JUNE 1983

BORDER CITIES GOLF COURSE SUPT. ASSOCIATION MICHIGAN

A PATCH of GREEN

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MICHIGAN & BORDER CITIES GOLF COURSE SUPERINTENDENTS ASSOCIATION

"A PATCH OF GREEN"

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Research Review

by Wayne C. Morgan

Biological Control of Turfgrass Diseases - An Unrealized Potential

Golf course superintendents may have an ally which provides defense against certain turfgrass diseases. Dr. R.M. Endo and Dr. P.F. Colbaugh of U.C. Riverside wrote such an outstanding article on the biological control of turfgrass diseases for the June, 1974 Golf Superintendent magazine, it is important that their information be re-emphasized whenever possible.

A method to control certain fungal diseases of turfgrass — always there but unrecognized — has been found. This is biological control. In other words, nature provides defenses against a group of fungal diseases. We came to this realization as the result of the reserch Dr. P.F. Colbaugh has been conducting on Helminthosporium leaf spot at the University of California at Riverside.

Let us review certain know facts :

Whenever temperature and moisture conditions are favorable and certain parasitic fungi are present, fungal diseases may develop on susceptible turfgrass varieties. Behaving in this manner are the obligate parasites, such as the rust and powdery mildew fungi, rather than facultative fungal parasites such as the Helminthosporium leaf spot and Sclerotinia dollar spot fungi. With the exception of the rust and powdery Mildew fungi, all other fungal parasites affecting turf are faculatative parasites.

OBLIGATE AND FACULATATIVE PARASITES

The two kinds of parasites differ in that obligate parasites obtain their food only from living plants and are incapable of breaking down dead plant or animal remains, while faculatative parasites are able to obtain food from both living and dead plants.

It is this difference, we believe, that makes it common for facultative fungal parasites to be biologically suppressed in turfgrass so that disease occurs only erratically. The obligate parasites, on the other hand, are not suppressed appreciably by saprophytic microorganisms because they seldom come in contact with competitive and antagonistic microorganisms.

The life cycle of obligate parasites is as follows :

1. Spores of the rust fungi are produced within the microorganism-free interior of the host plant;
2. The spores become airborne where they normally encounter few microorganisms;
3. The spores germinate and infect vigorously growing leaves and stems, which bear low populations of saprophytic microorganisms.

In contrast, faculatative parasites of turfgrass are subject to biological influences throughout their lifetime because they are constantly being exposed to antagonistic forces and to competition from other turfgrass microorganisms in these ways :

1. The density and short prostrate growth habit of turfgrass places the aerial portions of the plant in contact or in close proximity to the microbiologically active crop debris and soil.
2. The plants are constantly being exposed to microorganisms by means of foot traffic, by maintenance practices such as mowing, fertilization and irrigation, and by the varied activities of such creatures as earthworms, nematodes, birds, and insects.
3. Depending on the depth of the grass debris, a variable amount of the stems and roots will be covered by the biologically active crop debris.
4. Because of the extreme plant density, nutrients diffusing from fresh as well as dead grass clippings may stimulate microbial activity on the root surfaces as well as the microorganisms inhabiting the decomposing crop debris.

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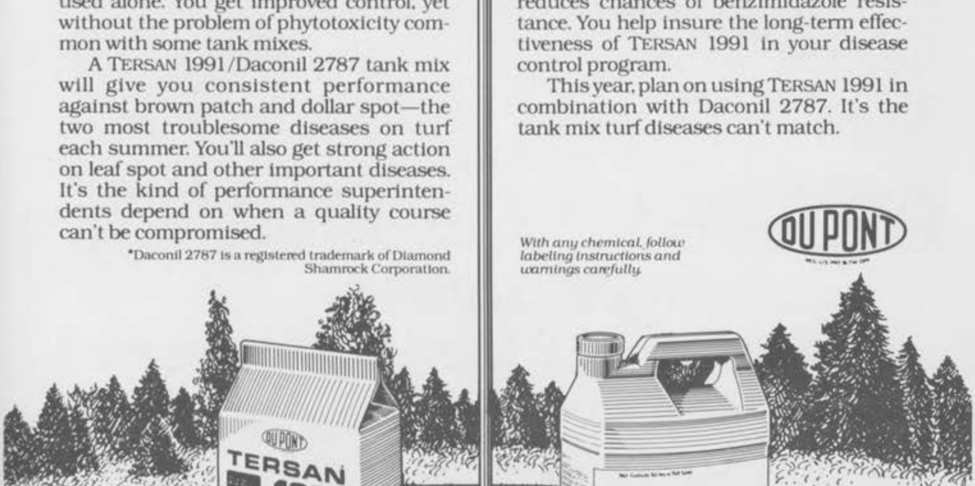

