

Establishment of a 12-ha Cacao Agroforest in Côte d'Ivoire

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Introduction

Our Vision

The deliberate inclusion of fruit trees, timber trees and annuals alongside cacao can be used to renew and diversify old or exhausted cacao farms. Contiguous land parcels can be aggregated in a structured system managed at community level. This allows farmers to have a diverse income, stable cacao yields, reduce the labour requirements and enhance the ecosystem services provided by cacao farming.

The project

Long term investigation of 3 cacao agroforestry schemes at scale in Côte d'Ivoire.

Aim

Build fundamental knowledge on the economic, agronomic and environmental benefits of cacao agroforestry.

Objectives

1. Assess the economic return of cacao agroforestry systems.
2. Assess the growth and yield of cacao and accompanying foods crops in an agroforestry.
3. Quantify the effects of cacao agroforestry on carbon sequestration and microclimate.

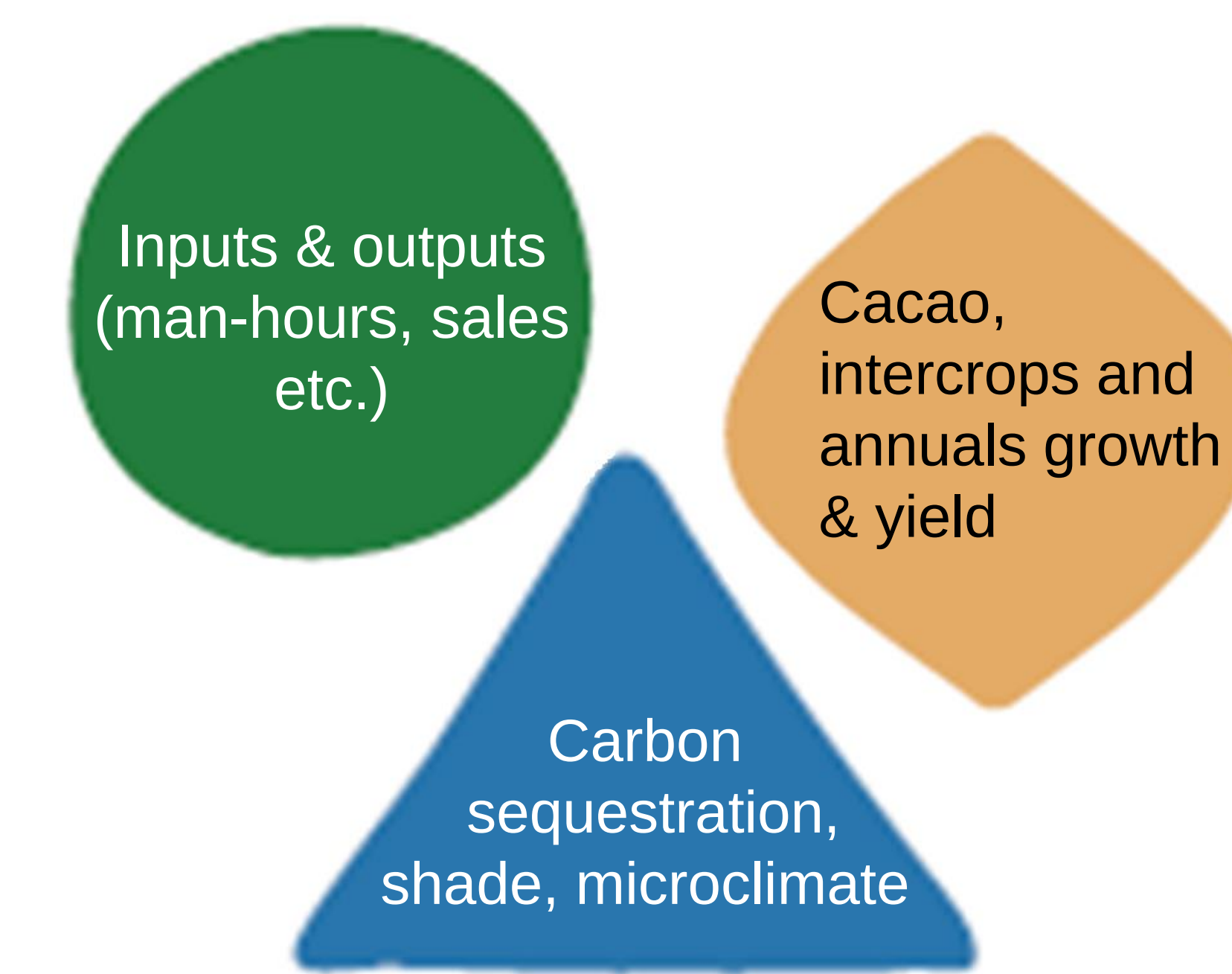
Methodology

