

POLICY DOCUMENT DETAILING THE USE OF THE STEPWISE INVESTMENT APPROACH FOR CLIMATE SMART COCOA ADOPTION BY FARMERS AND COMPANIES.

“Transforming cocoa farms in Climate-smart, productive, and profitable enterprises using data that farmers and industry can take to the bank.”

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).

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 phase of the adverse effect of climate change on Cocoa production.

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Overview

The International Institute of Tropical Agriculture (IITA) and Rainforest Alliance (RA), in conjunction with its partners The International Center for Tropical Agriculture (CIAT), The Sustainable Food Lab (SFL) and Root Capital (RC) through the Climate Change Agriculture and Food Security's (CCAFS) Phase 1 (2015-2018) on Mainstreaming Climate-Smart Cocoa (CSC) project laid the foundation for this second phase of CCAFS. Under phase one, a lot of progress was made which led to the development of the climate exposure maps for Ghana's cocoa sector and the recommendation of site-specific Climate-smart Agriculture practices for the cocoa sector which recently being used by the Ghana COCOBOD as a basis for the development of a climate-smart cocoa standard.

This novel approach to climate resilience, mitigation and adaptation in the cocoa sector promises to be the anchor towards sustainable production of the crop and the results of which can serve as a model for other crops in the region and beyond. What is lacking is the industries inability to push for the institutionalisation of these CSA packages (WCF Climate-Smart cocoa Manual) in the training programs of companies and other certification bodies. There is also very limited data on the stepwise approach for climate-smart cocoa and the need to establish a business case for CSA investment in both the cope and adjust zones.

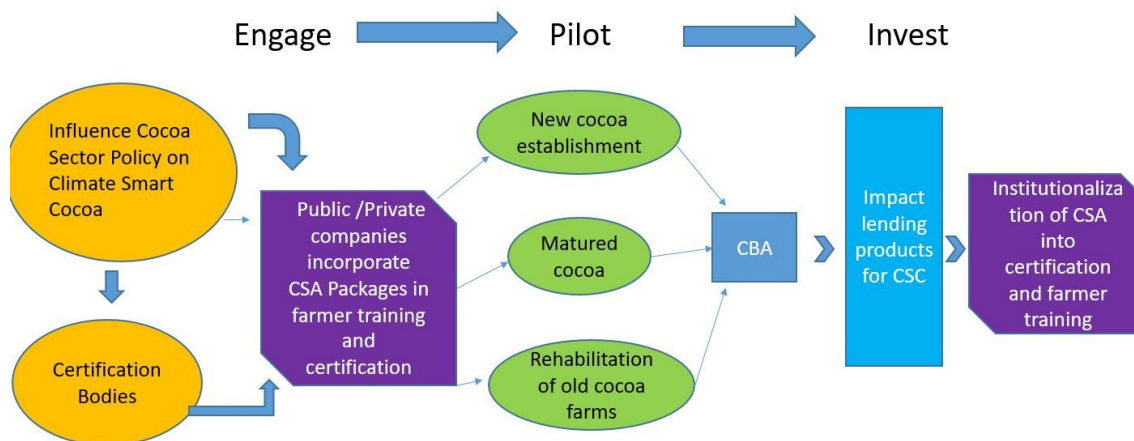
This document serves as a policy guide to help companies and cocoa sector stakeholders to adopt the use of the proposed stepwise Investment pathway using climate-smart cocoa practices.

Objectives of CCAFS II - CSC Project

This project proposes to leverage on the gains of CCAFS I to 1) influence a sector-wide policy on Climate cocoa by re-engaging both public and private sector companies in a bid to institutionalise this climate-smart approach in cocoa extension delivery and voluntary standards. 2) Co-generate CBA data for CSA packages with the private sector on the stepwise approach to facilitate the impact of lending.

Currently, the private sector companies working within the cocoa landscape in Ghana are very much interested in investing in climate-smart cocoa but what is lacking is to establish the business case for CSA investment. Through the CSC pilots, the project will conduct a detailed cost-benefit analysis of the CSA packages which will be a build-up on already existing cost-benefit information on cocoa farmer's perception.

