Then, after a Rockies home stand, the mix was taken out and the infield resodded for the Four Nations Cup Soccer Competition. Games were held on July 16. July 17 was an off day, and the four teams played again on July 18. The sod was removed, the "new" infield mix was reinstalled, and the field was ready for the return of the Rockies for a game on July 22.

Though the east stands appear to move "by magic," there's nothing mystical about it. It takes coordination and planning to execute. And there are a few other details that take concentrated, coordinated people-power, like removing the baseball mound, painting the football grid, putting up goal posts and safety nets, and accommodating TV crews, radio and print media — and keeping the turf in shape to maintain that lofty Mile High image and playability.

Home Turf

Lujan didn't exactly grow up in Mile High Stadium, but he did live near it as a kid. Whenever he got a chance to get inside, he ended up near the railing surrounding the field. He wasn't seeking autographs like the rest of the kids, but watching the grounds crew. He was fascinated by procedures such as lining the field and working the skinned areas. After high school and some college, he applied for a job with the Denver Parks Department and ended up with the assignment he always knew he wanted. At age 20 Lujan was "home" at Mile High Stadium. "When I leave for work, I tell my wife, 'I'll see you later, I'm going home,'" he says.

"I started working my way up from the first day," Lujan explains. "I signed on for all the events I could and took in everything that was going on. I worked for Steve Wightman. He's the best mentor anyone could have — I owe my career to him. When Steve took his current position with Jack Murphy Stadium, I was promoted to Steve's job. It's just what I was meant to do."

Lujan and his wife Antoinette have two daughters, Athina, 13, and Christi, 10. When not at Mile High, he spends as much time as possible with them. In his "spare" time, he plays golf to relax. "But this summer I increased my game by five strokes," he laments.

The keys to the success of Lujan and the field at Mile High itself are planning and communication, which he says are vital to sports turf management in general.

"At Mile High, we do as much as we can to have everything in place, ready to go when it's needed," he says. "Scheduling, monitoring everyone and everything that impacts the field, sticking precisely to specifications in materials and application rates, and manipulating the P.A.T. system give us pretty good control.

"The one thing we can't control is Mother Nature," Lujan concludes. "All we can do is predict what she might send our way and have all the equipment, supplies and people prepared to deal with whatever it is she decides on."

And because this is Denver, home of majestic peaks, driving winds, fluctuating humidity, subzero winters and scorching summers, what Mother Nature delivers could be just about anything — but nothing Tom Lujan and his Mile High stadium crew can't handle. ❑

Editor's note: Bob Tracinski is the manager of public relations for the John Deere Company in Raleigh, NC, and public relations chairman for the Sports Turf Managers Association.

Success With Overseeding Warm-Season Grasses

By Dr. Gil Landry

As the cool temperatures of fall slow the growth of warm-season turf, many sports facilities select the option of overseeding with cool-season grasses. Overseeding improves the aesthetic quality of a property by maintaining color. On playing fields, golf courses and parks, the active growth of cool-season grasses provides a smoother, more-cushioned playing surface and increased tolerance to wear.

Total turf care requires a complete, year-round maintenance program. Prior to overseeding, special consideration should be given to proper soil fertility, an aeration schedule that relieves soil compaction and the prevention of excessive thatch development.

Verticutting prior to overseeding improves seed/soil contact. Photos copyright: Larry Kassell.

Seeding rates generally range from 5 to 10 pounds per 1,000 square feet.

Your overseeding success depends on the selection of cool-season grass varieties compatible with existing grasses, adequate seedbed preparation, optimum timing, postplanting maintenance and proper handling of the spring transition.

Select cool-season grasses to fill your specific needs. Perennial ryegrasses, fine fescues and rough bluegrasses offer improved turf quality, increased stress tolerance and pest resistance, and greater manageability than annual ryegrass. "Intermediate" ryegrasses, with characteristics between annual and perennial ryegrass, perform adequately in some situations, especially where traffic is not a concern.

Mentioning cultivars is probably useless, since the 1990 National Turfgrass Evaluation Program had 123 entries while the 1986 test had 65. Performance of individual cultivars will vary according to regional weather conditions and specific site characteristics. Especially with the erratic weather patterns of the past few years, it's wise to evaluate university test results, the experience of other turf managers and the history of

performance on your own sites when making seed selections. Ideally, overseeding will result in a gradual transition from warm-season turf to cool-season turf in the fall and the gradual reversal of dominance in the spring.

Seeding rates play a major role in overseeding establishment and spring transition. Rates generally range from 5 to 10 pounds per 1,000 square feet. With higher seeding rates, fall establishment time tends to decrease. However, with the higher seeding rates, increased competition caused by the greater density of cool-season grasses also tends to increase spring transition time.

