



NEWSLETTER NO. 1

Natural Solutions for Organic Farming



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WELCOME & PROJECT KICK-OFF

Welcome to the first issue of our bi-annual BIO² newsletter! We are excited to embark on this Horizon Europe journey, which officially began in May 2025, and to share the first highlights of our work with you.



Our story started in Bologna, where partners from eight European countries gathered for an inspiring kick-off meeting hosted by CNR and co-organized by Innovation Acta S.r.l.. The two-day event set the stage for a collaboration driven by innovation and a shared commitment to making organic farming more sustainable.

Through lively discussions and vision-building, the consortium outlined the first steps toward developing natural, bio-based solutions – from microbial crop protection to circular fertilizers and animal health products. This first project phase has been filled with energy and enthusiasm. As we move forward, our focus remains clear: creating solutions that work with nature, not against it.

We invite you to explore this newsletter for a glimpse into how BIO² is taking shape – from our kick-off meeting to early research and outreach activities.





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

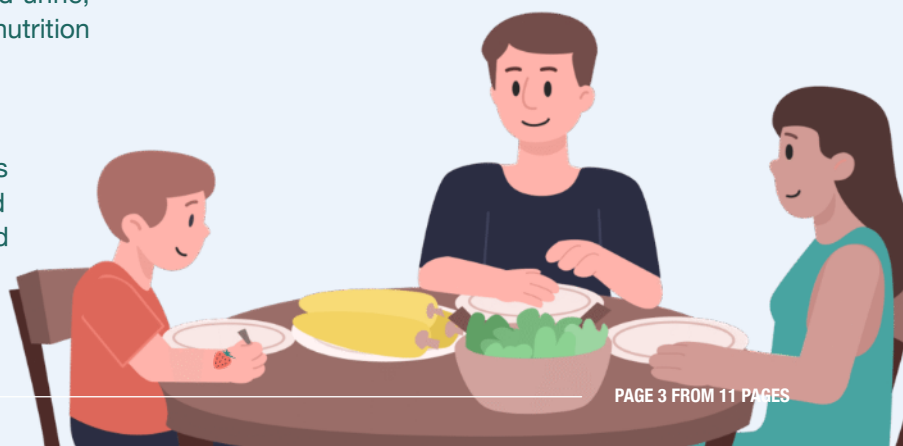
Microbial immunostimulants and bark extracts strengthen immunity and reduce antibiotic and antiparasitic use – protecting both animals and soil life. All BIO² innovations are tested under real organic farming conditions to ensure safety, efficacy, and scalability.

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





WP1 – BIOCONTROL BEGINS: MICROBES & SEAWEED AGAINST FUNGAL DISEASE

Authors: Katharina Schwaiger (acib GmbH), Roberto Foschino (University of Milan)

In the fight against plant diseases, BIO²'s Work Package 1 (WP1), led by the University of Milan, is turning to nature's own microscopic guardians – beneficial microbes and algae extracts – to protect crops without harming the environment.

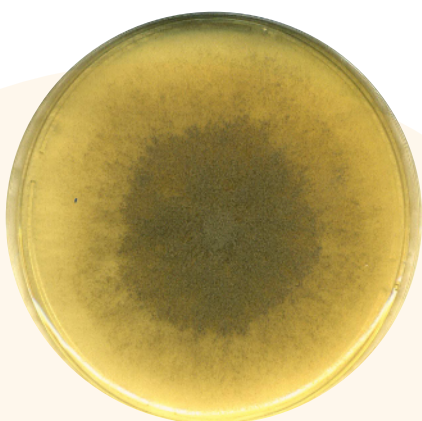
A New Chapter for Organic Farming

Even organic farming still depends on copper and sulfur sprays to fend off fungal diseases. They work – but at a cost. Over time, copper can accumulate in soils and harm beneficial organisms. Sulfur dust affects pollinators and soil life.

