EU CAP Network Focus Group

'Local perennial plant genetic resources in view of climate change and biodiversity loss'

Mini Paper 4
Developing participatory plant breeding for perennial crops

Concepción Muñoz Diez, Filippos Aravanopoulos, Veronique Decroocq, Gunars Lacis, Lorenzo León, Tommaso Frioni, Ivan Tsvetkov, François Warlop

June 2025

Funded by the European Union

Table of contents

INTRODUCTION – MOTIVATION

Participatory plant breeding (PPB), which involves collaboration among plant breeders, farmers, and other stakeholders, has been primarily applied to improve crop adaptation in marginal and heterogeneous environments. While PPB has been successful in annual crops, its application to perennial species remains limited and faces substantial challenges. These include restricted stakeholder engagement, insufficient integration of public-private partnerships, and the high costs associated with perennial crop breeding, particularly exacerbated by the extended juvenile phases of these crops. These biological constraints hinder the establishment and sustainability of the long-term collaborations essential to PPB. This Mini Paper aims to identify strategies to address these barriers and highlight best practices for advancing PPB in perennial crops. Strengthening such initiatives may enhance farmer-centred breeding, leverage traditional knowledge, facilitate the development of locally adapted cultivars, and ultimately, improve the resilience and adaptability of perennial crops in the context of climate change and evolving agricultural and market demands.

DISSERTATION

1.1 Description of Key Issues

Participatory plant breeding involves a diverse range of actors, including scientists, farmers, nurseries, extension agents, cooperatives, traders, and policymakers. This collaborative framework is designed to align breeding objectives with the needs of end-users. However, despite its potential, PPB for perennial crops remains underdeveloped due to several challenges:

- First, the lack of robust collaboration between stakeholders. The integration of public and private efforts is critical for creating a cohesive breeding strategy, yet these partnerships are often underutilized. PPBs should respond to the end-users needs. However, this requires exchange of information between stakeholders about the benefits of PPBs and the development of structured and long-term collaboration channels.
- Second, the long-life cycles and slow growth of many perennial crops hinder the establishment of long-term alliances between stakeholders and require the maintenance of continuous financial support.
- Third, the role of farmers as key stakeholders is often underestimated. Effective PPB requires that farmers participate not only in the evaluation of cultivars but also in defining breeding objectives. Providing incentives for their involvement

and creating platforms for their contributions can ensure that the breeding outcomes align with the practical needs of agricultural systems.

- Fourth, PPB encourages farmer participation in crop improvement, while traditional intellectual property (IP) mechanisms can sometimes restrict these practices. To address this challenge, it is essential to develop initiatives that create open-source materials or establish specific agreements between farmers, breeders, and public or private companies.

STATE-OF-THE-ART OF RESEARCH/PRACTICE

2.1 PPB definition and historical background

PPBs emerged in the late 1980s in response to critiques of post-Green Revolution, experiment-station-based research, which did not address the needs of smallholder farmers in developing countries. Currently, PPB includes all approaches to genetic improvement of crops that involve close collaboration between farmers and researchers. In particular, the term refers to the active involvement of farmers in at least one of the stages of a plant breeding program, including target setting, variability generation, selection and testing, plant material production and distribution.

PPB methodologies are more commonly applied in countries with low-income economies, to improve the adaptation of annual crops grown in marginal and heterogeneous environments. However, PPBs can also benefit market-oriented agriculture in favourable environments (Ceccarelli et al., 2009). In fact, 47 PPBs in 22 crop species have been developed in Europe, the USA and Canada, most of them in the context of organic production (Colley et al., 2021).

PPBs have other goals in addition to improving production, such as, align with farmer's needs, conserve local diversity, build farmer capacity and empowerment, influence policies and regulations, increase research efficiency, and deliver benefits to specific user groups (Ceccarelli et al., 2009). The effects of climate change impose new breeding targets. Therefore, adopting breeding strategies that allow a highly dynamic and efficient system of variety testing in farmer fields, might contribute to the adaptation of the crop to diverse environments while contributing to agrobiodiversity (Ceccarelli et al., 2013).

PPBs can be classified into two categories (Figure 1):

- *Breeder-led:* farmers are asked to join in PPB activities which have been initiated, managed, and executed by formal breeding programs.

