# SWEETPOTATO GERMPLASM EXCHANGE

Ian Baker, Isaac Macharia

# Introduction

- **Collecting**, **conservation** and **utilization** of plant genetic resources and their global distribution are essential components of international crop improvement programmes.
- However, **the movement of germplasm involves a risk of introducing plant quarantine pests** along with the host plant material; especially virus diseases.

# Importance phytosanitary measures

- Some plant pathogens, pests or weeds are generally distributed in most parts of the world but others are restricted in their occurrence.
- In most cases this limitation is due to:
  - -Unsuitable environmental conditions
  - -Lack of the required host plant
  - -Lack of opportunity to reach certain areas
- There is need to prevent introduction of harmful foreign weeds, pests and diseases.
- In most cases, introduced pest lack natural enemies

# Example: Recognized viruses that infect sweetpotato

| Genus | Virus | Transmission | Distribution |
|---|---|---|---|
| *Potyvirus* | SPFMV | Aphid | Worldwide |
| | SPLV | Aphid | Taiwan, China, Japan, Indonesia, Philippines, India, Egypt |
| | SPMSV | Aphid | Argentina, Peru, Indonesia, Philippines, China, Egypt, South Africa, Nigeria, New Zealand |
| | SPVG | Aphid | China, Japan, USA, Egypt, Ethiopia, Nigeria, Barbados, Peru, Spain, South Africa |
| | SPV2 | Aphid | USA, Taiwan, China, South Africa, Portugal, Australia, Barbados |
| | SPCSV? | Unknown | Caribbean Region, Zimbabwe, Uganda, Kenya |
| | SPVMV | Aphid | Argentina |
| *Ipomovirus* | SPMMV | Whitefly? | Africa, Indonesia, China, PNG, India, Egypt, New Zealand |
| | SPYDV | Whitefly | Taiwan, Far East |
| *Crinivirus* | SPCSV | Whitefly | Worldwide |
| *Cucumovirus* | CMV | Aphid | Israel, Egypt, Kenya, South Africa, Japan, New Zealand |
| Begomovirus | SPLCV | Whitefly | Far East, USA, China, Taiwan, Japan, Korea, Europe, Africa?, Peru |
| | SPLCGV | Whitefly | USA, Puerto Rico |
| | IYVV | Whitefly | Spain, Italy |
| | ICLCV | Whitefly | Israel |
| *Carlavirus* | SPCFV | Unknown | Africa, China, Taiwan, North Korea, Cuba, Panama, South Americaa, N. Zealand |
| | C-6? | Unknown | USA, Peru, Cuba, Dom. Rep., Indonesia, Philippines, P. Rico, Egypt, Kenya, South Africa, New Zealand |
| *Nepovirus* | SPRSV | Unknown | Papua New Guinea, Kenya? |
| *Caulimovirus* | SPCaLV | Unknown | South Pacific Region, Madeira, China, Egypt, P. Rico, Nigeria, Kenya? |
| *Ilarvirus* | TSV | Unknown | Guatemala |
| *Polerovirus* | SPLSV | Aphid | Peru, Cuba |
| *Tobamovirus* | TMV | None | USA |
| Unknown | C-3 | Unknown | Brazil. Unknown in others countries |
| | C-9 | Unknown | ? |

Courtesy: Segundo, CIP

# Germplasm exchange

- There are several initiative that have been put in place to facilitate safe movement of germplasm
- FAO/IBPGR has developed a technical guidelines for the safe movement of sweet potato germplasm

# Cont'

- IPPC has developed ISPMs that are important in movement germplasm
  - ISPM 1 Phytosanitary principles for the protection of plants and the application of phytosanitary measures in international trade
  - ISPM 2 & 11 (PRA)
  - ISPM 33 (Pest free potato (*solanum* spp.) Micropropagative material and minitubers for international trade)
  - ISPM 34 (Design and operation of post-entry quarantine stations for plants)