That's why BIO² scientists are developing a bio-based alternative: crop protection that doesn't fight nature, but works with it. Their goal? To create a truly organic biocontrol agent that can perform reliably under real farming conditions. "Our mission is simple but challenging," says Roberto Foschino, who leads the WP1. "We want to find natural materials that can replace copper and sulfur – not just in the lab, but in the field."

The Search for the „Microscopic Guardians“

Building on earlier research, the team began by screening a diverse collection of around 200 microbial strains – bacteria and yeasts previously isolated in Italy and Bulgaria from grapevines and their surrounding environments. These naturally occurring microbes are now being tested for their ability to protect crops from fungal diseases.



Petri dish with plant-pathogenic fungus



Effect of biocontrol agents (B) in grapeberries

To find out which ones might work, each strain first undergoes a simple but revealing test: it is placed in a Petri dish alongside a plant-pathogenic fungus to see whether it can slow down or stop the growth of the fungal mycelium. This "dual-culture" assay gives a direct, visual readout of antagonistic activity – and the results so far are encouraging. Under laboratory conditions, about 10% of all tested strains were able to inhibit the pathogen. This shows that antifungal activity is surprisingly widespread, whether through nutrient competition, the production of antimicrobial compounds, or even the ability of some microbes to activate a plant's own defence system.

Promising strains then undergo a more detailed series of tests to understand how they work. Our teams examine their enzyme production, which can help break down fungal cell walls, their ability to form protective biofilms, and their production of iron-chelating compounds that limit fungal growth. They also assess if these potential biocontrol agents can tolerate residues of copper, sulphur, or other fungicides that may remain in the field – a crucial trait for real-world use. In addition, the team tests their capacity to stimulate auxin production in plants, an ability that may further support plant health. Through this process, several groups of microorganisms have emerged as particularly interesting candidates. These include bacteria from the *Bacillus*, *Paenibacillus* and *Pseudomonas* genera, as well as yeasts and yeast-like fungi such as *Clavispora*, *Pichia* and *Aureobasidium*, found both inside plant tissues (endophytes) and on their surfaces (epiphytes). From these, the research-



Roberto Foschino



Green House for pre-field tests

chers aim to select a team of at least four complementary strains – „our Fantastic Four”, as Roberto Foschino calls them – each contributing a different mode of action.

Our Fantastic Four Get Their Coats

Another challenge begins once they reach the plant: how to keep them alive? The team tackles this with an encapsulation technique that combines calcium phosphate from fish bones with algal polymers such as fucoidan. This coating helps them adhere to the plant surface and protects the cells or spores while keeping them viable. Once the coating slowly degrades, the microbes start gradually colonise the plant tissues.

Exploring Algae as New Allies

Alongside microbe-based protection, another line of research led by NEIKER, BIO²'s Spanish partner, is exploring the antifungal potential of microalgae and cyanobacteria. Their researchers are producing aqueous and hydroalcoholic extracts from different algal species and testing them for antifungal activity. As with the microbial strains, the most promising algal extracts will also be encapsulated to ensure their stability and long-lasting effect in the field.

Why It Matters

Progress here doesn't just help plants. Using fewer harsh inputs can mean cleaner soils, healthier insect life (including pollinators), and better water quality – benefits that reach into ecosystems and communities. If the approach proves effective at scale, farmers gain practical biological options that support long-term soil fertility and landscape health, while consumers benefit from more nature-friendly ways to grow food.

Involved BIO² partners:



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WP2 – FROM WASTE TO VALUE: DESIGNING CIRCULAR FERTILIZERS

Authors: Alessio Adamiano (National Research Council of Italy, CNR), Katharina Schwaiger (acib GmbH)



Katharina Schwaiger

Alessio Adamiano

Keeping crops healthy is only half the story – they also need the right nutrients to grow strong. While WP1 focuses on protecting plants from diseases, Work Package 2 (WP2) works in parallel to answer another big question: how can we feed crops sustainably without depleting natural resources?

Led by the National Research Council of Italy (CNR), WP2 explores how waste and natural materials – from fish residues and seaweed to stabilized human urine and beneficial microbes – can be transformed into next-generation, bio-based fertilizers. Katharina Schwaiger, our Dissemination & Communication Manager, spoke with Alessio Adamiano, coordinator of the BIO² project and WP2 leader, about how his team is redefining what sustainable fertilization can look like.