Theory of Change for CCAFS II



The project will use existing communication channels already established with public/private companies and certification bodies in CCAFS I, to re-engage them in incorporating CSA packages in their trainings and voluntary standards, respectively. Companies will be engaged to co-learn with IITA and its partners in a Climate-smart cocoa pilot designed for new establishment, mature cocoa and rehabilitation of old cocoa farms. The output for the pilots will determine the cost and benefits analysis for applying the CSA Packages through the stepwise approach for all 3 stages of cocoa. This approach will be applied in 2 or 3 climate zones with the companies while also monitoring and generating evidence (data) on some key performance indicators for cocoa. Based on the results of the CBA, Impact lending products can then be developed by interested financial institutions and once there are financial products for CSA Practices, it will lead to a sector-wide institutionalisation of climate-smart cocoa in companies and other certification bodies.

Pilot Protocols

To facilitate the realization of the above-mentioned objectives, these protocols have been designed as part of the climate-smart cocoa consortium (IITA, SFL, RC, RA and CIAT) experimental guide to set up demo plots with the companies and NGOs interested in investing in a climate-smart way in cocoa systems through a co-learning process which will ultimately lead to scaling of CSA practices across the cocoa landscape in Ghana and beyond. Three major Pilots have been designed namely.

Protocol for Pilot 001 and 002 (Demo-Plots for CSC New Establishment (Adjust and Cope zone's))

As part of the Climate Smart Cocoa (CSC) pilots in Ghana, this protocol is a process guide to systematically help the project implementation team to support private sector companies to roll out/adopt CSC practices for renovating or establishing a new cocoa farm using the climate-smart approach. The climate-smart cocoa manual developed by the World Cocoa Foundation (WCF) and Rainforest Alliance (RA) will serve as a technical guide which is now being used in the development of a CSC standard for the cocoa industry by the Ghana COCOBOD.

For this protocol, climate-smart cocoa practices are in effect good cocoa agronomic practices that must follow these indicators below to make it climate-resilient.

1. **Timing and weather indicator;** This indicator entails carrying out the various practices at their prescribed period in response to change in weather pattern e.g. Having 6 months of cocoa nursery and 3 months of drip irrigation (plastic bottles) after transplanting.
2. **Spatial arrangement;** this focuses on using the required spacing and holing for planting of cocoa (3m x 3m), plantain (3m x 3m), cassava (2m x 2m) and shade tree planting on the various trial plots (12m x 12m triangular spacing).
3. **Moisture management:** this involves the use of mulch and drip irrigation on the plot to ensure adequate soil moisture, retention and utilization of nutrient to promote the growth of cocoa.
4. **Stepwise process:** this involves an incremental investment pattern based on farmers resource endowment in relation to available technical knowledge and the stepwise practices developed by IITA.

Please refer to table 3.0 for a SWOT analysis of these indicators.

Objectives

- PILOT 1: To demonstrate stepwise site-specific CSC practices for rehabilitation/new establishment in a trial @ cope zone and Adjust zones, respectively.
- PILOT 2: To demonstrate stepwise site-specific CSC practices for rehabilitation/new establishment + Irrigation @ Adjust zone only in a trial.

Location of Pilots/learning sites

The CSC implementation partners will provide the consortium with 3

communities in each climate impact zone where they already have on going activities with cocoa farmers.

