

# One step towards sustainable cocoa production: dynamic agroforestry



Severin Wiens & Katja Degonda

Master Students of Environmental Sciences, ETH Zurich, Switzerland (supervision: Dr. Christian Andres and Prof. Dr. Johan Six)

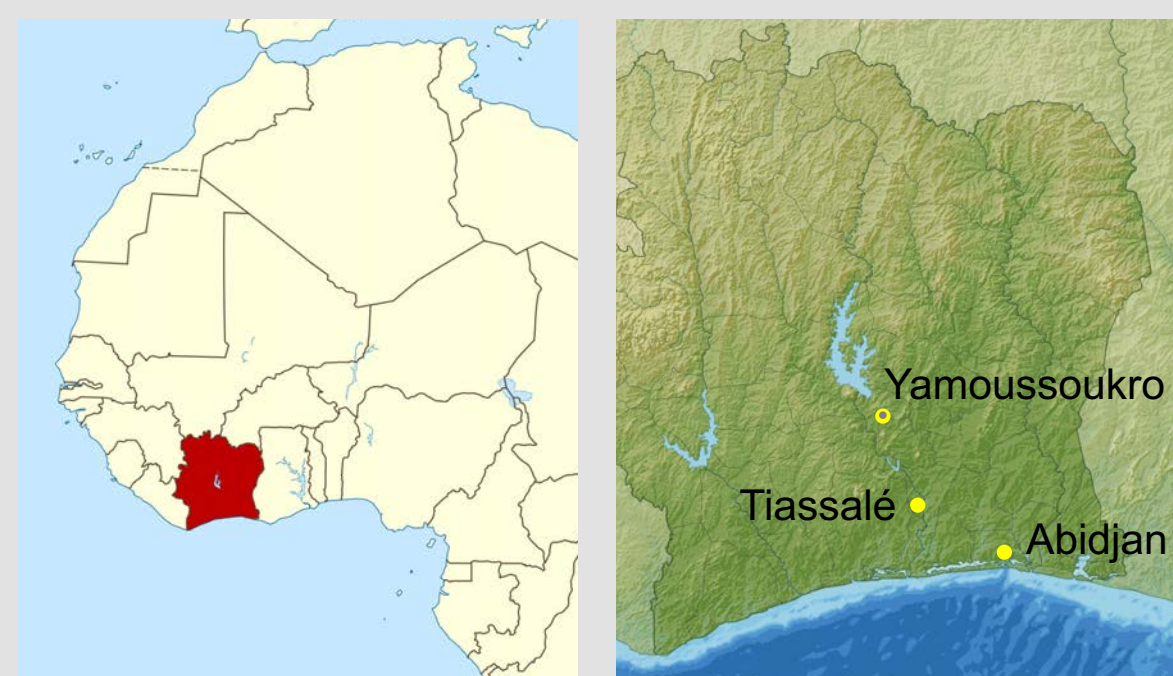
## 1 Introduction

**Worldwide cocoa demand is on the rise**, more than half of the world's supply is grown in unsustainable monocultures in West Africa<sup>1</sup>. This form of production comes with major disadvantages as it leads to large-scale loss of tropical forests, a decrease in biodiversity, degraded soils, high prevalence of pests and diseases, as well as vulnerability to climate change, and subsequently to unsustainable livelihoods of the farmers<sup>2</sup>.

**Dynamic agroforestry systems (DAFS) seem promising** in combatting many of these negative effects of monocultures. Applying large amounts of biomass through regular pruning (unlike in "common" agroforestry systems) may be a key factor for the regeneration of impaired soil health on marginal lands in order to increase the productivity and sustainability of cocoa systems<sup>3</sup>. In this study, we assessed critical success factors for the establishment of an organic, large-scale mechanized DAFS.

