



## Building on Cultural and Nutritional Heritage: African Plant Scientists Breeding African Crops for African Farmers

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By Lloyd Timberlake

In sub-Saharan Africa, more than one-third of the population suffers chronic hunger in a 'normal' year. This translates to approximately 237 million people, including more than 58 million children under the age of five.

It was against this backdrop that in 2011, Dr. Howard-Yana Shapiro of Mars, Incorporated and Dr. Ibrahim Assane Mayaki, CEO of the New Partnership for Africa's Development (NEPAD, now AUDA-NEPAD) conceived and co-founded the African Orphan Crops Consortium (AOCC).

The goal of the AOCC and its African Plant Breeding Academy (AfPBA) is to sequence, assemble and annotate the genomes of 101 traditional African food crops, the backbone of the continent's nutrition, that rural Africans know and understand to allow scientists to efficiently improve the crops' nutritional quality, productivity, climate resilience and disease and pest resistance, while training African scientists through the academy to best use the genetic information.

Ultimately, the objectives are to ensure that African plant breeders have access to and knowledge of ways to integrate the latest genomic technologies and tools to efficiently develop and release improved varieties of orphan crops to smallholder farmers for

cultivation. By this means, both diets and farmers' incomes are improved, allowing the 600 million people who live in rural Africa to grow their own food and nutritional security.

Driving the growth of the AOCC and AfPBA is a global consortium of partner organizations that provides vital resources, equipment and in-kind support, currently valued at \$80 million. In addition to AUDA-NEPAD and Mars, the consortium's founding partners include World Wildlife Fund, UC Davis, BGI and the World Agroforestry Centre, which hosts the AfPBA in Nairobi.

In 2018, the UN Food and Agriculture Organization (FAO) joined the consortium to mobilize improved nutritional security through the orphan crops approach in all its member states. Given that the heads of state of the African Union Assembly voted to endorse the AOCC initiative, all African governments are partners in the consortium.

The AOCC approach was further globally validated at the 2018 meeting of the FAO's Committee on Agriculture, when at a side meeting eight AfPBA graduates explained how they had taken their knowledge home to help fight malnutrition in their own nations and regions.

Dorcas Olubunmi Ibitoye, AfPBA graduate and head of the Genetics Resources Unit at the National

Horticultural Research Institute in Ibadan, Nigeria, works on several African orphan crops, including okra, papaya, and fluted pumpkin.

"My vision to excel as a plant breeder who develops better crop varieties that will revolutionize crop production in Africa and improve livelihoods was greatly influenced when I engaged with the AOCC and the African Plant Breeding Academy" she told the meeting. "This program transformed my approach to crop improvement by increasing my knowledge base, developing skills in the use of modern breeding techniques, and providing tools to facilitate efficiency and effectiveness in my work. I now have new confidence to achieve my vision for a well-nourished Africa."

Anna Lartey, FAO Director of Nutrition and Food Systems, told the meeting that what the AOCC has begun in Africa can stimulate a global revolution for orphan crops. She also showed the relationships between a successful AOCC program and the nutrition agendas of the 2030 Sustainable Development Agenda, with a focus on the Decade of Action for Nutrition.

The AOCC aims to genetically sequence de novo, assemble and annotate the 101 food crops, and re-sequence at least 100 lines of each crop species by 2023. Initial sequencing has been carried out on 54 species, with genome assemblies of eight published and



available in the public domain.

Opened in December, 2013, the AOCC Genomics Lab is a state-of-the-art sequencing and genotyping lab to support breeding programs of the selected crops.

By the end of 2019, the AfPBA had graduated 112 scientists from 27 African nations (87% PhDs, 38% women). The fifth AfPBA class was set to begin as soon as the pandemic allowed, and funding for a sixth class has been secured.

Since graduation, AfPBA alumni have launched 37 improved crop varieties and have established a continent-wide community of practice called the African Plant Breeders Association (APBA) to further the professional development of plant scientists on the continent, share research findings, and continue to educate about best practices in genomic applications and plant breeding.

Collectively, the graduates work to develop improved cultivars in more than 105 crop species, 55 of which are on the AOCC list ([see the list here](#)). There are at least 185 national breeding programs across the continent directed by AfPBA alumni that are focused directly on improvement of African orphan crops.

One early success of the consortium comes from Dr. Mathews Dida of Maseno University in Kenya and an alumnus of AfPBA Class II. He developed an early maturing, drought tolerant, high yielding finger millet variety, Maseno 60D. This variety matures much earlier than all other Kenyan finger millet

varieties. This allows farmers to harvest ahead of the worst of late season drought. Best of all, this rapid growth allows for a second season annual food crop that otherwise might be ruined by drought.

Mrs. Benta Onde'ngo, a farmer in Siaya County, Kenya, reports, "The finger millet variety, Maseno 60D, that I got from Prof Dida, gives me better yields and matures early compared to previous varieties I used to plant."

Cooking bananas called matooke in Uganda are an important food and cash crop in the country and all over East Africa, but they suffer pests and diseases that reduce their yields and productive lives by over 70%. Dr. Robooni Tumuhim-bise, an alumnus of the AfPBA has released several hybrid improved varieties, including NAROBan5. Jacinta Ndamira, a farmer in the Bushenyi district of western Uganda, said that NAROBan5 not only tastes good, but she can sell the bananas it produces and its planting material for a good deal more than the standard varieties. Also, it resists pests and diseases and thus remains productive for longer than other varieties.

AfPBA alumni have published some 171 scientific papers in peer-reviewed journals, and some 185 national breeding programs directed by alumni have focused on African orphan crops across the continent. Alumni have landed highly competitive plant breeding and research grants totaling more than \$13 million.

"The AfPBA empowers the top plant breeders in Africa, resulting in

a new community of leaders in crop improvement committed to delivering nutritional security to their nations," said Dr. Rita Mumm, director of the AfPBA since its launch in 2013 and past president of the US National Association of Plant Breeders.

"The impact of this uncommon collaboration, the AOCC, is grounded in its common goal to alleviate stunting due to malnutrition in Africa. The dedication of the AfPBA graduates and AOCC partners ensure its success," said Dr. Allen Van Deynze, AOCC Scientific Director and director of the Seed Biotechnology Center and Associate Director of the Plant Breeding Center at UC Davis.

"For the continent that is the most malnourished, the poorest, the most rural and the least forested, the AOCC gives Africa a chance through new science and its application to address many of its perennial problems of development," said Dr. Tony Simons, Director General of the Center for International Forestry Research and the World Agroforestry Centre. "Developing seeds, and giving families access to them, in order to grow more nutritious and diverse food crops will greatly improve the diets of Africa's children and improve nutrition, job prospects and quality of life, which will also contribute to the countries' economic and social development." 🌱

> [Read the African Orphan Crops Consortium 2019 Progress Report](#)

> [Read the full report: "21<sup>st</sup> Century Agriculture Renaissance: Solutions from the Land"](#)