Dr. Worf graciously filled in as a speaker at the July meeting. When this photo was taken he was unaware he was going to receive the DSA.

The look of a surprised man - Gayle Worf accepts the WGCSA "Distinguished Service Award" from Monroe Miller.

Gayle Worf accepts congratulations from WGCSA Director Randy Smith.

(Continued from page 1)

7. He has had the key responsibility for developing the concept for an Urban Agricultural Research Station and related integrated pest management programs for home owners in an urban environment.

8. He played a key role in the formation and development of the Wisconsin Turfgrass Association.

Gayle's interest in the turfgrass industry was particularly helpful during the early years of the WTA. His leadership, guidance and encouragement were fundamental in getting that organization to the point it is today.

Dr. Worf has received many honors and awards during his years on the UW-Madison faculty. He was the first plant pathologist to receive the "Distinguished Service Award" in Extension, an award which is the highest recognition from Wisconsin's statewide extension service. He is the Vaughn-Bascom Professor, an honor detailed in the July/August 1986 issue of the GRASS ROOTS. The Wisconsin Arborist Association, in 1982, honored him with their "Outstanding Service Award". Also in 1982, Gayle served as President of the North Central Division of the American Phytopathological Society.

Dr. Worf's popular and valuable feature in the GRASS ROOTS, "The Wisconsin Pathology Report", has demonstrated to WGCSA members his considerable writing skills. Very few realize, however, that the complete list of publications of Gayle's includes over 170 titles dealing with a myriad of subjects under the broad heading of Plant Pathology.

And isn't it curious that on the night we planned on presenting him with the DSA he graciously filled in as our meeting speaker. When the scheduled speaker called at the last minute to cancel, all thoughts turned to Gayle as a substitute. Once again, as he has done so often before, he bailed us out of trouble.

Kansas is Dr. Worf's home state. He was born there in 1929. Kansas State University awarded him a B.S. degree and a M.S. degree in Agronomy and Plant Pathology. He served as County Agent in Ness County, Arkansas from 1955 to 1958 and then he decided to attend graduate school again and chose the UW-Madison. He completed his PhD in Plant Pathology and Botany in 1961. For the next two years he was an Assistant Professor of Plant Pathology at Iowa State University in Ames. In 1963 he was invited to return to Wisconsin. He advanced to Associate Professor in 1966 and full Professor in 1969.

Gayle has travelled to the far reaches of Wisconsin, visiting golf courses and offering help in solving untold numbers of problems. The quality of his work on turfgrasses for well over twenty years has directly benefitted the members of the WGCSA and the golf players of Wisconsin. There is great pride in presenting him our "Distinguished Service Award".

Congratulations, Gayle!

Dedicated to the Memory of O.J. Noer

The 22nd Annual Wisconsin Golf Turf Symposium To Address "First Impressions"

The 1987 Wisconsin Golf Turf Symposium, sponsored by the Milwaukee Metropolitan Sewerage District and the Wisconsin Golf Course Superintendents Association, will be held on October 28th and 29th. This 22nd edition of the Symposium is titled "A Memorable Golf Course - First to Last". Our conference, the only true symposium offered year in and year out for all these years, will focus on the aesthetics of golf courses, a subject important to golf players, club members and Golf Course Superintendents. Eye appeal, pleasant surroundings and first impressions will be studied in depth. The program includes speakers that are golf course architects, Golf Course Superintedents, lanscape architects, golf professionals, plantsmen and our own Jim Latham, USGA Green Section Agronomist. Our luncheon speaker comes from the Crooked Stick Golf Club in Indiana, Mr. Joe Luigis. He is an interseting and well known speaker on the subject of golf and golf courses.

Inspired by the memory of O.J. Noer, the Symposium Committee has arranged for another great meeting. The Pfister Hotel will again be our headquarters. Details will be in your mail early this fall.

