BUNKER SAND

By Monroe S. Miller

The directors of our Club composed a survey of member satisfaction last year. It was directed by a University of Wisconsin-Madison professor in the School of Business (he is also a Club director) and was very professionally done. The survey covered all aspects of Club services.

The results of the golf course questions pleased me greatly. There was near absolute satisfaction with the condition of greens, tees, fairways and roughs. Only two things received marks that caught my attention.

The first was the hill climber that carries players from our ninth green to the clubhouse. It travels too slowly to suit a number of people. They seem to prefer being launched up hill to the leisure ride now offered. There isn't much I can do about that.

The other area that seemed to merit my attention was sand bunker condition.

The green committee imposed a moratorium on any sand additions to our bunkers several years ago. The better players have been pleased with the results. One of them, in fact, commented late last year that the bunkers were "near perfect".

Since that moratorium, we have been making extensive use of our bunker rakes with the "Maple Bluff modifications". The decreasing amounts of sand and the compacting action of the Bluff rake have really "hardened" the sand in the bunkers.

Problems are increasing for me, however. The sand depths are getting so skinny that we are having a little difficulty machine raking some bunkers. I am getting a little weary of looking at the contaminated sand in some of them. Call it old fashioned if you wish, but I prefer a brighter look to the bunkers. The visuals are much greater when the sand is clean.

Apparently, the decreasing amounts of sand are causing some problems for some of our players, according to the survey.

The responses were sorted by age groups—less than 30 - 40, etc. Interestingly enough, the dissatisfaction rose with age. If you assume some rough or approximate correlation between age and handicap, it all makes sense.

Now you understand the motivation for this issue's survey question. My conversations with colleagues about sand bunkers over the past few years have shown me I am not the only golf course superintendent struggling with pleasing his players over the bunker sand issue. The remedies being used merit an entire article of the GRASS ROOTS.

For now, a few questions and their answers will have to suffice. Here are those questions I put to a number of WGCSA members. Unfortunately, the sample isn't as large as I would like. But I think it is sufficient enough to see some trends and initiate some more thinking about the problem.

1. Do you know if your bunker sand conforms to USGA recommendations?
YES: 6 NO: 12

2. Are your players generally satisfied with your sand bunkers?
YES: 9 NO: 9

3. What is the source of most of your bunker problems?
Sand Quality: 4
Sand Consistency: 8
Bunker Drainage: 6

4. Do you hand rake bunkers daily?—0 for events?—2 or never?—16

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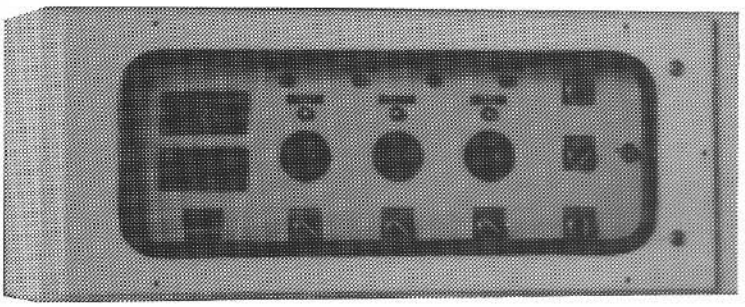

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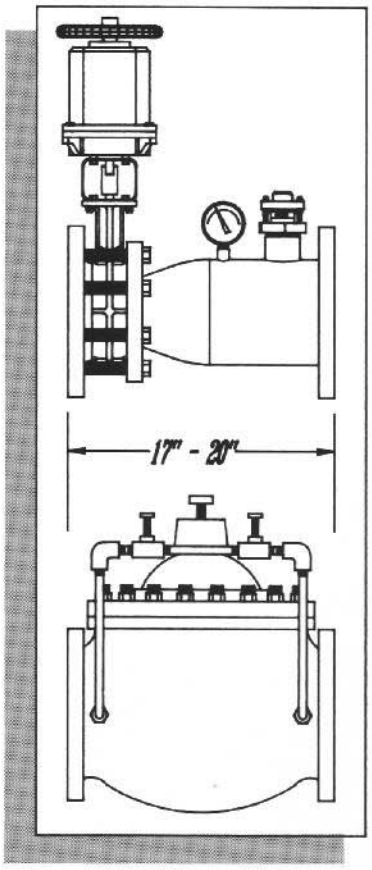

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IPM—We've Been Using It All Along

By Michael Semler

The pest management strategy that is known universally as Integrated Pest Management (IPM) has in recent years become a new buzz word in the golf course superintendent's dictionary.

