Progress on Cassava Genetic Transformation in Tanzania

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Summary

Cassava production in Eastern and Central Africa is affected by cassava mosaic disease (CMD) caused by cassava mosaic geminiviruses (CMGs) and cassava brown streak disease (CBSD) caused by cassava brown streak virus (CBSV). Management of these two diseases in Tanzania has been mainly through development of host resistance using conventional methods. Here we report a progress on control of these two major diseases using genetic engineering approach. To date a total of 1,014 *Invitro* plants have been multiplied from 56 collected high-yielding cassava cultivars but susceptible to both CMD and CBSD. Of the 56 collected cultivars, 13 are currently undergoing embryogenesis and organogenesis of which 3 have developed embryo cotyledons. Also three RNAi constructs, two targeting EACMV-Tanzania and one CBSV have been made and mobilized in Agrobacteria. In line with molecular work, the establishment and operationalization of a containment laboratory facility (BL-2) for cassava transformation has been set up at Mikocheni Agricultural Research Institute and is now operational. This is the first attempt by NARs in Tanzania to integrate genetic engineering for crop improvement.

Background

Cassava production in East and Central Africa is affected by Cassava Mosaic Disease (CMD), caused by Cassava Mosaic Virus: genus Geminivirus; family *Geminiviridae* and Cassava Brown Streak Disease (CBSD) caused by CBSV: *genus Ipomovirus, family Potyviridae*. Yields of virus-infected plants are highly reduced and in severe cases farmers abandon their fields thus undermine the main role of cassava as food security crop. Management strategies for these diseases in Tanzania has mainly been through development of host resistance through conventional approaches with limited success.

CMD-infected cassava plant

CBSD-infected leaf and roots

This work was set to improve both *CBSD* and *CMD* resistance in farmer preferred clones through genetic engineering approaches

Objectives:

- ❑ To improve both the CBSD and CMD resistance in farmer/consumer-preferred cassava clones currently available in Tanzania through genetic engineering approaches
- ❑ Start building capacity in scientific personnel and research infrastructure for cassava transformation at MARI
- ❑ To use the established facilities for the training of other scientists and technicians from the Eastern and Central Africa region
- ❑ To accelerate the development of capacity in all Eastern and Central Africa countries to deploy transgenic technologies in crop production

Materials and Methods

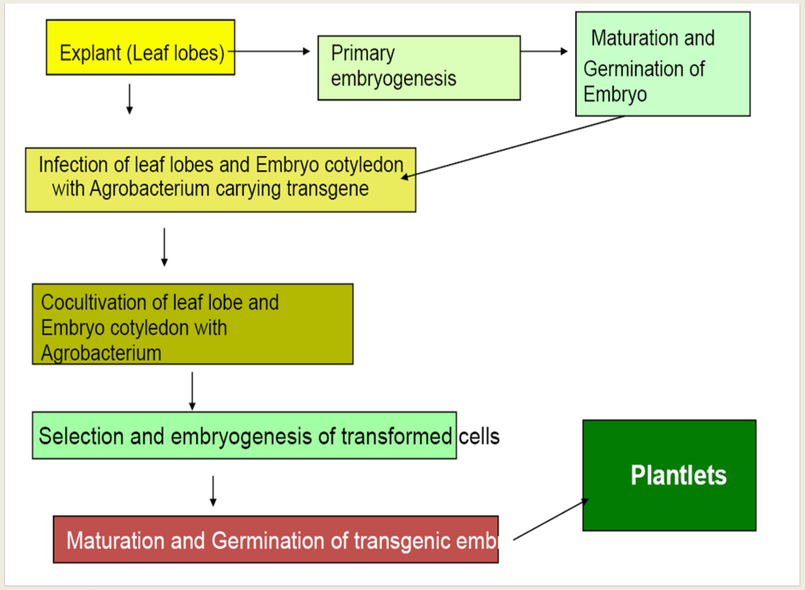
1.RNAi construction

Three RNAi construct targeting-*East African cassava mosaic virus* [EACMV]- (pGSA1285EAC1/5' and pGSA1285EAC2/3), CBSV-pGSA1285CBSV-CP were made using Tanzanian virus isolates

2.Micro propagation of farmer-preferred cassava landraces -MS+0.5mg/l BAP

3. Optimization of transformation protocol for cassava Landraces

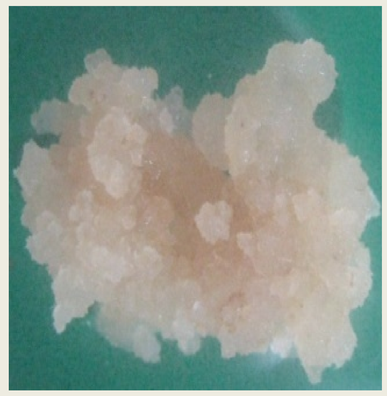
Cassava transformation scheme to be used at MARI

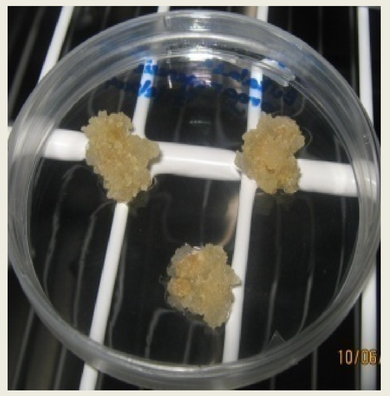


Conclusion

- ❑ Facility for containment research (Biosafety Level-2) is now in place for use by national scientists and other scientists in the region
- ❑ It is the first attempt of NARS to start integrating genetic engineering as a strategy of crop improvement in the region.
- ❑ For the first time MARI has managed to develop embryo cotyledons from Tanzanian cassava landraces

Somatic embryogenesis protocol optimized to produce somatic embryos from cassava landraces from Tanzania followed by organogenesis





Cassava cv. katakya undergoing embryogenesis (left) and organogenesis (right)

Cassava cv. katakya (left) and Sagalatu (right) developing embryo cotyledons after 4 weeks on MS 8 media

Table showing list of cassava landraces currently undergoing embryogenesis and organogenesis

Embryogenesis		Organogenesis	
Cultivar	Place of collection	Cultivar	Place of collection
Rushura	Kagera	Bukalasa	Kagera
Karatasi	Tanga	Rushura	Kagera
Gago	Tanga	Ngh'wazila	Mwanza
Milundika chini	Mwanza	Karatasi	Tanga
Marekani	Kagera	Konyu	Kagera
Mwarusha	Tanga		

Current and future activities

-Transformation of embryo cotyledons with double-stranded RNAi constructs
-Design and evaluate more double stranded RNAi constructs for CMD and CBSD

Acknowledgment

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