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"The summer of 1995 was one of the worst on record in the Mid-Atlantic region. Twenty eight consecutive days over 90° during a period of thirty straight days without rain. Talk about stress!!! We added Macro-Sorb® to our normal IPM program and experienced little or no turf loss — fairways, tees or greens. I'm convinced that Macro-Sorb® made the difference."

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Golf Course Superintendent
Hillendale Country Club
Phoenix, Maryland

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Circle No. 130 on Reader Inquiry Card

A - White grub populations and the efficacy of control can be affected by weather.

B - Natural enemies, such as this beetle larva dining on a caterpillar pupa—can be affected by weather.

C - The hot, dry weather of North Carolina caused sporadic outbreaks of sod webworms, as the moths laid eggs in drought prone areas.

tant by the negative consequences of hot, dry weather. Additionally, hot, dry weather often moves the insects deeper into the soil, and therefore more difficult to control. Many turfgrass managers irrigate sites before treatment. By thoroughly soaking the soil—two to three days in advance for white grubs and one day for mole crickets—two important functions are accomplished. First, the irrigation will cause the insects to move closer to the soil surface and be more susceptible to the control measure. This pre-irrigation also reduces the insecticide binding in the organic matter near the surface. The post-application irrigation is still required immediately after treatment.

Biological materials, such as entomogenous nematodes are just as susceptible (if not more so) to hot, dry conditions as conventional synthetic insecticides.

A good scouting program and attention to detail while applying insecticides can help you manage insect pests through adverse weather conditions. **LM**

TURFGRASS PEST CONTROL CALENDAR

When to scout for insects and mites

Pests	I*	P**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ants	II	A			S or Gr									
Armyworms and cutworms	III	A						S						
Bees and wasps	II	A							S					
Billbugs	III	D,E,F					S or Gr							
Chinch bugs	III	B						S						
White grubs	I	A			S or Gr					S or Gr				
Green June beetles	I	A				S					S			
Ground pearls	III	A						M						
Leafhoppers and spittlebugs	II	A						S						
Mole crickets	I	G,H			S or Gr					Ba				
Sod webworm	III	C,D,E,G						S or Gr						

*Degree of importance as pest: I= Important pest, frequent occurrence; II= Usually present, but generally not a pest; III= Occasional pest, treat when detected.

**Preferred grass species: A= Centipedegrass, fescue, and many other grasses; B= Saint Augustinegrass; C= Fescue; D= Bluegrass; E= Bermudagrass; F= Zoysiagrass; G= Bentgrass; H= Bahiagrass.

S= Sprays; Gr= Granules; Ba= Baits; M= Maintain the turf in healthy condition, irrigate.

Past experience a guide for new year

North

by JOHN WATKINS, Ph.D. / University of Nebraska

The 1995 growing season was a prime example of the ever-changing environment of the American Great Plains.

For much of the nation—the East and Midwest in particular—the spring weather was cold and wet, followed by a sudden onset of hot, dry weather that lasted the rest of the growing season. Several areas of the country set records for days without measurable precipitation, making it difficult to maintain quality turf.

Putting greens were thinned and did not respond to cultural practices. Residential, commercial, sports and other turfs were stressed to the limit, and irrigation bills were out of sight. In addition, the heat, drought and humidity contributed to leaf spot, melting out, dollar spot, fairy ring, necrotic ring spot, summer patch and nematode injury.

Rare maladies

Turfgrass managers were confronted with diseases that previously had not been problems or had rarely occurred in an area.

Only once in the 21 years

PHOTOS COURTESY DR. WATKINS

Red thread damage, relatively rare in the Midwest, was found on bentgrass greens and ryegrass fairways during summer's heat.

prior to 1995 had I seen red thread. Within a two-week period in May, half a dozen golf course superintendents called to report significant red thread damage to bentgrass greens and ryegrass fairways.

With air temperatures in the 90s and soil temperatures at a two-inch depth in the low 100s, putting greens died merely because the turf did not have a sufficient root system to maintain transpiration and tolerate the heat.

Because of the cold, wet spring, root depths were shallow (two to three inches), and the roots could not supply sufficient water to compensate for water lost to hot, dry, windy conditions. Plants died from drought stress and the greens were thin in areas.

Other factors contributed to the demise of putting greens as well:

- low mowing height;
- nitrogen-starved turf;
- rootzone layering.

Golf superintendents faced with similar problems this year could aerify and topdress with appropriate sand or mixes to overcome rootzone layering and support good root system development going into summer.