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From The Lakes To The Mountains— 1987 Edition

James M. Latham, Director
Great Lakes Region, USGA Green Section

"There are in nature neither rewards nor punishments—there are consequences."

—Robert G. Ingersol

It's really too early to speculate on just what name tag will be placed on this golf/growing season. 1986 was the year of the Black Layer. Maybe 1987 will be called simply "The Longest". Golfers may actually wear themselves out if we are blessed with normal fall weather. Lord knows they are wearing out enough turf this year. But without them there wouldn't be a need for us. Just what the consequences will be depends on the quality and quantity of turf and soil rehabilitation provided this fall.

It's been a rather weird season. Lack of snowcover in many areas last winter cost some courses a goodly amount of green grass this spring. The old-fashioned techniques worked best to prevent desiccation. Greens were "adequately" topdressed after the last application of snowmold preventers. Later, when no snow cover came, the thinking superintendents hauled water to keep some kind of moisture (ice, of course) on the surface. Cal Polsean, at Westward Ho, Sioux Falls recorded 400 man-hours were needed to supplement the 0.5" of precipitation over the winter.

Winter play got a good test at the Minnehaha Club there. They recorded 700 rounds of golf over the winter with no *apparent* turf problems on sand-topdressed greens by early June. BUT, play had been stopped on March 1, and not resumed until the greens were fully thawed. Superintendent Gene Reiter hauled some water, too.

On the other side of the coin, a Minnesota club had no such restriction, and in mid-June the footprints of two golfers were still visible (dead grass), complete with heel and toe prints. Just two people playing one day interfered with the play of the rest of the membership for over two months!

The grass greened up early this year, but didn't get any real growth until the warm rains came along in May. The primary spring complaint was rough greens. The 75 degree days were balanced by the 35 degree nights to get a zero score on spreading, fill-in growth. Some courses, though, were still recovering from the fall rains—like the washout at Kohler and the 30" rain that fell at Bay City, Michigan. Now, the Minneapolis/St. Paul area is starting over again with 21" within 7 days beginning July 27 (Interlachen gauge).

This season has been, in all but a few areas, a report on the effectiveness of irrigation systems. It should be a great selling year for multiple row irrigation. Between those toasty roughs came the centerline slops and the occasional *Pythium* spots and ruts.

Enough talk about the weather. The lightweight, floating head mowers are getting the best of *Poa annua* in fairways. The bent has really moved out this year, especially where superintendents have been able to adequately control the irrigation. Where the bent is well scattered through an area it can do its own thing without chemical help —but with patience.

Plant growth regulators have taken up the anti-Poa fight with a vengeance and are performing very well in bent, blue and ryegrass fairways. The only ill effects noted so far occurred when a crosswind blew one material around quite a bit and when a heavy rain washed another application into surface drainage areas. Good results were obtained on spring applications to fall seeded bent following turf eradication. There are still lessons to be learned, but the outlook is good. And there are other materials yet to be fully tested in this area.

None of these things are free and now that budgeting time is nearly upon us, let's look at some numbers. I note from the new Pannell-Kerr-Forster report that the maintenance cost per hole on Midwest courses in 1986 was $19,610. That's about $353,000 for 18 holes, a 9% rise over 1985. The national average was $21,101 per hole, up 7.8% from the previous year. Other areas: East, $17,607 per hole - up 11.8%; South, $20,568 per hole - up 7.8%; the Far West, $28,177 per hole - up 3.5%. The numbers are interesting, but their meaning depends on what one is trying to prove.

An entomological note: The mild winter certainly helped increase the golf course bug problem this year. Just note the number of strange yellowed blotches on greens—with a perfect green outline of a foot right in the middle. It's been a great year for cutworms and ants, too.

The Good Turn of the Year: Superintendent Vern Burks in Great Falls hired 30 Boy Scouts to transplant aerator plugs from the surviving parts of greens to the aeration holes on high mounds where the turf was lost to desiccation. His green cover, by the way, was a hydromulch fiber that had been successful for the previous nine years. This time it blew off.

