BBioNets
Boosting the adoption of Bio-Based Technologies

Cross-Fertilisation Meetings
Bio-Based Practices on Farms & Forests

Accelerating "Bio-Based Practices on Farms and Forests"

Key Takeaways

CFM No1 "Innovations in Nutrient Recovery"

11 December 2025 | Online | 11:00 CET

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The Cross-Fertilisation Meeting "Innovations in Nutrient Recovery" highlighted the growing strategic role of bio-based solutions in reshaping agri-food systems towards circularity and sustainability. Across diverse applications, from crop production and soil management to livestock nutrition, the presentations demonstrated that bio-based nutrient recovery technologies are not only agronomically robust, but also economically and environmentally compelling.

A central message of the event was that **recycled and bio-based nutrient inputs, including recycled nutrient fertilisers and biochar-based solutions, can effectively replace part of conventional mineral fertilisation without compromising productivity**. Their use supports lower-input farming systems, improved nutrient efficiency, and long-term soil health, while contributing to climate mitigation through carbon sequestration and reduced greenhouse gas emissions.

Equally important was the emphasis on short, circular value chains, which enable the transformation of agri-industrial residues into high-value bio-based inputs. These models strengthen regional agri-food ecosystems by reducing waste, lowering dependency on external inputs, and enhancing competitiveness and resilience across the supply chain.

Overall, the event confirmed that innovations in nutrient recovery are a key enabler of the transition towards more sustainable, cost-efficient, and climate-resilient agri-food systems. Bio-Based Technologies (BBTs), particularly biochar and recycled nutrient fertilisers, emerge as multifunctional tools capable of delivering tangible agronomic benefits while supporting circular economy objectives and long-term strategic sustainability goals.

The effect of displacing mineral fertiliser with bio-based fertilisers in cropping systems

***Presenter**: **Daniel Coonan** – PhD Walsh Scholar, TEAGASC - Irish Agriculture and Food Development Authority (Ireland)*

- **Effective nutrient recovery and partial replacement of mineral fertilisers -** Bio-based fertilisers can successfully replace a significant share of synthetic fertilisers without compromising crop yields.
- **Soil health improvement through circular bio-based solutions -** Long-term application of bio-based fertilisers contributes to maintaining or increasing soil organic matter, improving soil structure, and building soil carbon stocks. This supports circular resource use across the agri-food supply chain by valorising agricultural and food-processing by-products.

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- **Reduced environmental footprint of agri-food production -** The use of low-emission spreading technologies (LESS) significantly improves nitrogen recovery while reducing ammonia and greenhouse gas emissions. These practices align nutrient recovery innovations with environmental compliance and sustainability targets across the agri-food sector.
- **Economic and operational feasibility for farmers and value chains -** Many bio-based fertiliser streams are locally available and relatively easy for farmers to access, offering opportunities to reduce fertiliser costs and dependence on imported mineral inputs. This strengthens linkages between primary production and food processing, enhancing resilience in the agri-food supply chain.

> ***"Bio-based nutrient recovery technologies are not only agronomically sound, but also strategically important for building more circular, cost-efficient, and sustainable agri-food supply chains."***

Integrating Biochar in Swine Feed: A Sustainable Approach to Enhancing Livestock Production and Environmental Management

Presenter: ***Apostolos Malamakis –*** *Post-Doctorate Researcher, Center for Research and Technology Hellas, Institute for Bio-economy and Agri-technology - CERTH-iBO (Greece)*

