

CORDIS Results Pack on plant genetic resources and breeding

Advancing plant breeding to strengthen food supply

A thematic collection of innovative EU-funded research results

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Editorial

Advancements in the plant breeding sector are crucial for fostering a resilient, competitive and sustainable agri-food system. This Cordis Results Pack showcases 14 EU-funded projects supporting the plant-breeding sector across different aspects, from a better utilisation of plant genetic resources to the development of new breeding tools.

Plants are not only the foundation of our agri-food system but also supply feed, fibres and bio-based materials essential for our transition to a sustainable bio-based economy. Plant genetic resources (PGRs), such as seeds, tissues and DNA, are used for breeding crops with higher nutritional value and adaptability to specific growing conditions. These new and improved varieties are also more resistant to climate stress, pests and diseases.

Europe enjoys a wealth of PGRs, which play a key role in feeding its citizens, as well as kick-starting an innovative bioeconomy and helping conserve genetic diversity.

The [Plant Genetic Resources Strategy for Europe](#), published by the [European Cooperative Programme for Plant Genetic Resources](#) (ECPGR) is a key outcome of the EU-funded project [GenRes Bridge](#). The document lays out the strategic vision for the long-term conservation and sustainable use of PGRs in breeding and research across Europe.

The importance of an innovative, competitive breeding sector that can respond to environmental and societal challenges while supporting Europe's strategic autonomy in food production is further highlighted in the Communication titled [A Vision for Agriculture and Food](#). In addition, the Communication [Building the future with nature: boosting biotechnology and biomanufacturing in the EU](#) promotes innovation as a driver of sustainability and competitiveness, creating a supportive environment for research and innovation in advanced breeding and biotechnology.

This CORDIS Results Pack highlights projects that support the plant breeding sector from multiple perspectives, from enhancing the collection and use of PGRs to researching and developing innovative plant-breeding technologies to provide the genetic variation necessary for future crops.

The initiatives include improved tools for variety testing, collaborative research on breeding protein crops and underutilised species, the development of environmentally sustainable crops to help combat climate change, and the exploration of novel breeding technologies and AI to increase crop resilience.

Moreover, the Pack spans all levels of technological development and Horizon funding tools, from fundamental research to applied innovation and start-up acceleration. It supports plant breeding, underlining the collective impact of EU funding for research and innovation in this sector, and it also strengthens agricultural production and competitiveness across the EU.

The 14 selected EU-funded projects contribute to overcoming the current challenges facing the plant-breeding sector. This involves developing innovative methods for conserving, studying and utilising genetic resources at the European level.

These discoveries include new tools and strategies for breeding crops capable of withstanding multiple simultaneous stresses, while adapting to a more localised, diversified and sustainable food system.

How three-parent breeding improves efficiency in crop breeding

Two gene targets and a three-parent crossing method accelerate breeding by enabling resilience trait combinations beyond the reach of conventional crosses.

Heat, drought and shifting pest pressures are changing farming conditions faster than new crop varieties can be developed. Breeders must balance yield, quality, and resilience; yet combining traits from distant or wild plant relatives is slow and often prevented by biological incompatibilities.

With funding from the [European Innovation Council](#) (EIC), the [3P-Tec](#) project worked on a shortcut: a three-parent breeding method that can enable the combination of traits from three plants in a single crossing event, with the potential to incorporate traits from wild relatives that are often difficult to introduce into modern crop varieties using conventional crosses.





3P-Tec leverages the ability of a plant egg cell to be fertilised by two different fathers, producing viable offspring with one maternal and two paternal genetic contributions, allowing breeders to combine valuable traits in fewer generations.

Three-parent crosses widen breeding options

In standard breeding, an egg cell is fertilised by one sperm cell, producing offspring with two parents. 3P-Tec builds on an unusual but real biological event where an egg cell fuses with two sperm. As project coordinator Rita Gross-Hardt explains, “3P-Tec builds on the fundamental insight that a plant egg cell can be fertilised by sperm from two different fathers to produce viable offspring with genetic contributions from one mother and two fathers.” For breeders, this can mean fewer generations to assemble valuable traits, since two paternal trait sets can be introduced simultaneously.

The method also targets a common roadblock in crop improvement: hybridisation barriers that cause seed abortion when breeders try to cross genetically distant plants.

A gene lever that raises triparental success rates

Beyond the crossing concept, researchers showed that two enzymes, ECS1 and ECS2, influence the frequency of an egg cell fusing with more than one sperm, a process called polyspermy.

Using a high-throughput screening method, the team found that plants lacking both enzymes showed a threefold increase in polyspermy. This higher rate raises the likelihood of producing three-parent offspring, making the approach more efficient. This key mechanism and its impact on the efficiency of triparental plant recovery have been documented in a [peer-reviewed scientific publication](#).

From sugar beet prototype to future crop pipelines

The 3P-Tec project builds on earlier EU-backed work and has progressed beyond proof-of-principle towards crop-breeding

use. One concrete milestone is the transfer into a major European crop. Gross-Hardt notes, “A major milestone was the successful establishment of a triparental sugar beet as the first crop prototype.” Demonstrating the approach in sugar beets shows it can be applied beyond model plants, a key hurdle before breeders can use the method at scale.

The project also aimed to pave the way for use in additional crops, including potato, where breeders face growing pressure to deliver climate-robust varieties without sacrificing yield. Industrial breeders have been involved to ensure the work stays aligned with commercial timelines, robustness and scale-up requirements.

A non-transgenic route to faster, climate-smart breeding

The project coordinator frames 3P-Tec as non-genetically modified and closer to conventional breeding routes than transgenic methods, in accordance with current EU rules. Scaling this process could help breeders rapidly combine key performance and resilience traits, stabilising yields in extreme climates.

Once fully implemented, the technology’s practical value becomes most apparent in areas where conventional breeding has long struggled: enabling traits to be transferred across species boundaries without years of failed crosses, repeated backcrossing, and lost growing seasons.

PROJECT

3P-Tec - 3P-Tec - Three-parent breeding technology for plants of the future

COORDINATED BY

University of Bremen in Germany

FUNDED UNDER

Horizon Europe - The European Innovation Council (EIC)

CORDIS FACTSHEET

cordis.europa.eu/project/id/101057189

PROJECT WEBSITE

3patec.com/



Protecting potato yields from extreme heat and drought stress

Field trials and sensor plants pinpointed potato traits that help keep yields stable during heatwaves and drought, guiding breeders towards future-ready varieties.

Heatwaves and dry spells can quickly hit potato yields and tuber quality, even when farmers do everything right. The EU-funded [ADAPT project](#) set out to identify which widely grown potato varieties are better adapted to heat and drought, and which signals explain the difference.

The project combined European field trials with controlled experiments and large-scale data analysis, so breeders can build stress tolerance into the varieties people already buy. A farmer survey involving more than 550 growers helped to confirm that heat and drought are already the main pressures in many regions.



Field trials show which potatoes hold yield under stress

ADAPT ran stress-related field trials with up to 54 potato varieties to capture performance under drought and combined heat and drought. Field trials were carried out at Valencia in Spain and at Lewedorp in the Netherlands, with additional work in Serbia and Austria. Researchers compared responses under different farming regimes and collected samples for in-depth analysis of molecular events to determine how potato plants adjust their growth and metabolism in response to stress.

These datasets helped flag 'contrasting' varieties: plants that look similar in normal seasons but separate sharply under stress. As project coordinator Markus Teige explains, "The ADAPT project focused from the very beginning on commercial potato varieties that are widely grown all over Europe and the marketable yield was always an important criterion for us in the evaluation of all trials." The team also saw how climate stress can stack with pest pressure, including severe damage from the potato beetle during stressed seasons.

