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Genebank Management Relevant to Pre-Breeding

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Genebanks serve as repositories of genetic wealth, housing an extensive collection of seeds, tissues, and genetic material from a myriad of plant species. These invaluable stores of biodiversity act as a safety net, preserving the building blocks of life that underpin our food supply. However, their role extends far beyond mere preservation – genebank management is a linchpin in the process of pre-breeding, a crucial step towards creating crops that can withstand the challenges of the future.

In this exploration of genebank management and its relevance to pre-breeding, we delve into the intricate world of genetic resources, unraveling the vital role they play in crafting resilient, high-yielding, and adaptable crops. As we journey through the intricacies of genebanks, we'll uncover how these treasure troves of genetic diversity are not just time capsules of the past but are active agents in shaping the agricultural landscapes of tomorrow.

In vitro genebank

Seed genebank

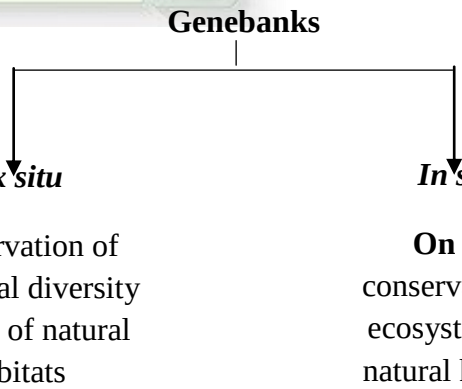
Botanical garden

Types of genebank

Genebanks can be broadly classified into two types

Ex situ conservation
1. Botanical gardens
2. Genebanks
3. Cryopreservation

In situ conservation
1. National parks
2. Wildlife sanctuaries
3. Sacred groves
4. Biosphere reserves



Infrastructure facilities

Establishing and maintaining a gene bank involves a range of infrastructure facilities to ensure proper conservation and management of plant genetic resources. Here are key components of infrastructure for a gene bank

Seed Storage Facilities

- **Cold Storage Rooms:** Equipped with temperature and humidity controls to preserve seeds for long periods. Maintaining low temperatures slows down seed aging.
- **Seed Drying Rooms:** Essential for drying seeds before storage to prevent fungal growth and maintain seed viability.
- **Freezer Rooms or Cryobanks:** For storing seeds at ultra-low temperatures, especially for recalcitrant seeds or those requiring cryopreservation.

In Vitro Conservation Facilities

- **Tissue Culture Laboratories:** Equipped with sterile workstations, growth chambers, and incubators for in vitro propagation and conservation of plant tissues.
- **Cryopreservation Facilities:** Including liquid nitrogen storage for preserving plant tissues at extremely low temperatures.

Documentation and Information Systems

- **Database Systems:** To catalog and manage detailed information about each accession, including origin, characteristics, and availability.
- **Barcoding Systems:** Facilitate accurate identification and tracking of genetic resources.

Greenhouses and Screen Houses

- **Climate-Controlled Greenhouses:** Enable the cultivation and maintenance of plants representing various genetic resources in a controlled environment.
- **Screen Houses:** Protect plants from pests and diseases while allowing natural pollination.

Field Genebanks

- **Land Area:** Designated plots for growing and maintaining living collections of plant genetic resources.
- **Climate Monitoring Stations:** Collect data on temperature, humidity, and other environmental factors to assess the suitability of the site.

Laboratories for Quality Control:

- **Seed Testing Laboratory:** Conducts germination tests, purity tests, and viability assessments to ensure the quality of stored seeds.
- **Molecular Biology Laboratory:** Performs DNA analysis for genetic characterization and identification of plant materials.

Security Measures

- **Surveillance Systems:** Ensure the physical security of the gene bank facilities.
- **Access Control Systems:** Restrict entry to authorized personnel.
- **Fire Prevention and Suppression Systems:** Protect against potential disasters.