- **Biochar as an innovation in nutrient recovery and feed efficiency -** The integration of biochar derived from agricultural biomass by-products into swine feed improves nutrient utilisation and digestion efficiency. Even low inclusion rates enhance weight gain and feed-to-weight conversion, reducing nutrient losses across the livestock system.
- **Circular BBTs across the agri-food supply chain -** The approach valorises agricultural residues and pruning through biochar production, transforming low-value biomass into a functional feed supplement. This strengthens circular bio-economy models by linking crop production, biomass management, feed manufacturing, and livestock farming into an integrated agri-food value chain.
- **Environmental performance and emission reduction -** Biochar use contributes to lower greenhouse gas emissions from pig manure by improving digestion and reducing pathogenic bacteria and nitrogenous compounds. This positions biochar as both a nutritional and environmental management tool within sustainable livestock production systems.
- **Economic competitiveness and product quality enhancement -** The proposed biochar-based feed supplement addresses major cost and quality constraints in pig farming, with the potential to reduce rearing costs by up to 25% while increasing pork value by approximately 10%. Improved fatty acid profiles, reduced toxins, and lower heavy metal content enhance final product quality, supporting market differentiation within the agri-food supply chain.

> ***"Bio-based technologies, such as biochar, can simultaneously support nutrient recovery, environmental sustainability, and economic resilience in livestock-focused agri-food supply chains."***

Short Value Chains: Turning Circular By-products into Biofertilizers

Presenter: ***Luca Brenna*** *– Commercial Director and Head of Impact, Tersan Puglia (Italy)*

- **Short value chains as a driver of nutrient recovery innovation -** Short, local value chains enable the efficient recovery of nutrients from agri-industrial by-products (e.g., food processing waste, pruning residues, olive mill by-products) and their transformation into high-quality biofertilisers.

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- **Bio-based fertilisers enhancing soil biology and carbon sequestration -** The BioVegetal biofertiliser, based on stable organic matter and a highly diverse microbial consortium, significantly improves soil biodiversity, soil organic carbon stocks, and resilience to abiotic and biotic stress. This supports carbon farming approaches and the generation of carbon credits, linking nutrient recovery with climate-smart agriculture.
- **Integration of circular bio-based technologies in agri-food supply chains -** By valorising by-products from olive oil, wine, pasta, and fresh produce processing, Tersan's model integrates waste recovery, biofertiliser production, and sustainability services (carbon footprint, water footprint, metabolic profiling) into a unified agri-food value proposition. This strengthens circularity across the entire agri-food supply chain.
- **Added value for companies, farmers, and final products -** The approach delivers measurable benefits at multiple levels: reduced reliance on mineral fertilisers, improved environmental performance, enhanced crop quality (nutritional, organoleptic, and shelf life), and stronger sustainability narratives for food brands. Importantly, circularity is embedded into existing business models with minimal operational disruption.

> ***"Short, circular value chains can transform agri-industrial residues into strategic bio-based inputs, reinforcing sustainability, competitiveness, and resilience within modern agri-food supply chains."***

Field Experiments with Recycled Nutrient Fertilizers (RNFs) Conducted in Baltic Sea Countries

Presenter: ***Damian Wach –*** *senior researcher, Institute of Soil Science and Plant Cultivation (Poland)*

- **Recycled Nutrient Fertilisers as viable alternatives to mineral inputs -** Field-scale trials across Poland, Estonia, Sweden, and Germany demonstrate that recycled nutrient fertilisers (RNFs), including struvite, ammonium sulphate liquids, composts, digestates, biochars, and animal-derived pellets, can replace a significant share of mineral fertilisers without negative impacts on crop yield or biomass accumulation.
- **Comparable agronomic efficiency across diverse crops and soils -** The multi-country experiments, conducted on nutrient-poor soils and under Good Agricultural Practices, show that RNFs deliver agronomic performance comparable to conventional fertilisers in crops such as winter wheat, maize for silage, broccoli, ryegrass, oats, and spring barley. In some cases, organic RNFs (e.g. pelletised digestate) positively influenced biomass accumulation and soil organic matter stabilisation.
- **Closing nutrient loops within regional agri-food systems -** RNFs derived from biowaste, manure, sludge, and biomass residues enable the recovery and reuse of nitrogen and phosphorus within regional production systems. Their application supports nutrient circularity, reduces dependence on imported mineral fertilisers, and contributes to improved nutrient management in sensitive regions.
- **Strategic relevance for sustainable agri-food supply chains -** By validating RNFs at field scale and across multiple countries, the study lowers the adoption barrier for farmers and advisors. The results support the integration of bio-based nutrient recovery technologies into mainstream fertilisation strategies, strengthening the environmental resilience and long-term sustainability of agri-food supply chains.

