	0.4	1	0.6	3	0.6
12 times	0	0.0	2	0.7	1	0.6	3	0.6
Total	**62**	**100**	**288**	**100**	**180**	**100**	**530**	**100**

Source: Baseline survey, 2018

Table 30: Frequency of fungicide use by society: 2017/2018 season

No. of times used	Kasapin		Goaso		Sunyani		Total	
	No.	%	No.	%	No.	%	No.	%
Once	4	9.8	42	18.7	39	29.3	85	21.3
2 times	14	34.2	73	32.4	36	27.1	123	30.83
3 times	12	29.3	74	32.9	34	25.6	120	30.1
4 times	5	12.2	18	8.0	19	14.3	42	10.5
5 times	2	4.9	6	2.7	4	3.0	12	3.0
6 times	1	2.4	5	2.2	0	0.0	6	1.5
7 times	0	0.0	1	0.4	0	0.0	1	0.3
8 times	1	2.4	1	0.4	0	0.0	2	0.5
10 times	0	0.0	1	0.4	0	0.0	1	0.3
24 times	1	2.4	4	1.8	0	0.0	5	1.3
25 times	1	2.4	0	0.0	1	0.8	2	0.5
Total	**41**	**100**	**225**	**100**	**133**	**100**	**399**	**100**

Source: Baseline survey, 2018

For weedicides application, the few (68 respondents) who did so, the majority (29, 43%) applied it only once per season (Table 31).

Table 31: Frequency of weedicide use by society: 2017/2018 season

Society		Number of times 1	2	3	4	Don't Know	Total
Kasapin	No.	5	1	0	1	0	**7**
	%	17.2	5.0	0.0	25.0	0.0	**10.3**
Goaso	No.	20	15	10	2	1	**48**
	%	69.0	75.0	71.4	50.0	100	**70.6**
Sunyani	No.	4	4	4	1	0	**13**
	%	13.8	20.0	28.6	25.0	0.0	**19.1**
Total	**No.**	**29**	**20**	**14**	**4**	**1**	**68**
	%	**42.7**	**29.4**	**20.6**	**5.9**	**1.5**	**100**

Source: Baseline survey, 2018

3.6.3.5 Input expenditures

Overall, solid fertilizer (GHS 3,123), followed by insecticide (GHS 626.70) recorded the highest annual mean expenditure outlay while weedicide costs (GHS 359.68) and labour costs (GHS 359.67) were the least expenditure items, as shown in Table 32. The relative and seasonal scarcity of labour in cocoa plantations has driven up rural wages, resulting in farmers' increased expenditure on labour costs in chemical applications, harvesting, pod breaking, and carting services. In view of this, the relatively low expenditure on labour could be partly attributed to the subsidies on labour costs for insecticide and fungicide application that is provided by the Ghana Cocoa Board (COCOBOD) through the cocoa mass spraying programme, even though not all cocoa farmers benefit from it. On average, sampled farmers in Kasapin spent more (GHS 419.07) on labour services than farmers from the other two societies. While a very blunt instrument for understanding the average investment made in expenditures on inputs, the pooled averages for each input cost center were summed, providing an estimate of a likely total expenditure. It is important to note the standard deviations signify there is a lot of variability in these estimates, with some farmers sharing, for example, that they spent 10,000 GHS on solid fertilizer whereas others spent 400 GHS. This estimate of 5,305.27 is likely an upper-end estimate of costs (and likely driven by farmers in Goaso).

Table 32: Farmer's annual expenditure on inputs by society

Expenditure (GHS)	Obs.	Mean	Standard deviation	Minimum	Maximum
Liquid fertilizer					
Kasapin	4	805.00	1,242.41	35	2,640
Goaso	20	423.70	402.72	50	1,500
Sunyani	3	165.83	59.18	97.5	200
Pooled	**27**	***451.54***	**571.08**	**35**	**2,640**
Solid fertilizer					
Kasapin	1	340.00	--	340	340
Goaso	9	3,696.00	2,976.09	400	10,000
Sunyani	1	750.00	--	750	750
Pooled	**11**	***3,123.09***	**2,952.76**	**340**	**10,000**
Insecticide					
Kasapin	16	458.13	526.15	60	1860

Goaso	9	3,696.00	2,976.09	400	10,000
Sunyani	1	750.00	--	750	750
Pooled	**26**	***626.70***	**615.80**	**60**	**3,050**
Fungicide					
Kasapin	3	103.33	106.81	25	225
Goaso	23	455.26	1,028.87	32	5,002
Sunyani	3	124.00	16	108	140
Pooled	**29**	***384.59***	**923.26**	**25**	**5,002**
Weedicide					
Kasapin	1	480.00	.	480	480
Goaso	17	306.35	280.64	60	910
Sunyani	4	556.25	720.27	90	1,630
Pooled	**22**	***359.68***	**380.09**	**60**	**1,630**
labour cost (GHS)					
Kasapin	68	419.07	668.09	38	4,630
Goaso	309	348.81	316.36	20	2,550
Sunyani	175	355.77	380.02	20	3,050
Pooled	**552**	***359.67***	**395.39**	**20**	**4,630**
Estimated total average costs*		**5,305.27**			

* Average pooled costs from each input source added together.

3.6.4 Land preparation and conservation practices

The baseline data revealed that most (77%) of the sampled cocoa farmers commence the cultivation of new cocoa farms through slash and burn method (see Table 33).

Table 33: Land preparation methods with new cocoa farms by society

District		Slash and burn	Minimum tillage	Other	Total
Kasapin	No.	19	3	0	22
	%	86.3	13.6	0.00	100
Goaso	No.	80	12	8	100
	%	80.0	12.0	8.0	100
Sunyani	No.	63	19	6	88
	%	71.6	21.6	6.8	100
Total	**No.**	**162**	**34**	**14**	**210**
	%	**77.1**	**16.2**	**6.7**	**100**

Source: Baseline survey, 2018

However, at the society level, more (22%) in Sunyani instead practice minimum tillage to establish new cocoa farms compared to the other two societies. The issue of soil and water conservation practices is undertaken, as indicated in Table 34, by approximately 50% of sampled cocoa farmers. The type of soil and water conservation practice undertaken is indicated in Figure 26, where the majority (at least 70%), irrespective of the society, mentioned intercropping with food crops as the major approach, then followed by the planting of shade trees. On average, Sunyani practices soil and water conservation more than the other regions.

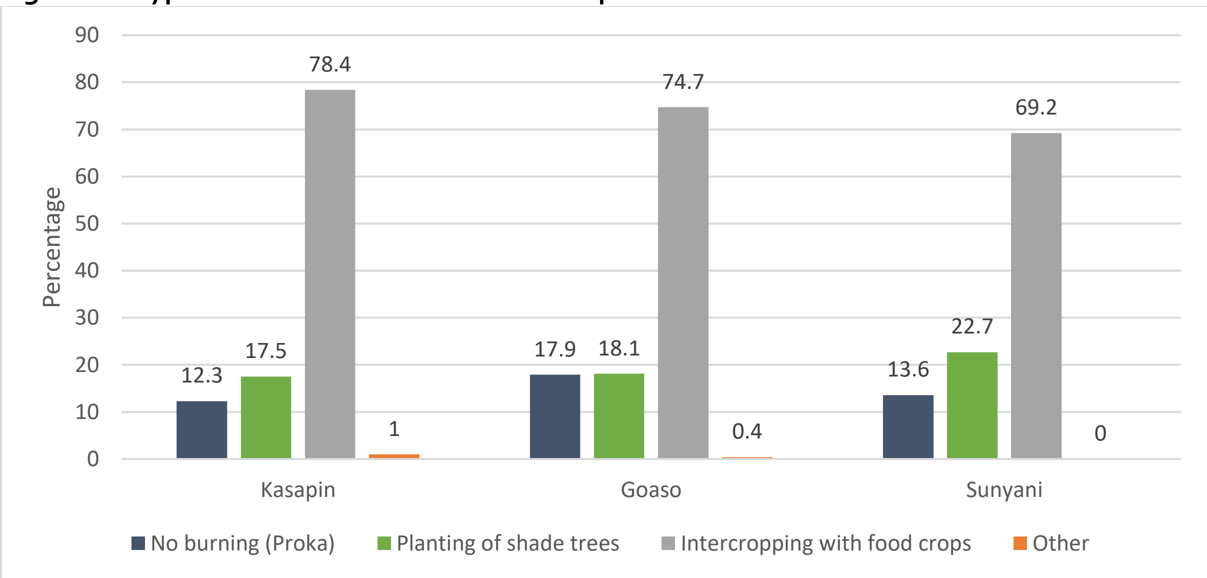
Table 34: Soil and water conservation (SWC) practice by farmers by society

Society		Do not practice SWC	Practice SWC	Total
Kasapin	No.	40	28	68
	%	58.8	41.1	100%

Goaso	No.	168	144	312
	%	53.8	46.1	100%
Sunyani	No.	73	111	184
	%	39.7	60.3	100%
Total	**No.**	**281**	**283**	**564**
	%	**49.82**	**50.18**	**100%**

