FEATURE ARTICLE

Polyoxin D (Endorse®)—A New Fungicide for Brown Patch and Large Patch Control

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Brown patch (*Rhizoctonia solani*) is among the most common summer diseases of cool-season grasses. Large patch is a spring and autumn disease of zoysiagrass (*Zoysia* spp.), which also is caused by *R. solani.* Fungicides are routinely used to control both diseases. **Recently, a new fungicide, polyoxin D was labelled for use on turf for the control of brown patch and large patch.** It is sold under the trade name of Endorse® and is marketed by the Cleary Chemical Corp.

Polyoxin D has a unique mode of action and is of microbial origin. Polyoxin is an antibiotic produced by the bacterium *Streptomyces cacaoi* var. *asoensis*. The antibiotic was discovered by Japanese scientists around 1965. Polyoxin D was evaluated in turf for brown patch control in the mid-1990s and was referred to as polyoxorim. **There are no other turf diseases known to be controlled by polyoxin D.** Basically, polyoxin prevents normal cell wall synthesis in sensitive fungi by blocking chitin production. It has no known adverse effects on other microorganisms that do not have chitin in their cell walls, such as bacteria and yeasts. Hence, although it is an antibiotic it is not likely to control bacterial wilt (*Xanthomonas campestris*). There is no toxicity to livestock or plants, but it is considered moderately toxic to aquatic invertebrates and fish.

Cell walls of fungi primarily are composed of either chitin or cellulose. Most fungi, including *Rhizoctonia solani,* have chitin in their cell walls; whereas, some fungi such as *Pythium* spp. have cell walls containing cellulose. Chitin is composed of chains of sugar molecules (i.e., amino polysaccharides) called N-acetyl glucosamine. When polyoxin D is absorbed by the mycelium of *R. solani,* it inhibits the incorporation of glucosamine into cell wall chitin. Hence, polyoxin D inhibits the synthesis of chitin. **The result is that cell walls are not produced or they are abnormal, thus rendering *R. solani* noninfectious.** Because polyoxin D is single site specific (i.e., a chitin synthase inhibitor), *R. solani* resistant biotypes could develop. It should be noted, however, that *R. solani* strains resistant to other single site specific fungicides used on turf have not been reported.

Polyoxin D is absorbed by leaves and molecules can move across the leaf (i.e., translaminar movement). It is unknown if molecules move upward or downward in plants and therefore polyoxin D probably is a localized penetrant. Endorse® is formulated as a wettable powder and contains 2.2% polyoxin D and 0.3% zinc. It is labelled for use on golf courses, home lawns, parks and commercial and institutional grounds. **The use rate is 4.0 ounces of product per 1000 ft^2 (118 grams/93 m^2) and provides 7 to 14 days of brown patch control**. Endorse® has both preventive and curative activity, but like most fungicides it probably performs better when applied preventively.

Preventive applications of azoxystrobin (Heritage®), chlorothalonil (Daconil Ultrex®, Concorde®, Echo®, others), iprodione (Chipco 26 GT®), flutolanil (ProStar®), fludioxonil (Medallion®), mancozeb (Dithane®, Fore®), myclobutanil (Eagle), thiophanates (CL 3336®, Fungo 50®), trifloxystrobin (Compass®), and vinclozolin (Curalin®, Touche®, Vorlan®) also effectively control brown patch. For curative control, it is best to tank-mix a contact fungicide (e.g., chlorothalonil, fludioxonil, or mancozeb) with one of the aforementioned penetrants.

Research has shown that brown patch in cool-season grasses is more effectively controlled when fungicides are applied prior to the onset of blighting (i.e., applied preventively). Proper cultural management strategies help to minimize disease severity. Imposing sound cultural practices would therefore be expected to ease the need for frequent applications of high rates of fungicides. Fertility and timing of fertilizer applications affects brown patch significantly. In particular, **autumn applications of a slow-release nitrogen (N) source to cool-season grasses results in less brown patch the following summer than spring applications of water soluble N.** Furthermore, autumn applied slow-release N plus phosphorus (P) and potassium (K) lowers brown patch severity the following summer when compared to autumn applied water soluble N plus P and K. Applications of high rates of N in the spring or summer can intensify brown patch. However, foliar feeding with low N rates (0.1 to 0.125 lb N/1000 ft^2; 5–6 kg N/ha) intermittently throughout the summer does not appear to enhance brown patch. Indeed, some studies suggest that foliar feeding on some occasions may reduce brown patch severity.

