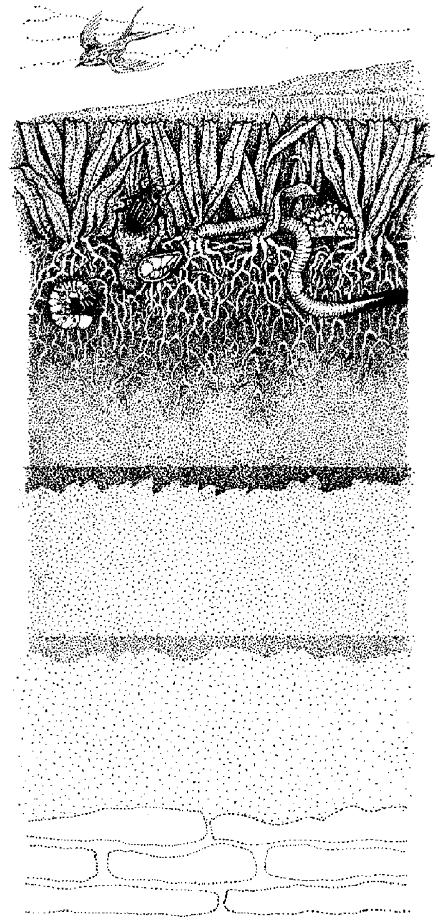
Cornell University Turfgrass Times

CUTT

Summer 1999 • Volume Ten • Number Two



It's A Watery World

In the education profession, we are always in search of a "teachable moment." A teachable moment occurs when the audience you intend to address is experiencing exceptionally good times or really bad times. It is at these times when we have their attention and they are likely to hear your message. This has happened several times in the last decade, especially around environmental issues such as pesticide use. Remember the bird kills associated with insecticide applications in the 1980's? More recently, the industry has become deeply concerned with the gray leaf spot disease that is devastating ryegrasses on golf courses. Gray leaf spot is capable of destroying scores of acres of rough and fairways in a matter of hours! Turf managers can't seem to get enough information about the disease, how it infects and how to control it. From an educator's perspective it is a perfect time to educate people on the basic tenets of pest ecology and plant pathology. ■

It follows then that the dry weather over the last few seasons that has culminated in the drought of 1999 in the northeast creates an opportunity for an important dialogue concerning a vital natural resource: water. How much do plants need? How best to apply? How to prepare and recover from drought? What if we could not use water any longer for turf management? We have a unique opportunity to discuss weather patterns, hydrology, soil physics and plant physiology. I for one am not going to miss it!

While we in the humid Northeast are discussing water use efficiency and drought stress management, in the arid Southwest, water use efficiency is a way of life. For example, many areas of the Northeast receive 30 to 40 inches of precipitation, while regions in the Southwest average between 2 and 12 inches of precipitation. When **the** most important resource becomes restricted for climatic or regulatory reasons, the turf industry in the Northeast feels the pinch quickly and then focuses on improved efficiency. Again out west, water use is closely monitored and irrigation management is a pre-

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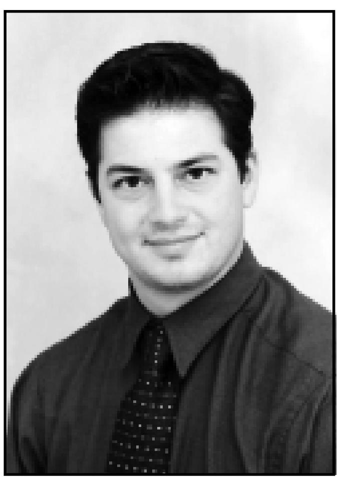
This Times

Short Cutts

It's New!

Turfgrass ShortCUTTS, ***a weekly link to turfgrass experts providing critical, timely information based on current weather conditions and the latest research, delivered to you by email or fax.***



Joe Heller, Senior Horticulture Consultant in Rockland County

Turfgrass ShortCUTTS Your Weekly Link to Turfgrass Information

It's July 15th and the Annual Member-Guest Tournament begins tomorrow. As you are driving around, scouting the course, you notice some areas that look droughty. It seems odd to you, since there has been adequate rainfall, and the soil seems moist. Is it wet wilt? Is it a disease? Gray leaf spot? You need to decide now!

Earlier in the season you signed up for the weekly report from the Cornell Turfgrass Program, *Turfgrass ShortCUTTS*, to keep abreast of current turfgrass management issues. Each week you receive a two page update on the latest weather reports, regional pest observations and recommendations based on the latest research from national experts. It arrives each Monday by noon either via email or fax.

You remember reading that Gray Leaf Spot was seen in the area and is often mistaken for drought stress. In fact, the *Turfgrass ShortCUTTS* experts indicated that irrigating will make it worse. A few recommendations are provided for control and you are able to decide on a course of action. The tournament is a success and everyone is raving about the turf conditions.

This is just one of many turfgrass issues discussed in *Turfgrass ShortCUTTS*, available to all turfgrass professionals for $50 per year via email, or $70 via fax. It is a small ex-pense for your link to national experts providing information based on current weather conditions and the latest research. Don't delay, the season is winding down and in today's world, current information could give you the edge you need to succeed. Contact Evie Gussack at (607) 257-8481 or <eg21@cornell.edu> for more information.

New Field Educator in Rockland County

It is our pleasure to welcome a new member to our turfgrass team in Rockland County, Joseph (Joe) Heller. Joe is a Senior Horticulture Consultant for the commercial landscape and turfgrass industry in Rockland County. In addition, he is an active member of the Hudson Valley Horticulture Team. Joe received his degree from SUNY Cobleskill and is currently pursuing an advanced degree through Empire College. Prior to joining Cornell Cooperative Extension Joe worked in retail nursery management and operated a landscape contracting business.

Joe has several exciting programs planned for the 1999-2000 season including a pesticide applicator training course; snow and ice management; a landscaper's education day; and a commercial driver license course. He is currently involved with the planning of the Cornell Turfgrass Short Course scheduled to be presented in the Hudson Valley in February 2000.