Source: Baseline survey, 2018

Figure 26: Types of soil and water conservation practices



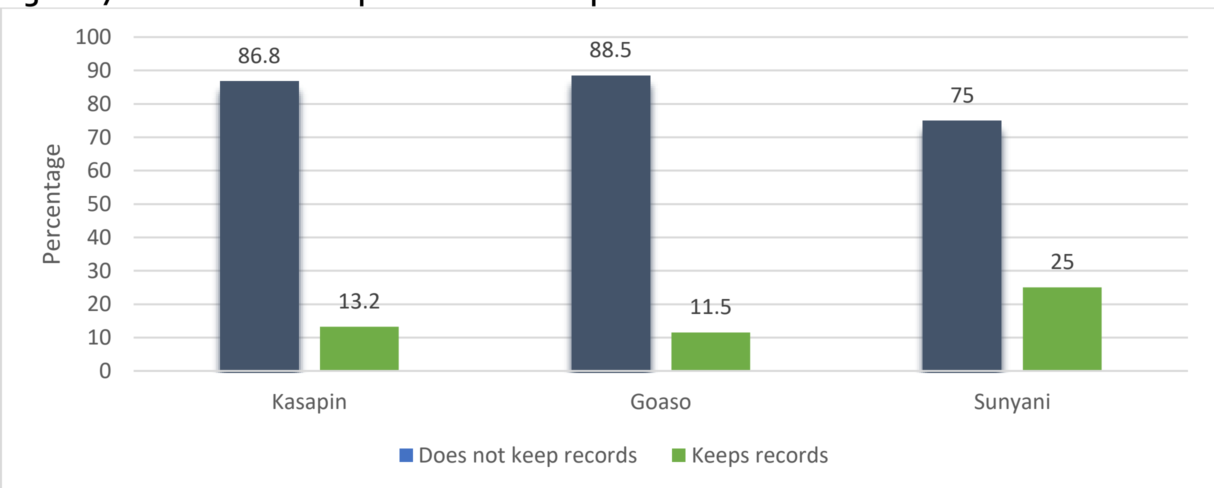
Source: Baseline survey, 2018

3.6.5 Other farm management practices

3.6.5.1 Farm record keeping

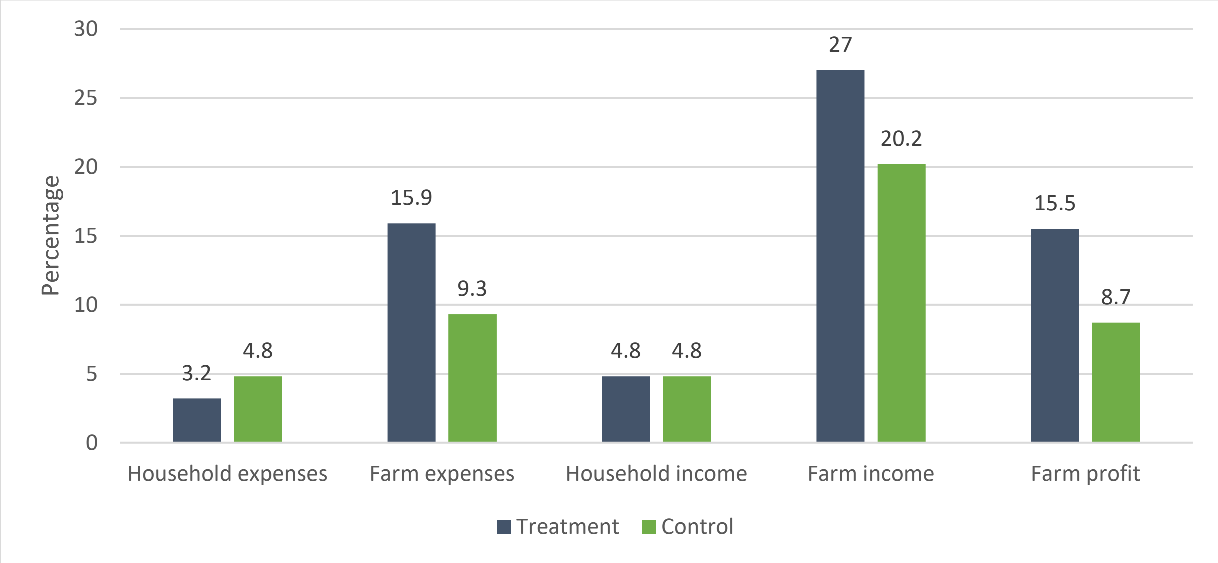
The survey found that the majority (84%) representing 473 cocoa farmers did not keep farm records (Figure 27). The few who kept some sort of farm records indicated documenting information on farm production activities and its associated expenses (Figure 28).

Figure 27: Distribution of respondents who keep farm records



Source: Baseline survey, 2018

Figure 28: Type of financial record keeping



Source: Baseline survey, 2018

3.6.5.2 Shade tree management

A high proportion (85%) of respondents indicated maintenance of shade trees on their cocoa farms (Table 35). The maintenance of shade trees is a standard practice needed for young cocoa trees to establish, after which too much shade becomes detrimental to cocoa yields. At the same time, lack of shade trees may also adversely affect yields. A small proportion (15%) of respondents who indicated that they do not maintain shade trees on cocoa farms may be affected due to the lack of shade trees.

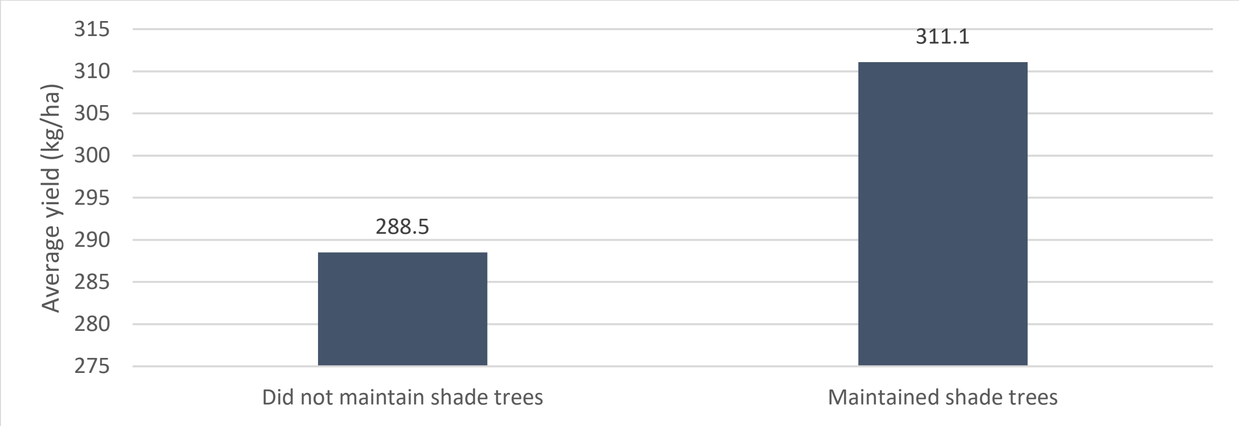
Table 35: Shade tree management by society

Society		Do not maintain shade trees	Maintains shade trees	Total
Kasapin	No.	9	59	68
	%	13.2	87.0	100%
Goaso	No.	53	259	312
	%	17.0	83.0	100%
Sunyani	No.	24	160	184
	%	13.0	87.0	100%
Pooled	**No.**	**86**	**478**	**564**
	%	**15.25**	**84.75**	**100%**

Source: Baseline survey, 2018

A further examination of the data, as highlighted in Figure 29, suggests that sampled farmers who maintained shade trees on their cocoa farms recorded higher cocoa yields (311 kg/ha) compared to farmers who did not (289 kg/ha), although the yield differences are not statistically significant.

Figure 29: Shade tree management and average cocoa yields

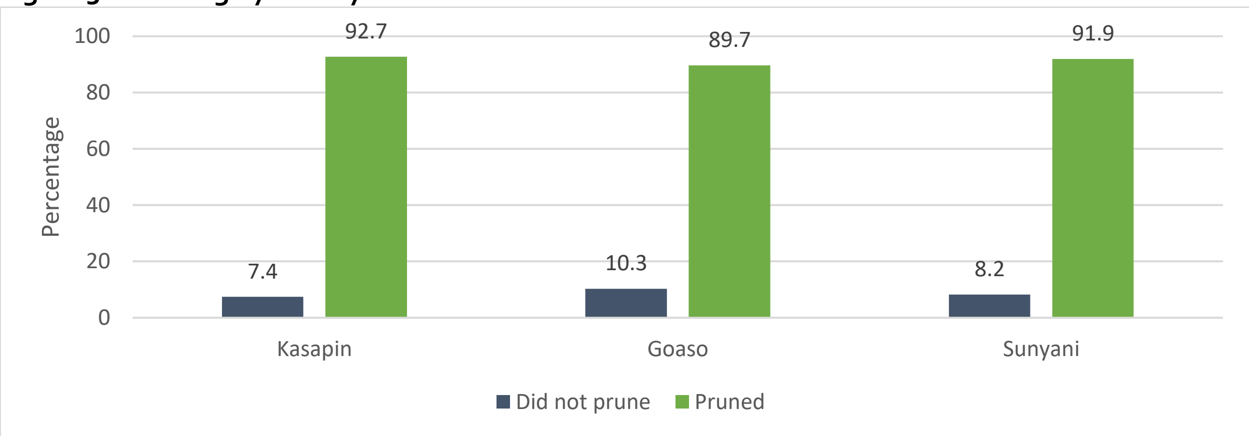


Source: Baseline survey, 2018

3.6.5.3 Pruning

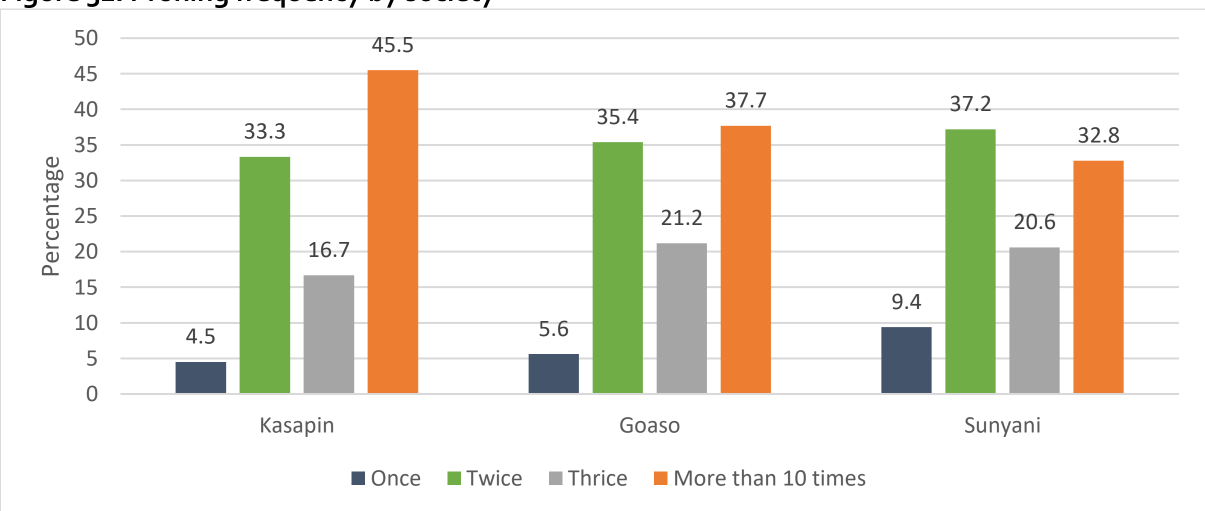
Pruning was a common practice with almost everyone reporting that they pruned (97%) (Figure 30). Most reported pruning at least twice, if not more than ten times in a year (Figure 31).