Irrigation timing also impacts brown patch severity. **A study conducted in fairway height perennial ryegrass (*Lolium perenne*) showed that irrigating at dusk intensified brown patch, whereas, irrigation during early morning hours reduced brown patch.** Evening irrigation intensifies brown patch by providing for a longer leaf wetness duration. Conversely, early morning irrigation does not extend the leaf wetness period and knocks *R. solani* foliar mycelium off leaves. Use of wetting agents as well as dragging or poling speeds leaf drying and may help to reduce disease activity. **Frequent irrigation that results in saturated soil conditions favors brown patch, particularly in shaded sites with poor air circulation.**

Continued on page 7

JB Comments

Thatch Versus Stem Biomass

Thatch is defined as an intermingled organic layer of dead and living shoots, stems, and roots that have developed between the zone of green vegetation and soil surface. Inherent in this definition is an assumption that this intermediate zone is dominated by dead organic material. This terminology has been satisfactory for many decades. However, the introduction of newer high-density turfgrass cultivars having vigorous lateral stem development dictates the need for additional refinement in the definition. **In the latter case this intermediate zone is dominated by living stoloniferous lateral stems rather than dead organic material. Accordingly, an additional term is proposed to describe this situation, which is stem biomass.**

It is important to have two differentiated terms because the cultural practices utilized in managing these two types of intermediate zones are distinctly different. In the case of thatch, an accumulated layer can be removed on a corrective basis by vertical cutting into the actual thatch layer dominated by dead organic material. In contrast, such an approach within a stem biomass dominated intermediate layer results in excessive damage to the turf which is quite slow to recover. In the case of stem biomass, the preferred cultural approach is a preventive basis involving a low nitrogen nutritional level, assuming the cultivar tolerates the lower level, combined with a close cutting height, with 1/8 to 1/10 inch (3.2–2.5 mm) being particularly effective for greens situations. An additional preventive approach that may be used when needed is grooming and/or relatively frequent, light vertical cutting. In other words, **stem biomass micro-correction is a surface-oriented approach in which preventive measures are essential.** In contrast, **management of a thatch preferably involves preventive approaches, but in addition, corrective approaches involving interior mechanical operations also are an option if needed.**

Polyoxin D (Endorse®) . . .

Continued from page 6

Brown patch is more intense in dense, high cut turfs when compared to lower mowing in more open stands. However, under high disease pressure conditions, mowing height appears to have little affect on brown patch severity. Generally, mowing high within the recommended range helps turf to better tolerate summer stresses, diseases, insect pests, and helps to reduce weed colonization. Hence, for numerous agronomic reasons, it is generally best to maintain the highest possible mowing height in the summer.

In summary, the best cultural practices for managing brown patch in cool-season grasses include the following: apply balanced N + P + K fertilizers in the autumn using as much slow-release N as possible; irrigate early in the morning; avoid excessive and/or nighttime irrigation; and maintain the mowing height high within the recommended range for the species grown. If possible, improve drainage and air circulation, reduce thatch, and alleviate soil compaction.

References

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Summer Stresses

Continued from page 1

9. Maintain as high a cutting height as possible within the confines of the particular use on putting greens, tees, fairways, and sports fields.
10. Avoid an excessive thatch accumulation that encourages root development in the thatch/mat layer only.
11. Minimize intense mechanical maintenance practices, such as topdressing, vertical cutting, and turf cultivation, during critical summer stress periods.

Adjustment of cultural practices to maximize root growth and development results in a turf with much better potential to survive summer stresses. The importance of roots in relation to turfgrass culture must not be overlooked by turf managers. Warm-season grasses generally possess more extensive root systems than do cool-season turfgrasses. Because of the very close mowing height, turfgrasses growing on putting greens possess a much shorter root system.