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not only does not control dollar spot, but it can actually enhance this disease. Hence, Heritage must be tank-mixed with another fungicide whenever dollar spot is active.

Fludioxonil. Novartis recently has registered Medallion® for use in controlling *Rhizoctonia* diseases in greenhouse crops, ornamentals and turfgrass. This fungicide also will be marketed as a pre-packaged mixture with Banner MAXX® under the trade name Foundation®. Medallion® and Foundation® will be sold under an experimental use permit in selected states in 1998. The common chemical name of Medallion® is fludioxonil. **Fludioxonil is an analog of a natural product called pyrollnitrin.** Pyrollnitrin is produced in nature by the bacterium *Pseudomonas pyrocinia*. As was the case with azoxystrobin, pyrollnitrin had to be stabilized to protect it from rapid solar radiation degradation.

Unlike azoxystrobin, **fludioxonil is a contact fungicide.** As such, its residual activity is relatively short-lived, and this is one reason why it will be offered in a prepackaged mixture with Banner MAXX®. Fludioxonil interferes with membrane transport processes in sensitive fungi. It is unclear whether this compound has single-site or multi-site activity. While fludioxonil has activity on summer patch and snow molds, its strength appears to be as a brown patch and *Helminthosporium* leaf spot fungicide. Early

testing indicates that fludioxonil has curative activity, but generally performs better when applied preventively. Fludioxonil is the first contact fungicide to enter the turf market in over 30 years. Another interesting aspect of this product is that **its residual activity is enhanced not only by mixing it with Banner MAXX®, but also by the plant growth regulator Primo® (trinexapac ethyl).** When Primo® is applied a few weeks prior to the application of fludioxonil, the effectiveness of the fungicide is improved. Evidently, the reduction in clippings removal accorded by the use of Primo® keeps fludioxonil on leaves longer, thereby increasing its residual effectiveness.

Polyoxins. The "polyoxins" are a class of antifungal compounds produced by the fermentation of *Streptomyces cacaoi* var. *asoensis*. Polyoxorim is a fungicide from this group (proposed trade name from PBI Gordon is STOP-IT®), which was shown to be extremely effective in controlling brown patch at remarkably low rates. The status of polyoxorim and similar compounds for use on turf is currently unknown.

Summary. Hence, turfgrass disease management strategies have been expanded to include not only the direct application biological agents, but also the development of microbial-based analogs of naturally occurring, antifungal compounds. 

Winter Coloration of Warm-Season Turfgrasses

J.B Beard

Annual visits to Japan have revealed a different philosophy in terms of winter color on dormant warm-season turfed fairways. Approximately 60% of the golf courses do not winter overseed, but rather apply a colorant to their zoysiagrass fairways. Typically **colorant applications are made from 2 to 4 times during the winter dormancy period.** They find this approach to be much less costly than winter overseeding of cool-season turfgrasses with its associated costs of mowing and other cultural practices throughout the winter. Most golf course fairways in Japan are composed of manila zoysiagrass (*Zoysia matrella*), except on the northern island of Hokkaido. Colorant application is being done on golf courses with 35,000 to 50,000 rounds of golf per year involving a substantial amount of play during the winter period.

It should be noted that many Japanese golfers tend to pick the ball off the zoysiagrass fairways during their stroke, which results in minimal divoting. The strong resistance to divoting typical of zoysiagrass turfs may be one of the reasons why this approach to hitting balls from fairways is quite common in Japan. Consequently, divot openings are not as extensive as on turfs in other parts of the world. Also, golf carts are not as widely used as in the United States.

Typically, the earlier usage of colorants on winter-dormant fairways in the United States had involved a single application. Do multiple winter colorant applications have the potential for use elsewhere in the world? Is this approach effective where extensive divot openings and intense golf cart traffic are a concern? Time will tell! 