



# **NARO'S BANANA BIOTECHNOLOGY PROJECT**

**Novel approaches to the improvement of banana  
production in Uganda – the application of  
biotechnological methodologies**

**USAID African Partnership in Biotechnology: Strategies for Biotechnology in Africa  
21-23 October 2002, Nairobi, Kenya.**



# Implementing partners



NARO

INIBAP (network of IPGRI)

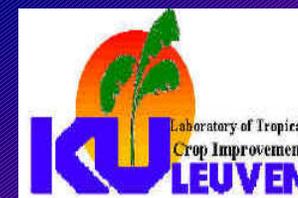
KUL

Makerere University

CIRAD

IITA

University of Pretoria





# BACKGROUND

## Funding sources

- Principle – Uganda Government (through the CGIAR- IPGRI, INIBAP network)
- Others – Belgian Government, USAID, Rockefeller Foundation.



# Project justification

Need to develop biotechnology capacity in NARO for fast response to challenges posed by pests, diseases and other stresses.

Weaknesses in conventional banana breeding

- Poor cooking quality
- Female sterility in preferred clones
- Long term nature of cross breeding as a banana improvement strategy



# Project justification (cont.)

- Potential for improving banana through genetic transformation
  - Short term banana improvement option
  - Resistance genes for black Sigatoka and nematodes already isolated and incorporated in banana (KUL, JIC)



# PROJECT GOALS, OBJECTIVES AND ACTIVITIES

## Goals

- To develop a centre of excellence in crop biotechnology at Kawanda with banana as a start up crop.
- To contribute to improved food security and family income in Uganda through bananas improved by a genetic transformation approach.



# Objectives

- To develop crop biotechnology capacity in NARO through biotechnological research on bananas
- To introduce resistance genes for black Sigatoka and nematodes into East African Highland bananas (Matooke cultivars)
- To identify and isolate genes for banana weevil resistance and introduce them into Matooke banana cultivars.
- To evaluate and disseminate the transformed banana plants



# Project Activities

- Capacity building
- Research activities



# Capacity building

- Upgrading existing facilities at Kawanda; installing the required equipment and associated infrastructure.
- Recruiting and training project personnel



# PROGRESS

- Tissue culture and molecular biology labs renovated
- More specialised equipment acquired



**Molecular Biology Lab**



**Tissue culture laboratory**



## Progress : Capacity building contd:

- Three technicians and a supervisor trained.
- Three PhD students started training
- Skills to do transformation (PhD) acquired at KUL



**Inside a growth room in  
tissue culture lab**



**Staff at work**



# Research activities

- Selection of target cultivars and establishment of a field collection (source of male buds)
- Development and maintenance of cell suspension cultures from
  - Immature male buds (back stopped by CIRAD)
  - Scalps I.e proliferating meristems (back stopped by KUL)



## Research activities (Cont.)

- Introducing black Sigatoka and nematode resistance genes into the selected Matooke cultivars
- Identification of weevil resistance genes and introducing them into banana cultivars.
- Evaluating performance of transformed banana plants.



# Progress: Research Activities

## Field collection (source of male buds)

- **Early maturing**
  - Mpologoma, Mbwazirume
- **Bunch size**
  - Nakinyika, Kisansa
- **Utilisation**
  - Kabula, Kibuzi
- **Utilisation**
  - Nakasabira, Nandigobe



# Development of cell suspension cultures

## Starting materials:

- Male inflorescence
- Scalps (highly proliferating meristems)