# Movement of sweet potato germplasm

- In order to minimize risk, effective testing (indexing) procedures are required to ensure that distributed materials are free of pests of quarantine concern.
- All germplasm should be tested for the absence of viruses in
  - the country of origin,
  - in an intermediate quarantine centre, or
  - in post-entry quarantine

# Role of KEPHIS is supporting Germplasm exchange

# Mandate of KEPHIS:

- **Preventing the introduction of harmful foreign pests, diseases and weeds**
- Grading and inspection of agricultural produce
- Certification of the quality of seeds, fertilisers and monitoring of agrochemical residue levels
- Offering advisory services on pest/disease management
- Plant variety protection

# Plant Import Categories

- **Plant import regulations in Kenya fall into three broad categories.**
  1. **Imports under permit-Low risk materials**
  2. **Imports through quarantine -Plant materials with high risk of transmitting pests including latent infection e.g viruses (Clonally propagated, seed)**
     - **Open quarantine**
     - **Closed quarantine (Sweep potato, Irish potato, cassava etc)**
  3. **Prohibited materials e.g. Tea**

# Plant Quarantine Station (PQS)

- Most of the sweet potato activities are undertaken at the station.
- Clean SP germplasm are received from CIP as tissue culture or seeds
- Several SP varieties are received from the region for cleaning

# Reference Laboratory for COMESA

- **PQS has been designated as a Regional Reference Laboratory for COMESA for Plant Health.**
- **Proposed function will include:**
  - Monitoring compliance with regional and international disease and pest control
  - Overseeing the appropriate certification process and providing testing services

# Cont'

- Standardizing and Validating diagnostic procedures and reagents on behalf of satellite and national laboratories;
- Build capacity in conducting risk analysis on relevant matters of SPS;
- Training of personnel from laboratories of member states;
- Operating inter-laboratory comparison schemes