Figure 30: Pruning by society



Source: Baseline survey, 2018

Figure 31: Pruning frequency by society



Source: Baseline survey, 2018

3.6.5.4 Nursery management

Only 113 (20%) nursed their own cocoa seedlings (Table 36), suggesting that the other 80% solely relied on the Ghana Cocoa Board for cocoa seedlings, other accredited suppliers of cocoa seedlings, or other farmers who nurse seedlings on behalf of accredited suppliers for their community.

Table 36: Farmers who nurse their cocoa seedlings

Society		Do not nurse seedlings	Nurse seedlings	Total
Kasapin	No.	61	7	68
	%	89.7	10.3	100
Goaso	No.	263	49	312
	%	84.3	15.7	100
Sunyani	No.	127	57	184
	%	69.0	31.0	100
Pooled	**No.**	**451**	**113**	**564**
	%	**80.0**	**20.0**	**100**

Source: Baseline survey, 2018

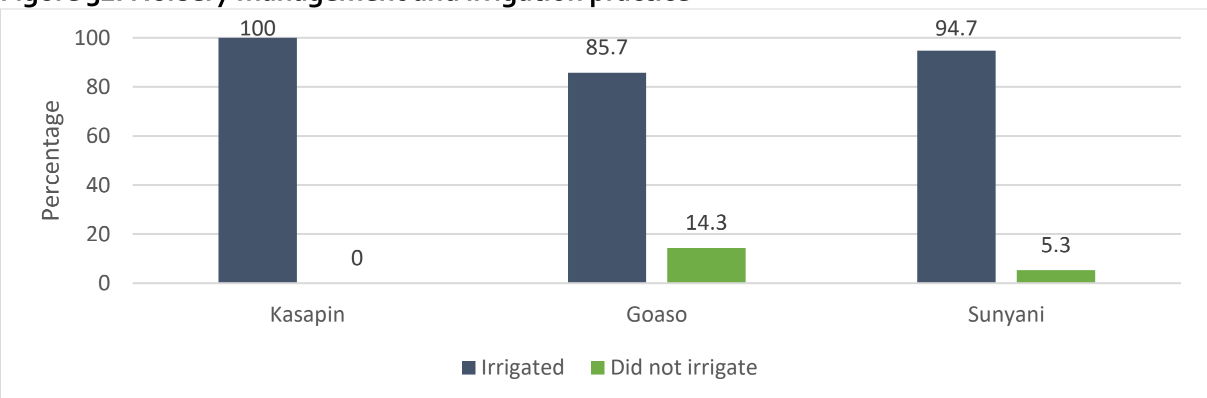
It is expected that owning a cocoa nursery comes with the responsibility of watering/irrigating the seedlings on a regular basis. Interestingly, the survey found that 10 respondents (9%) out of the 113 (100%) did not water/irrigate their seedlings (Table 37). These farmers are from Goaso (7 respondents) and Sunyani (3 respondents). Figure 32 shows this information graphically.

Table 37: Irrigation of cocoa nurseries

Society		Did not irrigate	Irrigated	Total
Kasapin	No.	0	7	7
	%	0.0	100	100
Goaso	No.	7	42	49
	%	14.3	85.7	100
Sunyani	No.	3	54	57
	%	5.3	94.7	100
Pooled	**No.**	**10**	**103**	**113**
	%	**8.8**	**91.2**	**100**

Source: Baseline survey, 2018

Figure 32: Nursery management and irrigation practice



Source: Baseline survey, 2018

The frequency of watering/irrigating cocoa seedlings is presented in Table 38. It was observed that 56 farmers (50%) who manage their own nurseries irrigate it daily, 13% of them irrigate every other day while 35% of them irrigate their seedlings twice a week. The rest of them irrigate their nurseries either weekly (2%) or every 2 weeks (2%). Nine percent of the farmers do not irrigate their seedlings.

Table 38: Frequency of nursery irrigation by society per season

Society		Daily	Every other day	Twice a week	Weekly	Every 2 Weeks	Total
Kasapin	No.	4	1	1	1	0	**7**
	%	57.1	14.3	14.3	14.3	0	**100**
Goaso	No.	29	4	14	1	1	**49**
	%	59.2	8.2	28.6	2.0	2.0	**100**
Sunyani	No.	23	10	24	0	0	**57**
	%	40.4	17.5	42.1	0	0	**100**
Pooled	**No.**	**56**	**15**	**39**	**2**	**1**	**113**
	%	**49.6**	**13.3**	**34.5**	**1.8**	**0.8**	**100**

Source: Baseline survey, 2018

3.6.6 Effect of Good Agronomic Practices (GAPs) on cocoa yield

The baseline study sought to assess the effect of the various agronomic practices on cocoa yield using regression analysis. Key GAPs, such as pruning, use of insecticides, use of fungicides, weeding, shade management, and the practice of soil and water conservation (SWC) were modeled and regressed on cocoa yield (kg) via an ordinary least squares (OLS) regression technique.

Pruning was measured as the number of times farmers engaged in mistletoe control and cutting of diseased branches annually. Insecticide use and pesticide use were both dummied, where a value of 1 was assigned to cocoa farmers who used these agrochemicals and a value of zero (0) assigned to farmers who did not use. The variable labeled "weeding" represents the estimated number of times a farmer weeds his/her farm annually. Similarly, shade management, a dummy variable, indicates whether farmers maintained shade trees (1) or otherwise (0), while the SWC, another dummy variable, depicts soil and water conservation practice (1) by farmers or otherwise (0). Table 39 shows the model results.

Based on the regression results, significant factors/variables that influenced cocoa yields were insecticide and fungicide applications and pruning, in that order. Insecticide use was observed to be the largest contributor to cocoa yield. Holding all factors constant, farmers who used insecticides in controlling insects and pests on cocoa farms are likely to increase yields by 113.48 kg/ha. Similarly, farmers who used fungicides and pruning observed 58.91 kg/ha and 57.39 kg/ha more yield than those who did not, *ceteris paribus*.

Table 39: Effect of good agronomics practices (GAPS) on cocoa yield

Dependent variable: Cocoa yield (Kg/ha)

No. of observations = 562

F (6, 555): 8.69; Prob. > F: 0.0000

R-squared: 0.0420; Root MSE: 226.02

Variables	Coefficient	Marginal Effect	Std. Err.	T	P>t

Pruning	57.39**	57.39	24.95	2.30	0.02
Insecticide use	113.48***	113.48	24.86	4.56	0.00
Fungicide use	58.91***	58.91	19.68	2.99	0.00
Weeding	2.67^{ns}	2.67	13.38	0.20	0.84
Shade management	17.74^{ns}	17.74	30.80	0.58	0.57
Treatment locations	28.36^{ns}	28.36	20.17	1.41	0.16
Constant	71.19^{ns}		54.40	1.31	0.19

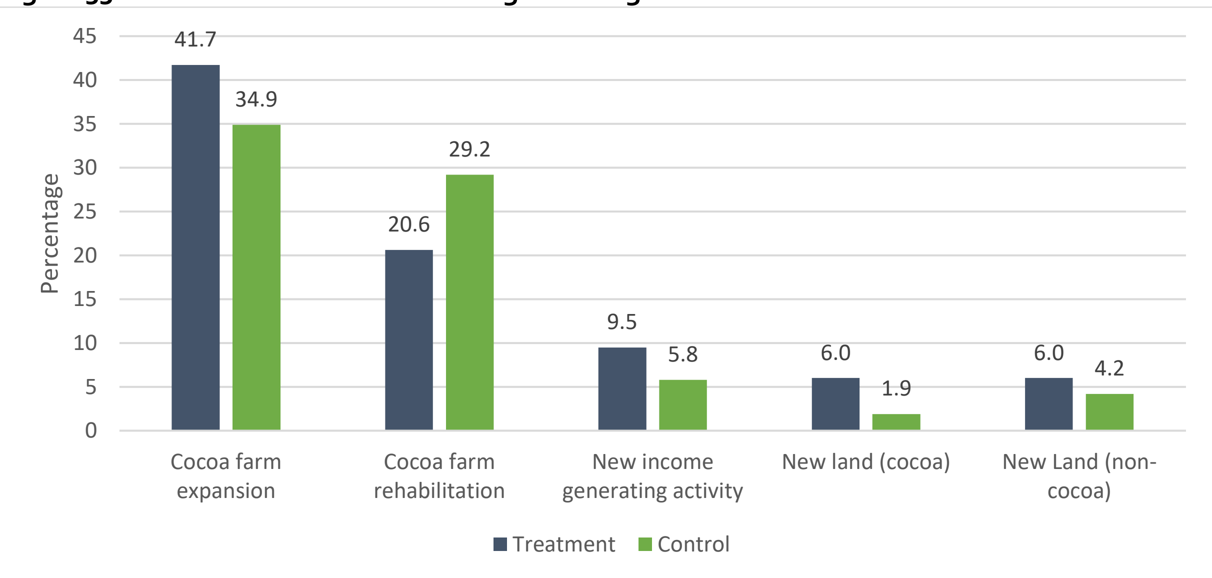
***, ** statistically significant at 1% and 5% respectively; ns = not statistically significant

Furthermore, it was observed that a unit increase in weeding increased farmers' yield by 2.67 kg/ha. This means that farmers who weed their farms more than once a year are more likely to observe higher yields than those who do not. Although not statistically significant, weeding and shade management practices were observed to be positive determinants of cocoa yield. Similarly, farmers in the treatment group (Sunyani and Kasapin) were seen to observe higher yields than those in the control group (Goaso), although not statistically significant.

