PRO-GRACE
PROMOTING A PLANT GENETIC RESOURCE COMMUNITY FOR EUROPE

Funded by the European Union

Managing phytosanitary risks in germplasm collections

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PGR ACCESS AND CAPACITY BUILDING

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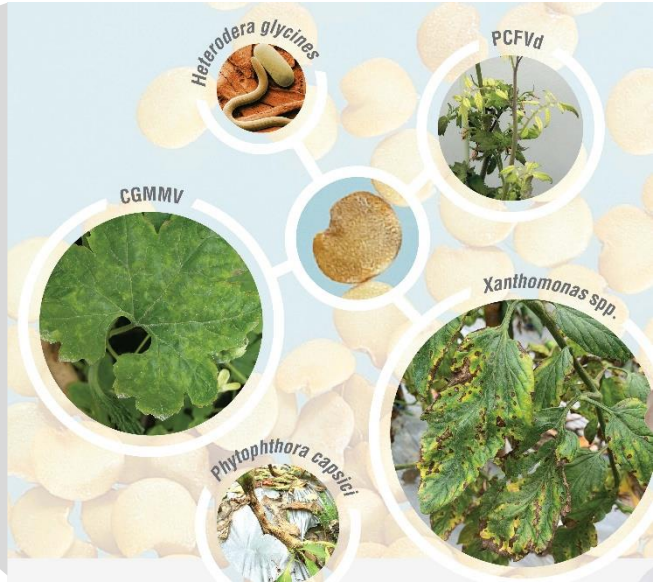
Seeds in the Genebank

Inside or on the surface of the seeds: seed-borne pathogens

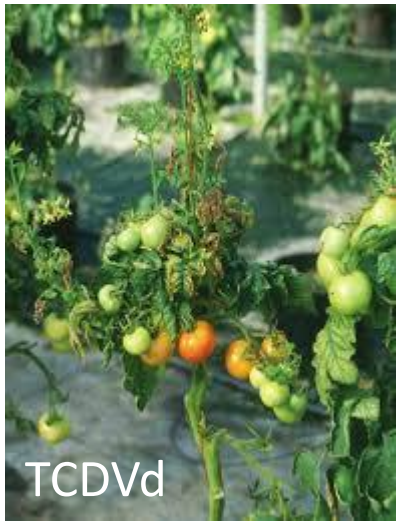


Seed-borne pathogens

- Viruses
- Viroids
- Bacteria
- Fungi
- Nematodes
- Concomitant Contamination

Current Situation – Legal Framework

- **Plant Health Regulation** (PHR, Regulation (EU) 2016/2031) as backbone
- Its primary goal is to ensure a **high and uniform level of phytosanitary protection** against plant pests within the EU territory
  - Pest Categorization:
    - **Quarantine pests**: insects, fungi, bacteria, viruses/viroids
    - **Regulated non-quarantine pests (RNQPs)**: bacteria, fungi, viruses, nematodes with high economic impact
  - Internal Movement: **Plant passports** (intra-EU)
  - Import Controls: **Phytosanitary certificates**



https://planthealthportal.defra.gov.uk/assets/factsheets/emergingViroidThreatsTomato.pdf

Quarantine Pests – Examples

- **Insects & nematode:**
  - Asian & Citrus longhorn beetles, Pine wood nematode
- **Fungi:**
  - *Fusarium circinatum*, *Cryphonectria parasitica*
- **Bacteria:**
  - *Xylella fastidiosa*, *Ralstonia solanacearum*
- **Viruses:**
  - ToBRFV, Citrus tristeza virus (severe strains)

Regulated Non-Quarantine Pests (RNQPs)

- **Bacteria:**
  - *Clavibacter michiganensis* ssp. *michiganensis*, *Pseudomonas syringae* pv. *lachrymans*
- **Fungi:**
  - *Verticillium dahliae*, *Fusarium oxysporum* f. sp. *lycopersici*, *Phoma lingam*
- **Viruses:**
  - CGMMV, Potato viruses X, Y, A, M, S, TSWV
- Economic impact significant despite widespread presence

EU surveillance - Current networks

- European Commission Plant Health Network
- EFSA Scientific Network on Plant Pest Surveillance
- Plant Health Network
- EUROPHYT – Traces NT
- European and Mediterranean Plant Protection Organization
- Euphresco*
- National Surveillance and monitoring systems

Gaps & Problems

- RNQP lists not harmonized across EU, crop-specific thresholds
- Tests are costly & time-consuming, bottlenecks for seed movement
- Emergency measures (e.g., ToBRFV) disrupt trade & compliance
- Passporting/inspections largely paper-based, uneven digital adoption
- Focus on seeds? Often focus on plants
- Different methods and standards
- Data integration & sharing
- Emerging technologies
- Sustainability of funding*

- **Fully integrated seed-health-oriented network**

Where Do We Want To Go?

