

Capacity Building in the Sweetpotato Weevil Resistance Research Component



The development of transgenic sweetpotato with gene(s) for resistance to the African sweetpotato weevils *Cylas puncticollis* and *C. brunneus* involves generation, testing and promotion of the new sweetpotato varieties and requires the active participation of scientists, opinion-and decision-makers in the country where these varieties are developed. Our vision is to build capacity so that there is the ability to adapt and develop technologies in the country where it will be adopted. Introduction of this technology has involved the establishment of facilities in Kenya and Uganda where the work was to be carried out, building practical knowledge and communication skills of the personnel involved and the development of the new varieties. Three doctoral students have been trained under this program.

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Opening of BecA facilities at the ILRI Campus Nairobi, Kenya attended by Kenyan President Mwai Kibaki (credit BecA)

Improving GM communication

The 1st Science and Communication Workshop on Biotech Sweetpotato for Africa course, held in Nairobi from August 9th-12th, 2010, was organized to impart skills and knowledge in communication of genetically modified (GM) crops to farmers, policy makers, stakeholders and sweetpotato team members. During this workshop, Dr. William Moar and Judith Rylott, both experts from large corporations which lead GM crop commercialization, provided useful guidance on research experiments which could be included into a regulatory dossier.

The Donald Danforth Plant Science Center (DDPSC) in the US and its Biosafety Resource Network invited members of the SASHA Weevil team to a Crop Biotechnology Product

Development Workshop in Kampala, Uganda on August 16th-18th, 2010. This workshop covered all aspects of deregulating a crop biotechnology product to be released. DDPSC is in charge of the development of the regulatory dossier of the weevil resistant sweetpotato (WRSP) products.

Two pamphlets on the benefits and safety of the new sweetpotato varieties have been produced after final review by CIP. Various copies have been shared in Kenya and Uganda in a number of workshops; over 250 were distributed to scientists on the African Crop Science Society Conference in Mozambique that was held in October 10-13, 2011.

Infrastructure development for genetically modified (GM) sweetpotato:

In Kenya, the Biosciences east and central Africa (BecA) Hub, a biosafety level II facility where the research work is taking place was officially launched on November 5, 2010 as a world class research facility by the president of Kenya, Mwai Kibaki. Noteworthy, the president had the occasion to see and be introduced to the research project focusing on the development of weevil resistant sweetpotato variety. As part of the project, an operating manual with standard operating procedures for this facility has been developed and reviewed by the CIP team.

At the National Crops Resources Research Institute (NaCRRI) in Uganda, several improvements have taken place from other sponsors (The Howard



Buffet and Rockefeller Foundations, and CIP). The biosafety level II screenhouse was constructed and the facility accredited for the research work by the biosafety authority in Uganda. Similarly a large confined field trial site (about 5 hectares in size) was constructed. In addition, the NaCRRI biotechnology laboratory construction was completed and equipped where transformation work at Kawanda was later transferred to. Two air conditioners were procured during the reporting period and were installed and are functioning well.

Training on biosafety regulation

Runyararo Rukarwa, a PhD student in Uganda enrolled at Ghent University for the postgraduate course Biosafety in Plant Biotechnology for the academic year 2009-2010. The course is an e-distance learning course combined with hands-on practical training during two on-campus sessions at Ghent University. The course is delivered in a modular format covering the entire range of disciplines related to biosafety: an introductory section on plant biotechnology and its applications for agriculture and industry (module 1 and 2); the basics of biological risk assessment (module 3); the components and procedures for food and feed safety assessment (module 4); environmental safety assessment (module 5); an overview of national and international regulatory systems is included (module 6); and risk perception and communication (module 7). During the second on-campus training, students were evaluated by performing written and/or oral examinations for each module. Students handed in a final assignment by preparing a GM assessment dossier on a relevant crop for the respective country, as well as a socio-economic data. Runyararo Rukarwa successfully passed the course and received an accredited postgraduate certificate from Ghent University.

The sweetpotato senior breeder from NaCRRI in Uganda, Dr. Gorrettie Ssemakula, enrolled at Ghent University for



Participating in a GMO Course in Uganda (credit M. Ghislain)



PhD student Runyararo Rukarwa (2nd from left) showing plants to Gorrettie Ssemakula, head of the Uganda sweetpotato program, in NaCRRI's biosafety level II screenhouse (credit J. Low)

the postgraduate course Biosafety in Plant Biotechnology for the academic year 2010-2011. The course started November 2010 and ended in August 2011. Gorrettie participated online in all module tutorials and discussion platforms which cover the entire range of disciplines related to biosafety and prepared specific training assignments for each module. Gorrettie had already attended two on campus sessions organized at Ghent University for practical training and tailoring of the content to specific regional or national needs and to be evaluated by means of examinations, a written dissertation and oral defense of this dissertation. The proclamation and deliberation took place July 7, 2011. Gorrettie Ssemakula obtained the postgraduate certificate from Ghent University on Biosafety in Plant Biotechnology. The examination period at Ghent University was immediately followed by a short on campus session at the Marche Polytechnic University of Ancona (Ancona, Italy) that took place the 4th and the 5th of July 2011 during which the students attended a workshop on risk assessment in cooperation with the European Food Safety Authority (EFSA) and a biosafety symposium organized by the Marche Polytechnic University of Ancona and Ghent University. The on-campus session in Ancona had a total of 41 participants comprising trainees with diverse backgrounds, an international faculty member and regulatory scientists. Trainees benefitted not only from the hands-on training, but also from the opportunity to interact with their fellow students, the faculty and regulatory scientists. In this way they were able to share and learn from various national experiences on the implementation of biosafety regulations. The first day lectures covered the work and procedures of EFSA related to GMO's, while the second day handled the experience of different international institutions in definitions, applications and management of GM crops and related biosafety issues.

