



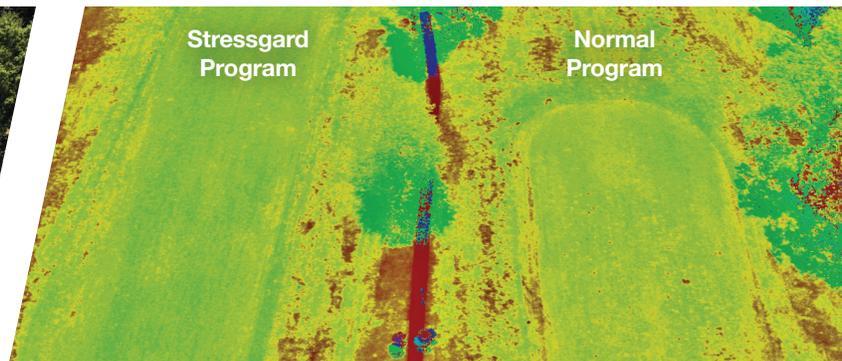
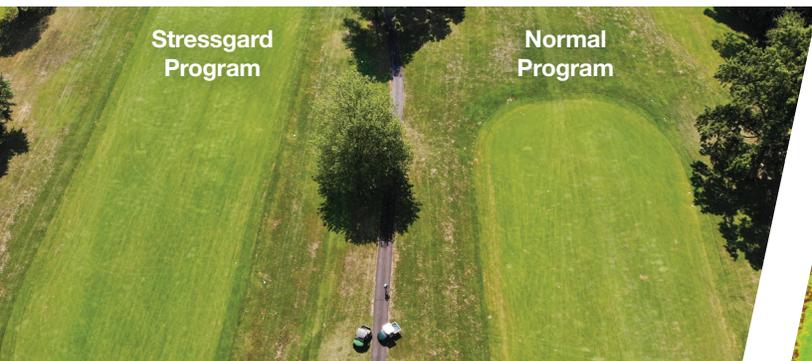
Green Solutions

Update

One Small Step for Stressgard[®], One Giant Leap for Plant Health

// Benefits Beyond Disease Control

Over the past 25 years, one technology has helped shape an entire category of plant protection products for golf course superintendents. Bayer Stressgard[®] fungicides offer plant health benefits that go beyond disease control to mitigate abiotic stresses across the golf course. The physiological benefits of Stressgard have been proven in the lab, controlled environments, university field trials, and real-world golf course demonstrations.



Stressgard fairway program demonstration at a golf course in southern PA. Both fairways were sprayed on a 14-day schedule. Normal program consisted of various competitor fungicides across a range of active ingredients. Stressgard program consisted of commensurate rates and classes of chemistry within the Stressgard portfolio including Mirage[®] Stressgard, Tartan[®] Stressgard, Exteris[®] Stressgard, Interface[®] Stressgard and Fiata[®] Stressgard. Picture was taken 10 days after previous application and hue angle was adjusted on the right picture to better see differences in green color. Differences are indicative of long-term plant health effects. (Bayer)

// A New Era of Turf Health Research

Bayer continues to explore the beneficial effects of Stressgard with research projects across the globe. One commonality across trials is that Stressgard fungicides consistently outperform tank-mixed pigments and plant-health products when it comes to overall turf quality and mitigating stresses like traffic, heat, shade, and drought. The remaining question after years of research is exactly how Stressgard works physiologically.

Stressgard contributes to chlorophyll health and stability leading to improved photosynthesis, stronger plants, and healthier turf. Here's the proof:

A 2019 research trial by Dr. Bingru Huang at Rutgers University investigated the influence of Signature[™] XTRA Stressgard and other phosphonate-based products and pigments on factors involved in turfgrass stress responses. These factors include:

// Chlorophyll related enzymes: Chlorophyll is built and destroyed in a cyclical pattern. Individual components of this process can be influenced by various abiotic stresses (heat, drought, traffic etc.). We can measure the enzymes associated with chlorophyll synthesis (the builders) and degradation (the destroyers) to gain a better understanding of what's going on during plant stress.

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// **Chlorophyll content:** Chlorophyll contributes to the machinery in the plant that carries out photosynthesis and builds energy reserves. Direct measurements of chlorophyll via extraction are most indicative of the health of the photosynthetic systems in the plant.

// **Membrane stability:** Measured via electrolyte leakage, membrane stability is a hallmark of stress response in intact plant cells and is widely used as a measure of plant stress tolerance.

