




# participatory and citizen science for a decentralized conservation and utilization strategy of Plant Genetic Resources

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

The INCREASE project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 862862.



Scan the QRcode  
for more  
information!

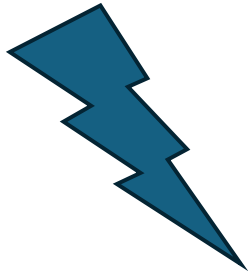
collection expeditions or transfer from other institutions along with available information

Germplasm input: wild landraces and varieties

Gene Banks:  
Conservation long-term and short-term with seed regeneration and germplasm characterization (phenotypic and genotypic) and data management

Distribution to expert users:  
researchers, plant breeders and seed companies

Very recently citizens ask for PGR to gene banks



No data feedback, with few exceptions mainly for genomics

**New varieties**

**The limited number of expert users (who generally focus on very limited number of environments), and the whole innovation scheme contribute to the very low utilization of PGR**

reduction of biodiversity planetwide. We must do so quickly. Stopping the destruction of natural environment, reducing CO2 emissions, rationing reducing pollution and land consumption, efficient and productive agri-food systems, built by embracing an ecological focus and biodiversity.

Biodiversity and agricultural genetic resources are crucial for global food security, their use is insufficient. Modern agricultural systems are based on only a few species and varieties, which are more vulnerable to pests, disease and climate events. We should be drawing from the genetic wealth preserved in seed banks and putting these varieties to use.

As part of the INCREASE project, an innovative approach to seed conservation. We want to improve the evaluation of genetic resources and encourage their use. This will help conserve

**“We should be drawing from the existing genetic wealth preserved in seed banks and putting these varieties to use”**

garden, balcony or terrace can participate. To date, nearly 8,000 people from across Europe have joined us.

Technology makes it easy to pull this off. Using our app, participants can select from more than 1,000 local bean varieties, whose genomes have been sequenced as part of the BEAN\_ADAPT project. The beans are mailed directly to their door. They then use the app again to input data and observations collected during the various stages of plant development, to the benefit of INCREASE researchers.



By **Roberto Papa**

Roberto Papa is the coordinator of the INCREASE project and a full professor in agricultural genetics at the Università Politecnica delle Marche (UNIVPM)

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Crucially, to prevent biopiracy and create a conservation catalogue, participants sign the agreement for the transfer of seeds using the INCREASE CSA app, which is connected to the FAO system

and guarantees full traceability. Through the same procedure, citizens can exchange seeds between themselves.