Tomorrow's fertilizers come from today's waste

Katharina: Why use materials like fish residues, seaweed, or human urine to make fertilizers – what makes them so valuable?

Alessio: These materials might sound unusual, but they are actually rich in nutrients that plants need. Our goal is to make better use of what's already available. Instead of relying on mined phosphorus or imported fertilizers, we're focusing on resources that are abundant but underused – such as side streams from fish processing, seaweed from the marine industry, or nutrients recovered from urine. By converting these into safe, effective fertilizers, we can create bio-based and circular products that support both crop growth and environmental sustainability.

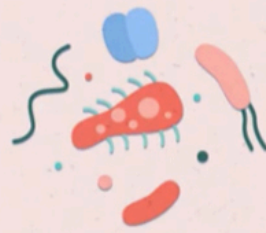
We're designing a balanced diet – but for plants

Katharina: How do these fertilizers actually work, and what makes them different from conventional ones?

Alessio: Plants need three main nutrients to grow – nitrogen, phosphorus, and potassium. Conventional farming usually provides these through synthetic fertilizers made from fossil fuels and mined minerals, which are effective but resource-intensive and pollute soils and water.

Organic farming relies instead on composts, manure, and plant-based fertilizers from conventional agriculture – these inputs are only permitted in organic farming out of necessity, as there are no viable alternatives. This means the raw materials may contain traces of pesticides or other residues that organic systems are trying to avoid. Studies Pesticide residues in organic fertiliser - Nibio, Birge, T., Saloniemi, I., Saikkonen, K. et al. *Environ Sci Eur* 36, 147 (2024) have shown that almost half of Norwegian and two-thirds of imported organic fertilizers contain pesticide residues, like glyphosate, which even in traces can harm soil life and sensitive crops like tomatoes or peas. Farmers need nutrient sources that are both reliable and clean.

And so, we're developing fertilizers that, for example, use beneficial microbes that help plants unlock phosphorus from materials such as fish bones or calcium-phosphate compounds. Others are made from marine ingredients like fish by-products and seaweed, which supply nitrogen and minerals. We're also exploring the use of fertilizers from human urine, which is chemically stabilized, purified, and dried into solid pellets. These contain balanced amounts of nitrogen, phosphorus, and potassium – the essential nutrients plants need.



Matching Fertilizers to Crop Needs

Katharina: Different animal species require different types of food—some feed mainly on meat, which primarily provides protein, while others feed mainly on plants. Is it similar with crops? Do different plants require different nutrients to grow well?

Alessio: Yes, that’s exactly the case. Different crops have distinct nutrient requirements. Leafy vegetables, for example, need more nitrogen to grow strong and green, while root and fruit crops like potatoes, grapes, or cereals depend more on phosphorus and potassium for healthy roots, fruits, and grains.

That’s why we’re not just developing new fertilizer ingredients – we’re also testing them on specific crops. In WP5, we’ll be applying these fertilizers to wheat, potato, grape, and strawberry under real organic farming conditions across Europe. The goal is to understand how each formulation performs in the field – how it supports plant growth, soil health, and overall productivity.

Katharina: At what stage is the work now?

Alessio: BIO² has already started the experimental activities with several ingredients of different origins, including struvite, fish protein hydrolysates, and fish residues rich in calcium phosphate. We’ve also begun the first preliminary tests on plants related to crop fertilization.

In parallel, we’re developing processes that combine phosphate-rich materials with phosphorus-solubilizing bacteria – this work is about to start. We’re also investigating the extraction of calcium phosphates from various food by-products and working with algal extracts, both from micro- and macroalgae, in combination with bio-control agents to produce new products for crop protection.

These activities aim to develop production processes that are currently at the laboratory and pilot scale and will later be scaled up to industrial level.

Closing the nutrient loop could change the future of farming

Katharina: Beyond the technical work, what’s the broader vision of WP2 for agriculture?

