



IMPACT OF STEPWISE CLIMATE SMART COCOA PRACTICES ON BENEFICIARY FARMERS-UNDER CCAFS PROJECT IN GHANA (PROJECT ENDLINE STUDY)

WRITTEN AND COMPILED BY;

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About CCAFS

The Climate Change, Agriculture and Food Security (CCAFS) program of the Consortium of International Agricultural Research Centers (CGIAR) seeks to marshal the science and expertise of CGIAR and partners to catalyse positive change towards climate-smart agriculture (CSA), food systems and landscapes, and position CGIAR to play a major role in bringing to scale practices, technologies and institutions that enable agriculture to meet triple goals of food security, adaptation and mitigation. The three main objectives of the program is to Sustainably increase agricultural productivity, to support equitable increases in farm incomes, food security and development, adapting and building resilience of agricultural and food security systems to climate change at multiple levels, and reducing greenhouse gas emissions from agriculture. In Ghana, the CCAFS program is being implemented in the cocoa sector by the International Institute of Tropical Agriculture (IITA) in partnership with the Rainforest Alliance.

About IITA

The International Institute of Tropical Agriculture (IITA) is a non-profit institution that generates agricultural innovations to meet Africa's most pressing challenges of hunger, malnutrition, poverty, and natural resource degradation. Working with various partners across sub-Saharan Africa, we improve livelihoods, enhance food and nutrition security, increase employment, and preserve natural resource integrity. The Climate Change Agriculture and Food Security (CCAFS) program in IITA-Ghana is determined to develop tailor-made stepwise climate smart management and finance packages to enhance the resilience and productivity of Ghanaian Cocoa farmers in the face of the adverse impacts of climate change on Cocoa production.

Citation

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EXECUTIVE SUMMARY

This report is an end line study report of the International Institute of Tropical Agriculture (IITA) project titled “Climate Smart Cocoa and its influence on voluntary standards and Impact lending in West Africa”. The project in Ghana focused on introducing cocoa farmers to Climate Smart Agriculture (CSA) practices using a “stepwise approach” which is termed “Stepwise Climate Smart Cocoa practices”. The study sought to ascertain the level of acceptance and adoption of the stepwise climate smart cocoa (CSC) practices within the project implementation areas in Ghana. Analysis of data from 1113 project targeted farmers using descriptive statistics and regression analysis showed that adoption of CSC practices is very high among farmers (Over 98% of farmers are aware and carrying out CSC practices) because of the project trainings and 99% of farmers stated that CSC practices are beneficial. Majority of farmers (53%) who were directly trained on stepwise CSC practices went on to train colleague farmers who were not part of the project partners’ Farmer Business Organization. The factors that influenced adoption of stepwise CSC practices are age of farmer, level of education of farmer, cocoa farming experience, household size, walking distance to farm and land size. Majority of farmers are willing to pay for CSC practices at a cost ranging from GHS 100.00 to GHS 480.00. Few farmers (3%) expressed having challenges with adoption of CSC, relating this to financial difficulties with affording practices, tiredness in carrying out practices, time consuming nature of carrying out practices and the fear of adoption.



INTRODUCTION

This study comes at the backdrop of the International Institute of Tropical Agriculture (IITA) project titled “Climate Smart Cocoa and its influence on voluntary standards and Impact lending in West Africa”. The project focused on introducing Cocoa farmers in Ghana to Climate Smart Agriculture (CSA) practices relevant to their context and needs to adapt to the impacts of the changing climate. The project introduced the beneficiary farmers to the “STEPWISE CSA PRACTICES” approach from a set of agronomic practices essential for cocoa growth and development. These stepwise CSA practices, a compendium of well researched climate smart agronomic practices developed by scientists of the International Institute of Tropical Agriculture (IITA), are climate adaptation strategies designed to help Cocoa farmers increase their yield.

Adopting a co-learning approach with partners such as Cargill and Produce Buying Company (PBC), IITA introduced carefully tailored agronomic practices (i.e., Pruning, Weeding, Cultural management, fungicide application, insecticide application, soil fertility management practices and fertilizer application) to cocoa farmers in the Zone of Influence. The concept of the “stepwise” is to support the gradual adoption of agronomic practices in an incremental manner based on farmers resource endowment. After receiving benefits from a preceding step, this is invested into subsequent steps to ultimately lead to increase in yield and income of smallholder cocoa farmers. The stepwise CSC pilots were implemented in two of CCAFS’ project demarcated climatic impact zones of Ghana namely, incremental adaptation zone (Cope zone) and systemic adaptation zone (Adjust zone) (Bunn et al., 2019).

OBJECTIVE

The main aim of the study was to ascertain the level of acceptance and adoption of the stepwise CSC practices within the project implementing areas. Specific aims of the study were to:

- i. Determine farmers level of awareness and the level of knowledge transfer

- of climate smart cocoa practices from trained farmers to other farmers
- ii. Determine factors that influence the adoption of stepwise CSC practices
- iii. Determine farmers willingness to pay for CSC practices
- iv. Identify the challenges associated with the adoption of CSC practices

METHODOLOGY

Sampling technique

The study used a multistage sampling technique to interview 1113 cocoa farmers in the Cope and Adjust climate impact zones of Ghana. A total of 342 (31%) respondents were interviewed in the Adjust Zone and 771 (69%) were interviewed in the Cope zone of Ghana. These cocoa farmers are specifically, Cargill and PBC trained farmers under the CCAFS Stepwise CSC pilot plots co-learning in the Cope and Adjust climate impact zones of Ghana. Out of the many cocoa farmers in these communities, the study focused on Cargill and PBC trained cocoa farmers. Farmers were then selected randomly from the pool of these farmers and interviewed. The study used both a structured and semi-structured questionnaire to engage cocoa farmers expected to have benefited from the stepwise CSC trainings. The questionnaire covered nine sections i.e. Socio-economics, Participation in CSC training, membership of farmer based association/organization, access to climate smart technology information, land ownership status, farmer access to agricultural input and CSC adoption, benefits of adopting CSC practices, willingness to pay for stepwise CSC practices and knowledge diffusion.

