European Cooperative Programme for Plant Genetic Resources
ECP/GR

STATUS OF THE NATIONAL CRYO-COLLECTION - GERMANY

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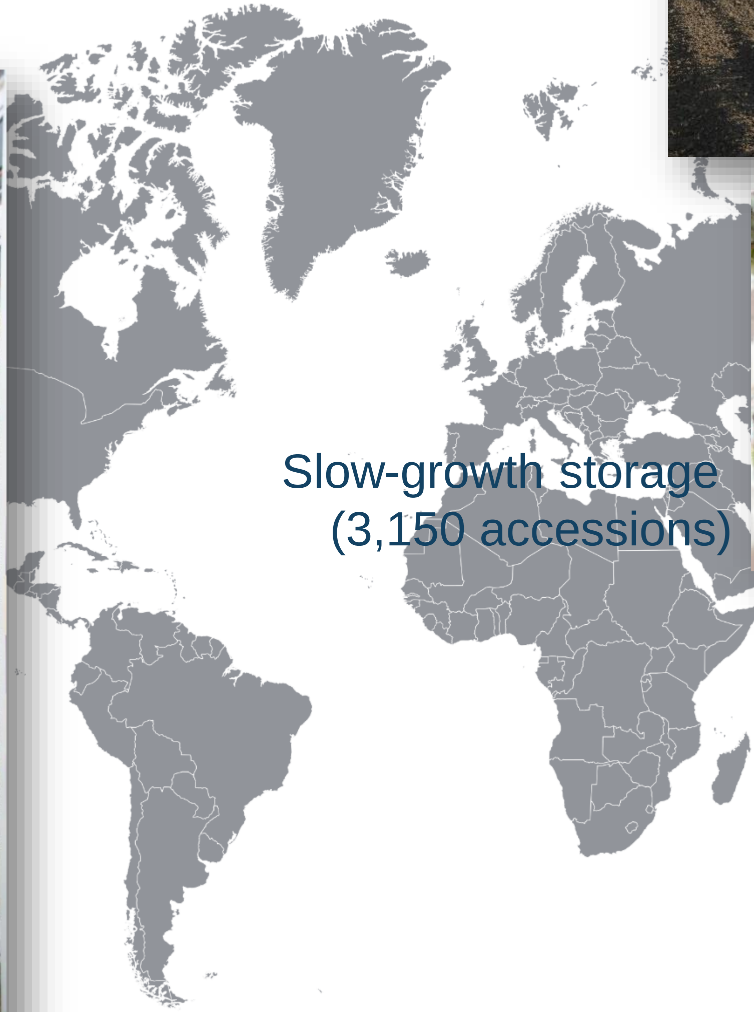
Leibniz Association

IPK LEIBNIZ INSTITUTE

Photo: M. Nagel (2019)

PGR maintenance at IPK

Seed cold storage
(~144,000 accessions)



Field genebank
(2,650 accessions)

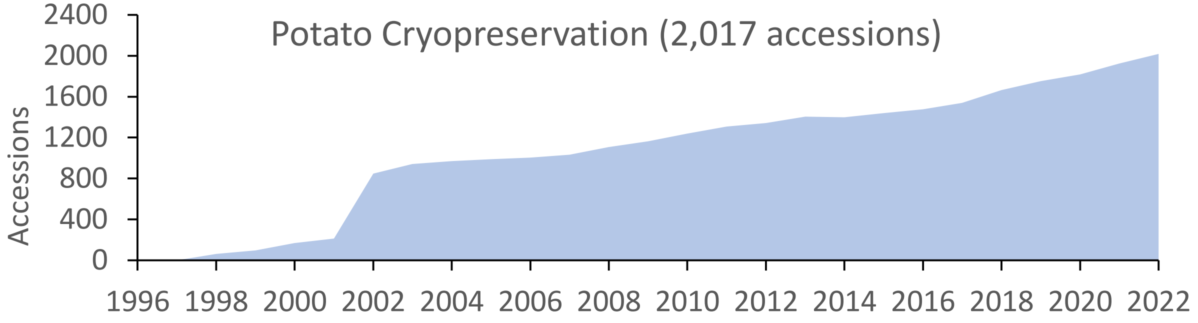
Slow-growth storage
(3,150 accessions)

