

Pyraclostrobin: A promising new fungicide for turfgrass professionals

By Wakar Uddin

Results from trials in the Northeast show that Insignia is highly effective in controlling gray leaf spot (blast), anthracnose basal rot, Pythium foliar blight, brown patch, gray snow mold, pink snow mold, red thread, rusts, take-all patch, leaf spot and summer patch.

Strobilurin, often referred to as "Strobie" by turf managers, continues to be an important fungicide type in turfgrass disease management, since the introduction of azoxystrobin (Heritage) to the turf market. More recently, trifloxystrobin (Compass) added another dimension to the spectrum of fungicides in the turfgrass industry. Tremendous success with these two compounds in the past has led to intensive search for new strobies in the fungicide industry.

Most recently, the discovery of pyraclostrobin by BASF has added yet another component to the turf fungicide market. Pyraclostrobin has generated tremendous interests in both the turf and fungicide industries. Registration of pyraclostrobin, tested as BAS 500 F, with the proposed trade name Insignia - is currently pending. It should soon become available in the U.S. market once it is approved by the U.S. Environmental Protection Agency (EPA) and state regulators in certain regions.

Although this new strobilurin is not yet available in the market, the name Insignia is not new to turf managers. The product has been extensively tested in demonstration trials across the country. Despite all the research and demonstration trials in the U.S. and Europe, information on the property and efficacy of this new strobilurin is still scanty in literature, as one would expect.

Traditionally, in the turf industry, a variety of questions are often posed by curious superintendents with regard to a new compound, after its discovery becomes public or the product is about to be registered. There is no exception in the case with Insignia, which has apparently received widespread attention from turf managers during the past few years. Based on questions that are most frequently asked by turf managers and the technical information available at this point, this article is compiled for turf managers' reference in turfgrass disease management programs. This hopefully will aid in reduction of the time a turf manager will spend in making phone calls or sending emails.

How pyraclostrobin works

Pyraclostrobin - a carbamic acid - reportedly has activities against fifteen major turfgrass pathogens with a wide range of efficacy from moderate to extremely high. Like the other strobilurins available in the market, one of the positive attributes of this compound is the low rate of use and relatively longer application intervals. This ulti-

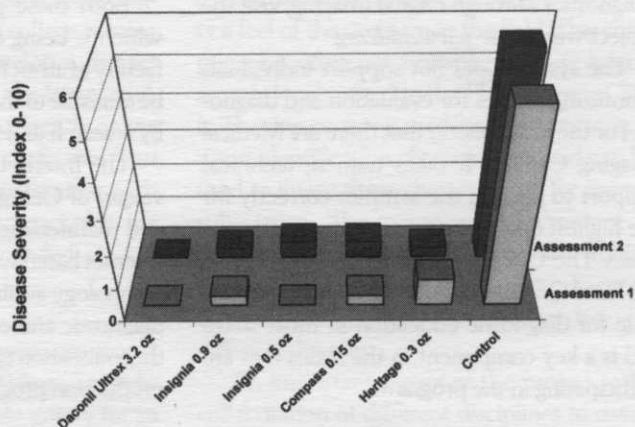


Fig. 1. Control of gray leaf spot in perennial ryegrass turf by three strobilurin fungicides and chlorothalonil applied at 14-day intervals. Disease severity (Index 0-10; 0=none;10=>90% turf area necrotic) was assessed twenty (Assessment 1) and twenty-eight (Assessment 2) days after inoculation.

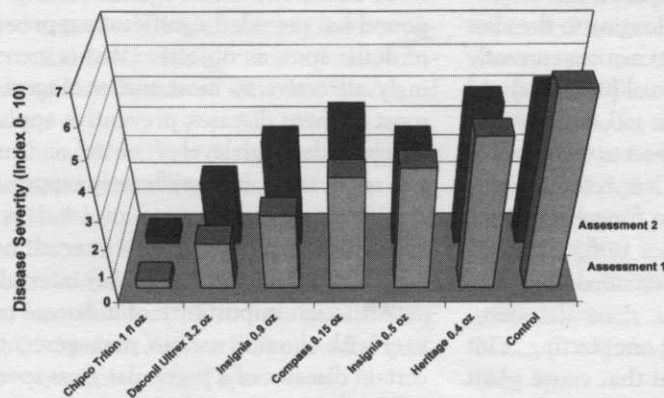


Fig. 2. Control of anthracnose basal rot of *Poa* in *Poa-Bent* mix green by fungicide applied at 14-day intervals. Disease severity (Index 0-10; 0=none, 10=>90 % turf area symptomatic) was assessed eighteen (Assessment 1) and thirty-three (Assessment 2) days after inoculation with *Colletotrichum graminicola*.

mately lead to the development of a sound fungicide program that is cost-effective.