Table 1: Sample Size

No	Community Name	Zone	No enumerated
1	Abotareye	Cope	90
2	Achiasewaa	Adjust	43
3	Ahyiresu	Adjust	38
4	Ahokwa	Cope	97
5	Agogoso	Adjust	32
6	Agyatakrom	Adjust	07
7	Atialeve	Cope	38
8	Badukrom	Cope	70
9	Betinko	Adjust	50
10	Camp (Sefwi)	Cope	58
11	Daboase	Cope	76
12	Kessekrom	Cope	69
13	Koforidua	Adjust	54
14	Nyameyehene	Adjust	31
15	Odumase Nyamebekyere	Adjust	44
16	Sefwi Asafo	Cope	166
17	Sompre	Cope	50
18	Katakyiwaa	Adjust	50
19	Yebrebrenyini	Cope	50
	TOTAL		1113



Analysis

The study used the SPSS 23 and Stata 64 version 15.1 to analyze the data. Tables and figures were developed using the SPSS software and the regression analysis on adoption was done using the probit model in Stata software. The extent of adoption of practices was calculated using the land area committed to a practice and relating that to the total land area available to the farmer.

Study Area

The study was carried out in the Ashanti and Western North Regions of Ghana. These areas cover the adjust and cope climate impact zones of Ghana. The Ashanti region falls between longitude 0 15 – 2 25 West and Latitude 5 50 – 7 40 North. It is bounded by the Bono, Ahafo, Central, Volta and Western North regions. Total land area – 24,389 square kilometers. About 1,463,340 hectares (60%) are arable. About 1,181,788 hectares (81%) of the arable lands are cultivated. The region experiences double maxima rainfall in a year, with peaks in May/ June and October. Mean annual rainfall is between 1100 mm and 1800mm. The mean annual temperature ranges between 25.5°C in the southern districts and 32°C in the northern parts of the region. Humidity is high averaging about 85% in the southern districts and 65% in the northern part of the region. The southern districts are covered with moist semi-deciduous forest whilst the Guinea savanna covers the northern part. The Guinea Savanna consists of short deciduous and fire-resistant trees. Riverine forests also occur along the Afram River and streams of the savanna zone. The Western North Region is one of the six new regions of Ghana created in 2019. The region is bounded by the Ivory Coast (Comoé District) on the west, the Central region in the southeast, and the Ashanti, Ahafo, Bono East and Bono regions in the north. The Western North Region has the highest rainfall in Ghana, lush green hills, and fertile soils.

RESULTS AND DISCUSSION

Socio-Demographics of Farmers

The socio-demographics of the surveyed cocoa farmers are presented in Table 2, these consist of their sex, marital status, educational level, and ages. A total of 1113 cocoa farmers surveyed from the two agro-climatic zones of the CCAFS project, out this number 718 were males and 395 were females representing 65 and 35 percent respectively. Most of the farmers surveyed were married, this number constituted 86 percent of the total farmers, 5 percent of them were widows/widowers. In terms of educational attainment, 38 percent of the farmers had completed Junior High School, followed by 26 percent who had completed Primary level of education. The results also show, that about 22 percent of the cocoa farmers surveyed had “no formal education”, less than 1% of the farmers had gone through Adult Education. Majority (90%) of the farmers indicated Christianity as their religion, farmers who indicated Islam as the religion formed 7 percent of the 1113 surveyed cocoa farmers.

Table 2: Selected Socio-Demographics of Farmers

Variable	Frequency	Percentage
Sex of farmer	Freq.	Percent
Male	718	64.48
Female	395	35.52
Total	1113	100.00
Marital status	Freq.	Percent
Married	960	86.25
Has partner but non-married	24	2.16
Single	34	3.05
Divorced	37	3.32

Widow/Widower	58	5.21
Total	1113	100.00
Education	Freq.	Percent
No formal Education	245	22.01
Primary	289	25.97
Junior High	419	37.65
Secondary	140	12.58
Post-Secondary	17	1.53
Adult Education	3	0.27
Total	1113	100.00
Religion of farmer	Freq.	Percent
Christian	1012	90.93
Islam	80	7.19
Traditionalist	17	1.53
Atheist	1	0.09
Other	3	0.27
Total	1113	100.00
Status in commu- nity	Freq.	Percent
Native	685	61.55
Settler-Farmer	428	38.45
Total	1113	100.00

The results from Table 2 shows that 62 percent of the cocoa farmers surveyed for the end-line evaluation were natives of the communities where their farms were located, the remaining 38 percent were settler-farmers (i.e., non-native migrants) of the communities where they undertake their cocoa farming activities. Additional analysis of the demographic is presented in Table 3 the average age for the surveyed farmers was 49.8 years, the average household size for the 1113 farmers is about 5.6 \approx 6. The average cocoa farming experience of the farmers

was about 22.5 years.

Table 3: Descriptive Statistics (Age, Household size & Cocoa farming Experience)

Variable	Obs.	Mean	Std. Dev.
Age of farmer	1113	49.797	11.672
Household size farmer	1113	5.675	3.607
Cocoa farming experience	1113	22.549	11.163

Farmer's level of awareness and level of diffusion of Climate Smart Cocoa practices

Training on Climate Smart Agriculture

Majority (98%) of the farmers indicated awareness of Climate Smart Cocoa (CSC) practices. The results also showed that 98% of the CCAFS project cocoa farmer-beneficiaries have had some previous training on climate smart agriculture, with remaining 2% having indicated otherwise (see table 4).



Table 4: Previous Training on CSA

Awareness of CSC	Frequency	Percent
No	12	1.08
Yes	1100	98.92
Total	1112	100.00
Previous Training on CSA	Freq.	Percent
Yes	1092	98.11
No	21	1.89
Total	1113	100.00

Most farmers surveyed were members of farmer-based organizations, their participation in CSA training was therefore required, hence most of the farmers selected FBO members as main reason for joining the CSA training programs. They also found climate smart agriculture was a good concept to adopt. Table 5 shows that 61 percent of the responses for “FBO membership” and 39 percent response for CSA as a good concept.

Table 5: Reasons for participations in CSA training

	Frequency	Percent of Responses
FBO Member	923	60.680
CSA concept is good	604	39.320
Total	1536	100.000
Valid cases:	1089	

In terms of number of years farmers have been participating in CSA training activities, table 6 shows that most of the farmers have between 1-5 years. This represents 86 percent of the total response obtained. About 13 percent of the cocoa farmers indicate 6-10 years as the length of participating in CSA training activities.