3.6.7 Investment in farm expansion and income diversification

It was observed that more than a third of the respondents from the treatment (42%) and the control group (35%) expanded their cocoa farms in 2018 (see Figure 33). Additionally, undertaking cocoa farm rehabilitation recorded the second highest investment activity. Additional income generating activities were also pursued by respondents from both groups, likewise the acquisition of new farmlands for cocoa and food crop production.

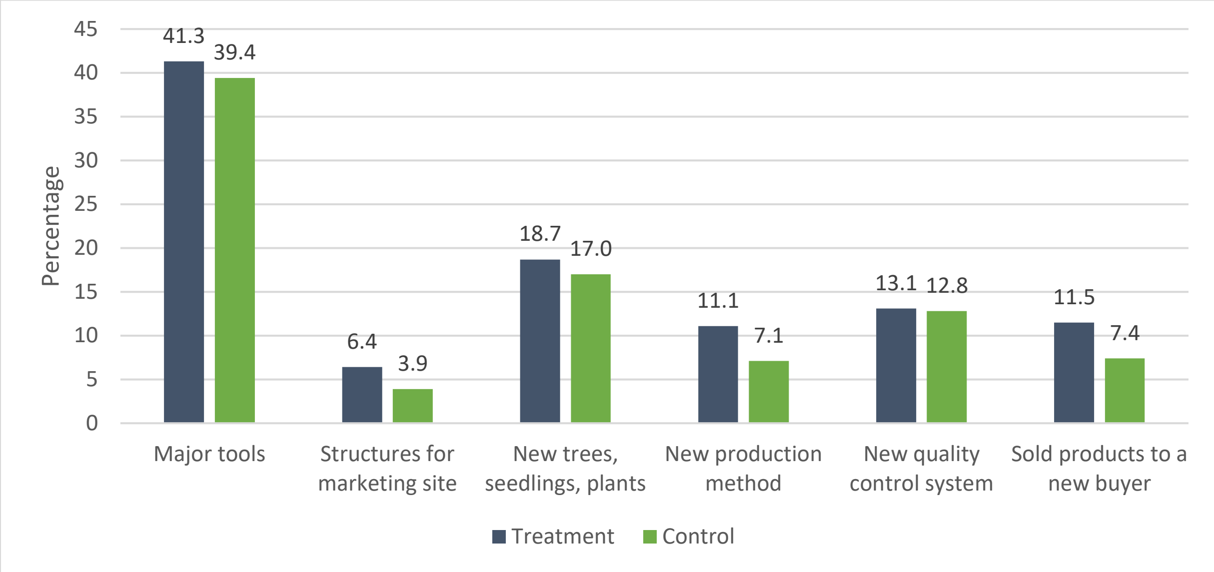
Figure 33: Farm investment and income generating activities



Source: Baseline survey, 2018

Respondents were asked to indicate whether they have invested in improved production systems and processes over the past year. The majority (41%) of respondents in the treatment group and about 39% of control group respondents indicated the purchase of major tools (equipment and machinery) during the period under review (see Figure 34). Moreover, few farmers indicated introducing new production and quality control methods on their farms in the last 12 months.

Figure 34: Farm investment and income generating activities



Source: Baseline survey, 2018

3.7 Women's Empowerment

The Women's Empowerment in Agriculture Index (WEAI) is a population-based framework through which empowerment, agency, and inclusion of women in agriculture are assessed. The pro-WEAI, which is the project-level Women's Empowerment in Agriculture Index, serves as a framework through which the empowerment and inclusion of women in agriculture are measured in agricultural development projects. Thus, it is used as an evaluation tool for changes in the women's empowerment and inclusion levels in various agricultural development projects.

This section highlights the findings from women cocoa farmers interviewed in Kasapin and Sunyani regarding their access to financial services, access to productive resources, group membership, and their autonomy in making key livelihood decisions. At the time of writing this baseline report, the analysis for the pro-WEAI data was ongoing and therefore men's data is not included nor are all of the indicators from the pro-WEAI reported on here.

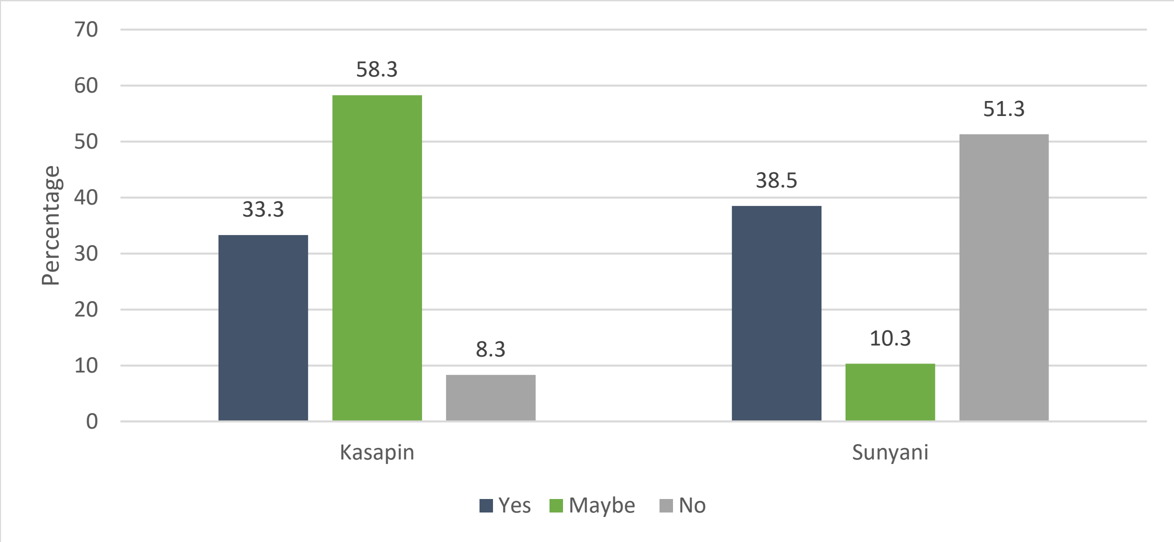
Forty nine (49) households (10 in Kasapin and 39 in Sunyani society) were randomly sampled from 252 households (68 in Kasapin and 184 in Sunyani) and the women (either the wife of the respondent or a single household head) interviewed. Thus, the information presented here comes from 49 women.

3.7.1 Access to financial services

Assessment of the pro-WEAI data showed, as indicated in Figure 35, that about a third of women in both Kasapin (33%) and Sunyani (39%) were very confident of their ability to borrow from formal financial institutions. Combining responses from those who believed they could or maybe could borrow from these sources, more women (92%) in Kasapin compared to Sunyani (50%) indicated their ability to borrow from a financial institution for any purpose. This is in contrast to earlier data that indicated no one had availed credit from a formal financial provider.

From another perspective, approximately 50% of women in Sunyani and 8% in Kasapin clearly indicated their *inability* to borrow cash from any financial institution.

Figure 35: Respondents' ability to borrow from a formal financial institution

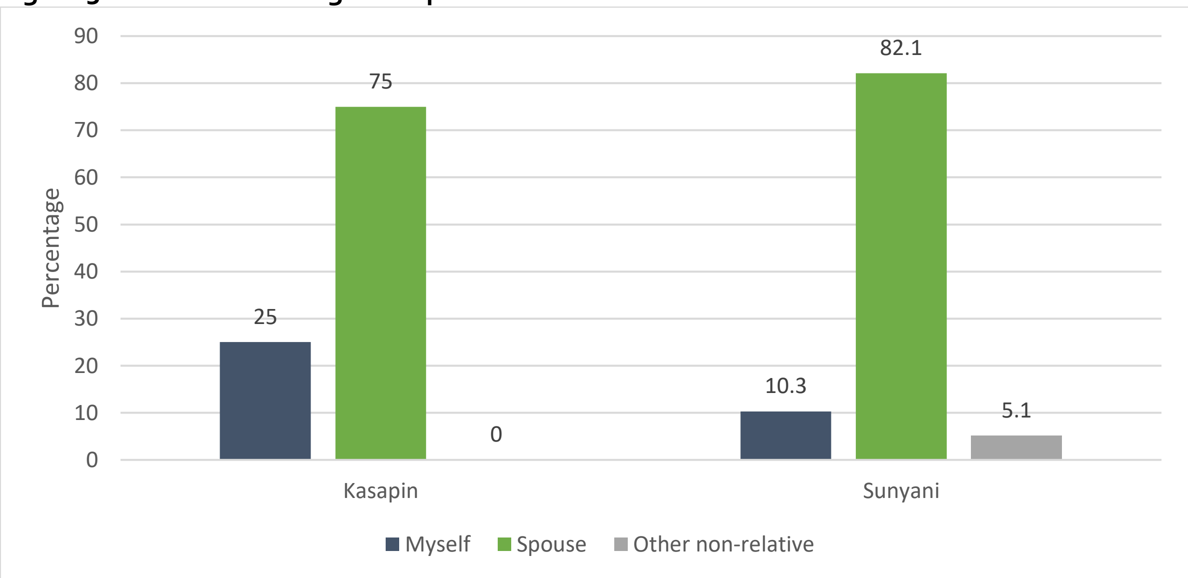


Source: Baseline survey, 2018

3.7.2 Access to productive resources

All 68 women respondents (100%) in Kasapin and 179 respondents (97%) in Sunyani (from the full sample) indicated their access to farmlands. In spite of their access to farmlands, the pro-WEAI data suggests that the decision on which crops to cultivate on their lands is mainly taken by their spouses, as indicated by 75% and 82% of these women in Kasapin and Sunyani respectively (Figure 36). This highlights the high influence of male spouses on the use of key productive assets in typical cocoa growing communities.

