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Steps towards food security via *in vitro* tissue culture

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CONTENT

- Introduction
- Germplasm conservation
- Tissue culture
- Advantages and disadvantages

Introduction

- More than 800 million people experience hunger and malnutrition everyday worldwide
- An estimated15 million deaths annually are caused by hunger and malnutrition
- 1 billion people considered food insecure in 2009
- World population expected to reach 8.3 billion by 2030

Broussard et al., 2010; Esquinas-Alcazar, 2005; FAO, 2005

Introduction

Loss of crop genetic diversity is linked to

- Industrial revolution
- Rapid changes in population size
- Ecological degradation
- Globalization
- Climate change

Castañeda-Álvarez et al., 2016; FAO, 1997; Mangelsdorf, 1966; Sivakumar et al., 2005

Introduction

- There is a need to protect our Plant Genetic Resources for Food and Agriculture (PGFA)
- Ensure proper characterization, evaluation, documentation and sustainable use

Germplasm conservation

- Germplasm bank is a collection of living genetic resources that are maintained for the purpose of animal and plant breeding, conservation and other research uses.

- Plant germplasm
  - seed
  - Leaf
  - Stem
  - Cells

Stem

Seeds

USDA, 2003

Germplasm conservation

Table 1. Germplasm conservation in Jamaica 2017

Institutions	***In vitro***	***Field***	***Seeds***
MICAF	X	X	X
BIB	None	X	None
CIB	None	X	None
UWI	X	None	None
NCU	X	None	None
CASE	None	X	None
SIRI	None	X	None
SRC	X	None	None
Farmers	None	X	X

MICAF - Ministry of Industry, Commerce, Agriculture & Fisheries
UWI - University of the West Indies
NCU - Northern Caribbean University
CASE - College of Agriculture Science & Education
SIRI - Sugar Industry Research Institute
SRC - Scientific Research Council

BIB - Banana Industry Board
CIB - Coconut Industry Board

SRC GENEBANK

- More than 125 species
- Food crops of economic importance
- Plants of medicinal and cultural importance
- Ornamental plants
- Endemic plants

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TISSUE-CULTURE PROPAGATION OF CASSAVA
(Manihot esculenta)

1. Media Preparation
Plant growth media is prepared prior to collection of plant samples.

2. Field Visit and Sample Collection from Source Plant
Samples are collected and taken to laboratory.

3. Initiation
A piece of plant tissue is (A) cut from the plant, disinfected (removal of surface contaminants), and (B) placed on a medium. A medium generally contains mineral salts, sucrose, and a solidifying agent such as agar. The objective of this stage is to obtain plantlets free of bacterial or fungal contaminations.

4. Multiplication
After 8-12 weeks, successfully established plantlets can be induced to produce more plantlets. These new plantlets can then be subcultured and made to produce more plantlets or transferred to shade house for hardening.

5. Acclimatization/Hardening
Following successful initiation and multiplication, plantlets with shoots and roots are now ready to be removed from tissue culture jars and placed in soil in the shade house (A). When this is done, the humidity must be gradually reduced over time because tissue-cultured plants are extremely susceptible to wilting (B & C).

Advantages

- Requires relatively small space
- Storage over long periods
- Pathogen and insect free planting material (STG)
- Rapid multiplication of uniform planting material
- Overcomes seasonal restrictions
- Safe germplasm transfer between countries

Disadvantages

- Expensive to set-up and maintain laboratory (lighting, cooling etc)
- Tissue culture skill required
- Labour intensive
- Risk of contamination
- Need for rigid system of documentation

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Thank you...