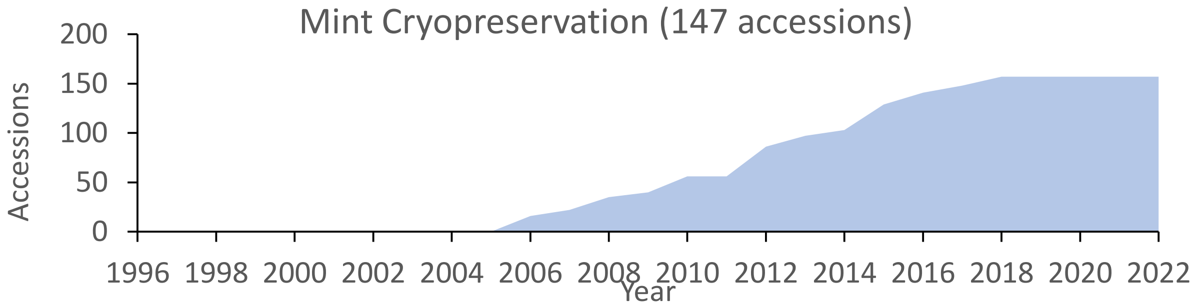
Cryo (2,400 accessions)

Photos: S. Rey (2016), L. Maine (2016), M. Nagel (2019)

