

Christelle Ledroit<sup>2</sup>, Bhupendra Singh Sisodia<sup>1</sup>, Ishwar Patidar<sup>1</sup>, Chigusa Keller<sup>2</sup>, Akanksha Singh<sup>2</sup>

<sup>1</sup>bioRe Association, Agronomy, India

<sup>2</sup>Research Institute of Organic Agriculture (FiBL), Switzerland

# Long term comparison studies of biodynamic and conventional cotton based farming systems



## Background

Long-term studies in the tropics have not been assessed in a systematic manner in comparison to temperate regions. To fill this gap, SysCom Long Term Experiment (LTE) project was started in the tropics in 2007. LTE is similar to the DOK trial. It provides solid agronomic and socio-economic data on the performance of major agriculture production systems in a long-term scope.

## Aim

The SysCom LTE project aims to establish a scientific basis for discussions on the performance and potential of four different management systems in tropical countries to a rational level.

## Methods

Located in the region of Madhya Pradesh, central India, the Long-Term Experiment (LTE) was implemented in a randomized block design with four replications in a cotton-based production system in a 2-year rotation with wheat, soybean, and chickpea. Four different management systems are being compared: organic, biodynamic, and conventional with and without GM cotton production systems. (Figure 1)

## Results

- After 10 years, biodynamic and organic Soil Organic Carbon (SOC) has shown to be significantly higher than both conventional systems (Figure 2)
- BD (biodynamic) have shown to have an over all higher beneficial fungal community in comparison to the other farming systems (Figure 3)
- Microbial biomass carbon and nitrogen were significantly higher in biodynamic systems in comparison to Bt-conventional systems (Figure 4)
- The earthworm's density were significantly higher in biodynamic and organic systems in comparison to both conventional systems during the surveys 2017-2018 (Figure 5)