Table 6: Years of participation in CSA Trainings

Years participation	Frequency	Percent
1- 5	943	86.43
6-10	147	13.47
>10	1	0.09
Total	1091	100.00

Participation in CCAFS project

The following are some of the reasons why a few of the farmers who did not participate in the CSA training activities. Most of the farmers indicated they were not invited for the training the main reason for non-participation. Others were of the view that the training would take much of their time. See Table 7.

Table 7: Participation in CCAFS project

	Frequency	Percent of Responses	Percent of Cases
I was not invited to any CSA training	16	84.21	84.21
The CSA concept is not for me	0	0.00	0.00
The training could take much of my time	3	15.79	15.79
The practices are expensive	0	0.00	0.00
Total	19	100.00	141.050
Valid cases:	19		

Membership of FBO

Membership of FBOs was high among the surveyed farmers, from Table 8, 97 percent of the farmers belonged to a Farmer Based Organization. About 99 percent of the farmers indicated they have been introduced to new technologies and practices since they joined their respective FBOs. See Tables 8 and 9.

Table 8: Membership of FBO

FBO Membership	Frequency	Percent
Yes	1082	97.30
No	30	2.70
Total	1112	100.00

Table 9: Introduction to new technology

New technology	Frequency	Percent
Yes	1078	99.63
No	4	0.37
Total	1082	100.00

Table 10: Introduction to Climate Smart Cocoa (CSC)

CSC	Frequency	Percent
Yes	975	88.00
No	133	12.00
Total	1108	100.00

Majority of farmers have been trained using demonstration fields (37%), farmer field school (24%) and coaching (28%) see table 12. 53% of farmers transferred the CSC knowledge obtained from extension officers (see figure 1) and majority of the practices transferred are pruning, weeding and fertilizer application (see figure 2).

Table 11: Approaches to Training

	Frequency	Percent of Responses	Percent of Cases
Demonstration Fields	736	37.38	74.19
Field Day	54	2.74	5.44
Video Show	0	0.00	0.00
Agric Show	0	0.00	0.00
Sensitization events	150	7.62	15.12
Media event	4	0.20	0.40
Farmer Field School	481	24.43	48.49
Coaching	543	27.58	54.74
Cross visits	1	0.05	0.10
Total	1969	100.00	198.49
Valid cases:	992		

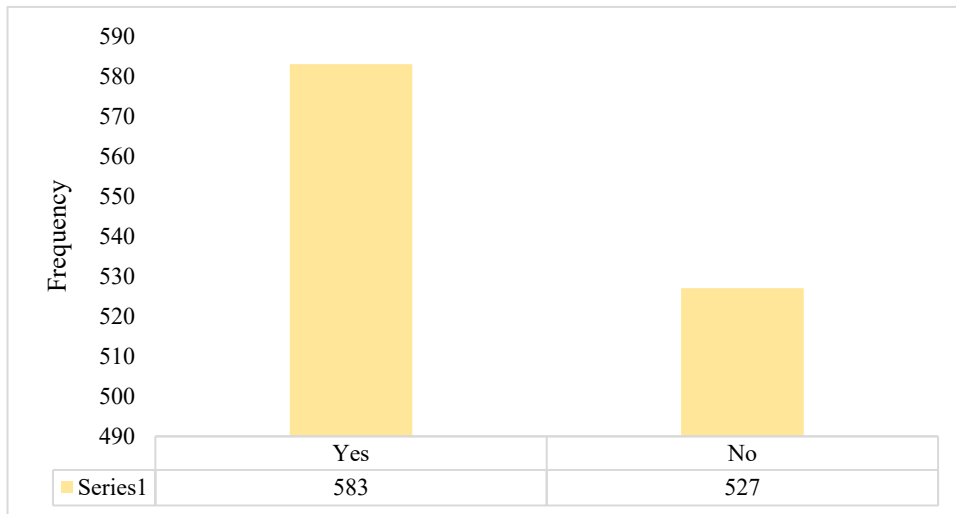


Figure 1: Technology Transfer

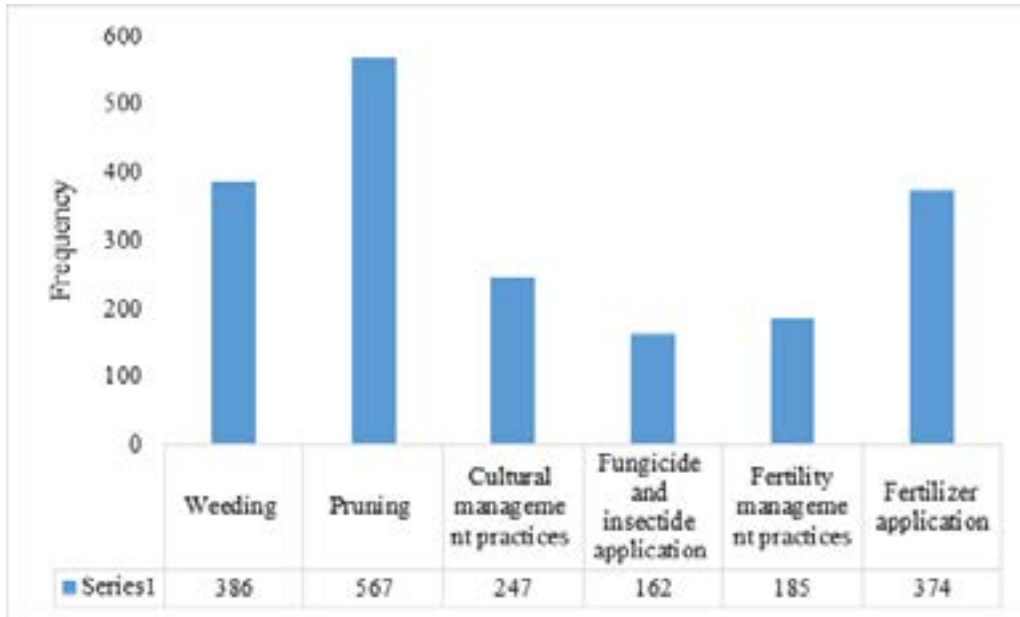


Figure 2: Practices transferred

Factors that influence the adoption of stepwise CSC practices

Majority of farmers held ownership of their farmlands (90%) see figure 3 and most farmers (71%) stated that the ownership status of their land determines their practice of CSC practices (see table 12). Most farmers had access to inputs and services i.e poultry manure, insecticide, inorganic fertilizer, extension services. The least accessed services are tractor services and credit (see figure 4).



