Limits to cocoa yields and their implications for livelihoods and poverty

Key message

We identify key ecological factors that could be manipulated by farmers to improve cocoa yields and income. These improvements could reduce aspects of poverty, but they would need to be accompanied by developments in communal infrastructure to be completely effective

Summary

- A range of policy initiatives aim to reduce poverty by improving cocoa yields and incomes, but it is unclear how these goals might be achieved.
- We show that cocoa yields appear to be limited by a few key ecological factors e.g. farms closer to the forest had higher yields, and some of these factors can be manipulated by farmers to improve yields.
- If these improvements can be realised, net incomes from cocoa could be increased significantly.
- We also show that only certain dimensions of poverty (education, assets, food security and life satisfaction) are likely to improve in response to improvements in cocoa yields and income.
- Communal infrastructure (e.g. health centres, water supplies) in addition to agricultural development will be required to reduce poverty in cocoa farming communities.

Background

A policy goal for the cocoa sector in Ghana is to improve yields and hence cocoa livelihoods. The evidence-base underpinning this goal is largely based on experimental farms, in which only a few factors (e.g. shade, fertilizer use) are typically explored in any single study. In contrast, much less is known about the multiple factors affecting yields on actual farms in forest-agriculture landscapes, which is a critical knowledge gap if yields and livelihoods are to be improved at landscapes scales.

Box 1 – Factors that might affect cocoa yields

There are two main groups of factors that might affect cocoa yields – ecological and farm management. Cocoa production potentially relies on a range of ecological factors – proximity to forest habitats, rainfall to provide water, fertile soils, insect pollinators and pest control. Farmers can also potentially affect their yields through the management of cocoa planting density, shade, fertilizer and pesticide applications. Lastly, yields change as the cocoa trees age. Our project aimed to understand the importance of these factors in affecting cocoa yields, and then explore the potential for farmers to manipulate them in order to improve their yields and livelihoods.

Our project ECOLIMITS has been collecting data relevant to these issues for the last four years from cocoa growing landscapes around Kakum National Park (Box 1). The aim of this policy brief is to summarise our results around three key questions:

- What factors affect cocoa yields?
- How might yields be improved and what implications might this have for livelihoods?
- How might yield improvements contribute to poverty alleviation?

What factors affected cocoa yields?

To identify the most important factors affecting cocoa yields around Kakum National Park, we set-up 36 study plots on cocoa farms in three areas around the park. On each plot, we measured the productivity of cocoa trees (the data used here are from the heavy crop in 2014/15), and we collected measurements relating to the various ecological and farm management factors listed in Box 1. We then used a statistical analysis to identify the most important factors affecting cocoa yields.

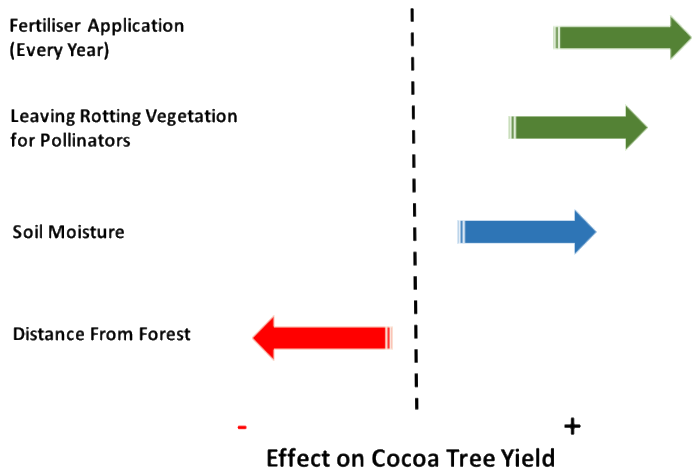
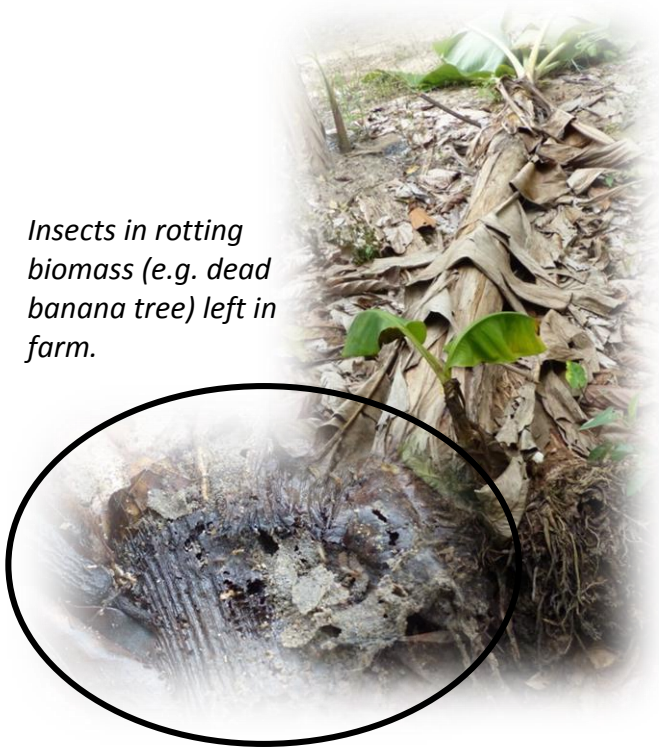