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BROWN IS NOT BAD

A unique problem occurred this year at several country clubs in the Philadelphia area. Due to a water shortage, their bentgrass/Poa annua fairways were not irrigated. To the surprise of some, the bentgrasses survived in excellent condition, but, as expected, the Poa annua died. The good golfers were pleased with the excellent playing conditions and the tight, firm playing surfaces.

The brown areas where Poa annua died were a shock to some of the other members. The average club member, with 10 to 30 years of country club experience, has been conditioned to lush, green playing surfaces. Golfers at these clubs like to boast about the "picture green" color of their turf. Most older club members were not concerned since they remembered the days before fairway irrigation.

The bentgrasses actually improved with water that came only from rain. Golf course superintendents observed the bentgrasses spreading into the dead Poa annua areas during the summer months. This further demonstrated that bentgrasses require little water during the summer.

The drought conditions which began in the summer of 1980 continue throughout the region. Further water restrictions may be imposed in the future. It appears that golf courses which are encouraging drought-tolerant species will be better prepared for the future. Many older golf courses, with high populations of Poa annua, a water-demanding plant, will have a significant transition period unless other grass species are introduced.

The transition period will be very difficult for many golf courses. Club members will have to accept brown areas in the beginning of the program until the permanent grass population increases. In all cases, it will take a strong golf superintendent and an

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In Defense of the Stimpmeter

by Donald D. Hoos
Director, Western Region,
USGA Green Section

To an archeologist in the 25th century, this extruded aluminum bar, 36 inches long, with a v-shaped groove extending along its entire length, may well be a puzzle. But to us, it's a Stimpmeter! We use it to measure the speed of greens. it has a precisely milled ball-release notch 30 inches from the tapered end (the end that rests on the ground). It is simple enough. However, this simple device has been embroiled in controversy ever since it became available to golf course superintendents in 1978. Why the controversy?

Some opponents feel too much emphasis is being placed on green speed. As an example, one can point to the greatly publicized rebuilding of greens at the Augusta National Golf Club, in Augusta, Georgia. The objective of the rebuilding was to regain speed and uniformity that had diminished with the passage of time. The publicized average speed of greens at this year's Masters Tournament ranged from 11.32 feet to 11.61 feet, with an average of 11.48 feet. Fast by anyone's standards.

Prior to manufacture and release of the Stimpmeter to member clubs, it was thoroughly tested by the Green Section staff and Frank Thomas, Technical Director of the USGA. Putting green speeds throughout the United States were measured under all kinds of conditions. Measurements were made at championship sites as well. From all these measurements, general ranges for putting green speed were determined and published as part of the instruction manual with each Stimpmeter.

Unfortunately, most club members never see the Stimpmeter Instruction Manual. What they know about putting green speed is what they learn during telecasts of the U.S. Open and Masters Tournament. Speeds at these events generally are in excess of 10 feet. Also, not pointed out during television coverage is that the course hosting such events has worked very carefully over a period of several years to have the golf course in the very best condition. These are courses with higher than average maintenance budgets peaking their greens at incredibly fast speeds for a one-week period.

But it should be pointed out that quality of putting greens is not measured by speed alone. Perhaps as important as speed is consistency from green to green. The Stimpmeter is a tool that can gauge consistency, just as a height of cut bar gauges mowing height. Smoothness and lack of grain are important factors in putting quality

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CLEM WOLFROM left, MERITORIUOS SERVICE AWARD RECIPIENT, BEING CONGRATULATED BY JIM TIMMERMAN, PAST PRESIDENT OF MTF. WOLFROM RECEIVED THE AWARD WHICH IS PRESENTED BY THE MICHIGAN TURFGRASS FOUNDATION AT THE 1983 MICHIGAN TURFGRASS CONFERENCE.