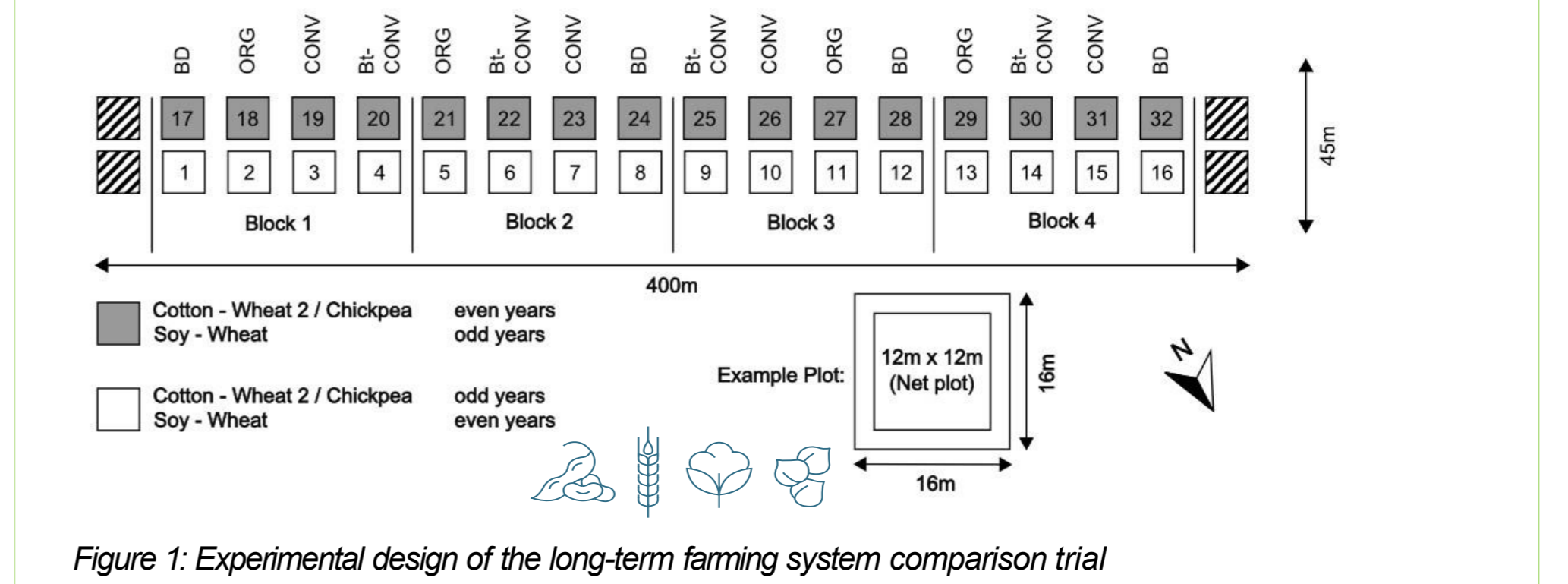


Figure 1: Experimental design of the long-term farming system comparison trial

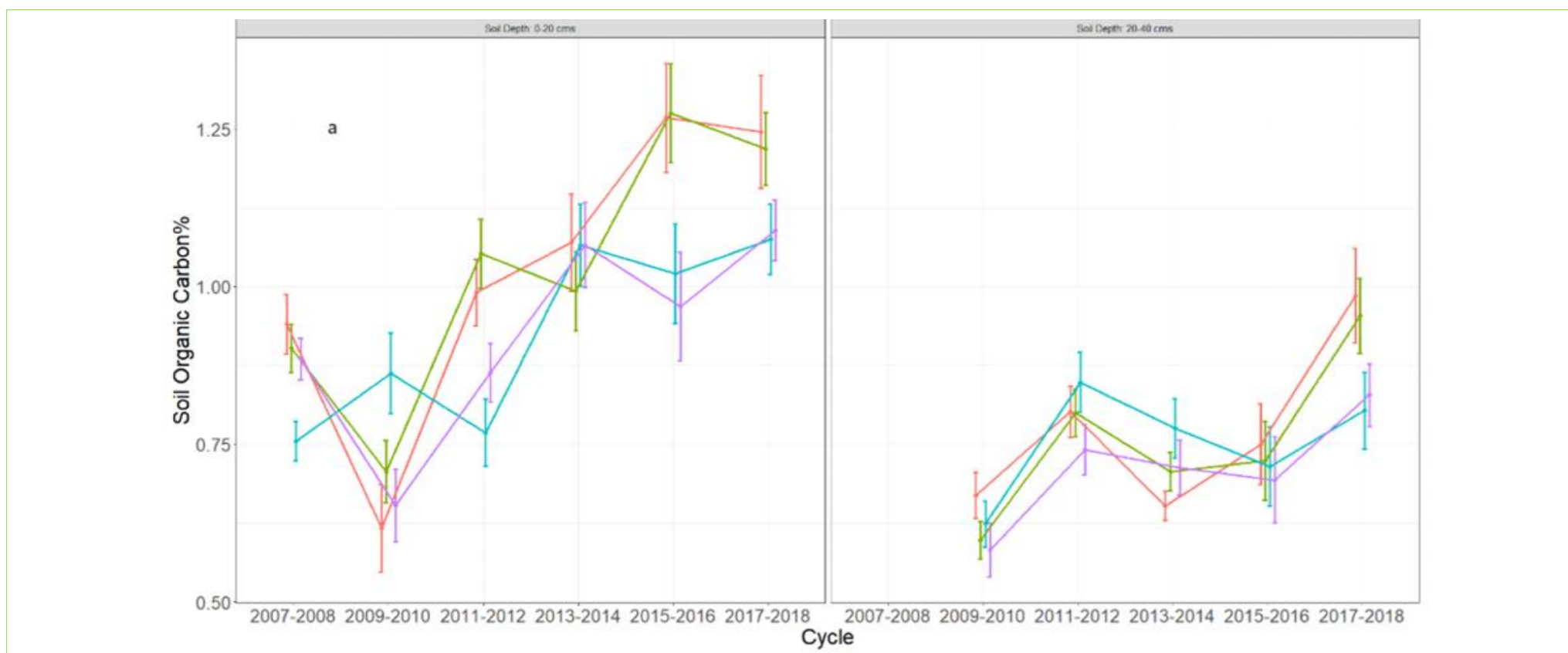


Figure 2. (a) Soil organic carbon concentration in the different farming systems, across the cycles, at different soil depths. Error bars represent  $\pm SE$  (Singh, 2025)