Sensor plants reveal early stress signals that matter for tubers

Field outcomes are the priority but ADAPT also tracked what happens inside the plant. In glasshouse studies, the team used high-throughput phenotyping and live-imaging 'reporter' potato lines to follow stress signalling in real time.

Sensor plants were developed to track secondary messengers, such as calcium (Ca²⁺) and reactive oxygen species. They were also developed as reporter lines for drought responses and stress-related hormones, such as ABA and jasmonate. Teige notes, "We could see that plants can react within one or two days with the first changes in their physiology."

Those early shifts then guided deeper molecular work, including studies linked to SP6A, a key tuberisation signal, to see how stress can disrupt the pathways that steer tuber formation.

Data tools turn complex biology into breeding targets

ADAPT built pipelines to integrate drone and sensor data with molecular readouts, enabling patterns to be compared across sites, seasons and varieties. One output is the [StressKnowledgeMap](#) app, an online tool that organises stress-response evidence into connected maps, so researchers can add new results and link them to models that explain how plants react under pressure.

The data also highlighted when measurements matter most. Drone phenotyping suggested that early growth traits can be strongly predictive of final yield, and irrigation influenced both yield and tuber quality, especially when applied early. Those insights point to where breeders should focus screening and where future trials could support more precise crop management.

For breeders, the bottleneck is turning multi-gene resilience into reliable molecular markers that hold across climates. ADAPT's combined datasets help narrow down the stages and traits that best predict yield resilience, especially in early growth phases, helping breeders prioritise which signals to convert into practical markers. The next step is to develop and validate those markers for heat- and drought-tolerant varieties. Teige sums up this next step: "Once that is done, it can be expected that in a time frame of 5-10 years, these new varieties will be available to farmers and contribute to stable yields with good quality also under different growth conditions."



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PROJECT

ADAPT - Accelerated Development of multiple-stress tolerAnt PoTato

COORDINATED BY

University of Vienna in Austria

FUNDED UNDER

Horizon 2020 - FOOD

CORDIS FACTSHEET

cordis.europa.eu/project/id/862858

PROJECT WEBSITE

adapt.univie.ac.at/

Holistic genotyping and phenotyping of plant genetic resources in Europe's gene banks

A European gene bank network shows the potential of dense, FAIR data to unlock wheat and barley genotypic and phenotypic diversity for climate-resilient crops.

Since the early 20th century, when many traditional crop varieties became incompatible with modern agricultural practices, countries began establishing gene banks to safeguard the genetic diversity of crops and their wild progenitor species. About 7.4 million uniquely identified samples of plant genetic material (accessions) are now stored in more than 1 750 gene banks around the world. These [plant genetic resources](#) – seeds, vegetative tissues or DNA – contain the keys that could unlock crop adaptation to a changing climate.

Despite their importance, the potential of plant genetic resources remains underexploited due to limited information on their genetic and phenotypic properties as well as uncertainty about redundancy among collections from decades of material exchange. The EU-funded [AGENT](#) project addressed these challenges. Using wheat and barley, two key European crops, AGENT demonstrated how coordinated management and characterisation of genetic resources in a European gene bank network can enhance their value for breeding climate-resilient crops.

Towards dense, high-quality genomic data on accessions

A central component of AGENT was the generation of high-quality genomic data, albeit on a limited scale. “Genotypic information enables precise identification of accessions, revealing genetically identical, highly similar or unique materials across collections. Unique genotypes highlight non-redundant diversity of global importance that is conserved ex situ in gene banks,” explains

AGENT project coordinator Nils Stein of the [Leibniz Institute of Plant Genetics and Crop Plant Research](#). In addition, genotypes shared among gene banks are of interest for comparative analysis of phenotypic data in various climatic conditions.

AGENT genotyped selected subsets of approximately 500 wheat and/or 500 barley accessions in each of the more than 10 participating gene banks. While insufficient for comprehensive diversity mapping, this pilot-scale genotyping demonstrated the conceptual value of dense genomic data for gene bank management, research and breeding.



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FAIR data integration

Gene banks have collected phenotypic information over time regarding their collections. To make data [findable, accessible, interoperable and reproducible](#) (FAIR), the consortium's gene banks collaborated on [data formats and standards](#) and [data stewardship](#) for curating historical wheat and barley data, and generating novel data.

This enabled integrated analyses across the combined individual datasets. "Viewing individual collections in the context of a much larger dataset is particularly beneficial to users of smaller collections that may not be representative of global variation within a species," notes Stein.

Genotypic and phenotypic information in a climate-aware gene bank network

A defined set of commercial wheat and barley plant genetic resources was exchanged among the AGENT gene banks and shared with breeding companies and farmer cooperatives for replicated multi-year field evaluations. The newly generated phenotypic information together with FAIRified historical phenotypic and genotypic information enabled the identification of climatically similar gene bank locations ('mega-environments').

Future dense genotypic information and subsets of phenotypic data on the global gene bank population could be used to predict

Applying [FAIRified genotyping and phenotyping] at scale, supported by increased funding, will enable a European gene bank network to provide strategically selected plant genetic resources, accelerating crop improvement, climate adaptation and long-term food security.

phenotypes for uncharacterised accessions under comparable conditions. Ultimately, comprehensive genotyping and phenotyping across gene bank collections would make plant genetic diversity shaped by past climate adaptation accessible for research and breeding. It would also reveal the extent to which plant genetic resources have continued to adapt or evolve since their acquisition.

"AGENT has shown the potential of interdisciplinary collaboration and FAIRified genotyping and phenotyping to strengthen breeding efforts," Stein concludes. "Applying these concepts at scale, supported by increased funding, will enable a European gene bank network to provide strategically selected plant genetic resources, accelerating crop improvement, climate adaptation and long-term food security."

PROJECT

AGENT - Activated GEnebank NeTwork

COORDINATED BY

Leibniz Institute of Plant Genetics and Crop Plant Research in Germany

FUNDED UNDER

Horizon 2020 - FOOD

CORDIS FACTSHEET

cordis.europa.eu/project/id/862613

PROJECT WEBSITE

agent-project.eu/



Cultivating resilient berries for Europe's sustainable future

New breeding tools and genetic resources are enabling Europe to deliver high-quality and climate-ready strawberries, raspberries and blueberries.



© Bruno Mezzetti

Europe's appetite for strawberries, blueberries and raspberries is rising, with cultivation areas, production and trade value growing over the past decade. As berry production becomes more strategic, breeders need to deliver resilient, high-quality varieties adapted to climate change and sustainable farming.

According to data from the [Food and Agriculture Organization Corporate Statistical Database](#) (FAOSTAT), the region produced nearly 1.8 million tonnes of strawberries alone in 2023, while blueberry production reached almost 200 000 tonnes.

"These crops are among the most valuable in Europe. The berry sector plays an important role in the European agri-food trade," says Bruno Mezzetti, project coordinator of EU-funded [BreedingValue](#). The project set out to improve breeding tools and expand genetic resources available for strawberries, raspberries and blueberries.

Mapping genetic diversity and breeding innovations

BreedingValue's 20 partners and 10 external collaborators studied an unprecedented diversity of genetic material. They characterised more than 1 500 strawberry populations and nearly 100 raspberry and blueberry populations.

The project used advanced genotyping, which reads a plant's DNA to identify genetic differences, and validated new phenotyping tools, including near-infrared spectroscopy and 3D and hyperspectral imaging, which measure traits such as fruit quality, plant structure and stress tolerance.