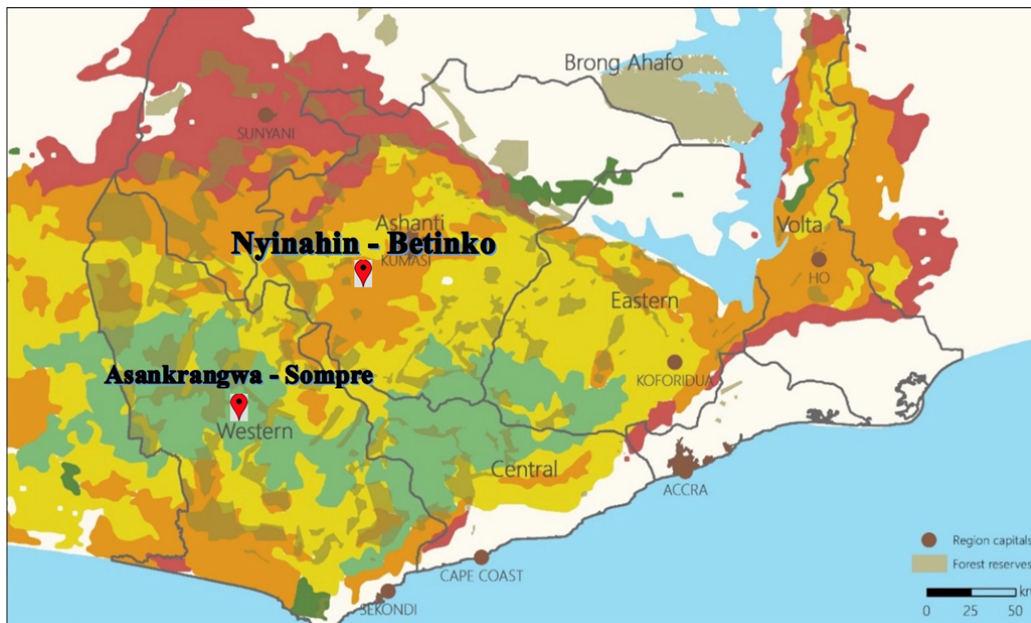


Figure 1. A map showing the learning communities for the CSC Pilots in Ghana for Agro Eco

Demo-Plot Selection and Plot Design

For pilot 001, one (1) acre plots will be demarcated each at both adjust and cope zones and used as demo plots, whereas for pilot 002, two types of one-acre demo plots will be demarcated in adjust zone one of which will be irrigated and the other without irrigation. Both pilots will also have control plots using farmers business as usual practices as the basis of comparison.

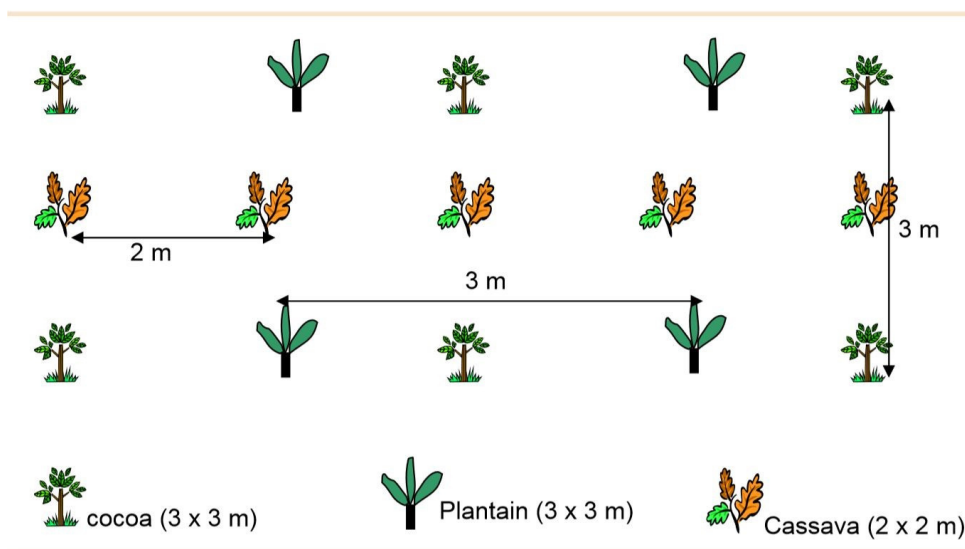


Figure 2. Schematic view of PILOT 001 Demo-Plots in Cope and Adjust zones

a. 1-acre Demo-plot for CSC New establishment showing spacing arrangement with food intercrops. Permanent shade trees will be planted at 12 x 12 m spacing alongside food crops.