Trial is located in Côte d'Ivoire in Tiassalé. Average annual rainfall for the past 5 years is 1183 mm . Soil texture is clay loam . Trial covers an area of c.a.12 ha (Figure 1). In 2017 land was cleared and the shade trees planted. Cacao plants were established in 2018.



Figure 1: Aerial picture of the trial take in April 2019.

Measurements



Trial design

- 3 agroforestry schemes (4ha each) and 1 control (0.2 ha)
- Split-Split-Plot Design (n=4; Table 1; Figure 2):

Table 1: Design levels

Level	Factor	Variables
Split-plot	Intercrop treatment	*Tk1, Tk2, Cn1, Cn2 and nil
Split-split-plot	Cacao type	Co1, Co2 and Co3

Plot 1		Plot 2		Plot 3		Plot 4	
Co3	Co3	Co1	Co1	Co2	Co3	Co2	Co1
Co1	Co2	Co3	Co2	Co3	Co1	Co3	Co3
Co2	Co1	Co2	Co3	Co1	Co2	Co1	Co2

Figure 2: Scheme layout. Each agroforestry scheme has 4 plots (in red), 8 split-plots (in yellow) and 24 split-split plots (in green).

*Tk1= teak TG1 ;Tk2= teak S66; Cn1=coconut 96 trees/ha; Cn2= coconut 120 trees/ha; nil= no intercrop ; Co1,2,3= cacao type 1,2,3.

Treatments

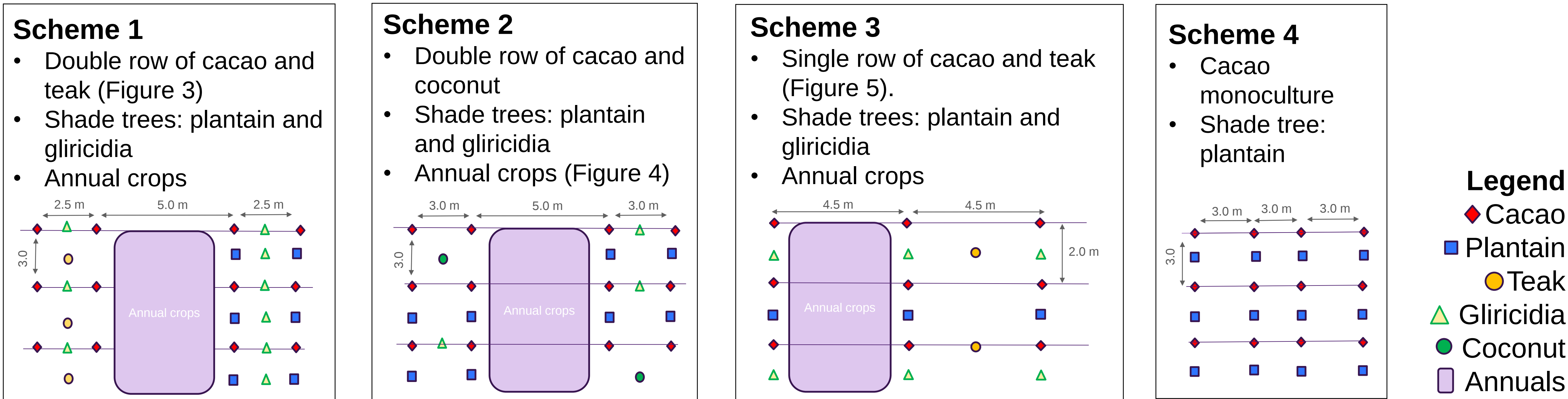


Figure 3: Scheme 1. Particular of the double row of cacao and teak in November 2018. Teaks are 4 months old. Cacao plants are 5 months old.