Back to the Future: The 2000 Short Course Season

The Cornell Turfgrass Short Course Season, under the leadership of Ms. Joann Gruttadaurio, has some new offerings and new opportunities. The 2000 season offers the introductory management course, as well as advanced topic-specific courses on the Cornell campus. Also, the 2000 season will bring the introductory Short Course to the Hudson Valley in February.

The Cornell Campus Series kicks off the week of January 10-14, 2000 with the Turfgrass Management Short Course. This is a return to the one-week format with an emphasis on the basics of managing lawn, golf and sports turf. Featured topics include fundamental principles of soil management; grass identification, selection, establishment, and primary care; integrated pest management; and weed, disease and insect diagnostics and control programs. As always, participants can expect a lively mix of lecture, discussion and hands-on laboratory experiences with the Cornell Turfgrass Team.

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Changing Landscape Management Behavior

Society is facing an interesting paradox regarding landscape management that might influence important education decisions. For the most part, industry economics suggest that people are increasingly more interested in paying for a high quality landscape or doing it themselves. On the other side, it seems that there has never been more concern for resource management and the environmental impact of landscaping practices than there is today. Desire and concern drives Best Management Practices (BMP) that preserve environmental quality and provide a pleasing landscape. BMP's are more knowledge intensive and it would be interesting to know what is the best way to educate people on these issues.

The Florida Cooperative Extension Service (FCES) instituted an Environmental Landscape Management (ELM) program to educate citizens on BMP's. There was a considerable amount of resources and focus invested in this program and the Extension faculty was interested in knowing what was the most effective delivery strategy. There were four groups of individuals in the study who were surveyed for their adoption of 39 landscape management practices from fertilization and watering, to soil testing and pest management. One group was the Master Gardener (MG) trainees who received both educational seminars and written publications on topics. A second group received only seminars, a third group only publications and fourth group did not participate in any education.

As you might imagine, the group that did not participate showed no improvement and even digressed with some of their practices, indicating that some education is good. Both the seminar only and publication only groups showed minor improvements in the measured areas, however, the MG trainees who received both seminar and publications on the information showed significant positive changes in their landscape management practices. It was suggested that seminars enable faculty to lay groundwork for the printed information and to motivate people to take action. A final note from a similar study indicated that people are likely to adopt environmentally friendly practices when they reduce their workload, incur no extra cost, conform to neighborhood norms, and prevent environmental damage.

(From: Israel, G.D., J.O. Easton and G.W. Knox. 1999. Adoption of landscape management practices by Florida residents. HortTech. 2:262-266.)

Roots of Summer Stress Tolerance

The summer of 1999 has demonstrated, once again, how the turfgrass industry is limited under periods of severe stress as a result of the genetic nature of our plant material. Cool season grasses, such as Kentucky bluegrass simply do not have the genetic capacity to sustain active growth under periods of high temperature and moisture stress conditions.

Researchers at Rutgers University have been exploring the genetic diversity of Kentucky bluegrass varieties for the last several years. Recently, research has been attempting to identify the specific mechanisms by which some bluegrass varieties are more able to tolerate summer stress conditions.

A field experiment was conducted in 1995 and 1996 to evaluate five stress tolerant and five intolerant varieties for canopy temperature, root and shoot growth as well as soil moisture depletion. Plots were maintained at 1.5" height of cut and fertilized to supply 4 lbs. of N per 1000 square feet.

The most fascinating result was the clear difference between stress tolerant and intolerant varieties when canopy temperature and stomate resistance was monitored. It was long suggested that *decreased* transpiration was an important strategy for summer stress survival. However, this research suggests that stress tolerant varieties are able to maintain water movement through the leaves while under stress, thereby providing transpirational cooling which likely sustains active growth during stressful periods. This transpirational measurement was supported by the soil moisture depletion observed at the 6" to 12" depth by the stress tolerant varieties. Interestingly, while there was no difference in root mass at the 6-12" depth, the tolerant varieties were extracting more moisture while intolerant varieties did not.

This work provides key observations that under conditions where a moisture reserve can be maintained deeper in the profile, there are summer stress tolerant bluegrass varieties are able to extract moisture, maintain transpirational cooling and sustain active growth. This information will be useful for breeders attempting to develop more stress tolerant varieties.

(From: Bonos, S.A. and J.A. Murphy. 1999. Growth responses and performance of Kentucky bluegrass under summer stress. Crop Sci. 39:770-774.)

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Scanning the Journals

A review of current journal articles

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Watery World

continued from front cover

Localized Dry Spots (LDS) occur when the sand grains become coated with organic acids that are thought to be a by-product of organic matter decomposition.

cisely managed practice with application limits set to keep the plants alive, but not assist with other challenges such as salt accumulation. Therefore, the question remains, what can turf managers do to maximize water use efficiency in a "watery world"? The first step is to understand some basic principles of water in the plant and soil.

A Liquid World

The majority of the earth's surface is covered by water, yet only about 1% is available for human consumption, recreation activities, agricultural production and industrial use combined. Additionally, water is the basis of all things biological. In fact most forms of terrestrial life (life out of the water) survive as a result of complex chemical reactions that function in water.

Specialized irrigation systems increase the precision of water application.

The water molecule possesses some unique properties that are worth being aware of so that water use efficiency can be maximized. Although water is an electrically neutral molecule (non-ionic), the way the two hydrogen and one oxygen (H_2O) elements are organized creates polarity, similar to a magnet where one end is more attractive to metal than the other. Polarity is vital to water movement through the plant-soil continuum. Specifically water polarity allows for association with other water molecules (cohesion) or with a solid surface (adhesion) and ultimately determines how much water will penetrate the soil and subsequently be available to the plant. Therefore, under drought conditions, as soils dry, the forces holding the water can be greater than the plant's ability to take it up.

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Interestingly, water movement through the plant-soil continuum is driven by simple forces that allow movement from a high concentration to a low concentration. For example on a warm dry day when the relative humidity (a measure of the moisture stored in the air) is low, water is literally pulled from the moist soil, through the plant and into the atmosphere. In fact it is this same pressure that then draws the water in the soil upwards and to the root surface. Comparatively, on warm humid days when the air is filled with water, the movement of water through the plant is limited because the concentration in the air is likely greater than that of the soil or plant. This has important physiological implications that will be discussed further.