Golf courses are increasingly coming under fire from some people for the types and amounts of pesticides used to maintain the high turf quality desired by the golfer. Our industry has responded by finally including IPM into our list of responses and management techniques instituted to maintain this turf quality.

I don't know about you, but I never stopped using IPM as my management style. I am certainly glad more is being written about it in the industry.

Superintendents are growing one of the most intensely managed crops known to man—golf course turf. The demand for perfection by golfers, the heavy traffic the turf receives, curveballs by Mother Nature and the unreasonable stresses that are put on turf have put us in this category. We have responded by applying more management techniques and plant protectants than nearly any other crop grown. In essence, we have been using IPM for so long that we just forgot to call it that.

IPM is culmination of all the pest management strategies available and then using all of these tactics in the most efficient and safest way to control the pest. It is not anti-pesticide, but rather emphasizes using pesticides more effectively and efficiently than has been done in the past.

Control measures often referred to in IPM strategies are: cultural, biological, chemical, mechanical and use of resistant varieties. Also included is periodic scouting to determine the levels of pests present. Superintendents are using these techniques everyday without even realizing it.

For golf courses, cultural and chemical control and the use of resistant varieties seem to be the most promising sources for our IPM programs. Mechanical controls (i.e.—the use of traps, barriers, heat and cold) appear to have a limited use on golf courses except in the removal of occasional rodents or animals. Biological control (i.e., the use of natural enemies) is gaining in popularity, but there still is a limited number of golf course pests which have natural predators that are viable control measures. However, research in this area is attempting to increase the types and amounts of control measures available.

This leaves us with the strongest points in our IPM programs. The first is scouting and monitoring pest levels. For example, by consistently monitoring weather data, probing the soil and looking at individual plants, we can determine what pests may pose significant problems in the future and what control measures can be used. The key is knowing what is happening on your golf course and making decisions for controls, if necessary, based upon this knowledge and your knowledge of acceptable pest damage. IPM is based on scouting, monitoring and knowing your golf course environment.

Another of our strong points in IPM is the use of cultural control measures. The list of cultural controls used by golf course superintendents is unsurpassed by any other agricultural commodity.

Water management and the desire to have the perfect soil moisture conditions have put us on the cutting edge of irrigation technology with its precision application and timing. When this technology can't provide the desired moisture levels, we even hand water the localized dry spots. Additionally, we install drainage tile to remove excess moisture and prevent wet areas. In some cases, we even mechanically remove dew in the morning to help relieve disease pressure. All of these help to provide the optimum growing conditions for turf and help to reduce the incidence of disease.

Our fertility programs are based on soil tests and monitoring these levels for optimum growth and minimum

disease incidence. Not only do we make necessary adjustments for major plant nutrients, but for micronutrients and soil pH as well. This maintains plant nutrient availability at adequate levels for proper turf health.

The benefit of aerification on golf courses has been known for a long time and now it has become a critical cultural management tool. These benefits not only include increasing soil porosity and subsequent root density, but a reduction of thatch as well. This thatch reduction diminishes the pest environment and leads to less plant stress and overall increased turf health.

Topdressing on golf courses is another management tool used to promote turf health. In addition to reducing thatch levels, we can change the root zone soil to a more desirable soil in terms of structure, compactability and water holding capacity. These are critical for healthy golf turf because of heavy wear and high traffic the turf receives.

Even most golf course tree maintenance programs are a form of IPM. By pruning or removing specific trees or branches, air circulation is increased with a subsequently reduction in disease pressure. This pruning also increases the sunlight reaching the turf canopy and increases the plants ability to photosynthesize.