An essential element in maintaining weed-free turf is the selection of top-quality, "certified" (blue tag) seed containing no annual bluegrass (*Poa annua*). Where early fall conditions are conducive to seedling diseases, choose seed treated with such fungicides as Apron, Koban or Subdue.

Under "normal" conditions, overseeding can be planned for two to four weeks prior to the date of the average annual killing frost.

Increased timing accuracy can be achieved by monitoring such indicators as daytime soil temperatures at a 4-inch depth approaching 75 degrees Fahrenheit range; night air temperatures consistently in the 50 degrees F range; and midday temperatures averaging below 70 degrees F. Obviously, the closer the timing of overseeding allows the emerging cool-season grasses to match the natural decline of the warm-season grass, the more efficient the fall transition will be.

Generally, the greater the existing turf is opened prior to overseeding, the better the establishment rate, wear tolerance and stress resistance of the cool-season grasses. However, the competition for warm-season grasses in the spring will be greater, too, and can delay a smooth transition.

Where there is little thatch, overseeding preparation simply may consist of close mowing or scalping. For a first-class turf surface on playing fields and golf courses, most managers prepare the seedbed by scalping, verticutting and coring. Core aeration should be performed about four weeks prior to overseeding. After seeding and dragging or raking the seed into the soil to achieve good soil contact, begin lightly irrigating to maintain good surface moisture without causing puddling. This can require three to five short irrigation periods per day until the seedlings are well-established. Then, gradually reduce the frequency and increase the time of irrigation until a normal watering program can be established.

Begin mowing when seedling height is 30 percent higher than desired. As always, remove no more than one-third of the grass blade at any single mowing. Make sure mower blades are sharp, and mow when the grass is dry to reduce seedling injury. Obviously, minimizing traffic during establishment is important.

continued on page 14

Success With Overseeding

continued from page 13

Avoid early nitrogen applications, which will encourage competition from the warm-season turf. It's best to hold fertilization until after seedling emergence, which is generally two to three weeks after seeding. Once the fertilization program begins, rates of 1 pound of nitrogen per 1,000 square feet per month of active growth is usually adequate.

A good year-round management program is your most valuable tool when it comes to a smooth spring transition. Proper mowing, irrigation, cultivation, thatch and traffic control, fertilization and pest management impact transitions. It's also essential to know and make use of normal climatic conditions to your area. Soil and night temperatures approaching 60 degrees trigger the resurgence of growth in most warm-season turfgrasses. As soil temperatures increase, it's critical to a smooth transition to maintain a mowing height that prevents the ryegrasses from shading out the bermudagrass. A gradual lowering of mowing height further speeds soil warming and increases the stress on the cool-season turf, while enhancing the warm-season turf.

Ideally, overseeding will result in a gradual transition from warm-season turf to cool-season turf in the fall and the gradual reversal of dominance in the spring.

Practices such as coring, verticutting and topdressing have been used as an aid in increasing soil temperatures. On the down side, these practices can also tend to inhibit the recovery of warm-season grasses. Sometimes attempting to force soil temperature increases by aeration can lead to early spring growth and premature reduction of the overseeded turf, especially when cool spring temperatures follow. Therefore, when possible, coring verticutting and topdressing should be avoided during the green-up period.

Once temperatures have risen adequately, warm-season turf growth can be encouraged and the decline of the cool-season grasses encouraged with an application of soluble nitrogen. Chemical growth regulators, such as Retard, Slo-Gro, Embark or Kerb, and certain crabgrass pre-emergence herbicides also have been shown to reduce the survival rate of cool-season grasses, thus easing the spring transition.

A proper, year-round management program is essential to maintaining a quality turf for your clients. Overseeding success as well as smooth spring transition depend on your ability to understand the impact of weather conditions on turf growth and to tailor your program to accomodate fluctuations and meet your client's needs. ❑

Dr. Gil Landry is an extension turfgrass specialist with the University of Georgia, developing statewide educational programs in turfgrass management. He is president of the Sports Turf Managers Association.

Controller Enclosures: *Outdoor Armor*

By Matthew Trulio

When it comes to scheduling irrigation for intricate landscapes, today's sophisticated controllers can do it all. They can collect evapotranspiration, temperature, humidity, microclimate and solar radiation data and calculate schedules. They can detect malfunctions such as pressure losses or environmental variables such as high temperatures and override the program to shut down down the system. They can be scheduled to irrigate different zones of planting beds and turfgrass differently. Combined with moisture and rain sensors, they can be programmed to irrigate "as needed." The list of possibilities is endless.

A stainless-steel enclosure protects a controller and delicate circuitry in a park setting. Photo courtesy: VIT Products/Strongbox.

