NEWSLETTER NO. 2

Natural Solutions for Organic Farming

WELCOME & PROJECT MEETING

Welcome to the second issue of our bi-annual BIO² newsletter. One year into the project, BIO² is moving forward – from concept towards application. This became clear at the end of May, when partners met in Tromsø for the first Annual Partner Meeting, hosted by Nofima AS.

Over two days, the consortium shared progress across all areas – from developing bio-based solutions for crop protection, nutrition, and animal health to testing them in real agricultural systems and evaluating their sustainability. The focus is shifting. Discussions on scale-up, industry perspectives, field trials, and material transfer showed a clear step towards implementation. At the same time, exchanges on growers' networks reinforced the link between research and practice.

We were also pleased to welcome Veronika Maurer, Scientific Coordinator of our sister project SCALE-it, underlining the growing connection between both initiatives. With renewed focus and shared momentum, BIO² now enters its next phase.

WHAT WE DO
BIO² AT A GLANCE

The Challenge

Organic farming is growing across Europe but still depends on some inputs that harm soil, biodiversity, and animal health – such as copper, sulfur, antibiotics, and antiparasitic drugs. Even fertilizers approved for organic farming can contain pesticide residues, threatening crops and ecosystems.
BIO² addresses these issues by developing natural, bio-based alternatives that support the EU Green Deal and the Farm to Fork Strategy for sustainable, circular food systems.

Our Natural Solutions

1. Microorganisms for Crop Protection
Beneficial yeasts, bacteria, and microalgal extracts are encapsulated in natural polymers, protecting them from field stress and extending their effectiveness – much like probiotics for plants.

2. Bio-based Fertilizers
Made from fish by-products, seaweed, recycled urine, and microbes, these fertilizers deliver balanced nutrition without residues or animal-based inputs.

3. Natural Animal Health Products
Microbial immunostimulants and bark extracts strengthen immunity and reduce antibiotic and antiparasitic use – protecting both animals and soil life. All BIO² innovations are tested under real organic farming conditions to ensure safety, efficacy, and scalability.

Our Impact

- **Reduce environmental pollution** from copper, sulfur, and pharmaceuticals
- **Preserve soil health**, biodiversity, and beneficial insects
- **Support a circular bioeconomy** through resource reuse
- **Help farmers transition to resilient**, sustainable systems

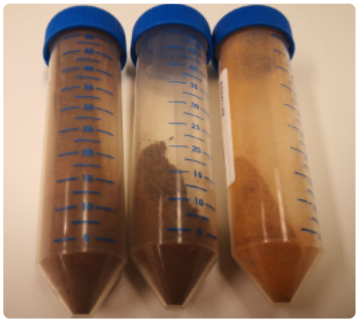
Key Facts

- **Programme:** Horizon Europe (Farm2Fork)
- **Duration:** May 2025 – April 2029
- **Budget:** € 6 million
- **Coordinator:** Dr. Alessio Adamiano (National Research Council of Italy, CNR)
- **Consortium:** 20 partners from 8 countries

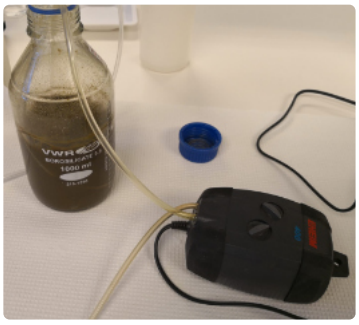
WP3 – NATURE'S PHARMACY FOR ANIMALS: BARK & MICROBIAL DEFENCES

Authors: Berit Marie Blomstrand (NORSØK), Katharina Schwaiger (acib GmbH)

Spruce bark



Bark extracts from coniferous trees



Lab work: Antiparasitic trial

Organic livestock farming aims to reduce the use of contentious veterinary inputs – but in practice, two groups of pharmaceuticals remain especially difficult to replace: antiparasitic, used against intestinal worms and other parasite infections, and antibiotics, used to treat bacterial and fungal disease.

Work Package 3 (WP3), led by Berit Marie Blomstrand from NORSØK, addresses both. Its goal is to develop bio-based alternatives for parasite control and immune support that can reduce the reliance on these pharmaceuticals while safeguarding animal health.

Katharina: WP3 focuses on alternatives to veterinary pharmaceuticals in livestock. What exactly are you developing?
Berit: We are working along two lines. First, we develop bark-based antiparasitic formulations, especially for use in lambs. Second, we produce microbial immunostimulants based on inactivated bacteria such as mycobacteria and corynebacteria. These are designed not to kill pathogens directly, but to strengthen the animal's own immune response - somewhat comparable to vaccination, although they act through broader activation of innate immunity rather than targeting a specific pathogen.

