(Continued from page 19)

are at least 30 strong contenders, including designs by Tom Fazio in California; Arthur Hills and Steve Melnyk, both of which are near Knoxville; Rees Jones and Jack Nicklaus, Jr., both at Pinehurst, N.C.; and a series of courses designed by a group working for Robert Trent Jones, Sr. in Alabama.

"But I think University Ridge has a lot going for it," said Whitten. "It's been open for almost a year so it's in better condition. We don't evaluate conditioning, but it has a subtle influence if a course is in good shape. It's also a good design and Bobby Jones' designs have fared well in the past in our surveys."

Whitten agreed with most public golfers who feel skyrocketing greens fees has gotten out of control.

"We've become a nation of one-round courses. You pay and play PGA West or even a Blackwolf Run once. But you can't stand a steady diet of it," he said. "With upscale public courses, courses that give you a country club feel for a day, you're no better off if you're an avid golfer than if you belonged to a club."

Whitten said Golf Digest has toyed with the idea of creating a category for low-budget or low-fee courses or penalizing courses that overcharge. "But there's no way to evaluate that," he said. "On the West Coast, a 45 dollar greens fee is a bargain. But in Wisconsin or Kansas it's pretty stiff. And 90 dollars really jacks you up to a resort category. That's not a daily fee in my mind. So there's no way for us to equate that and so we just stay out of it."

Whitten said he enjoyed playing golf in Wisconsin because he found many courses that he liked and many were considered bargains. Asked to pick his favorite course in Wisconsin, Whitten was quick to answer.

"That's easy," he said, "my favorite is Lawsonia. I just love old designs."

ANSWERS

(For the Wisconsin Golf Course Quiz on page 31)

1. 17.
2. Three—Jack Allis, Wayne Otto and Monroe S. Miller.
3. November 30, 1920 at the Drake Hotel in Chicago.
4. 1953 was the year the Green Section started personal visits to golf courses. The program we know as TAS was called the USGA Green Section Regional Turf Service.
5. Dr. Fanny-Fern Davis was action Green Section Director from 1943 to 1945. She conducted experiments with 2,4-D which as a result became widely used for broadleaf weed control on golf courses.
6. 127.
7. 1894.
8. 1895.
9. Yes. O.J. Noer.
10. 1983.

Irrigation Please!

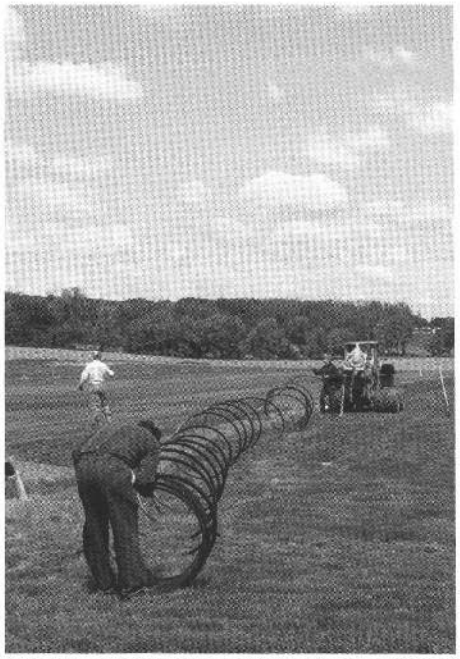
By Tom Salaiz

Thanks to the hard working efforts of the crew from Midwest Irrigation, installation of the irrigation system for the Noer Facility was completed on June 4. Eight long working days were spent pulling 3,000' of 2.5" PVC main and 7,200' of poly pipe, and installing 72 electric valves and 288 sprinkler heads.

The same evening the irrigation installation was completed, weather forecasters were predicting showers the following day. Talk about a sophisticated irrigation system! I knew irrigation technology was improving by leaps and bounds, but this is ridiculous. Well, it turns out we received only a trace of precipitation, so we apparently have a few bugs to work out.

Actually, the TORO NETWORK 8000 irrigation system is operating perfectly. Designed by Mr. Tom Emmerich, this state-of-the-art system will simplify the management of research projects requiring different irrigation regimes.

