Research Institute of Organic Agriculture FiBL
info.suisse@fibl.org | www.fibl.org




Microbial inoculations – Potentials, limitations and alternatives

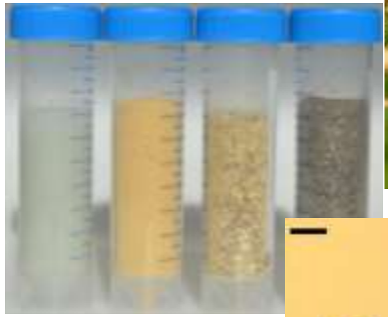
Dominika Kundel, Martina Lori, Carina Lipp, Paul Mäder, Cecile Thonar, Sarah Symanczik

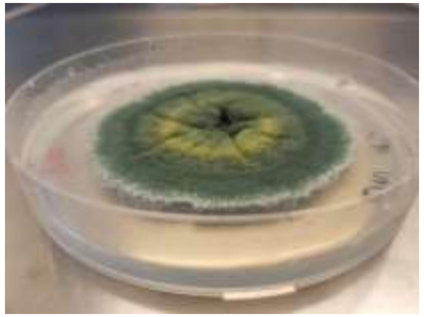
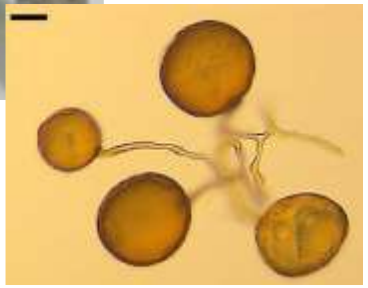
Jahrestagung der BGS/SGP/SGPW, 22.3.2024

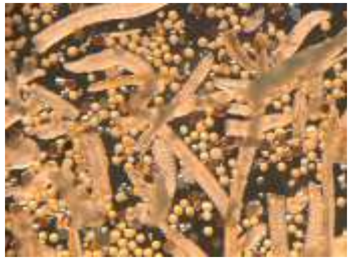
Microbial inoculants

- Definition: Formulations containing living or latent cells of efficient microorganism strains (bacteria, fungi, arbuscular mycorrhizal fungi, etc.)

- Mode of action:
    - Biocontrol: to improve plant fitness
    - Biofertilization: to improve plant nutrition
    - Biostimulation: to improve plant growth
    - All-rounder





Microbial inoculants on the market

Example: FiBL input list

- Category Fertiliser - Additives: 38 preparations from 17 suppliers
- Category Plant protection: 30 preparations from 11 suppliers

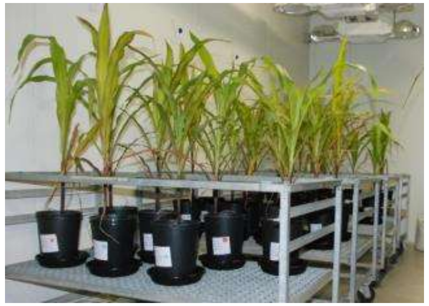
FiBL

The project Biofector

Overall aim

- Reduce the input of mineral fertilizers in European agriculture
- Develop adapted inoculants to improve the efficiency of alternative fertilization strategies