- Risk-based, harmonized RNQP approach for seeds
- **Cost efficient and reliable testing facilities**
- **Increased capacity to implement emergency methods**
- **EU/global annex with harmonized thresholds & test methods**
- Mutual recognition of results, role of ISTA accreditation
- Digital plant passports & ePhyto integration
- EU-wide framework to ensure safety & efficiency

Cost-efficient and reliable testing

- Sampling & Lot Definition:
  - ISTA rules, ISPM rules, special rules for genebanks? Pooling?
- Validated Test Methods:
  - EPPO PM 7 protocols (PCR/RT-PCR/ELISA/HTS)
- Emerging technologies:
  - metagenomics, portable diagnostics

A centralized facility with decentralized testing hubs?

Mutual Recognition of Tests & Certificates

- Laboratory Competence:
  - ISO/IEC 17025 accredited labs
  - ISTA accreditation for mutual recognition
- Certification Flow:
  - Plant passports, phytosanitary certificates, ePhyto integration

- **Recognition in EU**
- **Global recognition?**

WorldVeg Testing Facility

Infrastructure:

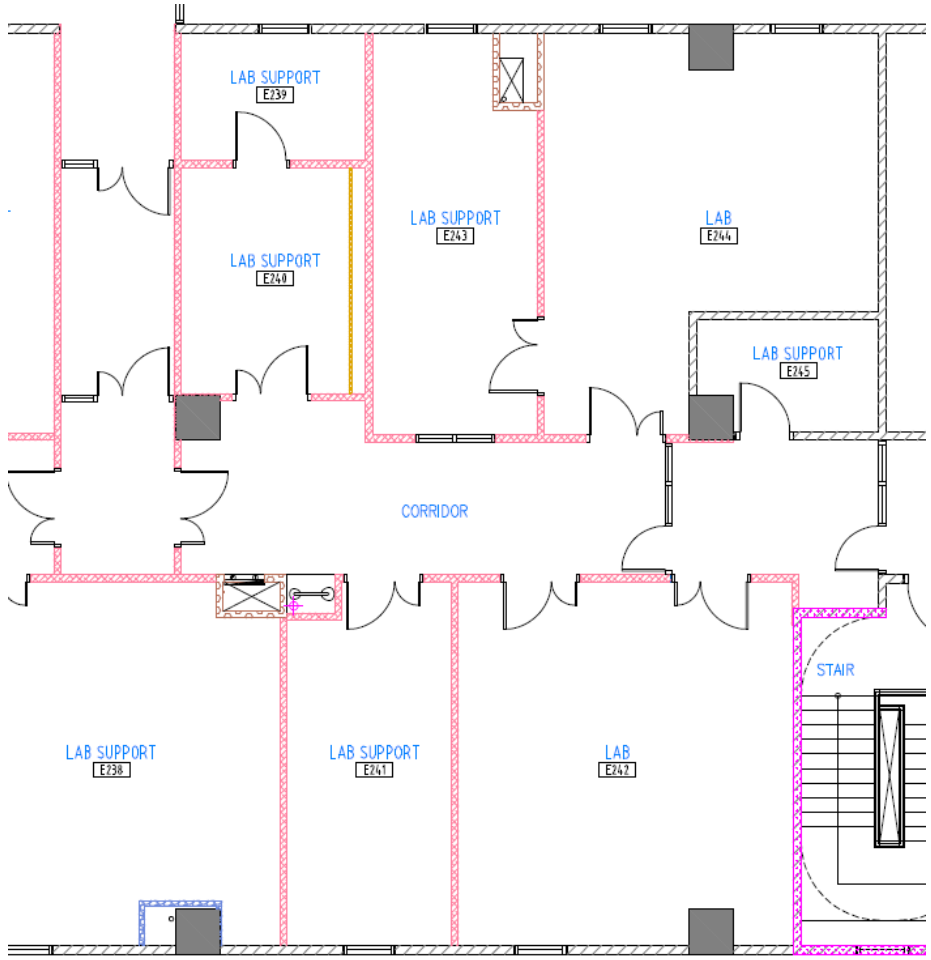
- Seed Health and Quarantine (SHQ) Lab

Facility:

- PCR
- Real-time PCR
- NonoDrop
- Microscope

Capacity:

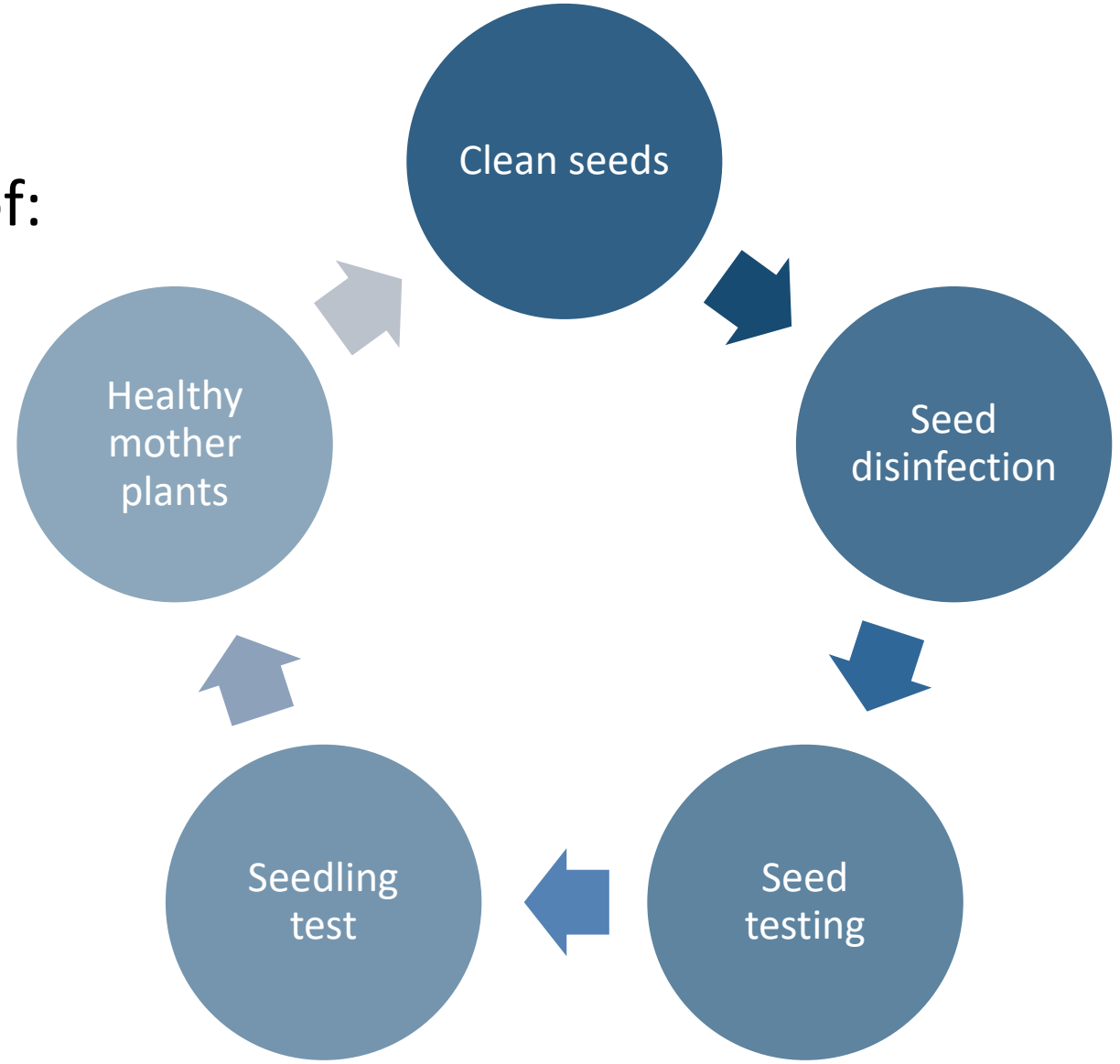
- Viroids
- Viruses (ToBRFV, ToMMV, PMMoV, TYLCV, PepMV, CGMMV)



