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Pythium Induced Root Dysfunction: A Disease of Creeping Bentgrass on High Sand Content Greens

Clinton F. Hodges
Professor of Horticulture and of Plant Pathology
Department of Horticulture
Iowa State University
Ames, Iowa 50011

Fig. 1. Growth of eight week old creeping bentgrass plants root inoculated with *Phythium arrhenomanes* or *P. aristosporum* and grown in sand. From left to right: healthy control plant, *P. arrlenomanes* infected (Canadian isolate), *P. arrhenomanes* infected (Iowa isolate), and *P. aristosporum* infected (Iowa isolate).

A new *Pythium* disease of creeping bentgrass has been recognized that attacks the roots of plants grown in high sand content greens. The disease occurs primarily on old golf courses where the greens have been rebuilt with sand; the disease is rarely found on newly constructed golf courses with sand greens. Creeping bentgrass established on the renovated greens in the fall of the growing season grows well and establishes a good cover by winter. The grass grows well during the mild periods of spring and early summer of the following year. With the arrival of hot, humid weather, the turf begins to die in a pattern typical of *Pythium*—induced "cottony blight" or "foliar blight." Close examination of diseased plants, however, fails to show any *Pythium* infection of above ground portions of the plants.

Examination of root systems of diseased plants reveals white, normal appearing roots that are field diagnosed as being healthy. No lesions or rot are present on the roots. When such roots are incubated under laboratory conditions, *Pythium* species frequently grow from the root tips, cortical cells, and vascular system within 6 to 12 hours. The *Pythium*—infected roots can result in the complete killing of a green within 7 to 10 days. Case histories of greens that have been attacked show that the disease may reoccur up to three growing seasons after the first outbreak of the problem. After three years, the disease may cease to be a problem or may occur at a much reduced level of activity.

Research has established that *Pythium arrhenomanes* and *P. aristosporum* are the pathogens responsible for the disease. *P. arrhenomanes* is the more common of the pathogens and occurs in all regions of the North American continent. This species causes a root rot of cereals in Canada and northern U.S.A. and has been a severe pathogen on roots of sugarcane in the southern U.S.A. *P. aristosporum* is restricted to the cooler regions of the north central and northwest United States and Japan. This pathogen causes snow blight of cereals and grasses in Japan.

Inoculation of creeping bentgrass roots with either *Pythium* species in controlled studies results in a severe reduction of plant growth. Total weight of plants with roots infected by *P. arrhenomanes* or *P. aristosporum* is 16% and 32%, respectively, of healthy control plants (Fig. 1). Examination of roots 3 to 4 weeks after inoculation reveals *Pythium* mycelium in root hairs and in somewhat swollen regions behind root tips. It seems that root hairs and root tips provide the primary sites for infection. Roots examined 8 weeks after inoculation are completely penetrated by the mycelium; the pathogens are found in abundance in the cortex, vascular tissue, and root tips. Some root tips are devitalized and the roots may be slightly buff colored compared with healthy roots. It is remarkable, however, that with the extensive infection of the roots there is no rot and visible lesions are extremely rare. The fact that growth of infected plants is severely reduced and that there are no rotted roots suggests that the reduction in growth of infected plants is due to the inability of infected roots to function properly. Infection may interfere with water uptake and/or other metabolic functions of the root. Because infection seems to interfere with root function, the disease has been termed "*Pythium*—induced root dysfunction."

(continued page 4)

Comments and Opinions . . Yours and Ours

A Granular Nematicide

MOCAP 10G, a nematicide/insecticide is now labeled for use on home lawns by the certified applicator. Professional turf persons can legally treat Kentucky bluegrass or zoysiagrass lawns before they are damaged by nematodes. This chemical should be applied only to well established lawns with a drop spreader. Granules must be swept from walks and driveways. Sod and soil should not be handled for 21 days. While the nematicide should be applied only over dry foliage, 1/2 inch of water is used to wash the active ingredient into the soil to avoid contact with unprotected humans and animals. A dose rate of 5-7 pounds of MOCAP 10G is used on 1,000 square feet or 200-300 pounds per acre.