The observation of the season: The development of grain on fairways, from tee toward the green, which can be worrisome at the start of a backswing. Golf cars. So get out the vertical mowers to go with the aerators.

And the worry of the year: Spots on some greens that look very much like the C-15 disease. . .except the grass isn't C-15. At this writing, tests are being rechecked at UW and MSU.

Remember When? USGA Championships were played on greens mowed at 3/16 inch—only 10 years ago at the Womens Open at Hazeltine. Maintenance programs have, since then, given the players the best conditioned golf courses they have ever seen. There are two operations responsible for most of this—light and frequent topdressing with properly sized sandy material (straight or mixed) and lightweight mowing of fairways. Both have their drawbacks but none are insurmountable. Both require additional operations but higher quality usually demands a higher price. Both demand enlightened operational management and that's why continuing education is so important to all of us today. Remember -

The Wisconsin Golf Turf Symposium: October 28-29

The North Central Turf Expo: December 8-10

Thank you,

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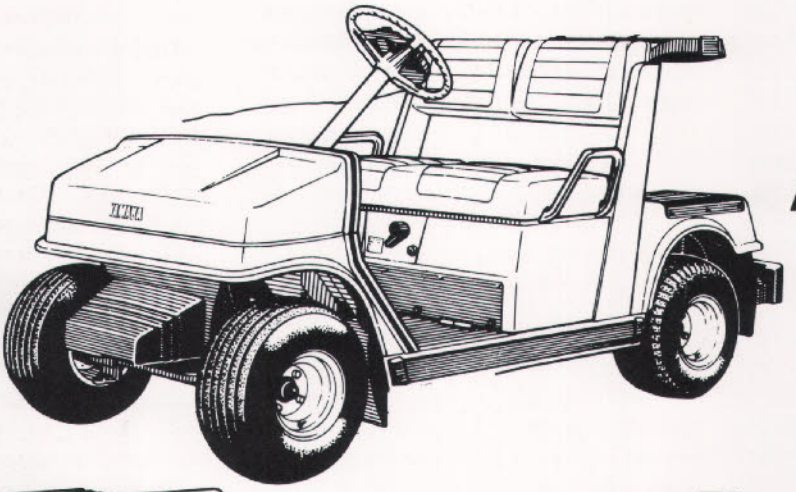

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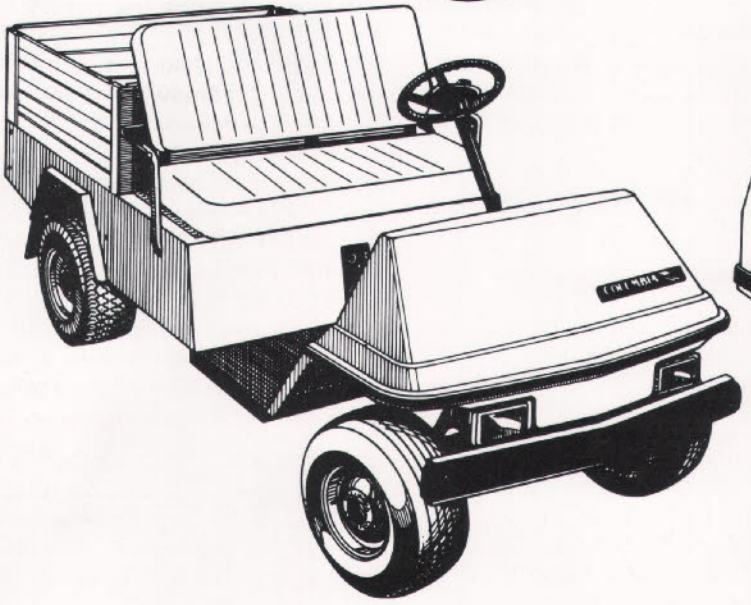