IPK, 2022

236 In-vitro accessions and cryostorage





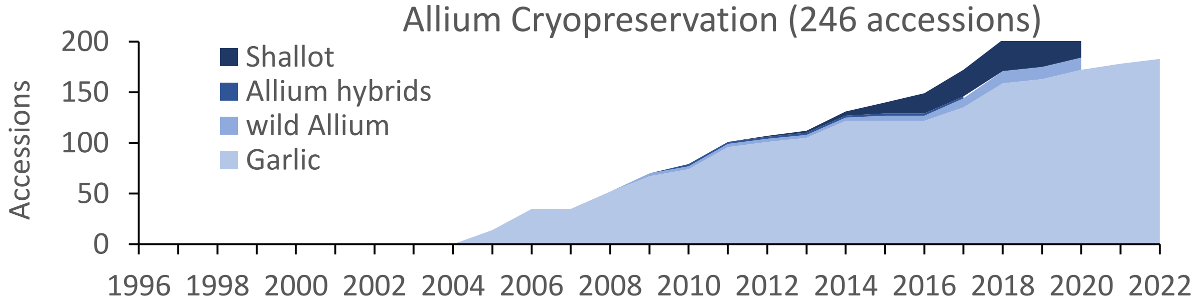


Photo: L. Main

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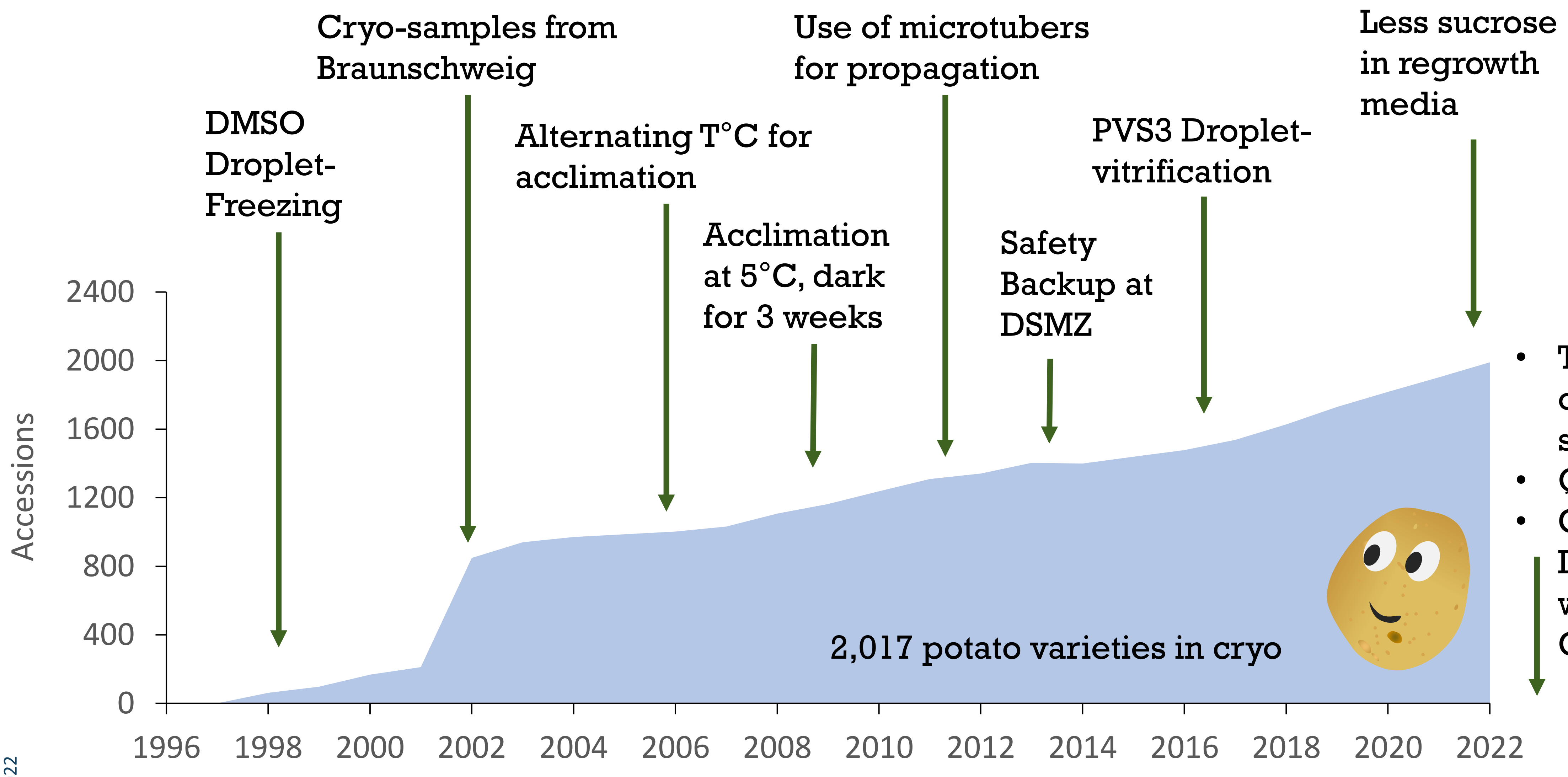
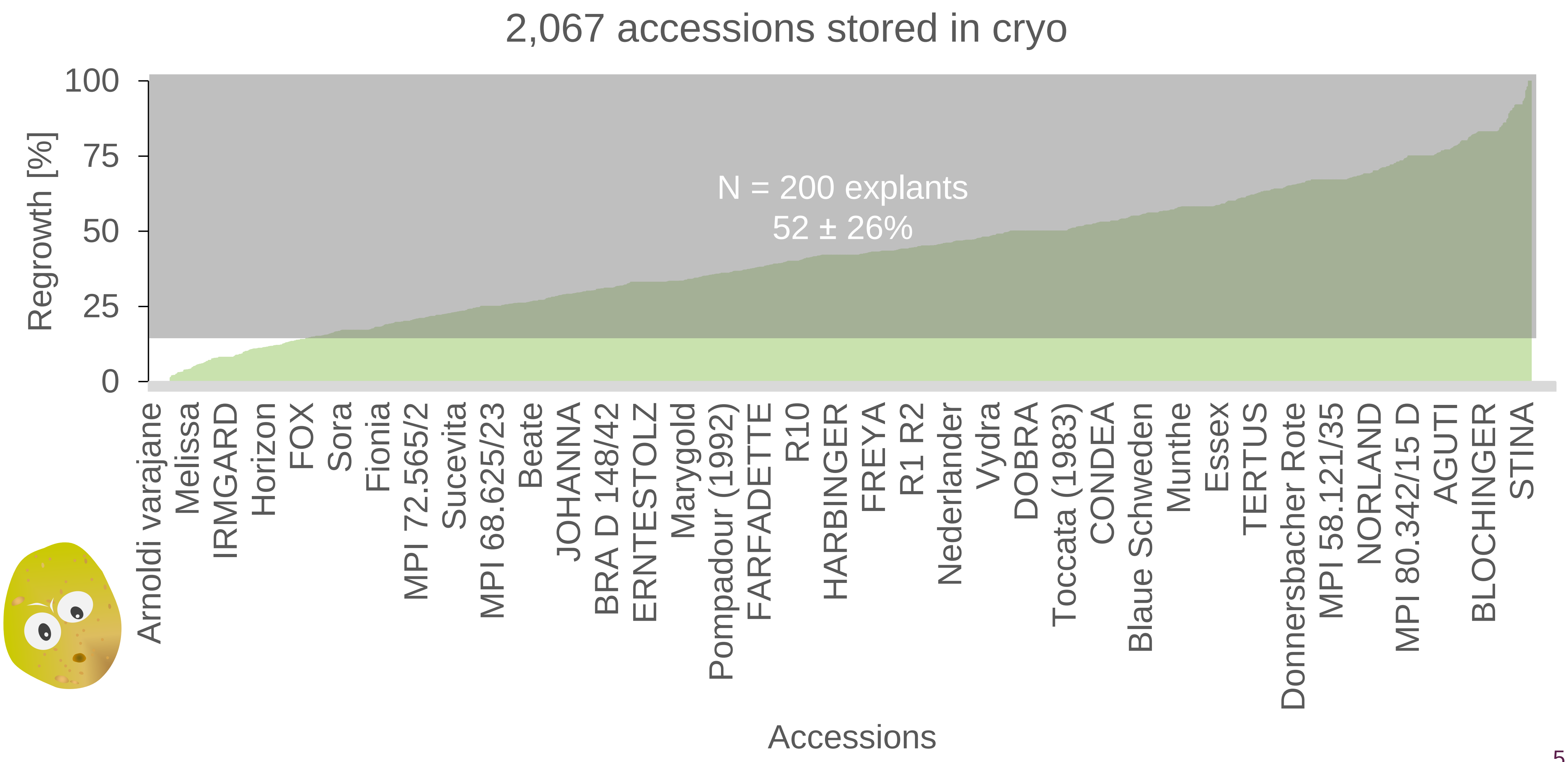
Potato cryo – adaptation during routine work



