Clean seed production in Ghana and Sub-Saharan Africa: The role of tissue culture and molecular biology tools

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Abstract

Records have it that Ghana is the leading exporter of yam (Dioscorea spp.). However, there is no existing formal seed system to facilitate the production of seed yam, and tubers meant for consumption are used as seed leading to high cost of tubers and low productivity. There is the urgent need to establish formal seed system for yam and the goal of the Council for Scientific and Industrial Research – Crops Research Institute (CSIR – CRI) is to play a leading role in this initiative. Traditionally, yams are propagated vegetatively by means of the edible tuber, which has low multiplication rate (1:10 compared to 1:200 in some cereals), long dormant phase of the tuber prior to sprouting and, are pathogen infested planting materials. CSIR – Crops Research Institute houses the Biotechnology Research facility, which plays host to researchers from West Africa, and has played a key role in the CAY-Seed project at the CSIR-CRI. The Biotechnology research has developed *in vitro* tools to facilitate the production of "clean" virus indexed planting materials for the seed yam industry. Technologies provided include the use of molecular tools to index yam for viruses, germplasm fingerprinting and conservation, clean macro and micro tubers of Tissue Culture origin, aeroponics systems for yam seedlings production from single nodes. Trainings in the construction of aeroponics system supported by socio–economic cost benefit analysis are provided for private sector stakeholders the yam industry by the laboratory. Currently, the Biotechnology facility has the full complement of facilities and technical personnel to provide needed support for a successful clean seed yam system in Ghana. The Laboratory gives credit to IITA yam team for the key role they have played through the YIIFSWA project to build capacity in the application of aeroponics system to yam production.

KEYWORDS: Clean seed yam, indexing, aeroponics, capacity building, tissue culture, fingerprinting

Recent Publications (minimum 5)

1. MK Osei, E Cornelius, E Asare-Bediako, A Oppong, MD Quain (2017). Status of Begomoviruses in Ghana: The Case of Vegetables and Root and Tuber Crops. Begomoviruses: Occurrence and Management in Asia and Africa, 297-314

2. Boateng, S.K., L. M. Aboagye, K. F. Egbadzo, D.K. Gamedoagbao, L.N. Allotey, **M.D. Quain** (2017). The performance of five selected pepper accessions in comparison with two local varieties. Agricultural and Food Science Journal of Ghana, Vol 10 (1) pp. 795 – 802

3. Abengmeneng, C.S., Ofori, D.A., Kumapley, P., Akromah, R., Jamnadass, R., **Quain, M**. (2016). Genetic relationships among 36 genotypes of Ceiba pentandra (L.) as revealed by RAPD and ISSR markers. American Journal of Agriculture and Forestry 4(4): 86-96

4. Marquez-Garcia, B., D Shaw, JW Cooper, B Karpinska, **MD Quain**, EM Makgopa, K. Kunert and CH Foyer (2015) Redox markers for drought-induced nodule senescence, a process occurring after drought-induced senescence of the lowest leaves in soybean (*Glycine max*). Ann Bot first published online April 7, 2015 doi:10.1093/aob/mcv030

5. **Quain, M.D.,** M.E. Makgopa, J.W. Cooper, K.J. Kunert, C.H. Foyer (2015) Ectopic phytocystatin expression increases nodule numbers and influences the responses of soybean (Glycine max) to nitrogen deficiency. Phytochemistry. http://dx.doi.org /10.1016/j.phytochem.2014.12.027



Biography

Marian Dorcas Quain holds a PhD in Botany with bias towards Biotechnology and Plant Physiology. Marian is a Principal Research Scientist at the CSIR-Crops research institute in Ghana as well as an Associate Professor at the CSIR-College of Science and Technologies. She has expertise in Molecular tools for fingerprinting, gene mining, transcriptomics, diagnostics, tissue culture, cryopreservation, genetic transformation, somatic embryogenesis, and aeroponics as applied in seed yam production. Her research has focused on using molecular tool to certify tissue culture cleaned planting material, diagnostics tools and studies on stress related genes. She has special interest in conducting outreach in application of biotechnology in agriculture. She has numerous publications in referred journals, books, and conference proceedings. She has also supervised several postgraduate students. Currently she leads Biotechnology research in her Institute and is the principal investigator in research projects with focus on production of clean planting materials of vegetatively propagated crops.

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