**AAAS Symposium**
**Unlocking Plant Genetic Diversity for Food and Nutritional Security**
**Washington, DC, February 13, 2016**

The urgent need to conserve and characterize plant germplasm due to climate change and human activities, and efforts to exploit genetic diversity in plant breeding programs were highlighted at this symposium, part of the annual meeting of the American Association for the Advancement of Science. The symposium was organized by the Plant Breeding Coordinating Committee, the USDA-sponsored advisory group made up of public sector plant breeders, and the National Association of Plant Breeders. These organizations have identified genetic diversity and plant genetic resource conservation as critically important areas, given that diversity is the raw material required for crop breeding progress.

**Paula Bramel** (currently the Scientific Adviser and formerly Deputy Executive Director of the Global Crop Diversity Trust, www.croptrust.org) provided a global overview of crop germplasm conservation efforts. Given the expected shift in optimum production environments due to climate change, germplasm bank collections will be crucial for increased breeding efforts for heat and drought tolerance. The Crop Diversity Trust's goal is a cost-effective, rational, and global system for the conservation and availability of crop diversity. The Trust has three priorities: (1) conserve germplasm forever, (2) strengthen gene bank information systems, and (3) collect and use wild relatives of our life-sustaining crops. It seeks long-term funding for the Crop Trust Fund, an endowment; and short-term grants to support conservation and enhanced use of key collections around the world, as well as operating costs for the Svalbard Global Seed Vault in Norway. Genesys has been the primary information system in use, but it is hoped that the new GRIN-Global will become a standard genebank management system. Crop wild relatives have been identified as a gap in current collections and are especially threatened by climate change. Priorities for the Crop Wild Relatives project include collection from areas of high diversity, developing human capacity, especially in developing countries, and incorporating wild germplasm into pre-bred lines to facilitate their use in breeding programs.

**Chiedozie Egesi (**head of the cassava breeding team at the National Root Crops Research Institute in Nigeria and project manager for Cornell University's NextGen Cassava project) reported on breeding activities to improve performance of cassava in Africa. Cassava is a critical source of food and nutritional security for 500 million farm families in sub-Saharan Africa, and is especially important for women. It is subject to many disease and insect stresses, yet breeding to address these stresses is hampered by the long breeding cycle and the fact that many genotypes flower and set seed poorly. In addition, the genetic diversity of African cassava is limited, because only a few germplasm introductions were made by Portuguese traders from Latin America, the birthplace of cassava, in the 16$^{th}$ and 17$^{th}$ centuries. Susceptibility of Latin American germplasm to African cassava mosaic disease (CMD) has restricted the use of that source of genetic diversity in African breeding programs. Recently, however, molecular markers allowed cassava breeders to identify a major gene for CMD resistance, at last enabling the use of South American cassava germplasm in African breeding programs. Development of high-resolution linkage maps, improved phenotyping methods, and genomic selection schemes are other recent innovations implemented to accelerate cassava breeding progress. A video of Chiedozie's presentation is available on the NextGen Cassava site, www.nextgencassava.org, and a follow-up news story appeared in The Economist (http://www.economist.com/news/science-and-technology/21693184-annual-aaas-meeting-looked-immune-system-roman-portraits-and-genetic).

**Walter Trevisan** (maize breeder with 44 years of public and private sector experience in the tropics and subtropics) described how relatively little of the genetic diversity of maize has been incorporated into elite hybrids. In the U.S. Corn Belt, Europe, and most of China, for example, maize hybrids rely primarily on just two of over 250 recognized global races of maize. Emerging disease threats (e.g., tar spot in southern Mexico and maize lethal necrosis disease in East Africa) require fuller use of plant genetic resources to identify and incorporate resistance. The Genetic Enhancement of Maize (GEM) project (www.public.iastate.edu/~usda-gem/) is a successful long-running public/private collaboration to introgress exotic germplasm into U.S. commercial hybrids. USDA-ARS provides annual funding of about $1.5 million and GEM cooperators provide in-kind contributions for trials, nurseries, and disease evaluations in the U.S. and abroad. GEM partners include about 26 U.S. private cooperators, 21 U.S. public cooperators, one non-governmental organization, 12 international private cooperators, and 4 international public cooperators. In 22 years, the project has developed 501 inbred lines (conventional and doubled haploids) from over 90 races of maize. Due to the importance of GEM in increasing genetic diversity of maize in temperate areas, it has been decided recently to continue the GEM project, while incorporating improvements to make it more compatible with the present speed and needs of maize breeding.

**Discussion**

**What importance is being placed on *in situ* conservation?**

Conserving genetic resources *in situ* (landrace varieties in farmers' fields and wild relatives in natural areas) is a necessary complement to *ex situ* storage, as it captures ongoing evolutionary changes in plant populations. Everything conserved *in situ* should also be collected for *ex situ* conservation as a backup. Farmers or communities may have to be compensated in some way to ensure continuity of *in situ* conservation.

**What about specialty crops or crops as yet undiscovered?**

The Crop Trust has focused mostly on agronomic crops and a few vegetable crops specified in the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). The Trust recognizes the importance of minor and specialty crops and hopes to expand to cover those crops in the future.

**Are there issues of ownership that affect availability of the germplasm?**

Concerns about the use of the Standard Material Transfer Agreement (SMTA), the access and benefit-sharing instrument of the ITPGRFA, have slowed the availability of crop diversity within the multilateral system. The Crop Trust is a key supporter of the multilateral systems and thus ensures that all collections that it supports utilize the SMTA to exchange germplasm. There are issues with the SMTA that need to be addressed for the future and currently there are efforts ongoing to find solutions.

**What can researchers do to help the press describe the value of plant genetic resources?**
Researchers can help to better communicate the future value of conservation and use of crop genetic resources. Better understanding of this value is critical given the current cost for conservation in relation to an as yet-unknown future value. The value of conservation is not always an economic value but a social value as well. Genebank curators, researchers, private companies, and others can help by highlighting good examples with economic or social value, to help demonstrate future value. Thus researchers need to work collaboratively with the press to document cases of past impact.

Audience size ranged from 35 to 50 over the course of the symposium, with participation from researchers, students, science writers, and representatives of communications offices.