

Review of the work of the African Orphan Crop Consortium



International collaboration empowering African scientists to use state of the art genetic techniques for breeding traditional African crops to end malnutrition and adapt to climate change. There are around 352,000 flowering plants species in the world. Out of these over 5,000 have been

used by humans for food production, about 120 are nationally important. Three crops stand out as major global crops (rice, wheat, maize) provide 68 percent of human calories. Over the years there has been debate about whether to concentrate funding on optimising a few major crops or spread the funding to cover the development of a greater diversity of minor crops.

Sometimes these are described as 'orphan crops' neglected by breeders because they are not cash crops. These crops have desirable traits for resilience in the face of climate change. They also play a role in promoting dietary diversity, reducing the risks of malnutrition and 'hidden hunger'. As they have received relatively little attention from breeders the potential exists for relatively large yield improvements. Harnessing modern genetics techniques could enhance these advantages. This is exactly the approach that the African Orphan Crop Consortium (AOCC) is undertaking. This is a public/private partnership of organisations with complementary skills to enable the project to be undertaken in a timely manner.

The germ of the idea arose from Howard-Yana Shapiro chief agricultural officer for Mars Incorporated who had already collaborated with a range of industrial and academic partners to work out the genome of cacao to improve its productivity. A chance meeting between Dr Shapiro and Ibrahim Mayaki, the head of an African development agency New Partnership for Africa's Development (NEPAD) led to the idea that the techniques could equally be applied to increasing nutrition in African traditional crops to prevent malnutrition. This resulted in the creation of an African-led international consortium including NEPAD, Mars Incorporated, The World Agroforestry Centre (ICRAF), World Wildlife Fund, Life Technologies, BGI, LGC and University of California-Davis.

Key objectives of the AOCC include sequencing the genomes of 101 traditional African crops and making the results freely available as open sourced data. The UC Davis African Plant Breeding Academy, hosted at ICRAF, aims to train African plant breeders in state-of-the-art genome assisted breeding techniques to speed up the process of breeding productive and nutritious varieties.

Many of the 101 crops have pre-existing desirable traits but they also have drawbacks in terms of yield, agronomy, processing or cooking characteristics. Developments could lead to financial savings in import substitution in conjunction with appropriate food processing technologies.

These crops include cereal, legumes, fruits, vegetable and oil producing species, ranging from annuals to perennial tree crops. Some are better known globally than others.

Crops under investigation include Finger millet, *Eleusine coracana*; its seeds are a valuable source of methionine in the diets of millions lacking this in predominantly starchy diets. Bambara groundnut *Vigna subterrenea* a major source of vegetable protein in sub-Saharan Africa adapted to land unsuitable for other legumes. Nuts are used in roasted snacks, cakes and breakfast cereal, or cooked like other beans.

New market opportunities have developed for some of the crops under investigation such as *Moringa oleifera* a fast growing multipurpose tree from India whose leaves can be dried and milled as a good source of proteins, calcium, iron and vitamins. Baobab, *Adansonia digitata* another multipurpose tree produces fruit pods containing dry white pulp rich in vitamin C and B2 easily processed as a powder to add to drinks, desserts and cereals.

Good progress is being made with gene mapping 20 species are predicted to be sequenced by the end of 2018. On the training front the third intake of students to the UC Davis African Plant Breeding Academy are due to complete in May 2018.

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