The irrigation system (Figure 1) is designed to independently irrigate 72 plots, 50 ft. x 50 ft. in size. This figures to just over four acres of irrigated research plots. Each plot is irrigated with four TORO Super 700 sprinklers. Three Network 8000 satellites are used for controlling irrigation with each satellite responsible for 24 plots.

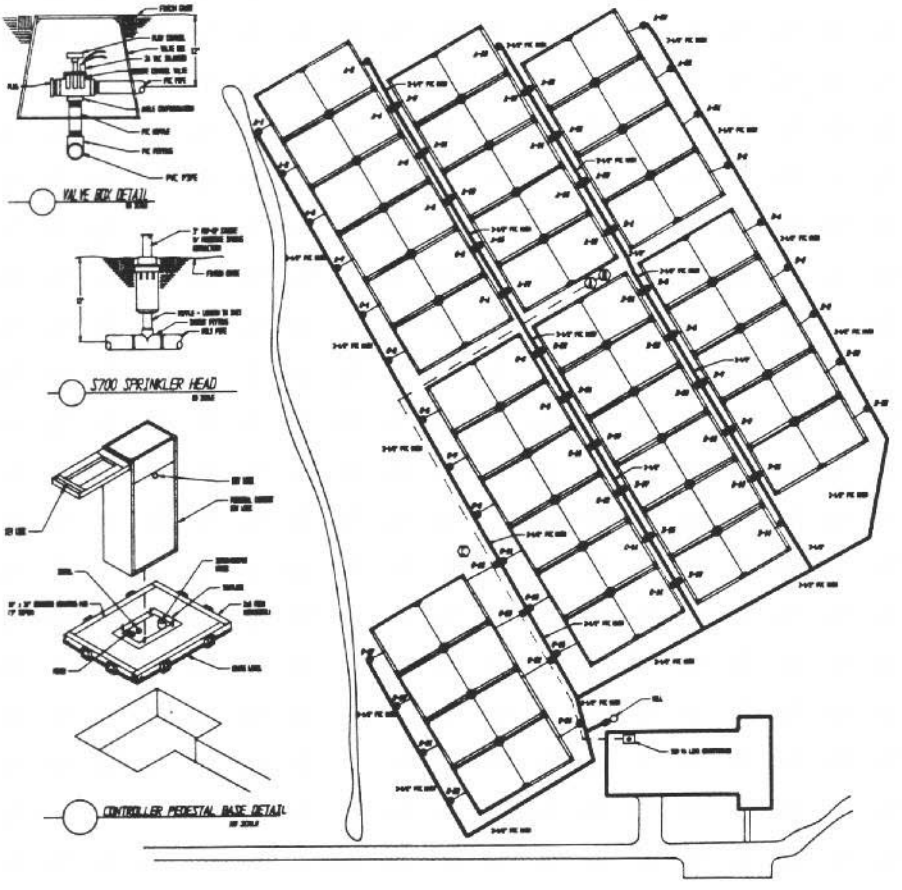


The irrigation system required thousands of feet of poly pipe.

FIGURE 1.

O.J. Noer Turfgrass Research and Education Facility

IRRIGATION PLAN



The programming capabilities of the satellites allow for a large amount of irrigation scheduling flexibility. Each satellite has eight programs and start times with up to four programs able to run simultaneously. Other useful features include five irrigation cycles, sy-

ringing capabilities, and global percentage adjustments of watering times for all programmed stations.

A special *Thank You* is extended to the TORO Company and everyone who contributed to the purchase of the irrigation equipment. Reinders Irrigation Division was especially generous.