Your 1982 Michigan Turfgrass Foundation Board of Directors. Left to right are Michael Edgerton, Gordon LaFontaine Executive Secretary), Kurt Thuemmel, Jerry Faubel (President), Robert Hope, Jerry Gill (Vice President), Bruce Wolfrom (Treasurer), James Timmerman (Past President), Gary Bartsch and Tuck Tate. Not pictured are Billy Olsen and John Read who had to chair afternoon sessions when the picture was taken.

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Stimpmeter, cont.

and are just as important on fast greens as on medium-fast greens. The speed at which greens are to be maintained should be a membership decision. If the membership wants fast greens, then they must be willing to provide budgetary support to reach this goal.

To achieve fast greens on a daily basis requires more maintenance. Fast greens must be mowed more frequently. Fertilization must be on a light and frequent basis. Watering must be done more carefully. Lower mowing heights needed to achieve fast greens also place the turfgrass plant under more stress. A reduced rooting depth can be expected under lower mowing heights. The shorter roots require more frequent irrigation and syringing during the summer to sustain the turfgrass plant. Shorter roots also reduce the grass plant's ability to recover from insect and disease attack. An increase in insecticide and fungicide use may be needed.

To achieve putting green speeds above 8'6" generally requires mowing heights below 3/16 inch. Mowing at these low heights requires additional time by the mechanic adjusting and setting the putting green mowers. Additional grinding and backlapping of bedknives and reels will be needed. Again, pressure is placed on the maintenance budget because of these practices.

Weather conditions also influence putting green speed. Through the year as day length and temperatures change, variations in growth rate occur. If the growth rate is slow, daily mowing and other practices produce faster speeds than if the grass is growing vigorously. In areas of the country subject to high summer temperatures, growth of cool-season grasses almost ceases. Bentgrasses become partially dormant. Maintenance practices that produce fast putting green speeds can be especially dangerous under these conditions. The plant's ability to recover from stress is especially reduced; one mistake could result in turfgrass loss that could require the rest of the season to recover. It is of little value to have fast greens on July 4 if there are no greens in August.

Comparisons between putting green speeds from one club to another are inevitable. Comparing the speed between greens at neighboring clubs has

CONTINUED PAGE 13

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been going on since golf has been played in this country, and it will continue, with or without the Stimpmeter. However, rather than compare putting green speeds, perhaps the comparison should be in dollars budgeted for putting greens, water, pesticides, and labor. Perhaps a mathematician could develop a formula to compare putting green speed and budget and also add in the weather for good measure. It is the grand total of innumerable agronomic practices that equals good putting qualities. Don't be blinded by speed alone.

The stimpmeter is a tool, plain and simple. It was invented in the 1930s by Edward S. Stimpson and refined by the USGA Green Section to give the golf course superintendent a way to measure the consistency in putting greens on his course. By using the tool on a regular basis, great inequities in putting green speeds over the course can be detected. If great disparity exists, then maintenance practices can be adjusted to even out the variations. Many superintendents have found the Stimpmeter to be a valuable tool and have made it work for them to make their courses even better. If you are one of those who consider the Stimpmeter an enemy, I would challenge you to know your enemy. Learn about the Stimpmeter. Educate your membership about its uses and how it works. Make it a tool you can use. Al Radko, former National Director of the Green Section, has suggested the following four-step program for use of the Stimpmeter:

Step 1. Following the steps recommended in the Stimpmeter Instruction Booklet, measure all greens thoroughly and record the average speed of each green. By thorough measurement it is meant that all areas of each putting green be averaged and recorded to determine the overall average of every green, including the practice green. At minimum, three separate areas of each green should be tested and averaged, except where contours or slopes limit the number of measurements per green.

Step 2. If the average speed of any

CONTINUED NEXT PAGE

Stimpmeter, cont.

green varies widely from the average speed desired, determine the cause and correct this deficiency to bring the reading up to the desired average speed. This may be done by additional mowing at first and if this does not correct the deficiency, by altering other management practices on deficient greens.

