

ChitoGuard™

Strengthening Turf Under Pressure

What is ChitoGuard?

ChitoGuard is a new chitosan biostimulant from Ocean Organics made from the most bioactive and bioavailable form of chitosan oligosaccharide on the market. It improves overall plant health under both abiotic and biotic stress, but particularly when turf will be under attack from pathogens. Third-party research from multiple universities shows the benefits of incorporating ChitoGuard into your plant health program. It can be applied via foliar application or to the soil.

How Does Chitosan Strengthen Plants?

Plants are equipped with defense signaling pathways to sense chitosan. Chitosan triggers a defense alarm for the plant and begins a cascade of defense responses.

During pathogen infection, plant cells use their chitin-degrading enzymes (chitinases) to break down the chitin in the pathogen. This process releases chitosan oligosaccharides (sometimes called chitooligosaccharides). These small molecular fragments sound the biological alarms and activate a defense signaling pathway, improving the “immune systems” of plants.

By pretreating plants with ChitoGuard (bioavailable chitosan oligosaccharide), it primes the plant for a stronger response to pathogens. It is similar to a vaccine – exposing plants to molecular fragments commonly found in pathogens helps plants be on guard and respond more efficiently.

Chitosan has also been shown to improve yield, nutrient uptake, root growth, and stress tolerance in various crops.

Stronger is Better

When turf faces abiotic and biotic stress, university research shows ChitoGuard improves

- **Turf Quality**
- **Chlorophyll Content**
- **Root Biomass & Viability**
- **NDVI**

ChitoGuard includes a highly bioactive form of chitosan oligosaccharide as well as a proprietary activator from Ocean Organics. ChitoGuard is the next step in Ocean Organics’ plant strengthening and stress management materials, which include Stress Rx®, XP®, Guarantee®, SeaBlend®, DeSal®, NuRelease®, and a full line of industry leading surfactants. Apply ChitoGuard at 6 - 10 oz/1000 sq. ft. either by foliar application or to the soil during peak periods of stress. Research shows ChitoGuard is best used in combination with Guarantee seaweed extract.

The Science of Chitosan

Getting the Terms Straight

Chitin is a polysaccharide found in crustacean shells (shrimp, crab), fungal cell walls, yeast, nematodes and other organisms. It is the second most abundant polysaccharide in nature, but it is not found in plants. It is a polymer of N-acetyl-D-glucosamine.

Chitosan is a linear polysaccharide made by treating the chitin in shells of crustaceans or other organisms with an alkaline substance. Chitosan is formed by the partial deacetylation of chitin.

Chitosan oligosaccharide, which is the active ingredient in ChitoGuard, is a low molecular weight form of chitosan that is particularly bioavailable for plants.

Chitinases are enzymes that break down chitin. These enzymes are found in organisms that have a reason to break down or digest chitin in fungi or certain animals.

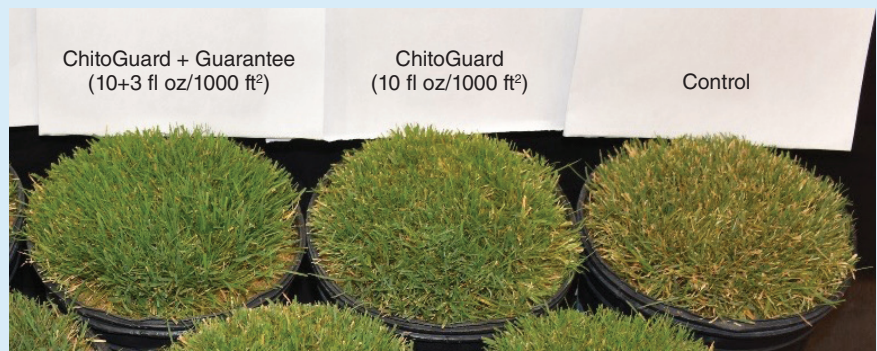


Photo 1: ChitoGuard improved turf visual quality in creeping bentgrass under heat and drought stress conditions as observed at the end of the stress treatment (day 35). Photo credit: Dr. Xunzhong Zhang, Virginia Tech.

