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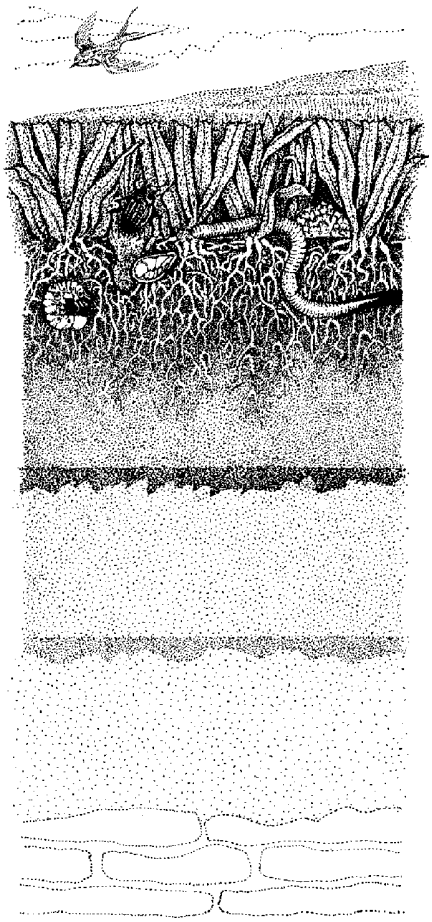

Managing White Grub Infestations

White grubs found in turfgrass are the immature forms of several kinds of scarab beetles. In high populations they can cause serious damage to lawns and golf courses. Late summer scouting for grubs in the soil below turf is the best way to determine where treatment is necessary. Treatment can be done while the grubs are small and susceptible to management, before heavy feeding begins in late September. Japanese beetle and European chafer grubs are the most important turf insect pest in New York State. Both species have life cycles that are similar in terms of basic biology and time window of sensitivity to biological and chemical controls. ■

Japanese beetle grubs overwinter as a third instar larva in the soil below the frost line. In spring, they move up in the soil to feed on roots, then pupate for one to three weeks within the cast skin of the grub. As the insect matures the cover splits and the adult beetle is ready to emerge. Japanese beetle adults crawl out of the ground in late June and early July. They can fly as much as a half a mile a day. The adults feed on the foliage of over 300 different species of plants. The beetles mate, and females are ready to lay eggs about one week after emergence. The female beetles lay 40 to 60 eggs in the soil over a two to three week period. Eggs hatch within two weeks into first instar and feed on roots for three to four weeks. These grubs molt and become second instars that feed for three to four weeks. The grubs molt again to become third instars by the middle of September. They continue to feed until they reach full size before winter. As temperatures drop in the autumn, the grubs migrate down in the soil.

European chafer grubs have an annual life cycle similar to Japanese beetles except that they feed later into the fall and start feeding again during warm spells in the winter. European chafer adults usually emerge slightly earlier in the spring than Japanese beetles. European chafer adults emerge at dusk and are attracted to lights and vertical objects in the landscape, often forming large swarms around small trees. Adult European chafers do not feed, staying above ground just long enough to mate. Mating pairs of European chafers fall from the trees and crawl back into the turf where females lay several dozen eggs over several days.

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Short Cutts

The Golf Turf Short Course will offer over 3 "tested" CEU's for GCSAA Certified Superintendents, which generally requires 2 to 3 trips to the national conference to achieve.

NYSTA and Cornell Turfgrass will offer a "field training" session on sports turf management Tuesday, October 6, 1998 at Doubleday Field in Cooperstown, NY.

Cornell Turfgrass Short Course Sessions for 1999

As announced in previous issues of *CUTT*, your Cornell Turfgrass team will be altering the traditional schedule of Short Course sessions to address the needs of our short course alumni, growing industry trends in specialized golf and sports turf areas, and to offer advanced training to established professionals toward certification.

The January Short Course will now be offered in two one-week sessions, starting Monday January 4th through Friday, January 8, 1999 with the Sports Turf Short Course addressing topics in athletic field design, construction, maintenance, and renovation. In addition, roundtable discussions will be held on communicating with coaches, presenting and justifying your budget, and addressing concerns over pesticide use.

The second week of the Short Course, from January 11 through January 15, 1999 will be focused on Golf Turf Management, offering advanced topics in design and construction, golf turf soil and nutrient management, innovative pest management programs less reliant on pesticides, and annual bluegrass management issues. Specific topic development will involve creation of curriculum teams that will include industry leaders, extension educators, and the Cornell Turfgrass Team. The Golf Turf Short Course will offer over 3 "tested" CEU's for our GCSAA Certified Superintendents. This amount of "tested" CEU's has traditionally been available only at GCSAA seminars, andgenerally requires 2 to 3 trips to the national conference!

Finally, for the third year of our commitment to the green industry on Long Island, we will be offering the Cornell Turfgrass Short Course on Long Island from February 15 through February 26, 1999. This is the traditional two week course for industry professionals that addresses the broader areas of turf management, with particular breakout sessions on golf, sports, and landscape management. Of course, the valuable hands-on laboratory sessions will be offered for students to identify grasses, weeds, and insects, understand soil physical properties, and learn equipment calibration.

If you'd like more information on the Short Course sessions for 1999, contact Joann Gruttadaurio, Director of Educational Programs for the Cornell Turfgrass Team, at (607) 255-1792.