Figure 36: Decision-making on respondents' farm lands

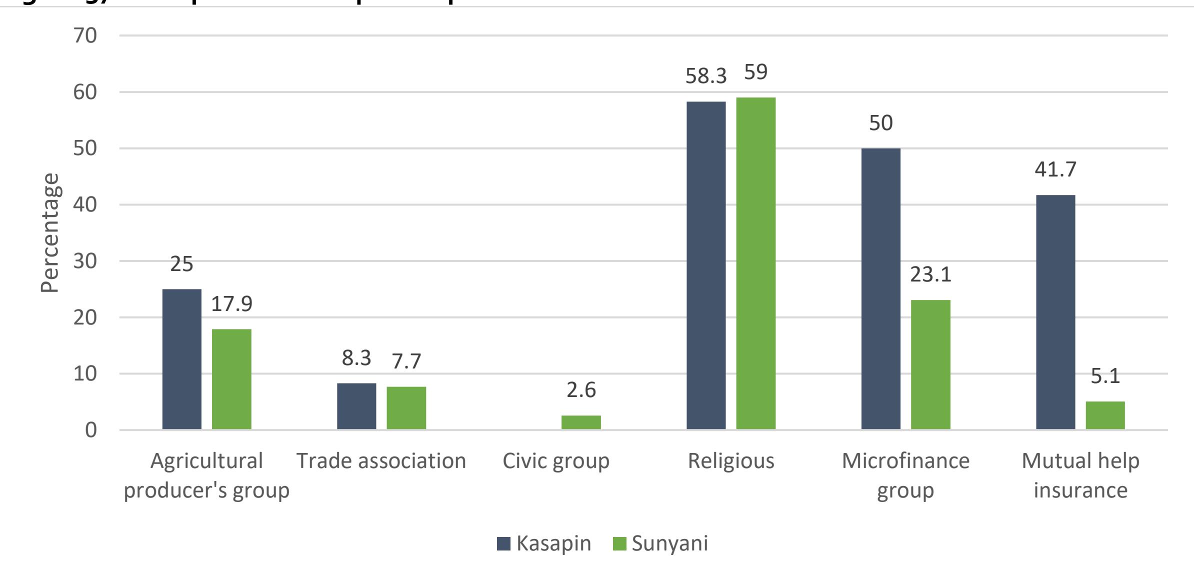


Source: Baseline survey, 2018

3.7.3 Group membership

Most of the women in Sunyani and Kasapin societies have opportunities to network with other individuals in their various communities. The respondents indicated membership of agricultural producer groups, trade associations, civic groups, religious groups, credit groups, and mutual help insurance schemes in their communities. The most joined groups were the religious (at least 58% of respondents), credit/microfinance, mutual help insurance, and then agricultural producer groups. These identified forms of social networks can be leveraged for enhanced income diversification strategies by cocoa farming households. This is presented in Figure 37.

Figure 37: Group membership of respondents



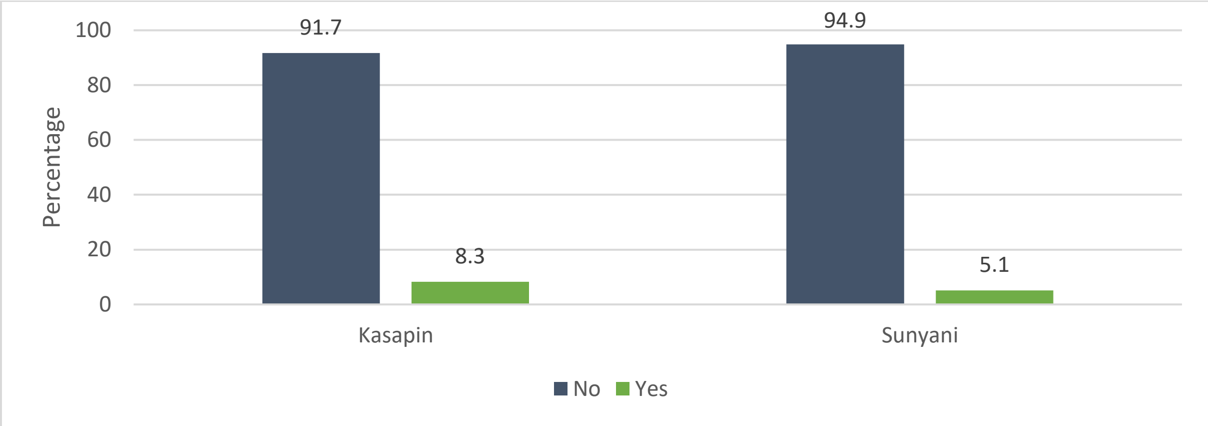
Source: Baseline survey, 2018

3.7.4 Autonomy in decision making

The extent of power possessed and exercised by these women in making decisions concerning income generating activities was considerably high. The responses to some statements posed to these women helped in assessing their perceived control over decisions as it relates to others' expectations of her. Each question asks the person to agree or disagree with whether the statement describes a person that is like her/him. The responses to the 11 key statements posed to the respondents are presented in Figure 38, statements 1 to 11. Overall, the results suggest women have a fairly high degree of autonomy in decision-making (indicating she can influence decisions). Interestingly, women in Kasapin appear to have more autonomy that women in Sunyani, but this may be driven more by the small sample size in Kasapin.

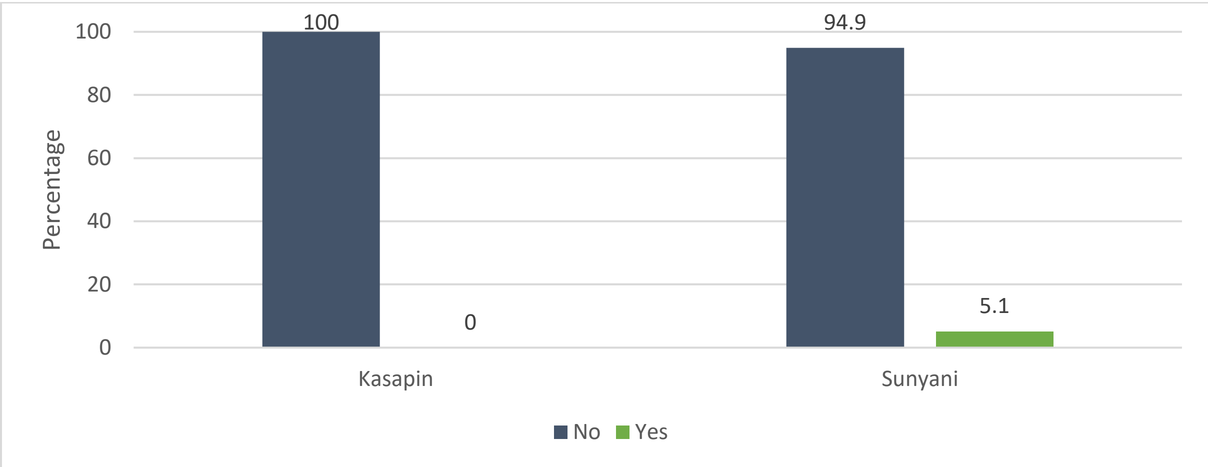
Figure 38: Responses to statements on decision-making abilities

Statement 1: "A person who cannot grow other types of crops here for consumption and sale at market. Beans, sweet potato and maize are the only crops that grow here."



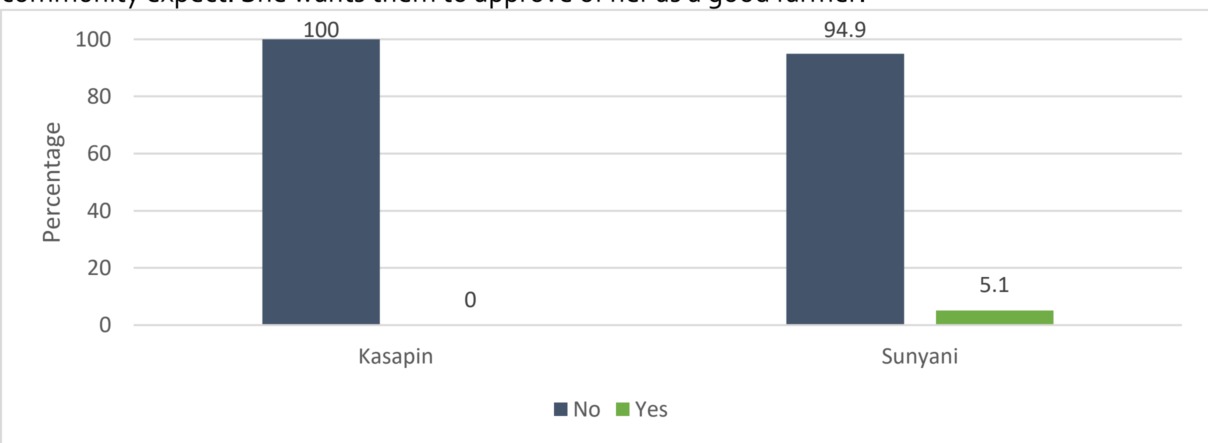
Source: Baseline survey, 2018

Statement 2: "A farmer that grows beans, sweet potato, and maize because her spouse, or another person or group in her community tells her she must grow these crops. She does what they tell her to do."



