



Productivity and profitability of different cacao production systems in Bolivia

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ISCR

Lima, Perú

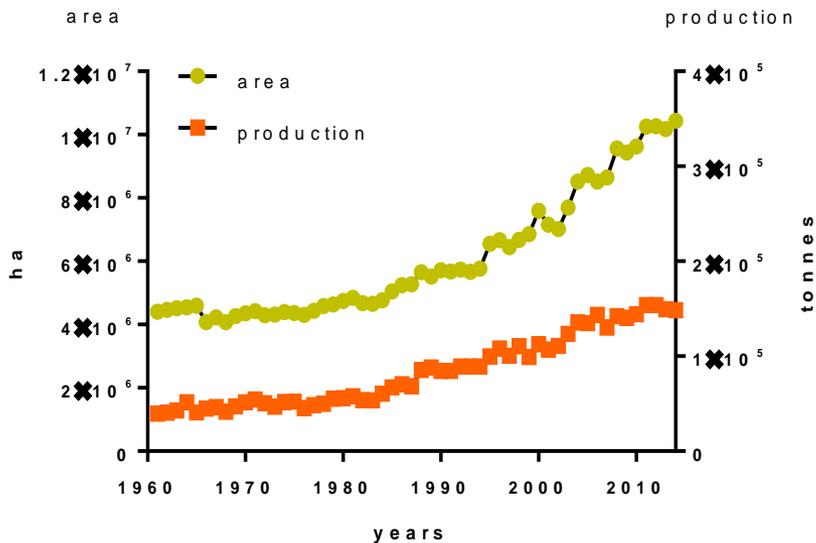
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Introduction

Increase in global demand



Intensification of management
Expansion of cultivated area in
tropical forest areas



Environmental problems, loss of
biodiversity, deterioration of
farmers' livelihood, etc.

Hypothesis and objectives

Rationale

More sustainable production systems such as **agroforestry** and **organic** managed systems are needed.

To guarantee a further extension, such systems need to be profitable for the farmers.

Hypothesis

Agroforestry and organic managed systems are expected to yield less cacao, but by-crops and premium prices, might economically compensate for the lower yields.

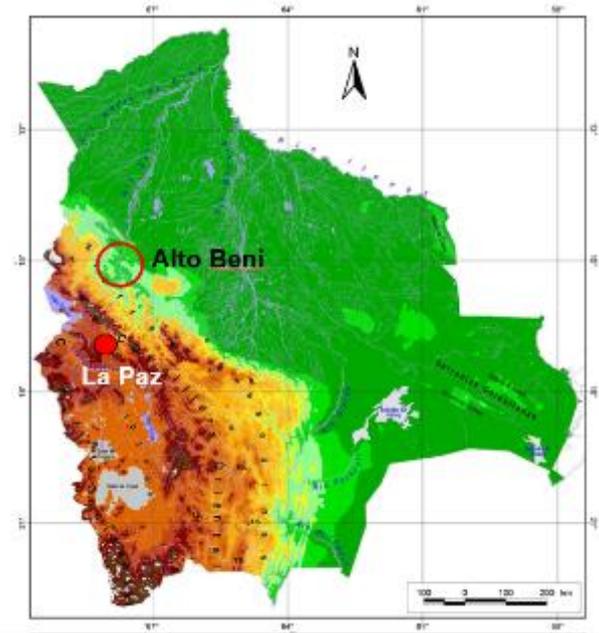
Objective

To compare the **productivity, return on labour** (return per working day) of four different cacao production systems, i.e., **agroforestry and monocultures under organic and conventional farming**.