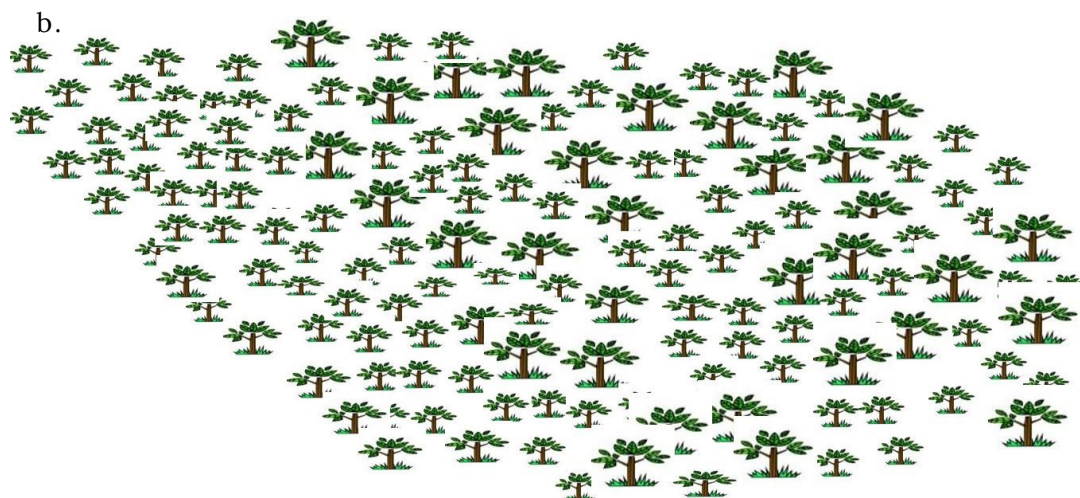


Figure 3. Schematic view of PILOT 002 Demo-Plots in Cope and Adjust zones

c. 1-acre Control Demo-plot for farmers BAU under New cocoa establishment

NB: Fig 1(a) and 1(b) will be replicated in both zones (cope and adjust) under different site-specific CSA recommendation for new cocoa establishment.

a) Same as fig2(a) + Irrigation with plastic bottles

b) Same as fig2 (b); 1 acre Control Demo-plot for farmers BAU under New cocoa establishment.

Responsibility: IITA, RA and companies will lead the project implementation at the learning sites.

Table 1: Cocoa Calendar for Establishment Phase @ Adjust Zone

		PRACTICES						
MONTH	YEAR	Land preparation	Land Management	Nursery Management	Seed stock	Shade Management	Transplanting	Additional Water Management practices
March	2020							
April	2020							
May	2020							
June	2020							
July	2020							
August	2020							
September	2020							
October	2020							
November	2020							
December	2020							
January	2021							
February	2021							
March	2021							
April	2021							
May	2021							
June	2021							

NB: These activities will run till December 2021

Table 2: Cocoa Calendar for Establishment Phase @ Cope Zone

		PRACTICES						
MONTH	YEAR	Land preparation	Land Management	Nursery Management	Seed stock	Shade Management	Transplanting	Additional Water Management practices
March	2020							
April	2020							
May	2020							
June	2020							
July	2020							
August	2020							
September	2020							
October	2020							
November	2020							
December	2020							
January	2021							
February	2021							
March	2021							
April	2021							
May	2021							
June	2021							

Measuring Performance / Resilience of cocoa new establishment

The team will do a mortality head count of young cocoa and shade trees that die as a result of water and heat stress at the end of the dry season and replace them with healthy ones.

Making a case for climate smart rehabilitation (SWOT Analysis)

Table 3: SWOT Analysis for Pilot 001 and 002

	STRENGTH	WEAKNESS	OPPORTUNITIES	THREATS
Timing and weather indicator	It takes advantage of natural process	It can fail	It's cheap	Unpredictability of weather pattern
Spatial arrangement	Allows for Ease of performing farm management practices	Strict adherence to plant population	Room for food intercrops (shade, food and additional income) E.g., Diversification	Unavailability of land Nutrient competition
Moisture management	Ensure strong establishment in terms of nutrients utilization.	Lack of technical knowhow	Availability of suitable materials for moisture materials	Possibility of Termite infestation of mulch materials
Stepwise process	Help farmers to know the impact of each CSA practices on yield. Proper allocation of farmers resources	Malpractice of CSC practices	Farmers get to understand the impact of every step on productivity. Helps farmers to prioritize cocoa management practices.	Land and tree tenure systems Unavailability of inputs

Demo Plots for Stepwise Prioritization of CSC Practices for Mature cocoa

PILOT 3 (Mature-4 years and above cocoa farms)

This pilot will be based purely on the stepwise prioritization of site-specific basic technological practices (BTPs) in cocoa adopted using climate-smart approaches. The CSA practices will be applied in a timely manner by following the cocoa cropping calendar strictly. The pilots will also be adjusted to the cocoa cropping calendar in all the 3 climatic impact zones and linked to the CSC Manual developed by World Cocoa Foundation and Rainforest Alliance with technical inputs from IITA.