VIRGINIA TECH

Researchers: Dr. Xunzhong Zhang

Table 1: ChitoGuard statistically improved root biomass and root viability in creeping bentgrass subjected to heat stress and mild drought stress in growth chambers. The grass was subjected to mild drought stress (55%-60% ET replacement) and heat stress (95/77°F, 35/25°C, day/night) in the growth chamber for five weeks, and then allowed to recover for two weeks under the optimum growing conditions. Treatments were applied five times every 14 days.

Treatment	Rate (fl oz/1000 ft ²)	Root biomass (g/pot)	Root viability (A490/g FW)
ChitoGuard + Guarantee	10+3	3.08a	0.59ab
ChitoGuard Alone	10	2.61a	0.56b
Control	0	1.59c	0.42c

Means followed by same letters within same column are not significantly different at P = 0.05.

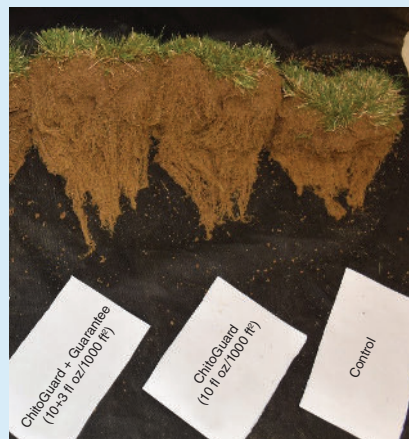


Photo 2: ChitoGuard improved root biomass and viability in creeping bentgrass under heat and drought stress conditions as observed at the end of the stress treatment (day 35). Photo credit: Dr. Xunzhong Zhang.

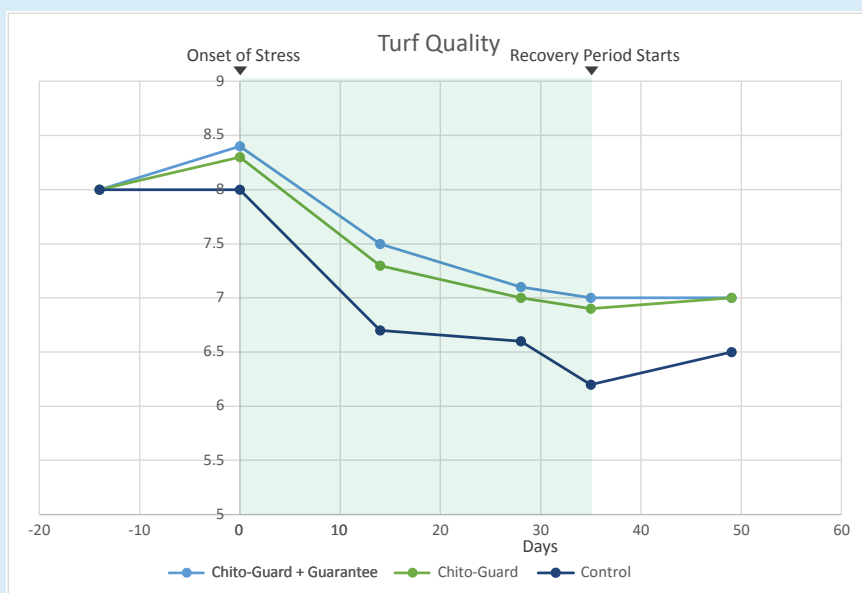


Figure 1: ChitoGuard with and without Guarantee seaweed extract improves turf quality in creeping bentgrass subjected to heat stress and mild drought stress in growth chambers. The addition of seaweed extract boosts turf quality during the stress period.

“Since almost all forms of predation that attack turfgrasses attack the weak first, it would seem that building the strongest stand of turfgrass possible is job #1 for today’s professional turfgrass manager.”