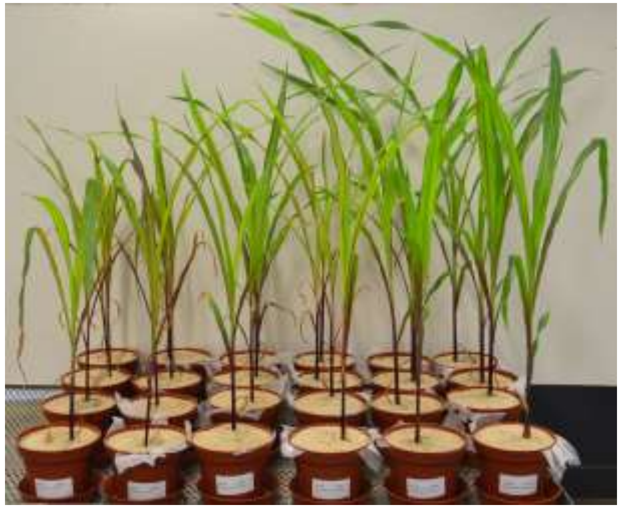
21 Institution in 11 countries

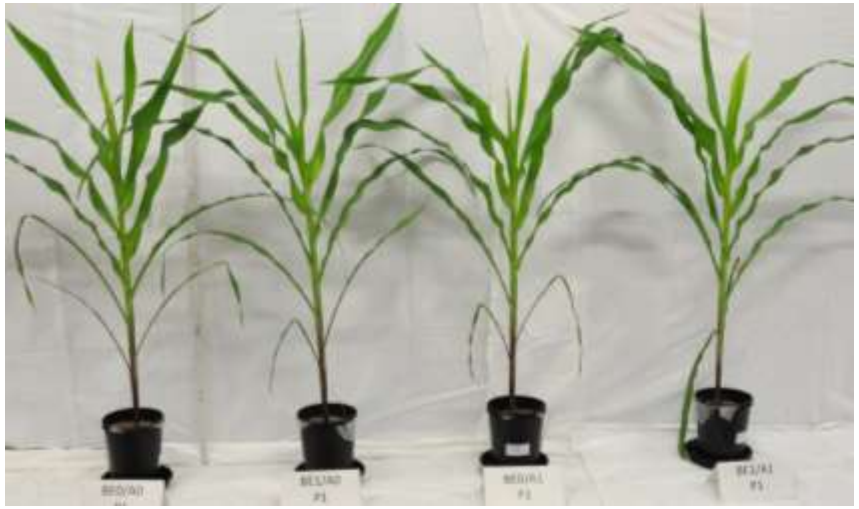


From controlled to field conditions

FiBL

Biofector @ FiBL – Testing across scales





FiBL

Symanczik et al. (2023) Limited effectiveness of selected bioeffectors combined with recycling phosphorus fertilizers for maize cultivation under Swiss farming conditions. Front. Plant Sci. 14:1239393. doi: 10.3389/fpls.2023.1239393

Biofector @ FiBL – Testing across scales

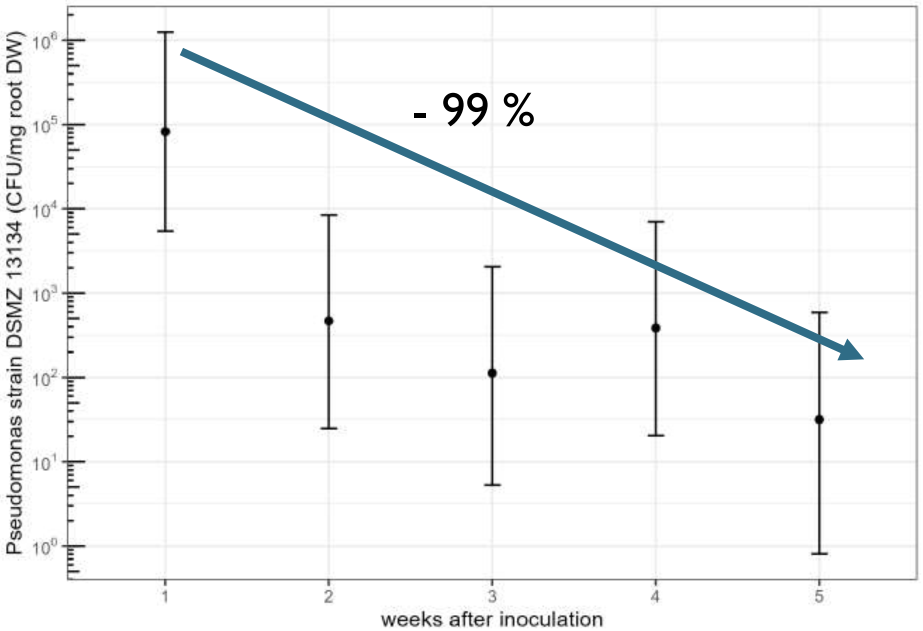
Screening experiment

Validation experiment

Field testing

- Minor growth promoting effects after 4 weeks
- No effects after 8 weeks and under field conditions

