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Biological Alternatives for Seed Treatment: *Enhancing Stress Resilience, Agronomic Performance, and Economic Viability in Crop Production*



Dr. Markus Weinmann

LUFA Speyer, Obere Langgasse 40, 67346 Speyer, Germany
E-Mail: weinmann@lufa-speyer.de | Tel.: +49 6232 136 1270



As Europe phases out chemical pesticides, how can we safeguard crop yields, protect biodiversity, and ensure food security?

The answer lies beneath our feet—in the power of microbial innovation.

The Challenge – Redefining Seed Treatment in a Changing Climate

- **EU Policy: Alignment with the Farm to Fork Strategy**

- 50% pesticide reduction, 20% less fertilizer use, nutrient loss mitigation

- **Market and Environmental Shifts**

- Increasing regulatory constraints & bans on key agrochemicals (e.g. neonicotinoids), innovation gaps
- Climate change-driven stresses
➔ intensified pathogen & pest pressure

- **Scientific Gaps**

- Limited scalability of biological alternatives
- Need for robust, high-performance bio-formulations
- Optimization of application methods to ensure field efficacy

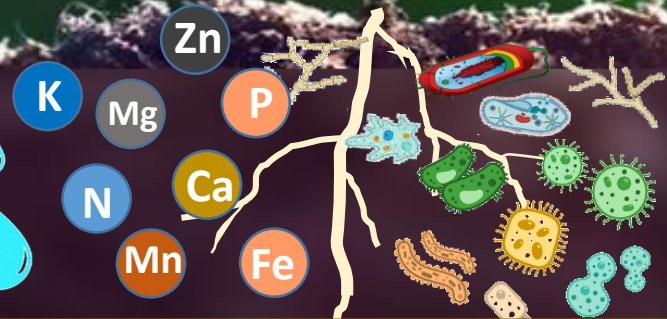
Novel disease problems:
Bacterial pathogens transferred by Cicadas



Cicadas nymphs



Rubber tubers



Picture: agrarheute.com; www.icl-group.com/

Solution - Microbial Innovation for Resilient Crops

Developing Next-Generation Biological Seed Treatments

Target Organisms:

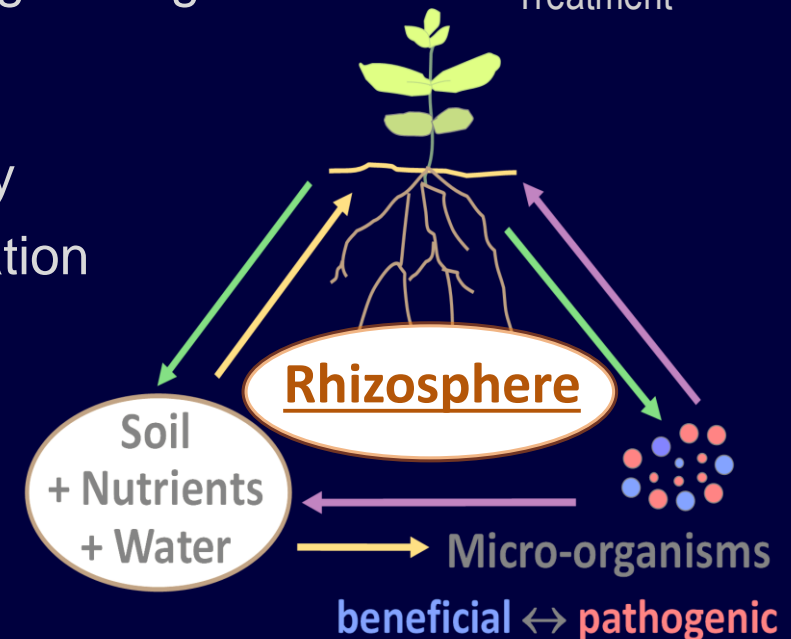
- *Entomopathogenic fungi* (e.g. *Metarhizium anisopliae*) for pest suppression
- *Mycoparasitic fungi* (e.g. *Trichoderma* spp.) for disease resistance
- *Plant Growth-Promoting Rhizobacteria (PGPR)* for enhanced stress resilience
- *Mycorrhizal fungi* (e.g. *Rhizophagus irregularis*) for root-system strengthening

Cutting-Edge Formulation Strategies:

- **Chitosan-based microencapsulation** for microbial viability and stability
- **Seed priming and microbial coatings** for optimal rhizosphere colonization
- **Precision application techniques** integrating AI-driven deployment

Expected Impact:

- ✓ Reduction in synthetic input dependence
- ✓ Enhanced resilience against biotic and abiotic stressors
- ✓ Increased agronomic performance and economic return for farmers



Future Research Directions & Partners Sought

Key Research Objectives:

- **Advancing biological seed treatments**
→ improved field persistence and efficacy for diverse geo-climatic conditions
- **Precision application techniques**
→ integrating microbial consortia with AI-driven deployment strategies
- **Multi-actor participatory research**
→ for knowledge exchange, large-scale field validation and innovation
- **Enhancing soil health and plant resilience**
→ through bio-based solutions, reducing synthetic input dependency
- **Regulatory framework optimization**
→ to accelerate investment and market access for bio-based seed treatments



Seeking Collaborative Expertise:

- ▶ **Scientific Research:** phytopathology, soil microbiology, biopolymer chemistry, ,,,
- ▶ **Industry & SMEs:** microbial and biopolymer formulations, seed treatment innovators, ...
- ▶ **Agribusinesses:** smart sensors and precision application techniques, AI-tools, ...
- ▶ **Agricultural Stakeholders:** farmers, grower associations, AKIS & implementation, ...