NYSTA Sponsors Sports Turf Management Sessions

The New York State Turfgrass Association in partnership with the Cornell Turfgrass Program will be offering two "field training" sessions on sports turf management, to address the growing need of scholastic and municipal grounds and sports turf managers. These sessions are scheduled for Friday, July 24 at Frontier Field in Rochester, NY and Tuesday, October 6 at Doubleday Field in Cooperstown, NY.

The hands-on oriented sessions will be offered on site assessment to solve existing problems, sports turf IPM, spreader calibration, infield skin care, and sports turf soil management. Session leaders include Kevin Trotta from the North Rockland Schools, Jim Hornung from

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Al Dungey, stadium manager, leading a field training session at Frontier Field in Rochester, NY.

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Topdressing with Crumb Rubber

Turfgrass management under high traffic conditions such as overused sports fields, walk-on/walk-off areas on golf courses, and pathways through lawns or botanical gardens, creates a unique challenge. For many years, researchers have been investigating the differences in turf species for the ability to tolerate high traffic, as well as designing high sand content root zones that resist compaction. Of course, the development of cultivation equipment has assisted with alleviating compaction problems. Yet, worn areas continue to develop.

Researchers at Michigan State University have reported using ground up synthetic rubber tires (crumb rubber) as a topdressing to minimize wear injury and reduce surface hardness. They evaluated two particle sizes of crumb rubber (large, 0.3" to 0.1" and small, 0.1" to 0.002") at five application rates to depths of 0.1", 0.2", 0.4", 0.7", at three application timings in July, September and October. To quantify the true contribution of the crumb rubber to reducing surface hardness, impact readings were taken with an instrument used in assessing road hardness (the Clegg Impact Soil Tester). The plots were mowed three times per week at 1.5" and fertilized to supply 5 lbs N per 1,000 sq ft.

Results indicated little to no significant difference in surface characteristics related to particle size, however the smaller particle size rubber applied at higher rates was able to reduce hardness and improve surface playing consistency as measured by ball bounce. In addition, the smaller particles migrated more effectively into the turf canopy thereby providing protection to the base of the grass plants (crown) and reducing the abrasive force of a foot contacting a soil particle and abrading the crown. This reduced abrasiveness resulted in increased turf cover under traffic.

Finally, while some rubber treatments did result in reduced growth in the summer months, as measured by clipping weights, soil temperatures were slightly warmer at the cooler fall dates (October). This warming could enhance growth and thereby improve wear tolerance in the "shoulder months" of March, April, October, and November. The authors concluded that the greater depths of topdressing with the smaller particles provide a more effective and immediate reduction in surface abrasion thereby improving the wear tolerance of the turf.

From: Rogers, J.N., J.T. Vanini, and J.R. Crum. 1998. Simulated Traffic on Turfgrass Topdressed with Crumb Rubber. Agronomy Journal 90:215-221.

Irrigation Management and Golf Turf Problems

As we progress through the heat of the summer months and the inevitable dry period arrives, questions arise as to the "best" method of irrigating turf. When is the best time to irrigate (timing)? How often to irrigate (frequency)? How much water should be applied each time (amount)? Does irrigation influence pest problems such as diseases and weeds?

"Golf courses are publicly criticized for using water during peak summer months, accounting for 2 to 5% of water used during peak demand times," say researchers at Kansas State University. Therefore, to improve our understanding of the importance of irrigation amounts and frequencies, they conducted a study on a perennial ryegrass fairway turf maintained at 0.5" with clippings returned, receiving 3 lbs. of N per 1,000 sq ft per year. The objectives of the study were 1) to evaluate water savings by monitoring evapotranspiration (ET) and irrigating to supply 80% of the amount lost to ET 3 days per week versus daily irrigation of 0.3", 2) compare preventative versus curative fungicide programs for disease management, and 3) evaluate the effects of two irrigation regimes on perennial ryegrass quality, weed and disease invasion, and pesticide requirements.

As one might have expected, the daily irrigated plots supplied over 200% more water than that recommended based on the 80% ET mea-

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Scanning the Journals

A review of current journal articles

Smaller rubber particles migrated more effectively into the turf canopy providing protection to the base of the grass plants and reducing the abrasive force of a foot contacting soil particles and abrading the crown.

While brown patch incidence was reduced, there were twice as many dollar spot infection centers in the daily irrigated plots.

Grubs

continued from front cover

European chafer grubs are found predominately in the rough areas and Japanese beetles are found mostly on fairways. Japanese beetles tend to prefer well managed irrigated turfgrass that is close to vegetation suitable for adult feeding.

Fewer than 5 grubs per sq ft indicates a low population, lower than the standard damage threshold of 7-10 grubs, and no need to treat, whatever the kind of white grub. However, the specific situation should be taken into account in the decision whether to spray.

Mapping Grub Locations

Intensive sampling of ten golf course fairways and roughs on two golf courses in Central New York from 1995 through 1997 allowed us to map the location of Japanese beetle and European chafer grubs. These maps suggest that there are extreme fluctuations in grub populations from year to year, and that years that are favorable for one grub species may not be favorable for a second species. There are clear differences in where we find the various grub species on this fairway: European chafer grubs are found predominately in the rough areas and Japanese beetles are found mostly on fairways. Japanese beetles tend to prefer well managed irrigated turfgrass that is close to vegetation suitable for adult feeding. They appear to prefer loamy soils in full sun. By comparison, European chafers are found in lower maintenance turf sites, without irrigation, and with sandy, well-drained soil textures. They are also commonly found surrounding small trees that serve as aggregation sites for mating pairs.