Backup and Redundancy Systems:

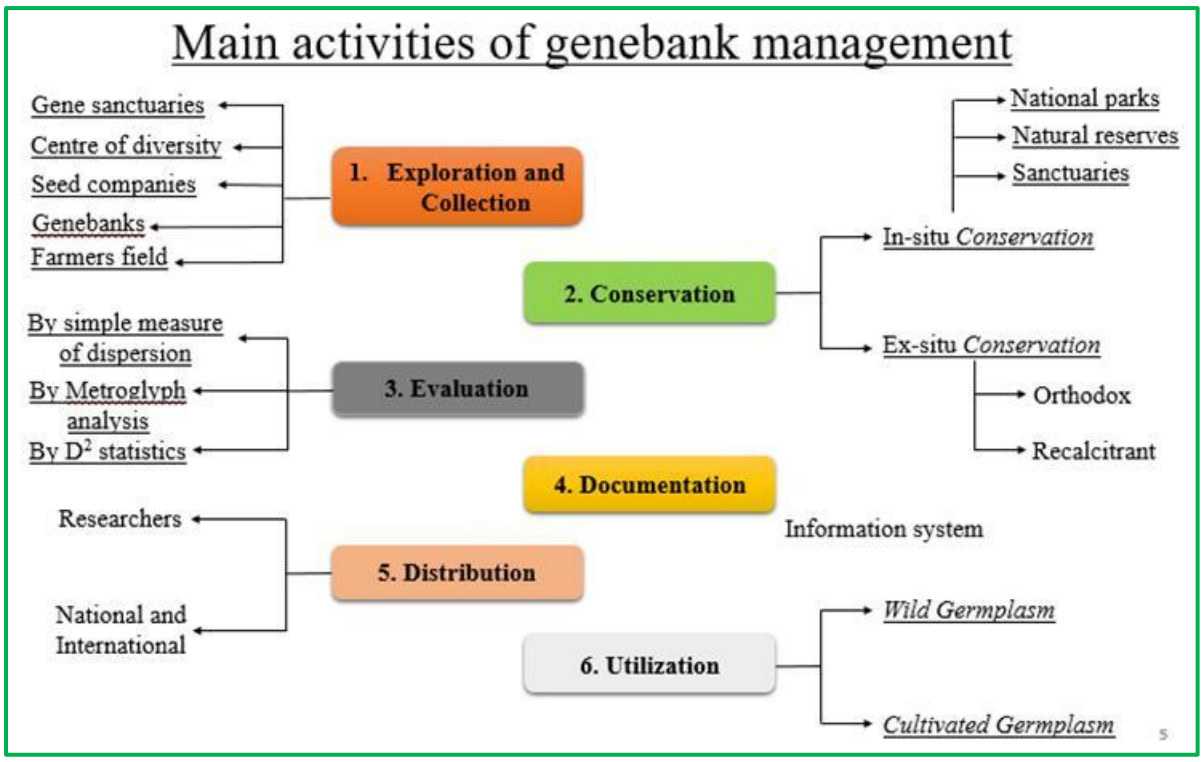
- **Backup Power Generators:** Ensure conti. operation, especially during power outages.
- **Backup Storage Facilities:** Duplicate storage locations to minimize the risk of catastrophic loss.

Infrastructure for Data Management:

- **Computing Facilities:** Support data management, analysis, and research activities.
- **Internet Connectivity:** Facilitate collaboration, data sharing, and communication.

Activities of genebanks

The main activities of a gene bank revolve around the conservation, documentation, utilization, and exchange of plant genetic resources. These activities are crucial for preserving biodiversity, supporting agricultural research, and ensuring global food security.