- Tracing experiment → ineffective establishment of inoculated strains



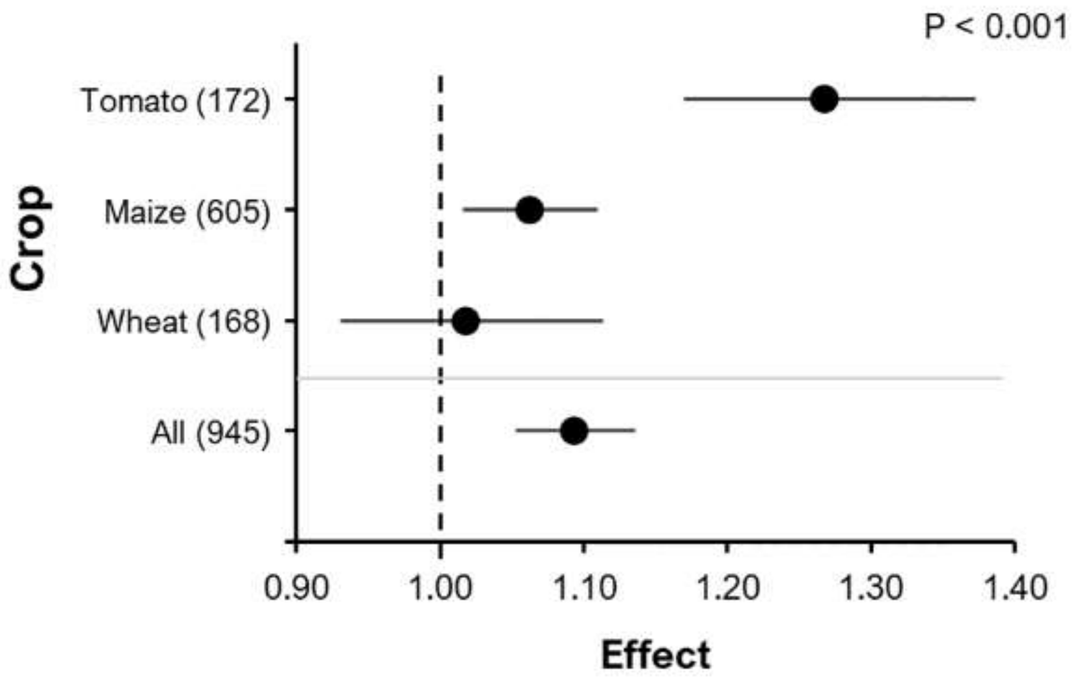
Symanczik et al. (2023) Limited effectiveness of selected bioeffectors combined with recycling phosphorus fertilizers for maize cultivation under Swiss farming conditions. Front. Plant Sci. 14:1239393. doi: 10.3389/fpls.2023.1239393

FiBL

Biofector Meta Study - Main Results

Nkebiwe et al. (accepted) Effectiveness of bio-effectors on maize, wheat and tomato performance and phosphorus acquisition from greenhouse to field scales in Europe and Israel: a meta-analysis. Front. Plant Sci. 15:1333249. doi: 10.3389/fpls.2024.1333249

- Results based on 94 pot trials and 47 field trials
- Effectiveness depending on
  - Crop

