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Biotechnology for Enhancing Agricultural Productivity in Sub-Saharan Africa – The Role of the IITA Bioscience Center

Melaku Gedil

International Institute of Tropical Agriculture (IITA), Nigeria

Abstract

The challenge of large yield gaps in sub Saharan Africa (SSA) provides an opportunity for biotechnological intervention. One of the strategies to boost agricultural productivity is genetic improvement of germplasm. However, genetic improvement of many of the under-studied staple food crops of Africa is hampered by lack of genomic resources. IITA deploys a wide array of techniques and tools to mitigate the myriads of constraints in agricultural production. Our mission is to develop and deploy innovative biotechnology products and new tools for modern molecular breeding, genetic engineering, disease and pest diagnosis, conservation and characterisation of biological diversity, and plant health management.

Key strategic objectives and major outputs:

• Employ next generation genotyping (e.g. GBS) to discover desirable traits and describe the germplasm collection at the Genbank for crop improvement. Thousands of accessions of yam, cassava, cowpea, banana, and maize have been fingerprinted by GBS (genotyping by sequencing)

• Plethora of genomics tools (markers, whole genome sequence, transcriptome) developed and applied to accelerate the selection of superior varieties by shortening the breeding cycles of target crops. Modern breeding schemes such as genome selection (GS), marker-assisted recurrent selection (MARS) and forward breeding using MAS for simple traits are deployed resulting in varieties with high nutritional quality, high yield and stress tolerance. IITA is also engaged in the development of data management and decision support tools tailored to the implementation of innovative breeding strategies.

• Genetic engineering for resistance to crop diseases for which there is no or limited host resistance (e.g. Banana Xanthomonas wilt, nematode resistant plantain and cassava resistant to virus diseases). Tissue culture and micro-propagation techniques such as temporary immersion bioreactor are used for rapid multiplication of planting material and to eliminate diseases from germplasm.

• User-friendly and affordable tools for disease diagnostics to determine the causal agent of important diseases to enable designing of appropriate control measures as well as to pre-empt emerging threats posed by pests and diseases.

• Enabling partners to develop adequate infrastructure and expertise through training and provision of laboratory and computational services to realise the full benefits of agricultural biotechnology. The Bioscience facility of IITA is Africa's gateway to modern technologies and a platform for innovation and discovery for our partners in SSA.

Keywords: Disease diagnostics, genotyping, markers, resistance, transcriptome, whole genome sequence

Contact Address: Melaku Gedil, International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, e-mail: M.Gedil@cgiar.org