

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

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Abstract

The debate on benefits of conventional and organic farming systems has recently gained significant interest. Results from systems comparisons in the South, however, are scarce. This study presents agronomic and economic data of a systems comparison trial in India. We observed significantly lower yields in organic systems in crop cycle 1 (2007-2008) for cotton (-29%) and wheat (-27%), whereas in crop cycle 2 (2009-2010) yields were similar in all systems. In contrast, organic soybean yields were only marginally lower (cycle 1: -1%, cycle 2: -11%). Gross margins were significantly higher in conventional systems in cycle 1 (+29%), whereas in cycle 2 they were significantly higher in organic systems (+25%) due to lower variable production costs. Soybean gross margin was significantly higher in an organic system (+11%) across the four harvest years. We suggest that organic soybean production is a viable option for smallholder farmers under semi-arid conditions in India.

Introduction

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 based to a large extent on fossil fuels and largely brought about at the cost of deteriorating soil fertility. Developing more sustainable farming practices on a large scale is of utmost importance (IAASTD, 2009). However, information about the performance of farming systems under organic and conventional management in tropical and subtropical regions is sparse.

Material and methods

This study presents agronomic and economic data from the conversion phase (2007-2010) of a farming systems comparison trial on a Vertisol soil in central India. A cotton-soybean-wheat crop rotation under biodynamic, organic and conventional (with and without genetically modified (GM) Bt cotton) management was investigated (Figure 1). A detailed description of the materials and methods used in this study can be found in Forster et al. (2013)

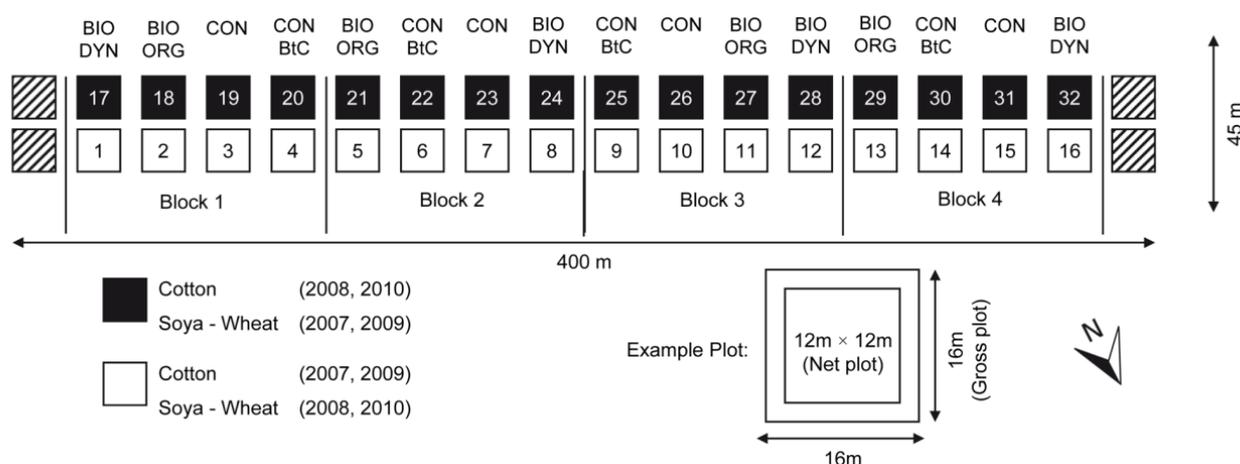


Figure 1: Experimental design of the farming systems comparison trial. Farming systems: biodynamic (BIODYN), organic (BIOORG), conventional (CON), conventional with Bt cotton (CONBtC).

Results

We observed a significant yield gap between organic and conventional farming systems in the first crop rotation (cycle 1: 2007-2008) for cotton (-29%) and wheat (-27%), whereas in the second crop rotation (cycle 2: 2009-2010) yields were similar in all farming systems (Figure 2). Lower variable production costs in organic farming systems (-32%) led to similar gross margins in all systems, averaging 104'909 Indian rupees ha⁻¹ (equivalent to 2'089 US Dollars ha⁻¹) per crop rotation (Figure 3). Conventional farming systems achieved significantly higher gross margins in cycle 1 (+29%), whereas in cycle 2 gross margins in organic farming systems were significantly higher (+25%).