Figure 1 The important factors affecting per tree cocoa yields from our yield model, ordered by importance.

The analysis identified seven key factors, the most important of which are shown in Fig. 1. **Cocoa yields were higher** on a study plot **if fertilizer was used**[1]**,** if the **farmer had planted a higher density of cocoa trees**, if **the tree was close to rotting vegetation** that might provide habitat for insect pollinators (see photo)[2], **if the soil was relatively wet** (soils are very sandy around Kakum)[3], **if the plot was close to Kakum forest**[4], if the **cocoa trees were not too old** and **the soil was not too alkaline**. We found no effect of shade cover on cocoa yield, although shade might affect soil moisture, which does impact yields. We need to do further work on this issue. Lastly, it is unclear why yields were higher close to Kakum forest, although this might be related to microclimate (more dew is deposited close to the forest).

Yield improvements and their consequences for livelihoods

How might our analysis help farmers improve their yields? It is very difficult for the farmers to change some of the factors we identified, such as how close a farm is to Kakum forest. But, **farmers could potentially improve their yields if,** for example, **they applied fertilizer** to their soils, **provided rotting biomass close to their cocoa**, and **improved their soil moisture**. If they were able to take these steps, what potential yield improvements might result, and what impact might this have on their livelihoods? To answer this question, we first used our analysis to estimate the yield improvements on each of our study plots if the farmer took these steps. Next, we calculated the profit farmers currently make by subtracting farm management costs from the income they received from selling their cocoa using household survey data – this is called a net margin. We then re-calculated this net margin for the yield improvements. **We found that a few farmers were currently making a loss**, but **if yields were improved nearly all farmers should be able to make a profit**. Overall, the **yield improvements, if they could be made, led to a 4-5 fold increase in net margins**.



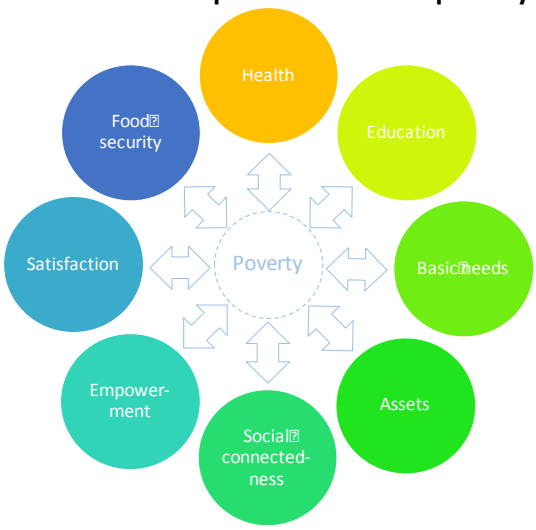
Insects in rotting biomass (e.g. dead banana tree) left in farm.

How might yield improvements contribute to poverty alleviation?

Poverty is increasingly being recognised as a multi-dimensional issue (Box 2). Our analysis suggests that farmers can increase their incomes by improving their cocoa yields, but what are the implications for other dimensions of poverty? We answered this question in two steps. First, we identified the poverty dimensions that were related to cocoa incomes using our household survey data. We found that cocoa incomes were related to four poverty dimensions:

[1] Farmers mostly applied NPK fertilizer, and application rates ranged from 0-7 times per year.
[2] Rotting biomass types recorded included dead banana trees, rotting palm fronds, empty cocoa pods, rotting fruit (e.g. oranges). Distances ranged from 7 to 100m.
[3] Soil moistures ranged from 12 – 24%.
[4] Plots were up to 5km away from Kakum forest.

Box 2 – The multiple dimensions of poverty



- Education – a child was less likely to miss school as cocoa income increased;
- Assets – a household was more likely to own a TV as cocoa income increased;
- Food security - a household was more likely to have adequate access to food throughout the year as cocoa income increased; and
- A family expressed higher overall satisfaction with life as cocoa income increased.