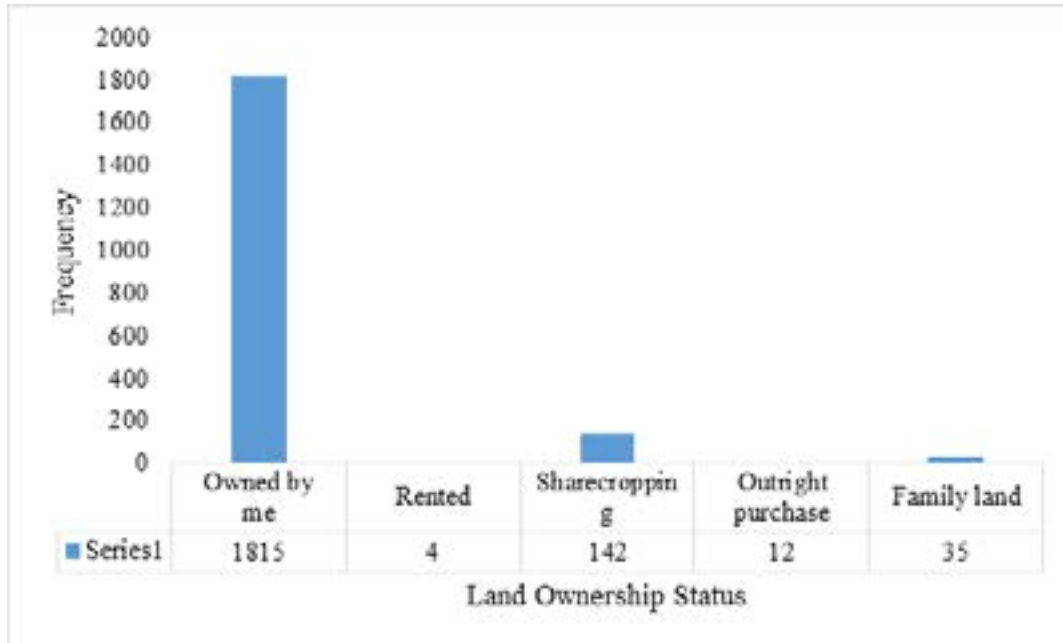


Figure 3: Land ownership status

Table 12: Land ownership and adoption

Who owns the land	Does the form of land ownership affect implementation of these practices		Total
	Yes	No	
Owned by me	1271	544	1815
Rented	3	1	4
Sharecropped	115	27	142
Outright purchase	12	0	12
Family land	24	11	35
Total	1425	583	2008

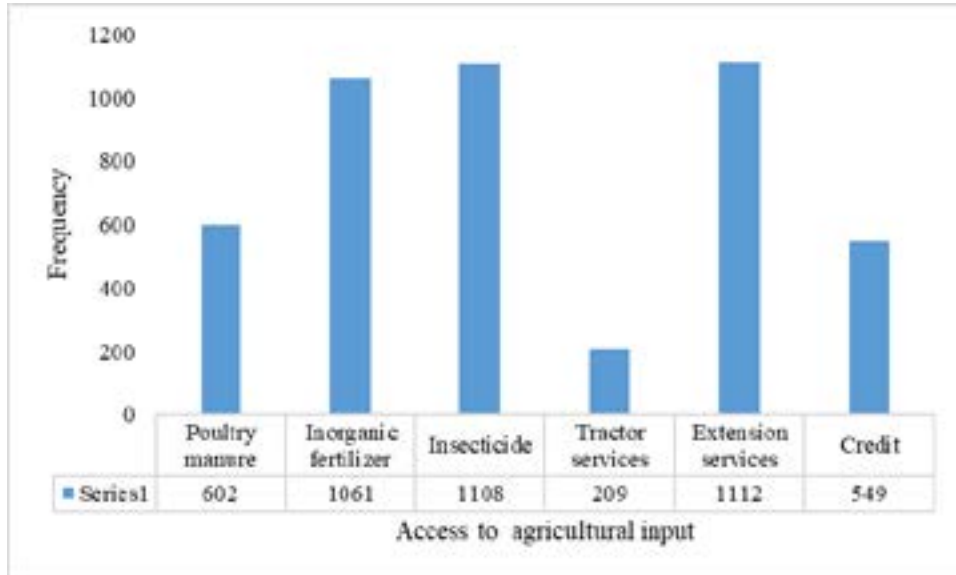


Figure 4: Access to agriculture input and services

In terms of benefits of CSC to farmers, 88% of farmers responded that CSC is beneficial to them. Among these benefits are increase in yield, reduction in pest and diseases, improvement in quality of beans, improvement in environment and improvement in the resilience and adaptation to CSC (see figure 6). For those who did not benefit from CSC, they stated reasons such as not being regular at CSC trainings.

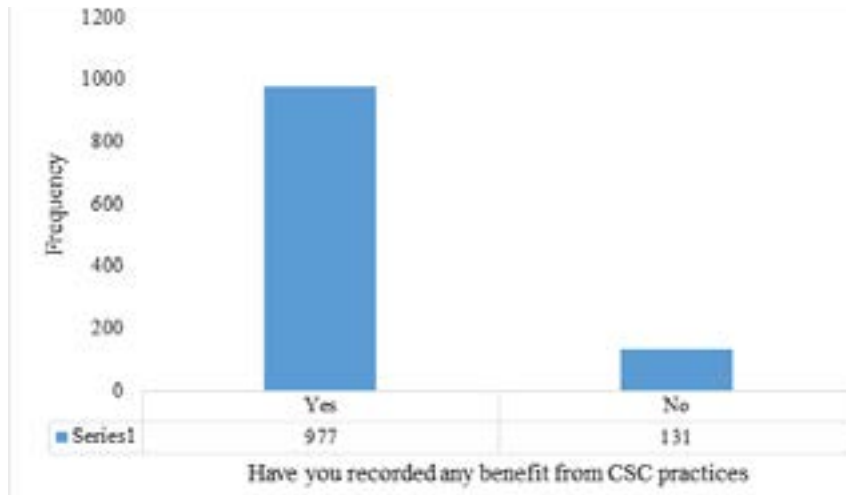


Figure 5: Have farmers received benefits from CSC?

In terms of benefits of CSC to farmers, 88% of farmers responded that CSC is beneficial to them. Among these benefits are increase in yield, reduction in pest and diseases, improvement in quality of beans, improvement in environment and improvement in the resilience and adaptation to CSC (see figure 6). For those who did not benefit from CSC, they stated reasons such as not being regular at CSC trainings.