A balanced fertility program to prevent starvation and raised mowing heights also would help. These practices may decrease putting speed, but rolling, topdressing, grooming, double-cutting or using plant growth regulators can help regain some speed. Light, frequent irrigation in the afternoon to keep the rootzone moist may inhibit root pathogens and root-feeding nematodes.

Drought strikes

Diseases and plant pathogenic nematodes also injure turf during drought periods.

The symptoms of leaf spot and melting out, which are fungal turf diseases, range from small oval spots on leaf blades to fading out of the turf, to extensive crown and root rotting. The leaf spot stage is most evident during wet weather with temperatures between 70° and 90° F.

At temperatures above 80° F, necrosis of the entire leaf blade causes leaf blight. As leaf blighting progresses, the turf fades to brown. During hot, dry weather, leaf sheaths, crowns and roots become infected, causing thin, open areas in the turf. Plants with severe crown and root rot usually die from the heat and drought stress.

Symptoms on bentgrass differ from those of Kentucky bluegrass and fine fescues. When bentgrass golf greens are infected, they have a smoky blue cast that progresses to a yellowing and, finally, blighting of the leaves and thinning of the turf. Injury to the bentgrass usually is more severe when it is growing under soil moisture stress or when it has been overfertilized with nitrogen.

Unsightly nuisance

The trend in golf green management toward lower nitrogen rates causing the darker green fairy rings were quite visible during May and June. They used the peat in the greens mix as a nutrient base and were abundant because of the extended cool, wet spring.

At that stage, fairy ring on the green is more an unsightly nuisance than a threat to the turf. The real problem comes from the fairy ring mushroom's mycelium that infiltrates the soil below the ring. It is hydrophobic and impervious to water, causing the grass immediately above the ring to die from lack of moisture during droughty periods. Aerifying the green and applying the fungicide flutolanil (ProStar) suppresses fairy ring.

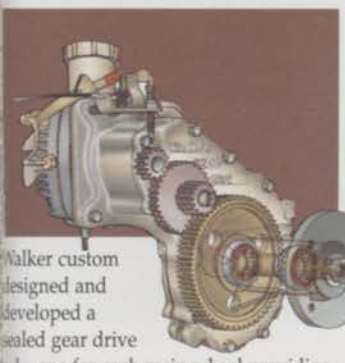
Drought stress also can predispose even well-managed turf to dollar spot. Warm days, heavy dews, dry soils and nitrogen-deficient turf are ideal conditions for dollar spot. Persistent drought periods accentuate dollar spot injury and hinder recovery when control measures are implemented.

In a two-year field trial, we obtained satisfactory control of dollar spot on bentgrass with 4-6 lbs. of N/1000 sq./ft. The nitrogen was a slow-release fertilizer applied monthly from May

Summer patch may appear when wet weather is followed by hot, dry periods.

Nematode damage: a non-descript yellowing and thinning of bentgrass and a decline and death of bluegrass.

WALKER DUAL HYDRO-AXLE



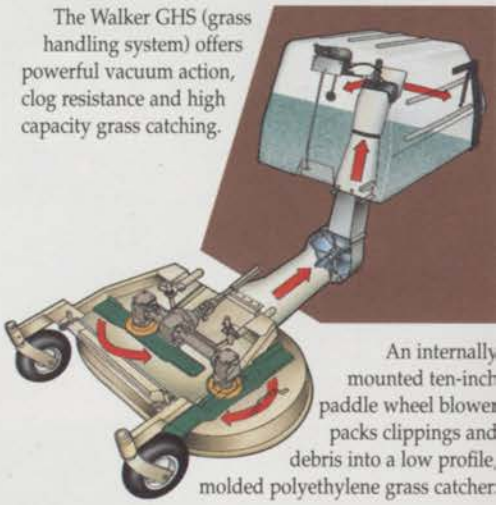
Walker custom designed and developed a sealed gear drive axle, one for each main wheel providing dual-hydrostatic performance. The hydrostatic transmission bolts directly to the gear case, providing a completely sealed, maintenance free drive unit.

ANATOMY OF A WELL DESIGNED MOWER

A Walker Mower is like no other. These rugged mid-size machines are built for the rigors of daily commercial operation and designed to mow virtually any property – places with rolling contours, irregular shapes, tight corners and open spaces.

EXCLUSIVE GRASS HANDLING SYSTEM

The Walker GHS (grass handling system) offers powerful vacuum action, clog resistance and high capacity grass catching.