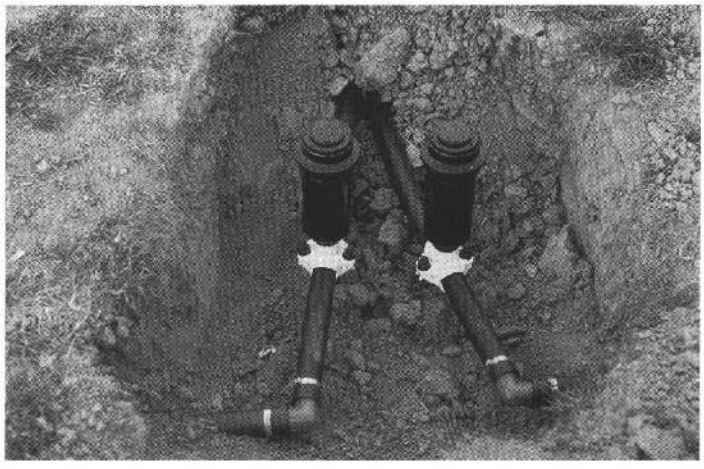
Also completed in early June were additional tree and woody ornamental plantings. Two Honeylocust were donated by Long Island Farm, seven Green Ash were donated by the Bruce Company, and McKay Nursery donated 29 Quaking Aspen, 71 Gray Dogwood, 63 Hazelnut, 23 Spiraea, and 17 Common Witchhazel. All the Green Ash and a majority of the Gray Dogwood were close to the fifth green of the University golf course, and the remainder of the plant material was on the grounds of the Noer Facility.

Midwest Irrigation pulled the main lines and control wires into the ground at the same time.

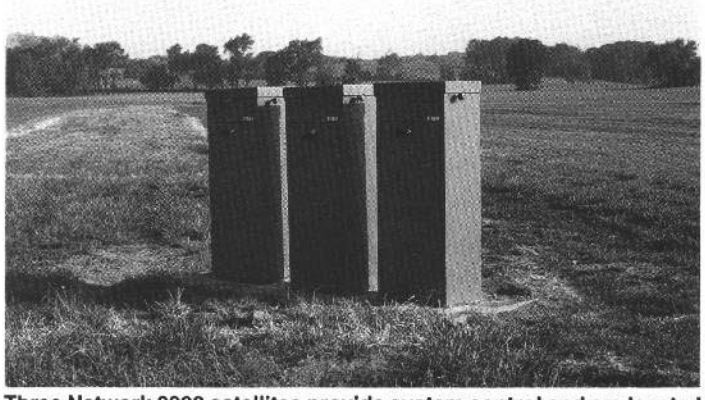
Two pieces of 1" poly pipe were pulled in tandem for adjoining plots.

In this picture the plow is pulling poly pipe along the perimeter of a plot.

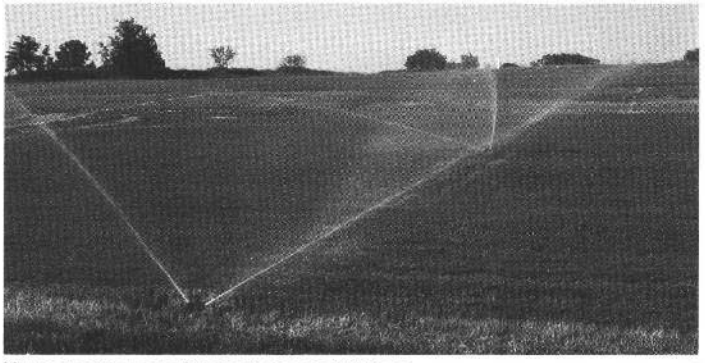
The Bruce. Co. planted the donated materials for the Noer landscape planting plan.



Kwikseal saddles and adjustable cutoff risers were used to hold the sprinkler head.



Three Network 8000 satellites provide system control and are located side-by-side for convenience.



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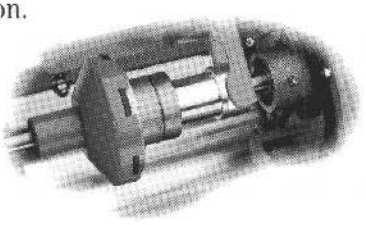

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Phosphorus and Potassium Mobility in Putting Greens

By Michael A. Werth

Editor's Note: *Michael Werth is a May 1992 graduate from the Univ. of Wisconsin-Madison Turf Management Program. He is currently employed at the University Ridge Golf Course.*

Phosphorus and potassium leaching in putting greens is important for several reasons. Some leaching of P from surface fertilizer applications can be desirable because it moves the nutrient deeper into the turfgrass rootzone where it may stimulate root development. On the other hand, leaching of P out of the rootzone is undesirable because the P can enter surface waters and promote aquatic weed and algae growth in ponds and lakes. Extensive leaching of K does not have undesirable environmental effects, but does represent excessive and inefficient use of fertilizer and indicates a need for more frequent and lighter applications of the nutrient.