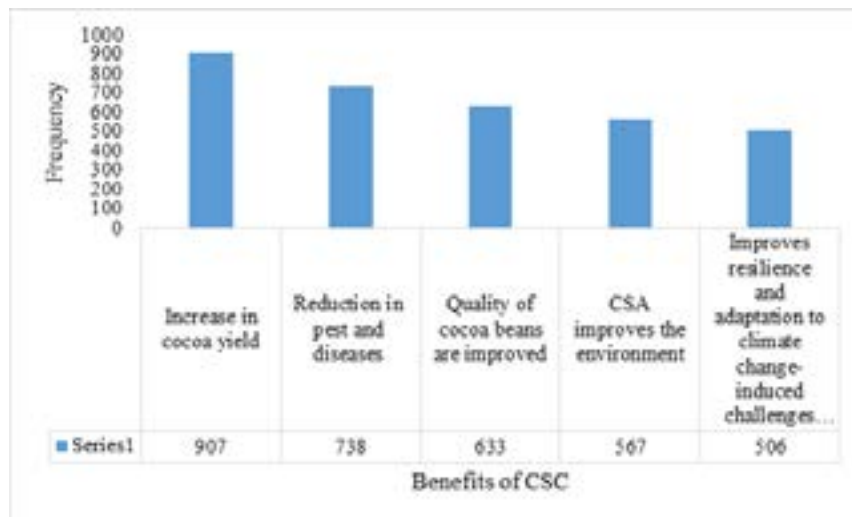


Figure 6: Benefits of CSC

Reason for No benefit from CSC

- I was not regular at CSC training
- I can't really tell (Have not recorded any reason down)

Analysis show that, farmers who took part in CSC trainings realized an increase in cocoa yield of about 37% (see figure 7). This translated into increase in income for most farmers as 91% of farmers stated that they have realized an increase in income (see figure 8). Other reasons related to the increase in income is good weather. For farmers who did not realize an increase in income, they attributed it to moribund farms, no rains, intense sunshine and poor farm maintenance (see table 13). Overall, 99% of farmers stated that the introduction of the stepwise CSC have been beneficial to them (see figure 9) especially through increase in yield, income and GAP. Farmers who said they did not benefit from CSC training stated that they were not consistent at trainings and the practices are expensive to carry out (see table 14)



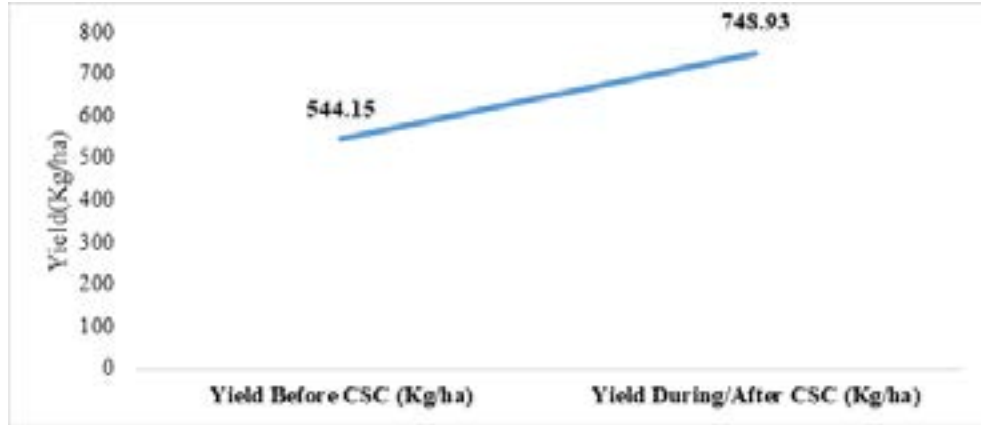


Figure 7: Yield before and after CSC introduction

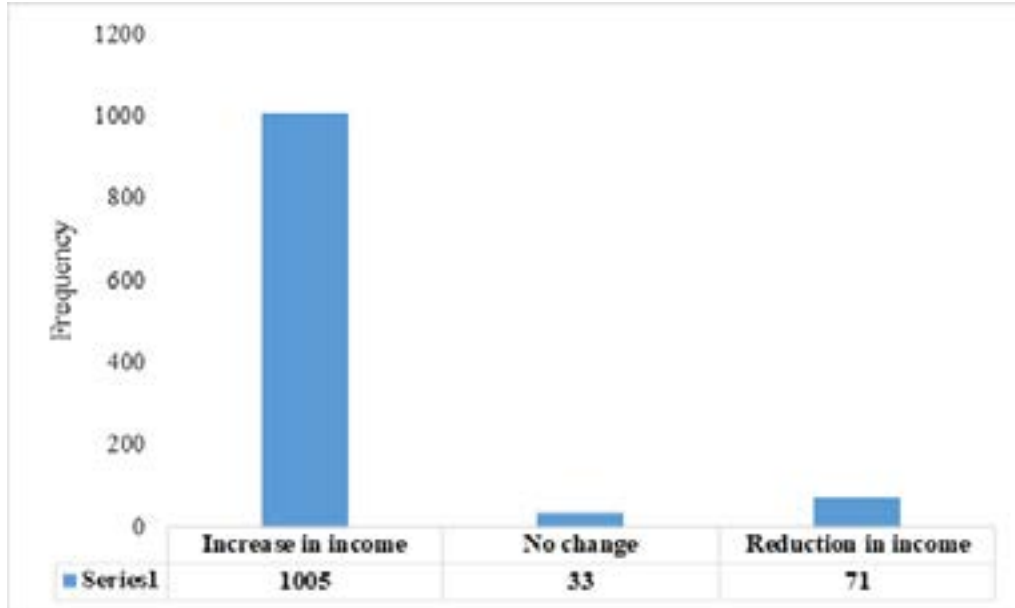


Figure 8: Change that occurred in income

Table 13: Reason for change in income

	Change	Reason
1	Increase in Income	<ul style="list-style-type: none"> • Training on CSC practices • Good weather
2	No change	<ul style="list-style-type: none"> • Cocoa plants not yet matured • Climate change • Ageing cocoa plant
3	Reduction in Income	<ul style="list-style-type: none"> • Moribund farm • No rains • Intense sunshine in the year • Poor farm maintenance