Soil Water

The soil has chemical and physical properties that are intimately linked and influence water and nutrient movement and availability. The ability of the soil to aggregate from smaller particles and larger particles "bridging" together creates pores where water (or air) can be stored. Soils with a high clay content and a collection of smaller particles, create very fine pores that hold water very tightly. This is why many fine textured soils do not drain well and the water within the pores allows for the soils to compact more easily. In comparison, sandy soils with a high proportion of particle sizes greater than 0.5 mm (medium to coarse sand) have a greater amount of large pores that drain more easily and are less prone to compaction. What often confuses many turf managers is when they utilize sand as a growing medium or a topdressing on fields and the sand is very fine. Many fine sands, especially when improperly amended with organic sources such as peat or compost can compact to an equal degree as a clay.

Porosity that results from the structure of the soil allows for air water and nutrient dynamics. Each of these components fluctuate regularly throughout the soil profile. When soils dry the pores have literally exchanged the water with air. When smaller pores fill with air they can also be difficult to re-wet. This also happens on many sand-based greens that are regularly allowed to dry out for tournaments. Localized Dry Spots (LDS) occur when the sand grains become coated with organic acids that are thought to be a by-product of organic matter decomposition. LDS creates a hydrophobic situation where the adhesive force, between the water and the soil particle is less than the cohesive force between the water molecules. As a result the water is repelled. In droughty years the LDS condition can worsen as a result of the regular reliance on irrigation systems that may not have uniform coverage. Ironically, even when the water is eventually applied, it is repelled by the air filled pores in fine textured soils or the hydrophobic surfaces of sand particles.

Plant Water

As mentioned previously, water is the substrate for many biological reactions. It follows then that green plants, such as turfgrasses, require water for chemical reactions. However, water also serves an important cooling function as it passes through the plant from soil on its way to the atmosphere in a known as transpiration. This cooling is essential for the plant to maintain internal temperatures that are conducive to biological function. If the turfgrass canopy temperature rises and the transpiration is slowed, as it is on warm humid days when the air is filled with water, the plants experience heat stress.

Water loss from a turfgrass community is characterized as evapotranspiration (ET). ET is the total amount of water lost from evaporation from the soil surface and transpirational water from the plant surface. In most turfgrass situations, ET is almost entirely from transpiration as most of the soil surface is covered by vegetation. In fact, the measure of ET is where the recommendation to apply 1 inch of water per week is derived. On average, throughout the season in many parts of the country approximately 1 inch of water is lost via ET.

What seems as a simple "flow-through" process with water passing from the soil through the plant into the atmosphere, is actually highly regulated within the plant. On a simple level, the pores in the leaf surface, known as stomates are created by cells that are regulated by molecules that cause swelling and shrinking. The swelling and shrinking of these cells causes the pores to open and close, thereby regulating water loss. Additionally, a more complex process occurs under dry conditions. For example, as the soil dries, roots send chemical signals upwards to the region where growth occurs. These chemical signals are hormones, specifically abscisic acid (ABA). ABA triggers a reduction in leaf growth so that the plant can conserve water. ABA is a critical survival element for many environmental stresses such as drought and cold.

Specific Differences

Turfgrass species and cultivars vary widely in their water use and ability to tolerate drought conditions. Studies have indicated that cool season grasses use about three times the amount of water than warm season grasses to produce a gram of dry matter. Interestingly, cool season grasses experienced a 29% increase in water use when grown in a dry climate as compared to humid conditions. While warm season grasses, experienced a slightly larger 35% increase in water use when dry and humid conditions are compared. Therefore, it is not only "who" you are in the turfgrass world, but more importantly it is "where" you are. Obviously, this has important implications as we strive to use turfgrasses outside of their normal climatic adaptation.

Essentially when it comes to discussing the turfgrasses aspects of water management it comes down to two major issues; ability to produce deep rooting and consumptive water use. As breeders strive to develop more drought tolerant varieties, there are many traits that influence stress tolerance and to be sure it is under strict genetic control. Yet, ultimately a plant that can produce a deep root system and can down-regulate water use will be a significant improvement.

Currently, when selecting a turfgrass variety, knowledge of climatic conditions is essential. Recent research has indicated that Kentucky bluegrass varieties demonstrate different water use requirements depending on the humidity level, just as much as the species differential discussed previously. For example, under humid conditions one bluegrass variety has a very conservative water use rate, yet under dry conditions, the same conservative variety has a much higher consumptive water use rate as compared to other varieties.

A humid air mass reduces evapotranspiration as a result of high water content in the air.

The Biological End

The turfgrass manager who does not have at least a modest understanding of simple biological principles is likely to become frustrated with the current drought conditions. However, by understanding some simple concepts, one realizes how very little control we currently have over the turf's ability to survive when conditions become harsh. The process of improving the "biological end" of water issues is complex and only recently understood at the level that we might influence with genetic engineering. There are still important management implications from the "delivery end" where management (mowing and fertility) as well as, water quality and application uniformity significantly influence performance.

Frank S. Rossi
Cornell University Turfgrass Team

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The Mysterious Role and Composition of Humus

IPM

Integrated Pest Management

IPM Corner

Advantages are due to the living organisms of the compost as well as the partially degraded materials that provide the bulk. When compost is further degraded by microorganisms in the soil, it becomes humus, a gel-like mixture of soil minerals, remnants of the microbes, and organic matter.

Understanding the nature and value of humus is a worthy enterprise for turf grass managers because of the tremendous capacity of humus to increase the health of the turfgrass root system. In order to gain such an understanding, it is necessary to delve into the processes that turn organic matter such as compost into humus.

Humus is a substance with incredible properties. It can be the product of microbial decomposition of plant or animal tissue. Its exact composition can be very different depending on the nature of the starting material, the decomposing organisms, and the microclimate. We can compost animal manures or brewery sludge mixed with plant materials such as sawdust or leaves to yield partially decomposed material that is excellent for encouraging plant growth. Recommendations for the use of compost in fruit, vegetable, and ornamental gardens are nearly universal since organic matter is such an important soil amendment. Composts provide nutrients, increase the ability of the soil to retain nutrients rather than allowing them to leach away, and help to suppress disease-causing bacteria and fungi. These advantages are due to the living organisms of the compost as well as the partially degraded materials that provide the bulk. When compost is further degraded by microorganisms in the soil, it becomes humus, a gel-like mixture of soil minerals, remnants of the microbes, and organic matter.