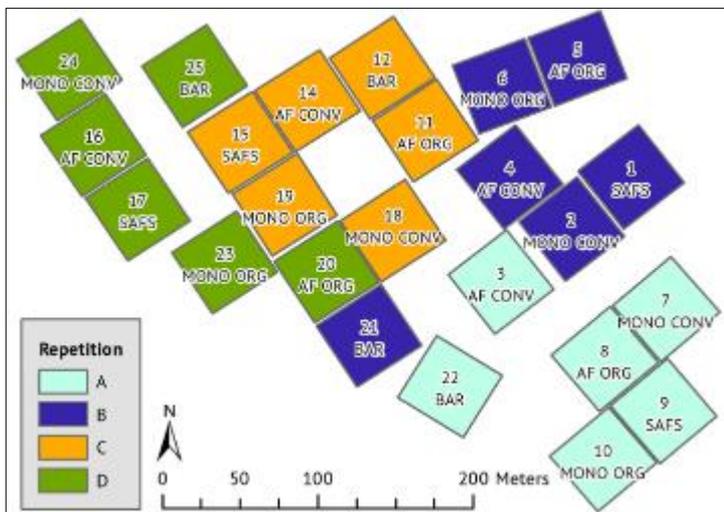
Methods

Site description

- Bolivia, Alto Beni, alluvial terraces of the river Alto Beni, transition zone Andean plateau and Amazon
- 400 m asl, precipitation: 1'550 mm, winter dry
- 20 years of fallow land before set up of trial



Trial layout



- Long-term trial, set up in 2008-2009
- Fully replicated 4 times
- Gross plot: 48 m x 48 m (144 cocoa trees), net plot 24 m x 24 m (36 cocoa trees)
- 12 cocoa varieties: 4 local selections, 4 introduced clones and 4 hybrids)

Trial layout



Agroforestry

Monoculture

Methods

Production systems

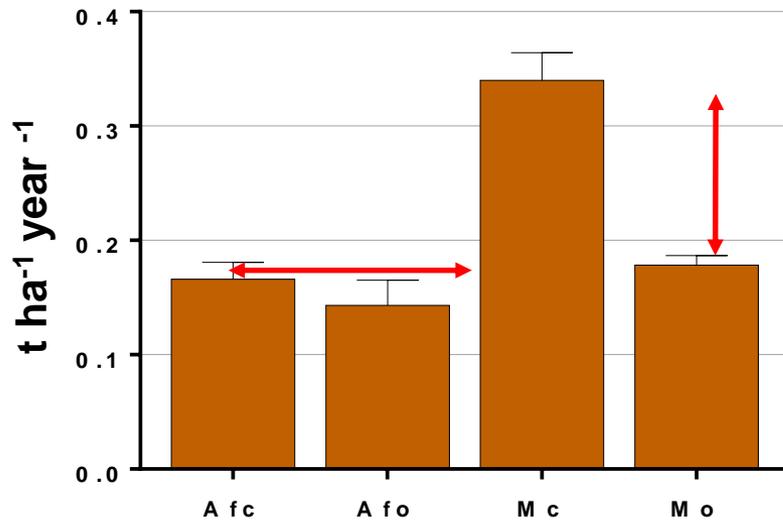
	Monoculture		Agroforestry	
Management	Conventional	Organic	Conventional	Organic
Shade tree canopy	- banana trees in establishment phase	- banana trees in establishment phase	42 trees plot ⁻¹ (227 trees ha ⁻¹): legumes, timber, fruit trees, etc.	42 trees plot ⁻¹ (227 trees ha ⁻¹): legumes, timber, fruit trees, etc.
Fertilization	Mineral fertilizer. Occasional foliar sprays	Compost	Mineral fertilizer. 50% of monoculture dose. Occasional foliar sprays	Compost. 50% of monoculture dose.
Weed control	Herbicides (4-5 year ⁻¹) Manual weeding, brushcutters	Perennial legume cover (<i>Neonotonia wightii</i>) Manual weeding, brushcutters	Herbicides (4-5 year ⁻¹) Manual weeding, brushcutters	Perennial legume cover (<i>Neonotonia wightii</i>) Manual weeding, brushcutters
Pest and disease control	Manual control, occasional pesticides	Manual control	Manual control occasional pesticides	Manual control