One of the most difficult management strategies facing superintendents is the cutting heights we are currently mowing some turf. Let's face it—grass was not meant to be mowed at 1/8 of an inch, or 3/8 of an inch, or mowed at all. It is at its healthiest when left alone. However, it is able to survive frequent cutting because the crown is close to the ground.

The golfers' demand for fast, tight, closely mowed turf has put unrealistic demands on a solid IPM management strategy. However, new technology is coming out which allows higher mowing heights without sacrificing speed and golf turf quality. In addition, new turf types which are able to tolerate close mowing conditions and stay healthy are coming on the market annually.

Along the lines of new turf varieties is the IPM strategy of using resistant varieties. Here again, genetic research is ongoing to produce turf which is hardier and more adaptable to the golf course situation. This research is producing varieties of grass which help our IPM strategies by offering one or more avenues of plant stress reduction.

Finally we come to the use of chemicals for pest control. They are, in fact, an important strategy in IPM. However, in striving for perfection, we need to remember to use the chemicals only as necessary in an overall IPM strategy, and not just to make ourselves "feel good". We certainly should not spray on set schedules which do not warrant their use when pest pressure is not present.

Through our periodic scouting and even after using all other methods of pest control, there often occurs a pest outbreak in which the only means of control is with chemicals. In this case, our IPM strategy includes the application of chemicals in the most reasonable and safest means possible to reduce the pest to acceptable levels.

IPM has been a part of the superintendent's management program since golf turf management began. Chemicals have also played a part in this management strategy. Unfortunately, the emphasis has always focused on the use of chemicals on golf courses, and not on all the other management tools we have been using to reduce and control pest outbreaks.

EDITOR'S NOTE: Remember, comments in this feature do not constitute legal advice. If you need such counsel, visit your golf course's attorney.

The First WGCSA Meeting of 1991 Brings More on Environmental Issues

By Tom Schwab

The Spring Business and Educational Meeting of the Wisconsin Golf Course Superintendents Association was held on March 18th in Fond du Lac. Three regulation packed talks filled the morning educational session. The theme for the morning session was, "Compliance with the Laws."

We, in the golf industry, are being seen more as keepers of the environment. It is imperative that we stay abreast of these ever-changing laws which are being instituted to protect that environment and ourselves.

The morning's first speaker was Deborah Epps of the Wisconsin Department of Emergency Government. She spoke about the community "right to know" law under SARA (Superfund Amendment Reauthorization Act). This law requires that anyone who uses, stores or manufactures a hazardous material in excess of specified weight limits must report them on a "State Tier Two Emergency & Hazardous Chemical Inventory" form.

This is intended to inform your local fire department and community about any potential hazards they could encounter should you have a fire or spill. A short list of some materials that could be found on your golf course along with the threshold amount one may have at any one time is as follows: Chlorine gas - 100 pounds, Gasoline - 1500 gallons, Golf Cart Batteries - 200 batteries.

There are not many other materials we use on the golf course that exceed the level where they have to be reported under SARA. For a more complete list you should contact Deborah Epps at (608) 266-1509. Although there is only a small list of materials we are required to report, if we happen to have one material and it spills or burns, and we have not filed a Tier Two form, she warns that we will definitely be referred for prosecution. It's also just the right thing to do to protect your community and emergency personnel.

Dr. David Kammel, an assistant professor from the University of Wisconsin in Madison, Agricultural Engineering Department, gave the second lecture. His subject was pesticide storage and handling facilities. Basically, the law says you need a handling facility in two cases: (1) If you do your mixing and loading within 100 feet of a well or body of water or (2) If you are farther than 100 feet from a well or body of water but you mix and load more than 1500 pounds of active ingredients annually. David told us about a variance farmers get that allows them to mix and load in or adjacent to their field which is the whole farm. He thought for superintendents each green, tee and fairway is considered a separate field. In other words, he thought we can mix and load in the field if we mix just enough water and pesticide to do one green, tee or fairway then move on to the next one and do the same. However, Paul Morrison, Section Chief for Groundwater and Regulatory Services for Agriculture, Trade & Consumer Protections, (608) 267-7726 said this is not the case. He said the law says we on the golf course can mix and load more than 1500 pounds of active ingredients in the field annually. The criteria is that we must have two mixing and loading sites. Each must be 100 feet away from a well or body of water, less than 1500 active ingredients annually, and at least ½ mile away from the other mixing site.