Climate Smart Cocoa PILOT Design

Industry experts are of the view that the BTP be encouraged/practised in the following order:

1. Weeding + Pruning (formation + sanitary) + Cultural
2. (Pest and Disease) Management
3. I+ fungicide and Insecticide Application
4. II+ Fertility Management (organic matter)
5. III + Fertilizer Applications

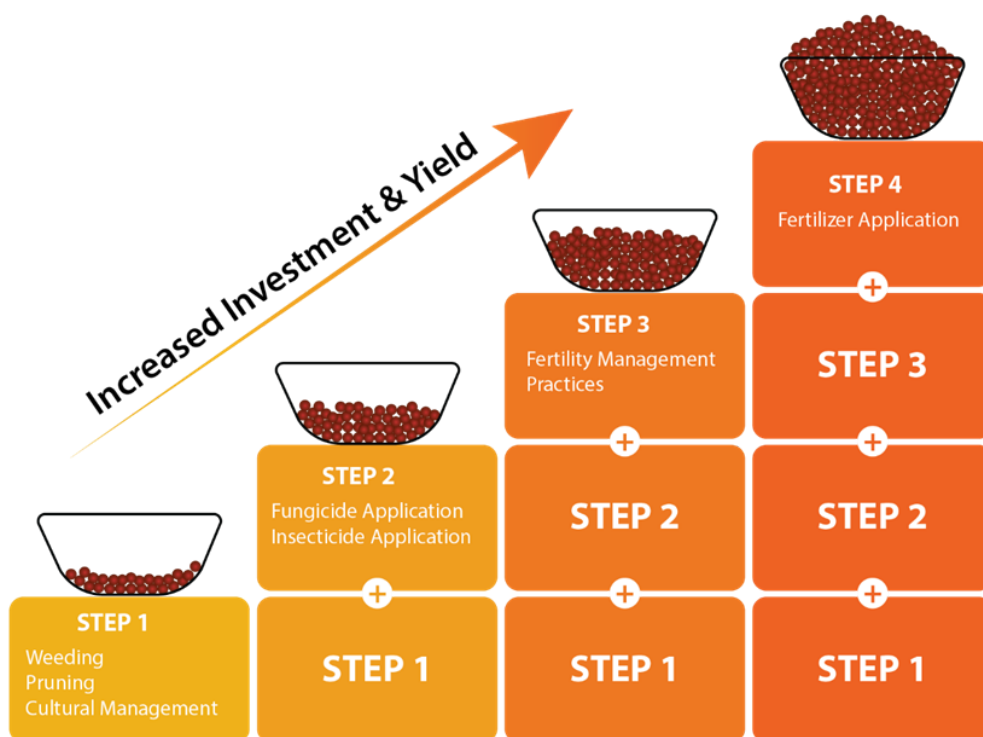


Figure 4. Climate Smart Cocoa PILOT Design

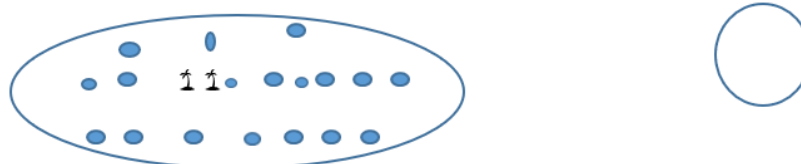
Experimental design

Two types of treatments will be adapted for this trial. A **simple** and **detailed design** is considered for this pilot. Whereas a simple design will have a control plot (FP) in addition to sub-plots for all the steps (capturing all practices per step) in the BTP, the detail design will also have a control plot i.e., if it is going to be another farmer's plot and subplots (capturing individual practices per step in an incremental way to understand the impact of each of the practices) see figure 1 and 2 for the schematic view of both designs) of both designs)

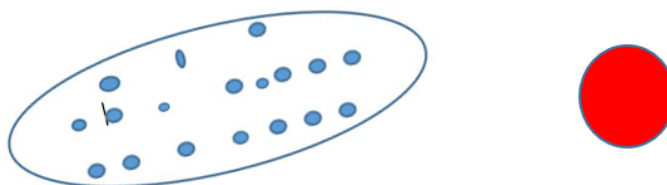
Farm Selection Criteria and Location

For a start, this pilot will be situated in the Adjust zone and Cope in 2 or 3 cocoa fields across zone to reflect the climate variability within a climate zone. Ideally, the team expects to have all the simple design and the detailed design on a single farmer's plot but if it is not possible, then the design can be demarcated separately on two farmer's plots and not too far from each other.

Control Plot (BAU) Covering 20 trees



Step I; Weeding + Pruning (formation + sanitary) + Cultural (Pest and Disease) Management



II. I+ fungicide and Insecticide Application



III. II+ Fertility Management (organic matter)



IV. III + Fertilizer Application



Figure 5: Plot design for SIMPLE TREATMENT

Plot demarcation and selection of tree

Twenty (20) cocoa trees will be selected for all the sub-plots and colour coded to reflect the stepwise process. Going by the planting distance of 3x3 meters, the area per every subplot will be 180 square meters. The distance between every sub-plot will be 5 meters to eliminate/reduce buffer effects. The following colours will be used to highlight all the steps; all steps in both simple and detailed design will correspond to the colour coding below.