Our studies indicated that some areas have the potential for grub problems every year, some areas will have grub problems most years and there are other areas that seldom, if ever, see grubs. The is mainly due to the proximity of turfgrass to feeding sites, soil characteristics of the various oviposition sites, and the wetness or dryness of the year. For example, well-drained hilltops may have heavy grub populations in relatively wet years while poorly drained low areas will have the best conditions for egg hatch and grub survival in very dry years. By early-August grubs are often sufficiently large that feeding damage may be apparent in high density areas. Ideally, it is the best time to look for beetle grubs in the soil. At this stage the grubs are still small but easily seen and identified. Early detection of heavy grub populations at this time will give adequate time for you to treat them.

Sampling Techniques

The techniques required to sample the soil underlying turfgrass areas are the most arduous and the most disruptive to the turf. The population of soil insects such as white grubs usually is distributed unevenly, so soil samples often must be as large as 1 sq ft. Because some turf-damaging grubs remain strictly in the soil, disruption of the soil is necessary to obtain accurate counts. When samples are taken with a spade, the depth of sampling is often variable because of the rooting habits, soil moisture, and soil texture. Most often sampling is much deeper than necessary in order to ensure that all grubs are found. One method of examining samples of sod and soil is to cut three sides of a square to a depth of 5 inches and turn back the cut area to expose the soil. This procedure allows many of the plants to keep their root system intact. Samples which involve 1 sq ft sometimes heal very slowly, leaving dead or dying patches of turf. Smaller samples often provide nearly as accurate an assessment of the grub population but recover much more quickly.

The quickest and least destructive method of collecting a soil sample is to use a cup cutter, 4 inches in diameter, to collect samples to a depth of 5 inches. Samples can be taken and inspected very quickly, enabling a scout to check several different locations and to provide more accurate information about spatial distribution of white grubs. The use of a cup cutter to determine grub populations in an area often reduces the need for blanket insecticide treatments for grub control. In general, treating grubs when they are small and feeding at the thatch soil interface produces the best control.

Analyzing the Sample

Grub sampling determines where the highest grub populations are found, which grub species is the most common, and what is the predominant developmental stage of the grubs found. Systematic sampling also indicates if a large number of the grubs are infected with bacterial or fungal pathogens, turf root health, thatch density, and, soil texture, compaction and moisture. Long-term benefits of systematic sampling are the identification of susceptible or favorable turf areas, the development of personal thresholds, and when undertaken before and after the application of an insecticide, treatment efficacy.

Fewer than 5 grubs per sq ft indicates a low population, lower than the standard damage threshold of 7 to 10 grubs, and no need to treat, whatever the kind of white grub. However, the specific situation should be taken into account in the decision whether to spray. Personal values should be incorporated in setting up the threshold level. The tolerance level, or action threshold, for turfgrass insects is site-specific and depends on many factors, such as pest species or complex, turfgrass species and cultivar, turf use, turf vigor, time of year, expectations, availability of curative control options, and budget. Turf managers often are less concerned with insect infestations that are found in autumn on cool season grasses, because most insects are noticeably less active at cooler temperatures and the turf is more able to recover from any damage that occurs.

Jennifer Grant, working with the New York State IPM Program, sampled and mapped thirty-six golf courses in Central New York each fall over a four year period for Japanese beetle and European chafer grubs. Each fairway was sampled using a standard cup cutter; four cores were taken across the fairway at 30 yard intervals, with sampling skewed toward roughs on wide fairways. The sampling team consisted of 3-11 people all trained to recognize grubs and larval stages and one or more persons capable of species identification. By carefully monitoring the time it took to map the golf course, Jennifer determined that it took an average of 2 labor hours to sample and map a typical hole, or 36 hours to map a typical 18 hole golf course (this means that it would take one worker 36 hours, 6 workers 6 hours, and 10 workers 3.5 hours). Using these estimates the cost of mapping a typical course would be $180 if your workers were paid $5.00 an hour, $252 if they were paid $7.00 an hour, or $360 if they earned $10.00 an hour. The estimated cost of grub insecticides would have been considerably higher: the cost for treating 25 acres of turf could range from $1,825-$3,684, while treating 60 acres could cost between $4,380-$8,842 using standard grub insecticides. Over the four years of this study 17 golf courses required no grub insecticide treatments, 16 golf courses required spot treatments, and only 3 courses required treatments on all fairways.

MIKE VILLANI, JANA LAMBOY, PAT VITTUM

Grub Week Event in the Planning Stage

We are currently working with Cornell Cooperative Extension to develop a plan for statewide grub sampling on turfgrass in golf courses, athletic fields, parks, and lawns. The goal is to assist local educators and turfgrass managers in scouting for grubs this year. Participation in a grub scouting team is fun for volunteers, getting out of the office for the day in a social outdoor activity that is good for the environment.

Grub scouting has been shown to save money and pesticide use, and will lead to more effective pest control. The event is an exercise in integrated pest management that illustrates several important concepts:

- locating and identifying the pest,
- understanding the biology of the pest,
- population thresholds,
- consideration of various effective solutions to the problem,
- effective use of control measures.