Step 3. Once the average speed is attained and the average speeds are consistent (within plus or minus 6 inches among all greens), then it will only be necessary to test three or four greens daily to insure that the greens remain consistent throughout. The number tested daily will depend on the number of mowers used — i.e., if three different mowers are used, then it will be necessary to test one green mowed by each, etc. If triplex mowers are used, then four greens at minimum should be tested daily (two on the front side and two on the back side).

Step 4. Once every month, re-test all greens to determine whether the average speed continues to be uniformly consistent.

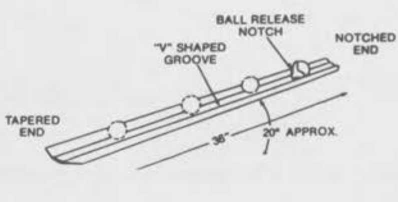
Variations in speed can do more to negate a player's skill than perhaps any other factor on the golf course. Consistency is the key word – not speed. Putting greens kept at speed over 8'6" as a daily average will need extra labor and manpower because of additional maintenance practices required. Under extreme weather conditions, there is also a much greater potential for turfgrass damage when putting green speeds are maintained above the fast range for regular membership play. As with any other tool, I would urge you to use the Stimpmeter to your professional advantage.

Speeds for Regular Membership Play

8'6" Fast	5'6" Medium Slow
7'6" Medium Fast	4'6" Slow
6'6" Medium	

Speeds for Tournament Play

10'6" Fast	7'6" Medium Slow
9'6" Medium Fast	6'6" Slow
8'6" Medium	



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21125 Northwestern Hwy.
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Godwin Glen Golf Club
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Brown Is Not Bad, cont.

understanding membership to implement the change.

For further reading, we refer you to the article which appeared in the August 1977 issue of "Golf Journal" entitled "Green is not Great". It emphasizes the importance of using minimal amounts of fertilizer and water to maintain the grases. This method will result in the growth of tough, permanent grasses.

Research Review, cont.

5. Faculatative fungal parasites usually survive in the soil and crop debris as well as in infected plants. Surviving propagules of the parasites in the soil and crop debris are exposed directly to the activities of saprophytic microorganisms and their survival is related, in large measure, to the intensity of microbiological activities in the surrounding environment.

INCIDENCE LOW; WHY?

In view of the millions of acres of turfgrass in the U.S. alone, we find it surprising that diseases caused by facultative fungal parasites occur only sporadically and infrequently. This is difficult to explain since even a small lawn consists of millions of low-lying plants of similar genetic background and disease susceptibility. The crowded plantings, dense turf canopy and surface litter favor the prolonged retention of high humidities, of guttation fluid, and of dew and the even temperatures required for fungal growth and rapid plant-to-plant spread of disease. Turfgrass pathologists have had to rely on natural development of the diseases in the field in order to evaluate the effectiveness of fungicides because most attempts to artificially induce disease have failed. It is generally unknown why there are such failures.

Much debris collects around the turfgrass plant : grass clippings, dead or dying lower leaves, stolons, rhizones, roots and tillers, all in various stages of decomposition. For convenience, we will hereafter refer to this debris as litter.

As fresh clippings are constantly added to the litter during the growing season, an effective and continuing source of substrates is provided for the litter-inhabiting microorganisms, we believe that the parasites usually lose out in this unevenly waged combat and exist in or on the moist litter in an inhibited or dormant state.

EVIDENCE OF BIOLOGICAL COMPETITION

Observation and experimentation suggest that the saprophytic microflora can play a major role in influencing the incidence and severity of facultative fungal parasites that attack turfgrasses. Experiments using 10 different facultative fungal parasites of turfgrass indicated that more disease was produced on plants grown in sterile soil than on plants grown in untreated fertile soil. One experimenter was able to greatly decrease root infection of wheat seedlings by spores of Helminthosporium sativum by adding a minute quantity of nonsterile soil to sterile soil. C.J. Gould noted that the "take-all" fungus develops best on bentgrass greens following soil fumigation, while J.R. Cook observed that the same fungus causes less disease following the addition of take-all suppressive wheat soil to bentgrass greens.