Control Plot	
Step 1	Red
Step 2	Blue
Step 3	Yellow
Step 4	Green
Optional Practices	Light Blue

NB: All cocoa trees for every plot will be painted or tagged with the corresponding colors and label.

Materials for plot demarcations

- 1.50 meters measuring tape.
2. Nylon ropes with colours corresponding to the colours above.
3. Laminated tags with details of sub-plot information (Labels)

Measuring performance indicators and CBA

All throughout the pilot, the team will collect data on some key performance indicators of the cocoa trees. These indicators will include the following;

1. Flowering intensity of the cocoa trees
2. Cocoa tree vigor; canopy health or vegetative cover
3. Pest and diseases
4. Pod count/yield

These measurements will be done for 10 trees out of the 20 trees on each sub-plot. This will help the team gather evidence on whether stepwise prioritization of CSA practices and incremental investment in cocoa is worthwhile by considering yield at the end of the season. (Please refer to IITA's protocol for measuring cocoa performance indicators in APPENDIX 1)

CBA; the team will also keep track of all expenses of input and labor cost for each of the steps and practices. This is to enable the consortium to conduct a detailed CBA and present a business case for CSA investment in cocoa production systems in Ghana.

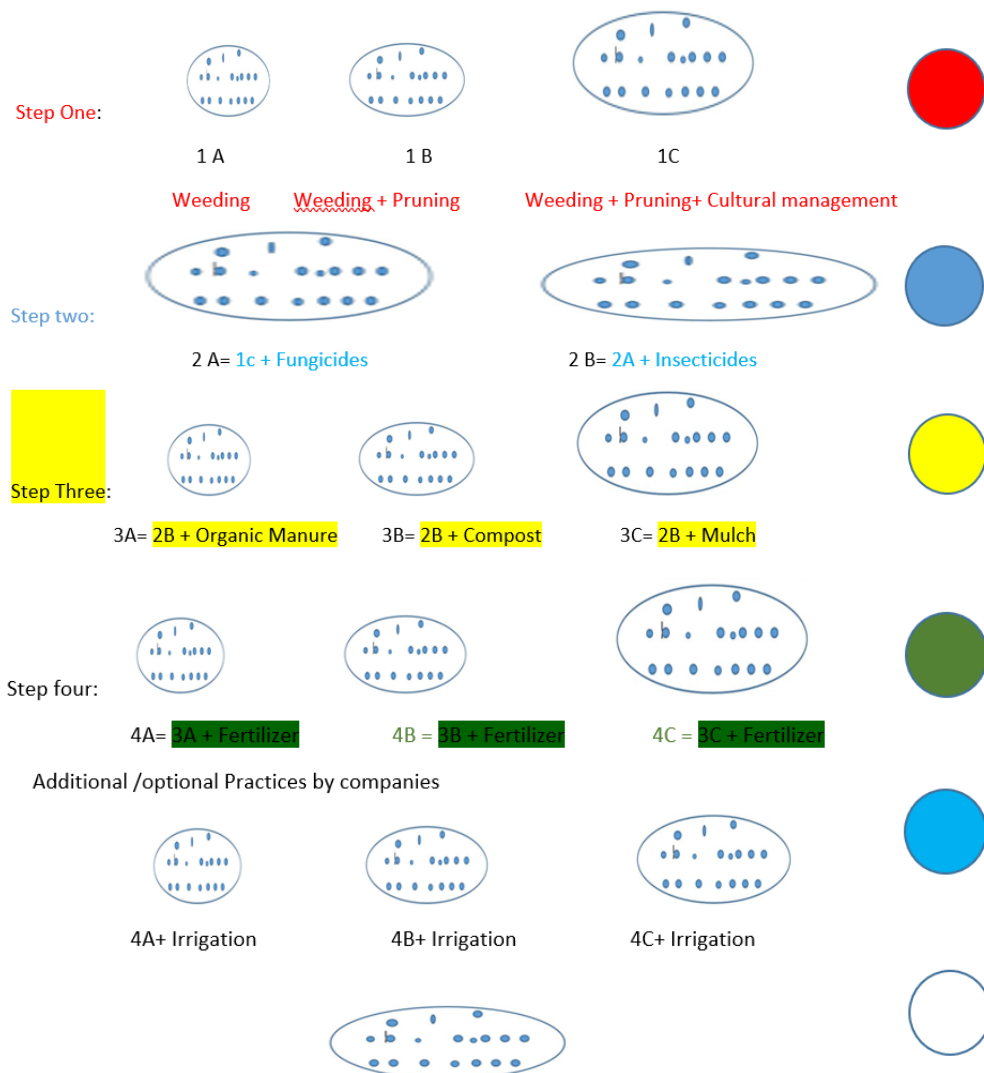


Figure 6: Plot design for DETAIL TREATMENT

Control Plot; Farmer own BAU Practices

Table 4: Cocoa Cropping Calendar with a stepwise approach

		STEP 5																
		STEP 4																
		STEP 3																
		STEP 2																
		STEP 1																
PRACTICES / TREATMENTS												RESPONSE VARIABLES						
PRACTICES																		
MONTH	YEAR	Weeding	Pruning	Cultural Management	Fungicide Application	Pesticide Application	Organic Manure	Compost	Mulch	Fertilizer Application	Irrigation	Flowering Intensity	Pod count/ Yield	Blackpod Disease	Mirids/Capsids damage	Shield / Stink bug damage	Canopy health	
March	2020																	
April	2020																	
May	2020																	
June	2020																	
July	2020																	
August	2020																	
September	2020																	
October	2020																	
November	2020																	
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December	2021																	

NB: These activities will run till December 2021.

Table 5: Protocol for Cocoa Performance indicators

INDICATORS	OBSERVATION / PERIOD OF OCCURENCE	RANK