We will be able to provide a brochure to interested organizations. For more information, please contact Jana Lamboy at the IPM Program, New York State Agricultural Experiment Station, Geneva, NY 14456; e-mail address: JSL7@nysaes.cornell.edu.

JANA LAMBOY AND MIKE VILLANI

Using these estimates the cost of mapping a typical course would be $180 if your workers were paid $5.00 an hour, $252 if they were paid $7.00 an hour, or $360 if they earned $10.00 an hour.

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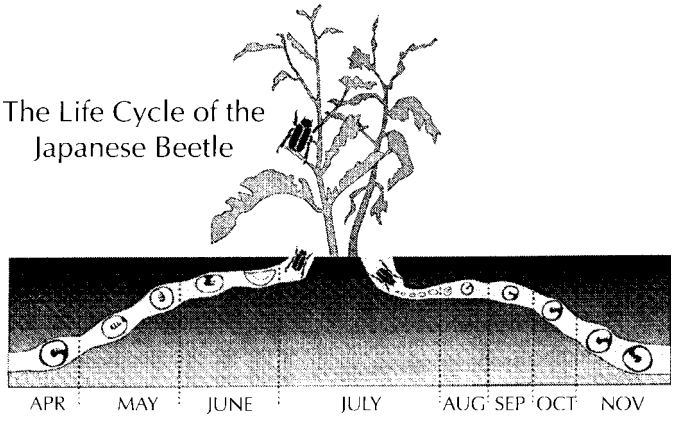

Turfgrass Soil and Water Management Program

Program Update

A lab study indicated that as little as 10 applications of natural organic fertilizer non-organic fraction (ash) can reduce the saturate flow rate by 15 to 25% and as much as 66% reduction after 100 applications.

This project will determine if seed treatment is effective in reducing the amount of pesticide (and nitrate) leaching from sand and sandy loam greens.

As with life, some things are changing and some stay the same. Changes include students graduating and a technician leaving. The technician in my program, Joe Deforest, recently took a job as the assistant golf course superintendent at the Lake Placid Club. Joe spent two years with us completing his B.S. degree in Turfgrass Management before working at the Robert Trent Jones Golf Course at Cornell prior to his time as a technician. We are certainly missing him this summer!

This spring two turfgrass management students graduated and have entered the work force. Peter Vidulich of Tribes Hill, NY, won several scholarships this year, including the Linder Award from Cornell, and was elected a member of Pi Alpha Xi, the honorary national society for Floriculture and Ornamental Horticulture. Peter is the second assistant golf superintendent at Piping Rock Golf Club on Long Island. Edward Dubisz of Buffalo, also a Linder Award winner, is the assistant golf superintendent at Medford Village Country Club in southern New Jersey. Ed also completed an undergraduate research project during the spring semester to determine the impact that the non-organic fraction of natural organic fertilizers and pesticides have on the saturated water flow rate of a typical sand-peat root zone for putting greens. A lab study indicated that as little as 10 applications of natural organic fertilizer non-organic fraction (ash) can reduce the saturate flow rate by 15 to 25% and as much as 66% reduction after 100 applications. We will be investigating possible funding sources to further these studies under field conditions.

Research this summer focused on pesticide and nutrient leaching from golf greens, soil amendments and turf as a phyto-remediation tool. Leaching studies involved developing best-management practices to reduce pesticide leaching. Previous research of ours has shown that during the establishment period (until the turf is dense and organic matter is accumulating), pesticides are much more likely to leach. One type of pest problem that occurs during establishment is damping off disease caused by *Pythium* species. This project, in conjunction with Frank Rossi and staff, will determine if seed treatment is effective in reducing the amount of pesticide (and nitrate) leaching from sand and sandy loam greens. Another study is determining if a nutrient loaded natural zeolite (Zeopro) amended sand green will have less nitrate, phosphorus and potassium leaching than a sand-peat green. Petri Anton, an M.S. student from the United Kingdom, is conducting additional soil amendment research involving the determination of the optimum cation ion exchange capacity of sand based greens. M.S. student Ruby Beil is studying the ability of tall fescue to clean up lead contaminated soil by accumulating lead in the shoots and roots as a low cost way of cleaning up toxic waste sites.

A. Martin Petrovic
Cornell University Turfgrass Team

Establishing the pesticide fate study.

Turfgrass Patch Diseases: The El Niño Connection

The 1998 season is turning out to be a bit unusual, in large part to the altered weather patterns brought on by El Niño. I predicted earlier that this would be a strange year for turfgrass diseases and that we would likely see an unusually high incidence of patch disease symptoms on susceptible grasses, regardless of the height of cut. This is expected from the increased accumulation of growing degree days, the high soil moisture levels earlier in the spring, the warmer soil temperatures in April, and the ensuing drought stress, which in some areas we have already seen.

My predictions appear to be coming true. Already this season, nearly 80% of the turfgrass samples that have come into the Plant Disease Diagnostic Laboratory have been diagnosed with some sort of patch disease problem. In some cases these problems have occurred in combination with other diseases. Of the patch diseases that have been diagnosed, Take-All patch has been the most prominent whereas Summer patch has been detected on other samples.