Next, we assessed how these dimensions of poverty (education, assets, food security, and overall satisfaction with life) might change if cocoa yields improved and incomes were increased. Our results are shown in Fig. 2. **Improving cocoa yields could reduce the likelihood that a child misses school** from 46% to 24%; **increase the likelihood that a household is able to own a TV** from 40% to 63%; **increase the likelihood a household will have adequate amount of food** from 72% to 82%; and **moderately increase overall life satisfaction** from 1.9 to 2.0.

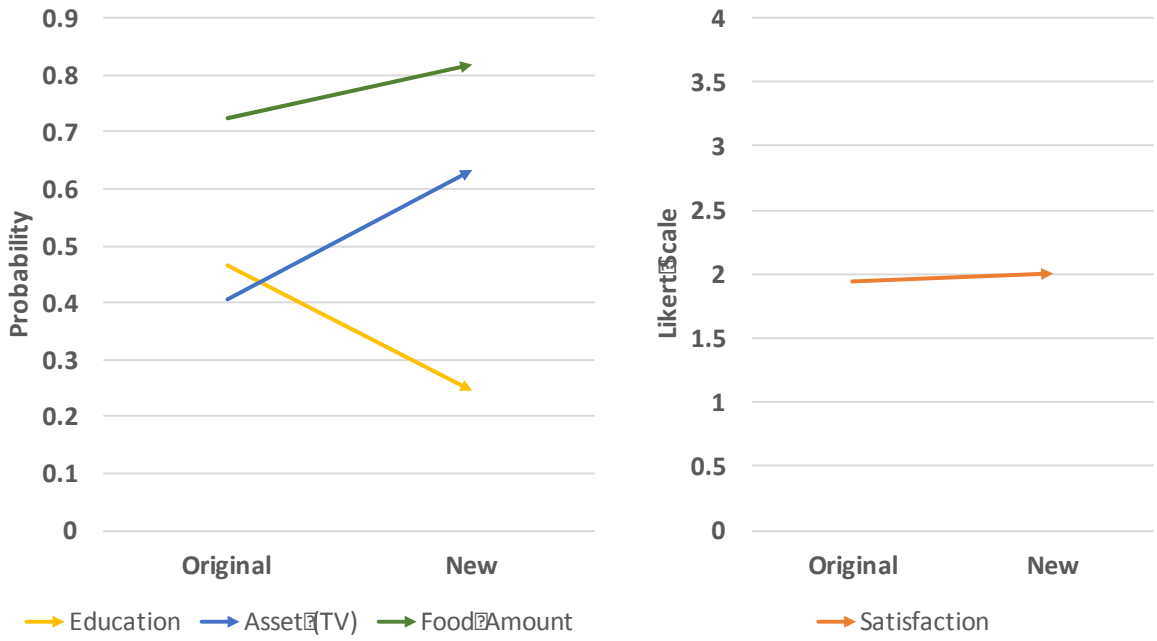


Figure 2 Lines indicate improvements in poverty measures from current (original) mean household measures to new levels if yields were improved and cocoa incomes increased. Factors are education (probability child misses school), asset (probability a household owns a TV), food security (probability household has adequate food throughout the year) and satisfaction (reported "satisfaction with life" on a 0 to 4 Likert score).

Other than these poverty dimensions, we found no evidence to suggest other dimensions (e.g. health, basic needs such as electricity, water, sanitation) were sensitive to cocoa yields and incomes. This suggests that policies aimed at agricultural development in the cocoa sector are unlikely to address all dimensions of poverty, and that other policy interventions will likely be required.

Recommendations

- Field experiments to better understand the impacts of rotting biomass and current management improvements (hand pollination) on cocoa yields, preferably replicated in different landscapes/locations. These might include the Kakum Hotspot Intervention Area (HIA), CRIG experimental farms, and a landscape in the NE of the cocoa zone.

- Further research by the ESPA team to better understand why only some farmers use fertilizer, the factors affecting soil moisture, and why farms closer to Kakum forest have higher yields. This work will then form the basis for recommendations on how farmers might improve yields and policy implications for the Ghana Cocoa-Forests REDD+ Programme (GCFRP).
- The major stakeholders in the cocoa sector consider a more holistic approach to poverty alleviation in cocoa farming communities by combining measures to improve cocoa yields and incomes with community infrastructure developments that address dimensions of poverty such as healthcare and basic needs (water, electricity, sanitation) that are unlikely to be affected by cocoa farming interventions.

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Details of the ECOLIMITS project are available here:
http://www.ecolimits.org/