The genetic analysis highlighted strong differences across species. "We found a wide diversity for strawberries, certainly wider than that available at least in the United States," Mezzetti notes. "This strengthens the potential of our breeding programmes." In contrast, the team identified gaps in genetic diversity for raspberries and especially blueberries, with reduced availability of germplasm (the collection of genetic resources available to breeders) and breeding material. This leaves Europe "almost totally dependent on new varieties obtained from international breeding programmes."

BreedingValue developed an innovative breeding strategy combining genomic, metabolomic (chemical compounds linked to flavour and stress response) and sensory analyses to identify plants with valuable traits for resilience and fruit quality.

In strawberries and raspberries, this work led to the identification of many molecular markers – genetic indicators linked to traits such as pathogen resistance, plant adaptability and fruit quality. Genome-wide association studies revealed additional resistance and quality genes, which could later be validated under the EU's framework for [new genomic techniques](#).

Building resilient, sustainable and market-ready berries

BreedingValue also assessed resilience to climatic and cultivation challenges. It identified germplasm with resistance

to biotic and abiotic stresses and demonstrated, through life cycle assessment studies covering 26 strawberry and raspberry field trials, that both existing cultivars and new selections adapt well to more sustainable production systems.

"The availability of this germplasm, combined with the new genotyping and phenotyping technologies developed, has strengthened the capacity of EU breeding programmes to produce new, higher performing varieties for our cultivation systems, also in response to climate change and the risks induced by the spread of new pathogens and parasites," states Mezzetti.

Additionally, the project performed consumer studies in different countries, putting their preferences at the heart of berry innovation. It developed harmonised sensory methods and [multilingual flavour and texture vocabularies](#) to align new varieties with consumer tastes.

To ensure long-term innovation, BreedingValue created the [Germinate Berry Database](#), an online resource containing methodologies and data on strawberry, raspberry and blueberry genetics for breeders and researchers.



The availability of this germplasm, combined with the new genotyping and phenotyping technologies developed, has strengthened the capacity of EU breeding programmes to produce new, higher performing varieties for our cultivation systems, also in response to climate change and the risks induced by the spread of new pathogens and parasites.

PROJECT

BreedingValue - Pre-breeding strategies for obtaining new resilient and added value berries

COORDINATED BY

Marche Polytechnic University in Italy

FUNDED UNDER

Horizon 2020 - FOOD

CORDIS FACTSHEET

cordis.europa.eu/project/id/101000747

PROJECT WEBSITE

breedingvalue.eu/



Crops that fight climate change from the inside out

EU-funded researchers are re-engineering photosynthesis in rapeseed to create climate-resilient crops that capture more carbon, use less water and maintain high yields under harsh conditions.

As climate change intensifies heatwaves, droughts and extreme weather, agriculture faces a dual challenge: feeding a growing global population while reducing its environmental footprint. An EIC-funded project called [Crop4Clima](#) is tackling both problems at once by redesigning the way plants handle carbon dioxide.



The market is eager for a game-changing solution that will allow crop adaptation to the new environment.

“The agriculture industry, and canola growers especially, are severely affected by the changing climate,” said Silvia Shaked, vice president of experimental technologies at Israeli biotech company [Evogene Ltd.](#) and project coordinator of Crop4Clima. “The market is eager for a game-changing solution that will allow crop adaptation to the new environment. I believe Crop4Clima can provide this solution.”

Launched in May 2023, Crop4Clima was funded by the [European Innovation Council \(EIC\)](#) and coordinated by Evogene Ltd. Its goal was to develop first-of-a-kind rapeseed and canola varieties that can absorb up to 60 % more CO₂, use around 20 % less water and maintain high oil content, even under conditions of drought and other climate stresses.

Reprogramming photosynthesis

At the heart of the project is a synthetic biology innovation that tackles a major inefficiency in plants known as photorespiration. This process occurs when the plant enzyme rubisco mistakenly binds oxygen instead of carbon dioxide, triggering a wasteful reaction that releases CO₂ and consumes energy. Photorespiration can reduce photosynthetic efficiency by as much as 20–50 %.

To overcome this bottleneck, researchers from the [Max Planck Institute for Terrestrial Microbiology \(MPI\)](#) developed a novel synthetic metabolic route called the tartronyl-CoA (TaCo) pathway. Rather than releasing CO₂ during photorespiration, this pathway captures and refixes it, effectively turning a loss process into a gain.

The result is a plant that behaves like it has received an internal engine upgrade: it conserves energy, assimilates more carbon and continues to grow even under stressful conditions such as heat and water scarcity.

From lab to field

Within Crop4Clima, the TaCo pathway has been successfully introduced into commercially relevant rapeseed lines using Evogene’s advanced plant-engineering platforms. Validation trials showed that the engineered plants perform consistently across generations, with clear improvements in growth, physiological health and yield.

The project has demonstrated several key benefits, including enhanced drought and heat tolerance, increased carbon assimilation and sustained seed quality – a crucial factor for canola growers and downstream food and feed markets.

Importantly, no commercial crops with this combination of traits currently exist. Rapeseed and canola are major crops in Europe and worldwide, and the technology demonstrates significant potential for application across other agricultural commodities such as soybean, cotton and rice.

Towards climate-smart agriculture

Beyond technical development, Crop4Clima is working towards commercial deployment. The project plans to establish a dedicated seed company and has already begun developing a business model aligned with evolving food value chains and climate goals. Pre-commercial agreements with industrial partners aim to bring the technology to full market readiness.

Overall, Crop4Clima provides compelling proof that targeted metabolic pathway engineering can deliver crops that are both more productive and more sustainable. By turning plants into more efficient carbon sinks, the project points towards a future where agriculture becomes part of the climate solution, rather than a victim of climate change.

PROJECT

Crop4Clima - Resilient and environmentally sustainable engineered crops to address climate change

COORDINATED BY

Evogene Ltd in Israel

FUNDED UNDER

Horizon Europe - The European Innovation Council (EIC)

CORDIS FACTSHEET

cordis.europa.eu/project/id/101113038

PROJECT WEBSITE

crop4clima.eu/



© Evogene Ltd



A European phenotyping infrastructure to boost plant science and innovation

A pan-European network of plant phenotyping facilities puts Europe at the forefront of sustainable agriculture, plant-based innovation and climate resilience.



© VIB Agro-incubator

Understanding how plants grow, adapt and perform in different environments is essential to be able to address some of the most pressing challenges of our time, namely climate resilience, food security, biodiversity and sustainable land use. It is also required for advancing plant-based innovations in areas like biomaterials, functional foods and plant-derived medicines.

The European Research Infrastructure for Plant Phenotyping (EMPHASIS) is Europe's coordinated response to this need. It

brings together cutting-edge plant phenotyping capabilities in a single, shared framework accessible to researchers, breeders and innovators across the continent.

The EU-funded [EMPHASIS-GO](#) project laid the foundations for EMPHASIS' long-term sustainability by establishing the legal, financial and organisational framework for future operation as a European Research Infrastructure Consortium (ERIC).

United front on plant phenotyping

Phenotyping involves the measurement of observable plant traits that emerge from interactions between genetic makeup, environmental factors and crop management. It is essential for understanding plant performance. While genetic technologies have advanced rapidly, phenotyping has remained a bottleneck. Without high-quality, large-scale plant phenotyping, much of Europe's plant genetic potential cannot be translated into resilient, productive crops.

EMPHASIS enables access to technologies and expertise that no single institute or country could have on its own. The quality-assured network – already more than 200 advanced plant phenotyping facilities throughout Europe – transforms previously fragmented national capacities into a coherent European infrastructure. According to Susie Robinson of [VIB](#), newly-appointed interim director-general of EMPHASIS: “This shared infrastructure, common standards, and pooled expertise allows us to ask biological questions that were previously out of reach, and to translate phenotyping data into real advances for crop improvement.”