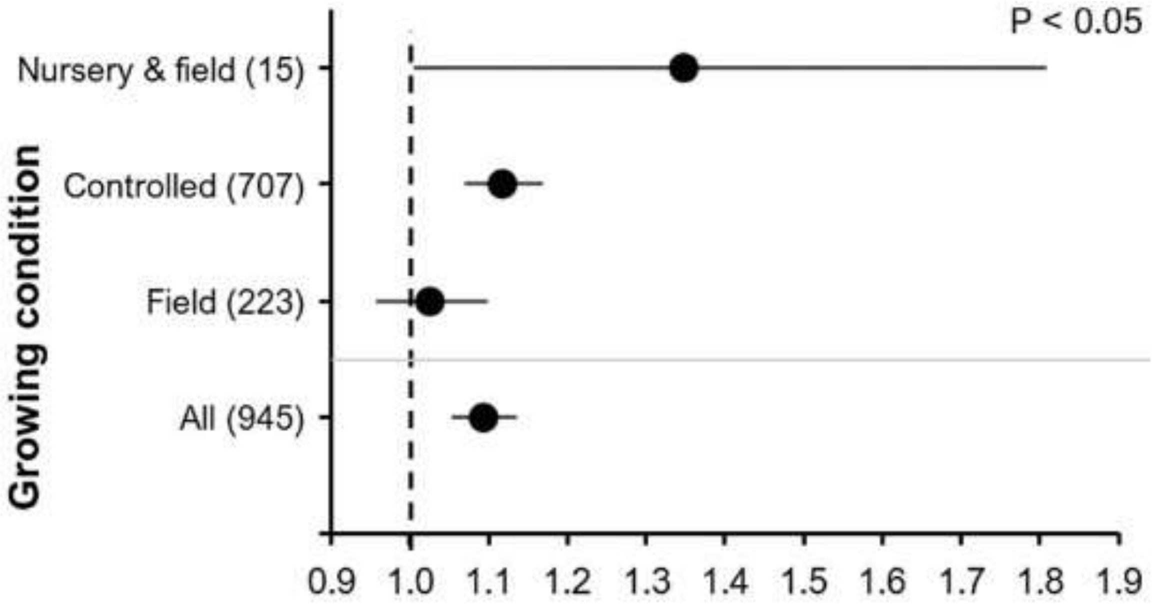


FiBL

Biofector Meta Study - Main Results

Nkebiwe et al. (accepted) Effectiveness of bio-effectors on maize, wheat and tomato performance and phosphorus acquisition from greenhouse to field scales in Europe and Israel: a meta-analysis. Front. Plant Sci. 15:1333249. doi: 10.3389/fpls.2024.1333249

- Results based on 94 pot trials and 47 field trials
- Effectiveness depending on
  - Crop
  - Growing conditions