Putting greens at the Nakoma Golf Club were used for this study. Soil samples were collected last November from all 18 greens plus the practice green at soil depths of 0 to 4, 4 to 8, and 8 to 12 inches. The samples were analyzed for Bray P-1 extractable P and K, pH in dilute calcium chloride, organic matter content, and percent sand and silt plus clay.

The putting greens sampled range widely in age and composition. This is reflected in the ranges and averages in soil analyses that were observed (Table 1). This is desirable for the present study because it gives a wide range of soil properties over which the effects of different factors on P and K mobility could be examined.

The organic matter content of 80:20 rootzone mixes, when expressed on a weight basis, generally ranges between 1.8 and 2.0%. Many of the greens in the present study have considerably more organic matter than this (Table 1) because of the use of highly organic native mineral soil when the greens were originally constructed. Percent sand in the top 4 inches of the older Nakoma greens averages 81%, as compared to 63 to 66% at greater depths. This reflects more than 10 years of core aeration and sand topdressing. Soil pH values range from 6.6 to 7.6. In general, the older the green, the longer it has been irrigated with hard water and the higher the pH.

In the newest greens, P levels at soil depths greater than 4 inches are typically less than 50 lb/A (Table 1). The older greens have as much as 439 lb P/A at the 8- to 12-inch depth. Thus, the evidence is that over time substantial amounts of P have leached in these greens. The soil K levels at different depths (Table 1) likewise suggest that K has been quite mobile over time.

The approach taken in this study was to mathematically relate P or K levels at the 4- to 8-inch soil depth to the levels of these nutrients, soil pH, organic matter percent, percent sand or percent silt plus clay at the 0-to 4-inch depth. From these relationships, it becomes possible to examine what factors contribute to P and K mobility and to calculate for different situations the approximate soil test P and K levels where leaching becomes pronounced.

Table 1. Ranges and averages of soil properties measured.

Soil property		Soil depth (inches) 0 to 4	4 to 8	8 to 12
Sand, %	Range	74 to 95	51 to 96	36 to 97
	Average	81	66	63
Silt plus clay, %	Range	2 to 13	2 to 45	2 to 63
	Average	13	28	31
Organic matter, %	Range	2.6 to 8.5	1.6 to 21.6	1.2 to 18.2
	Average	5.6	6.0	6.3
pH	Range	6.6 to 7.2	6.8 to 7.6	6.8 to 7.6
	Average	7.0	7.2	7.2
P, lb/A	Range	281 to 602	43 to 533	42 to 439
	Average	448	213	184
K, lb/A	Range	189 to 694	38 to 270	20 to 373
	Average	296	131	128

As illustrated in Figure 1, P levels in the 4- to 8-inch soil zone of the putting greens were determined primarily by the amounts of P and percent sand in the 0- to 4-inch zone. The higher the 0- to 4-inch P level or the higher the sand content of the soil, the more P leached into the 4- to 8-inch soil layer. This makes sense given what is known about P retention in soil. Phosphorus is adsorbed onto soil colloid surfaces. This takes it out of the soil solution and prevents it from leaching. Native soils have such high P adsorption capacities that P normally moves only very short distances in them. When significant movement of P does occur, it signifies that soil P levels have exceeded the soil's P adsorption capacity. Sand has little or no P adsorption capacity. Thus, as the sand content of the greens increased, the P adsorption capacity decreased and more P leached. Similarly, as soil P levels exceed the P adsorption capacities, more and more leaching took place.

The equation that mathematically describes the so-called response surface in Figure 1 was used to estimate the P levels in the 0- to 4-inch soil zone, at which there was significant leaching of P into the underlying soil. The calculations indicated that, in soil containing 65% sand, P leaching became substantial when the soil test P level exceeded 599 lb P/A. When the sand content was 95%, the P level where leaching began was only 2 lb/A. In other words, indicates are that in putting greens containing this amount of sand, the soil's P adsorption capacity is very, very low. It is, however, doubtful that it is as low as what calculations indicate. Regardless, the indication is that P leaches readily in USGA specification putting greens. Use of calcareous sand or a very acid peat high in aluminum or iron would undoubtedly increase the P adsorption capacity by a substantial amount and

(Continued on page 27)

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allow for buildup of higher soil test P levels before leaching becomes noticeable.