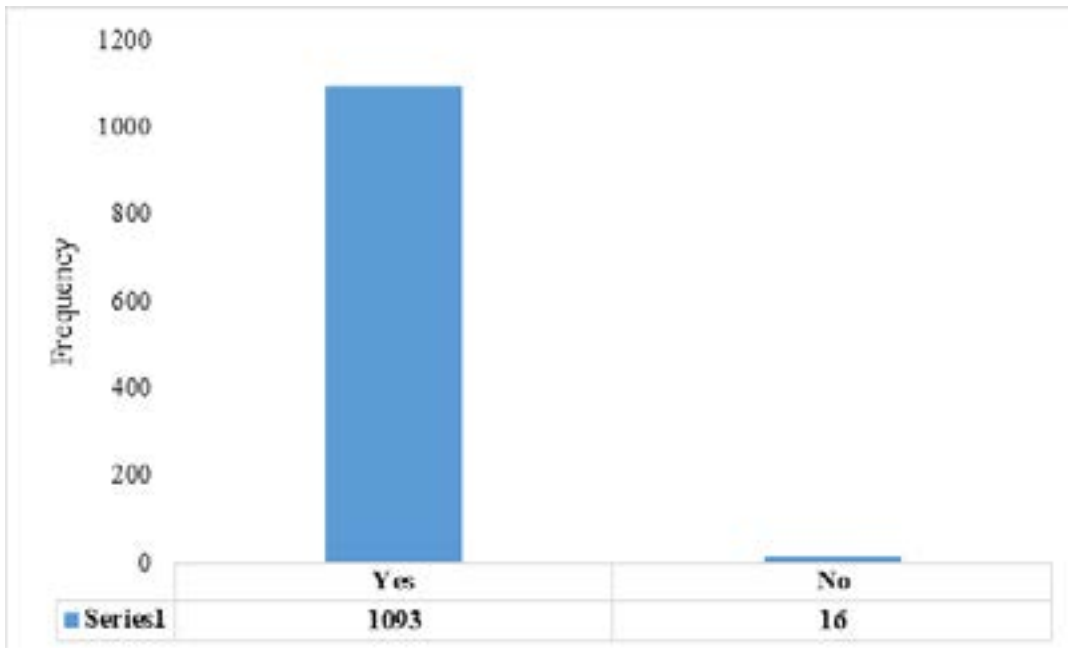


Figure 9: Has the project been beneficial?

Table 14: Reason for Project being beneficial or not

Beneficial	Not beneficial
<ul style="list-style-type: none"> • Increase in knowledge on GAP • Increase in Yield • Increase in Income 	<ul style="list-style-type: none"> • I have not been consistent at training • The practices were expensive to carry out

Farmers adopted all practices, with more than half of the farmers (53%) practicing pruning, weeding and cultural management. In terms of intensity of practice, majority of farmers still carry out pruning, weeding and cultural management intensely. These farmers commit averagely 82%, 72% and 65% of their lands respectively to the practice of pruning, weeding and cultural management practices. Fungicide and fertilizer application are the least intense CSC practices carried out by farmers (see figure 11).

The factors that influence adoption of CSC practices include:

- Age of the farmer: it was observed that the older the farmer, the reduced rate of CSC practice adoption. This means the younger a farmer, the more likely s/he is to adopt CSC practices *ceteris paribus*.
- Marital status:
- Level of education: Higher level of education has a significant and positive relationship with adoption of CSC, in that the more educated a farmer is, the more likely s/he is to adopt CSC practices.
- Cocoa farming experience: Cocoa farming experience has a significant and positive relationship with adoption of CSC, the more



experienced a farmer is in cocoa farming the more likely s/he is to adopt CSC practices ceteris paribus.

- Household size: Household size usually tends to indicate labour available to work on the cocoa farm. Therefore, the higher the size of a farmer's household, the more likely s/he is to adopt a CSC practice.

Walking distance to the farming and land size: The further a farm is, the less likely the farmer is to adopt CSC practices. This is because time needed to practice the needed CSC approaches is spent getting to the farm and energy is diminished for longer distances. In addition, land area has a significant relationship with adoption of CSC practices, hence the bigger a farmers farm the more likely s/he is to adopt CSC practices ceteris paribus (see table 15).