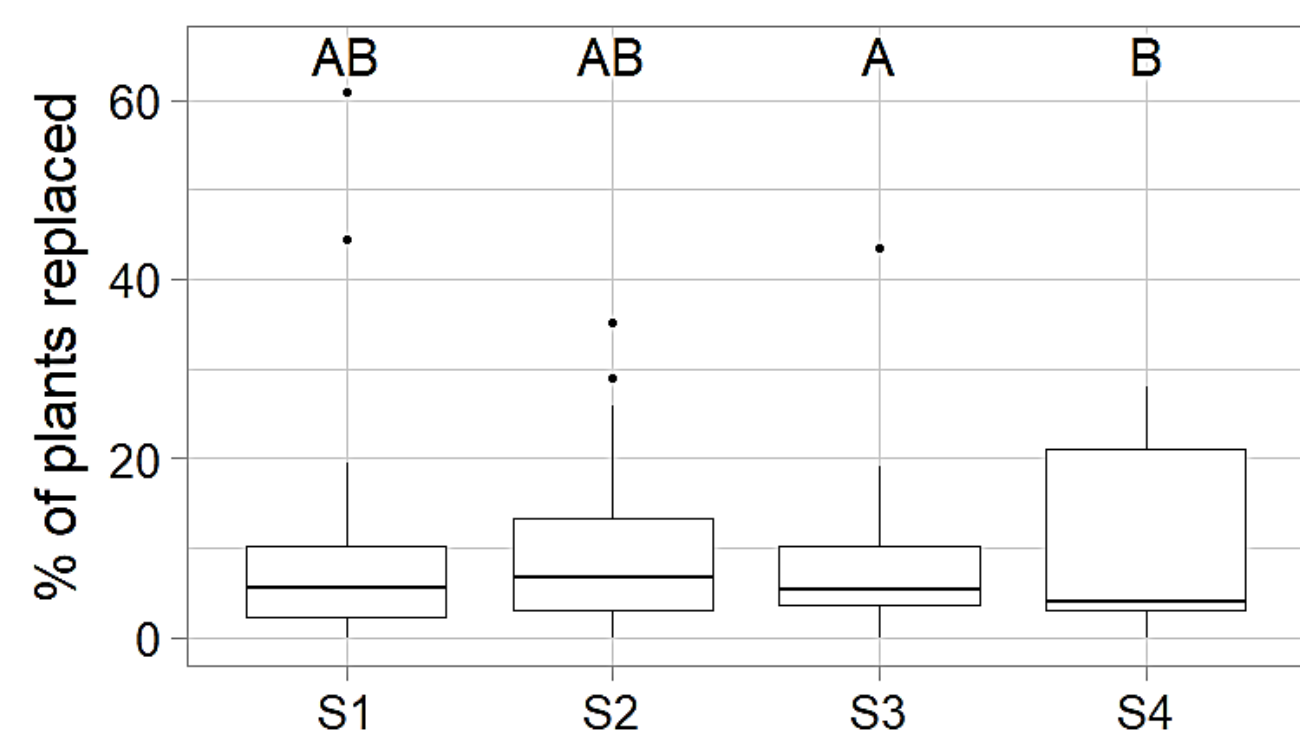
Figure 4: Scheme 2. Particular of the interrow cultivated with cowpeas in November 2018.



Figure 5: Scheme 3. Particular of the teak row in November 2018. Teaks are 4 months old.