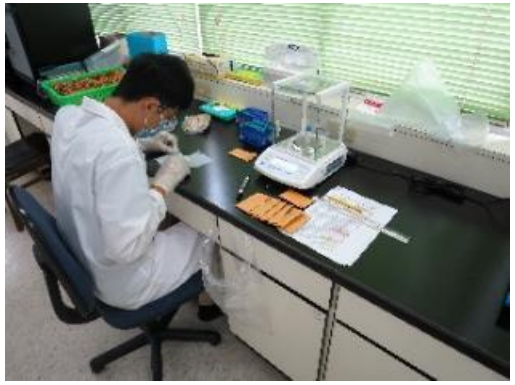
Testing Strategy

Tests to monitor the health status of:

- Seed
- Seedlings/mother plants



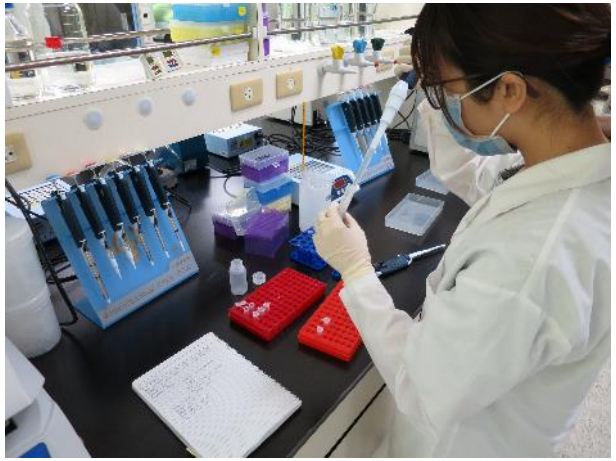
Seed/plant test by RT-PCR



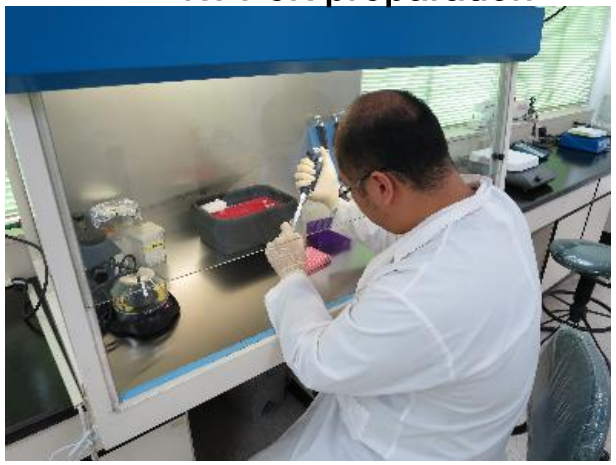
Sample preparation

Sample rupturing

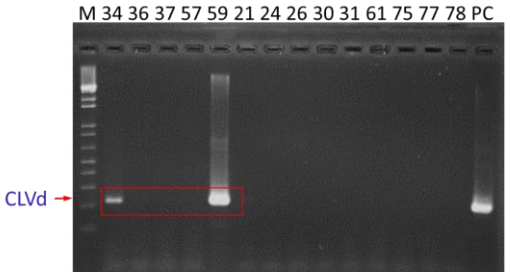
RNA extraction



RT-PCR preparation



RT-PCR



Electrophoresis

Safety beyond testing

- Targeted quarantine for high-risk pathogens/species: centralized facility?
- Post-entry quarantine where latent infections possible
- Annual proficiency testing & method validation updates
- EU surveillance network for seed health

WorldVeg Post Entry Quarantine Facility

- **Architecture**
  - Isolated seed storage
  - Post-entry quarantine greenhouse
- **Rules & Regulations**
  - The imported seed lots are stored in an isolated storage.
  - A post-entry quarantine proposal was approved by NPPO and the isolated storage/ post-entry quarantine greenhouse/ Lab for research passed the NPPO on-site inspection.
  - The seeds can only be sow in the indicated site and do the research in the indicated Lab.
  - All the materials need to be destroyed after the research finished under the NPPO's monitor.
  - For further utilization, a PRA should be proposed to NPPO and approved, then the seed can be used for other purpose.

Summary – Tasks of the EU Research Infrastructure

- Validated & standardized sampling/lot definition
- Capacity to execute diagnostic protocols, proficiency testing
- Network of accredited laboratories, mutual recognition of results
- Data management & traceability with digital passports
- Quarantine & containment capacity for high-risk pathogens
- Host a network specialized on seed health

Summary: Genebank Implications

- Small sample sizes require special sampling/testing protocols
- Adapted protocols for genebank material movement
- Integration with EU-wide infrastructure
- Support innovation in safe seed movement

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THANK YOU

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