Steps in Decomposition of Plant Debris

When a plant cell dies, the membrane surrounding the cell breaks apart, and the liquid or gel-like cell contents or cytoplasm leaks out. The cell membrane and cytoplasm are the most nutritious components of the cell, containing sugars, proteins, and oils. High in nitrogen and available energy, these cell components are easily digested by animals or microorganisms.

The next step in decay is much slower — the breakdown of the bulky cell wall structure of plant leaves, stems, and roots. Plant cells are supported by a cellulose wall that is like a rigid basket. Fibrous plant tissues may in addition contain thick cell walls reinforced with gluelike substances, lignin, cutin, waxes, or oils, all of which are resistant to moisture. Woody roots and stems have such secondary walls resistant to degradation by most organisms. However, even tree roots and trunks can be degraded by certain fungi that secrete special digestive enzymes. These biological catalysts breakdown the secondary walls, releasing sugars and other nutrients to the decomposing organism, and turn the wood to a soft, dark peaty material.

The organic matter that naturally falls to the ground includes hardwood leaves, conifer needles, tree branches, and the flowers, fruits, seeds, stems, and leaves of grasses and other annual and perennial plants. The time required for decay at the soil surface depends on the type of plant material, the temperature, whether it is buried, moist, and in an oxygen-rich environment, and whether the appropriate decomposing microorganisms are present.

Grass tissue resists degradation because of sturdy cellulose cell walls, lignins and waxes which humans can't digest, but ruminants can. Humans are limited in their ability to digest plant material by the enzymes secreted into the stomach, the acid conditions tolerated, and by the activities of the beneficial bacterial population that resides there. Wheat bran is considered roughage in our diet because it is high in cellulose and passes through the human system only partially digested. Ruminants like cows, goats, and deer can digest hay because of a specialized four-part stomach, with a microbial fermentation cycle followed by repeated chewing. Specialized beneficial bacteria thrive on chewed hay in the moist, warm culture of the stomach. The physical breakdown from chewing the cud combines with activity of the microbial enzymes. In this way, chemical cleavage releases soluble nutrients, valuable food substances both to the microbes and to the animal whose stomach is the incubator. The solids that pass through the gut are still rich in nutrients and living microbes.

The decomposition of grass tissue can take place in soils when given the right conditions: air, moisture, high nitrogen-to-carbon ratio, and an active microbial population. This soil process is important to the degradation of thatch, the layer of dead grass stems and lower leaves that forms a barrier between the roots and the green portion of the grass plant. A small amount of thatch is healthy, acting to shade the roots and cushion physical impacts. A thick layer of thatch can make chemical treatments less effective, absorbing pesticides and blocking dispersal into the root zone.

Contributions of Microbes and Earthworms

The decomposers in the soil contribute to the bulk of the organic matter. Earthworms take in soil mixed with dead and living organisms and pass it through their gut, depositing castings rich in digested substances and microbes. Their physical remains add to the soil organic matter. There are groups of fungi like the water molds that have cell walls made of cellulose or other unique variations of sugar chains bonded together. Bacteria and some fungi have cell walls made of chitin, a molecular structure similar in composition to the exoskeleton of insects and crayfish. Each type of cell wall can be broken down by certain decomposers that have the genetic ability to make the needed enzymes for release of the component molecules. This release provides nutrition for the decomposer or microbe, and left behind are undigested organic matter, secreted gluey substances, and dead microbial cells.

What is so Special About Humus?

Humus is the endproduct of ordinary decomposition. It is a mucous-like mixture of the most resistant tissues of plants and animals, and the dead cells of soil bacteria and fungi. Humus is a remarkable material, with a cation exchange capacity (CEC) several times that of clay particles. This means that humus can hold positively charged molecules (called cations), then release them later as the components in the soil water solution change. A soil with high CEC will retain nutrients on clay or humus, then release the nutrients, making them available to roots as the plant roots or microbes release hydrogen ions into the soil water. In acid soil conditions there is a high concentration of hydrogen ions, and cations such as calcium, potassium, or magnesium are exchanged more rapidly into the soil water. Humus and partially degraded organic matter retain water in a surface film that is still available to plant root hairs after the free water has drained away from the root zone. Humus will continue to break down very slowly over time, as weather conditions, nutrient availability, and microbial populations change. Tropical soils contain very little humus and organic matter since they are rapidly degraded and disappear completely at high temperatures.

The microbes of the soil make nutrients available to roots by degrading complex substances into simpler molecules. But how can humus change the texture of soil? This occurs because a natural byproduct of microbial decomposition is a gluelike substance, a sticky material used by fungi and bacteria to remain fixed to the surface of the material on which they grow or divide. These glues called glycoproteins become part of the colloid mixture that is humus, causing aggregates or larger particles to form in the soil. This results in a coarser texture if the soil is composed of clay, silt, or loam, a better soil for plants that is more friable, looser, and drains more freely. The microscopic root hairs will grow into the humus and organic matter, taking advantage of the added nutrients, beneficial rhizosphere microorganisms, and water retained by the humus. These root hairs have much more surface area than larger roots, such as those that grow rapidly into wet sand. Greater surface area leads to significantly more absorption of water and nutrients. A larger root system can support healthier top growth. In addition, the humus will retain water to provide a safety net in dry conditions.

Why Increase the Humus?

Why should a turfgrass manager try to increase the humus in the root zone? For three reasons: 1) humus increases nutrient availability for microbes and plants, 2) humus retains nutrients, reducing leaching, and, 3) humus improves soil texture through aggregation, increasing drainage.

The sources of organic matter in turfgrass soils are the original amendments at time of installation, grass clippings, thatch, and dead roots. In addition, soil insects, algae, earthworms, bacteria, fungi, and nematodes add substantially to the organic matter of the turfgrass root zone. Topdressing with compost is an excellent way to increase the organic matter, fertility, and microbial activity. Additionally, compost will reduce the problems of thatch layers, will help to suppress disease organisms, and over the long term will increase humus, reduce leaching, and improve the resilience of the turfgrass in times of stress.

