DuPont Pioneer Researchers Develop Custom Product Testing

Managed-stress-environment testing created for Pioneer® brand Optimum® AQUAmax™ products

DES MOINES, Iowa, June 20, 2013 – Custom research methods developed by DuPont Pioneer corn researchers to breed Optimum® AQUAmax™ products are being used to target other yield-robbing, environmental and disease stresses. During the testing of Optimum AQUAmax products – which are helping farmers grow corn in stressful, water-limited environments – a research program, called managed stress environment testing, was developed.

"One reason managed stress environment testing came about is that the baseline genetics in Pioneer germplasm are all very good," says Jeff Schussler, DuPont Pioneer senior research manager. "With the help of this testing process, we are optimizing our ability to identify small genetic improvements, which will continue to add up to better-performing corn hybrids."

Managed stress environment testing is not a standard operating procedure; in fact, it is unique to Pioneer for evaluating new products for specific corn stresses. Currently, Pioneer researchers use managed stress environment testing to evaluate corn responses to abiotic stresses associated with limited nitrogen availability, to important corn diseases and to plant damage from strong windstorms. Traditionally, corn breeders relied on diverse environments in widely scattered research locations to get close to a real-world evaluation of overall hybrid performance.

"From the Optimum AQUAmax hybrid research, we learned that designing an evaluation system to identify genetic variation clearly in a somewhat-controlled, field-testing situation pays off. It helps to bring products for specific environments to growers more quickly," Schussler says.

In developing the research tactics for managed stress environment testing a cadre of methodologies – under the umbrella of the Accelerated Yield Technology (AYT™) system – plays a central role. Acting as a filter to sort out specific environmental screens for disease, genetics, fertility and drought, the AYT system is used to test all phases of corn product development. Testing methods incorporate genetic mapping, marker assisted selection, whole genome modeling and precision phenotyping, among others.

The AYT system helps researchers pinpoint the product candidates that have the needed traits to advance and, conversely, the hybrids that can be removed from the group. Armed with data indicating the hybrid candidates most likely to succeed, researchers then move potential products into the field testing phase of managed stress environment testing.

Field testing the Optimum AQUAmax hybrid candidates specifically focuses on performance in drought conditions. At the first level of field testing, small plots were located in the perpetually dry Pioneer research locations of Woodland, Calif., and Viluco, Chile. The South American location allowed researchers to accelerate the evaluation process to two cycles of testing in one year.

"In the past, researchers counted on randomness, but would run into challenges when they wanted to evaluate performance for a specific trait in a particular environment. They just wouldn't have the data," Schussler says. "Now we know that you need to be more targeted with a structured research program to find genetic variation for specific traits."

Subsequent field testing for the Optimum AQUAmax products continues throughout the target environment: the drought-prone western Corn Belt. As the candidates to become Optimum AQUAmax hybrids pass small plot research evaluations, the hybrids move into the Pioneer Intensively Managed Product Advancement Characterization and Training (IMPACT™) testing system on cooperating growers' fields. The final step occurs on larger plots on farmers' fields in the form of thousands of strip trials in the western Corn Belt. Testing of Optimum AQUAmax products continues to move east and this year the hybrids were made available throughout most of the Corn Belt.

"We had a dream about what we could do with the genetics, and growers had a need," Schussler says. "There was a lot of excitement when growers finally got to try Optimum AQUAmax hybrids on their own farms."

Optimum AQUAmax products were planted on more than two million acres of farmland in 2012 for thousands of comparisons between the hybrids and other industry-leading products.

"Optimum AQUAmax products are a perfect example of delivering the right product for the right acre," Schussler says. "We had a living experiment of how our research strategy worked in the widespread drought of 2012."

Across the past two growing seasons (2011 and 2012) and among more than 12,600 comparisons, Optimum AQUAmax hybrids have shown an 8.5 bushel per acre yield advantage in water-limited environments and a 4.2 bushel per acre yield advantage in favorable growing conditions.*

"From the perspective of a corn breeder, it is very rewarding and exciting to ensure genetic diversity and develop products like Optimum AQUAmax hybrids that successfully perform in stress conditions without relying on a specific mechanism," Schussler says. "We are able to provide a much more robust genetic package and diverse products to growers."

*In 2012, Optimum AQUAmax products were grown in the United States in on-farm comparisons against competitive hybrids (+/- 4 CRM) in 3,606 water-limited environments with a win ratio of 69 percent and 7,663 comparisons under favorable growing conditions with a win ratio of 59 percent. Cumulative claim includes all 2011 and 2012 on-farm comparisons across the United States. Water-limited environments are those in which the water supply/demand ratio during flowering or grain fill was less than 0.66 on a 0–1 scale (1=adequate moisture as determined by Pioneer) using Pioneer's proprietary EnClass® system and in which the average yield of the commercially available hybrids was less than 150 bu/acre. Moisture levels were measured at the nearest weather station. Favorable growing conditions are locations where yield levels were at or above 180 bu/acre on average, regardless of moisture levels. Product performance in water-limited environments is variable and depends on many factors, such as the severity and timing of moisture deficiency, heat stress, soil type, management practices and environmental stress, as well as disease and pest pressures. All hybrids may exhibit reduced yield under water and heat stress. Individual results may vary. Δ