Let's get real, though. If you can afford that much pesticide, you can afford a facility. Even if you use much less, a facility is a good way to protect you, your employees and the golf course.

Kammel's facilities are comprehensive and take everything into account. They have a heated and ventilated storage building, a secondary containment or curb and dike system, a mixing/handling area, a loading/washpad area, and a worker safety area with fire extinguishers, shower, spill response kit, and personal protection kit. He said he is hoping to build a facility specifically designed for the golf course for us to observe. If you would like his plan or have any questions please call him at (608) 262-9776.

The final talk was from Sheldon Schall, a staff person from the Fire Protection Section of DILHR (Department of Industry, Labor & Human Relations). He told us about, "everything you ever wanted to know about underground and aboveground gas storage tanks but were afraid to ask". Concerning underground tanks, he addressed various leak detection and spill overfill requirements. He also touched on corrosion protection of underground tanks. Since most superintendents are beginning to use aboveground tanks there was much interest in the next part of the talk. He seemed to recommend removal of the old underground tanks over closure in place. That decision can be based on a personal preference until May 1, 1991, when new laws take effect. After that time underground tanks must be removed when switching to aboveground. On aboveground tanks, his talk covered containment capacity, containment valves, crash protection around tanks, set back from buildings and property lines, security, overfill protection, and plan approval. If you have any questions on the new laws after May 1, underground tank leak contamination insurance (Pecfa), or any other storage tank questions call Sheldon Schall at (608) 266-0956.

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NOER CENTER NEWS

A FURTHER UPDATE

By Monroe S. Miller

Anticipation is running high among those close to the construction of the NOER CENTER. As this is written (April 25, 1991), the building contractor is finishing interior details. Walls are painted, doors and window sills have been stained and ceiling tiles have been put in place.

The building mechanicals (HVAC) are pretty much in working order, and the plumbing fixtures are ready for installation. Many of the floor areas have their treatment in place.

The shop area will please every Wisconsin golf course superintendent. The room is large with lots of space for equipment storage, maneuvering and maintenance. The pesticide storage room and a soil prep room are subunits in this bay.

You'll like the entrance. The entry exterior is dressed with native Wisconsin limestone. The doors open to a vestibule first and then to a comfortable waiting area. The north/south hall leads to a conference room, a meeting room and a wet laboratory on the east side, and to two other corridors on the west side. Those corridors access the offices, a storeroom, a tool room and a mechanical room. The lockerroom and restrooms are there also. These two east/west corridors both lead to the shop area.

The accompanying photographs give an idea what the structure looks like. The final grade will show a building cut into the ground at the four foot mark. The grade comes close to the window level.

Remaining to be done before the NOER facility is complete are:

1) topsoil replacement and seeding of the research area
2) resolution of demolition procedures of the adjacent buildings
3) paving of the entry road and parking lot, and
4) landscaping of the building and surrounds.

Once the research area is established, the irrigation system will be installed.

Interviews of individuals under consideration for the NOER facility manager's position are underway.

Should you ever find yourself in Madison, please drive out to the NOER CENTER and see it for yourself. We are anxious for everybody to see what an industry can do to help itself.

The building as it appears looking to the southwest.

The NOER CENTER building as you look to the northwest.

A view looking southwest.

This photo affords a view to the northeast.