# Cont’

**The station has supported movement of germsplasm with the region.**

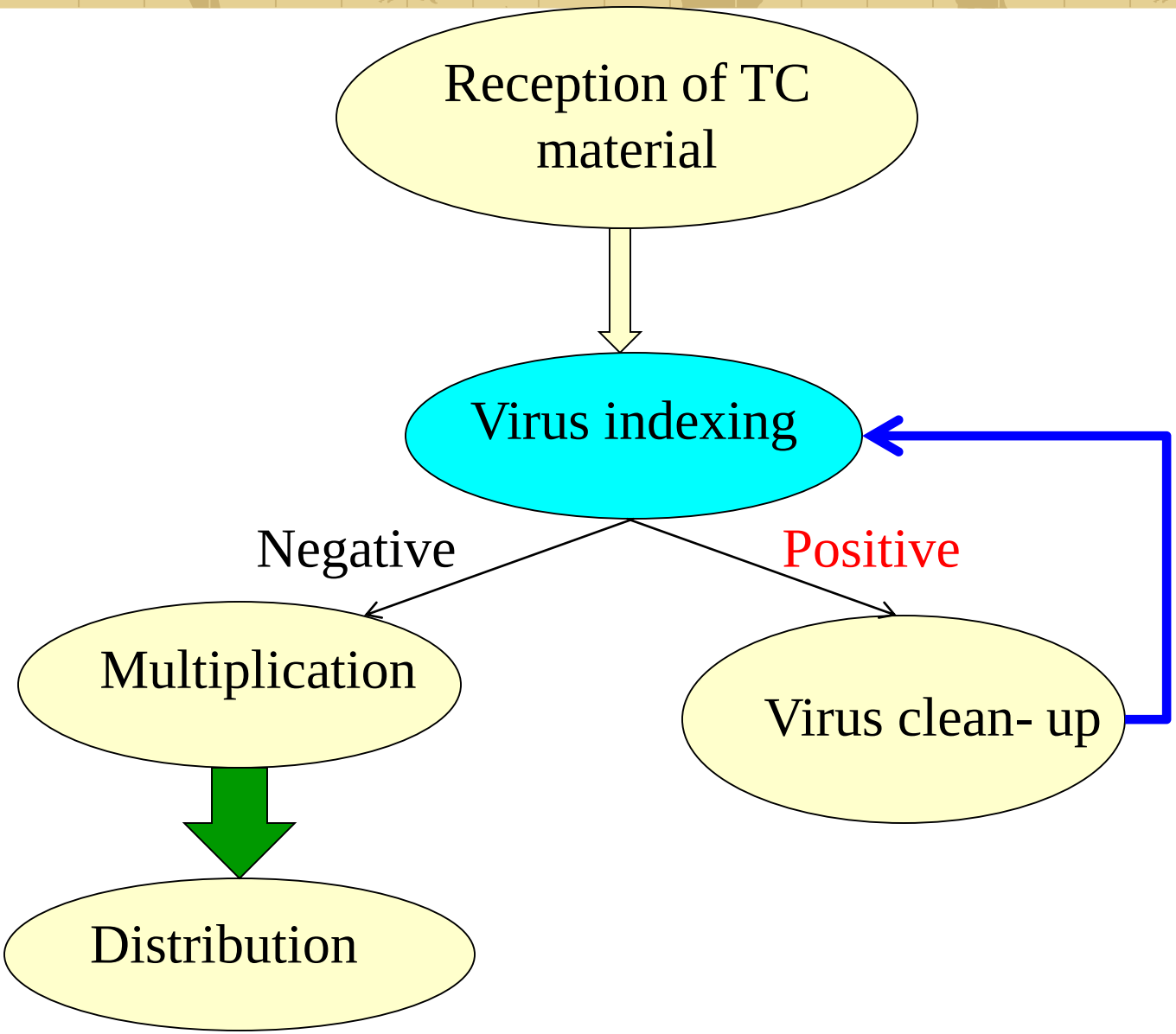
**There are:-**

- **Greenhouses and screenhouses for holding imported quarantine material**
- **Equipped pathology and virology laboratories for disease indexing**
- **A tissue culture laboratory for virus clean up and multiplication**

# Importation of SP

**Sweet potato is imported under quarantine regulation**

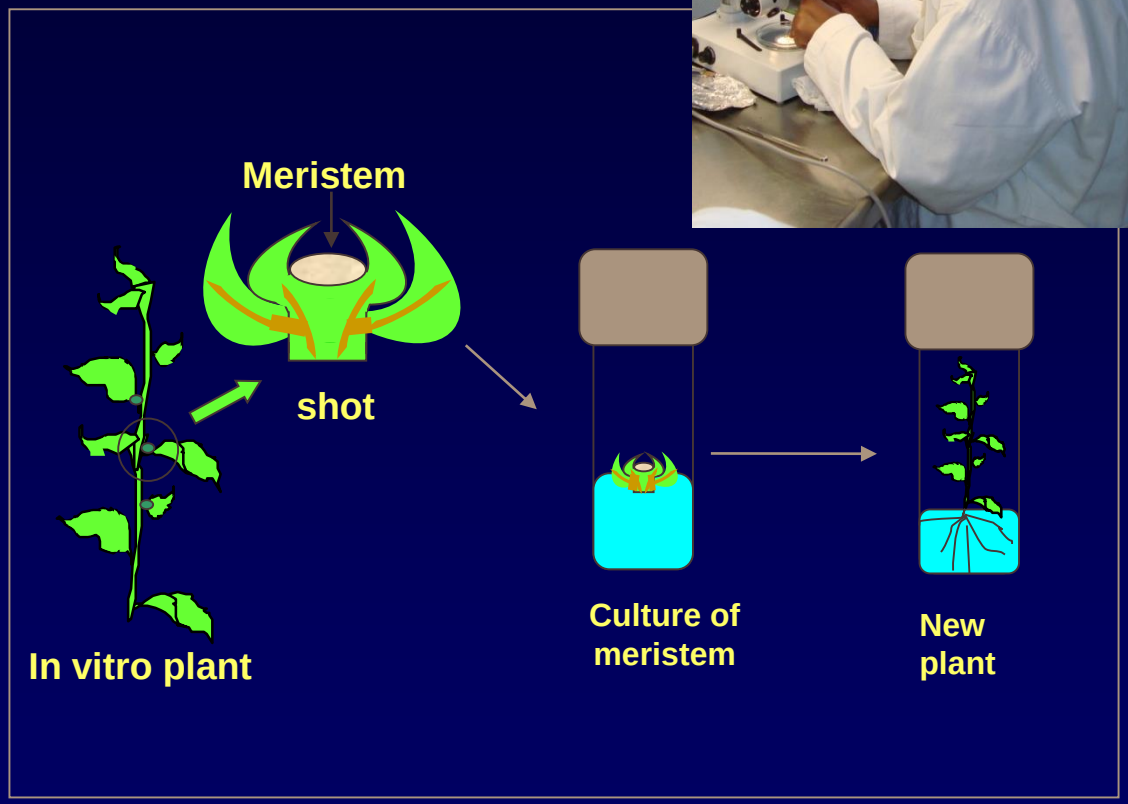
1. **Import permit with a Q label is issued**
2. **Imported material is accompanied by a phytosanitary certificate from importing country**
3. **Material is inspection at entry points**
4. **Plants are held in quarantine facility (OQ, CQ)**
5. **Material are multiplied in tissue culture or established in greenhouse (cutting)**
6. **Plants are tested for Bacteria and viruses**
7. **Infected material are cleaned through thermotherapy and meritem culture**