An internally mounted ten-inch paddle wheel blower packs clippings and debris into a low profile, molded polyethylene grass catcher.

The secret to getting the job done quickly and easily is a maneuverable machine with easy-to-operate controls. With Walker's patented combination of Forward Speed Control and steering levers, only gentle fingertip pressure is needed to put the machine through its paces. No other mower operates this easily. Forward/reverse, zero radius turns and braking are accomplished by lightly pulling the steering levers while Forward Speed Control adjusts and holds forward speed, functioning as a "cruise control." The operator relaxes since it isn't necessary to hold the steering levers when cruising forward.

EXCLUSIVE EASY OPERATING CONTROLS

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- Operator comfort – large contour molded seat.
- Compact overall size permits mowing and trimming in tight areas – eliminates extra trimming operations.
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- Mowing deck "floats" and follows ground contour with flexible deck suspension and spring counterweighting.
- Low center of gravity assures balanced and safe operation, even on slopes.

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QUICK MANEUVERABILITY DOES THE JOB FAST

COMPACT AND MANEUVERABLE

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- 11-HP Kawasaki FE350 engine
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- 36- or 42-inch cutting width

MODEL C

- 16-HP Kohler Magnum single cylinder engine
- Dual hydro-axle
- 36-, 42-, 48- or 54-inch cutting width

SIDE DISCHARGE

For operators who never want to collect grass clippings or vacuum, all four basic tractor models are available in the side-discharge configuration.

MODEL D

Water-Cooled Engine For Long Life And Economy

- 16.5-HP diesel or 21-HP gasoline water-cooled, 3-cylinder Kubota engine
- Shock mounted instrument panel
- Manual PTO clutch and brake
- Dual hydro-axle
- Dual tail wheels (extra flotation)
- Handles all decks

MODEL T

Mowing Maintenance Professional Use

- 20-HP Kohler OHV V-Twin engine
- Optional 25-HP high performance engine
- Shock mounted instrument panel
- Manual PTO clutch and brake
- Dual hydro-axle
- Dual tail wheels (extra flotation)
- Handles all decks

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Three grass handling system (GHS) decks available in 36-, 42- and 48-inch cutting widths.

Four side discharge (SD) decks available in 36-, 42-, 54- and 62-inch cutting widths.

42-inch mulching deck.

NOTE: All mower decks are interchangeable and will fit on any tractor, however, GHS decks will not function on the SD Model and Model S and Model C should be limited to maximum widths of 42- and 54-inch, respectively.

ATTACHMENTS

A 46-inch dozer blade, with quick-change implement hitch and power lift, is useful for moving snow, loose dirt and gravel.

A 47-inch rotary broom for lawn dethatching and raking, and for sweeping debris or light snow on hard surfaces (quick-change implement hitch required to mount broom).

Two snowblowers: a 36-inch single stage, manual lift and a 42-inch two stage, uses quick-change implement hitch and power lift. Optional soft cab.

Working with the GHS vacuum, the spring tine dethatcher removes and collects lawn thatch in one pass.

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through October. Although 6 lbs. of actual N per season is too high for a putting green, it is not too high for residential turfs. In this trial, dollar spot suppression at the 6-lb. N rate was comparable to that obtained by fungicides. This illustrates how a balanced fertility program can manage dollar spot.

Turf destroyers

Necrotic ring spot and summer patch are two of the most destructive, stress-related turf diseases. Necrotic ring spot destroys root systems during cool weather; summer patch destroys them when wet weather is followed by hot, dry periods.

Symptoms of either disease are virtually indistinguishable. Turf will show 6- to 12-inch circular or semi-circular patches, giving the area a pockmarked appearance. The dead grass is light tan and matted, and many of the patches will have a tuft of healthy grass in the center—the "frog-eye" symptom. Diseased roots will appear dark brown.

On established turfs, the most important control is to eliminate plant stresses that favor disease development. Avoid management practices that promote rapid top growth at the expense of root development, and keep adequate moisture in the rootzone by lightly and frequently irrigating.

When you scout for nematodes, take 20 core samples per 1000 square feet.

Keep thatch and rootzones moist. Applying compost materials or organic fertilizers can increase microbial activity, and certain microbes partially inhibit fungus that causes necrotic ring spot or summer patch. Also, other naturally-occurring fungi that compete with the pathogens for food help keep diseases in check. During extended dry spells, beneficial microbe activity is slowed or even suppressed, giving the pathogen a distinct advantage. A moist rootzone helps to reduce the stress of dry spells.