Basis of characterization and Evaluation of germplasm

CHARACTERIZATION

PLANT DESCRIPTORS

Foliage colour (7.1.1):

1. Light green	2. Yellow green	3. Green	4. Grey-green
5. Dark green	6. Bluish green	7. Purplish-green	99. Other (specify)

LEAF LENGTH [cm] (7.1.2):

FOLIAGE ATTITUDE (7.1.5):

3. Prostrate	5. Intermediate	7. Erect

CROSS-SECTION OF LEAF (7.1.7):

1. Circular	2. Semi-circular	3. Square
4. Pentagonal	5. V-shaped	99. Other (specify)

DEGREE OF LEAF WAXINESS (7.1.8):

3. Weak	5. Intermediate	7. Strong

International format for characterization of plant genetic resources

Different types of gene bank

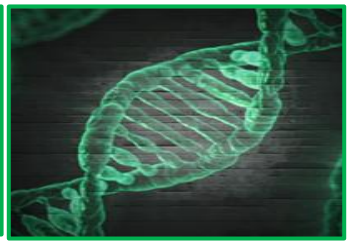
Seed gene bank: A seed gene bank, also known as a seed bank or genebank, is a facility that preserves and stores seeds of various plant species to maintain their genetic diversity. These banks play a crucial role in preserving biodiversity, ensuring food security, and supporting agricultural research. Here's an overview of key aspects related to seed gene banks.

Field gene bank: A field gene bank, also known as an in situ gene bank or on-farm conservation, involves the conservation of plant genetic resources in their natural environment, usually in the form of actively cultivated fields. Unlike traditional seed gene banks that store seeds in controlled environments, field gene banks aim to maintain and promote the diversity of crops directly in the fields where they are traditionally grown. Here are some key points about field gene banks

Pollen gene bank: A pollen gene bank, also known as a pollen repository or pollen bank, is a facility that focuses on the storage and preservation of pollen from various plant species. Unlike seed gene banks that store seeds, pollen gene anks specifically target the reproductive cells of plants.

Cryo genebank: A cryo genebank, short for cryopreservation genebank, is a specialized facility that uses cryogenic techniques to preserve biological material, such as seeds, plant tissues, embryos, or pollen, at ultra-low temperatures. The term "cryo" is derived from cryopreservation, which involves storing biological samples in liquid nitrogen or another cryogenic medium to maintain their viability over an extended period.

DNA genebank: A DNA genebank, also known as a DNA repository or biobank, focuses on the preservation and storage of DNA samples from various organisms, including plants, animals, and microorganisms. The primary goal of a DNA genebank is to conserve genetic material for research, biotechnology, biodiversity studies, and other scientific purposes.



Botanical garden: A botanical garden is a curated collection of living plants maintained for scientific, educational, and aesthetic purposes. These gardens are designed to showcase a wide variety of plant species, often organized by taxonomy, geography, or ecological relationships. Botanical gardens play important roles in conservation, research, education, and public engagement. Here are key features and functions of botanical gardens

Conclusion

Genebank management emerges as a cornerstone in the realm of pre-breeding, providing a reservoir of invaluable plant genetic resources essential for the future of agriculture. The intricate dance between nature and human ingenuity finds its rhythm in the well-orchestrated activities within genebanks. As we navigate the challenges posed by a changing climate, evolving pests, and a burgeoning global population, the significance of conserving and harnessing genetic diversity becomes increasingly evident.

Genebanks, with their meticulous documentation, preservation techniques, and collaborative networks, serve as the silent architects of agricultural innovation. The diversity housed within these repositories is not just a collection of seeds; it is a living library, a repository of resilience against the uncertainties that the future may hold. The genetic richness encapsulated within genebanks becomes the wellspring from which pre-breeders draw inspiration and raw material to craft crops that can withstand environmental stresses, pests, and diseases.

The activities of genebank management, from collection and conservation to distribution and research support, converge with the goals of pre-breeding. The varied genetic resources stored within genebanks become the palette from which pre-breeders paint the canvas of future crops, imbuing them with traits of resilience, adaptability, and nutritional value. As pre-breeding endeavors intensify to meet the demands of a dynamic agricultural landscape, genebanks stand as the bedrock upon which these efforts are built.

Furthermore, genebanks play a pivotal role in international collaboration, sharing genetic resources across borders to bolster global food security. The interconnectedness of genebanks fosters a sense of shared responsibility, recognizing that the challenges faced by one region may impact the agricultural landscape worldwide. Through collaborative initiatives, genebanks contribute not only to local sustainability but also to the collective resilience of global agriculture.

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