The mode of action of this strobilurin is noteworthy especially for those turf managers who often think along the technical line beyond the practical value or effectiveness of a chemistry. Studies have indicated that pyraclostrobin has preventive and curative properties against a number of diseases. It is inhibitory to a target fungal pathogen virtually at all major stages of the life cycle such as spore germination, germ tube elongation, mycelial growth, and sporulation.

More technically, these molecules inhibit mitochondrial respiration within fungal cells. Within the cells it blocks the electron transport at the cytochrome bc-1 complex. In cells which are exposed to these molecules, the level of ATP (adenosine triphosphate) in the target fungi are not sufficient for disease development.

The primary benefit of using pyraclostrobin might be most likely from a preventive use, as in most of the existing major fungicides. This will not only be relevant to increased efficacy but also to the long-term resistance management as preventive application provides reduction of initial inoculum; therefore, less disease severity and decreased selection pressure for development of possible mutant strains of the

pathogen over time and space.

Turfgrass pathogens

As a foliar spray, Insignia controls several turfgrass diseases caused by fungi from the classes *Ascomycete*, *Basidiomycete*, *Deuteromycete*, and *Oomycete*. The causal agent of take-all patch, *Gaeumannomyces graminis* var. *avenae*, is an important pathogen from the

Ascomycete fungi. Take-all is one of the serious root and crown diseases of creeping bentgrass that is often difficult to control by fungicides. *Rhizoctonia solani*, a commonly known *Basidiomycete*, is a serious pathogen that attacks almost every species of turfgrass under warm and humid conditions. It is a non-spore-producer in a typical brown patch pathosystem in turf, and it rapidly spreads through mycelia and/or bulbils (a structure produced by the fungus to withstand adverse conditions).

There are several fungi among turfgrass pathogens that fall into the class *Deuteromycete*. These fungi are most commonly known as fungi imperfecti which implies the imperfect ones; they are not considered *perfect* because the phase of reproduction involves non-sexual structures. When sexual reproduction of a fungus in this group is discovered, they are given a different name referring to sexual stage. In some cases, the sexual reproduction stage of a fungus is only found in cultures in the laboratory.

One good example is the gray leaf spot fungus or more widely known as blast fungus worldwide, *Pyricularia grisea*. The sexual stage of the blast fungus has not been found in nature, but is produced in the laboratory and known as *Magnaporthe grisea*. An example of a fungus from *Oomycete* is *Pythium*

apanidermatum. The unique nature of turfgrass pathogenic fungi belonging to the class *Oomycete* is that the fungi can concurrently produce both types of sexual (oospores) and asexual (zoospores) spores and, therefore, no alternative name with respect to the sexual or asexual spores is given. *Oomycete* is a highly controversial class in the fungal kingdom. Biology of these and other turfgrass fungal pathogens is extensively described in selected references.

For interested readers, one starting point for information on fungi that cause plant disease is www.apsnet.org.

The efficacy

Results from research trials in the Northeast and several other regions of the United States have shown that Insignia is highly effective in controlling a number of diseases of turfgrass. These include gray leaf spot (blast), anthracnose basal rot, *Pythium* foliar blight, brown patch (*Rhizoctonia* blight), gray snow mold (*Typhula* blight), pink snow mold (*Microdochium* patch), red thread, rusts, take-all patch, leaf spot (*Helminthosporium* leaf spot) and summer patch.

In addition to these diseases, this compound has provided significant suppression of dollar spot, an objective that is increasingly attractive to most turf managers. In most of these diseases, preventive application provided high level of control, and curative application also significantly suppressed the disease over a period of 14 days or longer. In many cases, 28-day intervals have been as effective as 14 or 21-day intervals.

Although importance of a disease may vary with climatic regions, management of certain diseases of a particular grass species adapted to a specific geographic area remains a top priority for turf managers. Devastating effects of gray leaf spot (blast disease) in certain regions is a good example. This disease is a serious problem in ryegrass turf in the Northeast and most of the Mid-west, and to a lesser extent in tall fescue and St. Augustine grass in the South. Fungicidal control of the disease remains a strong component of a disease management program in the turfgrass industry.

Strobilurins have traditionally been a good choice of systemic fungicide that is effectively integrated into a sound fungicide

