



Curative control of yellow tuft in creeping bentgrass

Fungicides may not be a cure-all for yellow tuft.



Yellow tuft (*Sclerophthora macrospora* [Sacc.] Thirumalachar, C.E. Shaw & Narasimhan), also known as downy mildew in St. Augustinegrass, can be a nuisance disease of all turfgrass species, especially during spring and fall in cool humid regions (6). This pathogen is an obligate parasite, which uses the turfgrass plant as a host and rarely kills it. Therefore, control measures are often curative; that is, they are implemented after disease symptoms are present. The presence of the disease affects aesthetics and sometimes ball roll. To our knowledge, very few replicated fungicide efficacy data are available to superintendents to use for controlling yellow tuft.



Advanced symptoms of yellow tuft (**above**) are obvious in this mixed annual bluegrass-creeping bentgrass putting green. The plants that are lime green are infected annual bluegrass; the darker green plants are uninfected. Photo by P. Dernoeden

This yellow tufted creeping bentgrass plant (**right**) mowed at greens height has a large number of tillers and a shortened root system, which makes it easy to detach the plant from the soil surface. Photo by S. McDonald

Yellow tuft biology

The yellow tuft fungus produces swimming spores borne in lemon-shaped fruiting bodies called *sporangia*. The symptoms of yellow tuft are distinctive, and infections are more numerous in low, poorly drained areas because water is necessary for the swimming spores to be distributed (6).

Soon after infection, diseased plants become light green to lime in color, leaf blades widen and growth is slowed. More advanced foliar symptoms include distinctly tufted plants caused by the proliferation of a large number of tillers. Plants turn yellow when the fungus is sporulating and sporangia are produced on leaf surfaces.



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Fungicides for yellow tuft control in turf

Product	Active ingredient	Rate/1,000 square feet	Fungicide class	Manufacturer
Subdue Maxx 1.3MEC	mefenoxam	0.5-1.0 fluid ounce	phenyl-amide	Syngenta
Chipco Signature 80WP	fosetyl-Al	4.0-8.0 ounces	phosphonate	Bayer Environmental Science
Insignia 20WG	pyraclostrobin	0.5-0.9 ounce	strobilurin	BASF Corp.

Table 1. Commercially available fungicides labeled for control of yellow tuft in turfgrass.

Yellow tuft control, Maryland, 2004

Treatment	Rate/1,000 square feet	Yellow tuft severity (0-5 scale)		% plot area diseased*
		Sept. 3	Sept. 17	Sept. 17
Insignia	0.5 ounce	2.9 a	4.5 a	51 a
Insignia	0.9 ounce	2.3 ab	3.7 a	33 a
Subdue Maxx	1.0 fluid ounce	0.9 b	0.5 b	1 b
Untreated		3.6 a	4.1 a	41 a

*Means in each column followed by different letters are significantly different.

Table 2. Curative control of yellow tuft, College Park, Md., in 2004.

Root systems of infected plants are short and bunched, and diseased plants are easily detached from the soil surface. The symptoms often are more severe in newly established stands and can mimic young annual bluegrass (*Poa annua*) plants in creeping bentgrass (*Agrostis stolonifera*) putting greens because of the lime-yellow color and bunch growth habit (1).

Yellow tuft also has been confused with yellow spot disease, which may be caused by various cyanobacteria and not fungi (7). There is, however, evidence that cyanobacteria may not be involved in the malady known as yellow spot (3).

Yellow tuft control

Currently, only three fungicides are labeled for the control of yellow tuft (Table 1). A report published in 1980 stated that metalaxyl (the original formulation of Subdue, Syngenta) had good activity on *S. macrospora*, but Banol (propamocarb, Bayer Environmental Sciences) did not (2). Since that time, few fungicide studies targeting yellow tuft have been reported. Four field trials were conducted in Connecticut, Maryland and Pennsylvania from 2004 through 2008, assessing various labeled and unlabeled fungicides for their

impact on curative (that is, post-plant infection) yellow tuft control in creeping bentgrass.