Alessio: We’re trying to show that it’s possible to close the nutrient loop – to reuse what already exists and reduce dependence on external inputs. This means fewer emissions, less waste, and more resilient local food systems.

Ultimately, it’s about creating a model of agriculture that’s productive and environmentally responsible. What we once considered waste can actually become a valuable resource – if we treat it that way.

Involved BIO² partners:





BIO² & STAKEHOLDERS

BIO² Meets SCALE-it

Tackling the challenges of organic farming takes more than one project – it takes collaboration. That’s why BIO² is joining forces with its sister project SCALE-it to accelerate the shift toward farming systems that are productive, circular, and free from contentious inputs.

While BIO² focuses on developing and testing new bio-based solutions for fertilizers, plant protection, and animal health, SCALE-it takes the next step: scaling these and other proven alternatives across organic farms in Europe and ensuring they can be widely adopted in practice. Coordinated by the Research Institute of Organic Agriculture (FiBL) in Switzerland, SCALE-it builds on a strong network of farmers, advisors, and researchers to test and demonstrate practical, scalable approaches that reduce the use of copper, antibiotics, antiparasitic drugs, and fertilizers containing residues.

With more than 65 on-farm demonstration trials in 13 countries, SCALE-it connects innovation directly with real-world farming. Local “Ambassadors” work side by side with farmers to test sustainable alternatives, gather feedback, and share best practices.

Together, BIO² and SCALE-it are closing the gap between innovation and application – turning scientific advances into real tools for organic farmers across Europe.



SCALE-it | NATURE-BASED INPUTS, ORGANIC FUTURE

[Learn more about the SCALE-it project here](#)

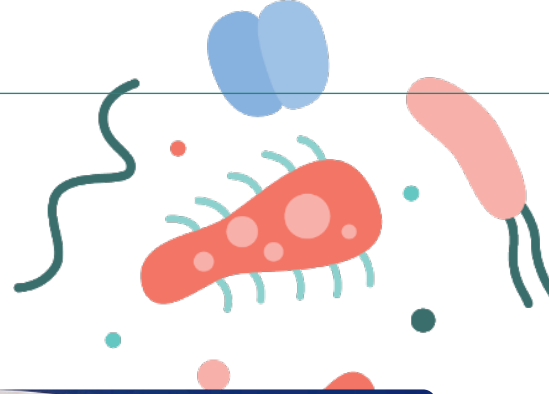
BIO² at Organic Innovation Days 2025

Earlier this month, BIO² took part in the Organic Innovation Days, organized by TP Organics in Brussels from November 3–5, 2025. The event brought together key voices in organic and agroecological research, innovation, and policy – making it one of the most relevant gatherings for Europe’s sustainable farming community. Although our project coordinator, Alessio Adamiano, was unable to attend due to illness – but we’re happy to share that he has fully recovered – the NORSØK team represented BIO² on his behalf, sharing the project’s vision. They reported strong interest from EU representatives and stakeholders, particularly regarding how BIO² contributes to innovation in organic farming systems. This year’s edition also marked the launch of TP Organics’ new Strategic Research & Innovation Agenda (SRIA), outlining the future direction of EU organic research. In addition, the final conference of the OrganicTargets4EU project and the award ceremony of the Organic Advice Contest, organized by IFOAM Organics Europe, highlighted the strong network driving this transition forward.





