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Delivering crop genomics to farmers' fields

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Improved crop varieties deliver the benefits of research in crop genetics and genomics to farmers and consumers. For a few major crops, the pipeline that delivers these varieties, beginning with genetic diversity and ending in farmers' fields, is still working well. For many crops, however, cutbacks in public seed processing, a critical bottleneck for some smaller companies' plant breeding programs, coupled with globalization of the seed industry has reduced the assortment of crop varieties delivered to U.S. farmers. Even for major crops, varieties that fill a broad array of needs may not be available. A tomato bred to ship well may not be suitable for high-value markets in metropolitan centers that focus on consumer preferences for flavor and freshness.

In recent years, an explosion of knowledge about crop genes and genomes has resulted in the identification of many genes responsible for important crop traits, especially in species such as rice or tomato that are well suited for genetic studies. With support from CSREES, a team of researchers, and extension personnel, has partnered to enhance the delivery system of publicly bred vegetable varieties through the Public Seed Initiative.

One critical question for setting investment strategies in crop genomics is whether tools developed for one crop species can be successfully applied to other crops. This initiative is defining the extent to which information about tomatoes can be useful for peppers, now the third most important vegetable in the U.S. and the focus of a number of rapidly

A MOBILE SEED CLEANING UNIT AND WORKSHOPS HAVE BEEN DEVELOPED TO ENHANCE SEED PROCESSING INFRASTRUCTURE

PHOTO CREDIT

"Using tools that monitor expression of thousands of genes simultaneously, researchers are revealing the genetic basis for the similarities and differences between pepper and tomato"

expanding markets. Using tools that monitor the expression of thousands of genes simultaneously, researchers are revealing the genetic basis for the similarities and differences between peppers and tomatoes. This allows scientists to quickly identify genes that underlie key crop traits and to assess which breeding tools can be successfully applied across different crops.

The Public Seed Initiative

The Public Seed Initiative (PSI) [www.plbr.cornell.edu/psi] aims to improve the delivery of benefits from upstream research in genomics to farmers and consumers. Existing grower networks in the Northeast and Northwest have been recruited to conduct on-farm trials of new varieties developed with tools from genomic research. Links between public breeders and seed companies, large and small, have also been strengthened. A critical bottleneck identified by some smaller companies was seed processing infrastructure, so a prototype mobile seed cleaning unit was designed and a series of workshops to train seed growers were developed. The seed cleaning unit currently serving several states is transported from farm to farm, providing education and the opportunity to enhance farm income with commercial seed crops.

Impact

Results from this project show that genomic tools created for tomatoes and potatoes will transfer directly for use in pepper improvement, expanding the impact of these investments well beyond their original scope. Through the PSI, more than a dozen public varieties are being evaluated through extension networks, by companies, and on farms from Maine to California, and viewed by wide audiences at a series of annual field days. Hundreds of growers have attended seed production workshops and hands-on plant breeding workshops. Based in part on demand created by participatory trials, a number of these plant varieties and breeding lines have been licensed on a non-exclusive basis to recipients including large multinational seed companies and smaller companies focused on regional, organic or specialty markets, and have been distributed to non-profit groups interested in genetic diversity and sustainable agriculture. Results from these trials have also identified new objectives for vegetable breeding programs, expedited by knowledge and tools from crop genomics and farmer demand.

Project Partners: *California State University, Fresno (J.P. Prince); Cornell University (A. Rangarajan, J. Rose); Northeast Organic Farming Association of NY (M. Glos and S. Johnston); the Farmers' Cooperative Genome Project/Oregon Tilth (J.J. Haapala), and USDA (J. Giovannoni, L. Robertson, J. Thies).*

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