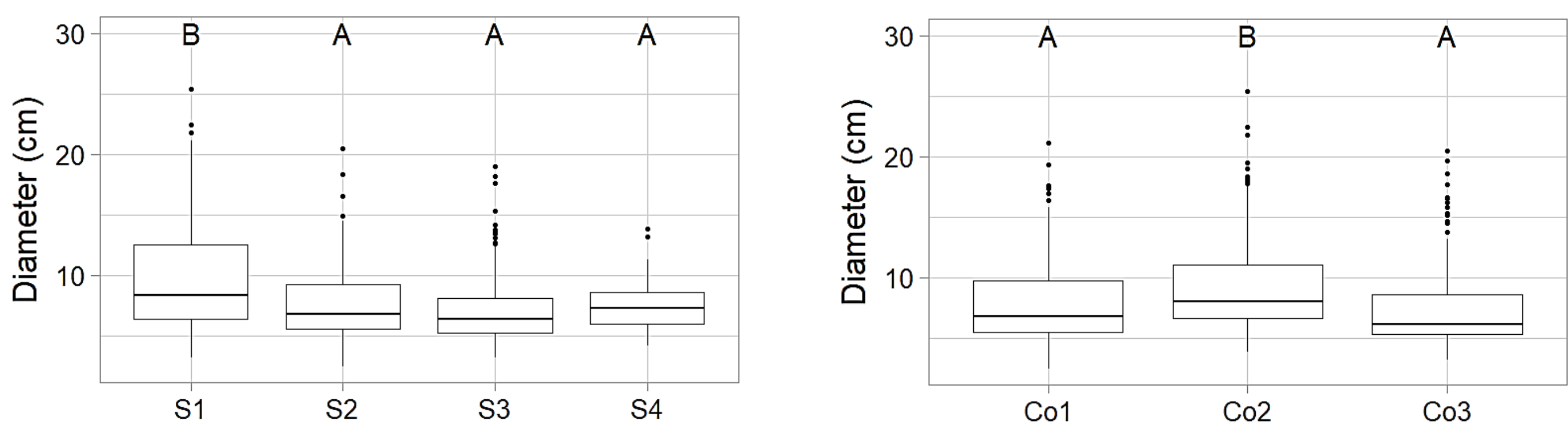
Results

Cacao mortality



Comparison of the percentage of cacao plants deceased that were replaced in October 2018. Horizontal line in each box indicates the median, while top and bottom edges of the box indicate upper and lower quartile respectively. Ends of vertical lines represent the maximum and minimum values excluding outliers (black dots). Letters at top of the boxes denote grouping based on significant differences in a linear model controlling for the rest of variables ($p<0.05$). S1,2,3,4 =Scheme 1,2,3,4

Cacao growth



Comparison of diameter (mm) between schemes (left image) or between planting materials (right image). Horizontal line in each box indicates the median, while top and bottom edges of the box indicate upper and lower quartile respectively. Ends of vertical lines represent the maximum and minimum values excluding outliers (black dots). Letters at top of the boxes denote grouping based on significant differences in a linear model controlling for the rest of variables ($p<0.05$). Co1,2,3= Different cacao planting materials.

Plantain yield

Plantain yield during the year 2018.

	S1	S2	S3
Yield per Scheme (kg)	7402	8509	4687
Yield per hectare (kg/ha)	1851	2127	1172
No. of Plantain per hectare (No./ha)	384	552	504
Yield per plant (kg/plant)	5	4	2

Discussion

- Average mortality for 2018 (10%) is acceptable.
- There are no significant differences in mortality between schemes, but final assessment need to include 2019 data.
- Diameter of the cacao plants is similar between schemes 2, 3 and 4.
- Diameter of the cacao plants in Scheme 1 is 37% greater than the average diameter of the cacao in other schemes.
- Co2 has greater diameter than Co1 and Co3 which might be related to the vigour of the cacao type or the initial state of the seedling at planting.
- Scheme 3 produced less than half the plantain of scheme 1 and 2, probably because it was planted later in the season.
- Scheme 2 has the highest total plantain yield. This is probably due to the greater number of plantains compared to Scheme 1.

Conclusions

- Data provides a good baseline for the study.
- Differences between cacao types and between schemes will be evaluated by comparing the growth relative to the baseline.
- Co2 seems more robust than Co1 and Co3 at this early stage.