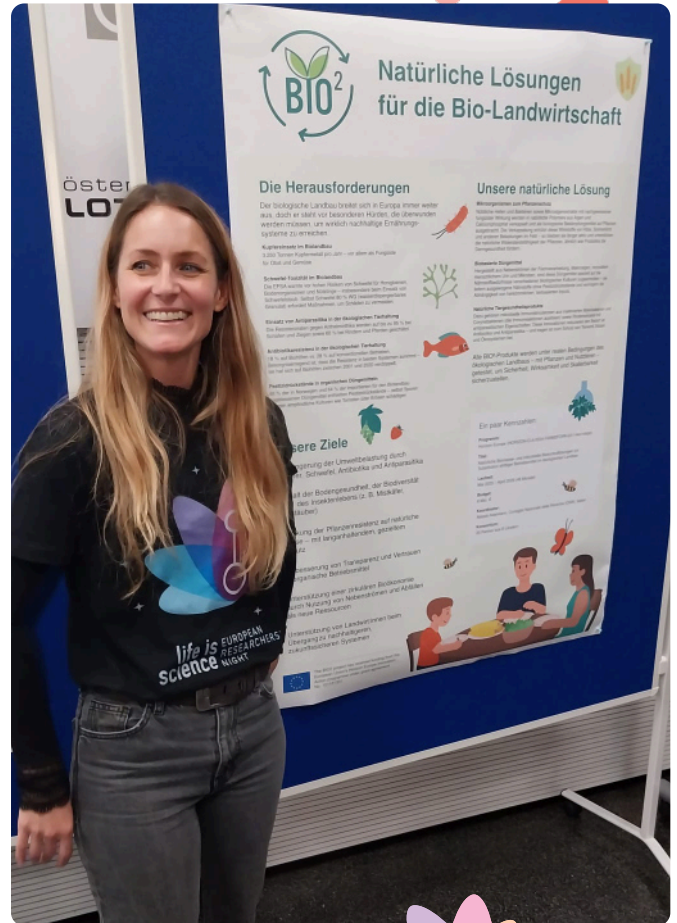
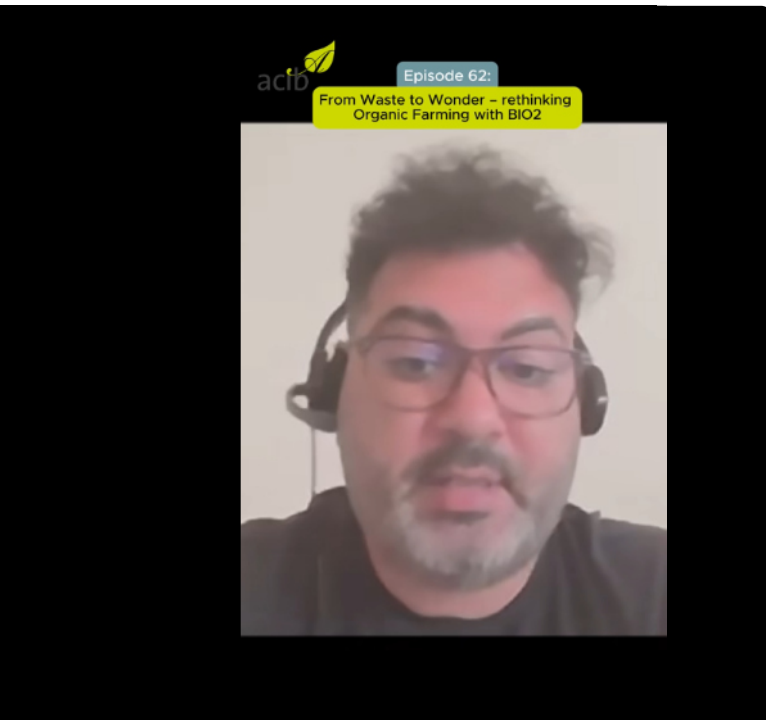
BIO² IN PUBLIC



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.

Podcast Feature: From Waste to Wonder – Rethinking Organic Farming with BIO²

In the latest episode of acib's BioteXperten Podcast, Felice Quartinello (acib GmbH) talks about his work in the BIO² project and how the team is developing innovative, bio-based tools for a more circular and resilient agricultural future. From microbial plant protection to bio-based fertilizers. [Listen here](#)



BIO² at the European Researchers' Night



BIO² was also featured at the European Researchers' Night – Life is Science in Graz. Katharina Schwaiger (acib) presented the project with a poster and engaged visitors in conversations. The discussions showed how strongly these topics resonate when research connects directly to real-world challenges.

NEWSLETTER EDITORIAL TEAM

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