## 2 The Site – Fredy's Plantation

The examined DAFS is a **50 ha plantation** located about 5km west of Tiassalé, central Côte d'Ivoire, established 2014. Cocoa trees are planted in rows with intervals of 4m together with different shade trees. **In some areas, trees are more vigorous than in other areas... → why?**



Video of the plantation:



## 3 Hypotheses and Methods

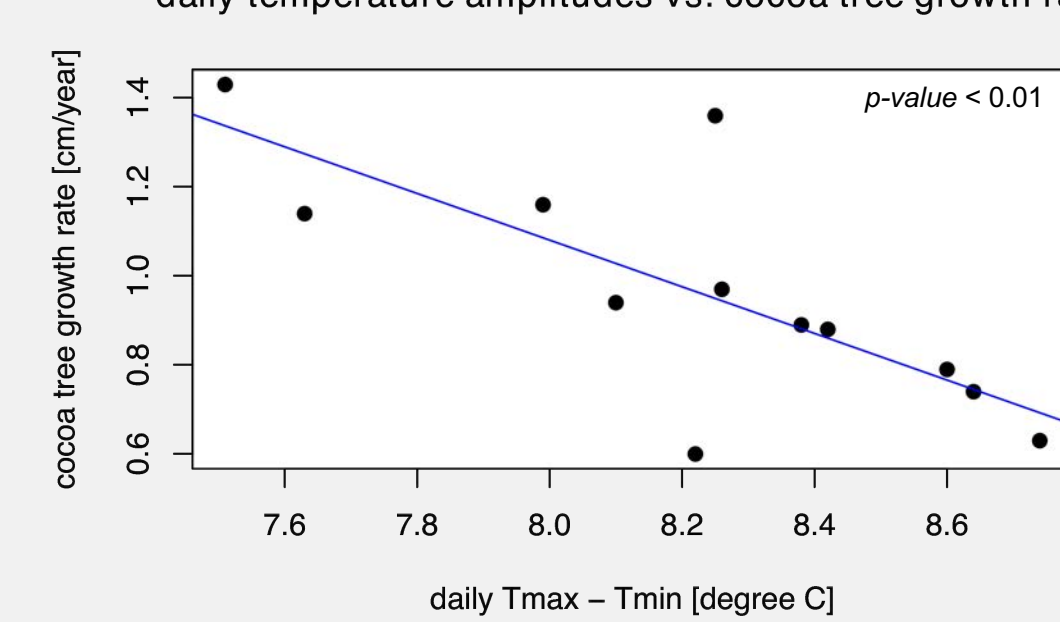
We evaluated growth and survival rate of cocoa trees, examined physico-chemical soil properties and collected climatic parameters to answer the following questions:

1. *Is cocoa tree vigour enhanced in plots with favourable soil and microclimatic conditions for vigorous cocoa tree growth?*
2. *Is Dynamic Agroforestry with periodic pruning and mulching increasing soil fertility?*

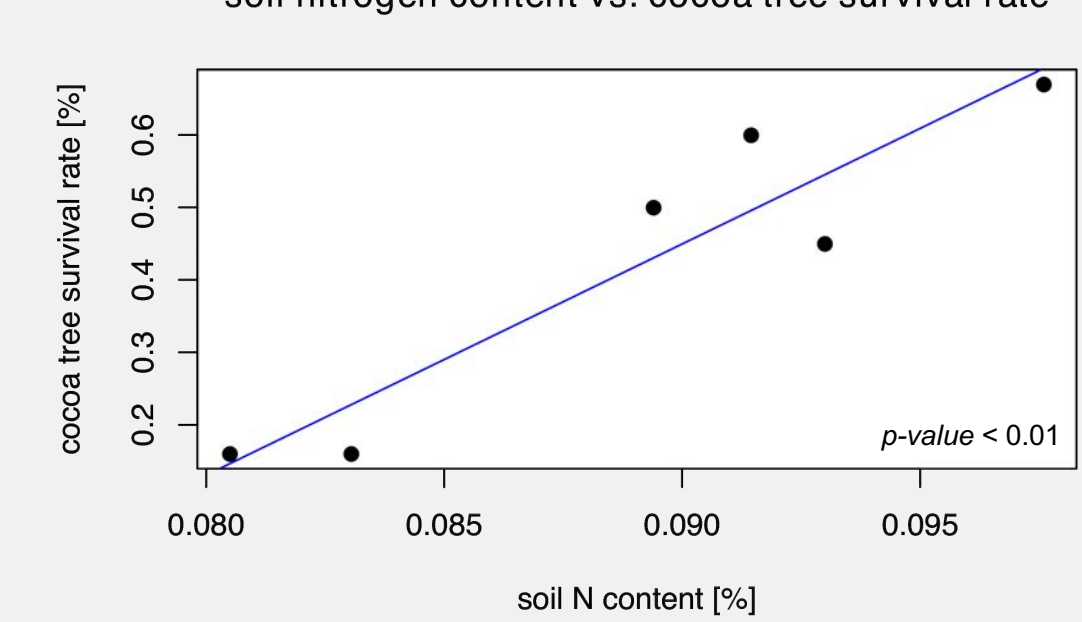
## 4 Preliminary Results and Conclusions

