RESEARCH PROJECT

BIO-CROP

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Bio-Based Agroecosystem Transitions in the Baltic and Nordic Regions through Integrated Relay Cropping Systems

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Summary

BIO-CROP is a collaborative research and innovation project designed to accelerate the transition to agroecological farming in the Baltic and Nordic regions. It introduces and implements Multilayered Relay Cropping Systems (MRCS) tailored to the region's climatic and socioeconomic conditions. These systems integrate crop diversity, allelopathic species, and on-farm bio-based inputs to improve soil health, enhance biodiversity, reduce input dependency, and build long-term farm resilience.

By addressing the limitations of conventional monocultures and chemical-intensive practices, BIO-CROP aligns directly with the European Green Deal, the Farm to Fork Strategy, the EU Soil Strategy for 2030, and the objectives of the CAP for more sustainable and resilient food systems.

BIO-CROP proposes a novel systems-based approach to cropping design that relies on vertical and temporal crop layering, combining cereals, legumes, cover crops, and allelopathic species in innovative relay cropping configurations. These systems are co-designed with farmers and advisors through Living Labs—real-world experimental platforms across seven countries. The project's Living Lab model enables farmers, researchers, policymakers, and value chain actors to co-create, test, and validate agroecological practices directly on farms under diverse soil and climate conditions. This participatory approach enhances the relevance, feasibility, and eventual adoption of MRCS at scale.

To support decision-making and knowledge transfer, BIO-CROP develops and tests practical innovations including field protocols, agroecological training modules, digital knowledge-sharing platforms, and farmer-friendly decision-support tools. These outputs are designed to empower stakeholders—from smallholders to policymakers—with actionable knowledge grounded in scientific rigor and realfarm experience. Evaluation of system performance includes environmental life cycle assessment (LCA), economic risk-benefit analysis, and social impact assessment using standardized frameworks and participatory methods.

The project also integrates youth and gender inclusion strategies to ensure the engagement of women, young farmers, and farming families in both fieldwork and decision-making processes. By fostering intergenerational learning and acknowledging women's roles in farm economics, BIO-CROP aims to make the agroecological transition inclusive and socially sustainable.

The consortium unites nine institutions from Lithuania, Estonia, Sweden, Norway, Finland, Germany, France, and Turkey. This broad collaboration facilitates cross-country comparisons and learning, enriching the outcomes and enabling replication in other European contexts. Living Lab experiences in France and knowledge transfer from Turkey provide complementary perspectives beyond the project's core region.

BIO-CROP delivers more than scientific knowledge—it provides scalable, practical pathways toward climate-resilient, economically viable, and socially accepted farming systems. Its evidence-based policy recommendations, value chain insights,

and community-grounded innovations will support the development of new incentives and institutional models for agroecological agriculture. By linking agroecological science with farmer knowledge and policy innovation, BIO-CROP sets a new standard for sustainable agriculture in cold-climate Europe and offers a model for transformative change globally.

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