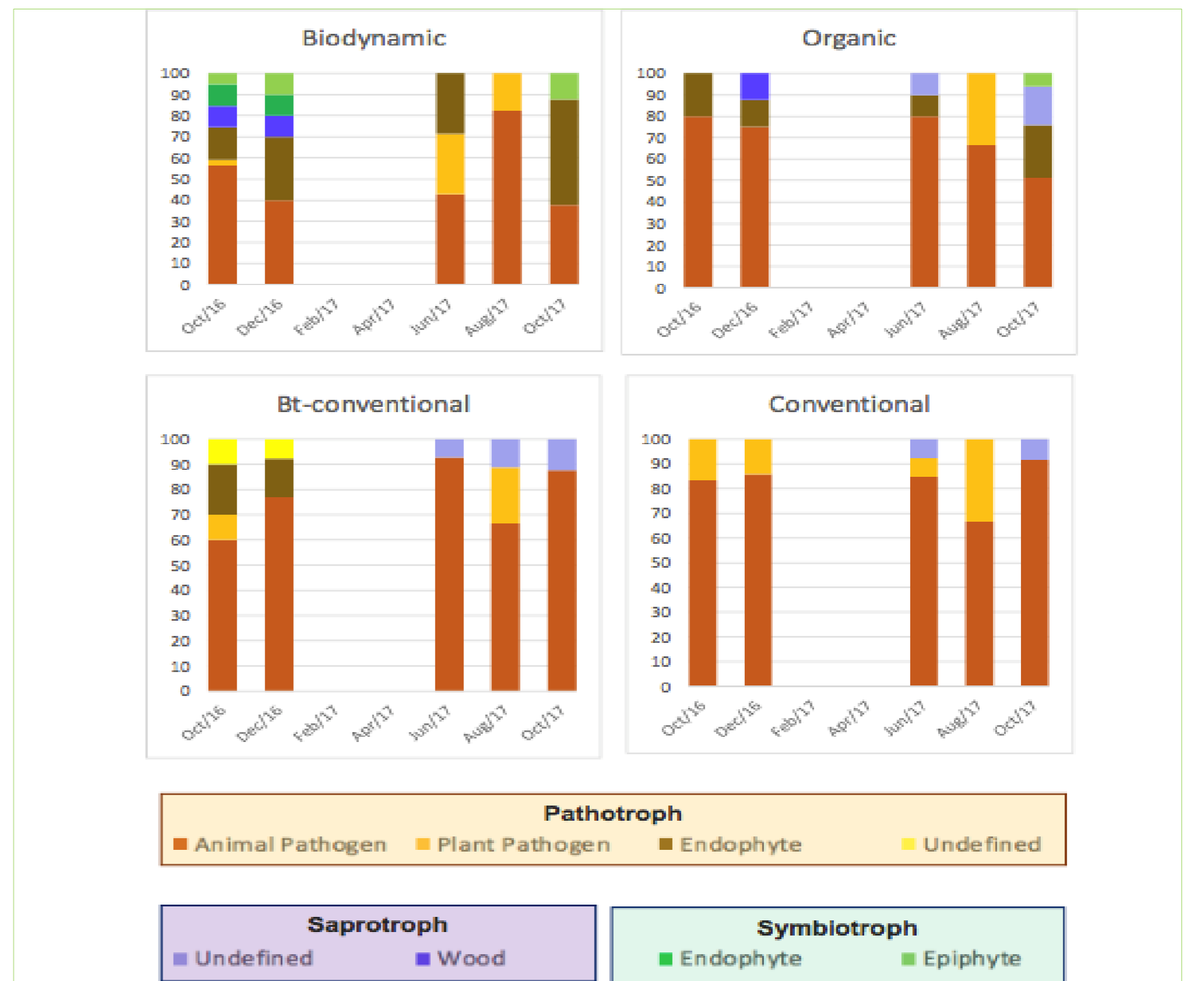


Figure 3. Fungi guilds and trophic modes of the fungal community in biodynamic, organic, conventional and Bt-conventional cotton farming systems on the long-term experiment (Ledroit, 2023)

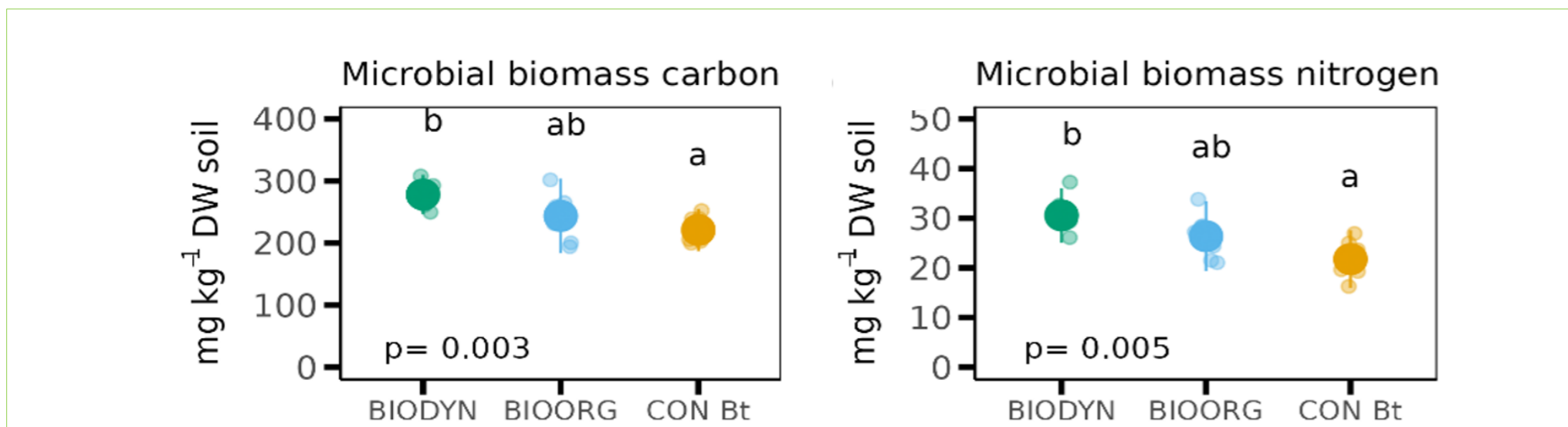


Figure 4. Farming system effects on biological soil quality indicators. BIODYN: biodynamic farming system; BIOORG: bio-organic farming system; CON Bt: conventional farming system with Bt cotton cultivation in the crop rotation (Lori, 2024)

