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Productivity and Profitability of a Cotton-based Production System under Organic and Conventional Management in India

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Abstract

The debate on the relative benefits of conventional and organic farming systems is more topical than ever. The achievements of conventional high-input agriculture were largely brought about at the cost of deteriorating soil fertility; furthermore, they were based to a large extent on fossil fuels. Developing more sustainable farming practices on a large scale is of utmost importance. However, information about the performance of agricultural production systems under organic and conventional management in tropical and subtropical regions is largely lacking. This study aimed to assess agronomic and economic data from a long-term farming systems comparison trial under semi-arid conditions in central India.

Four two-year crop rotations comprising cotton-soybean-wheat under biodynamic, organic and conventional management were investigated, including one conventional system with and one without transgenic *Bt* cotton, between 2007 and 2010.

Results showed 13 % lower yields in organic compared to conventional systems. Yields in cotton, soybean and wheat were on average 14 %, 7 % and 15 % lower, respectively. However, production costs of organic systems were on average 32 % lower than those of conventional systems, which led to similar gross margins in all systems.

To our knowledge, this is the first long-term field trial comparing the agronomic and economic performance of organic, conventional and conventional+*Bt* cotton-based farming systems. The results of our study suggest that organic farming is a promising alternative to conventional farming in cotton-based production systems in central India. The less capital intensive nature of organic systems may be particularly interesting for smallholder farmers as it decreases dependence on loans for farm inputs. Therefore, our findings have the potential to be useful for decision-making and in turn may lead to a redirection of agricultural policies.

Keywords: *Bt* cotton, economic analysis, long-term experiment, organic agriculture, smallholder farmer, soybean, systems comparison, wheat

Economic profitability of organic vs. conventional cotton-based production systems in a long-term field trial in India

Background

- Developing sustainable farming systems on large scale is very important for sustainable development of global agriculture (IAASTD, 2009).
- Scientific results about organic vs. conventional agriculture in the tropics are sparse.

Objective

- To assess productivity and profitability of cotton-based production systems under organic and conventional management in central India.

Material and methods

- Semi-arid climate zone
- Vertisol soil, Madhya Pradesh, India (Fig. 1)
- Time: 2007-2010 (conversion phase)
- Agronomic and economic data (plot level)
- Crop rotation (2 years): Cotton-soybean-wheat under biodynamic, organic and conventional (with/without Bt cotton) management (Fig. 2)



Figure 1: View of the farming systems comparison trial.

Results

- 7 %–15 % lower yield for all organically produced crops compared to conventional systems (Fig. 3).
- Lower production costs in organic systems, therefore similar gross margins in all systems (Fig. 4).

Conclusions

- Organic cotton production systems can produce high yields at low inputs of fertilizer and capital.
- Crucial factors for the economic profitability have to be considered such as access to knowledge and organic inputs (fertilizers, pesticides, non-GM seeds), existing market demand and certification system have to be considered.

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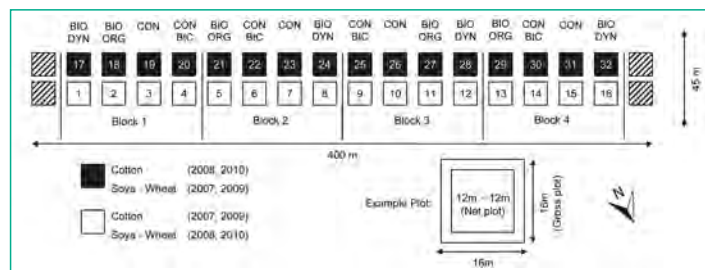
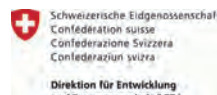


Figure 2: Experimental design of the farming systems comparison trial. Farming systems: biodynamic (BIODYN), organic (BIOORG), conventional (CON), conventional with Bt cotton (CONBtC).

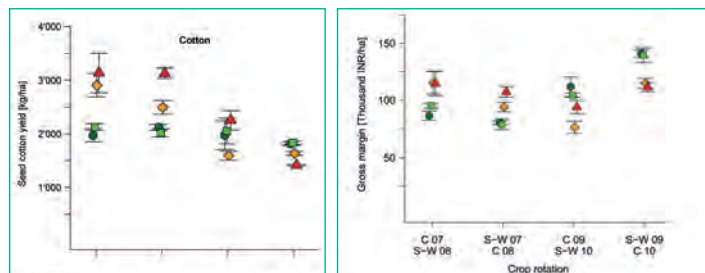
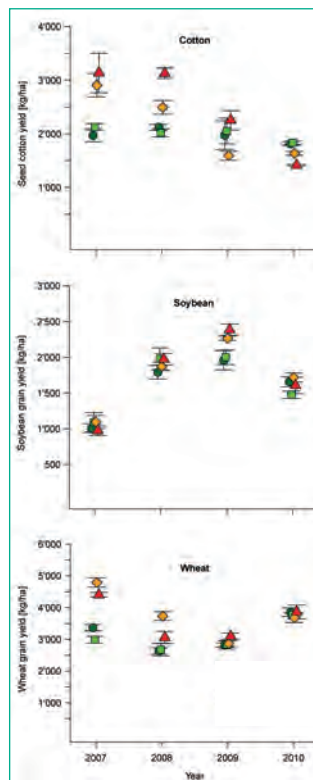


Figure 4: Gross margins of four crop rotations. C = cotton, S-W = soybean-wheat.



Farming systems:
● biodynamic (BIODYN),
■ organic (BIOORG),
♦ conventional (CON),
▲ conventional with Bt cotton (CONBtC).

Figure 3: Yield 2007-2010 in cotton, soybean and wheat.

Literature

IAASTD (2009) International assessment of agricultural knowledge, science and technology for development (IAASTD): Executive summary of the synthesis report. Washington, DC: Island Press. 606 p.
Forster D, Andres C, Verma R, Zundel C, Messmer MM, Mäder P (2013) Yield and Economic Performance of Organic and Conventional Cotton-based Farming Systems – Results from a Field Trial in India. PLoS One (submitted).

More information: <http://www.systems-comparison.fibl.org/>; *christian.andres@fibl.org