This project could be further enhanced by the engagement of local institutions

## Europe on a plate

The food and drink edition

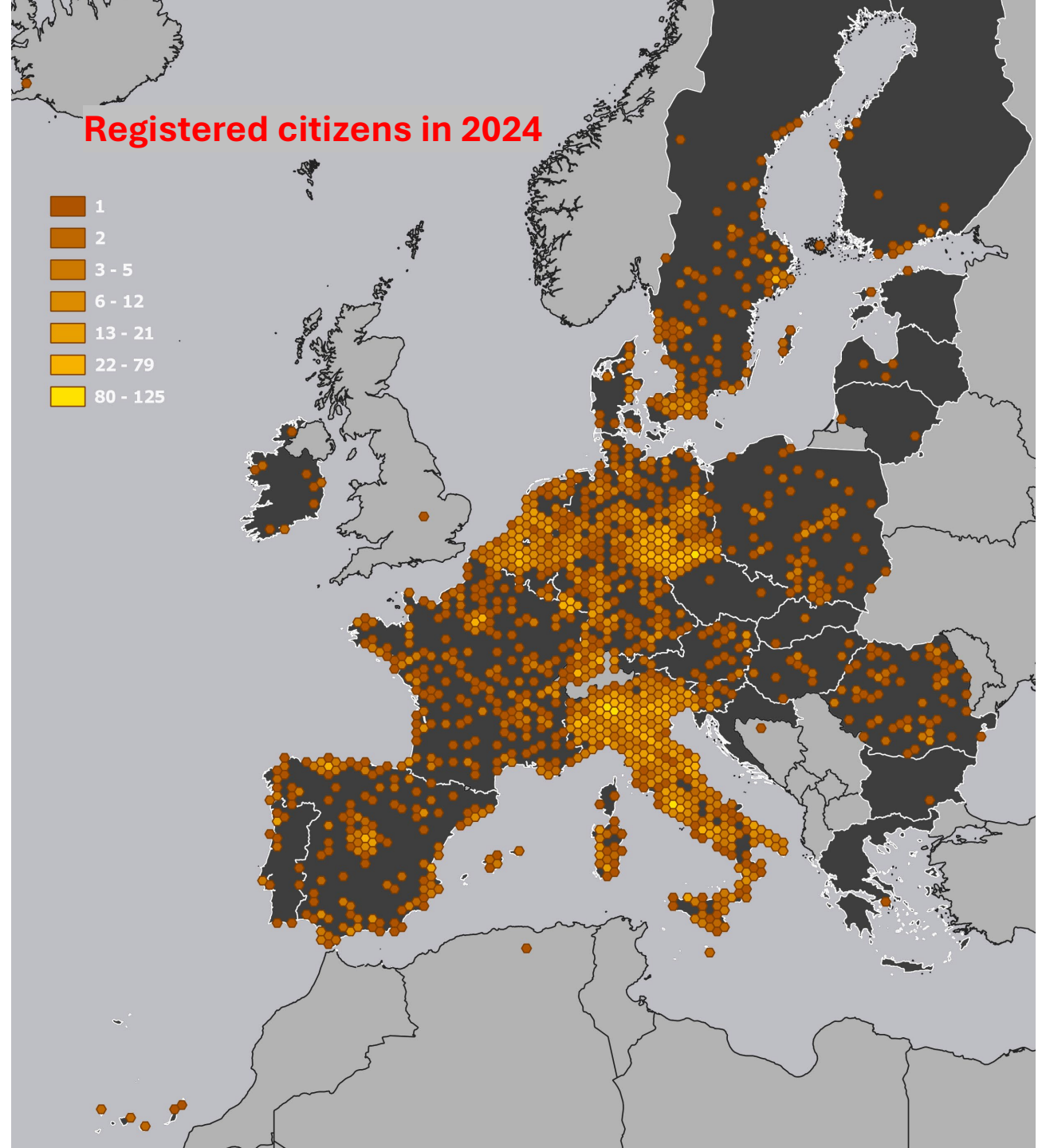


**Participatory approaches such as citizens' science could promote the utilization of PGR in agriculture and contribute to sustainability**

**2021-2024**

**More than 20,000**

**registered citizens from all  
EU countries**



## Full traceability of germplasm accessions (pure line SSD derived)

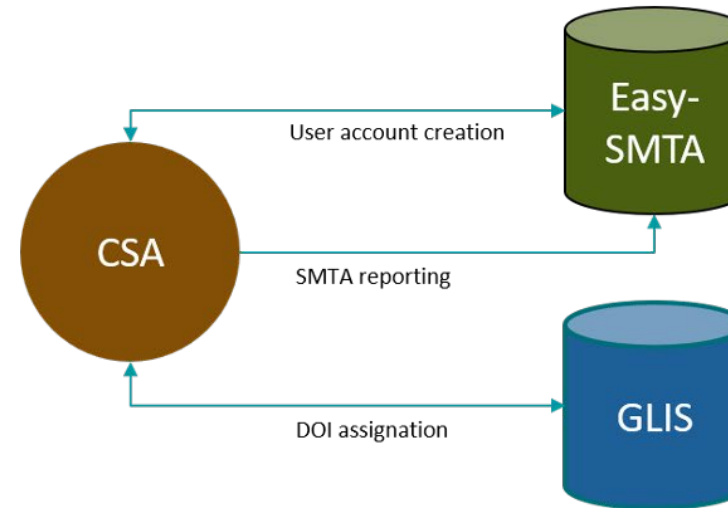
### „INCREASE CSA“ SMTA step to receive seeds

- PGR requires **Standard material transfer agreement (SMTA)** according to the Treaty, with FAO integration of the easy SMTA into App
- **DOI** Registration Module of the Global Information System (GLIS), seed exchange integrated with FAO APIs, Process Certification), Blockchain infrastructure
- **Only after SMTA acceptance, seeds send via mail**
- Seed exchange with SMTA between citizens possible since 2022

**SMTA & DOIs:** Marco Marsella, Emanuele Frontoni, Tommaso Pantaloni, Markus Oppermann

#### Seed packing and sending:

Elisa Bellucci, Abdalhadi MS Abulebda, Alice Pieri and many students (!)