- Professor James B. Beard

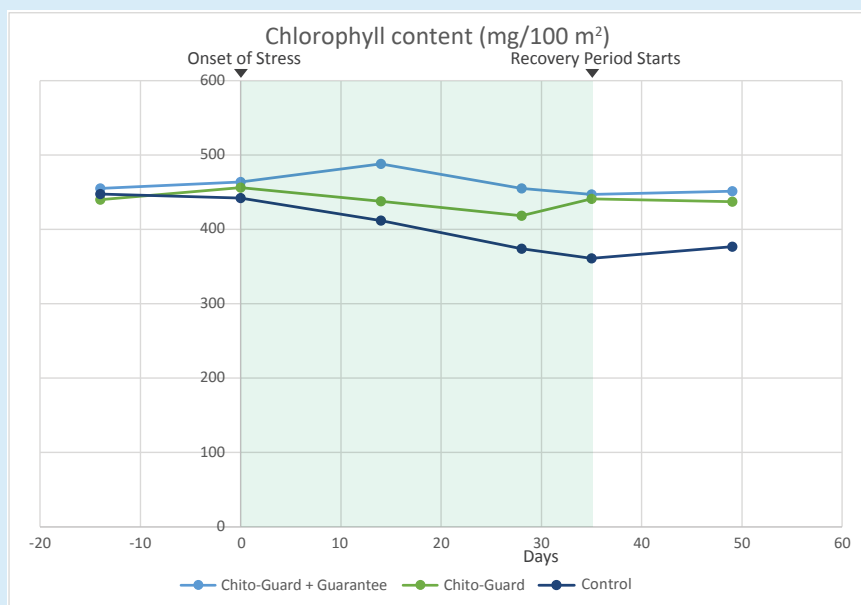


Figure 2: ChitoGuard with and without Guarantee seaweed extract improves chlorophyll content in creeping bentgrass subjected to heat stress and mild drought stress in growth chambers. The addition of seaweed extract boosts chlorophyll especially during the stress period.

Virginia Tech Continued

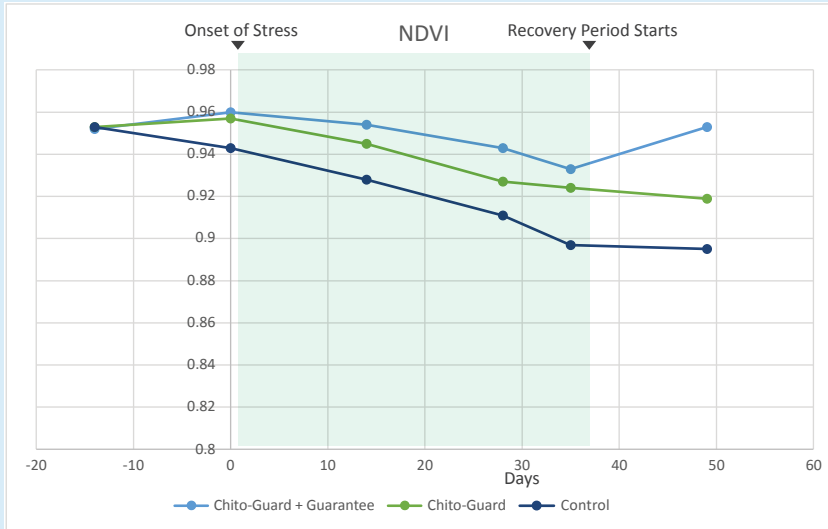


Figure 3: ChitoGuard with and without Guarantee seaweed extract improves Normalized Difference Vegetation Index (NDVI) in creeping bentgrass subjected to heat stress and mild drought stress in growth chambers. The addition of seaweed extract boosts NDVI throughout the trial.

MARK MAHADY & ASSOCIATES, INC.

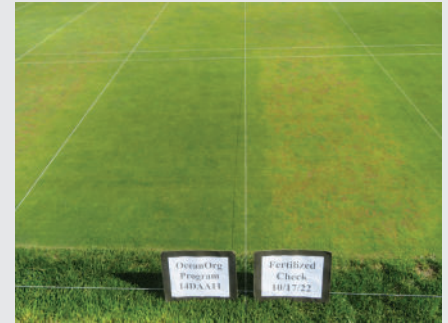


Photo 3: An Ocean Organics program that included ChitoGuard improved turf quality during a period of severe *Anguina pacificae* nematode pressure on a northern California *Poa annua* research green. The program consisted of five Ocean Organics products. It also included a fungicide program from Syngenta, but did not include any nematicides. From the report: "Note the robust *Poa annua* with good color and density." Mark M. Mahady & Associates, Inc., "2022 Evaluation of Products for Control of *Anguina pacificae* and Soil-Borne Nematodes on a *Poa annua* Putting Green." Photo Credit: Mark Mahady.

OREGON STATE

Researchers: Dr. Alec Kowaleski, Brian McDonald, et al.