Ronald F. Myers
Professor—Plant Pathology
Rutgers University

A government that robs Peter to pay Paul can always depend upon the support of Paul.

George Bernard Shaw

No amount of ability is of the slightest avail without honor.

Andrew Carnegie

Weed Control — 1930

Ground ivy, Gleconia hederacea, is the most familiar name for this lawn weed but there are others by which it is known in some localities: for example, Field Balm, Gill-over-the-ground, Gill-Ale, Ale-hoof, and Cat's-foot. The old method of exterminating Ground Ivy was to skim off the shallow layer that contained the roots and relay new sod or reseed. Now (1930) it has been discovered that the plants can be entirely destroyed without lasting injury to the grass by a single spraying with a solution of Sodium Chlorate. Care should be exercise in the use of Sodium Chlorate. It is inflammable and will ignite from friction if allowed to dry on clothing. (*Lawn Care,* February 1930).

Comment: This was our best control until the modern herbicide era.

Extra Warning. Keep your bluejeans wet or be ready for instant removal before a flash chlorate fire.

DECEMBER LAWN FERTILIZATION

For those who have responsibility for a Kentucky bluegrass-fine fescue turf area that has not received enough fertilization for adequate growth, late fall application can improve the color and density by late winter or early spring. Treatment with a N-P-K fertilizer that supplies 1 — 1-1/2 lbs. N/M per square foot will give a good response. If the area has had considerable fertilization in the past, nitrogen alone may be adequate. During fall it is easier to apply quick-acting types of nitrogen without turf injury. Late fall application usually reduces the need for spring fertilization.

ABSTRACT: Effect of Shading on Root Growth of Transplanted Sod. By: BB. Hessweltine and C.R. Skogley *ASPA Turf News,* January-February 1984.

Grass root initiation and growth is a seasonal phenomenon. Studies were initiated in 1976 at the Rhode Island Agricultural Experiment Station for the purpose of studying sod establishment in a shade environment. Two locations were used for these studies: the first received full sunlight while the second, in an adjacent area of mature white oak trees, received about 18% of incident sunlight. By the end of the season it was concluded that lack of adequate light reaching sod in the shaded location was primarily responsible for poor root initiation and growth. With these conclusions, it was decided to do a further study in 1977 to establish the effect of shade level and time of year on rerooting of transplanted sod. After a 28-day growth period, rooting of the sod was tested. Sod used in this study was a one-year-old blend of three Kentucky bluegrasses with a small percentage of red fescue. Plots receiving full sun had significantly greater root strength from April through August than all shade levels tested; however, in September the check and 80% sunlight treatments were statistically similar. In most cases, a decrease in percentage of incident sunlight received appeared strongly correlated with a decrease in rooting. It is apparent that sod should be transplanted in shade locations as early in spring as possible. With a significant degree of shade, prolonged post-installation care, particularly regarding irrigation, will be necessary.

Unscientific Elimination of Chemicals

BFC Chemicals Inc. has decided not to challenge the recent decision by the Environmental Protection Agency to cancel most use of the pesticide toxaphene. "We have reviewed the toxaphene decision document prepared by the EPA and, although we disagree with the EPA conclusions, we do not intend to challenge the cancellation because of the extreme cost associated with legal proceedings," BFC Chemicals wrote in a prepared statement. "EPA has made it clear that its evaluation of hazard is based on a worst possible case analysis. Many assumptions of an extreme nature, some of which are contrary to known facts, have been used in EPA's risk assessment."

"Moreover, the (EPA) document also fails to acknowledge the more than 30 years of manufacture without any indication of any form of illness in employees representing about 1,000 man years of exposure," the statement continued. (*Landscape and Irrigation,* March 1983, pp 24).

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edible — not toxic; nutritious, as a worm to a chicken, a chicken to a man, and a man to a worm.