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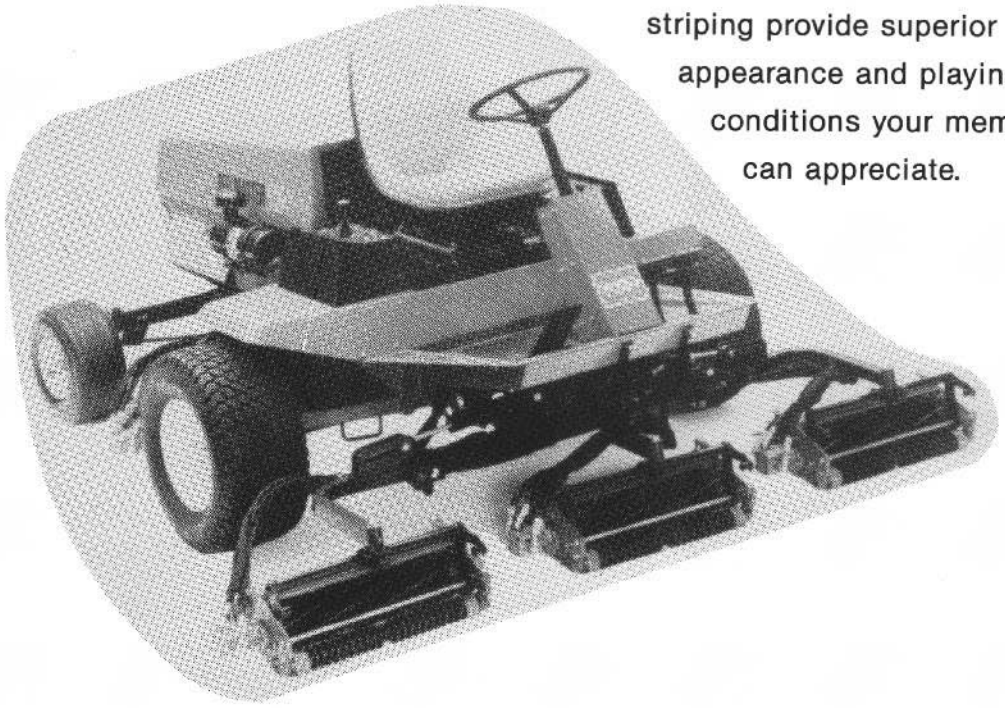

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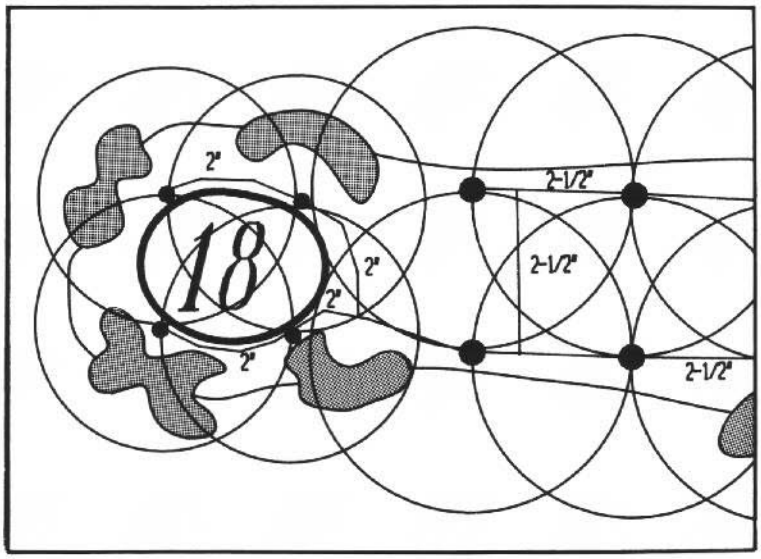

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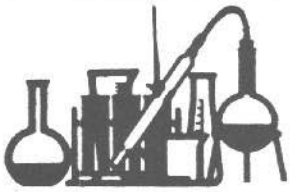

Observations From Fertilizer Demonstrations

By Dr. Wayne R. Kussow
Department of Soil Science
University of Wisconsin-Madison

Fertilizer demonstrations were conducted at the Yahara Hills Golf Course, Madison, Wisconsin, during the period 1988 to 1990. This is a brief summary of the results of these demonstrations.