Facilities, protocols, FAIR data stewardship and training

“EMPHASIS operates through four interconnected pillars: on-site and remote access to facilities and services, advanced phenotyping practices with standardised protocols, FAIR (findable, accessible, interoperable and reusable) data stewardship, and education and training,” explains Stijn Dhondt of VIB, outgoing EMPHASIS director. Users can access facilities and services on demand or through EU-funded calls. Strategic coordination in Belgium ensures coherence across Europe.

Facilities include high-tech controlled-environment platforms, intensively instrumented field sites, lean field networks, and digital and data platforms. As EMPHASIS programme co-manager Inês Pinho, also of VIB, explains: “Together, they allow plant performance to be studied across multiple scales – from cells to ecosystems, from laboratory conditions to real-world fields and from short experiments to long-term monitoring across multiple environments.”

Shared tools, standardised protocols and FAIR data practices improve comparability and reproducibility. Together with innovative training programmes, EMPHASIS is strengthening research quality and skills across the scientific community.

Pioneering research previously impossible to conduct

EMPHASIS-GO built on the success of the previous preparatory phase EU-funded projects, [EMPHASIS-PREP](#) and [EPPN2020](#). Through these three projects, hundreds of transnational access projects have enabled researchers, including those from under-represented regions, to use state-of-the-art facilities that would otherwise have been inaccessible.



EMPHASIS-GO has ensured the long-term sustainability of this user-centred, European plant phenotyping infrastructure and positioned it as a leading global hub for plant-based innovation, sustainable agriculture and climate resilience.

“EMPHASIS-GO has ensured the long-term sustainability of this user-centred, European plant phenotyping infrastructure and positioned it as a leading global hub for plant-based innovation, sustainable agriculture and climate resilience,” adds Enric Belles-Boix of VIB, EMPHASIS programme manager and day-to-day coordinator of the EMPHASIS-GO project. This unified approach is already enabling new types of research and innovation that were previously out of reach, from testing stress-tolerant varieties across climate gradients to combining high-resolution imaging with real-world field performance.

Susie Robinson concludes: “By enabling integrated research across environments, locations and countries, EMPHASIS is positioning Europe as a leader in climate-aware plant science, agri-tech and the wider bioeconomy for decades to come.”

PROJECT

EMPHASIS-GO - Bringing EMPHASIS to operation: European Infrastructure for multi-scale Plant Phenomics and Simulation for food security in a changing climate

COORDINATED BY

VIB VZW in Belgium

FUNDED UNDER

Horizon Europe - Research infrastructures

CORDIS FACTSHEET

cordis.europa.eu/project/id/101079772

PROJECT WEBSITE

emphasis.plant-phenotyping.eu/

Leveraging big data for better olive production

Characterisation of hundreds of olive varieties using material from five international germplasm banks accelerates olive breeding programmes.

User-friendly tools put these game-changing resources in the hands of scientists and farmers alike.



© Gen4olive Consortium

Throughout the Mediterranean, olive oil is a pillar of diet, culture and economy. As an ancient woody crop, the olive comprises over 1 200 varieties globally, yet large-scale commercial plantations rely on only about 5 % of this genetic diversity.

Currently climate change, disease and genetic erosion threaten the olive industry, and there is little genetic information available to support olive growers. The EU-funded [GEN4OLIVE](#) project characterised over 500 varieties of olives, developed user-friendly tools and funded multiple projects involving SMEs to ensure the future of sustainable olive cultivation.

A new role for germplasm banks

"Germplasm banks (GBs) are basically 'living libraries,' where plants, seeds and other genetic material from agricultural specimens are kept. The GBs protect crop diversity by acting as backup facilities in case of damage to the food supply.

The GBs are at the heart of the GEN4OLIVE project. Project coordinator Concepción Muñoz Díez states: "In GEN4OLIVE, the five participating germplasm banks – located in Spain, Morocco, Italy, Greece and Turkey – supplied exceptionally diverse and valuable plant material, enabling its thorough characterisation." Characterisation activities focused on a few key traits: climate tolerance, disease resistance, productivity and oil quality.

In addition to characterising material already stored in the GBs, the project added material as well. A core activity of GEN4OLIVE was identifying and conserving wild olive populations across the Mediterranean. Over 200 ancient olive trees were catalogued during the project.



SMEs accelerate pre-breeding programmes

Pre-breeding relies on a wealth of data to determine the best varieties for specific regions as well as which genetic traits are worth introducing. GEN4OLIVE identified genotypes among cultivated and wild varieties with superior tolerance to disease, drought and other biotic and abiotic stresses.

The project ran two open calls through which it funded 25 projects involving SMEs. Many of the SMEs applied GEN4OLIVE resources to create pre-breeding programmes, establishing field trials to test the performance of traditional varieties. A noteworthy project located in Georgia explored cultivars resistant to cold, with the potential to expand the region where olives can be cultivated.

These tools can give everyone access to expertise. A nurseryman can advise farmers and select the best variety for propagation according to end user's needs, and a farmer can diagnose a disease by taking a picture and analysing it through AI tools.

think big. Díez shares: "These tools can give everyone access to expertise. A nurseryman can advise farmers and select the best variety for propagation according to end user's needs, and a farmer can diagnose a disease by taking a picture and analysing it through AI tools."

The impact of GEN4OLIVE's solutions will be immediate, as stakeholders gain access to powerful digital tools. Over time, the development of genetic resources and the fine tuning of AI tools will lead to stronger breeding programmes and more sustainable cultivation. GEN4OLIVE has made the largest data contribution ever to the olive sector, and by ensuring data access to all stakeholders, the project has helped ensure the future vitality of olive production.

Digital tools extend expertise

Creating genetic resources and empowering the agricultural sector to use them requires a data interface. GEN4OLIVE built an [online database](#) that contains phenotypic data on over 600 varieties.

In addition to the database, the project used machine learning to develop mobile apps that can identify varieties and diseases. The [OliVaR](#) app has demonstrated up to 96 % accuracy in cultivar identification during training phases, establishing it as a highly promising tool for cultivar recognition.

The simultaneous development of genetic resources and the digital tools to use them encouraged project partners to

PROJECT

GEN4OLIVE - Mobilization of Olive GenRes through pre-breeding activities to face the future challenges and development of an intelligent interface to ensure a friendly information availability for end users

COORDINATED BY

University of Cordoba in Spain

FUNDED UNDER

Horizon 2020 - FOOD

CORDIS FACTSHEET

cordis.europa.eu/project/id/101000427

PROJECT WEBSITE

gen4olive.eu/



A genetic hub for smarter tomato breeding

Streamlined access to the most up-to-date genetic resources on tomatoes and collaboration between businesses and research institutions help protect this important food crop.



© MaciejBledowski/stock.adobe.com

Tomatoes are among the most widely cultivated vegetables in the world. As a result, there is already a wealth of genetic information on tomatoes available at germplasm banks and other research repositories. However, these resources are not consolidated to support breeders and growers in different environments.

There are other challenges facing tomato cultivation too. Due to its popularity, tomatoes are at risk of reduced genetic diversity, as a few attractive, tasty, high-yield varieties dominate the market. Add the pressures of climate change and emerging diseases, and this popular vegetable is more vulnerable than it seems. The EU-funded [HARNESSTOM](#) project addresses these challenges with targeted prebreeding programmes and a one-stop-shop for stakeholders interested in accessing genetic resources.