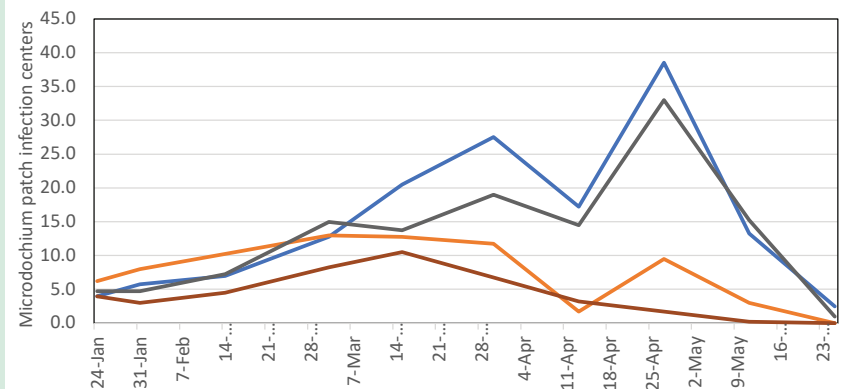


Figure 4: The treatment combining ChitoGuard, Guarantee seaweed extract, orthosilicic acid and Duraphite 12 resulted in consistently better plant health under the stress of *Microdochium* patch infection as compared to the untreated control, Duraphite 12 alone or Propiconazole in a field trial at Oregon State.

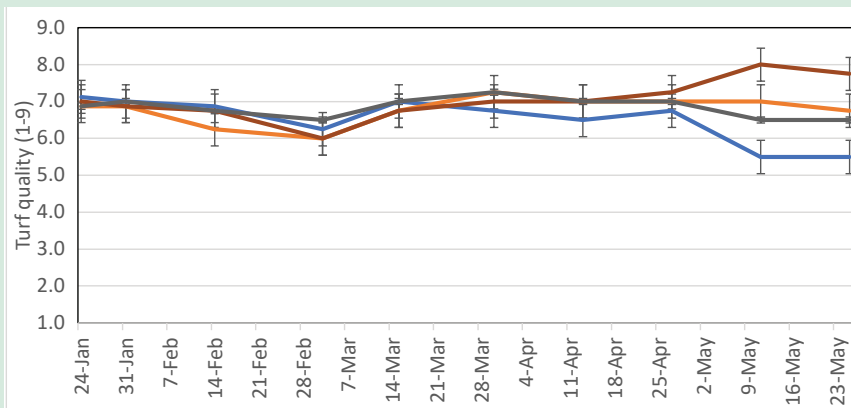
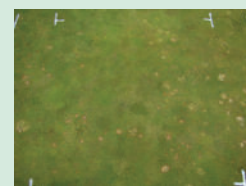
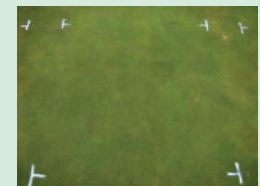


Figure 5: The treatment combining ChitoGuard, Guarantee seaweed extract, orthosilicic acid and Duraphite 12 resulted in consistently better turf quality during the stress of *Microdochium* patch infection as compared to the untreated control, Duraphite 12 alone, or Propiconazole in a field trial at Oregon State.



Photos 4 and 5: The Ocean Organics treatment consisting of ChitoGuard, Guarantee, orthosilicic acid, and Duraphite 12 improved turfgrass quality during *Microdochium* stress (top photo) relative to the control (bottom photo). Photo credit: Cole Stover, Oregon State, April 27, 2022.

UNIVERSITY OF WISCONSIN

Researchers: Dr. Paul Koch,
Kurt Hockemeyer, et al.

Field Trial Location: The field trial was conducted at the O. J. Noer Turfgrass Research and Education Facility in Madison, WI on a stand of 'Penncross' creeping bentgrass (*Agrostis stolonifera*) at fairway height.