In most years, Take-All patch is not that prevalent a problem in New York State whereas symptoms of Summer patch typically occur during the hot dry months of July and August. The early onset of these diseases is making disease control strategies difficult at best and ineffective in some cases.

To help turfgrass managers with the recognition of these two important disease problems I offer below a description of some of the conditions that tend to favor disease development of both Take-All patch and Summer patch. Since both diseases are characterized by circular to irregular patch-type symptoms, their diagnosis is often based on microscopic observations of infected plants.

Take-All Patch

Take-All patch is caused by the fungus *Gaeumannomyces graminis* var *avenae* where it is usually restricted to bentgrasses, particularly those growing in alkaline soils. Symptoms often appear during cool moist weather and can thus often appear in the spring. However, symptoms are more common in the late summer and early fall. Take-All disease is restricted primarily to creeping, colonial and velvet bentgrasses and is particularly a problem on newly constructed golf courses situated on previously-wooded lands. Although symptoms may persist for many years, usually the disease becomes less severe with time, particularly as microbial activity in soils is increased.

For Take-All patch to be a serious problem, soils must remain quite moist. The Take-All pathogen requires considerably more water for infection than do other patch pathogens and this may also explain why the disease is more common on newly-established golf greens where continuous moisture is applied to achieve a successful grow-in. Additionally, plant stresses brought on by waterlogging, drought, soil compaction, traffic, etc. all tend to exacerbate symptom development. The optimum temperatures for growth of the pathogen are around 70-75ºF and growth is completely inhibited at temperatures of 90-95ºF. All in all, *Gaeumannomyces graminis* var *avenae* is an opportunistic pathogen that is most aggressive when host defenses are low and microbial competition in soil is minimized.

Summer Patch

Summer patch is caused by the root-infecting fungus *Magnaporthe poae* and is one of the most dreaded and destructive diseases of lawn and golf turf in New York State. Varieties of Kentucky bluegrass and fine-leafed fescues are particularly susceptible to Summer patch as are some varieties of bentgrass and annual bluegrass. Plants become infected with *M. poae* when soil moisture is relatively high and soil temperatures reach 60-65ºF. During these conditions, the fungus colonizes the root systems and can suppress root growth but the plants remain asymptomatic. Roots and rhizomes typically will turn brown and brittle as the disease progresses underground without causing any apparent above-ground damage.

Despite fairly high levels of root infection, Summer patch would largely go unrecognized if air temperatures did not exceed 70-75ºF. This is primarily due to the fact that root growth can be quite restricted at temperature above 75 degrees and at these temperatures growth and reproduction of *M. poae* is more ideal. Frequently, Summer patch symptoms are evident when air temperatures are hot (85-95ºF). High soil temperature accompanied by high soil moisture is also important in favoring the activity of *M. poae*. In particular, sites with poorly-drained or highly compacted soils are especially prone to damage as are those areas that have developed a considerable thatch accumulation.

While Take-All and Summer patch are currently important diseases affecting New York State turfgrasses, it is essential to stay on your toes and keep your eyes peeled for other strange

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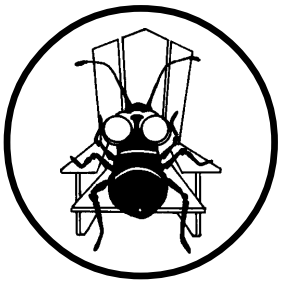

Pest Watch

Altered weather patterns brought on by El Niño would likely cause an unusually high incidence of patch disease symptoms on susceptible grasses due to increased accumulation of growing degree days, high soil moisture levels earlier in the spring, warmer soil temperatures in April, and ensuing drought stress.

Scanning the Journals

continued from page 3

The study of low maintenance fescue species indicated that Flyer and Jamestown II could reduce the quality of some mixtures. Furthermore, the Rebel II monostand under either mowing schedule, and the Reliant and Bighorn monostands mowed monthly provided equal to or better quality than most mixtures.

surements. There was no difference between preventative and curative fungicide use in the first year, however, in the second year, the curative program resulted in 64% less active ingredient applied.

Surprisingly, daily, morning irrigation resulted in reduced incidence of brown patch by about 5% over both years of the study. In fact, the untreated (no fungicide applied) plots had 30% less brown patch when irrigated daily at 5 AM versus ET-based irrigation also supplied at 5 AM It is suggested that the daily, morning irrigation may alter the microclimate (dew and guttation fluid that contains a food source for the brown patch organism), and may reduce midday moisture stress that could increase disease susceptibility. *However, while brown patch incidence was reduced, there were twice as many dollar spot infection centers in the daily irrigated plots*. There was no observed difference in weed invasion (crabgrass or dandelion) attributed to irrigation regime. Therefore, while this study suggests a clear influence of irrigation management on pesticide use and disease incidence, the substantial increase in water use from daily irrigation could be prohibitive.

From: Jiang, H., J. Fry, and N. Tisserat. 1998. Assessing Irrigation Management and Its Effects on Disease and Weed Levels in Perennial Ryegrass. Crop Science 38: 440-445.

Low Maintenance Performance of Fescue Species

Over the last several years, there has been renewed interest in expanding areas on golf courses (as well as school grounds, parks and the occasional home lawn) dedicated to low maintenance or reduced mowing regimes. In fact, the Spring 1993 issue of *CUTT* had an article by Jim Wilmot evaluating the performance of low maintenance mixtures.

