

## How Do Genuity® DroughtGard® Hybrids Corn Products Work?

- The drought tolerant biotech trait allows corn plants to better adapt to water stress by slowing water uptake from the soil and using it efficiently when water is limited for crop production.
- Genuity® DroughtGard® Hybrids corn products allow for improved distribution of resources to the developing ear, increased kernel set, and greater yield potential under drought conditions.
- DroughtGard Hybrids corn products are part of a systems approach combining drought-tolerant germplasm, best agronomic practices, and crop protection traits for improved drought tolerance, insect, and weed control.

Water availability is the most limiting factor for crop production. Researchers have been working for decades to enhance drought tolerance of crops through plant breeding techniques.<sup>1</sup> Genuity® DroughtGard® Hybrids corn products can deliver Hydroefficiency™ by building upon such drought-focused breeding efforts with a systems approach that includes agronomic recommendations, crop protection traits, and the industry's first drought-tolerant biotech trait (Figure 1).

### Introduction to Genuity® DroughtGard® Hybrids Corn Products

DroughtGard Hybrids corn products are part of a systems approach for Hydroefficiency combining the key elements of drought-tolerant germplasm, and with the world's first drought-tolerant biotech trait. This trait was developed utilizing a gene from soil bacteria, *Bacillus subtilis*, that encodes cold-shock protein CspB.<sup>2</sup> This protein allows the plant to acclimate to stress quickly and utilize water more efficiently. Regulating the stress response helps preserve water during the vegetative stages making more water available for future growth.

### What are Genuity DroughtGard Hybrids Corn Products?

The DroughtGard Hybrids systems approach allows plants to use water more efficiently during drought stress, allowing the crop to conserve soil moisture thus providing the opportunity to help minimize risk of yield loss from drought. This is called Hydroefficiency. The first key to the system is the use of agronomic management practices to enhance water storage in the soil and reduce evaporative losses. Selection of adapted, drought-tolerant genetics is the second key in Hydroefficiency. Finally, through biotechnology, if a drought occurs, DroughtGard Hybrids corn products can help slow down water consumption (using it more efficiently) to help endure the stress. Hydroefficiency helps corn plants withstand drought conditions and can help maximize kernels per ear and yield potential.

### A Systems Approach Helping Farmers Manage Risk

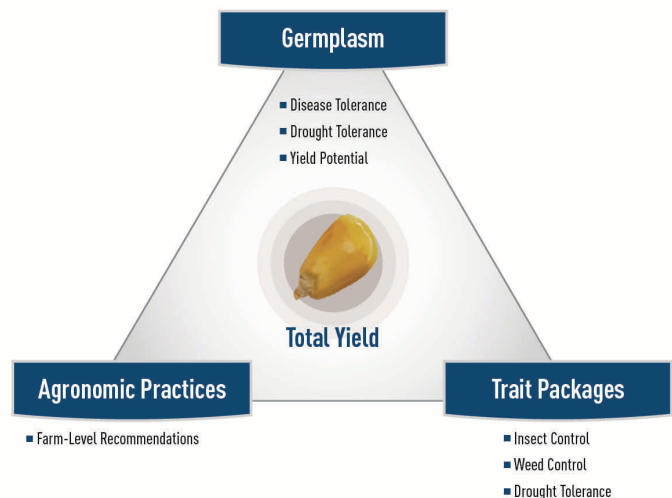


Figure 1. Genuity® DroughtGard® Hybrids corn products provide farmers with a systems approach to manage risk: drought-tolerant germplasm, best agronomic practices, and trait packages.

### What Does Drought Tolerance Mean?

Drought-tolerant plants can withstand a finite period without water, grow with less water, or use water more efficiently than other plants of the same species.<sup>2</sup> For a drought-tolerant corn product to be useful in agriculture it must be able to provide drought tolerance without sacrificing yield potential.

### Research

In research trials conducted from 2007 to 2011, products containing the drought-tolerant biotech trait in Genuity® DroughtGard® Hybrids corn products and a conventional control were tested under different water treatments applied at different timings. When averaged across years (2009-2011), yield increased in the limited water treatment by 6% for the products containing the drought-tolerant biotech trait when compared to the control.