Flowering intensity of the cocoa trees	<p>Flowering occurs in Ghana at definite peak periods. It is scanty and spasmodic from January to March, then very heavy at the beginning of the rains usually in April.</p> <p>The field enumerators are expected to observe the trunk and branches of all the marked cocoa trees while looking out the new flowers, rank it based on the intensity of the flowering.</p> <p>Flowering Starts from April to;</p> <p>Minor Crop: Mid May –Mid July Main Crop: September–December</p>	<p>0= No flowers</p> <p>1= very low flowering</p> <p>2= low flowering</p> <p>3=High flowering</p> <p>4= very high flowering</p>
Cocoa tree vigor	<p>Look out for the presence of leaves and vegetative flushes on the cocoa tree</p>	<p>0= almost no canopy (dead branches with virtually no leaves or very few leaves)</p> <p>1= Poorly vigorous (very few leaves and with lots of dead branches)</p> <p>2= Mildly vigorous (a few branches with leaves and a few new leaf flushes)</p> <p>3= vigorous (canopy with many branches and many leaves and flushes.</p> <p>4= Highly vigorous (very dense canopy with lots of branches, dense foliage and with leave flushes)</p>
Canopy health / vegetative cover	<p>Look out for the number of leaves that that are looking unhealthy and with dead branches on the cocoa tree cocoa</p>	<p>0= almost no canopy (dead branches and few leaves)</p> <p>1= poorly healthy (few leaves pale and yellowish with lots of dead branches)</p> <p>2= mildly healthy (many leaves of pale and yellowish color but no dead branches)</p> <p>3= Healthy (dense canopy with green color but less dense)</p> <p>4= Highly healthy (thick canopy with healthy looking leaves of green color and/or many vigorous leaf flushes)</p>

INDICATORS	OBSERVATION / PERIOD OF OCCURENCE	RANK
Cherelles count	<p>Look out for only young pods (Cherelles) on the cocoa tree that the Cherelles counting be done on the trunk and the main branches up to 2-2.5m of height</p> <p>From May to December</p>	Count and record the number of young pods (Cherelles) on all marked cocoa trees
Cherelles Wilt	<p>Look out for only wilted young pods (Cherelles) on the cocoa tree and that the cherelle counting be done on the trunk and the main branches up to 2-2.5 m of height</p> <p>Minor Crop: Mid May –Mid July Main Crop: September-December</p>	Count and record the number of wilted young pods (Cherelles) on all marked cocoa trees sub grouped under insect (mirids and shield bugs), fungi and unknown cause
POD COUNT		
Mature Pods	<p>Look out for only matured/Large pods on the cocoa tree trunk and branches</p> <p>Minor Crop: Mid May –Mid July Main Crop: Sept-Dec</p>	Count and record the number of matured/large pods on all marked cocoa trees
Pods damaged by rodents	<p>Look out for pods destroyed by rodent on the tree trunk and branches.</p> <p>It's easily recognizable with parts of the cocoa pod chopped off, often with ripe pods.</p> <p>Minor Crop: Mid May –Mid July Main Crop: September-December</p>	Count and record the number of large pods damaged by rodents.