When a nitrogen-rich compost is topdressed over turfgrass, the soil microbes will have a new source of nutrition. They will use the nitrogen from the breakdown of compost to increase the degradation of dead roots and thatch. The complex substances in the compost will favor a new balance of microbes with the specific ability to degrade the kind of organic matter present. There will be an increase in humus in the soil, leading to better nutrient-holding capacity (due to the increased cation exchange capacity and reduced leaching). Increased microbial activity will also speed up the degradation of pesticides in the soil. The high activity of microbes will tend to reduce the incidence and severity of turfgrass root rot diseases. After about three years of topdressing with compost, the improvement in the stand and resistance to drought and disease will be obvious. The health of the turfgrass and increased root surface area will reduce the necessity for pesticide applications. Understanding the microbial processes leading to decomposition of organic matter, including thatch and dead roots, will help move the turfgrass manager further along the integrated pest management continuum. Healthy turfgrass requires less maintenance and sets up the scenario for a more profitable season.

JANA LAMBOY, IPM SPECIALIST
CORNELL UNIVERSITY TURFGRASS TEAM

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Black Cutworm IPM: Are We There Yet?

IPM Corner

Northern areas are recolonized during the growing season by adult moths carried along storm fronts. Some suspect it may manage to survive farther north during mild winters but this has not been substantiated in New York.

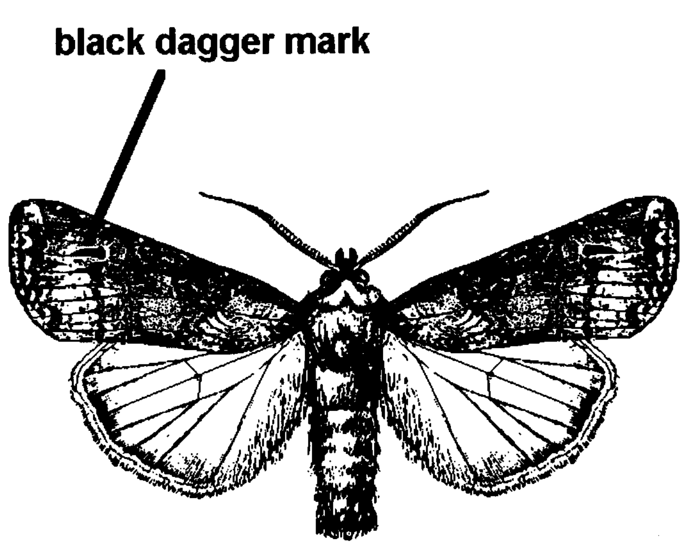
A major feature of any true IPM Program is the continual refinement that comes through reviewing our successes and failures. Golf Course Turf IPM has made great strides over the past decade and most major insect pests are far along the continuum, yet management of some pests remains far from "ideal". Such a pest is the black cutworm.

The Beast

In the U.S., the black cutworm, *Agrotis ipsilon*, overwinters well below the Mason-Dixon Line as pupae. Northern areas are recolonized during the growing season by adult moths carried along storm fronts. Some suspect it may manage to survive farther north during mild winters but this has not been substantiated in New York. They either land upon encountering colder air or precipitate out with heavy rains so can appear unexpectedly many miles from their origin. Once they recover from their flight, female moths lay their eggs, usually on blade tips, and larvae hatch in 3-6 days. They go through as many as 7 molts or instars in 3-5 weeks before pupating below ground. The larvae are active at night, burrowing into the thatch and soil to wait out the day. They feed on blades when young and stems when older, cutting off plants and dragging them into the burrow. This late feeding is the point where damage becomes visually obvious on greens.

Adult Monitoring

The initial appearance of adults in the north can be monitored using either pheromone traps or black light traps, set out early in the season (mid-March in southeastern New York), but both have their shortcomings. Black light traps are expensive, high maintenance and labor intensive but have the advantage of capturing both male and female moths (along with a wide variety of other insects). Pheromone traps are relatively inexpensive and simple to maintain but catch only male moths. The random deposition of storm-driven moths means there is no guarantee that zero captures means zero females nor any way to equate capture numbers to infestation levels, thus their usefulness is limited. A positive capture only means that chances are good that



females are also around and you may have larvae within a week. In agronomic crops, primarily corn, it is recommended that scouting for the damaging 4th instar should begin 168-300 GDD after first capture. On greens, damage would be readily noticeable by the time they reached 4th instar so the management decision should ideally be made prior to their reaching that stage.

Larval Monitoring

The standard method for monitoring larvae is the soapy water drench: 1 fluid ounce lemon-scented dish detergent per 2 gallons water applied to 2-3 sq ft of green and anywhere from 1-3 samples taken per green. The soap acts as an irritant, causing the larvae to emerge from hiding. The reliability of detecting young larvae by randomly sampling only two to six square feet of each green is questionable, particularly as young larvae are prone to falling back into their holes before being noticed. In addition it can be both time and labor intensive. Our experience has been that the soapy drench works best to confirm the presence of cutworm where suspect damage is already apparent. While this helps prevent misdiagnosis and a potential misapplication (cutworm damage superficially resembles dollar spot or ball marks) it doesn't serve the other goals of monitoring.

Management

Cultural recommendations include dumping clippings at 50 - 200 feet from greens to prevent newly hatched larvae from migrating back onto the green. Neither endophytic perennial ryes nor tall fescues are resistant however they shun feeding on Kentucky bluegrasses so a buffer of Kentucky bluegrass around a green may reduce the incidence of feeding (Chris Williamson, personal communication).

Of the bio-logicals, *Beauveria bassiana* reportedly has little effect and nematode results are inconsistent. This inconsistency is largely due to the added requirements nematode applications need to insure successful treatment. Closer attention must be paid to product viability and environmental conditions at the point of application. Timing to the appropriate life stage, in this case early instars, of the pest is critical. Our inability to consistently detect young larvae prior to damage not only hampers the effective use of nematodes, it precludes making an infes-

Black cutworm eggs cling to the tips of grass blades.

They feed on blades when young and stems when older, cutting off plants and dragging them into the burrow. This late feeding is the point where damage becomes visually obvious on greens.