Rough Area Study

The study was begun in the fall of 1987 in an area of rough seeded in 1964 and now dominated by creeping red fescue. The soil is a Virgil silt loam. Soil tests in 1987 revealed a soil pH of 6.6, 2.7% organic matter and 48 and 250 lb/A, respectively of Bray P-1 extractable P and K. The area received a uniform application of 4.4 lb P_2O_5/M and 2.8 lb K_2O/M in August, 1987. Weed control practices consisted of spring and fall applications of Trimec. Irrigation was performed by golf course personnel and was haphazard at best. Moisture stresses developed at some point in all three seasons. Thus, the over-all turfgrass maintenance level was low to medium and representative of many park lands, cemeteries, airports and athletic fields in the area.

Season average turfgrass color ratings (scale of 1 to 9) are presented in Table 1. Over the 3-year period, the fertilizers providing the best color responses were: Andersons 9-6-18, Brayton 30-4-8, Scotts 34-3-7, Milorganite, Brayton 18-5-9 and urea. Nitroform 38-0-0 fairly consistently provided the lowest color ratings.

Table 1. Season Average Color Responses of a Low Maintenance Creeping Red Fescue Turf to Various Fertilizers

FERTILIZER*	YEAR 1988	1989	1990	3-Year Average
Naturall 8-1-3	—	—	7.8	—
Nutralene 40-0-0	—	—	7.6	—
Sustane 5-2-4	—	6.9	7.2	—
SCU 32-0-0	7.5	7.9	—	—
SCU 37-0-0	—	—	7.8	—
Scotts 32-3-10	7.4	7.3	8.0	7.6
Brayton 30-4-8	7.4	7.4	8.2	7.7
Scotts 34-3-7	7.5	7.5	8.0	7.7
Milorganite	7.7	7.1	8.0	7.6
Brayton 18-5-9	7.3	7.2	7.9	7.5
ParEx 21-2-20	7.2	7.0	7.7	7.3
Nitroform 38-0-0	6.9	6.5	6.9	6.8
Spring Valley 25-2-5	7.0	6.8	—	—
Spring Valley 19-6-8	—	—	6.8	—
ParEx 24-4-12	7.1	6.8	7.7	7.2
Urea	7.2	7.2	8.0	7.5
ParEx 31-0-0	7.3	6.8	7.6	7.2
Andersons 9-6-18	7.3	7.3	8.4	7.7
Ammonium Sulfate	7.1	7.2	—	—
UFC Ammonium Sulfate	—	—	7.4	—
Lebanon 18-5-19	7.1	7.1	7.7	7.2
Blsd (years = replicates)	—	—	—	0.3

*N rate = 4.0 lb/M in 1988, 3.0 lb N/M in 1989 and 1990.

Rankings of the fertilizers based on turfgrass color ratings and tissue N concentration in 1990 (Table 2) reflect to a high degree relative performances of the fertilizers over the 3-year period. The six top-ranked fertilizers in 1990 were: Brayton 30-4-8; Anderson's 9-6-18; Scotts 34-3-7; Brayton 18-5-9; Scotts 32-3-10; and Milorganite.

Table 2. Relative Responses of a Low Maintenance Creeping Red Fescue Turf to Various Fertilizers in 1990

FERTILIZER	Rank Based On Color Rating	Tissue N	Overall Rank
Naturall 8-1-3	9	7	8.0
Nutralene 40-0-0	13	13	13.0
Sustane 5-2-4	16	17	16.5
SCU 32-0-0	8	9	8.5
Scotts 32-3-10	6	5	5.5
Brayton 30-4-8	2	1	1.5
Scotts 34-3-7	3	3	3.0
Milorganite	5	6	5.5
Brayton 18-5-9	7	2	4.5
ParEx 21-2-20	12	11	11.5
Nitroform 38-0-0	17	16	16.5
Spring Valley 19-6-8	18	18	18.0
ParEx 24-4-12	11	12	11.5
Urea	48	6.0	
ParEx 31-0-0	14	15	14.5
Andersons 9-6-18	1	4	2.5
UFC Ammonium Sulfate	15	14	14.5
Lebanon 18-5-19	10	10	10.0

Golf Tee Study

This study was begun in May, 1989, on a large golf tee constructed in 1963 from fill material. Although elevated, the tee is poorly drained. The turf on the tee is a mosaic of annual bluegrass and creeping bentgrass.