Weed Science

ABSTRACT: White-Rot Fungi and Topdressing Influence on the Composition of Thatch of Four Turfgrasses, by J. B. Sartain and B.G. Volk. *Agronomy Journal* 76:359-362, 1984. Cores of four highly-thatched turfgrasses (bermudagrass, *Cynodon dactylon* (L.) Pers.; centipedgegrass, *Eremochloa ophiuroides;* Kentucky bluegrass, *Poa pratensis* L.; and St. Augustinegrass, *Stenotaphrum secundatum* (Walt.) Kuntzel were placed in pots and inoculated with one of four species of white-rot fungi (*Polyporous giganteus, Coriolus versicolor, Phebia gigantea,* or *Phanerochaete chrysosporium*). Pots were reinoculated with the appropriate fungus 14 days after the initial inoculation and after the 6-month sampling. Subplot treatments of the split-plot design were three topdressings (none, 0.31 cm sand and 0.31 cm sand containing 4% colloidal phosphate). Cellulose content of bermudagrass and centipedegrass-thatch cores was significantly reduced by inoculation with *Phebia gigantea.* The white-rot fungi, *Coriolus versicolor,* produced the largest reduction in the lignin content of all four turfgrass species. Total oxidizable organic material of the bermudagrass and centipedegrass thatch was significantly reduced by the white-rot fungi. In general, topdressing reduced the cellulose and lignin content of the turfgrasses. Centipedegrass thatch consistently contained higher levels of cellulose and lignin than the other turfgrass species. Kentucky bluegrass thatch contained the lowest quantity of lignin, and St. Augustinegrass thatch the least cellulose. The overall magnitude of decrease in the components of thatch, which were determined in this study, was not great. Many factors influence the effectiveness of white-rot fungi in degrading cellulose and lignin; therefore, more information is needed on the factors before recommending one or more of these fungi.

Comment: Many have thought about this approach. Is there an efficient organism?

Phythium Dysfunction

continued from page 1

There are, at present, more questions surrounding the nature of *Pythium*—induced root dysfunction than there are answers. There are two questions of immediate interest. 1) Why does the disease occur only on high-sand content greens and almost exclusively on renovated greens on older golf courses? 2) Can control methods be developed to prevent the disease or to stop it after it has started? The *Pythium* species responsible for root dysfunction are commonly associated with soils in which grasses are grown. They are not, however, known to cause any problems in a soil medium. It is hypothesized that the microbiology of sand may be different or inadequate to the extent that there is little competition for the *Pythium* species involved. It is believed that the *Pythium* species may be present in the old collar and apron soils of renovated greens. When the *Pythium* species comes into contact with the sand it is rapidly colonized and roots are infected. The *Pythium* infected roots may function adequately during mild growing conditions with damage occurring only during periods of stress. The fact that the disease remains a serious problem for about three years after reconstruction and then diminishes in severity also is suggestive of a sand microbiology imbalance. Over a period of three years, a high sand green acquires organic matter and probably some wind blown silt. These changes may provide the basis for development of a microbiology more typical of soil. With a larger and/or more diverse microbiology, the potential competition for the *Pythium* species may increase and result in a decrease in their activity and subsequently the disease. Other influences on the disease may include irrigation and fertility practices on sand greens, and potential mechanical injury of roots by sand particles.

Control of *Pythium*—induced root dysfunction is not promising with present technology. Contact and systemic fungicides specific for *Pythium* species are not effective for control of root dysfunction. The primary problem is that there is no effective means of getting the fungicides in the root zone and there also is some question as to their effectiveness in the root zone. At present, intense aerification with application of the fungicides into the aerifier holes may slow the disease, but this procedure will not stop the disease. Wetting agents in conjunction with the fungicides have sometimes proven useful. Unfortunately, our experience to date indicates that most efforts to control the disease chemically are futile and on most diseased greens the turf must be reestablished after the stressful period of the growing season.

Acknowledgement

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A home without a lawn to see lacks grandeur true externally.
by Dr. Charles Straham at 94 years Deputy Commissioner of Education, State of New Jersey 1922-1940.

When tillage begin, the other arts follow. The farmers, therefore, are the founders of human civilization.
Daniel Webster 1840

North America broke off from Europe and Africa 180 million years ago. *American Scientist* - Vol. 72. 1984. *Editorial Comment:* Plus or minus a few years.