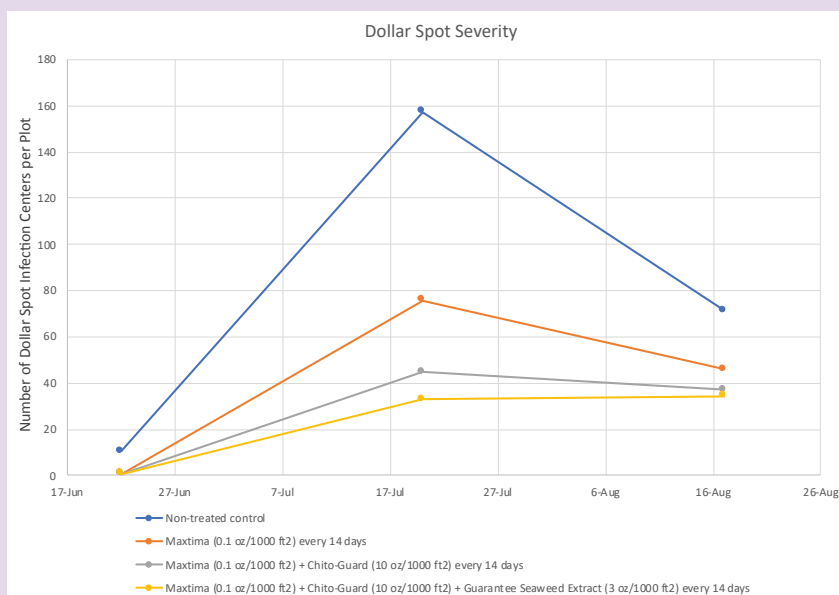


Figure 6. Mean number of dollar spots per treatment. Application of ChitoGuard and Maxtima fungicide resulted in better plant health under dollar spot pressure and heat stress as compared to the untreated control or Maxtima alone. The addition of Guarantee seaweed extract to the ChitoGuard treatment further improved performance. Note that Maxtima was used at a lower-than-normal application rate in order to see if the addition of biostimulants could make the lower rate a viable option.

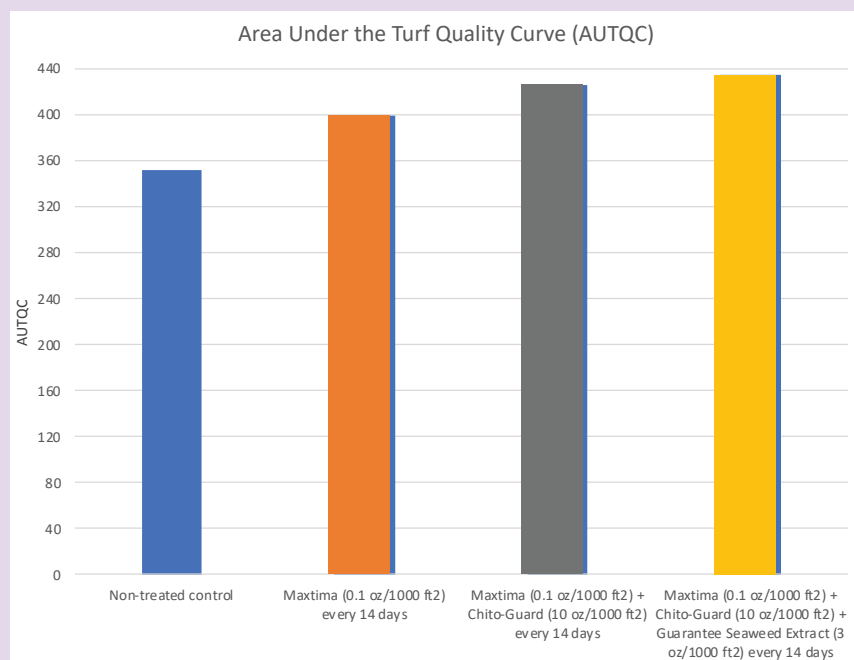


Figure 7. Mean turfgrass quality per treatment. Application of ChitoGuard and Maxtima fungicide resulted in better turf quality under dollar spot pressure and heat stress as compared to the untreated control or Maxtima alone. The addition of Guarantee seaweed extract to the ChitoGuard treatment further improved performance. Note that Maxtima was used at a lower-than-normal application rate in order to see if the addition of biostimulants could make the lower rate a viable option.

Ocean Organics has been processing seaweed and formulating fertilizers for over 40 years. Our innovative processing technology yields products richer than others yet with fewer solids and lower viscosity. This means our extracts, with better blending, mixing and stability characteristics, can be used with a broader range of materials. Our seaweed-based fertilizers, plant health materials and surfactants lead the industry in quality, effectiveness, cost efficiency and environmental sustainability.



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