

African yam bean: a food security crop?

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Biodiversity assures the evolutionary continuity of species. The collection and conservation of diversity within species are a safeguard against the loss of germplasm. They provide a buffer against environmental threats and assure continual and sustainable productivity. Global food security is becoming shaky with increasing dependence on a few major staple crops. This has resulted in an alarming reduction not only in crop diversity but also in the variability within crops.

The conservation and maintenance of agrobiodiversity of neglected and underutilized plant species such as African yam bean (AYB) in seed banks aim at contributing to food security and preventing a potential food crisis. Increasing the use of underutilized crops is one of the better ways to reduce nutritional, environmental, and financial vulnerability in times of change (Jaenicke and Pasiecznik 2009); their contribution to food security is unquestionably significant (Naylor et al. 2004, Oniang'ó et al. 2006). Among other things, the consumption of a broader range of plant species ensures good health and nutrition, income generation, and ecological sustainability.

Potentials of African yam bean

The plant (*Sphenostylis stenocarpa*) is one of the most important tuberous legumes of tropical Africa. It is usually cultivated as a secondary crop with yam in Ghana and Nigeria. A few farmers who still hold some seed stocks, especially the white with black-eye pattern, plant it at the base of yam mounds in June or July. The crop



Diversity in color, color pattern, structure, texture, brilliance, etc. of African yam bean seeds. Photo by Daniel Adewale, IITA.

flourishes and takes over the stakes from senescing yam. It flowers and begins to set fruits from late September and October. The large bright purple flowers result in long linear pods that could house about 20 seeds.

The seed grains and the tubers are the two major organs of immense economic importance as food for Africans. This indigenous crop has huge potential for food security in Africa. However, there are cultural and regional preferences. In West Africa, the seeds are preferred to the tubers but the tubers are relished in East and Central Africa (Potter 1992). The crop replaces cowpea in some parts of southwestern Nigeria (Okpara and Omaliko (1995). Researchers (Uguru and Madukaife 2001) who did a

nutritional evaluation of 44 genotypes of AYB reported that the crop is well balanced in essential amino acids and has a higher amino acid content than pigeon pea, cowpea, and bambara groundnut.

Apart from the use of soybean as an alternative to animal protein, protein from other plant sources is not often exploited. The protein content in AYB grains ranged between 21 and 29% and in the tubers it is about 2 to 3 times the amount in potatoes (Uguru and Madukaife 2001, Okigbo 1973). AYB produces an appreciable yield under diverse environmental conditions (Anochili 1984, Schippers 2000). Another positive contribution of the crop to food security is the identification of the presence of lectin in the seeds, which could be a potent biological control for most leguminous pests.

Biodiversity

Although the vast genetic and economic potentials of AYB have been recognized, especially in reducing malnutrition among Africans, the crop has not received adequate research attention. Up to now, it is classified as a neglected underutilized species or NUS (Bioversity 2009). Devos et al. (1980) stressed that the danger of losing essential germplasm hangs over all cultivated food crop species in tropical Africa, especially those not receiving research attention. The quantity and availability of AYB germplasm is decreasing with time. At one time, Klu et al. (2001) had speculated that the crop was nearing extinction; its inherent ability to adapt to diverse environments (Anochili 1984, Schippers 2000) may have been responsible for its continual existence and survival. Nevertheless, scientists think that the genetic resources of AYB may have been undergoing gradual erosion.

IITA keeps some accessions of the crop, but otherwise, its conservation in Nigeria is very poor and access to its

genetic resources is severely limited. Seeds of AYB seem to be available in the hands of those who appreciate its value, i.e., the elderly farmers and women in a few rural areas in Nigeria. The ancient landraces in the hands of local farmers are the only form of AYB germplasm; no formal hybrid had been produced as yet.

Improvement of the crop is possible only when the intraspecific variability of the large genetic resources of the species is ascertained. The genetic resources of AYB need to be saved for use in genetic improvement through further exploration in tropical Africa and for conservation.

Understanding AYB

Eighty accessions (half of the total AYB collection under conservation in the IITA genebank) were assessed for diversity using morphological and molecular methods. Thirty selected accessions were further tested in four ecogeographical zones in Nigeria to understand their productivity and stability. The breeding mode was also studied.

Findings show that each of the 80 accessions of AYB has a unique and unmistakable genetic entity, promising



Tuber yield per stand of AYB accession TSs96 at Ibadan, 2006. Photo by Daniel Adewale, IITA.

to be an invaluable genotype as a parent for crop improvement. Morphologically, two groups have evolved: the tuber forming and the nontuber forming.

Grain yield differed among individual accessions and across the four agroecologies. The average grain yield across the four diverse environments in Nigeria (Ibadan, Ikenne, Mokwa, and Ubiaja) was ~1.1 t/ha; however, grain yield at Ubiaja was well above 2 t. Most agronomic and yield-determining traits had high broad sense heritability and genetic advances, assuring high and reliable genetic improvement in the species. AYB is both self fertilizing and an outcrosser; the latter trait is exhibited at about 10%.

The good news is improvement through hybridization is possible within the species.



An African yam bean plant showing mature pods ready for harvest. Photo by Daniel Adewale, IITA.

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