- *Farmer-led:* scientists and/or advisors seek to support farmers own controlled, managed, and executed breeding systems. Scientists can support their own varietal selection and seed system.

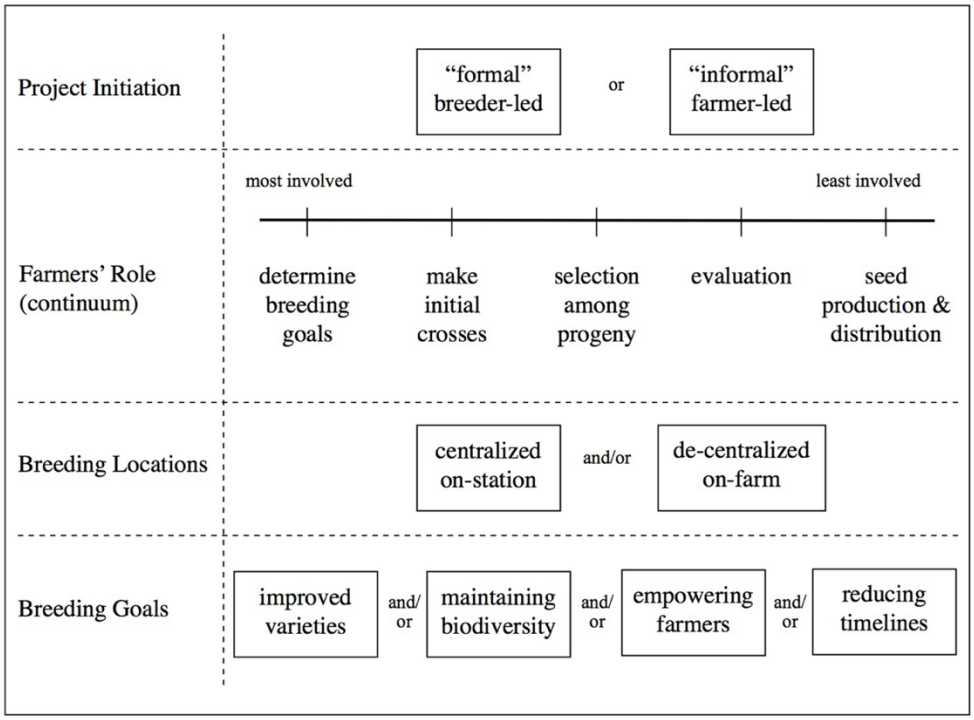

Figure 1. Components of PPBs (Source: Shelton and Tracy, 2016)

Specific forms of PPBs are **Participatory Variety Selection (PVS) and Evolutionary Plant Breeding (EPB) networks.**

PVS is a specific form of PPB, where the farmers are involved in evaluating finished varieties. Research has shown that PVS is an effective method for identifying cultivars preferred by farmers (Ceccarelli et al., 2009). The finished products/genotypes include released cultivars, pre-release cultivars and advanced selections from breeding programs.

PVS involves three key stages: a) defining farmers' needs, b) selecting appropriate advanced varieties or selections for testing under farmers' conditions, and c) conducting trials in farmers' fields and disseminating the selected varieties (Mamo et al., 2016).

Protocols for evaluating the genotypes and the criteria for their selection should be early defined and shared. To this end, initial training sessions and periodical meetings are required. To confirm the plant material is true to type and free from labelling or propagation errors, random samples (e.g., leaf samples) should be sampled and their identity verified using genetic molecular markers by the breeder or academic partners. In addition, uncommon observations, such as pest or pathogen outbreaks, should be reported on the participatory platform to alert other sites and characterize the plant material.

EPB networks are mainly applied to annual plants propagated by seeds. EPBs leverage natural evolutionary processes, such as selection and adaptation, to enhance the genetic diversity and resilience of crops. In EPBs, a genetically diverse population is planted in various environments, where mass breeding is conducted to develop an ideotype suited to each environment.