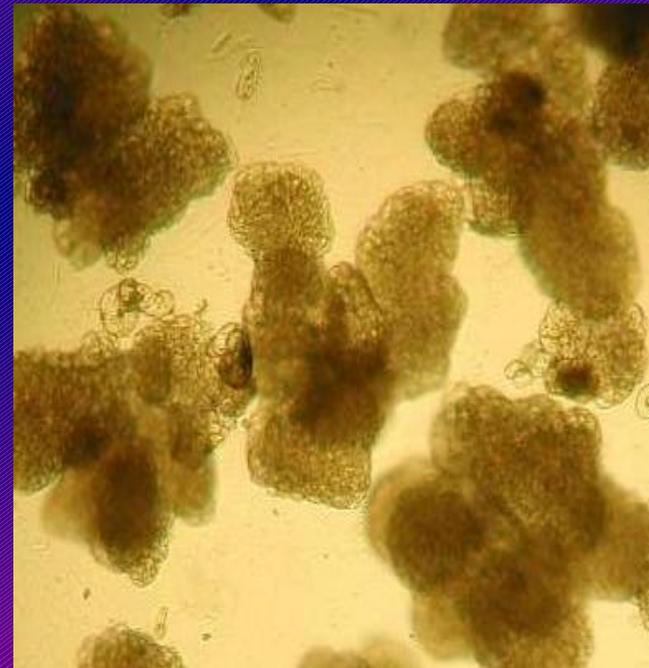
## Male Flower Responses

- Responses may be as low as 1 in 1000
- However 20-30% reported for Cavendish
- Somatic embryo development and germination achieved with Musa AAA-EA cv 'Nakyetengu'

# Embryogenic response from *Musa* AAA-EA cv 'Nakyatengu'



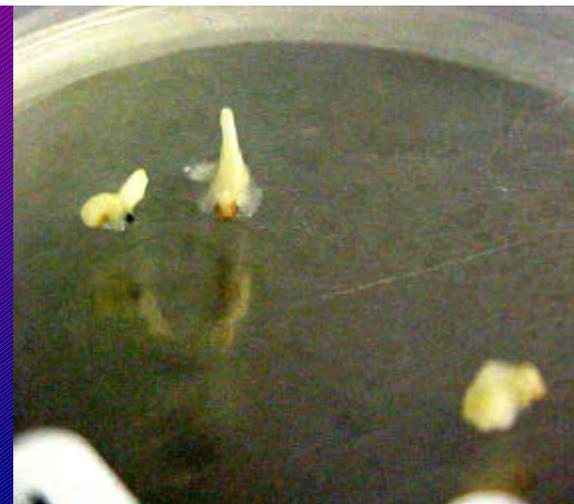
Embryogenic  
response from cv  
'Nakyatengu'



Cell suspension of  
cv 'Nakyatengu'



## Somatic embryo germination



Plantlets regenerated from somatic embryos of cv 'Nakyetengu'



Plantlets derived from cell suspensions prepared for field evaluation

## Scalp culture responses

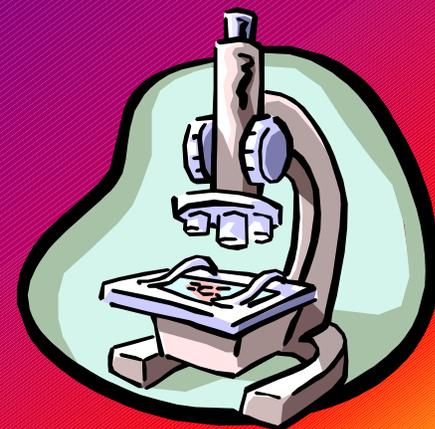
Highly proliferating meristems (scalps) of 50-80% recorded in 7-10 months on scalp induction media.





## Projected activities

- Optimisation of protocol for embryogenic induction of EAHB cultivars
- Identification and cloning of new genes
- Transformation of EAHBs
- Field evaluation





# CONCLUSIONS

## Good progress made

- Training of personnel in relevant skills
- Civil works at Kawanda almost complete
- Break-through in cell suspensions work on Matooke cultivars
- Linkages/partnerships developed and strengthened



# Implementation challenges

- Issues of biosafety policies and regulations
- Inadequate manpower and infrastructure
- Funding gaps in the planned activities.

A photograph of a banana plantation. In the foreground, several banana plants with large green leaves and clusters of unripe green bananas are visible. In the background, a person wearing a light-colored shirt and dark pants is bent over, working in the field. The ground is covered with dry leaves and straw. The text "Thank you for your attention" is overlaid in the center in a bold blue font.

**Thank you for your  
attention**