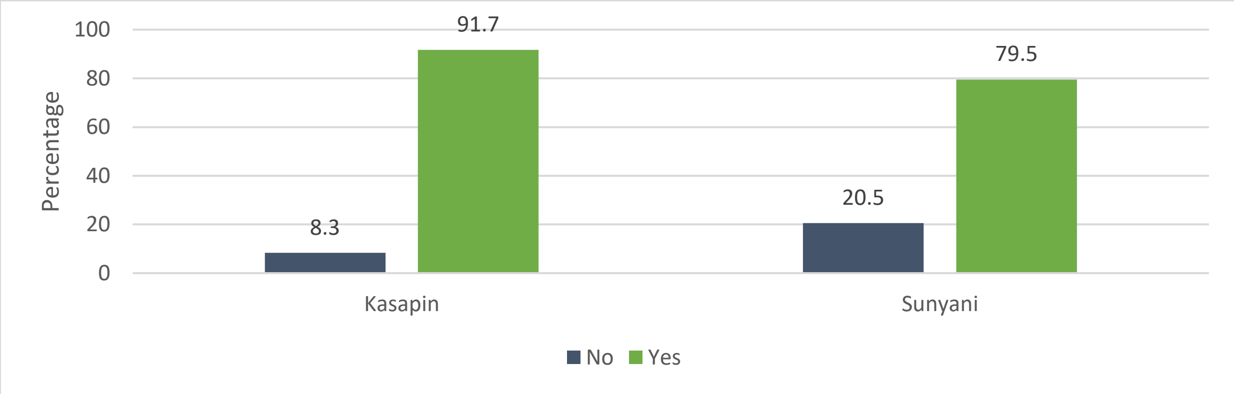
Source: Baseline survey, 2018

Statement 3: "A farmer that grows the crops for agricultural production that her family or community expect. She wants them to approve of her as a good farmer."



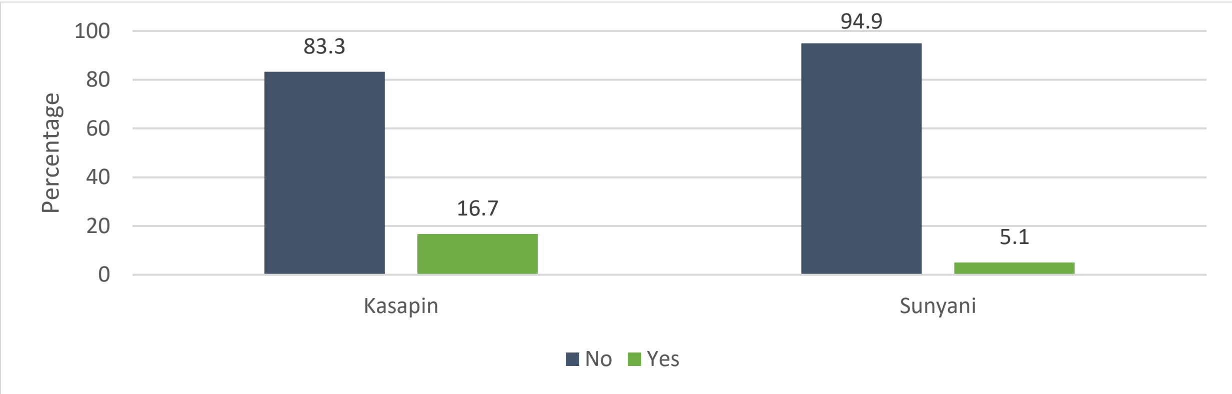
Source: Baseline survey, 2018

Statement 4: "A farmer that chooses the crops that she personally wants to grow for consumption and sale in market and thinks are best for herself and her family. She values growing these crops. If she changed her mind, she could act differently."



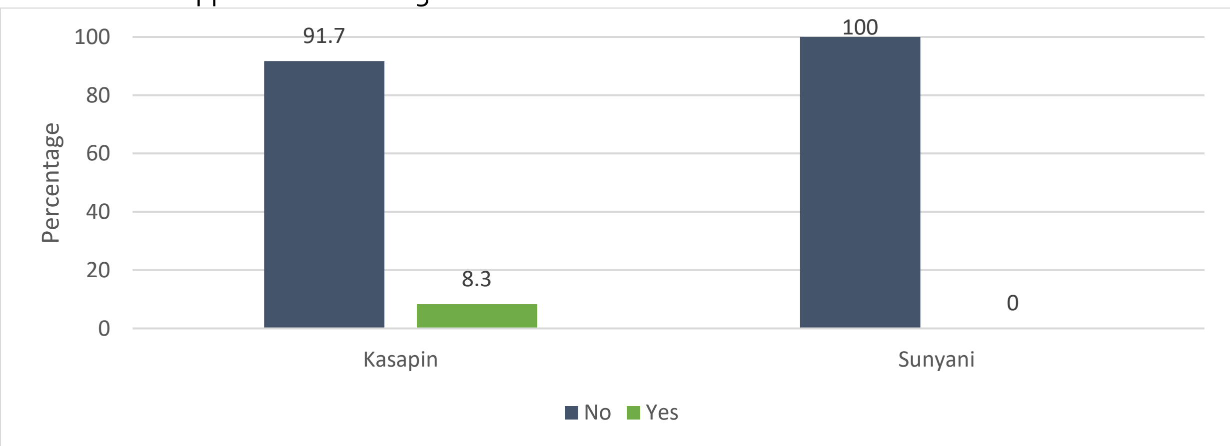
Source: Baseline survey, 2018

Statement 5: "A farmer that raises the types of livestock she does because her spouse, or another person or group in her community tells her she must use these breeds. She does what they tell her to do."



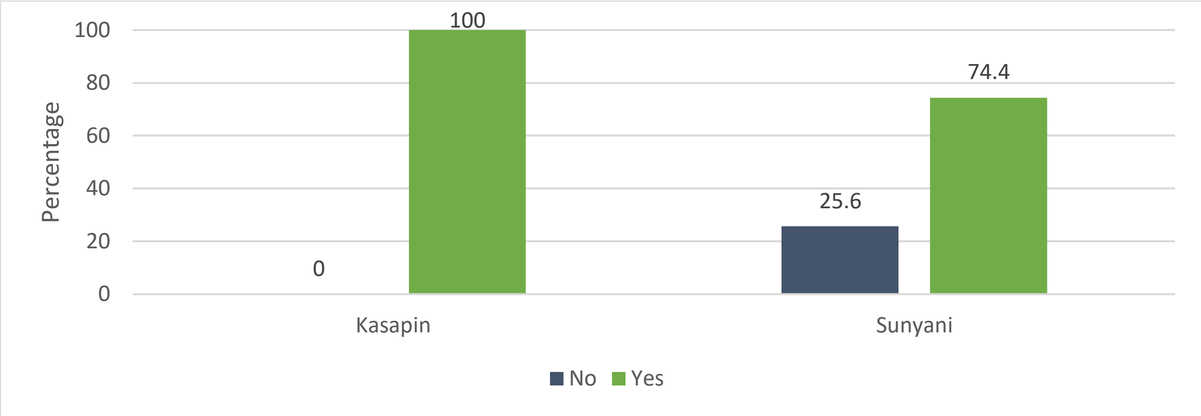
Source: Baseline survey, 2018

Statement 6: "A farmer that raises the kinds of livestock that her family or community expect. She wants them to approve of her as a good livestock raiser."



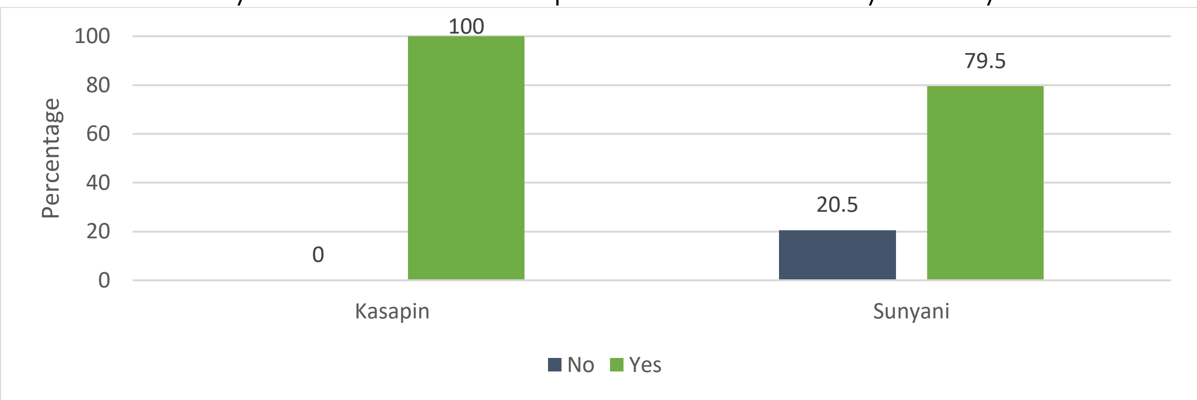
Source: Baseline survey, 2018

Statement 7: "A farmer that chooses the types of livestock that she personally wants to raise and thinks are good for herself and her family. She values raising these types. If she changed her mind, she could act differently."