The long-life cycles of perennial crops make it practically impossible to apply EPB. However, the extant populations of crop wild relatives, many of them growing in marginal environments, could be considered as a natural EPB network for every perennial crop. The genetic diversity of these populations reflects their natural adaptation to different edaphoclimatic conditions. Exploring the genetic diversity of these populations, along with the key environmental factors that affect them, could help identify genes associated with resistance to various biotic and abiotic stresses, which could be key for improving the crop.

Considering perennial crop wild relatives' populations as EPB networks would increase their perceived value, promoting their *in-situ* conservation and characterization. Implementing this proposal would require collaboration among breeders, researchers, local farmers, forestry agents, and policymakers.

2.2 Farmer's participation in PPBs

PPB involves various levels of farmer participation (Mamo et al., 2016) (Figure 1):

- *Consultative:* Farmers are involved in every stage of the breeding process, from identifying objectives to selecting parental materials, but the breeder makes the final decisions. Farmers help select genotypes in breeder-managed plots.
- *Collaborative:* Both farmers and breeders make decisions together, with open communication on selection criteria and priorities. Any changes to decisions require mutual agreement.

- *Collegial participation:* Farmers grow and select genotypes on their own fields, either individually or in groups, while maintaining organized communication with breeders.
- *Farmer experimentation:* In this approach, farmers independently decide how to conduct research with new genotypes, without breeder involvement or organized communication.

In the case of PPB in perennials, farmers are primarily involved in growing, evaluating, and selecting the plant material provided by breeders and academic partners. The plant material can consist of segregating populations, traditional cultivars or pre-release cultivars.

2.3 Stages of participation and main outcomes of PPBs

The development of a PPB program involves multiple stages, allowing farmers, breeders, and other stakeholders to participate in the crop improvement process at various levels, from defining breeding goals to selecting superior varieties. Farmer knowledge and preferences are central, informing breeding objectives and selection criteria.

- Stage 1: definition of target selection traits, environments and germplasm to be evaluated (segregating populations, traditional cultivars or pre-release cultivars).
- Stage 2: germplasm should be multiplied in a designated location. Preferentially, a nursery or academic partner, potentially a nationally recognized germplasm bank, should oversee the plant multiplication and distribution. This entity must hold a valid phytosanitary passport and ensure the authenticity of plant material through true-to-type verification using molecular tools.
- Stage 3: planting or grafting if the germplasm in the different stakeholders' locations.
- Stage 4: development of a participatory platform for farmers, breeders, and other stakeholders to record information about the core group of varieties, including mother plants and propagated material. This stage should occur alongside stages 1 to 3. Examples of such platforms are GDR (https://www.rosaceae.org/taxonomy/term/7) or CartoGraTree (https://cartogratree.org).
- Stage 5: establishing annual agendas including crosses, seed germination, plant growing, planting, performance scoring etc. Also, regular virtual meetings between academic partners and stakeholders, and training sessions. The early

establishment of common criteria and protocols for evaluation and selection is crucial for efficient breeding (see Mini Paper on genetic resources characterization).

- Stage 6: annual meetings between farmers, breeders and other stakeholders for updating, fine-tuning the program for the following year and selecting outstanding genotypes.

The main outcomes of PPBs are the following:

- Improved matching between farmers expectations for new varieties and innovation.
- Upscaling of the number of progenies obtained and that will be tested.
- Multi-site observations of the progenies/potential cultivars performances.
- Provide farmers with first-hand information about the performance of the germplasm evaluated in the PBBs.
- Increased awareness of the stakeholders on locally selected plant material

2.4 Examples of current PPBs involving long term collaboration among stakeholders

Apfel:Gut was launched in northern Germany in 2011, as a project based on a bottom-up principle. It originated from a FÖKO working group led by a small consortium involving organic growers and advisors (Figure 2A). The collective decision emerged to bring the breeding process back into farms. It now involves 11 different breeding sites. This setup facilitates the observation of breeding materials (clones) under diverse climatic conditions across the country. Embracing a participatory approach, various stakeholders actively engage in the breeding process, with activities such as collective fruit tastings with marketers, consumers, and other relevant actors (Figure 2B). see https://innobreed.eu/wp-content/uploads/2024/04/innobreed-CS-apfelgut-DE-final-1.pdf