Katharina: Why are these alternatives needed?
Berit: Because both anthelmintics and antibiotics come with challenges. While parasite control in ruminants is heavily dependent on anthelmintic drugs, resistance is now widespread across Europe. Recent data for sheep and goats indicates that resistance to benzimidazoles has reached an average prevalence of 86%[1]. At the same time, reducing antibiotic use is key in light of antimicrobial resistance. Reflecting a rising global trend, antimicrobial resistance (AMR) increased significantly between 2001 and 2020, with prevalence rising from 18% to 37% on conventional farms and from 10% to 24% on organic ones.[2] While overall resistance remains higher in conventional versus organic systems, these patterns are highly context-dependent, varying significantly across different hosts, pathogens, and geographic regions. Together, these trends highlight the urgent need for alternatives.

Katharina: What does the work look like in practice?
Berit: On the antiparasitic side, we start with wet spruce bark directly from the sawmill and prepare bark extracts for testing. On the immunostimulant side, we have already produced several candidates, including formalin-killed preparations of Mycobacterium and Corynebacterium strains as well as bacterial cocktails. These candidates are then assessed in laboratory models to understand how they affect immune functions.

Katharina: And have you already seen first results?
Berit: The first experiments are underway. For the immunostimulants, mouse-based studies and *ex vivo* immune assays are being used to investigate how the formulations affect neutrophils and macrophages and whether they can induce trained innate immunity. In parallel, bark extract trials are moving forward, with additional experiments planned to test different treatment formulations which are to be implemented in WP6.

Katharina: So WP3 is not only about finding candidates, but also about making them usable later on?
Berit: Exactly. A key part of WP3 is scale-up. We are developing production routes that make these compounds available in sufficient quantity and quality for the animal studies planned in WP6. The idea is not to stop at promising lab signals, but to prepare solutions that can be tested under more realistic conditions.

WP3 shows that the future of livestock health may not lie in a single replacement product, but in a smarter combination of parasite control, immune support and scalable bio-based production. If successful, this could open the door to livestock systems that are less dependent on both anthelmintics and antibiotics – and more aligned with the principles of organic farming.

[1] *Increasing importance of anthelmintic resistance in European livestock: creation and meta-analysis of an open database | Parasite*

[2] *Global trends in antimicrobial resistance on organic and conventional farms | Scientific Reports*

Berit Marie Blomstrand

Involved BIO² partners:

WP7 – MEASURING SUSTAINABILITY: HOW BIO² EVALUATES SUCCESSS

Authors: Katharina Schwaiger (acib GmbH), Agnese Hauka (AREI)

Innovation alone is not enough. For BIO² solutions to matter in practice, they must also be safe, sustainable, economically viable, and acceptable to the people who will use them. That is the role of Work Package 7 (WP7), led by Angese Hauka from AREI. WP7 brings together sustainability assessment, toxicology, economic analysis, and stakeholder engagement to evaluate whether BIO² products can succeed beyond the laboratory.

Their tasks don't just tick boxes, they stress-test BIO² innovations from every angle.

Task 1 looks beyond the lab and asks: What is the real footprint? From raw materials to end-of-life, life cycle assessment exposes where sustainability holds or where it breaks. Task 2 focuses on ensuring the safety of BIO² products. It evaluates crop protection solutions and alternatives to antiparasitic and anthelmintic treatments using human cell-based tests, in line with the Safe and Sustainable by Design (SSbD) approach. Task 3 shifts to the market reality: Can it survive outside controlled conditions? Costs, scalability, and value chains determine whether an idea can move from pilot to practice or stall. Task 4 brings in the people who matter: farmers, industry, advisors, regulators, end users. Because uptake isn't automatic – it's negotiated, tested, and built through trust, usability, and real-world relevance.

Together, these tasks do one thing: they cut through novelty and reveal what is actually ready to work.

Some of this work has already started. In environmental assessment, partners have identified raw materials, intermediates and final products, set up reference protocols for the life cycle assessment, and begun collecting inventory data for several BIO² materials, including fish protein hydrolysates, bark extract, fucoidan, alginates and human urine-derived inputs. These early steps matter because they define how environmental performance will later be measured and compared.

The next layer is human safety. WP7's toxicology work will use advanced cell culture systems to assess potential respiratory and oral exposure risks and to investigate how BIO² products interact with biological systems. At the same time, the economic work package will use cost-benefit and cost-effectiveness analyses to determine whether BIO² products can compete with the contentious inputs they are meant to replace.

A particularly important part of WP7 is what happens

beyond the lab. Through stakeholder engagement, the team will develop information toolboxes and training materials for the BIO² products, following AKIS principles (Agricultural Knowledge and Innovation Systems) and linking scientific development to practical uptake. The aim is clear: if BIO² solutions are to create real impact, farmers and industry need knowledge they can actually use.