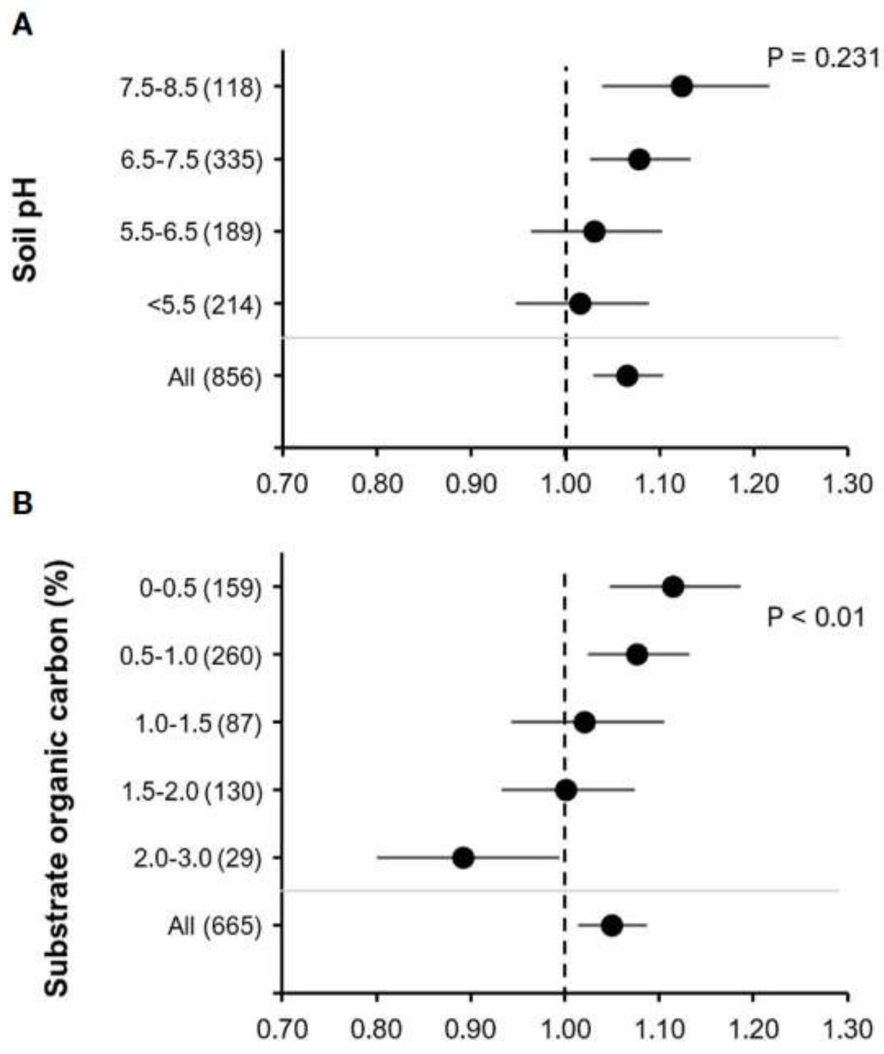


FiBL

Biofector Meta Study - Main Results

Nkebiwe et al. (accepted) Effectiveness of bio-effectors on maize, wheat and tomato performance and phosphorus acquisition from greenhouse to field scales in Europe and Israel: a meta-analysis. Front. Plant Sci. 15:1333249. doi: 10.3389/fpls.2024.1333249

- Results based on 94 pot trials and 47 field trials
- Effectiveness depending on
  - Crop
  - Growing conditions
  - Soil properties



FiBL

Microbial inoculations – Potentials and limitations

Potentials

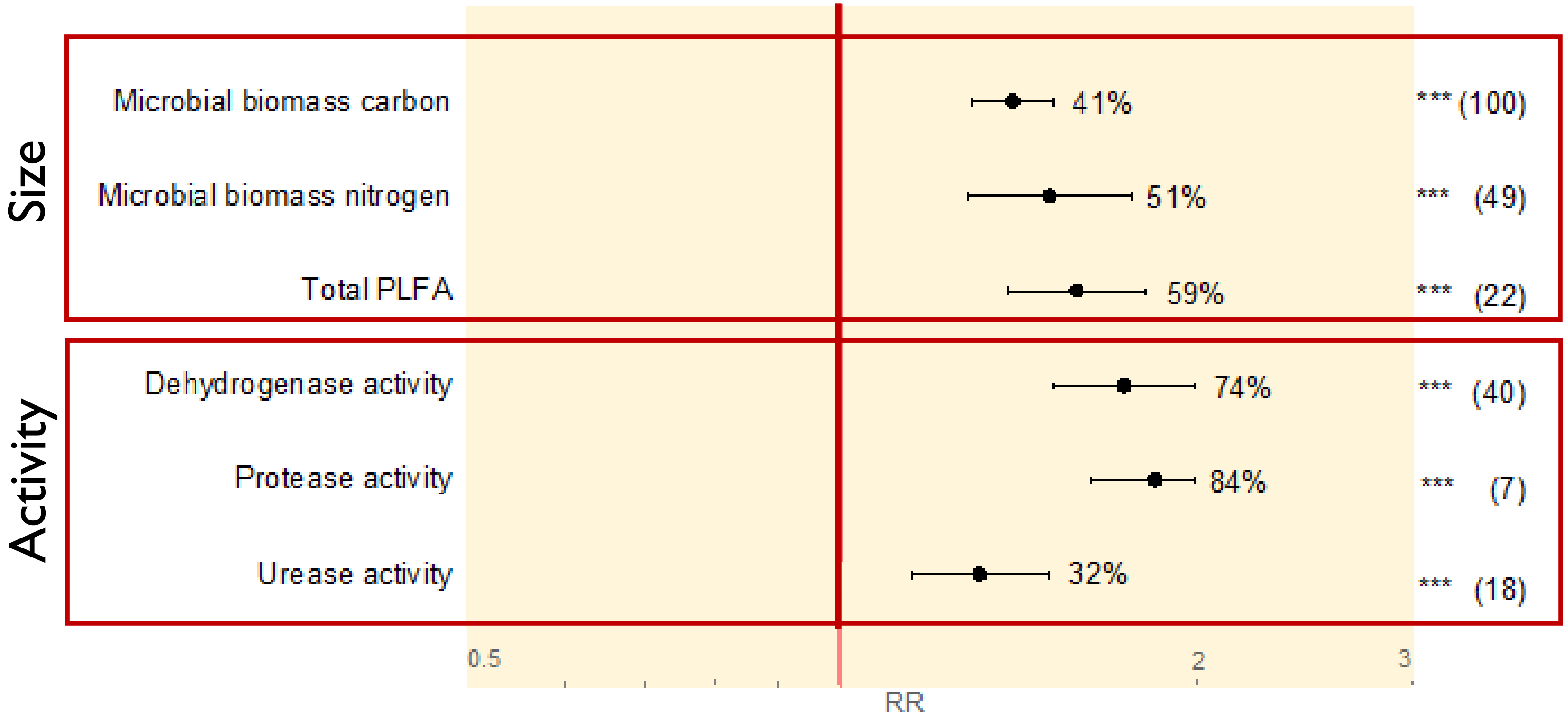
- Soils with low fertility
- Vegetables involving nursery cultivation (low microbial substrates)
- Dry and tropical climates (Schütz et al. 2017)
- Disease infested soils (Lutz et al. 2023)