Figure 2. (A) German and Belgian breeders and farmers met in orchards to discuss their respective projects and results. (B) Collective fruit quality assessment to address PPB goals (Source: https://www.reussir.fr/fruits-legumes/une-selection-participative-avec-les-producteurs)

Latvia Institute of Horticulture (LatHort) typically conducts pre-breeding activities, hybridization, and initial selection. Further testing of selected breeding material, particularly, pre-release cultivars, is then carried out on farms in different environments, with academic supervision. The advantage of such a distribution of activities is the efficient provision of multi-environmental trials, with savings in financial and other resources. Such a division of activities scheme for fruit crop breeding (apple, raspberries, black currants and Japanese quince) is applied by the LatHort, which carries out basic breeding and research and cultivar candidates are tested under agrotechnical conditions suitable for commercial cultivation using the demo farm network (https://fruittechcentre.eu/en/demo-network), which includes 22 entities from 3 neighbouring countries Latvia, Lithuania and Poland (Figure 3).

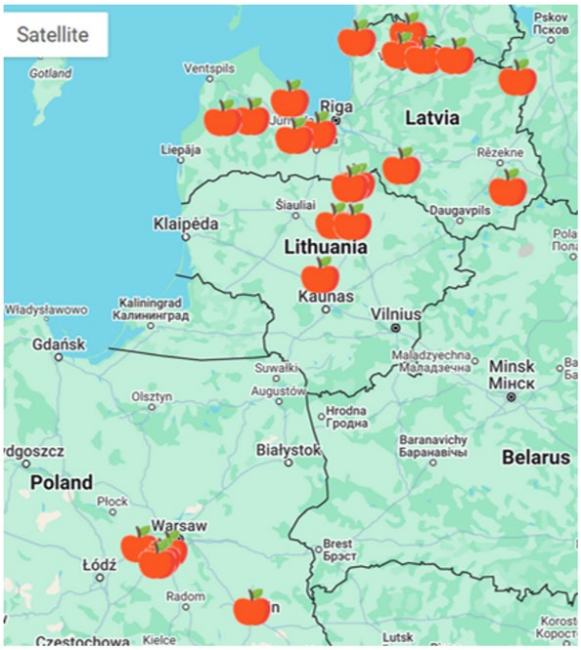

Figure 3. Distribution of the evaluation field trials of the PPB participated by LatHort. (Photo by Gunars Lacis)

Vitea.1 is the first project in Italy to conduct field testing of pathogen-resistant grapevine varieties developed using advanced new breeding techniques

(CRISPR/Cas9). Coordinated by the University of Verona and the spin-off EdiVite, the project involves collaboration with local growers' associations, including Coldiretti and Confagricoltura. The initiative aims to evaluate the field performance of grapevines with reduced susceptibility to downy mildew and powdery mildew, diseases that currently require growers to use large quantities of chemical control products. The initiative is carried out in collaboration with nurseries, stakeholders, and public bodies, ensuring broad participation and support.

Vivai Cooperativi Rauscedo (VCR), a world leading company in vineyard plant propagation, based in Friuli, north-eastern Italy, launched a breeding program in the 1990s in collaboration with local growers. This effort resulted in the licensing of 14 pathogen-resistant grapevine varieties and the establishment of a dedicated research centre (https://www.vivairauscedo.com/vcr-research-center/). Following the registration of these varieties, VCR facilitated the creation of a nationwide network of 16 experimental vineyards in partnership with local stakeholders, research institutions, regional and local administrations, regulatory bodies, and growers. Eleven of those experimental vineyards are located in 11 different Italian regions, while the remaining five are located in other European countries (https://vivairauscedo.com/contributi/download/quaderno18-resistenza-malattie.pdf). This network enables field and multisite evaluation of the new cultivars across Italy's key wine regions, ensuring their adaptability and performance under diverse local conditions (Figure 4).

