IM Performance Narrative Template (FY2017 Reporting)

Late-blight resistant potato through Biotechnology

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Project Summary: Late blight of potato, caused by *Phytophthora infestans* is one of the most devastating diseases of potato (*Solanum tuberosum* L.) in Uganda causing 40% to 60% yield loss and elsewhere in Sub-Saharan Africa. Worldwide losses due to late blight exceed several billion dollars annually. In Uganda, the cost of fungicide spray (chemicals, sprayers) is estimated to be 100-300 $/ha which would represents under 25% adoption of a variety completely resistant to LB an annual cost saving of 2,5 to 7.5 M$ considering 102,000 ha of potato. Considering an average value of 1,500 $/ha for ware potato and an average yield of 10 t/ha, a yield increase of 20% to 2X corresponds to an annual gain of 7.5 to 37.5 M$. Other benefits will also derive from reduced exposure to toxic chemicals of farmers and family. Potato varieties currently grown in Uganda, as elsewhere, are highly susceptible to late blight and control of this disease relies exclusively on multiple fungicide applications. Using biotechnology, we have introduced 3 resistance genes from potato wild species (RB, Rpi-blb2, Rpi-vnt1.1) into four varieties grown in Uganda and Kenya. In the greenhouse and after 2 seasons in the field, we observed complete resistance to late blight disease under natural infection without a single fungicide spray. The immediate goal of this project is to release the best transgenic event of one African variety in Uganda. To that end, additional testing are needed to develop a petition for general release based on a dossier documenting absence of risk to the human and animal health and the environment.

FY2017 Performance:

- One confined field trial (CFT) was completed successfully at the potato experimental station of KaZARDI – NARO in south west Uganda. The results confirmed the previous 2 CFT and provided a better yield estimate of 40 t/ha for the candidate lead event Vic.1 (the transgenic plant intended for general release).
- An application permit for multilocational CFT was prepared, submitted and approved by the national authority granting CIP and NARO to proceed at two more locations (Rwebitaba and Bunginyanya) where confined field trials were constructed.
- Tuber seeds of Vic.1 and Victoria (non-transgenic) were prepared at BecA Kenya and KaZARDI in Uganda for planting in October 2017.
- The molecular characterization of the insertion of the T-DNA has been achieved for the candidate lead event, 3 additional events of the same variety, and partially for 15 events of 3 additional varieties.
- Regulatory and stewardship plans have been prepared by CIP with the guidance from existing regulatory dossier (Simplot – USA) and internationally-recognized experts.

Successes: FY17 successes were three-fold: (i) confirmation of complete resistance for the third time of the LB resistant transgenic potato; (2) approval of the multilocational CFT; and (3) the molecular characterization of the T-DNA insertion. This was possible thanks to the financial support from USAID and the 2Blades foundation. We are also grateful to many colleagues including from our sponsors, CIP, and NARO in Uganda. The recent approval by the parliament of the Biotech and Biosafety bill in Uganda is a good sign that this product may eventually be released and bring the benefits to the small farm holders.

Challenges: This year we did not face major challenges but few difficulties that are common for such multiple public sector actors. Coordination for seed preparation, permit submission, and timely responses has been sometimes poor and resulted in un-necessarily delay but fortunately without significant consequences.

Lessons Learned: The development of transgenic varieties and their release by public sector institutions in developing countries appeared to be more and more achievable. Potato, banana, cassava, and maize products are now on the path towards release in several sub-Saharan African

countries. New plant breeding technologies, genetic engineering being one of them, must be embraced by the public sector institutions to develop crops with lower needs of chemical inputs, yields, and adaptation of climate change to meet the present and future food demand

Description of Expected FY2018 Activities:

- Complete the insertion characterization of all available sequence data from transgenic events (4 from Victoria and 15 from the other 3 varieties).
- Share and discuss these with regulatory experts and assess any additional characterization needed.
- Conduct the multilocational CFT-1 in Uganda from October to February and collect all data needed for the regulatory studies.
- Make a decision on the final lead transgenic event of the variety Victoria.
- Prepare tubers seeds for Vic.1, Victoria, and other promising candidate lead transgenic event from Victoria for planting next season.
- Conduct the multilocational CFT-2 in Uganda from March to July if the tuber seeds are available, and collect all data needed for the regulatory studies.
- Develop the writing of the regulatory studies.
- Write scientific publications in support of the project.