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African Orphan Crops Consortium Tackles 101 Crop Genomes, Training in Africa

Jan 18, 2018 | [Andrea Anderson](#)



Bambara groundnut, one of the orphan crops being profiled as part of the African Orphan Crops Consortium

SAN DIEGO (GenomeWeb) – Researchers at BGI and other centers are in the process of sequencing — and resequencing — the genomes of 101 plants for the African Orphan Crops Consortium (AOCC), an international effort to improve nutrition in Africa through genome-assisted breeding resources and training.

Howard-Yana Shapiro, chief agricultural officer at Mars Incorporated, who is also affiliated with the University of California at Davis, the World Agroforestry Centre (ICRAF), and the Massachusetts Institute of Technology Media lab, outlined the AOCC's goals during a session on African orphan crops at the Plant and Animal Genome conference here yesterday.

Along with genome sequencing, assembly, and

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annotation for 101 African orphan crops at BGI, the AOCC is slated to resequence 100 accessions per crop. Meanwhile, partners at Illumina and South Africa's Agricultural Research Council (ARC) reportedly plan to generate transcriptomic data for several tissues per plant.

Together, the data are intended to establish tools for informing orphan crop breeding programs and assessing genetic diversity in African crops. In particular, informative genetic markers are useful for everything from selecting quality seed to performing genome-wide association studies on crop yield, disease resistance, nutritional content, or other agriculturally beneficial traits.

Notably, the AOCC program also includes an educational and training component: through a UC Davis-led professional development course known as the African Plant Breeding Academy, held at the ICRAF in Kenya, hundreds of African plant breeders with doctorate or master's degrees will receive training in genomics, marker-assisted selection, and other crop improvement applications.

So far, two classes have completed the professional development program — six intensive weeks of training spread out over 13 months — and a third group is set to graduate in late May.

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Shapiro explained that he became engrossed in the prospect of developing resources to improve African traditional crops after learning about stunting, a form of chronic malnutrition that irreversibly limits growth and neurological development during childhood.

According to December 2017 data from United Nations Children's Fund (UNICEF), a partner on AOCC, almost half of deaths in children younger than five years old result from undernutrition. And in Africa, Shapiro noted that nearly 40 percent of children younger than five show signs of stunting.

Stunting does not necessarily stem from insufficient food in general, but a lack of sufficiently nutritious food during critical growth periods, Shapiro explained. Consequently, there are expected to be benefits to broadening the availability of nutritious crops with features such as high yield, drought tolerance, and/or pest resistance in affected areas.

"There's no reason why we can't improve nutrition in Africa," he said.

To that end, the AOCC was established in 2013 — spearheaded by investigators at Mars, UC Davis, the World Wildlife Fund, the African Union's New Partnership for Africa's Development, and ICRAF.

It has since grown to include partner organizations such as BGI, the UC Davis Plant Breeding Academy, Thermo Fisher Scientific, Illumina, LGC, South Africa's ARC, Bioinformatics Institute Ghent's "From Nucleotides to Networks" (BIG N2N) center, CyVerse, Biosciences Africa, Google Genomics, and the Alliance for a Green Revolution in Africa (AGRA).

The AOCC also teams up with other collaborators for specific research efforts, Shapiro noted. In a release issued yesterday, for example, Dow AgroSciences announced that it partnered with UC Davis and the AOCC to sequence 116 lines of Bambara groundnut, drumstick tree, and apple-ring tree.

At the same PAG conference session, Xin Liu, director of genomics at BGI-Shenzhen presented the list of African orphan crops being sequenced at BGI, as well as progress made on the genomes so far. Liu said the team is currently working on genomes for four-dozen crop species, which are at different stages of completion.

Of the 10 reference genomes that essentially complete at the moment, for example, eight are annotated, he said. Several more reference genomes are underway, representing plants with a range of genome sizes, ploidy, repeat contents, and heterozygosity patterns.

Both Liu and presenter Busiso Mavankeni, chief research officer with the crop breeding institute at Zimbabwe's Department of Research & Specialist Services, touched on the importance of one of the orphan crops being profiled: Bambara groundnut, a legume that is widely

cultivated in Africa and some Asian countries.

For his part, Liu offered a peek at data from the new Bambara groundnut reference genome produced at BGI. Meanwhile, Mavankeni shared results from a study of drought response in 20 Bambara groundnut accessions.

Still other investigators participating in the PAG session described the research underway on African orphan crops such as *Gynandropsis gynandra*, finger millet, and orphan tree crops, along with the rationale for developing genomic breeding tools in these plants.

Data generated for AOCC is being made publicly available with African Union endorsement, according to the consortium's web site.

With funding from Mars, AGRA, and others, each group of African plant breeders that pass through the African Plant Breeding Academy have their training, travel, visa, housing, and other expenses fully covered, said Shapiro, who noted that Illumina donated a HiSeq 4000 to the AOCC.

Rita Mumm, director and primary instructor at the African Plant Breeding Academy, explained that individuals attending the academy are trained to apply genomic data to a range of research and plant breeding applications using open source or freely available tools that are more likely to be accessible in resource-limited settings.

"A world-class team of experts in the areas of genetics, experimental design and data analysis, and plant breeding present the concepts and principles, which are demonstrated in action by accomplished scientists invited to share the details of their breeding programs focused on specific product targets," she wrote in an abstract for her presentation, adding that the professional development program "has become a forum for collaboration among its talented and highly motivated participants."

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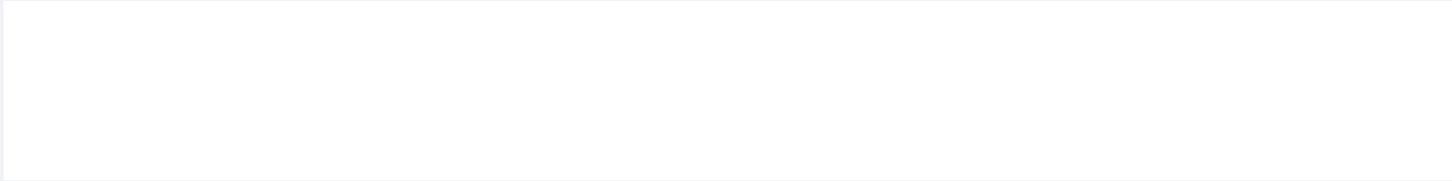
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