Unfortunately, the "working threshold" we're often forced to use is: "See damage, confirm cutworm, treat for cutworm." While this may mean using less material than blanket applications, it restricts us to using products effective against the larger, later instars.

Black Cutworm

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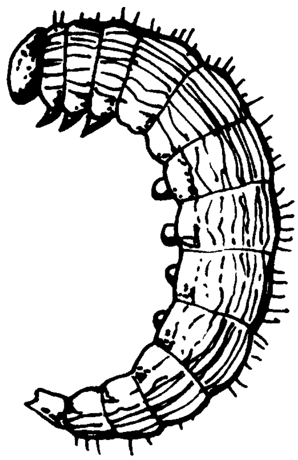
Cultural management options are limited and of unknown impact, biological options are also few and more difficult to utilize effectively, traditional chemical options will likely decline, and greater reliance will be placed on newer materials that require proper timing.



tation level decision based on an as yet to be determined threshold. As successive storm fronts may bring in waves of adults there is often a wide range of larval sizes present at any one time, further complicating the use of products targeted to specific life stages.

Traditional chemical materials registered in New York include; carbaryl (Sevin), acephate (Orthene), chlorpyrifos (Dursban), trichlorfon (Dylox, Proxal) along with the restricted use material, ethoprop (Mocap). As many of these are subject to FQPA their future availability is unknown. Newer materials available include halofenozide (Mach2) and spinosyn (Conserve) and may be preferable because of their lower mammalian toxicity. However, like nematodes, timing is an issue as they are most effective against early instars. Blanket applications applied 1 – 2 weeks after pheromone or black light capture may prevent noticeable damage from occurring but mean making applications blindly, without respect to need (both uninfested and infested greens being treated equally). Unfortunately, the "working threshold" we're often forced to use is: "See damage, confirm cutworm, treat for cutworm." While this may mean using less material than blanket applications, it restricts us to using products effective against the larger, later instars. The benefits of treating at that point is dubious as 1) damage has already occurred, 2) larvae may be nearly finished feeding so little damage is prevented unless several larval stages are present, 3) the population level of following generations may be reduced but is subject to infestation by later waves of migrating adults, thus the need for future treatments may be unaffected.

So Where Do We Stand?

The current options for monitoring either adults or larvae are unreliable for confirming presence or absence, inaccurate for proper timing of stage critical management options and inadequate to predict either treatment need or precise location. Cultural management options are limited and of unknown impact, biological options are also few and more difficult to utilize effectively, traditional chemical options will likely decline and greater reliance will be placed on the newer materials — materials requiring proper timing.

Where Do We Go From Here?

While the bulk of cutworm research is targeted to their role as pests of corn and other vegetables much of that information will, hopefully, be useful to turf situations as well. We've got a long ways to go with this pest and, with a fair number of other turf pests higher in priority due to their greater impact, it won't happen overnight. However, there are a number of research projects directed towards cutworm on turf, often in partnership with cooperating superintendents, so progress can be expected. We may not see the light but we are partly through the tunnel and headed in the right direction.

Gary Couch, IPM Specialist
Cornell University Turfgrass Team

Short Cutts

continued from page 2

The week of January 17-21, 2000 brings the encore presentation of the Advanced Turfgrass Short Course on Golf Turf Pest Management. This course was extremely successful and well received in 1999 by over 50 participants. Once again there will be national experts from all areas of pest management with an emphasis on improving your understanding of pest behavior, developing enhanced diagnostic skills and implementing environmentally responsible management programs. In fact, this year's course will have an entire session on selecting control programs based on their environmental impact.

The final offering of the Cornell Campus Series continues the Cornell Team's national emphasis on pollution prevention. The new advanced Short Course on Turfgrass Management to Preserve Water Quality will be offered the week of January 24-28, 2000 in partnership with Audubon International. This course will focus on management of golf and lawn turf from design and management for pollution prevention to communication and the development of a water quality protection program. International experts, as well as leaders from the Cornell Turfgrass Team will present the latest information from recently completed research on water quality. In addition, there will be important information on developing water quality management programs for properties interested in participating in the Audubon Cooperative Sanctuary Program.

Following an extremely successful three years on Long Island, the Turfgrass Management Short Course moves to the Hudson Valley the week of February 21-25, 2000. The one-week format will be identical to the campus-based short course and include hands-on laboratories and interaction with Team members. The location of the course is being investigated and will be announced in the next issue of *CUTT*.

If you would like information on any of the short courses, contact Joann, Director of Turfgrass Education at (607) 255-1792 or <jg17@cornell.edu>.

"Cornell On Course to Support Research"

Central NY GCSA Poa Annual Tournament

In an effort to bridge the gap between golf turf research and the golfer, the Cornell Turfgrass Team participated in the Poa Annual Research Fundraising Tournament held at the 2 golf courses at Rogue's Roost. They were not playing golf, rather the team members were placed strategically throughout the golf course to discuss how the research funds are put to work at Cornell. Golfers learned about grub scouting, weed control and disease diagnostics, as well as the importance of soil testing, preserving water quality, growing grass in heavily shaded areas. Many attendees commented how the information they learned will help them understand the challenges their golf course superintendents face as well as improving the quality of their own lawn.

"Get The Facts!"

Cornell Breast Cancer and Environmental Risk Factors Program

A few years ago the New York State Legislature, in response to citizen outcry for more information, established the Cornell Breast Cancer and Environmental Risk Factors (BCERF) Program. The BCERF program has a variety of resources and educational events available to raise awareness about what scientific information is telling us and needs to tell us about breast cancer and other forms of immune system ailments.

There are ad-hoc discussion groups held throughout the state and several regions have BCERF specialists in their county to address local concerns regarding breast cancer. Often these meetings include nationally recognized speakers in addition to experts at Cornell in toxicology and epidemiology. However, one of the most important contributions made by the BCERF program is the comprehensive scientific reviews of pesticides being conducted and published in various formats. Citizens can review the scientific evidence regarding pesticide use, breast cancer and other forms of cancer.

Recently, BCERF published extensive scientific reviews in addition to more easy to read fact sheets on 2,4-D and Diazinon, two commonly used pesticides in turf. If you would like copies of this or any other information published through BCERF you can access the program on-line at <www.cfe.cornell.edu/bcerf/>.

