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## Cocoa Yield Development of Different Sites, Varieties, Production Systems and Years, in Alto Beni, Bolivia

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### Abstract

One of the most essential limiting factors of cocoa (*Theobroma cacao* L.) productivity worldwide is pests and diseases. Each of the major production regions has its specific pests and diseases. Reported yield losses range from minor to almost 100 per cent.

In Alto Beni, located in the Amazonian watershed of the department La Paz, Bolivia, the Research Institute of Organic Agriculture (FiBL) and its local partners are addressing several problems of cocoa producers using a participatory technology development approach. Problems were identified in a participatory way and are, in order of priority, i) to reduce the incidence of pests and diseases, mainly the cocoa mirid (*Monalonion dissimulatum*) and Frosty Pod Rot (*Moniliophthora roreri*); ii) to evaluate the productivity of different cocoa varieties (local selections, introduced clones), and iii) to document the management practices and plantation layouts of high yielding cocoa farmers. In order to develop novel biological pest control measures, both the knowledge of cocoa yield development in the course of the harvest period, as well as the dynamics of pests and diseases are of great interest.

Data from three different research activities of the mentioned project are analysed for yield development, the appearance, and the incidence of pests and diseases, where available. The research data are from:

- a) On-farm trials in multiple locations which were established in 2004. The performance of 16 cocoa varieties has been assessed for 3 years (2010–2012).
- b) Four high yielding cocoa farmers' fields (2012 only).
- c) A long-term field experiment assessing the sustainability of five cocoa production systems (2011 and 2012). The trial investigates the influence of monocultures and different agroforestry systems under organic and conventional management on the yield development, among other agronomic, economic and environmental parameters.

**Keywords:** Cocoa, diseases, pests, production-system, yield-development

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# Cocoa Yield Development in Alto Beni, Bolivia: Influence of Sites, Varieties and Years

## Background

- Essential limiting factors of cocoa productivity are pests and diseases.
- To develop control measures for organic cocoa producers, knowledge of yield development and pest and disease dynamics are important.

## Objective

- Address problems of cocoa producers in Alto Beni, Bolivia, with a Participatory Technology Development (PTD) approach.

## Material and methods

- Problems identified by farmers' survey:
  - Pests, i.e. cocoa mirid (*Monalonion dissimulatum*), and diseases, i.e. frosty pod rot (*Moniliophthora roreri*) and black pod (*Phytophthora* spp.).
  - No reliable recommendations about varieties and field management.
- Trials to address problems:
  - On-farm trials assessing 16 cocoa varieties (established in 2004). Production system: simple organic agroforestry system with cocoa, zero external input.
  - Documentation of best practices of four successful cocoa farmers (2012 only). Production system: simple to complex organic agroforestry system with low to zero external input.

## Results

- In area IIb of Alto Beni (site: "Brecha F"), local selections Ila 58, III 06 and III 13 show both highest productivity and most rapid yield development (Figure 1).
- Ila 58, III 06 and III 13 produce > 75% of their yield until end of June (half month 12) thus they escape the 2nd peak of pests and diseases incidences in the half month 15 (Figure 1B).
- With good practices, one can produce more than 1 t ha<sup>-1</sup> of organic cocoa beans (Figure 2).
- Cocoa mirid, and the in Alto Beni novel disease frosty pod rot, can cause up to 50% loss of harvest (Figure 2) despite following good practices.

## Conclusions/Outlook

- For area IIb, varieties Ila 58, III 06 and III 13 seem to be promising to achieve high yields with little losses due to pests and diseases incidences.
- Replication of the trials in different years and weather conditions are essential to make our results more solid.
- Variety recommendations cannot be made until there are results about susceptibility to the novel disease frosty pod rot.
- The development of organic pest and disease control measures is essential to sustain productivity of organic cocoa farmers.

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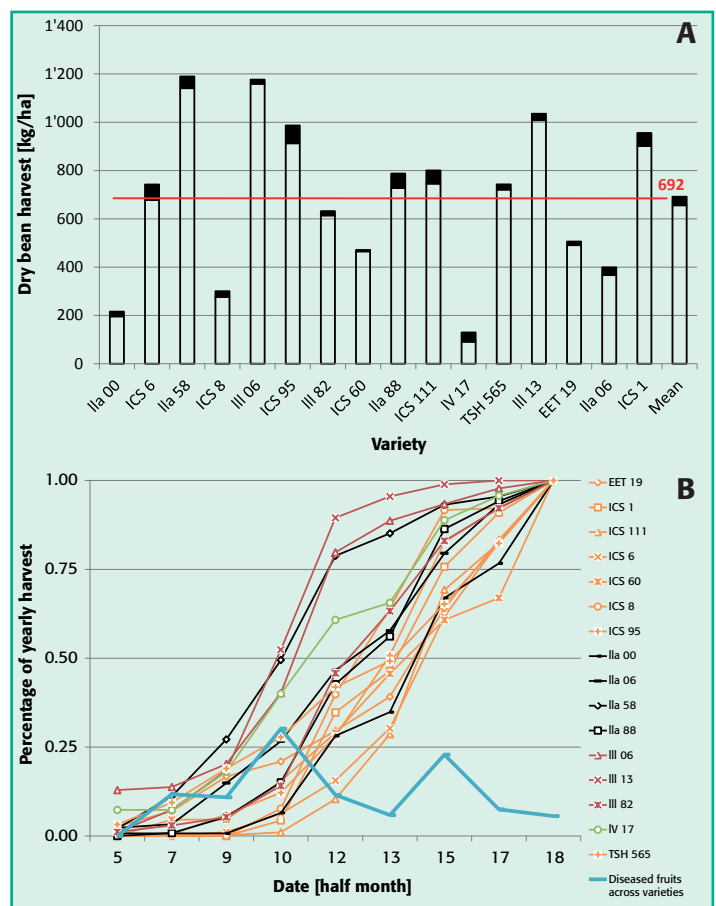
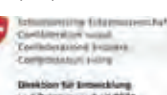


Figure 1: Assessment of 16 cocoa varieties in area IIa of Alto Beni, Bolivia, 2011; A: Productivity, red line = average of 16 varieties, closed bars are beans from partly diseased fruits marketed as 2nd quality. B: Precocity and pest and disease dynamics, orange lines are introduced clones, black, red and green lines are local selections of areas IIa, III and IV of Alto Beni, respectively; Dates are displayed as half months, i.e. 5 = 1st half of March, 7 = 1st half of April, etc.

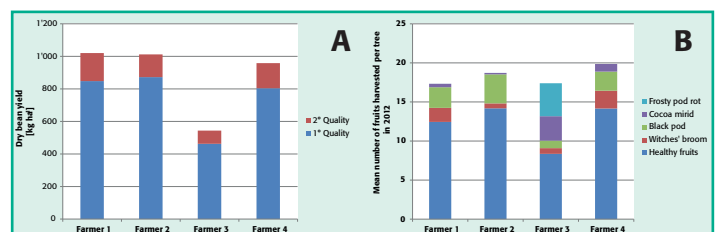


Figure 2: Cocoa harvest (A) and number of healthy and diseased fruits harvested per tree (B) in four high yielding farmers' fields, Alto Beni, Bolivia, 2012.

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