Table 3. Season Color Responses of an Annual Bluegrass Dominated Creeping Bentgrass Golf Tee to Various Fertilizers

FERTILIZER	N Rate lb/M	YEAR 1989	1990	Average
Nitrazine 59-0-0	4	7.7	7.6	7.6
Agriform 34-0-7	5	7.8	7.8	7.8
Nitroform 38-0-0	6	7.6	7.9	7.8
Johnsons 37-0-0	4	7.5	7.6	7.6
Lebanon 32-0-0	4	7.6	7.7	7.6
ParEX 31-0-0	4	7.9	8.0	8.0
Scotts 22-0-16	4	7.7	7.6	7.6
Sta-Green 15-0-30	4	7.6	7.5	7.6
Sta-Green 21-0-21	4	7.6	7.8	7.7
Milorganite 'F'	4	7.8	7.8	7.8
Sustane 5-2-4	4	7.9	7.6	7.8
Sta-Green 17-2-10	4	7.8	7.7	7.8
Johnsons 18-3-12	4	7.9	7.6	7.8
Scotts 32-3-10	4	7.9	—	—
Spring Valley 5-1-10	4	—	7.7	—
Nutralene 40-0-0	4	—	7.6	—
Spring Valley 21-3-12	4	—	7.8	—
Blsd (dates = replicates)		0.3	0.2	0.2

There were few significant differences among the season average color ratings of the various treatments (Table 3).

Between the two full-season fertilizers, Nitrazine 59-0-0 and Agriform 34-0-7, the latter produced better results and was comparable to several other fertilizers applied three times during the season. Unlike in the improperly irrigated rough area, Par Ex 31-0-0 was one of the best fertilizers in the tee demonstration.

Table 4. Relative Responses of an Annual Bluegrass Infested Golf Tee to Various Fertilizers in 1990

		RANKING BASED ON			
Fertilizer Applied	N Rate lb/M	No. Appl.	Color Rating	Tissue N	Overall Rank
Nitrazine 59-0-0	4	1	11	13	12.0
Agriform 34-0-7	5	1	1	1	1.5
Nitroform 38-0-0	6	3	3	2	2.5
HOJO 37-0-0	4	3	10	2	6.0
Lebanon 32-0-0	4	3	6	5	5.5
ParEX 31-0-0F	4	3	1	3	2.0
Scotts 22-0-16	4	3	10	11	10.5
Sta-Green 15-0-30	4	3	14	10	12.0
Sta-Green 21-0-21	4	3	5	7	6.0
Milorganite 'F'	4	3	4	4	4.0
Sustane 5-2-4	4	3	13	6	9.5
Sta-Green 17-2-10	4	3	8	9	8.5
HOJO 18-3-12	4	3	12	8	10.0
S. Valley 5-1-10DQ	4	3	7	12	10.5
Nutralene 40-0-0	4	3	9	14	11.5
S. Valley 21-3-12	4	3	4	15	9.5

Because of problems arising in color ratings from plots that vary in annual bluegrass populations, 1990 rankings considered tissue N concentration as well as color rating (Table 4). Although color and tissue N rankings were sometimes very similar, some large differences were noted. For example, HOJO (Howard Johnson's) SCU 37-0-0 had a color ranking of 10 but a tissue N ranking of 2. Thus, in this particular study, tissue N was likely a better measure of performance than was color rating.

Based on tissue N, the top-performing fertilizers in 1990 were: Agriform 34-0-7; HOJO 37-0-0; Nitroform 38-0-0; Par Ex 31-0-0; and Milorganite 'F'. With the exception of HOJO 37-0-0, these fertilizers also produced excellent color ratings over the two years of the study.