Maryland study

In 2004 the study site at the University of Maryland Turfgrass Research Center in College Park had fairway-height Crenshaw creeping bentgrass growing on silt-loam soil. The turf was severely diseased, and yellow tufted plants were evident in prodigious numbers uniformly distributed across the site.

Three fungicide treatments were evaluated, including Insignia (pyraclostrobin, BASF Corp.) applied at 0.5 and 0.9 ounce/1,000 square feet (0.15 and 0.27 grams/square meter) and Subdue Maxx (mefenoxam, Syngenta) applied at 1.0 fluid ounce/1,000 square feet (0.32 milliliters/square meter). Treatments were applied in 2.5 gallons of water/1,000 square feet (0.10 liter/square meter) on Aug. 6, 19 and 30. Results from this study have been reported previously (5).

Disease ratings

At all locations except for the Philadelphia Country Club site in 2007, yellow tuft was evaluated visually using a severity rating and a rating



of the percent of plot area infested. Severity was rated on a scale of 0 to 5, where 0 is no disease, 2.5 is a level of tufting that would be considered objectionable to superintendents, and 5.0 is when the entire plot area is yellow and tufted. Percent of diseased plot area was rated on a linear scale of 0% to 100%, where 100% is when the entire plot area is diseased. Data were statistically analyzed and the means were separated.

Data from this trial are shown in Table 2. Early results indicated that only Subdue Maxx had reduced yellow tuft severity compared to the untreated control (hereafter, the control). The level of suppression in plots treated with Insignia at the high rate evaluated (0.9 ounce/1,000 square feet) was not statistically different from the Subdue Maxx treatment or the control when rated on

Sept. 3. Data collected on Sept. 17 showed that only Subdue Maxx had effectively controlled yellow tuft. However, it was uncertain whether control was a result of the first, second or third application of Subdue Maxx because differences were not observed until early September. Therefore, additional research is needed to clarify the influence the number of applications might have on curative yellow tuft control.

Connecticut study

The 2006 study took place at the University of Connecticut Plant Science Research and Education Facility in Storrs. (2). Seven fungicide treatments were applied once or twice to a fairway-height stand of Putter creeping bentgrass. Soil was a silt loam with a pH of 5.9. Fungicide treatments were applied in 2 gallons of water/1,000 square feet (0.08 liters/square meter). The fungicides evaluated in this trial included: Subdue Maxx, Medallion (fludioxonil, Syngenta), Insignia and Heritage TL (azoxystrobin, Syngenta). It is important to note that neither Medallion nor Heritage is labeled for yellow tuft control. The full treatment list, rates, application dates and data are shown in Table 3. Results from the Connecticut study were reported previously (4).

Data from the Connecticut site indicated that there were no differences among any of the treatments two weeks following the first application of fungicides, and on average, 5.7% to 11.3% of the plot area was diseased. On Oct. 13, three weeks following the second application, only plots treated with Subdue Maxx had reduced levels of yellow tuft (1.7%), when compared to all other treatments (7.7% to 14.0% yellow tuft). Other data also indicated that Subdue Maxx was the only fungicide to reduce the severity of yellow

Yellow tuft control, Connecticut, 2006

Treatment	No. of applications	Rate/1,000 square feet	Yellow tuft severity (0-5 scale)*		% plot area diseased *	
			Sept. 22	Oct. 13	Sept. 22	Oct. 13
Heritage TL	2	1.0 fluid ounce	2.7 a	3.0 a	11.3 a	11.7 a
Heritage TL	1	2.0 fluid ounces	1.7 a	2.7 z	5.7 a	9.7 a
Insignia	2	0.9 ounce	1.7 a	2.7 a	9.0 a	9.3 a
Insignia	1	0.9 ounce	2.2 a	2.7 a	8.3 a	9.3 a
Medallion	2	0.25 ounce	3.0 a	2.3 a	11.3 a	7.7 a
Medallion	2	0.50 ounce	1.8 a	2.3 a	8.0 a	8.0 a
Subdue Maxx	2	1.0 fluid ounce	1.7 a	1.0 b	7.3 a	1.7 b
Untreated	—	—	2.7 a	3.7 a	10.7 a	14.0 a

*Means in each column followed by different letters are significantly different.

Table 3. Curative control of yellow tuft, Storrs, Conn., 2006.