Prebreeding tackles core concerns

Prebreeding is an essential component of modern agricultural practices. The process involves identifying advantageous traits in existing stock, both cultivated and wild varieties, and using cutting-edge technologies such as gene sequencing to transfer these traits to other breeding lines. Prebreeding allows stakeholders to rapidly develop new plant varieties with desired traits.

HARNESSTOM developed prebreeding programmes that targeted some of the major challenges in tomato cultivation:

disease resistance, tolerance to climate change and quality. Highlighting the project's focus on collaboration between public and private entities, the [Spanish National Research Council \(CSIC\)](#) partnered with the private multinational seed producer [Enza Zaden](#) to improve tomato resilience



HARNESSTOM
*collaborated closely
with local farmers
from Valencia and
Catalunya in Spain
and Lazio in Italy to
introduce genetic
resistance to major
viral diseases.
As a result, local
farmers can now
introduce disease
resistance into
their locally grown
traditional varieties.*

to climate stressors. "We managed to increase tolerance to high temperatures and limited water by introducing tolerance genes identified from some wild relatives of tomatoes in the previous EU projects [TomGEM](#) and [TRADITOM](#)," explains project coordinator Antonio Granell.

Prebreeding efforts to improve the flavour of cherry and globe varieties were also successful. In another series of prebreeding programmes, project partners in Spain and Italy worked to improve disease resistance. Granell shares: "HARNESSTOM collaborated closely with local farmers from Valencia and Catalunya in Spain and Lazio in Italy to introduce genetic resistance to major viral diseases. As a result, local farmers can now introduce disease resistance into their locally grown traditional varieties."

developed a database, the [HarnesstomDB](#), to consolidate information dispersed in other databases or in published scientific articles.

Stakeholder response to the database has been positive. Granell foresees a time when "more breeders, scientists, farmers and garden growers are using HarnesstomDB to select the best materials for their purposes." He adds: "During the project, company breeders attended several courses and had the opportunity to do hands-on training with the database. Currently over 100 people have registered to access the HarnesstomDB."

Irresistible, versatile, delicious and nutritious, tomatoes will always have a place on the world's table. By leveraging prebreeding to address threats to this important crop and consolidating information useful to breeding the best tomatoes possible, the HARNESSTOM approach is key to securing the future of tomato cultivation.

PROJECT

**HARNESSTOM - Harnessing the value of
tomato genetic resources for now
and the future**

COORDINATED BY

The Spanish National Research Council (CSIC)
in Spain

FUNDED UNDER

Horizon 2020 - FOOD

CORDIS FACTSHEET

cordis.europa.eu/project/id/101000716

PROJECT WEBSITE

harnesstom.eu/en/index.html

Accessible resources though HarnesstomDB

Improving the quality and safeguarding the vitality of tomatoes through prebreeding efforts is essential; however, equally important is making sure all stakeholders – scientists, breeders, farmers and garden enthusiasts – have access to the existing wealth of information on tomato genetics. The project



Participatory science drives food legume genetic conservation

Improved management and use of food legume genetic resources, supported by citizen science, has laid the foundations for greater food security and healthier living.



© Elisa Bellucci and the INCREASE Consortium

Food legumes – such as beans, lentils, chickpeas and peas – are a healthy source of plant-based proteins for human consumption. They are also a cornerstone of sustainable agriculture, with their nitrogen fixation improving soil health and reducing the need for energy-intensive fertiliser and pesticide production. In addition, they support biodiversity, with their species variability, flowers and plant structures supporting pollinators and overall ecosystem health.

Increasing domestic production of plant proteins is a key objective of the EU, as stated in the [Vision for Agriculture and Food](#). The six-year EU-funded [INCREASE](#) project, ending in April 2026, has focused on improving the conservation, characterisation and use of Europe's food-legume plant genetic resources, specifically of the chickpea, common bean, lentil and lupin.

Food-legume genetic resources: data, tools, technologies and plant materials

INCREASE has developed innovative data management solutions, including 'gold standards' for data sharing and data integration from decentralised into central infrastructures. Collection of decentralised data, supported by clear methodologies and best practices, has enhanced the value and effective use of new information, further augmented by user-friendly visualisation tools. In addition, 'intelligent collections' – nested core germplasm collections of different sizes – have captured the full genetic diversity of each crop and improved accessibility for research, breeding and sustainable use.

"Adoption of advanced genotyping and phenotyping technologies combined with AI has enabled scientists to better identify and characterise traits of highest relevance to users," explains INCREASE project coordinator Roberto Papa of [Marche Polytechnic University](#). Furthermore, these technologies have led to new knowledge and capabilities, such as gene discovery or genomic prediction, easily accomplished with a web-based search and visualisation tool to identify appropriate sources of germplasm.

Finally, engagement of non-European partners and international organisations has expanded INCREASE's scope and reach while adding benefits for European users, including the integration of existing international data and genetic resources into databases.

Participants receive seed kits with a randomised combination of six common bean varieties (more than 1 100 varieties are used in the experiment) and a control line. The [citizen science app](#) 'INCREASE CSA' guides them through the growing season and enables them to submit information like flowering time and seed size, pictures of plant characteristics and photos of foods prepared with their harvested beans. It also allows users to search for specific traits and request beans from fellow EU citizens, promoting seed exchange, participatory biodiversity management and decentralised conservation.

"The app's blockchain-based system acts as legal and digitally traceable framework, integrating image analysis and AI. It supports secure exchange of data and germplasm and legal compliance with the Standard Material Transfer Agreement of the Food and Agriculture Organization's International Treaty on Plant Genetic Resources for Food and Agriculture," adds Papa.

INCREASE won the prestigious [2024 EU Grand Prize for Citizen Science](#) for its significant contribution to building a more inclusive, sustainable European society and to advancing scientific knowledge through citizen participation.

INCREASE and its citizen scientists have achieved a step change in Europe's legume conservation efforts and paved the way to the identification of novel climate-resilient varieties, supporting food security and healthier food systems.

PROJECT

INCREASE - Intelligent Collections of Food Legumes Genetic Resources for European Agrofood Systems

COORDINATED BY

Marche Polytechnic University in Italy

FUNDED UNDER

Horizon 2020 - FOOD

CORDIS FACTSHEET

cordis.europa.eu/project/id/862862

PROJECT WEBSITE

pulsesincrease.eu/



2024 EU Grand Prize for citizen science

With a decentralised conservation approach, citizens participate in conservation and evaluation of legume plant genetic resources from gene banks, typically accessible only to expert users.

INCREASE's [citizen science experiment](#) (CSE) has involved the public (e.g. citizens, schools, farmers, associations) in a large-scale scientific experiment, with more than 26 000 participants as of December 2025. "With a decentralised conservation approach, citizens participate in conservation and evaluation of legume plant genetic resources from gene banks, typically accessible only to expert users," notes Papa.



Innovations in plant variety testing focus on sustainability and resilience

Integrating genomics, phenomics, environmental data and machine learning enables more efficient and better prediction of plant varieties' resilience to climate change.

New plant varieties are an essential component of productive agriculture. Marketing a new variety requires that new candidate varieties are distinct from existing varieties, primarily using morphological criteria. In addition, the traits must be uniform and stable. This 'distinctness, uniformity and stability' (DUS) testing is necessary to be awarded [plant variety property rights](#).