WP7 therefore acts as BIO²'s reality check. It ensures that project success is not measured only by scientific progress, but by something more demanding: whether these solutions are robust enough to work in the field, safe enough for people and ecosystems, and practical enough to be adopted.

Agnese Hauka, AREI, WP7 Lead

Field trials conducted within the Latvian Farmers Network on wheat (left), potato (centre), and strawberry (right).

Involved BIO² partners:

Agroresursu un ekonomikas institūts

AZTI Member of Basque Research & Technology Alliance

Consiglio Nazionale delle Ricerche

Sofia University St. Kliment Ohridski

NEIKER Member of Basque Research & Technology Alliance

FERTINAGRO Biotech

NIBIO Norsk institutt for bioøkonomi

NORSØK Norwegian Centre for Organic Agriculture

Università degli Studi di Udine

grönn gjødsel

Universität Rostock

AVA Associació Valenciana d'Agricultors

Rovensa Next

acib austrian centre of industrial biotechnology

ROMB Research Organization and Manufacture of Bioproducts

BIO² & STAKEHOLDERS

ReMade@ARI Annual Meeting (1-4 October 2025)

BIO² reached the scientific community at the ReMade@ARI Annual Meeting in Leuven, Brussels (1–4 October 2025), where our partner **University of Udine** was represented by Laura Zanin. In her invited oral presentation, she introduced the BIO² concept and its vision for sustainable, bio-based innovation.
ReMade@ARI – a Horizon Europe initiative connecting researchers to advanced European lab infrastructures for developing recyclable materials – provided the perfect setting for these discussions. The exchange with scientists showed strong interest and opened up new connections for future collaboration.

EIT-Food e-breakfast (17 December 2025)

BIO² was featured at an EIT Food e-breakfast, where our partner **NEIKER** presented on trained immunity as a promising approach to reduce antibiotic use in livestock. The session highlighted how strengthening natural defense mechanisms could support more sustainable farming. The lively discussion showed strong interest in practical alternatives to antibiotics.
The EIT Food e-Breakfast series is a dynamic webinar format bringing together partners, experts and startups to exchange ideas, present their work and spark new collaborations. These one-hour sessions create a space for open discussion, helping participants connect across the agrifood ecosystem and explore innovative solutions together.

Norwegian Organic Congress 2026 (9-10 February 2026)

BIO² took the stage at Norway's key event for organic farming – the Norwegian Organic Congress 2026 – bringing together farmers, advisors and researchers shaping the sector's future.
Our partners **NLR, NORSØK**, and **Grønn Gjødsel** showcased the project through a poster highlighting what BIO² is all about: practical, field-driven innovation for organic systems.
From beneficial microbes and marine biomass to nutrients recovered from fish by-products and wastewater – BIO² is turning natural resources into real solutions.
And it's not just theory.
Field trials are already underway across Europe, from strawberries and potatoes, grapes to wheat, working hand in hand with farmers to ensure solutions are practical, relevant, and ready for real-world use. Learn more on our homepage: Farmers at the Heart of BIO². The strong interest at the congress, especially in on-farm testing and circular nutrient solutions, confirmed one thing: connecting research with practice is exactly what's needed right now.

Our Norwegian partners Marianne Sletsjøe and Stanislav Strbac from NLR, Lars Riiser Evju from Grønn Gjødsel and Anne-Kristin Løes and Berit Marie Blomstrand from NORSØK presenting the BIO² project through a poster

From conference buzz to real-world innovation: BIO² in Uppsala (15-17 June 2026)

BIO² showed up at the Nordic-Baltic Scientific Conference at SLU – a key meeting point for experts working on sustainable agriculture, nutrient recycling and the circular bioeconomy. Alessio Adamiano (**CNR**) presented the project and sparked strong interest around turning waste into value. Then things moved off stage. Together with Anne-Kristin Løes (**NORSØK**), he visited Prithvi Simha, founder of **Sanitation360 AB**, to explore a living lab for circular sanitation at SLU. The idea: collect human urine, stabilise it (no ammonia loss, no pathogens), and turn it into a dry fertiliser. The product: Granurin. Nutrient-rich, circular and already tested in Sweden.

Early barley trials on Gotland look promising–and what's even more striking: the system already works far beyond the lab, scaling up to a football stadium in Uppsala with up to 10,000 people. It is not yet approved for organic farming, but clearly showing strong potential.

Alessio Adamiano (CNR) at the Nordic-Baltic scientific conference in Uppsala, Sweden

From waste to resource: circular sanitation station at SLU's living lab.