> ***"Recycled nutrient fertilisers are technically sound, agronomically effective, and strategically important tools for advancing circular, low-input, and sustainable agri-food production systems."***

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Use of Biochar and Its Principal Benefits for Soil Health

Presenter: ***Gabriel Beltrán Maza*** *– senior researcher, Venta del Llano Centre of the Andalusian Institute for Agricultural, Fisheries, Food and Organic Production Research and Training – IFAPA (Spain)*

- **Biochar as a stable bio-based tool for nutrient recovery and carbon sequestration -** Biochar, produced via pyrolysis of plant-based biomass, is highly recalcitrant and remains in soils for decades to millennia. Its application supports *Innovations in Nutrient Recovery* by improving nutrient retention, reducing leaching losses, and acting as a long-term carbon sink, with approximately 2.8 kg of CO_2 captured per kg of biochar applied.
- **Improvement of soil physical, chemical, and biological properties -** Due to its high porosity, surface area, and cation exchange capacity, biochar enhances soil structure, reduces bulk density and compaction, increases water retention, and provides habitats for beneficial microorganisms. These effects are particularly relevant for degraded, sandy, or compacted soils within agri-food production systems.
- **Enhanced crop resilience and productivity -** Biochar application improves plant resistance to both abiotic stresses (drought, salinity, water stress) and biotic stresses (soil-borne diseases), while also supporting better germination and yield stability. Additionally, biochar can adsorb heavy metals in contaminated soils, improving food safety outcomes in the agri-food supply chain.
- **Greenhouse gas mitigation and climate-smart agriculture -** The use of biochar contributes to reduced methane (CH_4) and nitrous oxide (N_2O) emissions from soils, supporting climate mitigation strategies and carbon farming schemes. These benefits position biochar as a strategic bio-based technology for sustainable soil management and low-carbon agri-food value chains.

> ***"Biochar is a multifunctional, bio-based solution that simultaneously improves soil health, enhances nutrient efficiency, and supports climate resilience across agri-food production systems."***

Download the presentations **View the recording**

What are Cross-Fertilisation Meetings?

BBioNets' **Cross-Fertilisation Meetings** are essential events designed to connect the project's regional **Forest and Agriculture Networks (FANs)**. While each FAN addresses unique **regional realities and specific challenges**, there is significant common ground regarding biomass availability, exploitation potential, and shared needs. By networking across borders, the project aims to collectively increase the impact of local work significantly.

These meetings were designed to help participants:

- **Share Difficulties**: Exchange common challenges and concerns regarding the application and scaling of **Bio-Based Technologies (BBTs)**.
- **Discover Opportunities**: Outline new breakthroughs, emerging technologies, and potential market opportunities across regions.
- **Promote Knowledge**: Capture, validate, and widely promote practical knowledge created by national EIP-AGRI Operational Groups (OGs).
- **Forge Collaborations**: Facilitate bilateral and multilateral collaboration opportunities among FANs and OGs.

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The Six-Part Series: Topics and Schedule

1. **Innovations in Nutrient Recovery:** 11 December 2025
2. **Innovative Hemp Practices:** 15 January 2026
3. **Sustainable Sheep Wool Processing:** 29 January 2026
4. **Efficient Woody Biomass Utilisation:** 12 February 2026
5. **Circular Approaches in Olive Groves:** 26 February 2026
6. **Opportunities in Green Biorefineries:** 23 April 2026

BBioNets Project Identity	
Full Project Title	**BBioNets** – Creation and promotion of Forest and Agriculture Networks to boost Bio-Based Technologies adoption and Value Chain development (GA No 101133904)
Start – end date	1/11/2023 – 31/10/2026 (36 months)
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