Other practices to control necrotic ring spot or summer patch include a balanced fertilizer program with slow-release nitrogen fertilizers and a fungicide program. Benzimidazole-type fungicides can be applied curatively. Other fungicides can be used preventively in early fall or mid-spring. Apply them with sufficient water to drench them into the rootzone.

If you're establishing new turf, avoid planting pure stands of susceptible Kentucky bluegrasses. Use a blend of improved drought-tolerant cultivars or mix in 15 to 20 percent, by weight, of the newer brown-patch-resistant turf-type perennial ryegrasses with the Kentucky bluegrass blend.

The improved drought-tolerant cultivars will be less prone to stress and thus, less prone to summer patch. Remember, blends or mixtures are only as good as their components, so choose your cultivars carefully. □

SYMPTOMS OF COOL-SEASON TURFGRASS DISEASES

Disease	Key symptoms	Control strategy
Leaf spot/ melting out	1) dark spots on leaves 2) yellow, thinning turf 3) brown roots and crowns	1) use resistant cultivars 2) fertilize properly 3) irrigate properly 4) apply fungicides
Dollar spot	1) bleached lesions on leaves; reddish-brown margins 2) four- to six-inch patches of straw-colored turf 3) silver dollar-sized, bleached spots on bentgrass greens	1) use resistant cultivars 2) increase the nitrogen level 3) irrigate properly 4) apply fungicides
Fairy ring	1) circles of dark green grass some with dead areas in the ring	1) remove infested sod and soil; replace with clean soil and reseed 2) aerify and irrigate 3) spot treat with flutolanil
Necrotic ring spot	1) pockmarked circular depressions in turf with healthy tufts ofgrass in centers 2) brown to black roots and crowns	1) use resistant cultivars 2) raise mowing height 3) use light, frequent irrigation 4) apply organic fertilizers 5) aerify 6) apply fungicides
Nematodes	1) yellow, wilted, thinning turf 2) reduced root system with brown lesions on roots	1) sample the affected area, obtain a nematode analysis 2) fertilize properly 3) irrigate properly 4) raise the mowing height 5) apply a non-fumigant nematicide, if available

SOURCE: DR. WATKINS

For warm-season disease control: know your turf!

South

by BRUCE MARTIN, Ph.D. / Clemson University

Diseases can seriously limit the successful culture of warm-season turfgrasses. Fungi are most of the living causal agents of disease in warm-season grasses, but nematodes are a problem, too, particularly in sandy soils.

Successfully managing diseases in warm-season grasses depends on knowing the requirements of the particular grass in question, the biology of the pathogens, and good turf horticultural practices. Pesticide applications are valuable in an overall integrated pest management system, but they must be used responsibly.

Brown patch

A major disease of cool-season grasses, brown patch also commonly attacks warm-season grasses, including bermudagrass, St. Augustinegrass, centipedegrass and zoysiagrass. The primary causal agent is *Rhizoctonia solani*, but the strain which causes the disease differs from those encountered as pathogens of cool-season grasses.

Brown patch symptoms appear in the spring, as the turfgrass is breaking dormancy, or in the fall, as the turfgrass approaches dormancy. Individual disease patches may be 20 or more feet in diameter. Shoots along the outer border of patches usually are yellow due to rotted leaf sheaths near the soil surface.

Dollar spot

This disease occurs on all of the warm-season turfgrasses, but gets severe in bermudagrass

and zoysiagrass. Best conditions for dollar spot are warm, humid weather. Dollar spot can be more severe on nitrogen-deficient turf or turf that has become drought stressed before rain or high humidities occur.

Symptoms differ depending on the grass's height of cut. On turf cut low, patches of about one to two inches in diameter develop. On higher-cut turf, patches may exceed five inches in diameter. Characteristic leaf lesions are a bleached tan with distinct reddish brown or purplish margins. Leaves may become girdled. In early morning, it is not uncommon to see a gray mycelial growth.

Spring dead spot

Spring dead spot of bermudagrass occurs in transition zone areas of the U.S. It is common in the Piedmont and mountain areas of the Carolinas and Georgia, but rare in the coastal regions. Hybrid bermudagrasses are particularly susceptible, but common types may also be afflicted. Several fungi probably cause this disease. All are relatively slow-growing, root-colonizing fungi.

