

# Locally selected cacao cultivars perform better than international cultivars in both agroforests and monocultures

## Objective

To compare the yield performance of locally selected clones with international commercial clones and full-sib families in different cacao production systems.

## Methodology

In a long-term trial in Bolivia 12 different cultivars were compared in 5 different production systems (Fig. 1).

The cultivars compared were:

- 4 local clones from the selection programme of the farmers' cooperative El Ceibo in Bolivia: **Ila22, III6, III13, Ila58**
- 4 commercial clones: **ICS1, ICS6, ICS95, TSH565**
- 4 full-sib families obtained with the crossing of the commercial clones with the clone IMC 67: **ICS1x, ICS6x, ICS95x, TSH565x**.

Data on yields, flowering and diseases were recorded per tree every 15 days between 2015 and 2019. 4 trees of each cultivar included in each net plot (24 x 32 m).

## Overview of the long-term trial

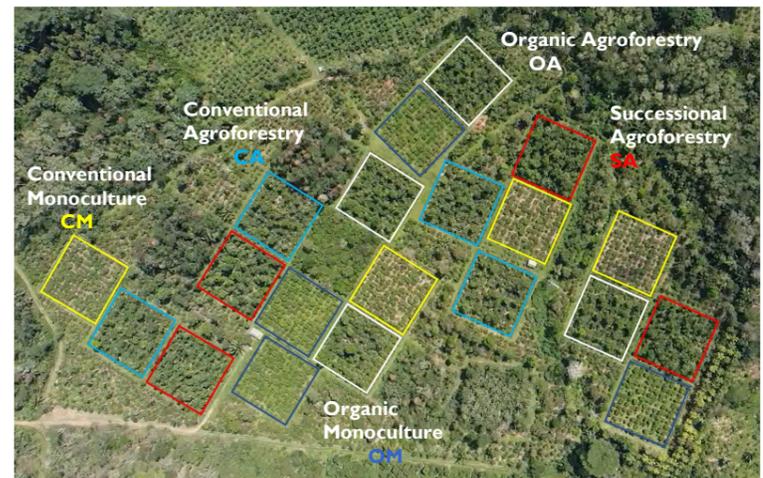
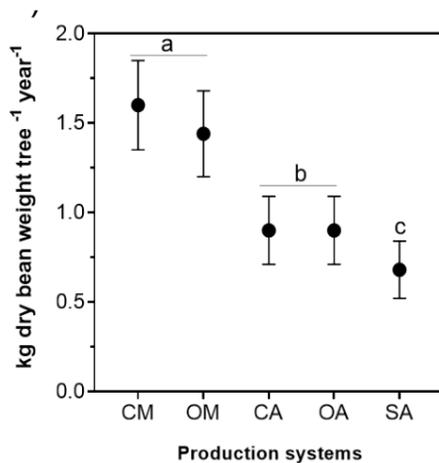


Figure 1: The long-term trial was established in 2008/9. The trial follows a complete randomised design with 4 repetitions. Plots size is 48 x 48 m. Agroforestry systems, in addition to cacao trees, have palms, bananas, timber and fruit trees at a density of about 300 trees ha<sup>-1</sup>. SA has higher tree and crop diversity (e.g., ginger, curcuma, copoazú) at a density of about 800 trees ha<sup>-1</sup>.

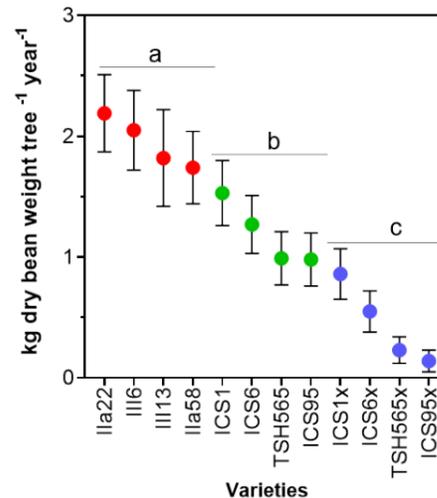
## Results

### Higher yields in the monocultures. No differences between organic and conventional management



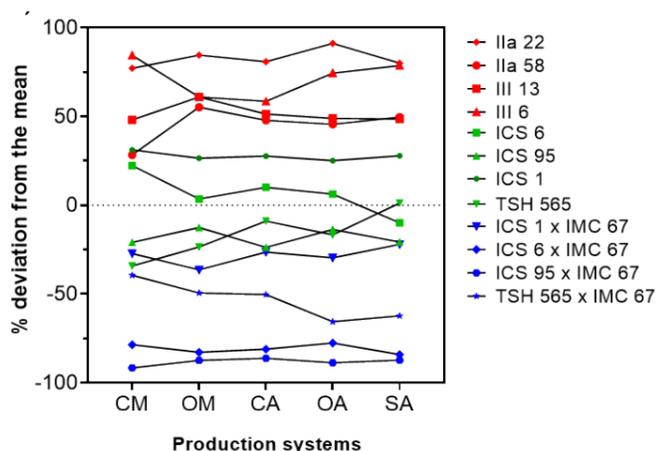
The higher productivity in the monocultures was driven by higher flowering intensity, fruit set, and aboveground biomass production. On the contrary, pod losses due to cherrille wilt and fungal diseases were not decisively different between production systems.

### The local clones had the highest yield in all production systems



The local clones allocated more assimilates to reproduction instead of vegetative growth, i.e., trees were smaller but with higher yields. Local clones had lower flower intensity but they had higher fruit set, which indicates a higher percentage of successfully pollinated flowers.

### The best performing genotypes had good performance in all production systems and vice versa



No cultivar was identified to be better suitable for a certain production systems, only slightly variations between systems were found.

## Conclusions

- Our results show the need to invest in local selection programs as well as breeding programs using locally selected genetic material to increase yields.
- We highlight the potential for organically managed cacao production systems since they had similar yields as the conventionally managed. This might bring additional income to farmers when organic premium prices is paid.
- There is a need to select and breed for genetic material more adapted to low light intensities to increase cacao yields in agroforestry systems and promote their broader adoption to increase the sustainability of cacao production.
- It is highly recommended the use of clones instead of genetic material coming from crossings without previously testing their performance