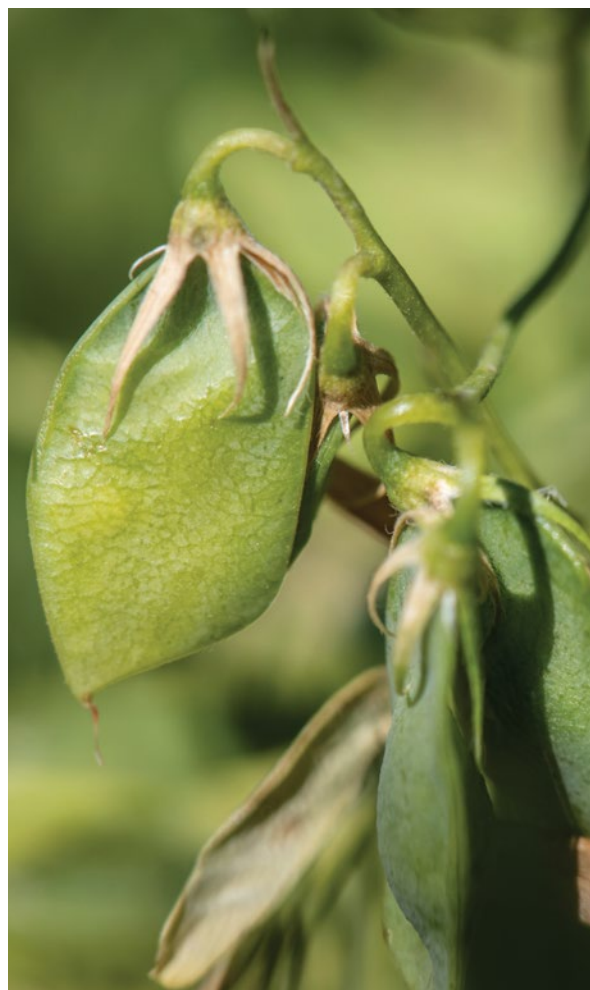
The new variety must also perform well. This is determined through 'value for cultivation and use' (VCU) testing, which measures the performance of plant species by evaluating traits such as yield, quality and disease resistance.

DUS and VCU testing are part of statutory testing across Europe. The EU-funded [InnoVar](#) project set out to increase the efficiency of these tests and to extend testing capabilities to include traits of resilience and sustainability by leveraging state-of-the-art technologies.

Thus, InnoVar, and its sister project, [INVITE](#), facilitated the introduction of new plant varieties that are better suited to varying conditions and sustainable management practices.

Genomics, phenomics and imaging

Genomics has huge potential for use in DUS and VCU testing, increasing efficiency by reducing the number of reference varieties required in expensive field trials. Phenomics using drone imaging to capture information about plant development



© Dr Nora Mendlé Drienyovszki, University of Debrecen

reduces the time needed to measure traits relative to labour-intensive manual recording.

"InnoVar demonstrated that genomics can identify multiple traits relevant to DUS and VCU tests and that aerial images can be integrated into both, increasing testing efficiency. In addition, the project demonstrated that it is possible to complete DUS testing in only 1 year using two locations rather than 2 years in one location," explains project coordinator Lisa Black of the [Agri-Food and Biosciences Institute](#).

Leveraging environmental data and machine learning

Environmental data is an important consideration when assessing varieties' suitability in different growing scenarios. Soil type and weather patterns are key to performance and will become increasingly important as climate changes. Machine learning can look for patterns and predict variety performance based on complex genomic, phenomic, phenotypic and environmental data.

InnoVar developed an innovative plant variety recommendation system that uses the high-performance low-risk (HPLRTM) approach to evaluating varieties' response to inputs depending on crop and location. It identifies and ranks varieties in terms of sustainability and resilience. "Our focus on resilience and sustainability instead of maximum performance will ensure new plant varieties contribute significantly to sustainable agricultural systems more resilient to climate challenges," says Black.



Our focus on resilience and sustainability instead of maximum performance will ensure new plant varieties contribute significantly to sustainable agricultural systems more resilient to climate challenges.

New database and template for the future

InnoVar conducted extensive field trials, overcoming the challenges of COVID-19 disruptions to distribute trial seed across five agro-climatic zones and 10 countries. This enabled the team to generate a database of harmonised genomic, phenomic, phenotypic and environmental data collected from DUS and VCU trials across Europe.

The project clearly showed that the plant variety testing process should be tailored to agri-climatic zones, but there is potential for harmonisation across regions in Europe. InnoVar's outcomes have been disseminated to plant variety testers through the EU's community plant variety office (CPVO) and the international union for the protection of new varieties of plants (UPOV), as well as to farmers via outreach activities.

"Future projects can build on InnoVar's outcomes to ensure that more efficient ways of variety testing are introduced to capture information on sustainability and resilience," summarises Black. Uptake in Europe should be widespread, with the continent's new plant varieties ready to face the challenges of climate change.

PROJECT

InnoVar - Next generation variety testing for improved cropping on European farmland

COORDINATED BY

Agri-food and Biosciences Institute in the United Kingdom

FUNDED UNDER

Horizon 2020 - FOOD

CORDIS FACTSHEET

cordis.europa.eu/project/id/818144

PROJECT WEBSITE

h2020innovar.eu/



Engineering plants with microfluidic jet injections

Outdated crop breeding methods threaten global food security. A new jet-based platform will change this by delivering genetic material directly into plant cells in an efficient and high-throughput way.

Feeding growing global population requires crops that are more resilient and better adapted to climate changes, leading to better yields. Yet crop breeding is constrained by outdated methods that are slow, species-limited and

inefficient. With climate change, increasing pathogen pressure, and reduced yields, there is an urgent need for tools that can deliver genetic material to plant tissues quickly and safely.



Overcoming DNA transformation barriers

Traditional transformation methods suffer from low efficiency, limited species compatibility and poor cell survival. [Agrobacterium-mediated transfer](#) relies on bacteria to deliver new genes but is labour-intensive and restricted to certain crops. [Protoplast-based methods](#) remove the cell wall to enable DNA uptake, but the resulting cells are fragile and often fail to regenerate whole plants. [Gene guns](#) bombard tissues with DNA-coated particles, a broadly applicable but damaging approach that yields low transformation efficiency.

The ERC-funded Plant-a-Jet project set out to address this bottleneck with a novel jet-based platform designed to deliver genetic material directly into plant cells with high precision. The team embraces [genome editing](#) as an alternative strategy to plant engineering. This approach uses targeted molecular tools to precisely change specific DNA sequences, enabling controlled and predictable genetic modification.

The ‘BuBble Gun’

Central to the project is the ‘BuBble Gun’, a device that generates ultra-fast liquid jets inside a micro-chip, which was developed by the earlier EU-funded [BuBble Gun](#) project. A laser pulse briefly heats the liquid, forming a microbubble that drives the jet forward. This jet carries DNA or gene-editing proteins into plant tissue, assisted by tiny particles that temporarily open pathways through the cell wall.

“Our method operates under normal lab conditions, causes minimal damage and can be scaled simply by creating many jets in parallel,” highlights project coordinator David Fernandez Rivas.

This gentle yet powerful delivery mechanism comes as an improvement to gene gun technology that requires bulky equipment. The ‘BuBble Gun’ preserves cell integrity and supports precise targeting, key attributes for genome-editing applications.

Proof-of-concept demonstrations

The plant cell wall remains one of the biggest obstacles in plant biotechnology. Instead of relying on a single strategy,

the team combines mechanical penetration from the solvent jet with chemical aids that momentarily soften the wall. This dual approach increases the likelihood of successful entry while keeping tissues viable. Additionally, it may enable transformation of recalcitrant species previously inaccessible to standard methods.

Initial experiments demonstrate that the ‘BuBble Gun’ can deliver genetic cargo rapidly and with remarkable precision. Importantly, the cargo reaches its target without degradation.