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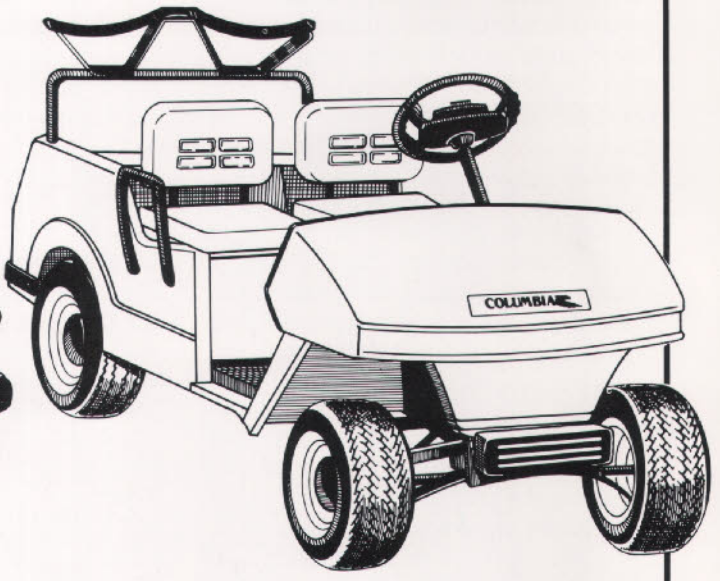

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FALL FERTILIZATION OF TURFGRASS
Part II. The Practice

By Dr. Wayne R. Kussow

Maintenance of top quality turf depends as much on what transpires in the fall of the year as what we do to bring the turf through the stresses of summer. As reviewed in the July/August issue of THE GRASS ROOTS, the heat of summer dramatically reduces turfgrass vigor and its capacity to rapidly recover from any type of injury. It is only with the onset of declining fall temperatures that turfgrass has the opportunity to regain lost vigor, to prepare for the ravages of winter and to build capacity for regrowth the following season.

The purpose of fall fertilization is to ensure that nutrition does not limit the biochemical and growth responses of turfgrass to the more favorable temperatures of autumn. Timing of fall fertilization is one of the keys to its effectiveness. The turf must be photosynthetically active when the fertilizer is applied but stimulation of shoot growth should not occur.

Time of Application

The figures in Part I of this article readily define the time for fall fertilization. When mean air temperatures* drop to 50°F, turfgrass photosynthesis is still 80 to 90 percent of maximum but respiration rates are only about 20 percent of their optimum levels. Consequently, net photosynthate production is high. Coupled with these biochemical responses to low mean air temperature is a sharp reduction in shoot growth rate. Because photosynthate production is high and shoot growth slow, the remainder of the plant is well supplied with carbohydrates for below-ground growth, winter hardening and storage purposes.

At this point it should be apparent that fall fertilization does not refer to fertilizer applied after September 21, start of the calendar fall, nor is it dormant fertilization. Rather, it is fertilization that occurs after the mean air temperature has declined to 50°F or less and well before the first killing frost (defined as a temperature of 28°F for two or more consecutive hours).

A single day with a mean air temperature of 50°F does not signal the start of the fall fertilization period. One such day can readily be followed by a couple of weeks of unseasonably warm weather. Thus, 3 to 5 days with mean air temperatures of 50°F or less can constitute a realistic definition of the start of the fall fertilization period.

Choice of N fertilizer has an effect on when fall fertilizer is applied. Ideally, the N should become available to the turfgrass as soon as the fall fertilization period begins. When soluble N fertilizers such as ammonium sulfate or urea solution are used, application should be at the start of the fall fertilization period. Turfgrass responses to urea prills does not occur until 5 to 7 days after application because of the time required for the urea to be converted to ammonium. With slow release N fertilizer such as urea formaldehyde or Milorganite, the delay in turfgrass response time is more on the order of 10 to 15 days after application.