Symptoms include dead circular areas of turf, two or three feet in diameter, found in spring as bermudagrass breaks dormancy. Patches of diseased turf may persist for several years. Older patches develop a "frog-eye" symptom with healthy grass in the center.

Generally, spring dead spot develops in turf that is three to six years old. Excessive thatch, late-summer nitrogen applications, and low temperatures in winter predispose turf to spring dead spot.

Gray leaf spot

Gray leaf spot is caused by *Pyricularia grisea*, a very common disease of St. Augustinegrass occurring in hot humid weather. It is more severe in new turf, in shady locations with poor air movement.

Infections occur on leaves and stolons, first as small brown spots with a distinct brown color, to a purple border around the infected tissue. Lesions may become very numerous and expand to completely consume leaves and girdle stolons. Severe infections may leave turf with a scorched appearance. The disease is sometimes called "blast" due to this symptom.

Leaf spot

Bipolaris sorokiniana causes leaf, crown and root diseases of bermudagrass and zoysiagrass during warm, wet weather in mid-summer. The diseases start as leaf spots, and may progress to crown and root rots. *Exserohilum rostrata* has been reported to cause a leaf spot of St. Augustinegrass and bermudagrass. However, these diseases are rarely severe where these grasses are cultured in open, sunny locations, with good soil drainage. If they occur, it may be a sign of other stresses to the turf that can be managed culturally.

On bermudagrass or zoysiagrass, small dark brown lesions appear on leaf blades and sheaths and may expand to larger, irregular, straw-colored lesions. Stolons and roots may develop a dark, or dry rot. The turf may brown and thin, over a period of weeks or months.

Pythium diseases

More of a problem in cool-season grasses, some Pythium species cause general decline by infection of roots.

St. Augustinegrass is susceptible during prolonged warm, wet periods. Poor surface and subsurface drainage favors pythium fungi, and encourages algae in areas where disease has weakened the grass.

Fairy ring

Symptoms appear as rings or arcs of green, stimulated turf which may be accompanied by declining grass and mushroom formation. Problems develop when mushroom mycelia accumulate in the soil and dry it out. Fairy rings may persist and increase in diameter over years. The fungi may colonize old roots, stumps, or thatch, or may be mycorrhizal on living trees. Newly-constructed putting greens may develop infestations after only a few months or years.

Nematodes

Turf infested with damaging nematode species appears unthrifty; weeds invade weak or dead areas. Infested areas tend to wilt prematurely, even when adequate soil moisture is available. In most cases, nematodes occur in very sandy soils. **LM**

CONTROL PRODUCTS FOR WARM-SEASON TURF DISEASES

Brown patch	Eagle WSP; Daconil 2787F; Daconil 90WDG; Daconil Ultrex; Prostar 50 WP; Bayleton 25 WP; Banner 14.3EC; Rubigan AS; Chipco 26019 50WP; Chipco 26019 23.3%F; Fore 37%F; Fore 80WP; Terraclor 75 WP; Turfside 10G; Curalan 41.3% F; Curalan DF; Cleary's 3336 50WP; Cleary's 3336 46%F; Sentinel 40WG
Dollar spot	Eagle WSP; Daconil 2787 F; Daconil 90WDG; Daconil Ultrex; Banner 14.3 EC; Bayleton 25WP; Curalan 50WP; Curalan DF; Rubigan AS; Chipco 26019 50WP; Chipco 26109; 23.3%F; Fore 80WP; Cleary's 3336 50WP; Cleary's 3336 46%F; Vorlan DF; Vorlan Flo; Sentinel 40WG
Spring dead spot	Rubigan AS; Eagle WSP
Gray leaf spot	Daconil 2787F; Daconil 90WDG; Daconil Ultrex; Banner 14.3%EC; Sentinel 40WG
Leaf spot	Daconil 2787F; Daconil 90WDG; Daconil Ultrex; Chipco 26019 50WP; Chipco 26019 23.3%F; Banner 14.3%EC; Curalan 50WP; Curalan Flo; Vorlan DF; Vorlan Flo; Fore 37%F; Fore 80WP; Eagle WSP
Pythium diseases	Aliette 80WP; Koban 30WP; Subdue 2E; Subdue 2G; Banol 6E
Fairy rings	Prostar 50WP
Nematodes	Mocap 10G; Nemacur 10G; Nemacur 3E

Note: each product has specific use rates and intervals. Read labels and follow specifications as listed on label.

SOURCE: DR. MARTIN

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