The putting green soil K levels were analyzed in the same manner as for P. The amounts of K in the 4- to 8-inch soil zones were found to be dependent on the amount of K, the organic matter content and soil pH in the 0- to 4-inch soil layer, but not on the amount of silt plus clay present. In comparing the influences of organic matter and pH, the effect of pH was found to be far more important. Hence, a simplified response surface was developed based only on the influences K and pH in the 0- to 4-inch depth on the amount of K found in the 4- to 8-inch soil depth.

As shown in Figure 2, as soil pH increased at a given level of K in the 0- to 4-inch soil depth, the amount of K in the 4- to 8-inch soil layer decreased. In other words, less leaching took place. This influence of soil pH on K leaching can be explained on the basis that K leaching rates in these putting greens are dependent on soil cation exchange capacity and this cation exchange capacity arises primarily from the organic fraction. It is a well-established fact that the cation exchange capacity of organic matter is entirely pH dependent. It increases rapidly as soil pH increases. This increased cation exchange capacity provides more bonding sites for K and, therefore, reduces leaching.

A common perception seems to be that as the pH of a putting green increases, calcium ions become so abundant that they block the bonding of K to cation exchange sites, K leaching increases and more frequent or heavier K fertilization is required. Under the conditions of the present study, where soil pH ranged from 6.6 to 7.2 in the top 4 inches of the rootzone, this clearly was not true.

Calculations similar to those performed for P were done for K as well. Simulating first, a high sand green with 8% silt plus clay (the maximum allowed) and 2% organic matter by weight, indications were that K leaching occurs at any K level from the 0- to 4-inch soil zone unless the soil pH is 6.85 or greater. Increasing the soil pH to 7.4 has the apparent effect of creating a K retention capacity in the soil of 242 lb K/A. Interestingly, this is very close to the 250 lb K/A figure that is often cited as the K level above which K leaching becomes excessive in high sand putting greens.

It must be clearly understood that the relationships and figures presented here really only apply to putting greens similar to those at the Nakoma Golf Club. They could be quite different for greens constructed from different materials. Nevertheless, indications are that the mobility of P and K in putting greens may be much greater than one would suspect from looking at data for native soils.

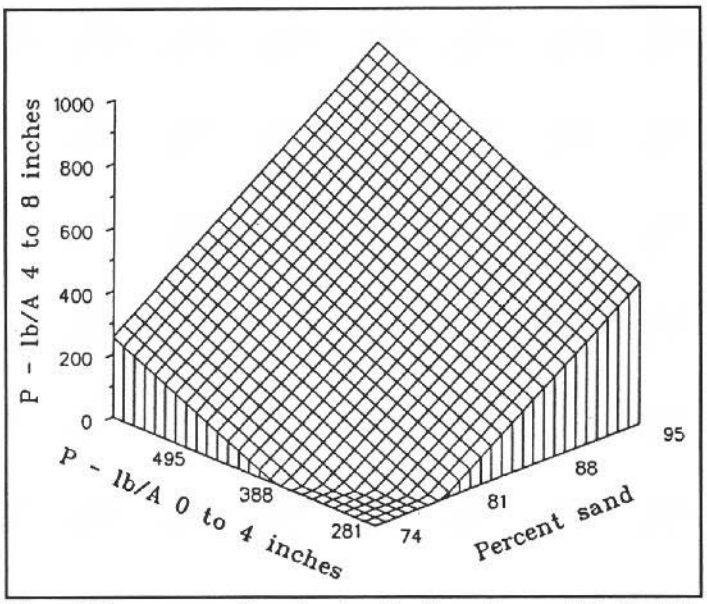

Figure 1. Response surface showing the dependency of P in the 4- to 8-inch soil depth on P and percent sand in the 0- to 4-inch depth.