Nitrazine N-59 Study

Nitrazine N-59 is a granulated product comprised of 27.9% urea – N and 72.1% melamine – N. Urea provides for rapid turfgrass response while melamine is the SRN component. Biological release of significant amounts of N from melamine does not begin until about two months after application. Thus, during the second month after application turfgrass response declines as the urea is depleted and before melamine – N is released at a rate that satisfies turfgrass needs.

To overcome this second-month available N deficit, the recommendation is that Nitrazine N-59 be applied in conjunction with a more conventional SRN. In 1989, several SRN's were tested for this purpose. Among the four SRN's examined (SCU, Nitroform UF, IBDU and Sustane), the results with IBDU were outstanding. This observation led to single-season applications in 1990 of Nitrazine N-59 with various proportions of IBDU on creeping red fescue-dominated turf at rates of 2 and 4 lb/M/season. The 2 lb N rate was insufficient as far as turfgrass N requirements in late season were concerned. Therefore, the discussion that follows focuses on the 4 lb N/M rate.

Before reviewing the results of this study, one point needs to be made very clear. The site of the study was in the rough at the Yahara Hills Golf Course. Irrigation was made available, but only periodically. Moisture stresses occurred between June 15 and August 15 and again in September. The stress was most severe in early August and the turfgrass actually began to enter dormancy.

Color ratings and tissue N concentrations (Table 5) clearly indicated that the ½ Nitrazine ½ IBDU combination was superior to the other two Nitrazine-IBDU combinations and to Agriform 34-0-7. The lowest color ratings (Table 5) were recorded August 15, which preceded reinitiation of irrigation in preparation for an August 29 Wisconsin Turfgrass Association Field Day. During this period of severe moisture stress only the ½ Nitrazine ½ IBDU treatment proved capable of maintaining turfgrass color ratings above the minimally acceptable level of 7.0.

Table 5. Turfgrass Color Ratings and Tissue N Concentrations at a Season N Rate of 4 lb/M

	Color Ratings		Tissue Nitrogen (%)	
Fertilizer	Range	Average	Range	Average
⅓ Nitrazine - ⅔ IBDU	6.6.-9.0	7.8	2.30-4.18	3.17
½ Nitrazine - ½ IBDU	7.2-8.7	8.0	2.84-4.09	3.36
⅔ Nitrazine - ⅓ IBDU	6.4-8.5	7.4	2.45-3.28	2.89
Agriform 34-0-7	6.4-9.0	7.6	2.62-3.52	3.15
Blsd		0.3		0.31

Changes in turfgrass color ratings during the season are shown in Figure 1. The most erratic color responses were those observed for the ⅓ Nitrazine ⅔ IBDU combination and Agriform 34-0-7. Greatest color stability was achieved with the ½ Nitrazine ½ IBDU combination. This combination was notably superior to all other fertilizer treatments in terms of turfgrass recoloration after the severe mid-August period of moisture stress.

In summary, the combination of ½ Nitrazine-N and ½ IBDU-N appeared to hold considerable promise as a full-season turfgrass fertilizer. In essence, this amounted to application of 0.86 lb WS + urea-N, 1.44 lb. Melamine-N, and 1.70 lb IBDU-N. Testing of this N combination under more favorable moisture conditions and on different turfgrass species is highly recommended.

Influences of Fertilizer Grade on Soil Test P and K Levels

The rough area fertilizer demonstration provided the opportunity to observe changes in soil test P and K when turf was fertilized with various grades of fertilizer. The amounts of P and K applied over the three-year period ranged from zero to 8.3 lb P and zero to 25 lb K per 1,000 ft². By relating changes in soil test P and K to rates of application, it becomes possible to estimate the annual rates of these nutrients required to maintain initial soil test levels.

Regressions of changes in soil test P and K (lb/A) on the amounts applied over the three-year period yielded the following equations:

$P = 7.33 + 1.11$ Fertilizer P (lb/A) $R^2 = 0.859$

$K = 40.9 + 0.436$ Fertilizer K (lb/A) $R^2 = 0.920$