Depending on location in Wisconsin and weather, the fall fertilization period may be no more than two weeks or so in duration. Therefore, application of N sources not immediately available to the turfgrass should precede the actual start of the fall fertilization period by the number of days required for response to the N fertilizer. In order to do this, we need to be able to predict the start of the fall fertilization period. Long-term weather records are the only basis for predicting when mean air temperatures in the fall are likely to decline to and thereafter remain at or below 50°F. Examination of these records reveals that the state can be conveniently divided into thirds and each one-third assigned a date for the start of the fall fertilization period. These dates, shown in Figure 1, have a 70 percent probability. In other words, in the long run, these dates will be reasonably accurate 7 years out of 10. We do however, have to keep in mind that in any given year and in an average of 3 years out of 10, the actual time when the fall fertilization period begins can vary by so much as 15 days from the dates shown. Regardless, these dates are the best basis available for deciding when to commence fall application of urea prills or slow release N sources.

Nitrogen Rates

Three variables influence fall N rates: (1) the expected duration of the response period; (2) the N source; and (3) whether or not fall fertilization is used in combination with dormant N fertilization. Weather records reveal that on the average, Wisconsin has two distinctly different fall fertilizer response periods. In the northern one-third of the state, the average duration is only about 10 days, while the southern two-thirds of the state has an average response period on the order of 20 to 22 days. It seems reasonable, therefore, to suggest lower fall N rates for the northern one-third of the state (Table 1).

Slow-release N sources are typically applied at somewhat higher rates than soluable materials. This, too, is incorporated into Table 1. Finally, ranges in N rates are shown for each combination of state region and type of N fertilizer. These ranges reflect my judgement on what the N rates should be when only fall N is applied and when fall N is followed by dormant N. The lower rates shown are those suggested for use in conjunction with dormant N.

Phosphorus and Potassium

Researchers have demonstrated that fall-applied P promotes turfgrass growth and K, through its influences on carbohydrate production, can reduce winter injury. But don't expect these responses unless your soil tests indicate a need for P and K fertilizer. When turfgrass is already adequately supplied with these nutrients, the effects of additional P and K on the grass are significant.

If soil testing is not being done on a regular basis or there are reasons to suspect a need for P and K, fall is definitely an excellent time to apply them. In these instances, a convenient way to judge P and K needs is according to the likely removal rates by the turfgrass during the season. The ratios

of $N:P_2O_5:K_2O$ in bentgrass average about 5:1:3.5 and in Kentucky bluegrass about 5:1:4. Thus, for example, if the season's N rate on bentgrass is 2.5 lb/m, at least 0.5 lb P_2O_5/m (2.5 lb N/5 x 1) and 1.8 lb K_2O/m (2.5 lb N/5 x 3.5) need be to applied each year just to maintain soil tests near pre-existing levels.

The above approach for estimating K needs does not apply to sand-based or USGA greens. Potassium leaches easily from these greens and needs to be replenished. Research suggests a replenishment rate of 4 lb or more of K_2O/M/season. This is preferably applied via several applications spread throughout the season. If not, fall is clearly the optimum time for a single annual K application.

Benefits and Concerns

Research has demonstrated numerous benefits from fall fertilization. Some have already been discussed, but are being repeated here to make the list complete. Fall fertilization has the potential of:

1. Enhancing root, stolon and rhizome growth.
2. Increasing stored carabohydrate levels.
3. Improving fall color.
4. Reducing weed populations the following year through more vigorous turfgrass growth.
5. Reducing disease incidence.
6. Increasing rates of recovery from winter injuries.
7. Delaying the need for spring-applied N.
8. Reducing spring clipping weights.
9. Eliminating fertilizer burn.