Dr. Pete Dernoeden and other researchers at the University of Maryland have been investigating the use of fescues for low maintenance areas (no supplemental irrigation or fertilizer) for several years. Their most recent work evaluated the performance of fescue species (Flyer creeping red fescue, Jamestown II chewings fescue, Bighorn blue sheep fescue, Reliant hard fescue, and Rebel II tall fescue) as monostands and in mixtures. When mixtures of fine fescue were used, previous data suggested that improved quality could be achieved with higher amounts of Reliant and Bighorn. In addition, two mowing regimes were evaluated: 1) mowing as needed to a height of 2.5" or 2) monthly mowing to 3.5". Traditional turf establishment procedures were followed using starter fertilizer and regular irrigation, however, following establishment no further fertilizer or irrigation was supplied.

In general, mowing as needed to 2.5" provided better spring quality, while the monthly mowing at 3.5" provided higher fall quality in two of the three years under study. The monthly mowing regime resulted in a 40% reduction in mowing frequency and had substantially less crabgrass invasion.

"The basic premise for mixing species is to provide genetic diversity that could help survive stress resulting from environmental factors or pests." However, this study indicated that Flyer and Jamestown II could reduce the quality of some mixtures. Furthermore, the Rebel II monostand under either mowing schedule, and the Reliant and Bighorn monostands mowed monthly provided equal to or better quality than most mixtures. Therefore, this study suggests the importance of evaluating cultivars and species for performance and the influence of mowing schedules on the quality of the low maintenance areas, especially from a weed management perspective.

From: Dernoeden, P.H., M.A. Fidanza, and J.M. Krouse. 1998. Low Maintenance Performance of Five Festuca Species in Monostands and Mixtures. Crop Science 38:434-439.

Mercury Fungicide Residues in Golf Turf Soils and Clippings

Modern golf turf management requires significantly more precision than our predecessors could have imagined to meet increasingly high quality and performance expectations of today's player. Paramount to developing this precision is the introduction of less persistent, more active, "reduced-risk" pesticides in the last decade. Prior to this trend, environmentally persistent materials such as mercury-based fungicides (mercuric chloride (Calo-clor) and phenyl mercuric acetate (PMAS)) were widely used for disease control, especially low temperature pathogens such as the snow molds. Regulatory agencies in the prairie provinces of Canada were interested in understanding the potential residues associated with mercury use. In fact, similar to US

restrictions, concern over mercury use led to national restriction in Canada in 1993, with sales allowed until December 1997, and use until December 2000.

An extensive survey was conducted on the greens of seven golf courses from various areas of Alberta with a varied history of mercury use. Clipping samples were obtained following mowing and soil samples taken from the greens, collars and surrounds. Interestingly, there was great concern that these levels would be highly leachable, thereby requiring the green to be considered hazardous waste should it ever be renovated and removed. This did not turn out to be the case, as mercury levels found in leachate were low.

However, soil samples revealed that chronic (7 to 40+ years) mercury use resulted in levels 1 to 50 times higher than the acceptable regulatory limit in Canada (6.6mg/kg). *In fact, on one course, two greens which had not received mercury in the last 15 years still had 5 times the regulatory limit for mercury (23 to 33 mg/kg) in the top 2" and over 6 times more at the 4" to 6" depth.* In general, the older the green, the longer the mercury use, the higher the levels of mercury found in the soil. This was not the case for clippings, where a green that received only 1 mercury application had the same (below regulatory limit) amount of mercury as the greens that received many years of applications.

The authors of the study suggest that while the soils and clippings are not hazardous waste, they still must handled and disposed of in a way that reduces the risk for contaminating other soils and water bodies. This study is likely to have a substantial impact on the golf turf industry over the next few years. This could include how reduced soil mercury levels may explain higher incidence of pests such as moss, and how we might deal with clippings and soils from contaminate greens.

From: Byrtus, G. 1998. An Assessment of Mercurial Fungicide Residues in Golf Course Soils and Clippings. 1997 Annual Report from the Prairie Turfgrass Research Center, Olds, Alberta.

On one course, two greens which had not received mercury in the last 15 years still had 5 times the regulatory limit for mercury (23 to 33 mg/kg) in the top 2" and over 6 times more at the 4" to 6" depth.

Plant Disease Diagnostic Clinic

The Plant Disease Diagnostic Clinic at Cornell provides golf courses with diagnostic services. The number of turfgrass samples processed through the clinic has increased steadily over the past few years. We believe the clinic can provide golf courses with the fast, accurate, professional services they need.

The fee structure varies depending on the type of diagnoses required. Identification of pathogens of fungal and bacterial diseases is performed for a $25.00 fee. This service will provide the client with the causal agent of the disease and any control recommendations that are available. Nematode identification services are available for a $40.00 fee.

When submitting samples for analysis to the clinic, provide as much information as possible to help ensure an accurate diagnosis of the problem. Forms for submitting samples are available from the clinic.

The turfgrass sample should contain all parts of the grass. Using a cup cutter works well. Wrap the sample in a paper bag and mail it in a sturdy box as quickly as possible. If the sample can not be mailed immediately, keep it refrigerated or out of direct sunlight. Try to collect the sample prior to the application of any pesticides. Once pesticides have been applied it may be difficult to obtain an accurate diagnosis. It is helpful if the sample comes from an area that has early symptoms of the problem. Dead areas often contain a number of secondary organisms that may hinder the detection of the primary pathogen.