Limitations

- Ineffective microbial strains
- Poor product quality (Salomon et al. 2022)
- High investments

FiBL

Alternatives: Indirect management of soil microbes via improved management practices



→ Organic farming has a strong positive effect on the size and activity of microbial communities

FiBL

Lori et al. (2017). Organic farming enhances soil microbial abundance and activity—A meta-analysis and meta-regression. *PloS one*, *12*(7), e0180442.

Alternatives: Indirect management of soil microbes via improved management practices

Positive effects on soil microbes through:

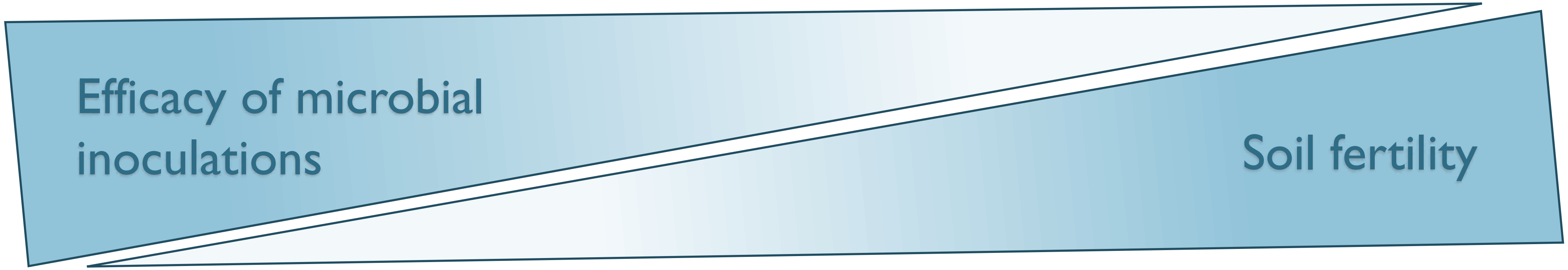
- Diverse crop rotations (with legumes)
- Organic fertilizers
- High organic carbon content

FiBL

Lori et al. (2017). Organic farming enhances soil microbial abundance and activity—A meta-analysis and meta-regression. *PloS one*, *12*(7), e0180442.

Conclusion

- Context specific effectivity of microbial inoculants



- Careful consideration of limitations
- Adoption of management practices promoting soil microorganisms

FiBL

Many thanks for your attention

Many thanks to all my colleagues of the soil science department at FiBL and project collaborators

For more information