Prithvi Simha (Sanitation 360) and Alessio Adamiano (CNR) at the circular sanitation station at SLU

Turning marine side streams into sustainable farming solutions (24-27 June 2026)

In June 2026, our BIO² partners Bruno Iñarra and David San Martin, both from **AZTI** and Miriam Pinto from NEIKER took part in the 13th International Conference on Sustainable Solid Waste Management (KOS2026), held from 24–27 June on Kos Island, Greece. The conference brings together researchers, industry experts and policymakers from across the globe to exchange ideas on circular economy, waste valorisation and resource recovery, with a strong focus on turning waste streams into valuable products.

At the event, Bruno Iñarra (AZTI) delivered an oral presentation on the use of fisheries by-products for high-value agronomic purposes. His talk showcased how marine side streams can be transformed into bio-based inputs for agriculture.
This contribution aligned closely with the broader discussions at KOS2026, where innovative solutions for waste-to-value, bioeconomy and sustainable resource use were at the centre.
Looking ahead, these insights will also be further consolidated in a book chapter on mineral recovery and utilisation from marine side streams, to be published in November 2026 – reinforcing AZTI's role in advancing circular bio-based solutions across sectors.

Bruno Iñarra (AZTI) presenting on the use of fisheries by-products for high-value agronomic purposes at KOS2026.

Bruno Iñarra and David San Martin (AZTI) at KOS2026

BIO² IN PUBLIC

Newspaper „La Repubblica“ in Italy

BIO² reached a broad public audience in Italy through a feature in **La Repubblica**, one of the country's most influential national newspapers. Represented by our partner **University of Udine**, the project's concept and vision for sustainable, bio-based innovation were shared with readers across central and north-eastern Italy.
As one of Italy's leading dailies – with a strong national reach and a key role in shaping public debate – La Repubblica offered BIO² valuable visibility beyond the scientific community.
Over the past months, the BIO² team has been busy sharing our project's vision with both the scientific community and the public – through video, audio, and live events.

Focus PROGETTI DI RICERCA — A CURA DI DI4A UNIUD

WATER PEARL > IL PROGETTO GUIDATO DALL'UNIVERSITÀ DI UDINE HA L'OBIETTIVO DI RAFFORZARE LA FILIERA TROVANDO VARIANTI PIÙ RESISTENTI DI FAVE E PISELLI

Ecco come nascono i legumi del futuro

La ricerca è finanziata per quattro anni dal programma Ager con 458mila euro

IL PROGETTO

OLTRE IL LABORATORIO

LA FILIERA

COORDINAMENTO

LEADERSHIP

IL MODELLO

BIO² Instagram Channel launched!

BIO² is now on Instagram! Join us for a closer look behind the scenes – real work with farmers, fresh research insights, and updates along the way.

Klick to follow

UPCOMING EVENTS

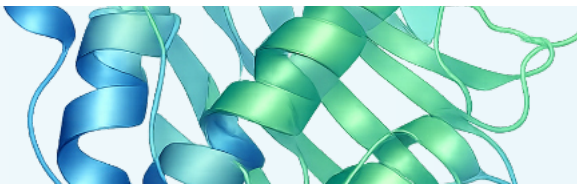
You want to connect with our BIO² members in person? Meet us at these upcoming events:

Kliment's Days 2026: 5-6 November, Sofia, Bulgaria

BIO² will be represented at the upcoming International Conference on Natural Sciences & Biotechnology – Kliment's Days 2026 (5–6 November). Our partners **ROMB Ltd** and **Sofia University** will present the project through poster contributions in the fields of Biotechnology and Education.

esib/2026 EUROPEAN SUMMIT OF INDUSTRIAL BIOTECHNOLOGY

TOGETHER WITH MaPEB INTERNATIONAL CONFERENCE ON METABOLIC & PROTEIN ENGINEERING FOR BIOSYNTHESIS
12-13 NOVEMBER 2026



ESIB 2026: 10-12 November, Graz, Austria

BIO² will also be presented by acib at the European Summit of Industrial Biotechnology (ESIB) 2026. We contribute with a talk from Felice Quartinello (**acib**) to the following session on OLinWASTE explores EU Bioeconomy Innovation: Integrated Approaches to Waste Valorisation and Sustainable Biorefineries . The session will bring together Horizon Europe projects working on waste valorisation, circular biorefineries and bio-based solutions for crop protection, while also addressing how research can be translated into real-world impact – right at the heart of BIO²'s mission. More infos: www.esib.at

NEWSLETTER EDITORIAL TEAM

Coordinator: Alessio Adamiano, CNR
Newsletter text: Katharina Schwaiger, acib GmbH; Alessio Adamiano, CNR; Berit Blomstrand, NORSØK, Agnese Hauka (AREI) **Layout:** Dietmar Cseh, acib GmbH
Pictures: BIO² and Partners, Contact: alessio.adamiano@cnr.it

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www.bio2project.eu