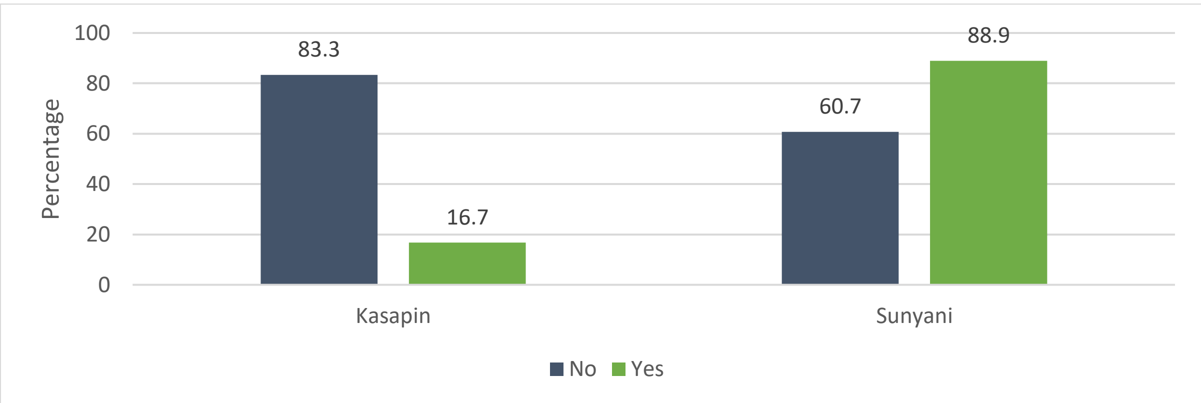
Source: Baseline survey, 2018

Statement 8: "Are you like a farmer whose expenditure is determined by necessity?"



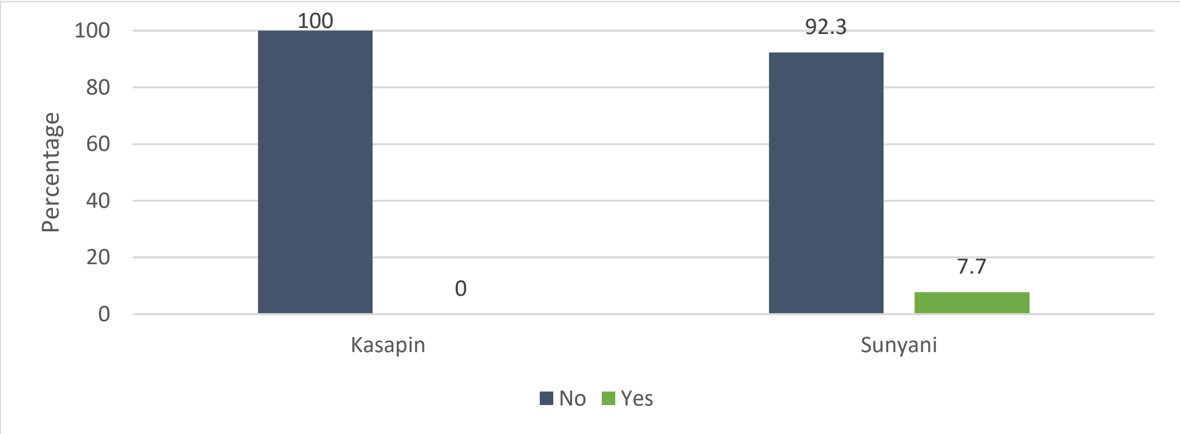
Source: Baseline survey, 2018

Statement 9: "A farmer who uses her income how her spouse, or another person or group in her community tells the farmer how she must use it. She does what they tell her to do"



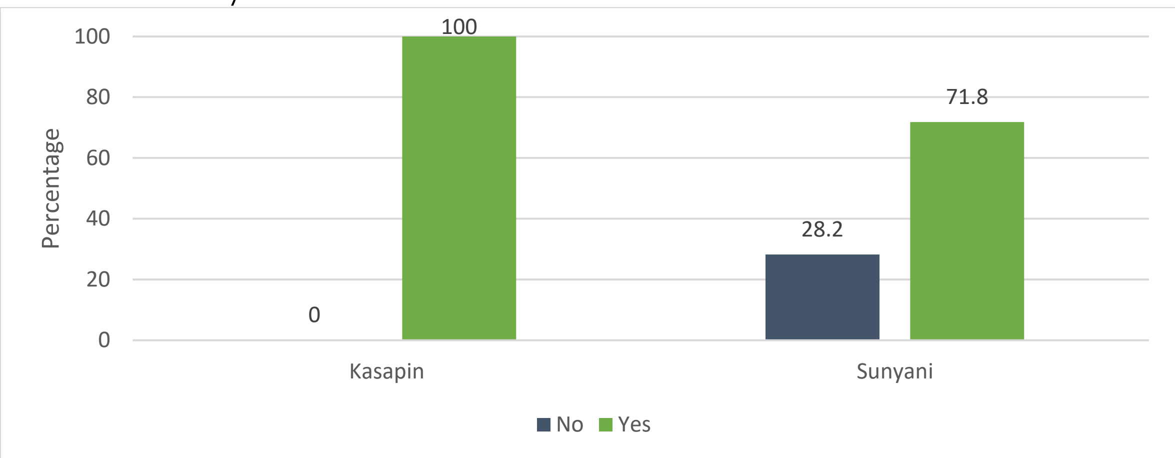
Source: Baseline survey, 2018

Statement 10: "A farmer who uses her income in the way that her family or community expect. She wants them to approve of her"



Source: Baseline survey, 2018

Statement 11: "A farmer who chooses to use her income how she personally wants to, and thinks is best for herself and her family. She values using her income in this way. If she changed her mind, she could act differently"



Source: Baseline survey, 2018

4. DISCUSSION

Core to FarmGrow is an assessment of a cocoa farmer's ability to invest in his or her land to increase cocoa yields from 400 kg / hectare to 1500 kg / hectare (over 300%) over an 8- to 10-year period by developing a geo-data enabled precision agriculture service and technology platform. A cocoa farmer's ability to invest is driven by the potential of their land to produce cocoa, the farmer's ability and willingness to adopt GAPs well-known to influence productivity, and the farmer's financial capability and willingness to invest to improve their farming operations. The results related to these three factors are discussed below in greater detail, along with special discussions on income diversification, and gender.

4.1 Land Potential and Adoption of Good Agricultural Practices

Table 40 outlines FarmGrow adoption observations that guide an agronomist's interactions with and profiling of a farmer. This baseline survey did not cover planting material nor the soil conditions but did cover the degree to which farmers self-reported applying fertilizers, insecticides and their pruning, weeding, and harvesting behaviors.

Table 40: FarmGrow Adoption Observations

Adoption Observations (AOs)	
Plant Material	1. Planting Material - Genetic Potential
Farm Condition	2. Tree age
	3. Tree density
	4. Tree health
	5. Debilitating Disease
GAPs	6. Pruning
	7. Pest and Disease and Sanitation
	8. Weeding
	9. Harvesting
	10. Shade Management
Soil	11. Soil Condition (pH separately)
	12. Organic Matter
	13. Fertilizer Formulation
	14. Fertilizer Application

The results of the Sat4Farming baseline study indicate that there is much room for improvement in farm conditions, adoption of GAPs and soil conditions. There is low use of liquid and solid fertilizers (about 30 and 13 percent, respectively) and weedicides (about 10 percent). Weedicides themselves are not promoted as a practice given concerns about biodiversity, it is the actual observation that weeds have been removed that is assessed by FarmGrow. There is relatively high use of insecticides (~95 percent) and fungicides (~70 percent); however, qualitative data indicates that the challenge they face with the use of insecticides and fungicide is the timing of application. When households do not own their own equipment and have to rely on someone to spray their farm, the application of the sprays are often late, reducing their effectiveness.

Almost all farmers reported pruning last year, with most reporting either pruning twice or more than 10 times. Approximately 85 percent of farmers reported maintaining shade trees on their cocoa farms; for those who maintain shade trees, their estimated yields are much higher (311 kg/hectare compared to 289 kg/hectare among those without shade trees).

Most farmers (77 percent) rely on slash and burn to prepare their land. Qualitative interviews reveal that slash and burn is not always used for cocoa, but for clearing land in general for intercropping or the planting of other cash crops. Farmers share that this reduces the need for weedicide chemicals and results in easier removal of tree stumps when some trees have been cut down. However, between 32 and 47 percent of farmers did report establishing a new farm, which often can require clearing. Given the low yields and the fairly large farm size, these in combination raise a concern about deforestation. Fifty percent of farmers reported using soil and water conservation techniques; intercropping followed by planting of shade trees were the most reported techniques used.

While not necessarily promoted as a GAP, recordkeeping was also found to be low (84 percent reported not keeping records). This has important implications for a farmer's ability to understand his/her income and expenditures related to their farm and is an indication of whether they see their farm as an actual business.

Finally, regression analysis revealed that insecticides followed by fungicides and pruning were the techniques most influential on yields. This suggests that for farmers who may have limited funds to apply all good agricultural practices could see the most impact from applying insecticides and fungicides. Mars researchers shared that pruning may be significantly related to the other two techniques as pruning reduces the need for insecticides and fungicides when dead or disease limbs are also removed. Pruning also directs energy and nutrients into fruit-bearing branches. Therefore, farmers should consider pruning prior to insecticide and fungicide use given its double benefits to the tree.

4.2 Financial Capability to Invest

Based on the baseline data, the difference between the income of farmers (20,238.59 GHS; 3,643.90 USD) and expenditures of farmers (15,349.97 GHS; 2,763.71 USD) results in a balance of 4,889.59 GHS (876.45 USD[10]). According to a 2018 study published on Ghana cocoa farmers for The Living Income Community of Practice[11], the estimated living income for Ghanaian cocoa farmers located in the Ashanti, Central, Eastern and Western Regions was 17,568 GHS (3,992.72 USD; using 4.4 GHS/1 USD as the exchange rate used by the Living Income Study). The living income is based on 1,464 GHS/month for a family of 2 adults and 3 children multiplied by 12 months. This suggests that the FarmGrow farmers may likely be achieving a living income; however, the average household size is 6 among the FarmGrow farmers. Indeed, the question is raised about the per capita income when you compare the per capita income from a 5-person household achieving a living income as estimated by the Living Income Study (3,514 GHS/person; 798 USD/person/year) compared to a household of 6 measured by the Sat4Farming study (3,373 GHS/person; 766 USD/person/year).