// The Results

Stressgard® provides healthier turf and more consistent playing surfaces through positive improvements in key physiological processes in the plant. Though previous research has shown the positive effects of Stressgard on chlorophyll and photosynthesis under heat stress, this new research further confirms stress mitigation through the maintenance of chlorophyll and membrane stability. Under heat stress conditions, when compared to the untreated control and other competitive products, turf treated with Signature XTRA Stressgard resulted in:

// **Significantly higher levels of chlorophyll** indicating healthier photosynthetic systems during stress. (Figure 1)

// **Significantly lower chlorophyll degrading enzyme activity** indicating protection or mitigation of chlorophyll destruction during stress.

// **Significantly lower electrolyte leakage** indicating greater membrane stability during stress. (Figure 2)

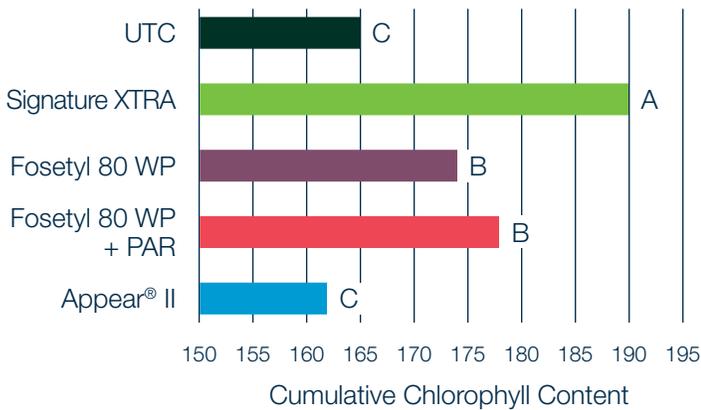


Figure 1. Cumulative chlorophyll content among treatments before, during and after 42 days of heat stress. Note significantly higher chlorophyll content in Signature XTRA Stressgard treatment.

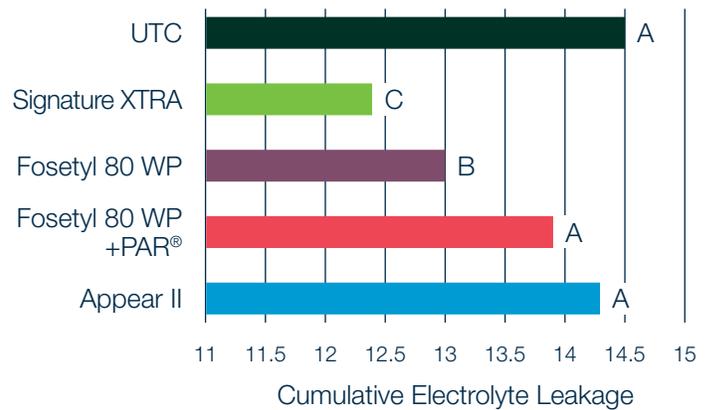
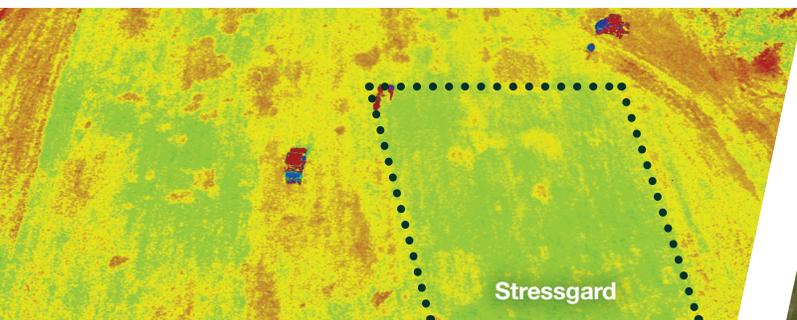


Figure 2. Membrane stability as indicated by cumulative electrolyte leakage throughout the duration of the stress study. Note significant reduction in membrane leakage with Signature XTRA Stressgard treatment, signifying a more stable membrane.

// Conclusion

Photosynthesis is the driver of all plant energy production and subsequent processes. The protection and maintenance of chlorophyll with Stressgard ultimately improves the turf's ability to photosynthesize, which is beneficial to all turfgrass under any stress condition. Two decades of research has continued to support the unique and unparalleled effects that Stressgard fungicides deliver beyond disease control. And it's one of many reasons why Stressgard creates better golfing experiences that redefine normal.



* Hue angle adjusted. Stressgard demonstration plot on a bermudagrass fairway in south Florida. Stressgard plot was sprayed with Exteris in mid-Oct 2019, followed by Mirage 21 days later. Remainder of fairway was untreated and struggling with traffic stress that created weakened turf, reduced color and poor performance, heading into the peak golfing season. Picture was taken 12 days after Mirage application, differences are indicative of long-term plant health effects. (Bayer)

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