PESTS AND DISEASES	SYMPTOMS / PERIOD OF OCCURENCE	RANK
<p>Capsids/ Mirids</p>	<p>Cocoa mirids pierce the surface of cocoa stems, branches and pods, killing the penetrated host cells and producing unsightly necrotic lesions. Mirids feeding on shoots often result in the death of terminal branches and leaves, causing dieback. Mated female mirids lay up to 60 eggs that are embedded in the bark of stems or inside the pod husk. Pests usually occur on trees exposed to sunlight since such trees tend to bear more fresh shoots and pods. Although the insect is attracted to trees exposed to sunlight, after locating their source of food they inhabit shady areas on trees.</p> <p>All Year round</p> <p>Minimum occurrence: Feb- July Maximum occurrence: Aug-Jan</p>	<p>Count the number pods damaged/infested. Rank severity damages on flashes.</p> <p>Rank based on Severity of damage</p> <ul style="list-style-type: none"> • Count the number of wilted cherelles caused by capsids/ Mirids • Count the number pods damaged/infested by Mirids • Rank the severity of damage on flushes 0 - 4 as below. <p>0= no damage</p> <p>1=no severe damage (hence very few necrotic lesions on young shoots)</p> <p>2= mildly severe (medium presence of necrotic lesions on shoots and little dieback of branches)</p> <p>3= Severe (high presence of necrotic lesions on shoots and high dieback of branches)</p> <p>4= highly severe (very high presence of necrotic lesions on shoots and almost total dieback of branches)</p>
<p>Cocoa shield bug (Bathycoelia thalassina)</p>	<p>Owusu-Manu (1976) estimated annual crop loss to its infestation in Ghana at 18% Both adult and nymph feed on the pod. Mature pods may turn yellow at the points of attack and may also become distorted.</p>	<ul style="list-style-type: none"> • Count the number of wilted cherelles caused by shield bugs • Count the number pods damaged/infested by shield bugs.
<p>Black pod (P.megakarya)/ (P.palmivora)</p>	<p>Obvious symptoms are the rotting or necrosis of pods. Pods can be attacked at any stage of development, and the initial symptoms are small, hard, dark spots on any part of the pod, Internal tissues, including the beans, are colonized and shrivel to form a mummified pod.</p> <p>Minor Crop: Mid May –Mid July Main Crop: September-December</p>	<ul style="list-style-type: none"> • Count the number of wilted cherelles caused by Black pod • Count the number pods damaged/infested by BP

PESTS AND DISEASES	SYMPTOMS / PERIOD OF OCCURENCE	RANK
<p>Mistletoe (<i>Tapinanthus bangwensis</i>) (<i>Phragmanthera incana</i>)</p>	<p>Mistletoe belongs to the family Loranthaceae. It is a plant parasite that lives on other plants for food and water. Mistletoe affects many plants including cocoa and if unchecked can cause serious problems on cocoa farms. Infestation by Mistletoe results in death of branch from the point of attack with heavy infestation leading to the death of many branches</p> <p>There are two types of Mistletoe in Ghana. One species (<i>Tapinanthus bangwensis</i>) is recognized by its red flowers and berries; it flowers twice a year in Ghana and can live up to 18 years. Another is also caused by <i>Phragmanthera incana</i> causes about 20% infestation and has yellow flowers and blue fruits.</p>	<p>0= no mistletoe present</p> <p>1= little M present (approx. 1/4th of canopy colonized)</p> <p>2= mildly M present (approx. 2/4th of canopy colonized)</p> <p>3= heavily infested (approx. 4/4th of canopy colonized)</p>
<p>Yield</p>	<p>Count of all the healthy and mature pods at harvest(s) for each of the 20 cocoa trees per plot Or Recorded by farmers of harvested pods for each of the 20 cocoa trees per plot.</p>	

Pest and Disease Symptoms

MISTLETOE



CAPSIDS DAMAGE









CANOPY HEALTH















RESEARCH PROGRAM ON
**Climate Change,
Agriculture and
Food Security**



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