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Scanning the Journals

continued from page 3

Monitoring has become commonplace around the world and consequently a substantial database of water quality monitoring on golf courses is available to draw conclusions on the larger impact on water quality.

Nevertheless, the overall conclusion was that widespread and or repeated water quality impacts by golf courses are not occurring. In addition, none of the authors of the individual studies that were reviewed concluded that significant toxicological effects were occurring..

Golf Course Impacts on Water Quality

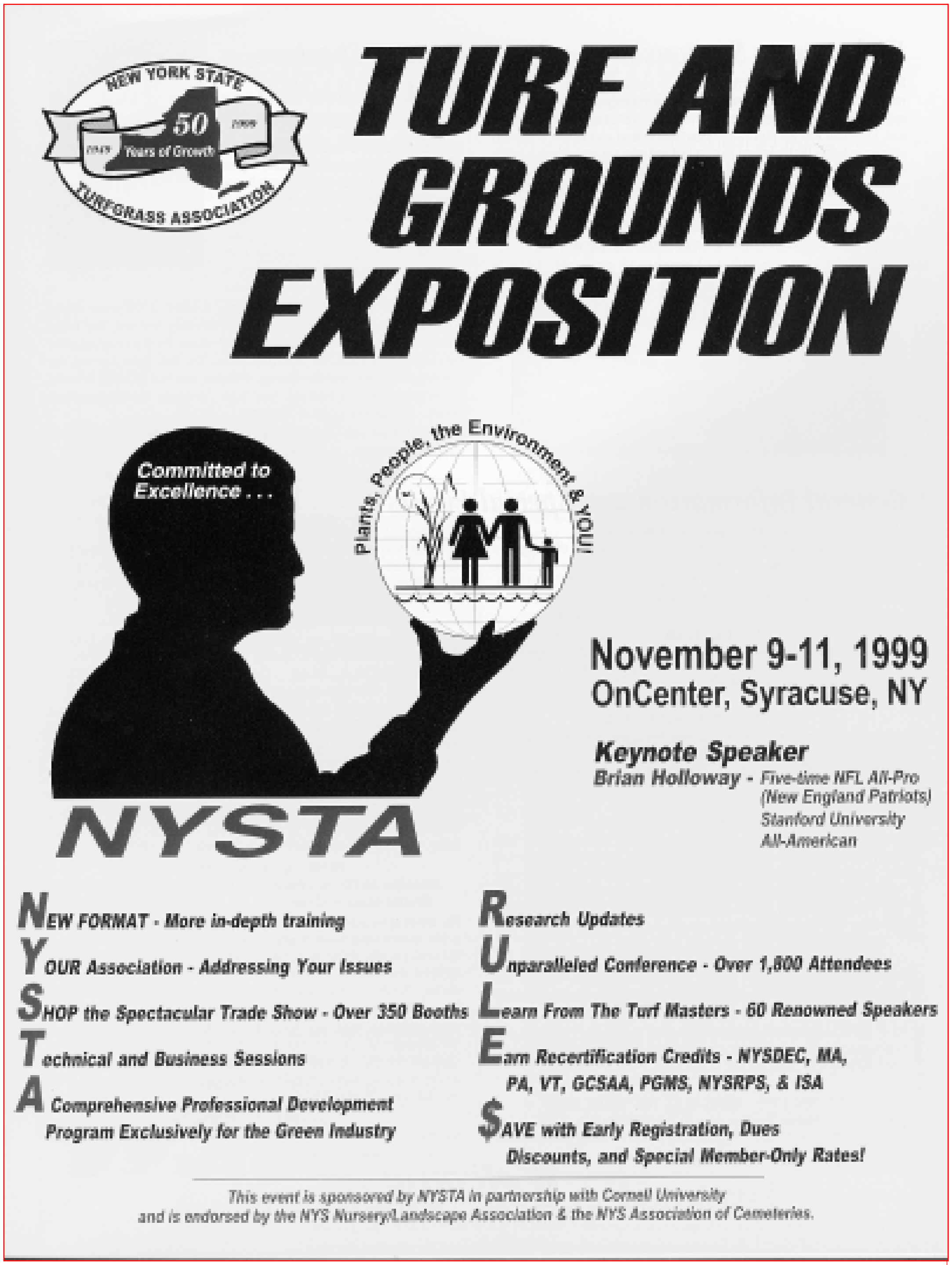
New golf courses continue to be constructed while significant concerns persist regarding sustainable land development and the potential impact golf courses on water quality. As a result of these concerns, local, state and federal government agencies have begun to require some form of water quality monitoring for nitrate-nitrogen and pesticides applied to golf courses for permitting and water quality maintenance purposes. Monitoring has become commonplace around the world and consequently a substantial database of water quality monitoring on golf courses is available to draw conclusions on the larger impact on water quality.

An environmental monitoring company received funding from the Golf Course Superintendents Association of America to identify water quality monitoring studies conducted on golf courses. Nineteen studies of 40 different golf courses across the country were included in this report that met stringent quality control measures for sample handling and laboratory analysis. This represents an important evolution in environmental research as many previously reported studies were conducted under highly controlled experimental conditions.

While the study presented some complicated data management challenges as a result of the lack of good geographical distribution (no sites in the mid-continent US), large amount of non-detectable samples and various prior land uses. Nevertheless, the overall conclusion was that widespread and or repeated water quality impacts by golf courses are not occurring. In addition, none of the authors of the individual studies that were reviewed concluded that significant toxicological effects were occurring. Still, regarding nitrate-nitrogen, while the maximum contaminant levels (MCL's) was not exceeded in surface water, 3.6% of groundwater samples exceeded MCL's. The percentage of pesticides detected in surface water and groundwater was 0.29 and 0.07% respectively. In addition, in several cases diazinon, not available for use on golf courses, was included in the percentages.

Interestingly, there were more and higher groundwater detects than surface water which is suggested to be related to the coastal plain courses in the study with flat sandy soils (similar to those found on LI). Finally, there was a slight statistical indication that detected pesticides tended to be of the more persistent and mobile type. Consequently, the importance of proper use of inputs and management, with some key information about pesticide and fertilizer chemical properties provides substantial water quality protection.