Data collection

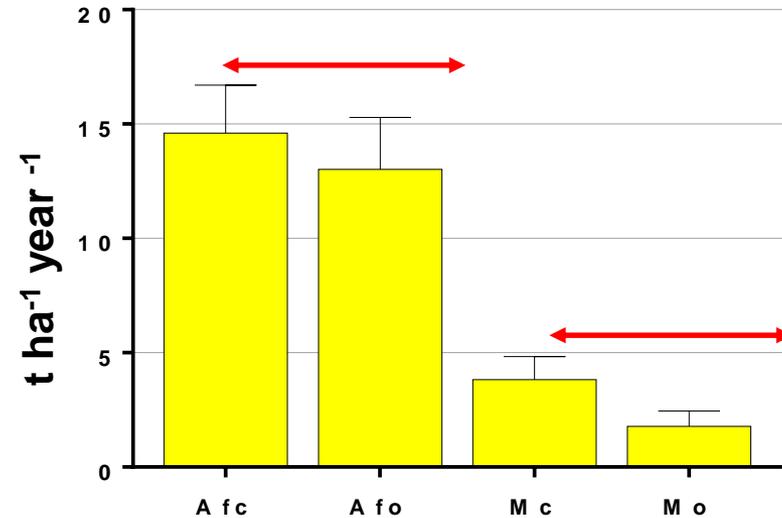
Cacao and by-crop yields, costs, revenues, and labour were registered during the first **5 years after establishment**, i.e. 2010-2014 (young plantation)

Productivity

Cacao



Plantain / Banana



Cacao yields were higher in monocultures (40%)

Cacao yields were higher under conventional management in the monoculture but no differences between organic and conventional in agroforestry

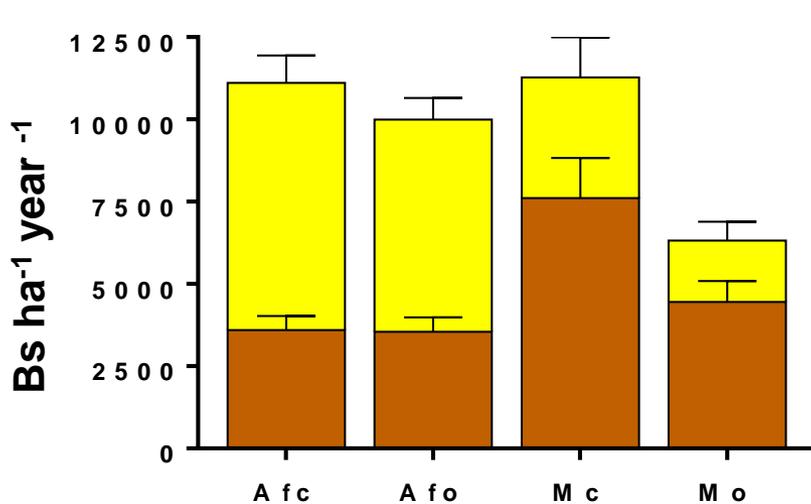
Banana/plantain yields were higher in the agroforestry systems

No differences in banana/plantain yield between organic and conventional management

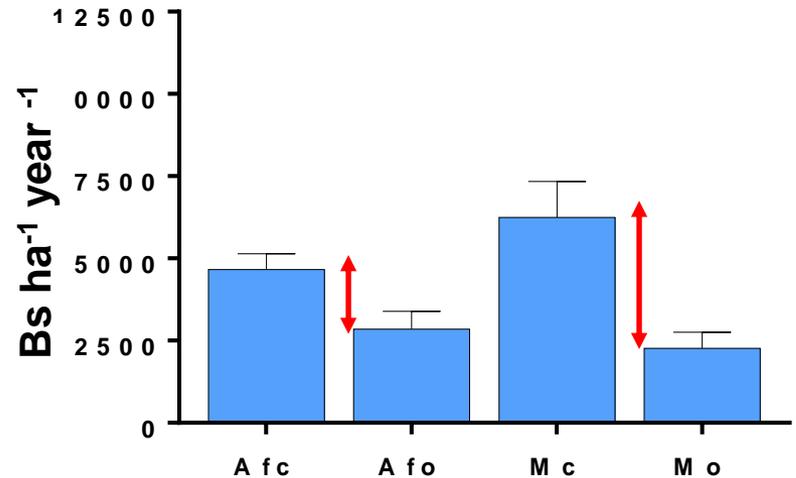
Afc: Agroforestry conventional
Afo: Agroforestry organic
Mc: Monoculture conventional
Mo: Monoculture organic