The collection of samples for nematode analyses varies slightly. It helps to send in an sample of healthy turf as well as problem turf to be used in the determination of the primary pathogen. The best time of year for nematode analyses is in the spring, about a month after the grass greens up, and in mid-autumn. A minimum of 6 subsamples, approximately 1" in diameter, should be collected from an area that is a 1/2 acre in size. The subsamples should be collected randomly throughout the area. The samples should be collected at a depth of around 4". The subsamples should be mixed together thoroughly. Approximately a pint of soil should be transferred to a plastic bag and shipped as soon as possible. Again, if time doesn't permit immediate shipping, keep the sample refrigerated.

Call the clinic with any questions prior to submitting a sample. The clinic strives to get you fast, accurate results and prior clarification of questions enables us to get your results on a more timely basis. Contact: Plant Disease Diagnostic Clinic, 334 Plant Science Bldg., Cornell University, Ithaca, NY 14853; (607) 255-7850.

KAREN SIROIS
CORNELL UNIVERSITY TURFGRASS TEAM

The Plant Disease Diagnostic Clinic can help golf courses identify pathogens of fungal and bacterial diseases and any control recommendations, plus nematode identification services.

Short Cutts

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During the Golf Turf Field Day we will be walking the front nine of the Cornell golf course discussing the current research being conducted under golf course conditions: evaluating biocontrol products for disease control, annual bluegrass exclusion programs, managing tees under shaded conditions, and managing people when the heat is on.

NYSTA in partnership with the Cornell Turfgrass Team presents the 1998 Turf and Grounds Exposition in Syracuse, NY November 10-13.

NorthAmeriCare Park, John LiBurdi from the Town of Colonie, Brian Eshenaur of Cooperative Extension, Dominic Morales of SUNY Delhi, and Bob Emmons of SUNY Cobleskill. At each location, the Stadium Manager will be giving attendees an inside look at the workings of a high profile sports turf facility.

If you'd like more information on the Winning Fields programs, contact the NYSTA office at (800) 873-8873.

Golf Turf Field Day '98

The excitement continues to build here at the Cornell Turfgrass Research and Education Center and the adjacent Robert Trent Jones Golf Course at Cornell University in anticipation of the 1998 Golf Turf Field Day. The Field Day is scheduled for Tuesday August 18, 1998 from 9 AM to 4 PM. This year your Turfgrass Team will be highlighting our research on golf turf issues such as: understanding the new generation of insecticides; establishing and trafficking the new bentgrasses; evaluating the biocontrol aspects of the bioject; integrating biological and traditional disease control methods; and determining the fate of pesticides at establishment. Plus, as an added attraction, we will be walking the front nine of the Cornell golf course discussing the current research being conducted under golf course conditions, specifically: evaluating biocontrol products for disease control, annual bluegrass exclusion programs, managing tees under shaded conditions, and managing people when the heat is on.

To make your day a more enjoyable one, we are currently working with several motor coach companies and industry representatives to sponsor "bus trips" to the Field Day. Sit back and relax while you travel through beautiful upstate NY, arriving relaxed to learn the latest in golf turf management. If you'd like more information about attending or sponsoring a bus, call the Turfgrass Team at (607) 255-3090.

The New York State Turf and Grounds Exposition for 1998

The New York State Turfgrass Association in partnership with your Cornell Turfgrass Team is proud to announce that the final plans are set for the 1998 Turf and Grounds Exposition. Once again, the Exposition will be held in Syracuse, NY from November 10 through 13, 1998. NYSTA is pulling out all the stops to provide you with the latest educational opportunities in turf and grounds management, bringing in leaders from around the world to speak on topics in golf turf, sports turf, lawn and landscape, and grounds management.

Some of the highlights this year include presentations by Jim Moore, the Director of Construction Education for the United States Golf Association; our own Marty Petrovic on golf turf soil management; Andy McNitt from Penn State University speaking on the latest in sports turf design, construction and management for safety; Mary Hirshfeld from the Cornell Plantations on selecting perennials and ornamental grasses; Dr. Mike Raupp from the University of Maryland on insect management in the landscape; our own George Hudler reviewing the year in trees; and as a special treat, the horticulturists at Hershey Park in Hershey, PA will be providing insight into the various horticulture issues at a high profile facility.

The keynote speaker, Jim Tunney, a retired NFL referee is making a return visit to the Exposition this year following his wildly successful motivational talk at the 1994 show. He will likely provide many useful tips for living, as well as some enjoyable stories from the professional playing field. Of all the speakers NYSTA has had to "kick-off" the Exposition, Jim remains one of our favorites.

If you'd like more information on the 1998 Exposition contact the NYSTA office at (800) 873-TURF (8873).

An Apology

Due to the illness of some staff and various other problems that generally fall under the heading of Murphy's Law, we apologize for the lateness of this summer issue of *CUTT*. Though we try to have the newsletter to you at the beginning of each season, sometimes we are foiled. Look for the fall issue quick on the heels of this one.

The El Niño Connection

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diseases that could appear at any time as we continue to experience drastic fluctuations in air and soil temperatures. Should problems arise that you are unable to identify, our turfgrass team of diagnosticians at the Plant Disease Diagnostic Laboratory are available to answer your questions and look at your samples.

