

Advances in Forage Technologies and Genetics – A Commercial Update of Future Technologies
Randy Hegwer
Technical Product Manager, Southern Business Unit, Pioneer Hi-Bred International Inc.

Agricultural productivity gains mean more food, feed and fuel from the same land area. Ag biotechnology delivers across the board as a component fueling the productivity gains. Yet, after 10 years of 1st generation pest and weed control the capability of this technology really has barely scratched the surface. Biotechnology is now delivering 2nd generation insect and weed control products as well as agronomic traits, healthier, better tasting food, and improved animal feed quality products. Pioneer® is aggressively working to increase the yield of its products utilizing a wider tool kit of biotechnology, including molecular markers, gene discovery, genetic mapping and proprietary AYT™ accelerated yield technology.

Pioneer is also continuing to develop drought tolerant products that will help farmers reduce their production risks. Pioneer has industry leading drought tolerance and has been breeding for drought tolerance for more than 50+ years. Pioneer is identifying drought tolerant genes from a uniquely diverse proprietary set of germplasm. The parents, grandparents, great grandparents of hybrids (like 31G70, 33F88 and 31R87) have been developed and evaluated under drought conditions. Pioneer is using a multi-prong approach of conventional breeding, molecular breeding and transgenic technology to produce high yielding hybrids with improved drought tolerance, thus minimizing the potential yield loss during periods of moisture stress. Molecular breeding is used to identify corn genes associated with superior drought tolerance, and to move those genes into new germplasm to improve drought tolerance of all new hybrids. A third approach to improving drought tolerance is using novel genes from other species (transgenes). Like other familiar transgenes (Bt genes, for example), drought genes are inserted into corn germplasm in the laboratory and the plants are subsequently tested in the field. During the next decade, Pioneer will introduce transgenic solutions that will further improve drought tolerance. The goal is to develop corn hybrids that prevent a portion of yield loss under transient water stress and maintain yield parity under optimal conditions. Testing is first conducted in managed stress environments during the proof-of-concept stage. If the gene proves efficacious, testing then continues more broadly in stress environments. These genes are being evaluated across different types of drought stress. The best germplasm along with transgenic traits will be combined to deliver amazing drought tolerance. More than one gene will be required to give the “robust” drought tolerance needed by growers.

Although still relatively early in Pioneer’s research pipeline, an aggressive pursuit of technologies will provide enhanced efficiency in nitrogen use to help farmers reduce their input costs. Each year, U.S. farmers apply an average of 138 pounds of nitrogen per acre of corn. Pioneer is utilizing both traditional and transgenic methods to deliver products that require reduced quantities of nitrogen while maintaining overall high yields or, alternatively, increase the overall yield at existing levels of nitrogen. Pioneer is in *Phase 1, Proof of Concept* with its high nitrogen efficiency hybrids and anticipates having a product ready for the commercial market in the middle of the next decade. There is excitement about the impact this trait will have on improving the value proposition for growers and the impact it could have on farmers in developing countries where nitrogen is not available or cost prohibitive. Equally important, the benefit this trait could have on the environment by reducing the amount of nitrogen inputs and reducing our environmental footprint. All three approaches to developing improved yield, drought tolerance and nitrogen use efficiency must rely on dependable testing sites.

Optimum™ GAT™ trait (glyphosate + ALS tolerance) is the first trait as a member of the Optimum family. It is proprietary technology for ALS and glyphosate resistance. Optimum™ GAT™ offers a new and better choice in glyphosate tolerance that helps maximize yield and productivity, while improving crop safety and expanding weed control options. This trait allows multiple modes of action to provide farmers with longer lasting, broader spectrum weed control

under more conditions. Farmers will benefit from increased profit potential when growing crops containing the Optimum® GAT® trait. Pending regulatory approvals and field-testing, Pioneer anticipates a U.S. commercial launch for Optimum® GAT® corn in 2010 and a soybean introduction in 2011. The trait is currently in *Phase 4, Pre-Launch* for soybeans and corn.

Optimum® AcreMax™ products represent the next step in Pioneer's commitment to delivering more effective and efficient below and above-ground insect control solutions to growers. Optimum® AcreMax™ 1 is the first single-bag solution for corn rootworm resulting from over 5 years of continued research. This trait offers refuge reduction from 20% down to 2 to 5% in cotton production areas. It is refuge in the bag - no more separate CRW refuge. It is based on the strength and unique characteristics of the CRW trait in the Herculex® family of products. Pioneer's Optimum® AcreMax™ 1 insect protection system continues to make positive advancements in the regulatory review process and pending its final approval, will be the first reduced and integrated corn rootworm refuge product in the marketplace that will offer growers an opportunity to reduce CRW refuge, raise overall farm yields and ensure the durability of in-plant insect protection traits. Optimum® AcreMax™ 2, a refuge in-the-bag solution for control of both below and above ground insects pests may be on the market by 2012, pending regulatory approval.

Pioneer is committed to the responsible development and deployment of the leading product technologies that growers demand. Pioneer is committed to combining germplasm strength and trait stability to create the highest performing product portfolio in the industry with AYT™ system doubling the rate of genetic gain, Optimum® AcreMax™ products and a robust pipeline of drought tolerance, and nitrogen use efficiency products.