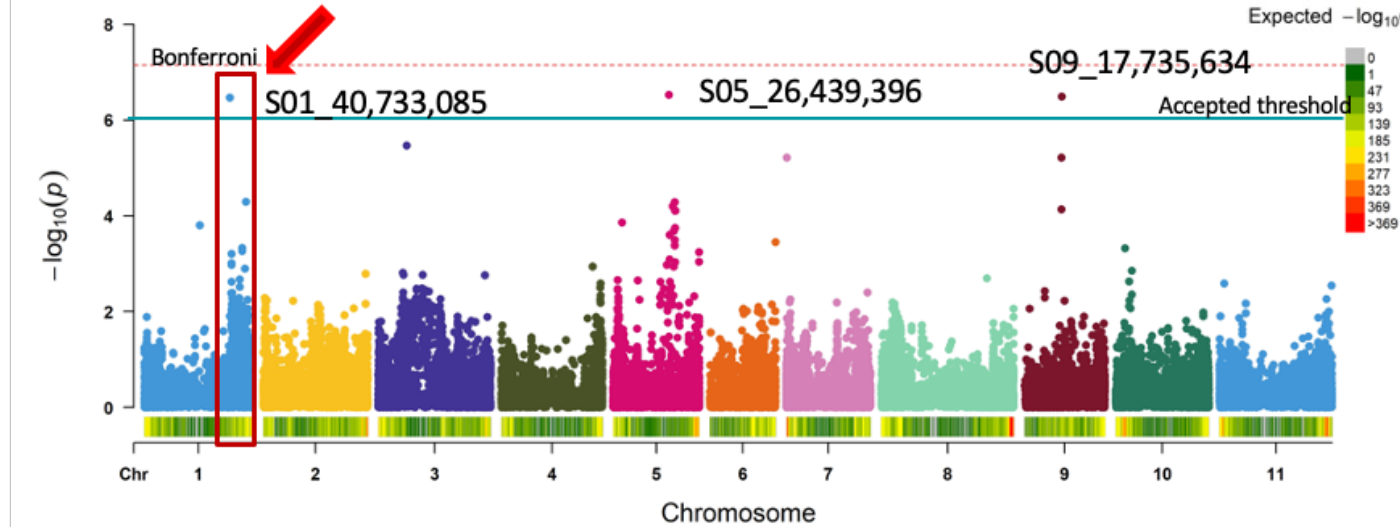
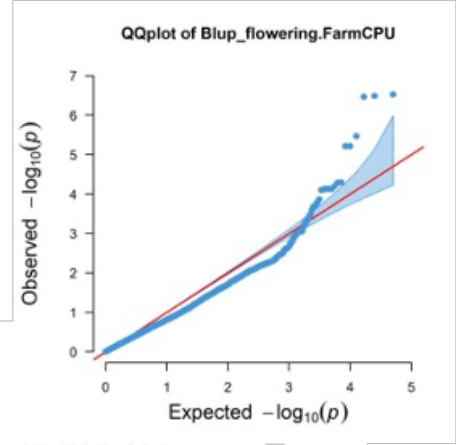
Ongoing...  
**Flowering GWAS – explorative results**

3) **GWAS** model FarmCPU

$$Y = G + Q + K$$

↓ BLUP values  
 ↓ Admixtur e Qi values K=2  
 ↓ Kinship matrix IBD

- 669 genotypes
- 50,155 GBS SNPs



On Chr1 hotspot region of genes associated to flowering observed also in BeanAdapt GWAS

- Awaiting daily weather data
- More replicates per genotype (Round 3)
- Additional Sequence data – also WGS

A decentralized PGR conservation system could be, as a complement to the gene banks system, a reliable strategy by adopting procedures that could warrant the proper conservation and evaluation of the accessions over a medium/long-term commitment at a limited cost promoting PGR utilization and agriculture diversification

The **INCREASE CSE** strategy is based:

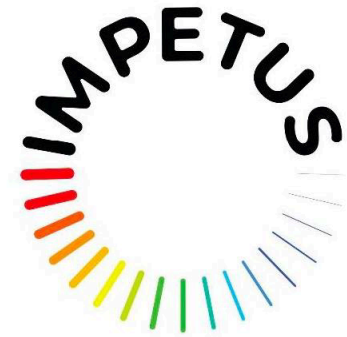
- 1) By the combination of **strict traceability** procedures adopting the utilization of Easy SMTA and the doi traceability systems for seed distribution and seed exchange
- 2) On the the **adoption of innovative technology** from genomics, AI, informatics, and climate analysis tools, that could largely improve the conservation and valorisation of PGR under a decentralized system of conservation.
- 3) On the adoption of decentralized conservation will also have many other **positive “side effects”** such as promoting the **diversification of agriculture improved science education, favouring social integration supporting social and urban agriculture, and facilitating access to quality food for the poorest, particularly in urban areas.**



# WINNER

## EU PRIZE FOR CITIZEN SCIENCE 2024

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EUROPEAN UNION PRIZE FOR  
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