Figure 4. Experimental vineyard part of the VCR network, established by the cooperative of growers 'Cantina di Vicobarone' with the support of Università cattolica del Sacro Cuore and VCR in the Colli

Piacentini, under the Operational Group ValorInVitis. The vineyard includes ten new pathogen resistant varieties obtained by a PPB process. (Photo by Tommaso Frioni)

Bulgarian grapevine participatory breeding: The intensive collaboration between the Agrobioinstitute - Sofia, the Historical Museum - Kardzhali and the Belogradets Winery began in 2005, with the discovery of the wild form of vine in the Thracian sanctuary nearby village Tatul (492 m above sea level) in the Rhodope Mountains. Viticulture and winemaking were a livelihood for the Thracians as early as 3000 years ago. In this context, a PPB was developed to explore the possibilities of using this old wild grape (*Vitis vinifera* ssp. *sylvestris)* for wine production. Field trials, pre-breeding, breeding and vinification experiments were done with the active involvement and financial support of the partners. The first 5 ha planted with the old wild grape were established 3 years ago in Belogradetz Winery and the first promising pilot wine has been already elaborated.

Figure 5. Rhodope Mountains, the selected wild Vitis and the wine elaborated by Belogradetz Winery. (Photo by Ivan Tsvetkov)

Participatory Variety Selection (PVS) on Olive: The long time required to release new cultivars has hampered systematic olive breeding. In 1992, an olive breeding program was initiated in Córdoba (Spain) by the University of Córdoba and the IFAPA (Andalusian Institute for Agricultural and Fisheries Research). The program aimed to develop new cultivars characterized by early bearing, high productivity and oil content, improved oil quality, disease resistance, and adaptability to different growing systems. Although this program began as a public initiative led by these institutions, it eventually evolved

Figure 6. Locations of olive PPB field trials in Spain and Portugal. (Photo by Lorenzo León)

into a PVS process, involving farmers and other stakeholders in the broad testing of advanced selections in different edaphoclimatic conditions. Currently, the program encompasses numerous collaborations across the main olive-growing regions in Spain and Portugal (Figure 6). As a result, several new cultivars have already been released, and promising genotypes are now in the final stages of selection. Nonetheless, there remains significant room for improvement, particularly in refining the program's overall design. This includes establishing formal annual meetings among all stakeholders and developing a participatory platform to record and manage all relevant information.

2.5 PPBs in European Projects

- **Novafruits:** is a Belgian and French initiative started more than 10 years ago, involving researchers (from University of Gembloux and CRA-W), practitioners (from CRRG) and fruit growers from both countries (Figure 7). The partners selected apple and pear cultivars as genitors; crosses were performed by CRA-W. Seedlings were distributed among farmers, and participative selection started with no plant protection to select only the most robust accessions. Since the project started, several varieties have been released (such as Coxybel apple), primarily reserved for the participating farmers as a premium for a limited period. Since 2022, NOVAFRUITS is part of the Horizon Europe project InnOBreed as a case study. More information: https://innobreed.eu/wp-content/uploads/2024/11/innobreed-CS-NOVAFRUTIS-Final-draft.pdf

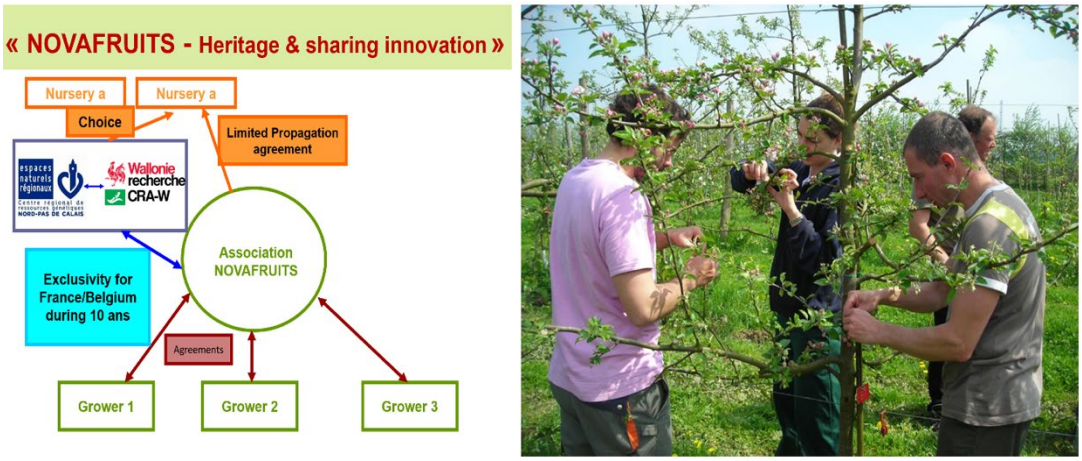

Figure 7. Novafruits governance scheme and collaborative field work (directed crosses) (Photo by François Warlop)