Yellow tuft control, Pennsylvania, 2007

Treatment	Rate/1,000 square feet	% reduction in yellow tuft from original (0-100)**			
		May 18	May 27	June 12	June 26
Medallion	0.25 ounce	0.0 c	0.0 b	6.8 c	10.0 c
Subdue Maxx	1.0 fluid ounce	10.0 b	8.5 a	27.5 b	50.0 b
Medallion + Subdue Maxx	0.25 ounce + 1.0 fluid ounce	15.3 a	8.0 a	65.0 a	75.0 a
Untreated	—	0.0 c	0.0 b	5.8 c	10.0 c

**Yellow tuft severity was rated on a percent reduction from the original amount of disease that was plugged into the plots. 0 = no reduction in disease, 10 = a 10% reduction in the original amount and 100 = total elimination of disease symptoms from the plots. The higher the number, the greater reduction in disease observed.

*Means in each column followed by different letters are significantly different.

Table 4. Curative yellow tuft control, Philadelphia Country Club, 2007.

Yellow tuft control, Pennsylvania, 2008

Treatment	Rate/1,000 square feet	Yellow tuft severity (0-5 scale)*					
		May 10	May 17	May 25	June 1	June 8	June 22
Banol	2.0 fluid ounces	4.0 a	3.83 a	4.00 a	3.83 a	4.00 a	4.00 a
Chipco Signature	4.0 ounces	4.0 a	3.93 a	4.00 a	3.93 a	4.00 a	4.00 a
Stellar	1.2 fluid ounces	4.0 a	2.33 b	3.73 a	3.40 ab	4.00 a	3.67 a
Subdue Maxx	1.0 fluid ounce	4.0 a	2.17 b	2.83 b	3.00 bc	2.17 b	2.53 b
Subdue Maxx + Medallion	1.0 fluid ounce + 0.25 ounce	4.0 a	2.17 b	2.43 b	2.67 c	2.00 b	1.43 c
Untreated	-	4.0 a	4.17 a	4.00 a	3.90 a	4.10 a	4.13 a

*Means in a column followed by the same letter are not significantly different.

Table 5. Curative yellow tuft control, Philadelphia Country Club, 2008.

tuft compared to all other treatments. Throughout this study, no differences in the percent of plot area diseased or disease severity were observed among plots treated with Heritage, Insignia, Medallion and the control.

Pennsylvania studies, 2007 and 2008

Both Pennsylvania studies were conducted on a sand-based (90% sand and 10% peat) nursery green at Philadelphia Country Club, Gladwyne, Pa. The turf was A-1 creeping bentgrass that was seeded in autumn 2004. Irrigation was supplied as needed to prevent drought stress. Turf was mowed at a height of 0.115 inch (3 millimeters) six times per week.

Dollar spot (*Sclerotinia homoeocarpa*) and brown patch (*Rhizoctonia solani*) were controlled periodically with preventive applications of Daconil Weatherstick (chlorothalonil) at 2.0 fluid ounces/1,000 square feet (0.64 liters/square meter). Chlorothalonil was used because it would not be expected to have an effect on yellow tuft. Three A-1 creeping bentgrass plugs heavily infested with yellow tuft were placed in the center of each plot one month before treatments were applied. Treatments were applied in 2.0 gallons of water/1,000 square feet using a carbon dioxide-pressurized backpack sprayer equipped with an 8008 flat-fan nozzle.

2007 study

In 2007 the three fungicide treatments evaluated were: Medallion (0.25 ounce/1,000 square feet), Subdue Maxx (1 fluid ounce/1,000 square feet) and a tank-mix of Medallion + Subdue Maxx (0.25 ounce + 1 fluid ounce/1,000 square feet). Data from 2007 are shown in Table 4.