Let's co-develop the next generation of bio-based seed treatments and drive Europe's transition to sustainable agriculture.

Previous Scientific & Technological Expertise

Participation in EU-funded projects

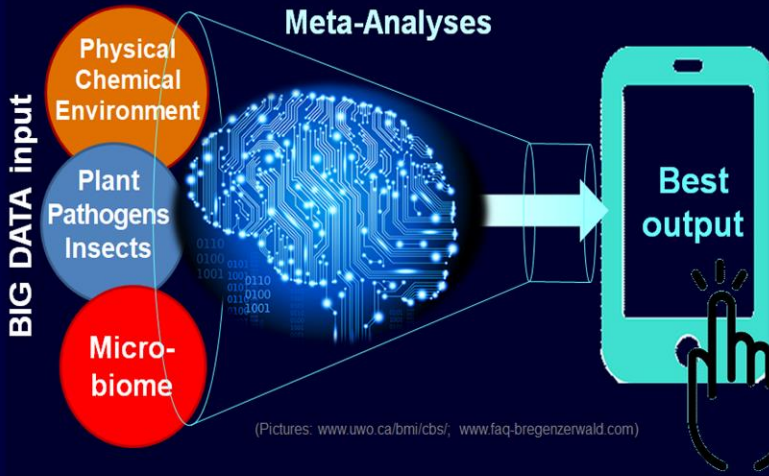
- **BIOFECTOR** – Soil biodiversity & rhizosphere microbiology
- **SOLACE** – Biostimulant-based crop resilience enhancement
- **BioFAIR** – Bioinnovation for sustainable agriculture
- **KLIMACrops** – Climate-resilient cropping systems



Technological & Scientific Strengths

- Expertise in microbial consortia engineering and plant-microbe interactions
- Advanced formulation strategies (biopolymer encapsulation, seed coatings)
- Precision agriculture integrating remote sensing and AI-driven analytics

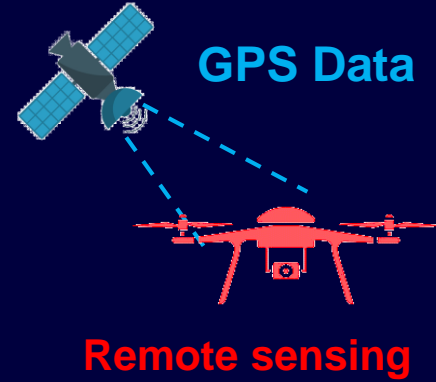
Vision of Evidence Based Agricultural Science



Recent research brought biologicals to the edge of mainstream adoption.

Now, we need the right partnerships to bridge science with scalable agricultural impact.

Conclusion & Call for Collaboration



Key takeaways:

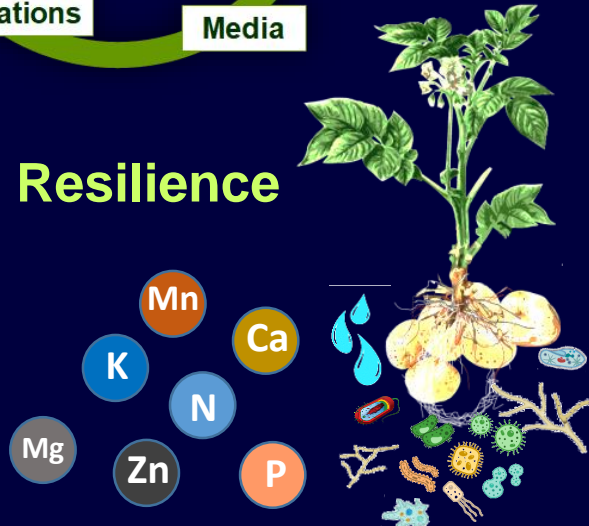
- Biological seed treatments offer a viable alternative to synthetic inputs
- Innovative microbial consortia, formulations & application strategies drive sustainability
- Interdisciplinary collaboration is essential for large-scale impact

Next steps:

- Actively forming a Horizon Europe R&I consortium
- Seeking partners for joint research, technology co-development, field validation, and market deployment
- Open for discussions—contact us to explore synergies



Stress Resilience



Together, we can transform European agriculture - one seed at a time.

Cordial Thanks for Your Attention!

Dr. Markus Weinmann

Head of Department I/1: Research, Resource Protection, and Seed Testing.

Obere Langgasse 40, 67346 Speyer

Tel.: 049 (0) 6232 136 127

Email: weinmann@lufa-speyer.de

Internet: www.lufa-speyer.de

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