- **FRUITDIV** is a Horizon Europe project that started in January 2024, it aims to characterize and introduce in breeding programs crop wild relatives of the pome

and stone fruit species. In the frame of FRUITDIV, crop x wild progenies are produced by academic partners and then distributed to stakeholders such as nurseries, farmers and citizens for planting and recurrent characterization in a multi-site design. A participative platform is being designed for all private and public partners involved in the crop x wild breeding programs. See www.fruitdiv.eu.

- **GrapeBreed4IPM** is a Horizon project focused on developing disease-resistant grapevine varieties tailored to local environmental and pedoclimatic conditions, with the goal of reducing dependence on chemical pesticides. The project also aims to study consumer perceptions of these new resistant varieties and their wines, which are less familiar compared to traditional ones. Additionally, it will provide farmers, winegrowers, and advisers with best practices and guidelines for integrated pest management, fostering more environmentally friendly and sustainable viticulture across Europe. The project has the three following main participatory aspects: i. Co-design a shared approach with stakeholders along the value chain in different European regions; ii. Develop traditional breeding programs for new disease-resistant varieties in collaboration with local stakeholders. iii. design and share decision support tools and best practices to optimize cultivation practices adapted to resistant varieties.

EXISTING BEST PRACTICES AND TOOLS

- **Development and signing of a Memorandum of Understanding (MoU)** among the stakeholders involved in the PPB. This document outlines shared principles and commitments among participants and ensures transparency, trust, and confidence between them to promote commons values and help achieve the objectives of the PPB project effectively. See project NOVAFRUITS for an example of MoU in this context.
- **Adopting standardized protocols** for germplasm evaluation is essential for generating consistent and high-quality data, ensuring global relevance and scientific rigor. The GEN4OLIVE project (https://gen4olive.eu) is a prime example, focusing on the development and implementation of common evaluation protocols for olive germplasm, which enhances data comparability and supports international breeding efforts.
- **The use of standardized information management systems** is essential for handling the large volumes of data in breeding programs. Open-source tools like Field Book, a mobile app that replaces paper field books, enhance data collection speed and accuracy. Similarly, the Breeding Information Management System (BIMS), also open source, helps breeders efficiently

organize, analyze, and share data such as pedigrees, phenotypic and genotypic records, and field trial results.

- **The development of georeferenced PPB field trial networks** is essential for systematically collecting and uploading integrated meteorological, phenotypic, and genotypic data. These networks enable researchers and breeders to monitor crop performance across diverse environmental conditions, facilitating more precise selection and adaptation strategies. A broader-scale example of such an initiative is CartograPlant (https://treegenesdb.org/ct), an open-access repository and web-based analytical framework. Designed to support data sharing and visualization, CartograPlant integrates genotype, phenotype, and environmental datasets, promoting collaborative research.

CONCLUSIONS

Participatory plant breeding holds immense promise for addressing the challenges faced by perennial crops. By promoting collaboration among stakeholders, prioritizing producers' needs, researching G×E interactions, and incorporating farmers' expertise, breeding programs can more effectively meet the demands of climate resilience, reduction of pesticides use and agricultural productivity. Successful practices in annual crop PPB offer valuable lessons that can guide the development of similar frameworks for perennials.

Given the costs associated with maintaining perennial crop platforms, PPB offers a cost-effective, decentralized evaluation approach that addresses farmers' needs, provides academic and technical support, and generates new cultivars adapted to climate change and market demands.

RESEARCH NEEDS

To promote the development of PPB for perennial crops future research should prioritize the following strategic areas:

1. Germplasm characterization and accessibility

Develop centralized, standardized, and openly accessible databases to document and share diverse perennial crop germplasm, enabling broader use and exchange while complying with biodiversity laws.