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In trials, products containing the drought-tolerant biotech trait in DroughtGard Hybrids corn products responded to limited water conditions with increased ear growth during silking, which subsequently increased the number of kernels, harvest index, and overall grain yield when compared to the control. Under limited water, leaf area was reduced for the products with the drought-tolerant biotech trait more than the control in 2009 by -3.3% and 2010 by -3.5%.<sup>3</sup> Also in the limited water treatment, more water was available at a soil depth of 0.5 m for the products containing the drought-tolerant biotech trait in DroughtGard Hybrids corn products when compared to the control (Figure 2). This means the corn products with the drought-tolerant biotech trait utilized less water, allowing more water to be available later in the season.

In yield evaluations, for the limited water treatments the products containing the drought-tolerant biotech trait in DroughtGard Hybrids corn products had higher yield than the control corn product in 2007 (9.3%), 2008 (7.0%), 2009 (11.7%), and 2010 (7.3%).<sup>3</sup> Yield differences were not observed in 2011 possibly due to mild environmental conditions during the grain fill stage.

The purpose of this study was to help understand the physiological responses associated with increased grain yield for the DroughtGard Hybrids corn products when water availability is limited. Results indicate that under limited water availability, yield advantages seen by products containing the drought-tolerant biotech trait in DroughtGard Hybrids corn products when compared to the control are mostly driven by increased harvest index and not caused by changes in total dry matter production of the plant.

Based on the results of the study a model was proposed that the CspB protein in DroughtGard Hybrids corn products may work by temporarily reducing leaf growth when the plant is under stress.<sup>3</sup> Reduced leaf growth may lead to a reduction in water use (observed by reduced sap flow and higher residual soil water content). The reduced water use resulted in higher water use efficiency and less stress during the silking phase, which may have led to increased ear growth when compared to the control corn product. The larger ears then attracted more assimilates during grain fill increasing kernel set, harvest index, and grain yield.

## Genuity® DroughtGard® Hybrids Corn Product Advantages

In 2012, approximately 250 growers across the Western Great Plains planted DroughtGard Hybrids corn products on their

farms in large-scale, on-farm trials, known as Ground Breakers®. The DroughtGard Hybrids corn products had strong performance in trials, with the commercially projected products showing an average yield advantage of more than 5 bu/acre over competitor products.

## Summary

Improvements in crop yield and stress tolerance will take a multi-tool approach including the integration of advances in breeding, biotechnology, and agronomic management practices.

### Sources:

- <sup>1</sup> Campos, H. et al. 2006. Changes in drought tolerance in maize associated with fifty years of breeding for yield in the U.S. corn belt. *Maydica* 51, 369-381.
- <sup>2</sup> Waltz, E. 2014. Beating the heat. *Nature biotechnology*. Vol. 32, 7
- <sup>3</sup> Nermal, K.S. et al. Physiological responses related to increased grain yield under drought in the first biotechnology-derived drought tolerant maize. 10.1111/pce.12446.

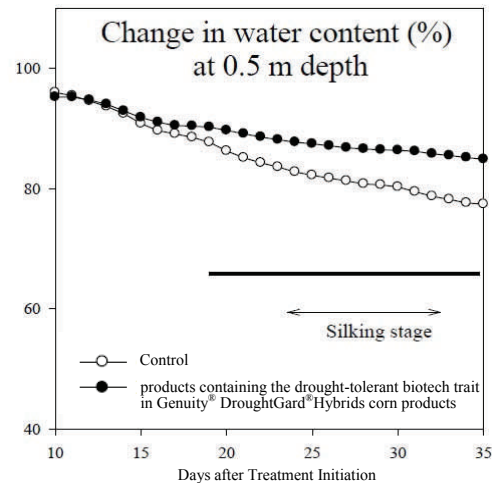


Figure 2. Change in water content after treatment initiation.

**Growers should talk to their grain handler or product purchaser to confirm their buying position for this product.**

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**Individual results may vary**, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.

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