1. Enhanced cocoa tree growth and survival rate with:
  - Lower daily temp. amplitude (diff. Tmax – Tmin)
  - increased soil fertility (higher organic C and N)
  - lower soil bulk density
  - higher water holding capacity of the soil

daily temperature amplitudes vs. cocoa tree growth rate

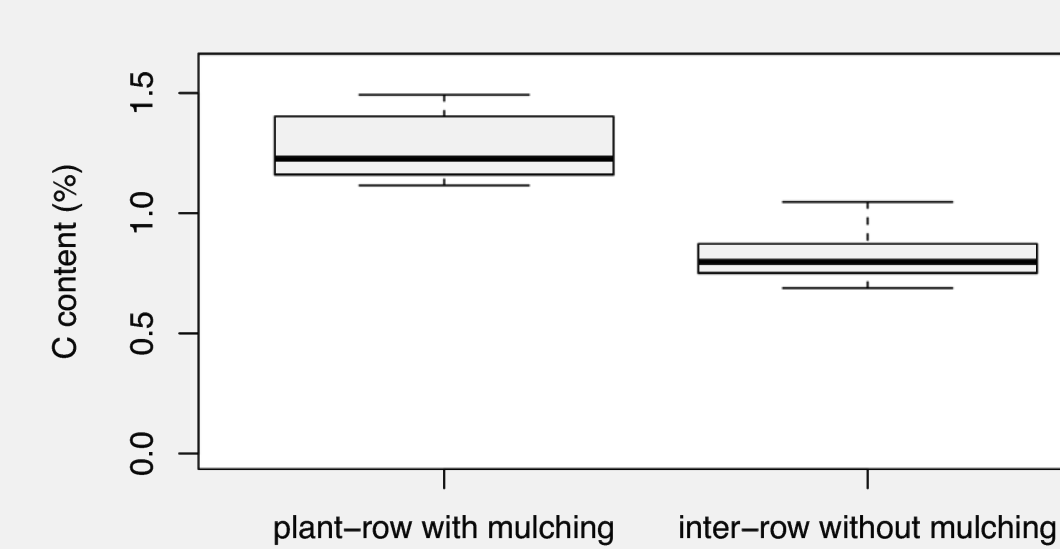


soil nitrogen content vs. cocoa tree survival rate

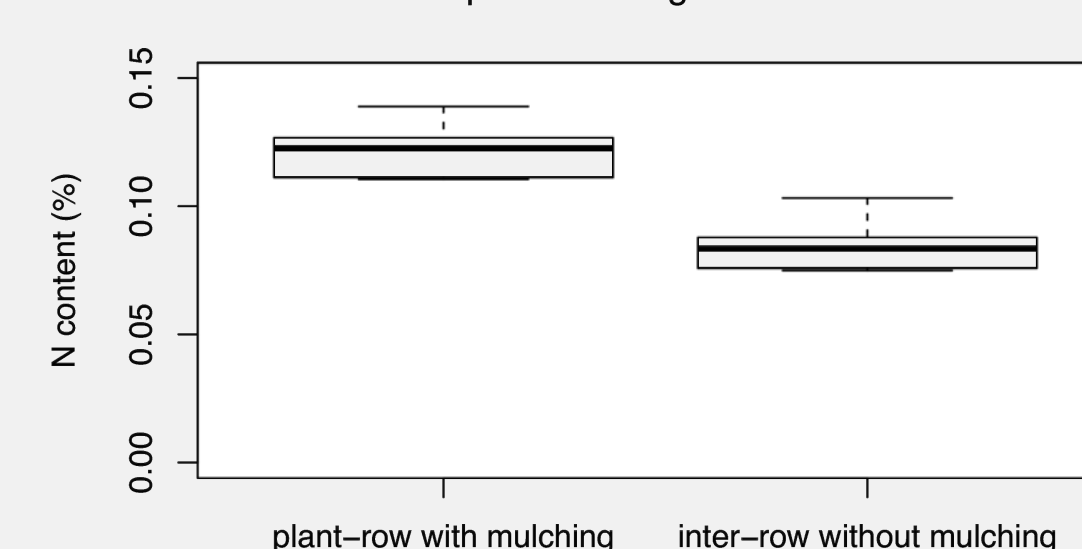


2. The DAFS increased soil fertility through the application of large amounts of biomass

top-soil carbon content



top-soil nitrogen content



Even more plausible explanation for poor cocoa tree growth: **insufficient precipitation amounts...**

- Tiassalé: 1150 mm/year
- recommended<sup>4</sup>: 1500 mm/year

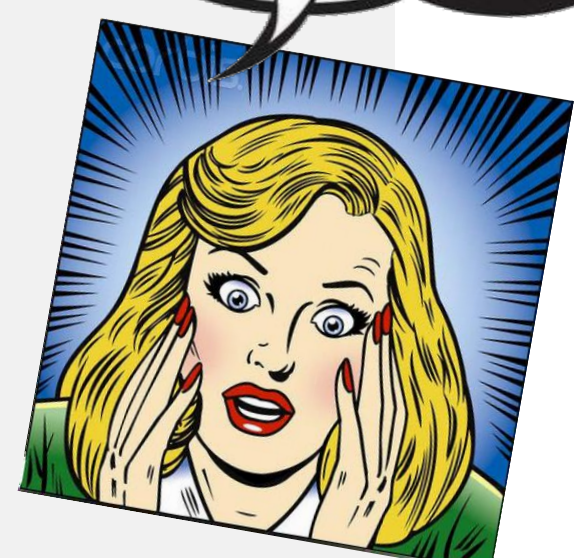
... and dry season might be too long<sup>4</sup> for cocoa trees without irrigation ...

Monthly precipitation at the site as a 4-year mean in mm.

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
8	56	130	110	151	254	76	45	79	122	96	27

→ Improved water retention strategies or irrigation should be considered

Deficit of 350 mm/year!  
Serious!!!



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Contact

Severin Wiens: wienss@ethz.ch  
Katja Degonda: kdegonda@ethz.ch  
Dr. Christian Andres: christian.andres@fibl.org  
Prof. Dr. Johan Six: jsix@ethz.ch  
www.fredysplantation.ch

## 5 References

- <sup>1</sup> Hütz-Adams et al. 2016. Strengthening the competitiveness of cocoa production. *Sudwind eV*: Bonn, 156
- <sup>2</sup> Schroth et al. 2016. Vulnerability to climate change of cocoa in West Africa. *Sci. Tot. Env.*, 556, 231-241
- <sup>3</sup> Milz. 2012. The gloomy outlook for cocoa production in the Ivory Coast. *Ecotop Consult, La Paz*
- <sup>4</sup> ICCO, International Cocoa Organization 2013. <https://tinyurl.com/hbfxfuv>, accessed 2018.