These findings provide strong evidence that the platform can support DNA-free genome editing directly in plant meristems, potentially bypassing the long regeneration phases required by existing technologies.

Next steps

The project now focuses on demonstrating efficiency in several high-value crop species, including those that are notoriously difficult to transform. Parallel work aims to improve throughput, enhance precision, and refine the micro-jet design to support industrial-scale deployment.

The potential impact of the Plant-a-Jet is multifold, offering opportunities for faster, more accessible and high-throughput genome editing.

“Our approach could help accelerate the development of improved crops and modern strategies for breeding climate-resilient crops,” concludes Fernandez Rivas.



Our approach could help accelerate the development of improved crops and modern strategies for breeding climate-resilient crops.

PROJECT

Plant-a-Jet – In planta jet injection: Efficient genetic engineering of resilient crops

COORDINATED BY

University of Twente in the Netherlands

FUNDED UNDER

Horizon Europe – European Research Council (ERC)

CORDIS FACTSHEET

cordis.europa.eu/project/id/101113293



Turning genome duplication into a plant breeding tool

Genome duplication has shaped plant evolution for millions of years. This natural process can now be used to breed more resilient, productive crops.

Plants have an extraordinary ability to duplicate their entire genome, a process known as polyploidisation. This phenomenon has played a central role in plant evolution: all seed plants have experienced at least one round of whole-genome duplication.

Polyploid plants often show enhanced traits compared to their diploid ancestors, including improved stress resilience and flexible reproductive strategies. These advantages have long attracted the attention of plant breeders, yet the underlying genetic and epigenetic mechanisms remain poorly understood.

Turning an evolutionary force into breeding strategy

The EU-funded [POLYPLOID](#) project set out to study polyploidisation across a wide range of crop and model species. The goal was to translate evolutionary insights into practical breeding tools. In this context, the team combined interdisciplinary expertise in genomics, epigenomics, transcriptomics and phenotyping across different plants.

“We followed a multi-species approach which enabled direct comparisons that would be impossible by a single lab,” states project coordinator Emidio Albertini.

How genome duplication reshapes plants

POLYPLOID investigated the impact of genome duplication on plant genetics and phenotype. Across various model species, the team observed structural genome changes, [non-random gene loss or retention](#) and targeted epigenetic modifications shortly after polyploidisation.

[Transcriptome and methylation analyses](#) showed coordinated changes in gene expression affecting stress tolerance, cell-cycle regulation, reproductive development and cell wall architecture. In several species, the number of differentially expressed genes increased with ploidy level, highlighting genome duplication as a powerful driver of regulatory innovation.



"We identified a set of 'ploidy-sensitive' genes whose expression consistently changes with genome doubling," highlights Albertini. "These genes form a molecular signature of polyploidy."

The team also investigated how genome duplication contributes to [apomixis](#), a form of asexual reproduction through seeds which allows plants to produce offspring without fertilisation. This reproductive strategy is frequently associated with polyploid genomes and is of great interest to breeders because it allows the introduction of traits across generations. By identifying candidate pathways and molecular markers linked to apomixis, the project laid the groundwork for breeding approaches that combine polyploidy with clonal seed production.

Overcoming the triploid block

A major barrier to exploiting polyploidy in breeding is the [triploid block](#), a post-zygotic mechanism that prevents viable seed formation after crosses between plants of different ploidy levels. POLYPLOID addressed this challenge by analysing crosses between diploid and tetraploid individuals. Researchers focused on abnormal endosperm development, a common cause of seed abortion.

Although the project has not yet fully overcome the triploid block, it has identified key pathways involved, including sugar and lipid metabolism and epigenetic gene silencing. [Candidate genes emerging from Arabidopsis studies](#) are now being explored as potential levers to stabilise seed development.

Towards sustainable, resilient agriculture

The most significant achievement of POLYPLOID is the creation of an unprecedented, multi-layer dataset linking genome structure, gene regulation, reproduction and field performance. These insights will pave the way for polyploid-based breeding, offering crops with enhanced stress resilience, improved quality and reduced input requirements.

"Polyploid-based breeding is likely to influence future European food systems by producing crops with customised quality traits," concludes Albertini.

As climate change intensifies pressures on European agriculture, POLYPLOID provides a blueprint for using genome duplication as a deliberate breeding strategy rather than a chance event.



Polyploid-based breeding is likely to influence future European food systems by producing crops with customised quality traits.

PROJECT

POLYPLOID - THE POLYPLOIDY PARADIGM AND ITS ROLE IN PLANT BREEDING

COORDINATED BY

University of Perugia in Italy

FUNDED UNDER

Horizon 2020 – MSCA – Excellent Science

CORDIS FACTSHEET

cordis.europa.eu/project/id/101007438

PROJECT WEBSITE

polyploid.eu/



Building a European research infrastructure for plant genetic resources

Gene banks and other repositories are joining forces to better collect and share plant material and information essential to Europe's ability to produce resilient crops.



© Nora Capozio and Darya Chernokova (Euroseeds)

To feed a growing population, agriculture has increasingly relied on a limited number of crop varieties that perform well under controlled conditions. As a result, many traditional varieties and wild relatives have disappeared from fields, along with genetic traits that once helped plants cope with adversity.

Europe's ability to respond to climate change, food insecurity and biodiversity loss depends in part on how well it understands, conserves and uses its plant biodiversity. The EU-funded [PRO-GRACE](#) project has laid the foundations for a coordinated, distributed European research infrastructure for plant genetic resources, addressing long-standing fragmentation and lack of standardisation in processes and procedures.

Genetic diversity, climate resilience

The focus on a narrow range of high-yielding plant varieties has boosted productivity but sharply reduced genetic diversity, leaving crops increasingly vulnerable. “A single new pathogen or a rapid change in temperature can threaten entire harvests because genetically uniform crops tend to respond in the same way to stress, making them simultaneously susceptible,” explains Giuseppe Aprea of the [Italian National Agency for New Technologies, Energy and Sustainable Economic Development](#), project coordinator.

To address this, plant breeders and scientists need information on traits that could help crops adapt. Repositories of accessions – unique, identifiable samples of plant material – are an essential tool. The [European Search Catalogue for Plant Genetic Resources](#) (EURISCO) currently documents more than two million accessions, yet this is only a fraction of those housed in the approximately 400 European gene banks and institutions. Furthermore, in situ (field-based) accessions remain largely undocumented.

Coordinated infrastructure of European plant genetic resources

PRO-GRACE laid the foundations for a distributed research infrastructure linking existing gene banks, conservation centres and research institutes. To date, there are more than 30 member facilities in 17 European countries. Countries will retain ownership and expertise of national nodes while operating within a shared European framework coordinated by a central hub.

The members of the European research infrastructure will agree on shared standards for accessions’ descriptions, documentation and materials’ requests. Furthermore, “for in situ resources, such as crop wild relatives and traditional varieties still grown on farms, the infrastructure will support monitoring, documentation and backup in ex situ facilities, helping prevent biodiversity loss that is currently poorly recorded and often a risk,” notes Aprea.

Standardised protocols, FAIR data management

Harmonised protocols are a prerequisite for reliable comparison, quality assurance and safe exchange of material. PRO-GRACE developed quality standards for collecting, regenerating and

storing plant material, and it laid the foundations to align with procedures governing the exchange of genetic resources across Europe and internationally.

The proposed infrastructure will also improve data organisation and sharing by applying FAIR data principles, ensuring information is findable, accessible, interoperable and reusable. This will enable researchers and breeders to locate relevant material more easily and compare traits across collections with confidence. As Aprea notes: “Standardisation is a key step in turning Europe’s diverse collections into a coherent and trustworthy system.”