Concerns commonly expressed about fall fertilization and N application in particular are: (1) reduced winter hardiness; (2) greater snow mold injury; and (3) enhancement of *Poa annua*. Older turfgrass literature repetitively cautions against late season N applications, the main reason given being that of reduced winter hardiness. What is important to recognize is that this precaution is based on research conducted at a time when annual N rates commonly ranged between 10 and 20 lb/M. More recent research has shown that at today's N rates, application of as much as 5 lb/N/M in October or November does not significantly influence winter injury in turfgrass. On the contrary, fall N rates in the range of 1.0 to 2.0 lb/m generally increase fall and spring carbohydrate levels in turfgrass and result in less winter injury.

To date, there is no evidence that fall N applied at the rates given in Table 1 increases the incidence of snow mold. What has been observed is that fall N speeds spring recovery from the disease when it occurs.

The question of the effects of time of N application on *Poa annua* has been well researched. In bentgrass sod, the best approach for maintaining high Poa density is a spoon-fed program wherein 0.25 lb N is applied bi-weekly throughout the season or 0.5 lb N applied monthly. Shifting to less frequent N application reduces Poa density. The greatest reductions in Poa density in bentgrass greens have been achieved with three N applications per season wherein the last application is delayed until after August. Similar results have been achieved with Kentucky bluegrass, particularly when the first N application has been delayed until mid- or late May and the last application until late October. Nitrogen fertilization of bentgrass sod or Kentucky bluegrass sod in April and/or August has been found to invariably favor *Poa annua*.

Summary

Fall fertilization is a management practive based on the physiological responses of cool season turfgrasses

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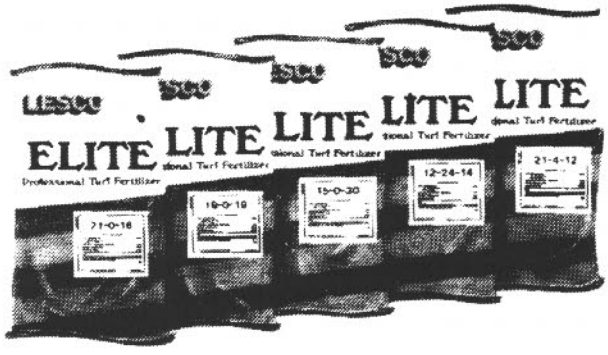

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to the declining air and soil temperatures of fall. The potential benefits are many and have been confirmed by researchers in various locations throughout the region of cool season grasses. The practice is, however, not conducive to maintaining high *Poa annua* densities in turf.

To realize the full benefits of fall fertilization, guidelines for the practice need to be carefully observed. The key guidelines are:

1. The fertilizer is applied at a time such that the N is not readily available to the turfgrass until mean daily air temperatures have declined to 50°F or less.

2. The rate of N application is in the range of 1.0 to 1.5 lb/M (45 to 65 lb/A). This rate should include any N applied once the grass is dormant.

3. Spring N application is delayed as long as possible and preferably until mid-May or later.

4. Application of P and K with the fall N is advisable unless soil tests indicate no need for these nutrients.

Fig. 1. Approximate dates when mean air temperatures decline to 50°F.

Table 1. Recommended rates of nitrogen for fall application.

Portion of Wisconsin	Type of Nitrogen	
	Soluble	Slow Release
	lb N/M	
Northern 1/3	0.50 to 0.75	0.75 to 1.0
Southern 2/3	0.75 to 1.0	1.0 to 1.5

*Mean air temperature = $\frac{\text{daily high temperature + daily low temperature.}}{2}$

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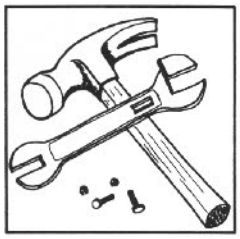

Light Weight Fairway Mowers
(and related thoughts)

By Thomas R. Harrison

The current popularity of mowing fairways with some type of light weight equipment has added a new dimension to the care and maintenance of our equipment. Many different styles and configurations of equipment are being tried with no one particular type of mower standing out as being the best, most cost efficient, and longest lasting type to use. Several interesting facts have been learned so far.