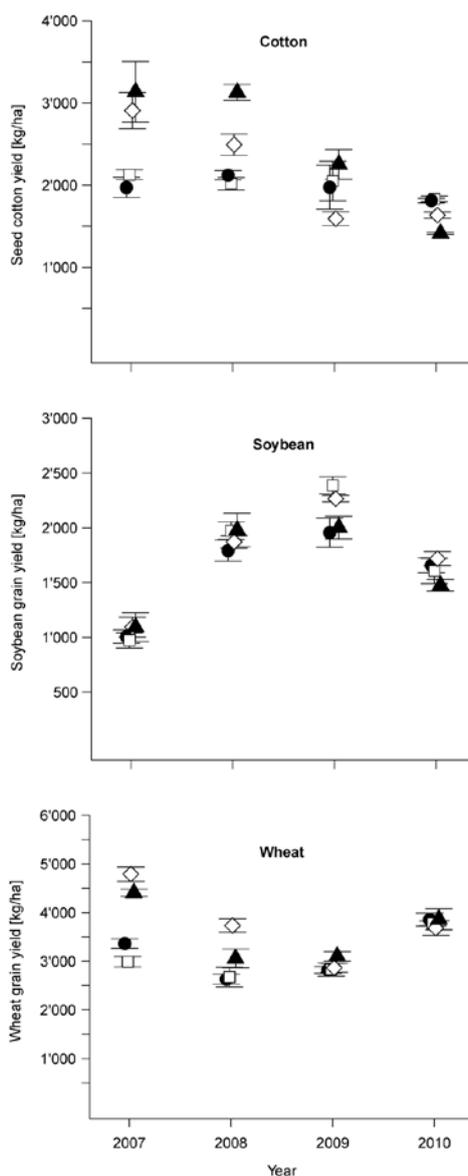


Figure 2: Yield 2007-2010 in cotton, soybean and wheat. Farming systems: ● biodynamic (BIODYN), ■ organic (BIOORG), ◆ conventional (CON), ▲ conventional with Bt cotton (CONBtC).

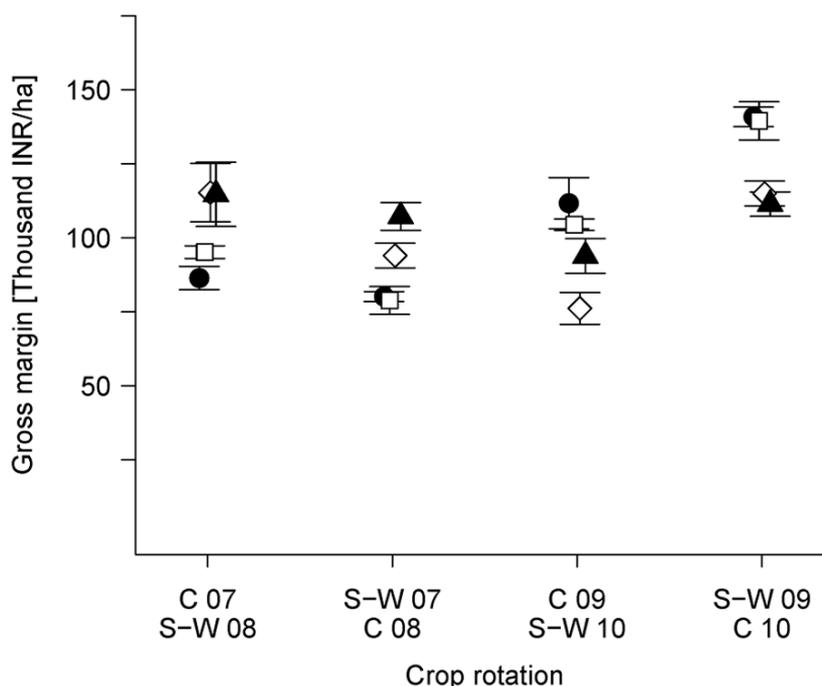


Figure 3: Gross margins of four crop rotations. C = cotton, S-W = soybean-wheat. Farming systems: ● biodynamic (BIODYN), ■ organic (BIOORG), ◆ conventional (CON), ▲ conventional with Bt cotton (CONBtC).

Discussion

Our findings show the potential benefits of organic farming systems under the premise that marginal farmers have access to knowledge, purchased inputs such as organic fertilizers, pesticides and non-GM seeds, and assuming that there is a market demand and well developed certification system (Forster et al. 2013). Future research needs to elucidate the long-term productivity and profitability, particularly of cotton and wheat, and focus on the ecological impact of the different farming systems. Furthermore, the results need to be verified in further crop cycles and on geographically spread on-farm comparisons.

References

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