- Triplicates of 3 x 65 shoots
- QR code
- Combined Data Storage with GeneEver

Regrowth varies and require furhter improvements



IPK, 2022, unpublished data

Running Projects

- Garli-CCS – Garlic Conservation and Cryopreservation Strategy
  ECPGR Grant Scheme Activity
- PotEND – Endophyte interactions in response to complex abiotic stress during potato cryopreservation
  DFG funding
- Duckweed Cryopreservation
  Philipp-Schwartz, Humboldt Fundation
- Svalbard – 100 year experiment, storage of seed
  Norwegen Government

Published Article

Corrales, C., et al. (2023). Cryopreservation. Biodiversity Biobanking – a Handbook on Protocols and Practices. https://doi.org/10.3897/ab.e101876

Senula, A. and M. Nagel (2021). Cryopreservation of plant shoot tips of potato, mint, garlic, and shallot using Plant Vitrification Solution 3 , Springer US. 2180: 647-661. https://doi.org/10.1007/978-1-0716-0783-1

Bajerski, F., et al. (2021). Microbial occurrence in liquid nitrogen storage tanks: A challenge for cryobanking? Applied Microbiology and Biotechnology. https://doi.org/10.1007/s00253-021-11531-4

Stock, J., et al. (2020). The transcription factor WRKY22 is required during cryo-stress acclimation in Arabidopsis shoot tips. Journal of Experimental Botany 71(16): 4993-5009. https://doi.org/10.1093/jxb/eraa224

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Bajerski, F., et al. (2020). Factors determining microbial colonization of liquid nitrogen storage tanks used for archiving biological samples. Applied Microbiology and Biotechnology 104(1): 131-144. https://doi.org/10.1007/s00253-019-10242-1

plants

MDPI

Review

Challenges and Prospects for the Conservation of Crop Genetic Resources in Field Genebanks, in In Vitro Collections and/or in Liquid Nitrogen

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Abstract: The conservation of crop genetic resources, including their wild relatives, is of utmost importance for the future of mankind. Most crops produce orthodox seeds and can, therefore, be stored in seed genebanks. However, this is not an option for crops and species that produce recalcitrant (non-storable) seeds such as cacao, coffee and avocado, for crops that do not produce seeds at all; therefore, they are inevitably vegetatively propagated such as bananas, or crops that are predominantly clonally propagated as their seeds are not true to type, such as potato, cassava and many fruit trees. Field, in vitro and cryopreserved collections provide an alternative in such cases. In this paper, an overview is given on how to manage and setup a field, in vitro and cryopreserved collections, as well as advantages and associated problems taking into account the practical, financial and safety issues in the long-term. In addition, the need for identification of unique accessions and elimination of duplicates is discussed. The different conservation methods are illustrated with practical examples and experiences from national and international genebanks. Finally, the importance of establishing safe and long-term conservation methods and associated backup possibilities is highlighted in the frame of the global COVID-19 pandemic.

Keywords: clonal crops; collection management; cryobiotechnology; cryopreservation; field collections; field maintenance; germplasm storage; in vitro conservation; recalcitrant seeds

1. Introduction

In the course of crop domestication, many plants have been selected for quantity and/or quality of their seed, while some have been cultivated for their roots, tubers, fruits, stems and leaves. Plant genetic resources for food and agriculture (PGRFA) are of strategic importance to ensure sustainable crop production [1], nutritious food and food security for humans and to enhance economic prosperity of the present and future generations. They comprise the sum of genes, gene combinations or genotypes which serve as a reservoir for direct use in food production systems and for breeding new varieties [2].

Since the beginning of agriculture, selection of plants and seeds for sowing, growing, harvest and storage gave rise to locally adapted varieties, so-called "landraces", that reveal specific variations of morphological and yield characteristics and quality traits. In the mid-19th century, the rediscovery of Gregor Mendel's work and the introduction of breeding schemes resulted in the development of high-yielding and more stress-tolerant varieties leading to higher crop yields. This laid the foundation

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Proposals for collaborative activities

- Projects on characterization, evaluation, genotyping with other working groups, i.e. Solanaceae, Berries, Medicinal plants to support
  - the identification of duplicates and unique material
  - to prioritize cryopreservation of European accessions
  - to guide collection management
- Handbook of suitable and robust cryo-protocols
- Cryopreservation workshops and COST Actions
- Exchange of cryo-material for safety duplication
- Joined studies to work on fundamental mechanisms

Thank you for your attention!

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