Initial selection of equipment is important. There are so very many different pieces of iron being touted as "light weight mowers". Some work, some never will. The superintendent needs to thoroughly field test and inspect any potential purchase for quality of cut and, of equal importance, how long will it last. There is a lot of extremely light duty equipment available that will cut great but its life is short. There are larger more durable pieces available but they have trouble with their quality of cut in the hot, humid months of the summer. They are useless parked for 6-8 weeks. (I ought to know - I own one.) When you are purchasing, it is important to know these limitations and not have to go back after your equipment distributor when your superlight weight fairway mower won't hold up and the life expectancy is 3 years instead of 10.

No matter which type of equipment you buy, the level of preventive maintenance has to be higher. Our old tractors and gang mowers needed little daily maintenance to go through the season successfully. These new mowers need more frequent oil and lube intervals plus a much higher level of reel maintenance. The cost of these new mowers is extremely high, which when coupled with a shorter life expectancy make it imperative that we carefully extract every hour of life we can out of these machines. Compared to tractors and gang mowers, light weight mowers cost a bundle to purchase, maintain and repair. The per acre cost to maintain fairways today is tremendously greater than 10 years ago.

This push to "improve our fairways" has been accelerating at a faster than necessary pace. Too many superintendents seem to be on a drive to outdo the next person. Money is sometimes too readily available to buy more equipment to make playing conditions "better". It's really a vicious circle we are creating for ourselves. Improvements are fine for the sake of improvements, but I firmly believe that too many superintendents are on a bent to one up their neighbors for ego's sake or whatever. The use of light weight mowers has brought on a tremendous improvement in fairway conditions but at a very hefty price. The race for improved fairways, I fear, is not over. For I suspect that there are superintendents out there who are plotting to go one step further. Some superintendents are using riding greensmowers on fairways which do a super job of fine cutting turf, but the drawbacks are initial cost, durability and equipment life. Nevertheless they give a good finished product. But when will someone try to better his neighbor and put walking greensmowers on fairways? I can see two superintendents at a monthly meeting discussing this. One says to the other, "Did you hear what Monroe did? He put walking greensmowers on his fairways." The other fellow says, "That's nothing, I hear he hired the entire Village of Waunakee to run 'em." Not so funny really, because given enough time someone will do it. Topdressing fairways and using the stimpmeter on fairways is already being done.

The fervor to have slick greens is also getting out of hand. We are stressing turf well beyond its limits, in order to roll the ball on the green much faster than it really needs to. The final degree of fast greens will be a top dressing consisting of 10% portland cement, coupled with a 40% latex medium green paint, and 50% medium sand. That ought to cut down on rolling resistance to the ball. We certainly don't need any grass blades in the way.

This race to have faster greens, lower cut fairways, and fast fairways is leading the golf turf industry into a much more complex and expensive era of course maintenance. I for one am not convinced that it is entirely necessary. We are racing to outdo one another and not thinking about quality. In all this talk about fast and low cut turf, no one talks about quality, healthy turf. Likewise people seem less interested in buying quality, long lasting equipment and taking care of it. We complain about U.S. automakers building a poor quality product yet we, as golf course superintendents, are beginning to follow the same path. We are putting too much stress on the plants and we are not willing to look at a turf area and say, "My greens may not be the fastest but more important, they are healthy and they look good." That is quality. Equipment maintenance is the same way. We shouldn't look at the care of these expensive machines and say that's "good enough". Good enough is when we service the equipment on schedule and sharpen the reels properly. Here again it's too easy to spend a lot of money replacing equipment earlier than necessary because we didn't take care of it and it's too easy to spend large sums of money on reel grinders that are fast but do a poor job in the long run. Quality is disappearing from our work place, but only because we are all in too big a race to outdo the next fellow and pump up our egos about how fast this is or how low cut that is. The question "Where does it all end" is answered very simply when we all shift the emphasis from fast and low cut to "quality".

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