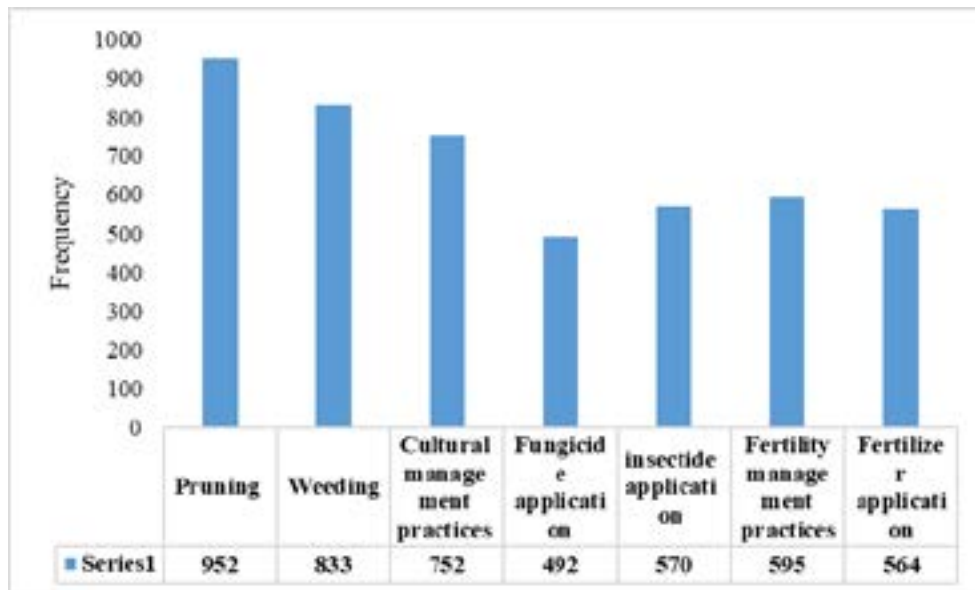


Figure 10: Number of people who adopt a practice



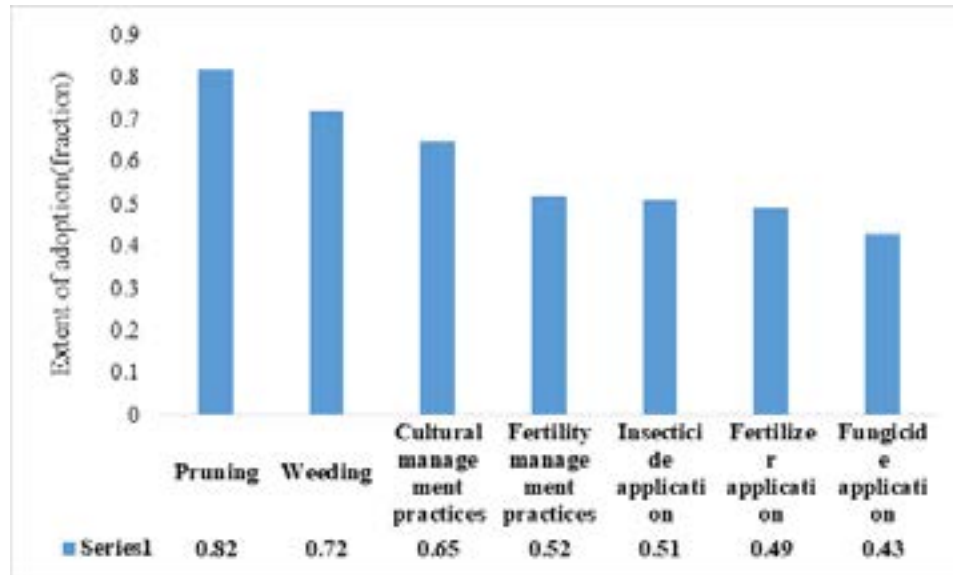


Figure 11 Extent of adoption

Table 15: Adoption regression result

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bit regression               Number of obs   =    1,107
                             LR chi2(12)      =   552.83
                             Prob > chi2      =    0.0000
                             Pseudo R2      =    0.4495

