Dynamic agroforestry – a tool for successful smallholder-grown cocoa in times of climate uncertainty

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Dynamic agroforestry – Characteristics and claimed advantages
What is dynamic agroforestry (DAF)?

Main characteristics

- Very high plant density and diversity
- Very high pruning intensity
- Systematic stratification
- Managed succession

Andres et al. (2016)
What is dynamic agroforestry (DAF)?

**Main inputs (challenges)**

- No external inputs
- Knowledge & labour
- Time (long-term projects)
Agroforestry ≠ DAF

Main difference to “normal” agroforestry (AF)

• AF mostly spontaneous/natural systems, established from secondary forests with relatively minor interventions by humans
• DAF mostly systematic/intentional, established from scratch with relatively major interventions by humans
Agroforestry ≠ DAF

Spontaneous/natural, often established from secondary forest
Agroforestry ≠ DAF

Systematic/intentional, often established from scratch
Claimed advantages of DAF

In addition to advantages of “normal” AF

• Substantial harvests of by-products during establishment phase
• Getting to a mature forest-like system much quicker
DAF research project
Systems compared („Treatments“)

**Full-sun “monoculture”**
- Normal plant density, low diversity
- No stratification
- Low to no pruning
- Few external inputs
- Low inputs of knowledge and labour

**Shaded agroforestry system**
- High plant density and diversity
- Systematic stratification
- High pruning intensity
- No external inputs
- High inputs of knowledge and labour
Location of research plots
Project context

Western Region

- **SANKOFA** project setting up 400 hectares of on-farm DAF from 2019 – 2023, from scratch
- Some soils and microclimates marginal for cocoa
- Work on 40 DAF / T plots (mostly established in 2018)
- Small-scale, mainly resource-poor farmers
Location of research plots
Project context

**Eastern Region**

- **Sronko Farms** established 10 hectares of on-farm DAF since 2016, from secondary forest
- Soils and microclimate optimal for cocoa
- Work on 20 DAF / T plots (established in 2016 – 2018)
- One resourceful “large”-scale farmer
Methods

Parameters assessed
• Soil fertility
• Cocoa vigour and survival rate
• Local microclimate, soil moisture and temperature
• Productivity and profitability (preliminary)
Hypotheses

Bio-physical

- DAF improves soil health compared to traditional farming practices (T)
- DAF leads to better growing conditions and therefore higher vigour and survival rate of cocoa than T
Do DAF improve soil health compared to T?

Sronko Farms

![Graph showing soil health parameters for DAF and TRAD farms.](image)
Do DAF improve soil health compared to T?

Sronko Farms

Measured in years 1-5!
Better growing conditions cocoa vigour and survival rate in DAF than T?
Better growing conditions cocoa vigour and survival rate in DAF than T?

YES!
Better growing conditions cocoa vigour and **survival rate** in DAF than T?
Better *growing conditions* cocoa vigour and survival rate in DAF than T?

Lower air temperature amplitude in DAF 2019 - 2021
Lower max. soil temperature in DAF 2019 - 2021
Lower min. soil temperature in DAF 2019 - 2021
Higher soil moisture in DAF except at 25cm (most active root zone of cocoa) 2019 - 2021
Better growing conditions cocoa vigour and survival rate in DAF than T?

- Nice result for farmers to successfully establish cocoa in a challenging climate
Hypotheses

Bio-physical
• DAF improves soil health compared to traditional farming practices (T)
• DAF leads to better growing conditions and therefore higher vigour and survival rate of cocoa than T

Socio-economic
• DAF leads to higher harvests of by-products during the establishment phase compared to T
• DAFS have a better economic performance (return on labour, gross margin) than T
Higher harvests of by-products during establishment in DAF than T?

Does that pay?
Better economic performance in DAF than T?

![Bar chart showing labour installation (h/ha) for DAF and TRAD. The chart indicates significantly higher labour installation for DAF compared to TRAD.](chart.png)
Better economic performance in DAF than T?
Better economic performance in DAF than T?
Better economic performance in DAF than T?

Measured in year 1!

Factor 5
Better economic performance in DAF than T?

Dataset incomplete
Conclusion

• DAF is a promising low-tech strategy for farmers to successfully establish cocoa in an uncertain climate, even in marginal cocoa growing regions, with a high potential to regenerate degraded lands
• More data is needed to draw conclusions about the productivity and profitability of DAF vs. T for cocoa farmers
• DAF needs a lot of support in the beginning (first three to five years)
  – Investment
  – Training
• Functioning DAF programs at national levels are needed for DAF to reach scale
Thank you for your attention!

Project partners:

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