Geographical area of application: All EU member states

Sectors: Agriculture, Forestry, Academy and Public Sector-Policy makers

2. Environmental impact and G×E analysis

Conduct long-term, multi-location trials under both organic and conventional systems to understand genotype-by-environment interactions and guide selection of climate-resilient and regionally adapted varieties.

Geographical area of application: All EU member states, with emphasis on different edaphoclimatic zones where the crop is currently grown, as well as potential new areas for cultivation.

Sectors: Agriculture and Academy

3. Utilizing wild relatives as EPB networks

Leverage the resilience traits of wild crop relatives by establishing selected populations as EPB networks, especially in marginal environments, promoting on-farm conservation and co-evolution strategies.

Geographical area of application: All EU member states, with emphasis on different edaphoclimatic zones where wild relative populations are distributed.

Sectors: Agriculture, Forestry, Academy and Public Sector-Policy makers

4. Climate adaptation research infrastructure

Create dedicated research observatories and long-term monitoring stations to study climate impacts on perennial crops and support adaptive breeding strategies.

Geographical area of application: All EU member states, with emphasis on different edaphoclimatic zones where the crops are cultivated.

Sectors: Agriculture and Academy.

5. Tailored information systems for perennial breeding

Develop crop-specific, user-friendly digital tools to manage complex breeding data, with features like real-time phenotyping, genomic prediction, and traceability.

Geographical area of application: All EU member states

Sector: Agriculture, Forestry, Academy and Public Sector-Policy makers

6. Stakeholder Integration in the Breeding Process

Establish inclusive mechanisms, such as Open Participative Digital Platforms, to allow farmers, researchers, private sector, and policymakers to collaboratively shape breeding goals and participate in cultivar development and evaluation.

Geographical area of application: All EU member states
Sector: Agriculture, Forestry, Academy and Public Sector-Policy makers

IDEAS FOR INNOVATIONS

Innovative approaches to PPBs in perennial crops should include:

- Develop interactive digital platforms (e.g. SeedLinked, https://seedlinked.com) to support real-time data sharing, trial feedback, and collaboration among farmers, breeders, and researchers of the EU member states.
- Establish EU-wide climate observatory networks to collect and analyse long-term environmental and phenological data on perennial crop performance.
- Create sustainable funding mechanisms and multi-actor operational groups under European Innovation Partnerships - EIP-AGRI- to support collaborative pre-breeding and PPB initiatives. See Kotschi et al., (2022) or Liveseeding project (https://liveseeding.eu/deliverables-publications).
- Promote the use of modern breeding tools, such as marker-assisted selection and computer-aided breeding, to increase efficiency and precision.
- Build centralized, standardized, and publicly accessible germplasm databases to enhance genetic resource sharing while ensuring compliance with biodiversity regulations.
- Design clear, functional frameworks for education, co-creation, and collaboration, including agreements on intellectual property and benefit-sharing among all stakeholders of the EU member states.

REFERENCES

Ceccarelli, S., Galiè, A., & Grando, S. (2013). Participatory breeding for climate change-related traits. In Genomics and Breeding for Climate-Resilient Crops: Vol. 1 Concepts and Strategies (pp. 331–376). Berlin, Heidelberg: Springer.

Ceccarelli, S., Guimarães, E. P., & Weltzien, E. (2009). Plant breeding and farmer participation. Rome, Italy: Food and Agriculture Organization of the United Nations.

Colley, M. R., et al. (2021). Exploring the emergence of participatory plant breeding in countries of the Global North – A review. The Journal of Agricultural Science, 159(5-6), 320–338.

Dincheva, I., Badjakov, I., Tsvetkov, I., Dzambazova, T., Kondakova, V., & Batchvarova, R. (2011). GC-MS determination of secondary metabolites in red wine from Bulgarian wild grape (Vitis vinifera ssp. sylvestris). Journal of Mountain Agriculture on the Balkans, 14(6), 1331–1343.

Dzhambazova, T., Tsvetkov, I., Atanassov, I., Rusanov, K., Martínez-Zapater, J., Atanassov, A., & Hvarleva, T. (2009). Genetic diversity in native Bulgarian grapevine germplasm (Vitis vinifera L.) based on nuclear and chloroplast microsatellite polymorphisms. Vitis: Journal of Grapevine Research, 48(3), 115–121.