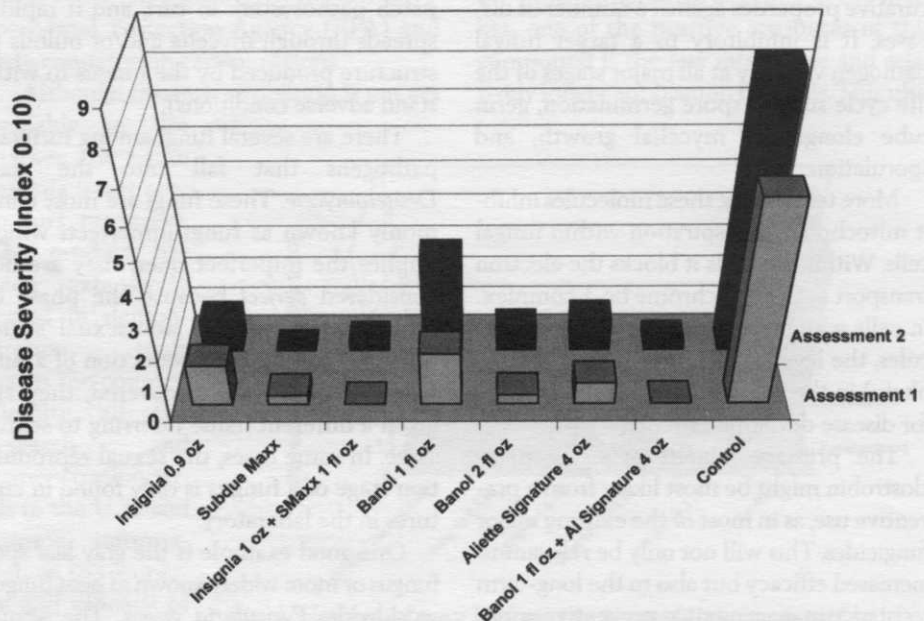


Fig. 3. Preventive control of *Pythium* foliar blight in perennial ryegrass turf. Disease severity (Index 0-10; 0=none;10=>90% turf area necrotic) was assessed three (Assessment 1) and four (Assessment 2) days after inoculation with *Pythium aphanidermatum*. SMaxx=Subdue Maxx; AI Signature=Aliette Signature

program. Heritage and Compass have been used extensively, but cautiously, with proper rotation and tank-mixes with other contact and systemics of different modes of action.

Research at Penn State has shown that Insignia is extremely effective in controlling gray leaf spot as seen with other strobilurins and Daconil Ultrex (Fig. 1). The study further revealed that different rates, intervals, and formulations (0.5 - 0.9 oz. per 1,000 sq. ft.; 14-28 days; WG or EC) provided similar control of gray leaf spot.

Despite the excellent controls provided by the strobilurins, turf managers must exercise caution in choosing this class of chemistry because their modes of action are the same or very similar. Because of the risk of cross-resistance problems, only one strobilurin must be chosen for rotation or tank-mix, and the instruction in the label must be followed.

Based on regional observations, one of the reasons for Insignia apparently becoming a hot topic is the new challenges in fungicidal control of anthracnose basal rot, which is a major concern in the industry. Anthracnose basal rot has been prevalent in Poa and/or bentgrasses in Poa/bentgrass greens. In recent years, this disease has been reported to occur almost all year round. It has been diagnosed in turf under snow cover in January in some locations in the Northeast, and it is unlikely that these structures were remnants of fall infection as supported by the viability and spore/acervuli counts per symptomatic plant.

Frustration is mounting in the golf industry as superintendents cannot find a good answer for chemical control of this disease. The wide range of efficacy in strobilurin fungicides, particularly, azoxystrobin has been reported from various regions in the past. It is unclear whether this will also be true for Insignia as the population biology of the anthracnose fungus in U.S. is not well understood.

Studies conducted at Penn State in the summer of 2001 indicated that Insignia provided satisfactory control at high (0.9 oz) and low (0.5 oz) rates at 14 days (Fig 2.). It also provided similar control at 21

days when used at high rate. Further tests on extended intervals and tank-mixes for preventive and curative controls will be conducted in 2002.

Additionally, the broad-spectrum nature of Insignia is evident from significant suppression of Pythium foliar blight and dollar spot diseases. In a study conducted at Penn State in 2000, Insignia (0.9 oz) provided control similar to that of standard Pythium materials such as Banol (2 oz), Subdue Maxx (1 oz), and Aliette Signature (4 oz) (Fig. 3).

Strobilurins, in the past, have not been effective in controlling dollar spot. Further, resistance development in *Sclerotinia* populations especially to Demethylation Inhibitor (DMI) fungicides often causes serious problems in dollar spot management. However, significant reduction of dollar spot by Insignia has been reported.

Control of a wide range of turfgrass diseases caused by fungi from various classes is a major strength of pyraclostrobin, and such an extraordinary broad-spectrum nature of this new strobilurin will undoubtedly become a strong component in an integrated disease management program when the product becomes available in the market.

Wakar Uddin is an Assistant Professor of Plant Pathology at the Pennsylvania State University. His degrees in plant pathology are a B.S. and M.S. from the University of Nevada and a Ph.D. from the University of Georgia. His specialties are the epidemiology of turfgrass diseases and biology of the pathogens; fungicide efficacy and integrated turfgrass disease management. His research involves management of gray leaf spot of perennial ryegrass turf caused by Pyricularia grisea. A second component of his research encompasses biology of Colletotrichum geminicola and management of anthracnose basal rot in Poa and creeping bentgrass greens. He teaches two resident courses in turfgrass pathology at Penn State and also offers an on-line course, "Diagnosis and Management of Turfgrass Diseases," as part of Penn State's World Campus distance education program.