Food security through virus indexing, tissue culture and genetic engineering of underutilized crops

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Project summary

Tissue culture is one of the most widely used biotechnologies in African agricultural improvement. When coupled with various therapies it can be used for elimination of viruses from plants. The known therapies include: Thermotherapy, Chemotherapy and Electrotherapy. Thermotherapy combined with meristem tip culture has proven to be successful. However, the rate of success can be improved by combining two or more different treatments as well as developing resistant and/or tolerant crops against various stresses through genetic engineering. The aims of this project were to (1) Identify the viruses present in the plants (2) Produce clean planting materials through tissue culture using one or more of the above mentioned cleaning methods, (3) pass clean plantlets to partners for multiplication and subsequent distribution and (4) Generate protocols and develop stress tolerant/ resistant plants .

Outputs

Information on viruses affecting Taro, Yam, Garlic, Passion fruit and different methods of cleaning to generate clean planting materials.

Tissue culture methods have been developed for various crops.

Clean planting material obtained for Taro, Yam, Garlic and Passion fruit

Protocols for enhancement of cowpea, sorghum and Taro through genetic transformation have been developed.

Generation of protocols for rapid multiplication of the Baobab tree.

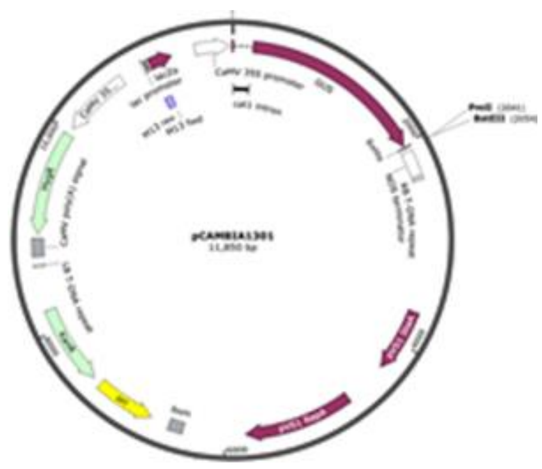

Fig 1: Plasmid with Gus reporter gene to test transformation efficiency

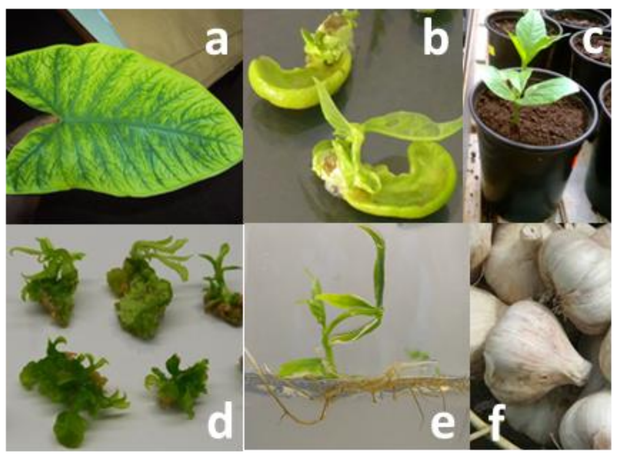

Fig 2: a:Infected taro leaf; **b**: shoots emerging from cotyledonary nodes in cowpea; **c**: Baobab plantlet in the greenhouse; **d**:Shoots from leaves of passion fruit **e**:Root development in cowpea shoot; **f**:garlic bulbs

Outcomes

Trained personnel in diagnostics, tissue culture and genetic transformation applying the developed and improved techniques and training others in their institutes.

Capacity building to various partner institutes through the trained personnel and development of partnerships with institutes having the same goal.

Through partnership with Institut des Sciences Agronomiques du Burundi (ISABU) and University of Burundi, farmers in Burundi now have access to clean taro plantlets which will lead to increased yield.

Economic gains and better livelihood for farmers through use of clean planting material that have shown potential to increase yield up to five times the initial yield.

Partnerships

1. Kenya Agricultural and Livestock Research Organization (KALRO).
2. University of Nairobi.
3. Biosciences Eastern and Central Africa (BecA).
4. Egerton University-Kenya.
5. ISABU-Burundi.
6. Agricultural Research Corporation (ARC)- Sudan.
7. Ethiopia Institute of Agricultural Research (EIAR)- Ethiopia.
8. National Agricultural Research Organization (NARO)- Uganda.
9. Mikocheni Agricultural Research Institute (MARI)- Tanzania.

Potential to scale-up

- Most farmers lack clean planting materials and subsequently recycle infected material season after season with generation of lower yields.
- There is high demand for clean planting material as well as resistant and tolerant varieties of crops of economic importance.
- There is therefore need to train more personnel as a means to adopt protocols in the NARS or private sector, develop new protocols for more diverse crops and more importantly to discover more genes of economic importance that can be transferred to susceptible species to make them resistant/tolerant to various stresses.
- SME tissue culture companies can be lucrative and relatively low tech and help many farmers.

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