ERIC B. NELSON
CORNELL UNIVERSITY TURFGRASS TEAM

Training for Success

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must be trained each season and returning employees refreshed on techniques and informed of updated methods. Some turf managers have written training sheets similar to the one above for all their key jobs. There are two advantages to this. First, a written list of instructions ensures that no crucial information is forgotten. The list can easily be changed or updated at any time. Second, it provides the same information for all key staff people who train, so all workers will receive the same kind of orientation.

Turf managers should see the value of effective employee training programs in terms of job performance, employee morale, and elimination of costly mistakes on the job. However effective training programs must be carefully planned, and adequate time must be set aside specifically for training to occur. Properly planned and conducted, employee training and development benefits the employee, the customers, and management by improving job performance and increasing employee satisfaction.

THOMAS R. MALONEY
CORNELL UNIVERSITY TURFGRASS TEAM

Properly planned and conducted, employee training and development benefits the employee, the customers, and management by improving job performance and increasing employee satisfaction.

Figure 1

Job Instruction Training in Action: String Trimmer Example

Task to be taught: Operation of a gas powered string trimmer.

Step 1: Prepare the worker and the work place.
Tell the employee what you are about to do. Create a relaxed environment where you will not be interrupted. Acquire and arrange materials needed: trimmer, ear protection, safety glasses, gasoline, oil and extra trim line.

Step 2: Tell the learner how to do the task.
Explain safety equipment issues including clothing, hearing, and eye protection. Explain how to pull-start the equipment, how a choke works, how the throttle works, where the on-off switch is, and how to adjust the line.

Step 3: Show the employee how the task is to be performed.
Show the employee how to put on safety equipment, turn switch to on position, adjust choke in preparation for starting, adjust throttle and start engine. Demonstrate the back-and-forth movement required to use the trimmer safely and efficiently. Show how to tell when the trim line should be adjusted. Show how to turn the machine off, and how to adjust the trim line safely, with the machine turned off. Show how to check and fill gas and oil.

Step 4: Let the learner do the task.
Give the string trimmer to the employee and have the employee repeat the steps just demonstrated in Step 3. Provide a few handwritten notes or a checklist to help the employee remember each step. Coach the employee, making suggestions and answering questions, as needed.

Step 5: Review the work.
After leaving the employee to perform the task independently, check back to see that the trimmer is operating properly and that the employee is using it correctly. Review the quality of work to see that trimming is done completely and at the correct height. Provide feedback that reinforces desirable work habits and helps the employee set goals for improvement. Encouragement is extremely important.

Training for Success

Human Resource Update

Job Instruction Training is a five-step process:

- ***prepare***
- ***tell***
- ***show***
- ***do***
- ***review***

Most turf supervisors became supervisors after they established themselves as competent in the technical areas of their work. However, a supervisor's technical competence does not necessarily translate into training ability. The key to effective training is to have a plan and to follow several key steps. The trainer must be patient and willing to understand and adapt to the needs of the learner. Perhaps the most straightforward and practical approach to on-the-job training for small business managers is Job Instruction Training. This process can be summed up in five steps: (1) prepare, (2) tell, (3) show, (4) do, and (5) review.

Job Instruction Training came into widespread use during World War II when many industrial workers went to war, and their replacements had to learn new jobs quickly. The process became a quick, effective way to train American factory workers. The last four steps listed above are those typically referred to as Job Instruction Training and they are effective when training for a variety of tasks. In order to make the process more comprehensive, a preparation step has been added.

Employee Training Steps

Step 1: Prepare the worker and the work place. Have materials and equipment ready and have the work place properly arranged just as you want the workers to keep it. Put the workers at ease and get them interested in learning the job.

Step 2: Tell the learner how to do the task. Explain, illustrate and question the employees carefully to see that they understand how to do the job. Stress the key points and be patient. Be careful not to present more information than the employees can master.

Step 3: Show employees how the task is to be performed. After the careful explanation provided by Step 2, show the employee how to do each part of the job. Emphasize key points.

Step 4: Let the learner do the task. Have the employees tell and show you what they are doing and have them explain the key points back to you. Provide feedback and continue the process until you are certain the workers know how to do the job.

Step 5: Review the work. After letting the employees perform the task on their own, return and review the quality of the work. Provide feedback that reinforces good work habits and helps the employees set goals for improvement. Encouragement is extremely important.

Figure 1 is an example of Job Instruction Training in action. The example is how to train an individual in the operation of a gas-powered string trimmer. Note that some of the information in these training steps is provided in greater detail than may be required. This detail is provided to ensure that basic information in the training process is not overlooked.

Job Instruction Training is especially important in a seasonal business. New employees

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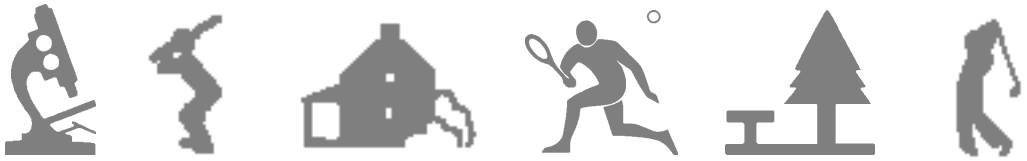

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