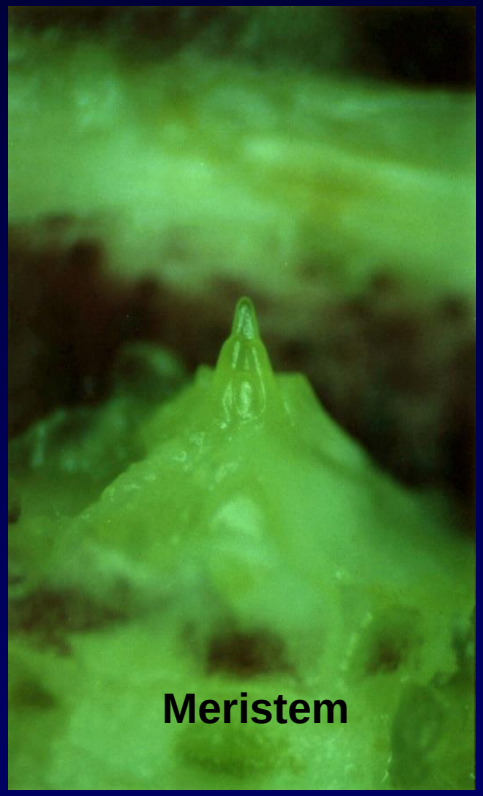

Reception of TC material
Virus indexing
Negative
Positive
Multiplication
Virus clean- up
Distribution