Several workers have demonstrated that soil moisture deficiency is associated with an increased amount of turfgrass diseases caused by the dollar spot fungus, by the greasy blight fungus, and by the Fusarium blight fungus. Field studies in California demonstrated that Helminthosporium leaf spot and foot rot are most severd within temporarily drought-stressed areas of Kentucky bluegrass. The Helminthosporium fungus spores did not germinate on grass clippings that were kept moist (Figure 1); but if the grass clippings were first air-dried and then remoistened, the spores germinated (Figure 1), colonized the clippings and sporulated abundantly.

The inability of these spores to germinate was associated with microorganisms on moist litter (Figure 1); specifically, certain bacteria from the litter produced a gas that inhibited spore germination. The multiplication and growth of the litter-inhabiting microorganisms were drastically reduced by drying the litter. It was also demonstrated that air-dried litter following remoistening released a far greater concentration (300 per cent) of proteins and carbohydrates into water than did continually moist litter.

Thus, we believe that spores of the Helminthosporium fungus exist in an inhibited, inactive condition on moist litter. When the litter dries out, the inhibitory has produced by certain litter-inhabiting bacteria disappears, and the bacteria and other microorganisms become dormant. Following irrigation, the spores on the remoistened litter germinated in the absence of the inhibitory gas, and a short period of time is required before the bacteria that produce the inhibitor can reestablish a suppressive environment.

Following germination, the spores of the Helminthosporium fungus grow very rapidly and vigorously because of the release of proteins and carbohydrates from the remoistened, formerly dry litter. The antagonistic and competitive saprophytic microorganisms also benefit from the released proteins and carbohydrates, but before they can reestablish an inhibitory environment the parasite has infected the leaf sheath. Thus, we believe that H. satinum develops following alternate cycles of wetting and drying.

COMPETITION IS ABSENT

Snow mold diseases are common and destructive under snow cover in the northern U.S. and Canada. This may be because most of the saprophytic microorganisms are inactive at low temperatures while the snow mold fungi are unaffected. Therefore, the various snow mold fungi probably sevelop in the absence of the competition and antagonism. In addition, freezing and thawing of dead and living grass tissues probably also releases abundant nutrients for the fast-growing snow mold fungi.

The opposite situation should also be investigated, since at very high temperatures (above 100 degrees F) the growth of the saprophytic microorganisms may also be reduced. This may permit high-temperature parasites such as Pythium aphanidermatum to grow in the relative absence of competition.

DOLLAR SPOT LIMITED

Finally, the limited size of patches of turf affected by the dollar spot fungus may be due to the competitive and antagonistic microflora. The Sclerotinia fungi commonly produce enzymes that break down components of plant cell walls and various constituents may leak from the dead cells as well. This sudden release of nutrients may greatly stimulate the multiplication and activities of the saprophytic microflora which probably occur in fairly high numbers on the nitrogen-deficient turfgrass plants that are attacked commonly by the dollar spot

CONTINUED NEXT PAGE

fungus.

BIOLOGICAL CONTROL IN FIELD

We believe that biological control of faculatative fungal parasites is actually operating in turfgrass in the field. This is an important phenomenon that should be explored as a supplemental or additional method of control.

Our research with the Helminthosporium leaf spot disease suggests that control of this disease can be obtained by simply through watering in such a way as to keep the litter moist but not sopping wet. If the canopy is sparse, the root system short or the soil thin, several short weekly waterings may be necessary as well to keep the litter moist.

The research also indicated that the cause of the dry spots must be found and corrected – e.g., wind destruction of sprinkler patterns, insufficient overlap of sprinklers, uneven terrain, soil compaction, water repellency of the litter, too rapid delivery of water, etc. We have been successful in completely stopping the progress of the Helminthosporium disease in several home yards and golf greens by recommending aerification of the dry spots and proper watering.

CULTURAL PRACTICES HELP

The Significance of the research of Helminthosporium is that understanding the basis of initiation of fungal activity in the field has provided us with a new method of control – i.e.; biological control. We are hopeful that further research will reveal additional examples of biological control. We are hopeful that further research will reveal additional examples of biological control that can be exploited through slight changes in management and cultural practices. Proper watering in order to avoid drought stress is probably one of the most important.

Biological control may not be as effective with turfgrass varieties that are highly susceptible since even very low populations of the parasites could initiate infections that spread rapidly throughout the infected plant. Some degree of host resistance appears necessary to fully exploit the potential of biological control.

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