Moreover, people's ability to accurately estimate their income and expenditures is historically known to be difficult due to various challenges, notably the difficulty of households to recall expenditures and incomes sources due to irregularity of both.[12] Therefore, the estimated balance of

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[10] Exchange rate as of 29 January 2020; 5.6 GHS to 1 USD; https://www.xe.com/

[11] Smith S and Sarpong D. 2018. Living Income Report: Rural Ghana Cocoa growing areas of Ashanti, Central, Eastern, and Western Regions. Sustainable Food Lab, GIZ and ISEAL. https://docs.wixstatic.com/ugd/0c5ab3_55017cee608047d494f56b496925ae4a.pdf?ct=t()

[12] Deaton A. 2001. "Counting the world's poor: problems and possible solutions (English)". *The World Bank research observer. -- Vol. 16, no. 2 (Fall 2001), pp. 125-147.* http://documents.worldbank.org/curated/en/732521468331772731/Counting-the-worlds-poor-problems-and-possible-solutions

4,889.59 GHS in available income after estimated expenditures is very likely to be over- or under-estimated. To better understand the reliability of these estimates, these estimates were compared to recent data collected among cocoa farmers by KIT.

In 2018, KIT estimated that cocoa farmers in Ghana generated 1,885 USD on cocoa income alone (prior to adjusting for costs incurred for cocoa farming).[13] KIT estimated that after accounting for input and hired labour costs, an average cocoa household in Ghana earned a net income of 1,510 USD from cocoa alone; suggesting that expenditures on cocoa were 375 USD. The Sat4Farming survey estimates that on average, households earn 9,716.45 GHS income from cocoa alone (1,742.33 USD) and cocoa-related expenses were estimated at 1,527.22 GHS (273.52 USD), resulting in an adjusted cocoa income of 8,189.23 (1,466.53 USD). The difference between the Sat4Farming and KIT studies for estimated cocoa income is approximately 43 USD. This suggests that the Sat4Farming and KIT estimates are fairly comparable.

When indicators of vulnerability such as food security and a household's ability to come up with emergency funds were assessed, 52 percent of households were found to be food insecure and 39 percent did not feel they could easily come up with the funds if they faced an emergency. Moreover, as was seen above, the standard deviations for some of the estimates also mean that there is quite a bit of variability in the estimates of income and expenditures among the cocoa farmers in this sample. All these factors raise a caution of assuming households have the ability to invest significant amounts of funds to renovate or rehabilitate their cocoa farms to attain the gains in productivity and that farmer segmentation will be critical to understand the financial capability of farmers to invest in their farms. Among those reporting to have spent anything on their cocoa farm, farmers are currently spending anywhere between 1,527.22 GHS (273.52 USD) and 5,305.27 GHS (950.53 USD). These estimates come from two different sources in the survey where one asks farmers to estimate what they spend on crop production generally (1,527.22 GHS) and then when they are asked to estimate what they spend on specific inputs for cocoa farming, such as (labor, purchase of weedicide, fungicide, pesticide, fertilizer), resulting in an estimate of 5,305.27 GHS (950.53 USD). These are quite different estimates and the latter is likely driven by one to two farmers in Goaso, suggesting the real average costs are much lower. The current average yield achieved is 307 kg/ha which is approximately 100 kg/ha lower than the assumed yield level for the project assumptions (400 kg/ha).

If a typical farmer fully adopted GAPs, Mars research (unpublished) estimates that a farmer might be expected to spend 4,492 GHS to simply maintain their current farm (no renovation), resulting in an expected return of 400-500 kg per hectare. For renovating their farm (which is not inclusive of the 3-4 years of foregone income while new trees are being planted), a farmer would be expected to spend between 5,500 to 9,442 GHS, resulting in an expected return of 1.5 metric tons per hectare. These estimates are purposefully high as they include the estimated cost of labor if a household needed to pay for all the labor costs associated with the activities, versus relying on household labor. Therefore, for some households, the actual labor costs associated with these estimates could be lower. However, given many female-headed farming households do have to rely more on labor, these estimates have important implications for women farmer's abilities to fully adopt promoted

[13] Bymolt R, Laven A, Tyszler M. 2018. Demystifying the cocoa sector in Ghana and Côte d'Ivoire. Chapter 12, Household income, poverty and wealth. The Royal Tropical Institute (KIT).

practices. When the current average yield of 307 kg per hectare is compared to the targets of either 400-500 kg per hectare for farm maintenance and 1.5 metric tons per hectare that would result from farm renovation, there is significant room for improvement. Farmers in Kasapin, despite their smaller land size, are the closest to achieving yields that would result from basic good farm maintenance.

Given the variability in estimated income and expenditures noted in this report and the estimated costs for fully adopting good agricultural practices or renovating one's cocoa farm, the need for outside investment is vividly apparent. If estimated incomes are GHS 9,716 and farm renovation can cost a similar amount (GHS 9,442), the investment gap is significant. However, despite the likely need for external investment, the results show there is very little use of credit among these farmers, either due to low access to credit or aversion to taking credit because of mistrust of financial institutions and/or high interest rates. When credit is noted, it is often coming from informal lenders such as the local cocoa purchasing clerk. Therefore, the assumption for the project theory of change that farmers will have access to credit does not currently hold true and needs to be addressed.

Qualitative interviews conducted prior and during the baseline report indicated dis-interest and mistrust among formal financial institutions to extend credit to farmers due to both farmer unwillingness to repay and consequential poor repayment rates. Many loans used through local purchasing clerks are for costs such as education fees, health emergencies, or funeral costs. The quantitative data shows approximately 27 percent of farmers relied on the purchasing clerk for supporting health emergency costs. Farmers also indicated that due to the seasonality of cocoa farming and their significant household expenditure, there was always the difficulty to save, which affected their ability to attract credit. Most of the communities visited had no organized saving groups (i.e. village savings and loan associations) despite farmer interest in being part of such savings mechanisms. Farmers also felt that crop diversification and intercropping could help them have regular access to funds and facilitate their ability to save and access credit.

4.3 Income Diversification
Income diversification among cocoa farmers is seen as both a means to improve income but also as a risk mitigation strategy. The survey results found that some farmers are likely earning more money from other income-generating activities or income sources than cocoa, particularly if they rely on remittances, non-cocoa farming, and general trade/small businesses. Qualitative data found that farmers desired more information on income diversification but also found that accounting for all income sources by a household is difficult, which may indicate that the sources captured in this report do not represent all income sources. This information is critical to understand and capture as it could be highly influential in a farmer's ability to offset the foregone income that could be generated by a poor yielding cocoa farm as it is being rehabilitated or renovated. It also could influence a farmer's ability to access credit given some of these other income sources might be more reliable during seasons when there is no or little cocoa income.

4.4 Gender
The baseline study did not provide a deep analysis of gender differences; these results will be captured in a different report. However, it is important to note that 29 percent of the farmers represented in this study were female cocoa farmers (as defined by Touton as the primary farmer)

who were often widows and having less education than men. The early analysis of the proWEAI data shows that women may have very little final decision-making power regarding what is grown on the land but she does appear to have some influence over the decisions such as how money is spent, what income-generating activities are being pursued. Women also have some use of financial services; approximately 30 percent of the women felt they could borrow from a formal financial if she needed.

The qualitative data collected during the baseline also found that women have to rely more on external labor to help in pruning, harvesting, and spraying. Women face particular social norm challenges that also keep them from actively participating in cocoa farming activities. If a woman were to accompany her husband to sell the beans, even other women perceive her to be too inquisitive or considered an "iron lady" (meaning she'd have too much influence over her husband). Men discourage women from engaging in the sale of cocoa as they do not believe women can read scales correctly. As a way to bridge the gaps in performance of farming activities between men and females, a high premium was placed on training for females to equip them with skills and ability to perform some farming activities. Based on this proposition, the timing for training on GAPS delivered by agronomists, was noted not to be favorable to women. According to men, due to a skills gap among females, they always have difficulties in purchasing farm equipment. For instance, according to men, women do not know the difference between good and bad farm tools in general and cutlasses in particular.

Women are primarily in charge of intercropping activities and for running small businesses. This could have important implications for households when they make a decision to renovate their farm as this could put more pressure on women to make up the gaps in foregone income. This emphasizes the importance for ensuring women are engaged in the process for making financial decisions for the cocoa farms. This should continue to be explored and the risk to women's independent livelihoods and financial protection considered.

4.5 Limitations

It is important to note that this study relies on a comparison group that was selected based on geography which could introduce differences that will have to be controlled for when comparing results at the endline. Kasapin and Sunyani are both locations where Touton is piloting the FarmGrow application; Goaso was selected as a location where they would delay introduction of FarmGrow until after the endline is completed.

Farmers were not randomly selected by Touton to be candidates for the study; only "investment ready" farmers are approached for FarmGrow which means they are the "cream of the crop" among all possible farmers that Touton engages. Also, most primary farmers tend to be men as Touton prefers to work with landowners given their ability to make decisions on the farm and landowners tend to be men. However, this study suggests that not all farmers are landowners and some are also caretakers. Therefore results from this study may not reflect cocoa farming households as a whole.

5. CONCLUSION

The baseline results suggest that there is much room for improvement among cocoa farming households and significant investment is needed to help farmers improve their current yields of 307 kg per hectare to the desired 1.5 metric tons per hectare. Low adoption rates of critical good agricultural practices and low financial investments in the farm are resulting in substandard yields for farmers. Most farmers in this study are known to have old trees (30 years and beyond) that produce very little and given that between 32 and 48 percent of farmers have established new farms recently indicates that farmers are relying more on the expanded use of land to maintain incomes than intensifying efforts on existing farms. This has important implications for the sector and land management efforts more generally. These concerns are those that FarmGrow aspires to address: by supporting farmers in the adoption of GAPs and supporting the farmers' understanding of the investment needs and the potential returns on investment will provide them with a clearer roadmap to improving their income and professionalizing their farmers as well as providing the cocoa sector with a more reliable and sustained source of cocoa for years to come.