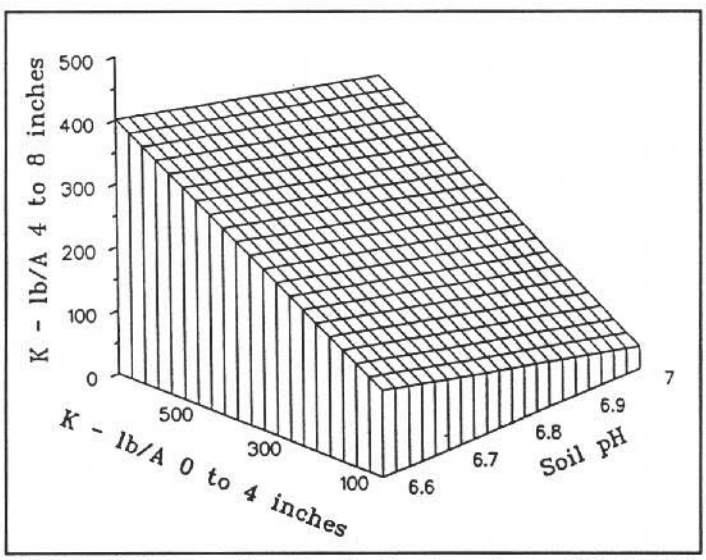

Figure 2. Response surface showing the dependency of K in the 4- to 8-inch soil depth on K and pH in the 0- to 4-inch depth.

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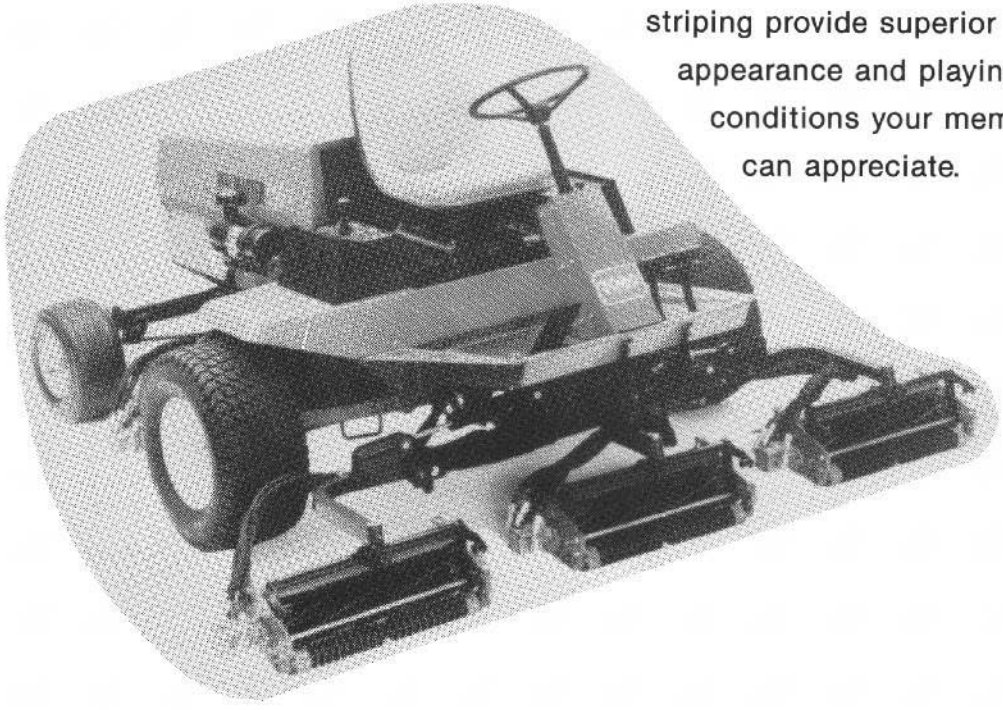