# Thermotherapy (34-36°C for 1 month)


Growth chamber

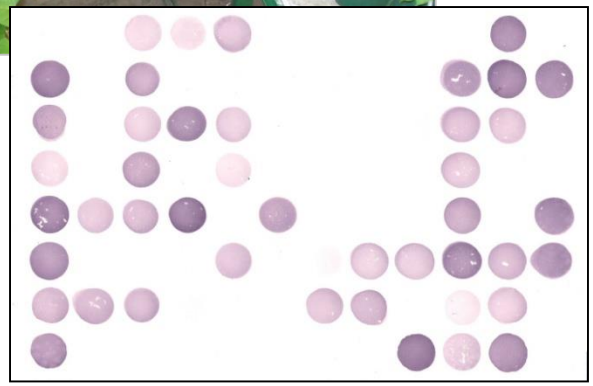
# Meristem culture

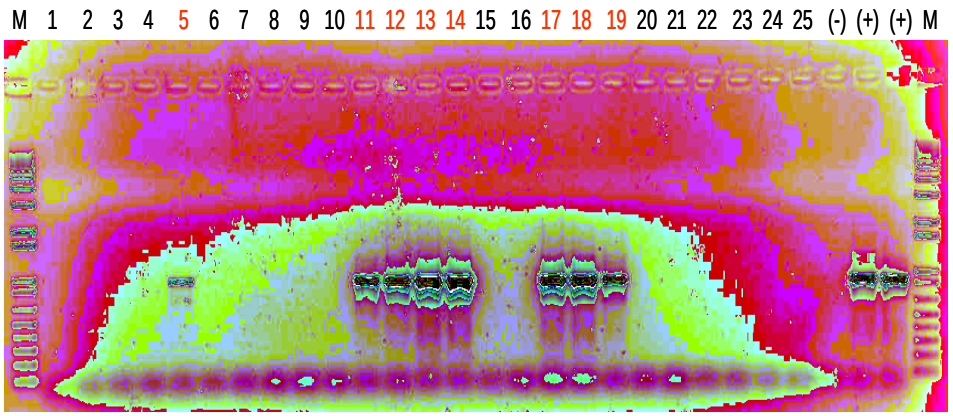


# Virus indexing

- Cleaned plant are first indexed for viruses through:
  - Grafting in I. setosa
  - NCM ELISA
  - PCR





# Diagnostic equipments



**Realtime PCR**

# Growing plantlets in a greenhouse


# Current Virology and tissue laboratory

Dr. Wilson Songa, Agriculture Secretary

# Laying the foundation stone of the new laboratory at Plant Quarantine Station

# New laboratory

# Challenges

- There is need to developed harmonized regulation for germplasm exchange within the region.
- There is need to offer training in virus indexing and cleaning within the region.
- Facility for mass production in region need to be enhanced and established where they do not occur

# PROGRESS AND FUTURE PLAN

# Proposed SASHA Investment in PQS

1. Renovation of sweet potato screenhouses
2. Renovation of soil sterilisation
3. Renovation of growth room
4. Construct one quarantine greenhouse
5. Training in virus indexing and PCR (Segundo)
6. Introduction of bar coding system for gene bank

# Old screenhouse


# New Screenhouse

# Small quarantine greenhouse

# Progress so far

- Introduction of tissue culture, cleaned and virus indexed (11 varieties) sweet potato to Tanzania
- Training of ISAR, Rubona staff in Virus indexing and cleaning
- Cleaning and indexing of Mozambique materials (67 clone in progress)
- Recruitment of tissue culture technician (Rosemary)

# Plantlets for hardening

# Transferred to Hardening shade

# Ukerewe – Primary multiplication beds

# Ejumula – Primary multiplication beds

# *Progress of multiplication in Bukoba*

| Variety | When delivered | No. of plantlets delivered | Total no. of primary beds | Estimated quantity of cuttings |
|---|---|---|---|---|
| Ejumula | Dec 2009 | 74 | 9 | 30,500 |
| Ukerewe | Feb 2010 | 200+10,341 | 37 | 54,500 |
| Polista | Feb 2010 | 104+9,694 | 34 | 51,000 |
| Jewel | May 2010 | 1,500 | June | |
| Simama | May 2010 | 100 | June | |
| Derther | May 2010 | 70 | June | |
| Car Dar | May 2010 | 50 | June | |
| SPK2001/261 | May 2010 | 100 | June | |
| SPK2001/264 | May 2010 | 64 | June | |
| Ejumula | May 2010 | 10,000 | June | |
| Kabode | | | | |

# Development of new diagnostic methods

- **Partners**
  - **CIP-Lima**
  - **FERA, UK**
  - **Mikocheni, Tanzania**
  - **KEPHIS-PQS**
  - **(BECA)**
- **Methods**
  - **Sweet potato virus microarray**
  - **Sweet potato virus lateral device**
  - **High through put sequencing**
  - **Cryotherapy (Cold treatment)**

# Clean material in Maruku, Bukoba Tanzania