The sweetpotato research team at NaCRRI underwent a training workshop on 4th – 5th November 2010 with a main objective of imparting knowledge and skills on biosafety compliance procedures for research involving use of modern biotechnology tools. A regulatory handbook for genetically modified sweetpotato has been developed.

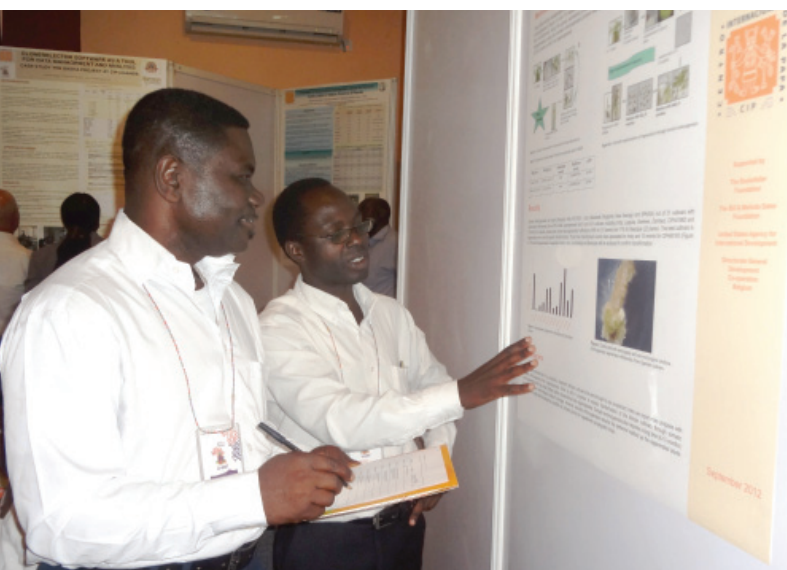
A GMO Detection Workshop was held on 24-25 October 2011 at the Namulonge biotechnology laboratory (NaCRRI Uganda). The training was conducted through an interactive and semi-informal approach using PowerPoint presentations and open discussions. However, most of the focus went to the practical sessions in which (a) a quantitative detection of roundup-ready soybean was performed and (b) a detection of the transgenic sweet potato events generated by SASHA. Although GMO detection per se is not a component of this program and not a requirement of local biosafety regulation, it was a good opportunity to expose the Ugandan scientists to the technical challenges and certification issues posed by such regulation.

Upgrading skills of African scientists in biotechnology

The Kenyan PhD student and research assistant, Lydia Wamalwa, completed a short-term training program on Polymerase Chain Reaction (Q-PCR) analysis of gene expression on September 27th –October 17th 2010. The program included training on cDNA synthesis, RT-PCR to check the quality of the samples, Q-PCR to test the expression of weevil resistance genes in sweetpotato leaf, storage root periderm (skin) and parenchyma (flesh) and statistical analysis of the data.



Transgenic sweetpotato plants in the greenhouse at BecA – ILRI Campus, Nairobi, Kenya (credit L. Wamalwa)



PhD student Abel Sefasi defending his poster to Dr. Adu-Dapaah at 2012 SPHI meeting (credit J. Low)



Visit by Chancellor Merkel, Germany to the BecA Lab at ILRI Campus, Nairobi (credit BecA)

studies of modern breeding for sweetpotato were presented. In addition to the theoretical lectures, the participants had hands-on practical training both on molecular marker analysis and the use of the software CloneSelector. In addition, there were field visits to a potato processing company and a food processing pilot (Agristo and ILVO FOOD Pilot Plant) as well as to seed and biotech companies (Devgen, Cropdesign) and the GM potato field trial testing a potato resistant to *Phytophthora infestans*.

From October 28th to November 8th, 2013 Runyararo Rukarwa was trained in particle gun bombardment at the Ghent University in Belgium. Ghent organized a practical training in particle gun bombardment and discussed the set-up of the experiments. Different aspects of particle gun bombardment which include: preparation of the gold, coating of the gold with plasmid DNA, different parts of the particle gun device, performing a bombardment and analysis of the samples (ELISA), input and demonstration were covered during the training. Consequently, Runyararo repeated all steps 3 times to get acquainted with the protocol and the handling of the machine. In addition, some biolistic materials were supplied in order for her to do a first test of 15 bombardments upon return in Uganda which she did.

The last two years have been particularly important for the development of scientific articles needed for the submission of PhD thesis of our three PhD students on the WRSP team. Seven were already published whereas four are under preparation. One student, Abel Sefasi, graduated in 2013; Runyararo Rukarwa graduated in August 2014, and Lidia Wamalwa will graduate before the end of 2014.

THESIS TITLES

Sefasi, Abel. Efficient regeneration and transformation systems for improving resistance to weevils in Ugandan sweetpotato cultivars. Makerere University.

Rukarwa, Runyararo. Enhancing sweetpotato resistance through transgenic breeding. Makerere University.

Wamalwa, Lidia. Genetic transformation of sweetpotato against weevils. Kenyatta University.