

Increasing Genetic Diversity in Public and Private Sector Maize Breeding Worldwide

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ABSTRACT:

The importance of access and utilization of genetic plant resources for improvement of modern cultivars is widely recognized. The maize seed industry has struggled to maintain a long term germplasm introgression to incorporate genetic diversity into their elite breeding pools because of lack of adaptation and undesirable agronomic traits associated with exotic maize germplasm, the time required to extract valuable material, and the rapid nature of breeding cycles in commercial programs.

In the early nineties, at the conclusion of the Latin American Maize Project (LAMP) project, the US participants pursued discussions of how materials identified with good potential could actually be utilized to broaden the diversity of U.S. maize. The Germplasm Enhancement of Maize (GEM) Project resulted from these discussions and the urgency of broadening and enhancing the maize germplasm. After 24 years of existence nearly 60 entities representing the private, public, and non-governmental organizations (NGO) from the US and from twelve other countries now collaborate to achieve GEM objectives.

The diversity of maize been utilized in farmer's fields across the globe has been decreased substantially in the last 2-3 decades. Some of the reasons: the maize seed industry has been consolidated in fewer larger seed companies and more mergers are about to happen; the already narrow but highly successful US germplasm has been "exported" and incorporated into many cultivars around the world to bust heterosis and incorporate yield genes, substituting local adapted germplasm; new molecular breeding techniques (like Genomic Selection) will inevitably decrease genetic variability even faster; the usage of Germplasm Bank accessions that could help on improving this situation has been facing increased restrictions to be widely utilized; and, finally, the impressive genetic gains achieved by the commercial breeding programs in this last 20-30 years have increased tremendously the yield and adaptation gap between the germplasm bank accessions and the commercial cultivars, making even more difficult and timing consuming to utilize the array of genetic diversity available in these banks.

Some major seed companies have already realized the need to increase genetic diversity in their maize breeding programs in order to maintain future genetic gains and some results have been sporadically been presenting. Public-Private-Partnership efforts are essential as complement of these efforts. Since they provide useful more adapted germplasm for introgression to perform breeding and testing activities; allow evaluation of germplasm for abiotic and biotic stress resistance (especially for diseases and pests not yet endemic in the several cooperator countries); provide more information about yield, agronomic and grain quality traits; and finally conduct research to identify useful haplotypes from exotic donor genomes.