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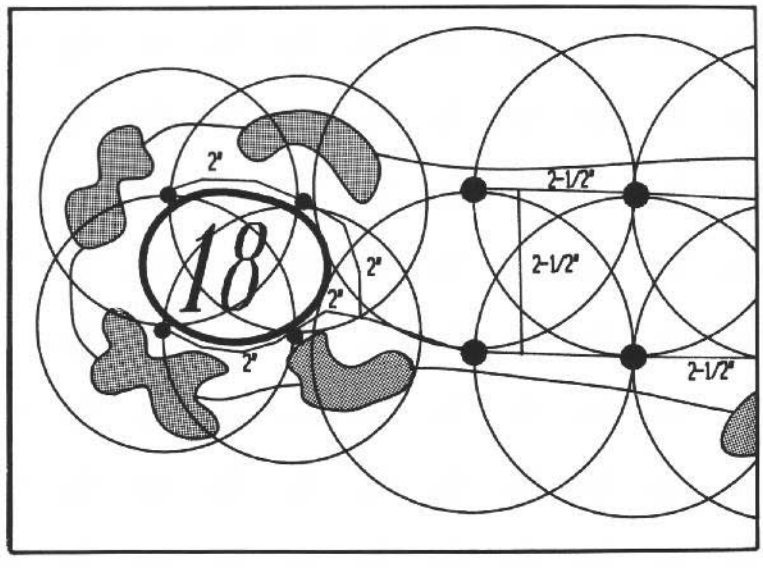

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Ferger Hosts Meeting at Country Club of Beloit

By Bill Knight

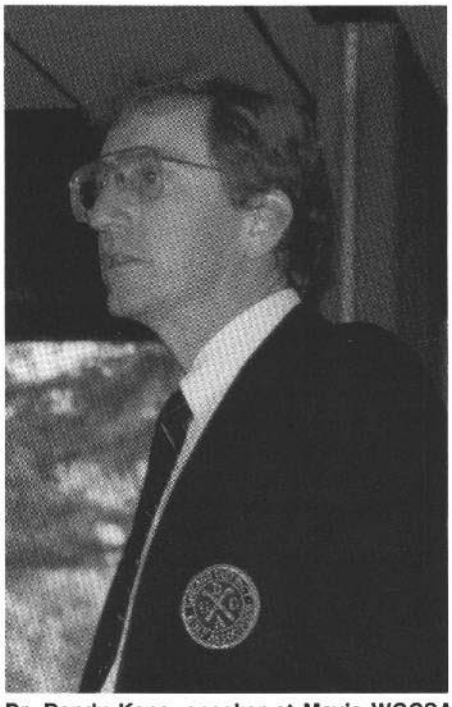
The May meeting of the WGCSA was held at the Country Club of Beloit. Host golf course superintendent Don Ferger delivered on excellent weather and a beautifully conditioned golf course.

Forty-nine golfers played in the two best ball/one worst ball event. The narrow fairways and mature trees took their toll on many golf shots during the day.

Results of the event were: First place: Chad Ball, Skip Wilms, John Feiner and Ed Devinger. Second place: Don Ferger, Dave Ferger, Jim Ferry and Chris Johnson. Third Place: Ron Grunwald, Chris Pinkerton, Mike Handrich, Roy Zehren and Bill Knight. Closest to the pin: Skip Wilms. Longest drive: Chuck Wollner.

After an excellent dinner, the evening was concluded with a lecture by Dr. Randy Kane of the Chicago District Golf Association. The CDGA represents 250 clubs and 70,000 to 80,000 golfers. Dr. Kane's main job is to identify disease problems. The title of his talk was "Disease Control of the 90s—Hit or Miss?"

Dr. Kane talked about southern turf diseases moving north as weather conditions change. He also emphasized the need to rotate systemic fungicides with contact fungicides to prevent diseases from becoming resistant to some fungicides.



Dr. Randy Kane, speaker at May's WGCSA meeting in Beloit.

He also made the point that some chemicals would not be re-registered in the future because of the enormous expense and the fact that turf is considered a minor crop.

A great big "thank you" to Don and the CCB staff for their part in making the day a success.

Decision Awaited

(Continued from front page)

Each candidate was taken to the O.J. Noer Turfgrass Research and Education Facility for a tour. While there, industry representatives from sod production, professional lawn care and golf turf were given the opportunity to meet with each candidate long enough to form an opinion on how each would relate to Wisconsin's grass industries. Jim Huggett, Terry Kurth and Monroe S. Miller represented their respective professions.

The opportunity was given to let the search committee know if any of the interviewees were unacceptable.

None were, by the way. The individuals interviewed represented an enormous range of experience and education. It seems the industry will be well served by whomever successfully completes the hiring process.

Again, we should know of Dr. Newman's replacement sometime in July.