PRO-GRACE delivered a feasibility assessment and proof of concept showing how such an infrastructure could operate. Building on this momentum, the newly established GRACE-RI consortium is now preparing a roadmap application for the European Strategy Forum on Research Infrastructures. “Bridging conservation and application, the research infrastructure will preserve Europe’s plant agrobiodiversity while positioning plant genetic resources as a cornerstone of Europe’s response to climate change, food security and sustainable development,” concludes Aprea.



Bridging conservation and application, the research infrastructure will preserve Europe’s plant agrobiodiversity while positioning plant genetic resources as a cornerstone of Europe’s response to climate change, food security and sustainable development.

PROJECT

PRO-GRACE – Promoting a Plant Genetic Resource Community for Europe

COORDINATED BY

Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) in Italy

FUNDED UNDER

Horizon Europe – Research Infrastructures

CORDIS FACTSHEET

cordis.europa.eu/project/id/101094738

PROJECT WEBSITE

grace-ri.eu/pro-grace

Promoting underutilised crops to boost farm resilience

Social, cultural, economic, and institutional factors also reinforce the dominance of a few crops, making it difficult for farmers to diversify.

Humans have a remarkably narrow agricultural base. Out of an estimated 300 000 edible plant species, we only consume about 200. The reasons are not easy to explain, however, as multiple factors are at play.

Most wild plants have traits that make them unsuitable for cultivation, so farmers have traditionally selected the ones that are easy to grow and store. Conventional agriculture also [favours monoculture](#), resulting in soil degradation and reduced biodiversity, while the global food system is structured

around crops that can be efficiently grown, transported, and marketed. This has left many underutilised crops (UC) behind.



Social, cultural, economic, and institutional factors also reinforce the dominance of a few crops, making it difficult for farmers to diversify.

“Social, cultural, economic, and institutional factors also reinforce the dominance of a few crops, making it difficult for farmers to diversify,” explains Marta Vasconcelos at the Catholic University of Portugal. Yet, cultivating and consuming underutilised crops could boost agricultural biodiversity and reduce our reliance on the small number of plant species we depend on.

Promoting the breeding and farming of underutilised crops

In the EU-funded [RADIANT](#) project, Vasconcelos and her colleagues brought together a multi-actor consortium to focus on UCs. The team co-developed solutions for increasing agrobiodiversity through sustainable dynamic value chains (DVCs) that promote the breeding and farming of these crops.

Project partners put in extensive work on promoting breeding and farming. The researchers characterised numerous collections of selected underutilised crop populations in various locations and explored their biotic and abiotic stress tolerance or looked for improved nutritional traits.

RADIANT also worked with pilot farms and conducted participatory research with 20 [Aurora Farms](#) across Europe. This involved 45 additional farmers who kept diaries to record practical knowledge and challenges.

Sustainable DVCs were established by connecting farmers, researchers, processors, and consumers, including through a dedicated phone app that facilitated information sharing. A conceptual framework was developed to aid in creating sustainable business models. Finally, a blockchain-based traceability system was piloted in processing-focused supply chains to improve transparency and trust.

Open access knowledge on underutilised crops

This work led to the publication of 50 open-access [publications](#) and tools, including the [Agrobiodiversity Toolbox](#) and CropBASE-EU, a global knowledge base for underutilised crops.

The project conducted several workshops to understand the drivers and obstacles to UC farming and consumption, created extensive dissemination materials, and produced several policy proposals based on the results. The team also put on the RARE FOOD FAIR, a public-facing event which celebrated food diversity and brought together producers, researchers, and consumers.

“Together with our sister projects, we laid the foundation for the [Underutilised Crops Cluster](#), which brings together dozens of stakeholders who share an interest and passion for promoting underutilized crops across their multiple dimensions,” notes Vasconcelos.

The project also created, tested, and validated 14 new products for human and animal consumption based on underutilized species.

Supporting EU food systems through agrobiodiversity

“The RADIANT project exemplifies how fostering agrobiodiversity can transform food systems,” says Vasconcelos. “By promoting the cultivation and use of a wider range of crops and supporting dynamic, participatory approaches to agricultural innovation, RADIANT helped ensure that farming systems are more resilient, productive, and sustainable.”

RADIANT tools, networks, and policy recommendations will remain available on open-access platforms, and the project has already inspired a range of follow-up projects.

“The seed was sown, the results have sprung, and the outcomes are ahead,” says Vasconcelos. “It is exciting to see what the future of RADIANT will bring.”

PROJECT

**RADIANT - ReAlising Dynamlc vAlue chaiNs
for underuTilised crops**

COORDINATED BY

Catholic University of Portugal in Portugal

FUNDED UNDER

Horizon 2020 - FOOD

CORDIS FACTSHEET

cordis.europa.eu/project/id/101000622

PROJECT WEBSITE

radiantproject.eu/



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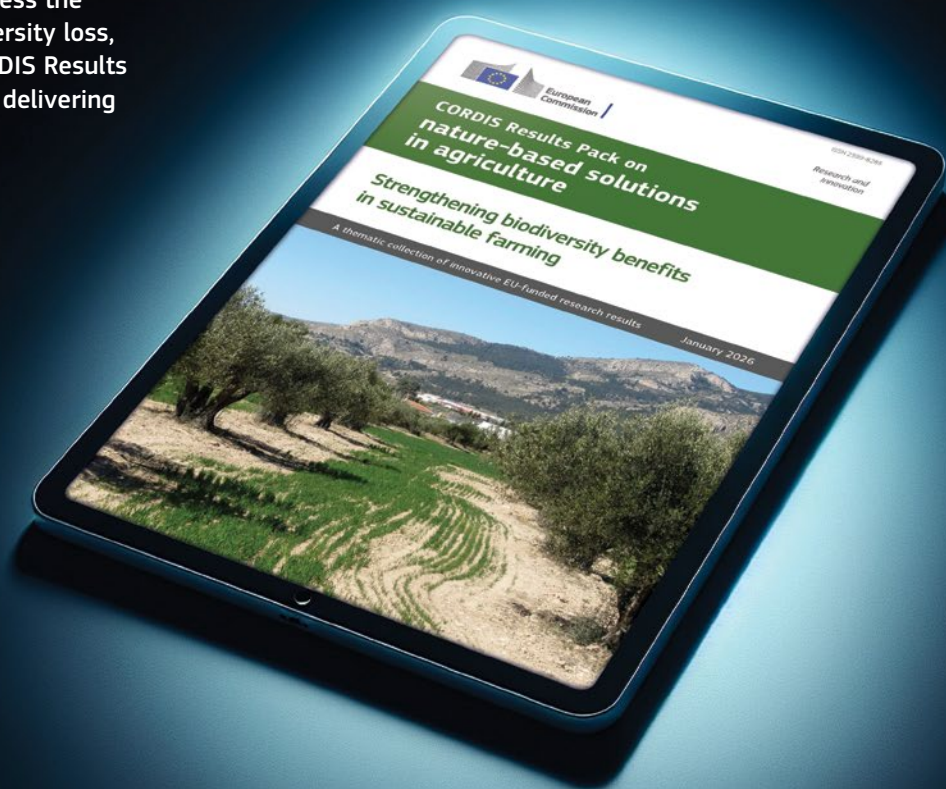
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RESULTS PACK ON NATURE-BASED SOLUTIONS IN AGRICULTURE

Integrating biodiversity and nature conservation with farming practices can help to address the intertwined global challenges of biodiversity loss, climate change, and pollution. This CORDIS Results Pack showcases 12 EU-funded projects delivering nature-based solution in agriculture.



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