-2  likelihood = -338.56239

```

ADOPTION_STATUS_FULL	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
ZONE	-.32333	.1319211	-2.45	0.014	-.5818906 -.064760
SEX	.1066273	.1253055	0.85	0.395	-.138067 .352221
AGE	-.0127078	.0070191	-1.81	0.070	-.0264649 .001044
MARITAL_STATUS	-.0620003	.1585309	-0.39	0.696	-.3727151 .248714
LEVEL_OF_EDUCATION	.2062567	.0560435	3.63	0.000	.0948456 .317667
COCOA_FMEXP	.0327167	.0074321	4.40	0.000	.0181501 .047281
HHSIZE	.0051359	.0179694	0.29	0.775	-.0300835 .040351
INDIGENE_OR_SETTLER	-.7760519	.1323539	-5.86	0.000	-1.035461 -.516643
WALKING_DISTANCE_TO_FARM	-.0089021	.0010631	-4.78	0.000	-.0125537 -.005250
LESS_TO_PREVIOUS_TRAININGS	.2787261	.7398791	0.38	0.706	-1.17141 1.72888
Credit	1.035668	.1392534	7.44	0.000	.7627367 1.308600
LAND_AREAcacre	.0761062	.0076761	9.91	0.000	.0610614 .091151
_cons	-2.159028	.7948856	-2.72	0.007	-3.716975 -.601081

Farmers' willingness to pay for CSC practices

Majority of farmers (61%) are willing to pay for the CSC practices (see figure 12). Generally farmers are willing to commit averagely GHS 100 to CSC practices in a season but responding to individual practices, farmers are willing to commit between GHS 100 to GHS 480 to CSC practices in a season (see table 16).

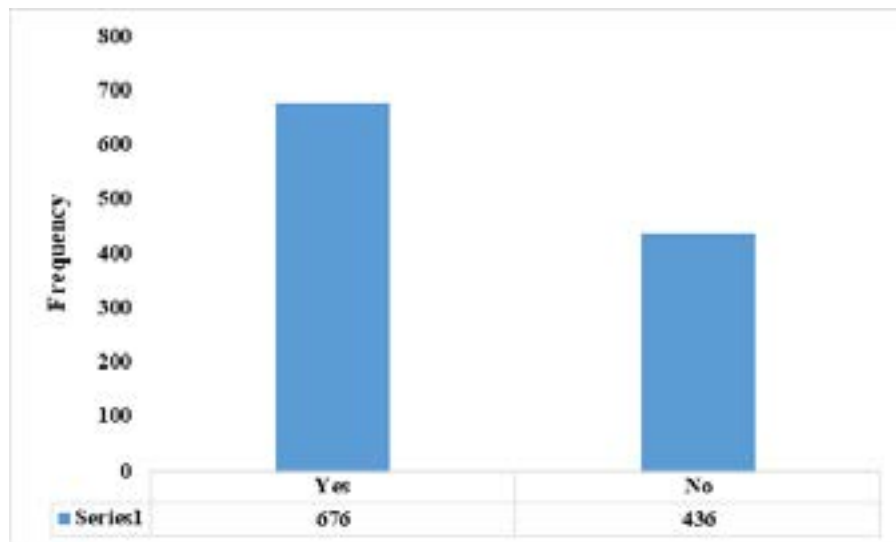


Figure 12: Willingness to pay for CSC practices

Table 16: Average amount farmers are willing to pay

	Practices	Average amount farmers are willing to pay(GHS)
1	Overall practices	100.00
2	Pruning	180.00
3	Weeding	200.00
4	Cultural practices	100.00
5	Fungicide	150.00
6	Fungicide application labour	70.00
7	Insecticide	250.00
8	Insecticide application(labour)	100.00
9	Fertility management practices (materials)	140.00
10	Fertility management practices (labour)	60.00
11	Fertilizer	480.00
12	Fertilizer application(labour)	100.00

Challenges associated with the adoption of CSC practices

Majority of farmers (97%) do not face challenges in adopting CSC practices (see figure 13). The 3% facing challenges have challenges in terms of financial difficulty, tiredness of carrying out practices, time consuming nature of carrying out practices and fear of adoption (see table 17)

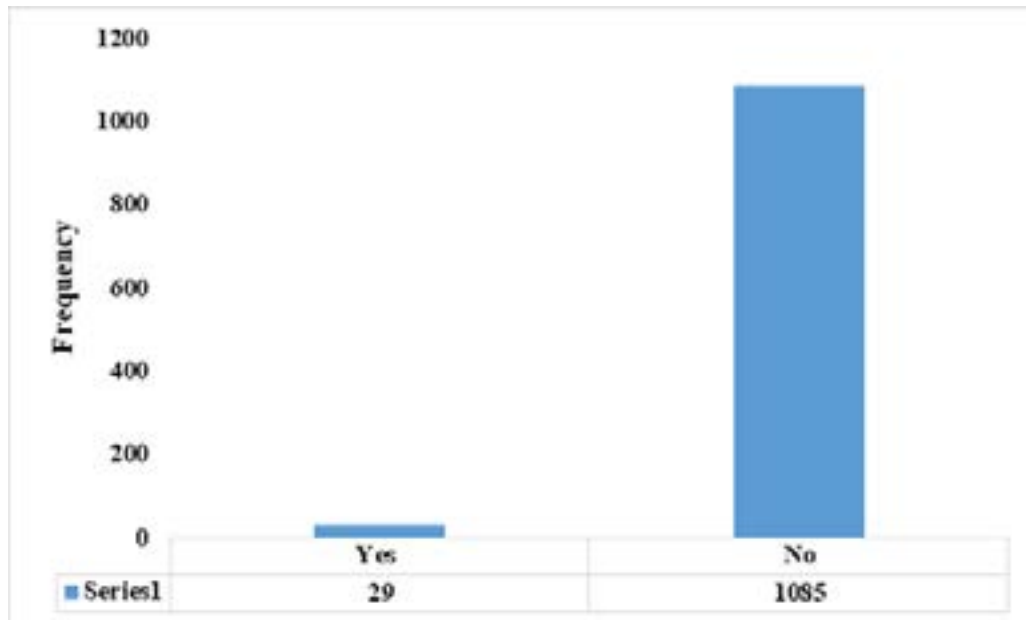


Figure 13: Whether respondents faced challenges in adoption

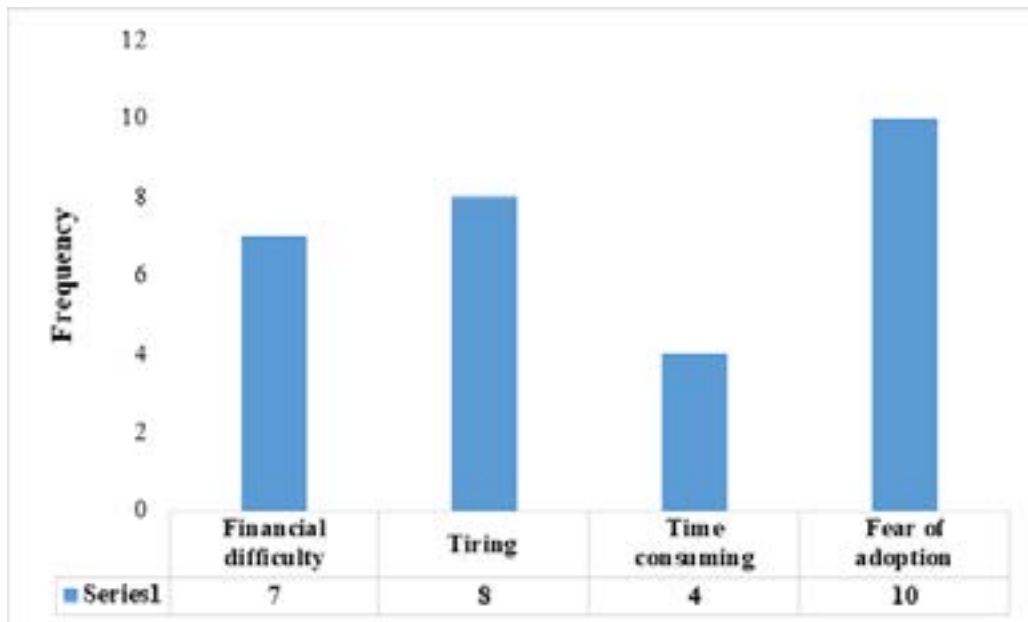


Figure 14: Challenges of adopting climate smart cocoa (CSC)

Conclusion

- Majority of respondents interviewed were male (64%) and 78% of respondents are educated. 62% of respondents are natives and the average age of respondents is 50 years.
- Most respondents (98%) are aware of CSC and have received training in CSC. The dominant training approaches used were demonstration field, farmer field school and coaching. 53% of farmers transferred CSC to other farmers and the most transferred practices are pruning, weeding and fertilizer application.
- Majority of farmers owned their farmlands and had access to inputs and services such as poultry manure, insecticide, inorganic fertilizer, extension services. The least accessed input and services are tractor service and credit. 88% of farmers benefited from the stepwise CSC through increase in yield, reduction in pest and diseases, improvement in quality of beans, improvement in environment and resilience to climate change. Those who didn't benefit stated absence from CSC trainings as reason. Farmers who practiced CSC experienced 37% increase in yield. Also, 91% of farmers stated they had an increase in income as a result of practicing stepwise CSC.
- The factors that influence adoption of stepwise CSC are age of farmer, level of education of farmer, cocoa farming experience, household size, walking distance to farm and land size. Majority of farmers are willing to pay for CSC practices at a cost ranging from GHS 100.00 to GHS 480.00.
- Majority of farmers (97%) do not have challenges adopting CSC practices. The few who have challenges are dealing with financial difficulties with affording practices, tiredness in carrying out practices, time consuming nature of carrying out practices and the fear of adoption.

Recommendations

- Farmers, Farmer based organizations and cocoa buying companies must invest in stepwise CSC since it improves the yield and income of farmers, builds farmer and farm resilience, and promotes supply chain resource availability.
- The youth should be supported by Government and cocoa buying companies in cocoa farming to enhance adoption of innovations and climate smart practices.
- Government must initiate the policy process by engaging relevant stakeholders in the cocoa industry in developing a national policy for adaptation and mitigation in the phase of the impact of climate change on cocoa farming in Ghana.
- Government must intervene by rolling out interventions i.e subsidy on inputs, provision of credit facilities through state banks and provision of extension services to facilitate adoption of climate smart practices.
- Stakeholders i.e., Government and Cocoa buying companies must invest in technologies that make practicing of CSC practices easier and faster to enhance its attractiveness to farmers.
- Research institutes must invest in co-learning trials in farming communities to allay the fear of farmers in adopting new practices and innovations.



References

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