Kotschi, J., Schrimpf, B., Waters-Bayer, A., & Horneburg, B. (2022). Financing organic plant breeding—New economic models for seed as a commons. Sustainability, 14, 10023. https://doi.org/10.3390/su141610023

Mamo, T., & Singh, A. (2016). Participatory Plant Breeding and Participatory Variety Selection. Retrieved from Plant Breeding E-Learning in Africa.

Rondia, A., Dumont, B., Donis, T., Rey, J.-B., Stievenard, R., Bruneau, G., & Lateur, M. (2024). Screening apple cultivars better adapted to organic fruit production – A transborder and participatory approach. Proceedings of the 21st International Conference on Organic Fruit Growing, Filderstadt, 13–18. [https://www.ecofruit.net/wp-content/uploads/2024/02/13-18-SB31-Reviewed-Paper-Lateur-Screening-apple-cultivars-better-adapted-to-organic-fruit-production.pdf] (https://www.ecofruit.net/wp-content/uploads/2024/02/13-18-SB31-Reviewed-Paper-Lateur-Screening-apple-cultivars-better-adapted-to-organic-fruit-production.pdf)

Shelton, A. C., & Tracy, W. F. (2016). Participatory plant breeding and organic agriculture: A synergistic model for organic variety development in the United States. Elementa: Science of the Anthropocene, 4, 000143.

Sievers-Glotzbach, S., & Christinck, A. (2021). Introduction to the symposium: Seed as a commons—Exploring innovative concepts and practices of governing seed and varieties. Agriculture and Human Values, 38, 499–507. https://doi.org/10.1007/s10460-020-10166-x

Sperling, L., Ashby, J. A., Smith, M. E., Weltzien, E., & McGuire, S. (2001). A framework for analyzing participatory plant breeding approaches and results. Euphytica, 122, 439–450.

Tsvetkov, I., Atanassov, A., Jankulova, M., Vulchev, V., Todorov, I., Pandeliev, S., Malenin, I., et al. (2006). Development and evaluation of a Bulgarian grapevine genebank. In G. Martelli (Ed.), Proceedings of the 15th Meeting of the International Council for the Study of Virus and Virus-like Diseases of the Grapevine (pp. 261–263). Stellenbosch, South Africa.

Tsvetkov, I., Dzhambazova, T., Georgieva, L., Bayatova, M., Georgiev, D., & Kondakova, V. (2016). Explore the use of wild grapes (Vitis vinifera ssp. sylvestris) as grapevine rootstocks. Journal of Mountain Agriculture on the Balkans, 19(3), 197–211.

Tsvetkov, I., Georgieva, M., & Dzhambazova, T. (2017). Affinity and growth dynamic of selected wild grape form (Vitis vinifera ssp. sylvestris) grafted on different rootstocks. Journal of Mountain Agriculture on the Balkans, 20(1), 259–266.

Warlop, F., Dapena, E., Lateur, M., Bastiaanse, H., Blazquez, M. D., Fillatre, J.-Y., Gomez, C., et al. (2010). Urgent need for new apple breeding methods better adapted to low-input agro-ecosystems. In Proceedings of the EUCARPIA 2nd Conference of the "Organic and Low-Input Agriculture" Section (pp. 106–110). Paris, France.

Wolter, H., & Sievers-Glotzbach, S. (2019). Bridging traditional and new commons: The case of fruit breeding. International Journal of the Commons, 13(1).

https://innobreed.eu/wp-content/uploads/2024/06/1_2024_16_05_InnOBreed-Int-Traing-Courses_CRA_W_Principles-of-organic-participative-apple-breeding-approaches.pdf

https://www.ecofruit.net/wp-content/uploads/2024/02/13-18-SB31-Reviewed-Paper-Lateur-Screening-apple-cultivars-better-adapted-to-organic-fruit-production.pdf

https://innobreed.eu/wp-content/uploads/2024/04/innobreed-CS-apfelgut-DE-final-1.pdf

https://organic-farmknowledge.org/tool/45994

https://www.liveseed.eu/wp-content/uploads/2021/06/Financing-models-SO.pd

Funded by the European Union