(From: Cohen, S.Z., A. Svrjcek, T. Durborow and N. Lajan Barnes. 1999. Water quality impacts by golf courses. J. Environ. Quality 28:798-809.)



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1999 Field Day Called "Best Ever!"

Cornell Turfgrass Field Day

At first glance, the Cornell Turfgrass Field Day '99, held on Tuesday August 17, 1999 at the Cornell Turfgrass Research and Education Center in Ithaca, NY, marked a great improvement in the weather from a stormy 1998. But the comparisons did not stop there. Most attendees remarked at the high quality research on display and the attention to detail paid by the faculty and staff at the Turfgrass Research Center.

Over 200 attendees were treated to a tour of Cornell's Robert Trent Jones Golf Course adjacent to the Turf Center where research with biological controls and a new irrigation system with GPS information available was presented. In addition, a comprehensive weed control research program headed by our new weed scientist, Dr. Leslie Weston, was available for review. After the traditional Cornell chicken barbeque, several honored guests were recognized including retiring IPM Director, Dr. Jim Tette, followed by the exciting presentation of the annual NYSTA contribution to the Cornell Turf Program. The afternoon sessions remained well attended despite much lingering in the trade show area. Afternoon tours focused on bentgrass putting green management, turfgrass disease control and environmentally responsible insect management programs, as well as several National Turfgrass Evaluations.

As this collage of photos shows, activities and speakers abound at the exciting 1999 Field Day.

Plans are underway to develop 2 acres of lawn and sports turf research at the Center as well as the new 5.5 acres of landscape horticulture research with herbaceous perennials, woody plant materials and weed control in ornamentals. These additions should make for an exciting first Field Day of the new millennium on Tuesday August 15, 2000! See you there.

Gray Leaf Spot

continued from back cover

As far as we know, there is no known resistance to gray leaf spot in perennial ryegrass or tall fescue germplasm and culturally we are limited to adjustments of cutting height, and management of leaf surface moisture by adjusting irrigation practices and air movement.

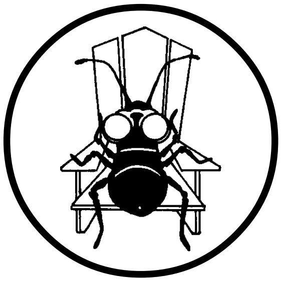
Essential to the management of this disease is an accurate and timely diagnosis, since symptoms may be easily confused with other diseases and abiotic stresses. This is particularly important because of the explosive nature of this disease. If the disease is allowed to reach epidemic proportions, nearly all control strategies may fail. However, if the disease is correctly diagnosed early in its development, many strategies may be effective. Golf course superintendents have typically relied on fungicide applications for the control of gray leaf spot. From among the fungicides currently registered in New York State, the most effective are those based on chlorothalonil (e.g., Daconil, Thalonil, etc.) and azoxystrobin (Heritage). Whereas Heritage may provide longer residual control than chlorothalonil, cost becomes an issue if superintendents move toward spraying roughs.

In summary, this is a disease with which we should be extremely concerned because of its extreme destructive potential. Turfgrass managers who are responsible for large areas of perennial ryegrass and tall fescue should keep close watch during the latter part of the summer and be prepared to deal with this nasty disease should it raise its ugly head.

Eric Nelson
Cornell University Turfgrass Team

As far as we know, there is no known resistance to gray leaf spot in perennial ryegrass or tall fescue germplasm and culturally we are limited to adjustments of cutting height, and management of leaf surface moisture by adjusting irrigation practices and air movement.

Gray Leaf Spot: A Potential Threat to Perennial Ryegrass and Tall Fescue



Pest Watch

Although this disease has been known for nearly 30 years, it had never been a serious problem on golf course turf until recently.

Under optimum conditions, the disease may progress rapidly over a 48 hour period, killing an entire stand of perennial ryegrass in 3-5 days.

From year to year, many turfgrass diseases seem to come and go. In some years, they can be quite destructive, whereas in other years, little or no damage may be observed. Over the decades, few diseases have raised panic annually among turfgrass managers, with the possible exception of Pythium blight and summer patch. In the past couple of years, another disease has been causing panic in the mid-Atlantic region of the U.S. and is raising concern among golf course superintendents in the Northeast. The disease is gray leaf spot caused by the fungus, *Pyricularia grisea* (= *P. oryzae* = *Magnaporthe grisea*). Although this disease has been known for nearly 30 years, it had never been a serious problem on golf course turf until recently.

The first major epidemic was observed in 1992 where it was restricted to the warmer, humid regions of the U.S., particularly through the mid-Atlantic region comprising Maryland, Virginia, Delaware. It has now reached many parts of the east and midwest, ranging from Pennsylvania to North Carolina and as far west as Nebraska and Oklahoma.

Major foliar symptoms of this disease are evident during the hot humid weeks of summer toward the end of July and the first part of August. Overall symptoms appear as small (1-2") reddish-brown patches that enlarge very rapidly, similar to those associated with Pythium blight or Brown patch. However, there is no foliar mycelium or smoke rings associated with these patches. Symptoms may also resemble those of heat or drought stress. However, upon visual inspection of leaf blades, a water-soaking and yellowing appearance of the leaf tips is first observed along with distinctive leaf spots. The circular spots may take on a grayish or grayish-brown appearance with purple to dark brown borders and a yellowish halo. These lesions may resemble those caused by species of *Dreschlera*. Under optimum conditions the disease progresses rapidly with the lesions coalescing causing an overall blight of the foliage. Grass blades may take on a twisted appearance and in the early morning hours may appear to be felted or fuzzy. This is due to the massive production of very characteristic spores in the lesions. This massive production contributes to the destructive nature of the disease, since vast amounts of inoculum are available for infection.

Under optimum conditions, the disease may progress rapidly over a 48 hour period, killing an entire stand of perennial ryegrass in 3-5 days. Hot humid weather where leaf blades remain moist for prolonged periods of time is ideal for disease development and symptoms are often more severe on south-facing areas. Symptoms are also typically more severe in higher cut turf such as in roughs and on fairways as opposed to putting greens, since canopy humidity is maintained at a higher level.

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