Profitability

Revenues



Costs



Bs stands for bolivianos. 1 US \$ is approximately 7 Bs

Revenues from cacao higher in monoculture than agroforestry, but revenues from by crops in agroforestry overcompensate this

Premium price for organic cacao was 13% higher than for conventional

Costs were lower in agroforestry systems: less fertilizer, less weeding

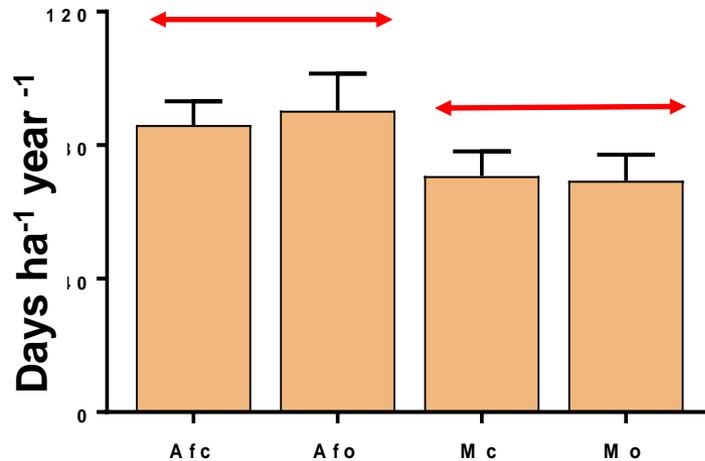
Costs were higher under conventional farming: fertilizers and herbicides

➔ implication for smallholder farmers, who usually hold limited savings and lack of access to credit

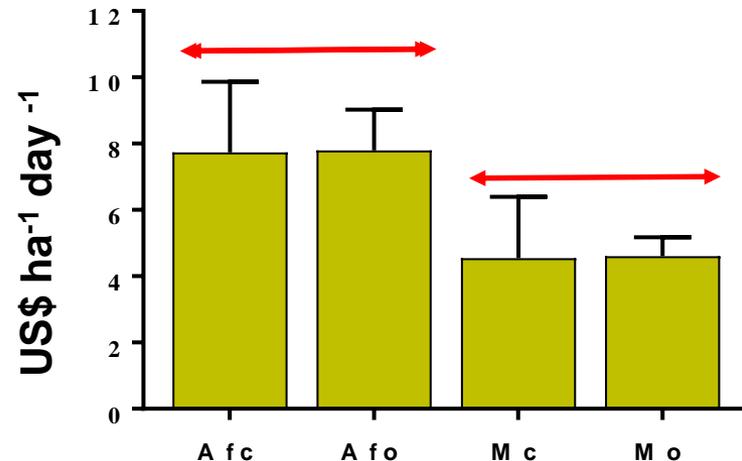
Afc: Agroforestry conventional
 Afo: Agroforestry organic
 Mc: Monoculture conventional
 Mo: Monoculture organic

Return on labour

Working time



Return on labour



Agroforestry were more work demanding than monocultures (16%)

Organic management was not more work demanding than conventional management

Return on labour was twice as high in the agroforestry systems compared with the monocultures, it did not differ between organic and conventional management

It exceeds the amount of 1.90 US\$ day⁻¹ set by the World Bank as the international poverty line, but is still a bit lower than the minimum salary in Bolivia (8.7 \$ day⁻¹).

Conclusions and perspectives

Agroforestry systems and organic management may be as profitable or even more profitable than full-sun monocultures and conventional farming in young cacao plantations

Adding to: the maintenance / enhancement of biodiversity and farmers' livelihood

Major role of by crops not only for self-consumptions but also in revenue

Thoughtful planning of agroforestry systems including market oriented by-crops combined with by-crops for self-consumption

Further development of accessible markets for by-crops

Further monitoring until reaching full production is indispensable for having comprehensive understanding of productivity and profitability

E.g. : a potential fast cacao yield increase in monocultures will be compensated by the sales of a broader range of by-crops and timber trees?

E.g. : narrow yield gap between organic and conventional monocultures?

Acknowledgments

Funding partners



Bolivian partners



Thank you for your attention