On May 18 (seven days after the original treatment), Subdue Maxx alone (10%) and the tank-mix treatment (Subdue Maxx + Medallion; 15%) had reduced the percent of the original amount of yellow tuft when compared to Medallion (0%) applied alone and the control (0%). On May 18, the level of suppression provided by the tank mix was significantly greater than that provided by Subdue Maxx alone. On June 12 and June 26 a similar trend was observed in which plots treated with Subdue Maxx alone (28%-50% reduction) and the tank-mixture (65%-75% reduction) provided a significant reduction when compared to plots treated with Medallion alone (7%-10% reduction) and the control (6%-10% reduction). The appearance of yellow tuft symptoms in the trial began to decline naturally in control plots with warmer, drier weather, and no additional ratings were obtained in 2007.

2008 study

In 2008, five fungicide treatments were evaluated for curative control of yellow tuft: Banol, Chipco Signature, Stellar (fluopicolide + propamocarb, Valent Professional Products), Subdue Maxx alone, and Subdue Maxx + Medallion. Stellar was labeled in 2007 for control of *Pythium* blight, but its effect on yellow tuft is unknown.

All treatments initially were applied on May 3, and there were no visual differences in yellow tuft severity among plots when plots were rated on May 10 (Table 5). However, on May 17 (14 days after the initial treatment), plots treated with Stellar, Subdue Maxx alone and Subdue Maxx + Medallion had less severe tufting symptoms, and plants appeared a typical green color when compared to the turf in plots treated with Chipco Signature, Banol and the control. On May 25 (eight



The plot shown at the bottom of the photo is an untreated control, whereas the top plot was treated with Subdue Maxx. No treatment provided complete yellow tuft control in any trial year or site. Photo by S. McDonald



The research says

- No fungicide treatment provided complete curative control of yellow tuft in any of the four study years.
- The most consistent curative yellow tuft control was achieved with multiple applications of Subdue Maxx.
- There may be a significant benefit from tank-mixing Medallion with Subdue Maxx, but the reason for this added benefit is unknown.
- The most significant reduction in yellow tuft was observed following the second application of Subdue Maxx or Subdue Maxx + Medallion.
- Yellow tuft is difficult to manage with fungicides, and cultural practices such as moderate fertility, adequate surface and subsurface drainage and regular vertical mowing also may be necessary for effective management.

days following the second application), only plots treated with Subdue Maxx and Subdue Maxx + Medallion had less severe symptoms than the control. Plots treated with Banol, Signature and Stellar had a level of disease symptoms similar to the control on May 25. On June 1, 8 and 22, similar results were observed, and only plots treated with Subdue Maxx and Subdue Maxx + Medallion had less tufting symptoms than the control. Thereafter, a prolonged period of drier weather conditions prevailed and symptoms naturally declined.

What does the research mean?

Yellow tuft is a difficult disease to manage with fungicides. A combination of cultural and chemical practices may be needed to manage this disease more effectively. Moderate fertility, adequate surface and subsurface drainage and regular vertical mowing are a few cultural methods for managing yellow tuft (1,6).

No fungicide treatment provided complete curative control of yellow tuft in any of the four study years. Results from all sites and years indicated that the most consistent curative yellow tuft control was achieved with multiple applications of Subdue Maxx. Data from the 2007 and 2008 Pennsylvania trials strongly suggested there was a significant benefit from tank-mixing Medallion with Subdue Maxx. The reason for this added benefit is unknown. Medallion is a contact fungicide that would not gain entry into plants and have activity on this obligate parasite, but Subdue Maxx is taken up and translocated from the point of entry. It is possible that Medallion's formulation may assist in the uptake of Subdue Maxx, thus providing an additional level of control.

In field trials in Rhode Island, the tank mixture of Subdue and chlorothalonil (Daconil 2787) provided exceptional curative control of yellow tuft (2). Chlorothalonil also is a contact fungicide, which, when applied alone, would not be expected to affect an obligate parasite like *Sclerophthora macrospora*.

Generally, the most significant reduction in yellow tuft was observed following the second application of Subdue Maxx or Subdue Maxx + Medallion. Therefore, superintendents targeting yellow tuft curatively may observe a decline in the severity of yellow tuft when applying these materials twice on a 12- to 14-day interval. Insignia and Chipco Signature are labeled for yellow tuft control and may be effective in a preventive rather than a curative program. Banol, Heritage TL, Medallion and Stellar are not labeled for yellow tuft control, and our results indicated that when applied alone they did not provide a significant level of curative activity.

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