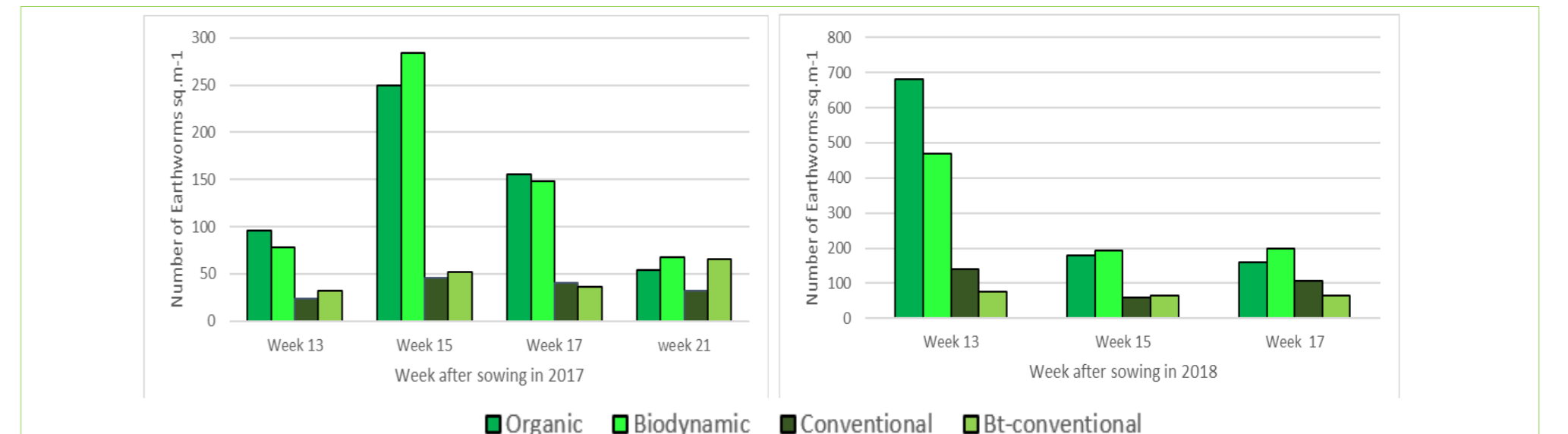


Figure 5. Earthworm density per square meter for the survey 2017 (a) and 2018 (b) on the long-term trial comparing organic, biodynamic, conventional, Bt-conventional cotton systems (Ledroit, 2023)

## Conclusion

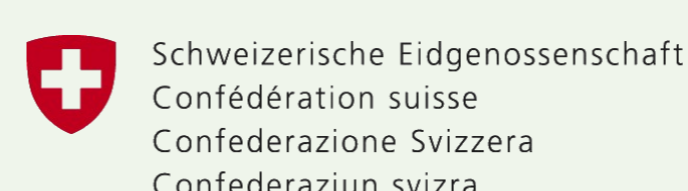
The holistic biodynamic management systems have shown a potential positive effect on the different soil biological soil quality indicators, however deeper mechanistic understanding is needed on the effects of Biodynamic systems.

SysCom India LTE is a platform where a one health approach could be used to explore the interconnectedness between soil biodiversity, plant nutrients and human health.

## References:

- Ledroit C., 2023, Socio-Ecological sustainability of cotton farming systems in Central India, PhD thesis, Coventry University, UK.
- Lori M., Kundel D., Mader P., Singh A., Patel D., Sisodia B.S., Riar A., Krause H., 2024, Organic farming systems improve soil quality and shape microbial communities across a cotton-based crop rotation in an Indian Vertisol, FEMS Microbiology Ecology
- Singh A., Bautze D., Kiboi M., Patidar I., Bhullar G.S., Nitin Konde N., Sisodia B., Ledroit C., Riar A., 2025, Long-term impacts of farming systems and preceding crops on soil organic carbon and physiochemical properties in Vertisols of subtropical India, Soil Advances

## Donors



Swiss Agency for Development and Cooperation SDC

This project is supported by the Coop Sustainability Fund.



LED LIECHTENSTEIN DEVELOPMENT SERVICE