What controllers can't do, however, is protect themselves. Even the most high-tech, flexible, reliable — and expensive — piece of controller wizardry is vulnerable to the elements, vandalism and theft. That's where controller enclosures, cabinets or "boxes" come in. They protect your controller investment.

"Enclosures are particularly necessary for controllers in high-traffic areas like parks, mostly to prevent vandalism," says John Tilton, general manager of Cross Brothers, which offers both stainless-steel and cold-rolled steel enclosures. "But enclosures also keep irrigation clocks safe from the environment."

Materials and Design

Enclosures are made from a number of different materials. However, there are two you're most likely to encounter in researching them:

• *Cold-rolled steel.* Cold-rolled steel is "new" steel — it isn't made from scrap metal like hot-rolled steel. Its carbon content is lower, which makes it less prone to rust and corrosion. But left unprotected, cold-rolled steel will rust. That makes paints and painting methods used to protect enclosures made from this material critical.

"One thing we're experimenting with is a cold-rolled steel anti-graffiti cabinet," says Larry Pellerin, production for Le Meur Manufacturing, which makes both stainless-steel and cold-rolled steel enclosures. "It's a little costly right because our volume isn't up, there's a paint available that is graffiti-proof. We've started to offer that option to our customers."

• *Stainless steel.* Stainless steel is steel alloyed with chromium. The better grades of stainless steel (grade 304 or better recommended and used by most enclosure manufactuers) will not rust and require little or no cleaning. However, they can be 30- to 40-percent higher in price than cold-rolled steel.

A number of manufacturers produce both stainless-steel and cold-rolled steel versions of their products. Between the two, most recommend going stainless when budget allows.

"Customers sort of 'migrate' to stainless steel over the years," explains Don Pagano, president of VIT Products/Strongbox, which offers both stainless-steel and cold-rolled steel enclosures. "When you first bring your products to an area, people hesitate at first but eventually come to the conclusion that, yes, they've had vandalism and theft problems. They'll be specifying and using enclosures, but usually they start with painted metal models. Then they'll discover that stainless steel does better than painted metal in terms of maintenance. No matter how well they're made, standard-steel boxes are only as good as their coatings, and even those are only as good as the person installating the enclosure, who might scratch it in the process. Once you have a scratch on any painted steel box, rust will begin. That means sanding and repainting. Stainless steel doesn't have that problem."

Mike Deming, vice president of sales and marketing for Rainman/Division of Electrorack, which manufactuers both stainless and cold-rolled steel enclosures, agrees. "You've got to consider quality and longevity," he notes. "Municipalities in particular don't want to replace enclosures in a year or two. You may save a few dollars with a less expensive box, but it's just not economical when you have to replace it every year or so. A stainless-steel box will last at least 10 years."

Adds Rick Malkin, a product manager for the commercial division of Rain Bird Sales Inc., "We have found that in order to get a high-quality metal painted properly it costs as much as stainless steel."

Stainless steel and cold-rolled steel aren't the only materials being used in enclosure construction. Plastic enclosures are available; however, they are usually designed for smaller, less sophisticated, indoor-mounted controllers and are not a viable (or wise) protection choice for today's high-end units. Another enclosure material option is fiberglass.

continued on page 16

Controller Enclosures

continued from page 15

"The advantage of fiberglass is that it's less expensive than stainless steel," asserts Mike Devine, president of Hot Box Manufacturing Inc., maker of fiberglass enclosures for backflow protection devices, which recently added enclosures to its line. "Fiberglass also won't rust like galvanized steel. Our enclosures are UV- and vandal-resistant and, because we use a 'male' mold in their manufacturing process, they are rough and nonreflective on the outside."

Features to Consider

To the unenlightened viewer, one stainless-steel or cold-rolled steel enclosure may look just like the next, but there are subtle and not-so-subtle design differences. For example, some manufacturers, such as Cross Brothers, manufacture their products with slanted or cambered roofs, so that rain or irrigation water runs off. In addition to product-specific design features, however, any enclosure should have:

• *Weatherproof sealing.* Water is the enemy of electronics. Rubber gaskets or seals around door openings are a must. "Make sure the doors fit very tightly," Pellerin of Le Meur suggests. "In addition to keeping moisture out, that prevents anybody from being able to pry them open with a bar or rod."

• *Ventilation.* Heat is another enemy of electronics. Adequate enclosure ventilation is crucial. (In extreme heat situations, electric fans have been installed inside enclosures.)

Ventilation is usually accomplished through louvers, the placement of which depends on the particular manufacturers. Many, however, incorporate screens of various mesh sizes, which keep out insects, dirt and even dust.

"Ventilation is critical, especially in areas of high humidity," says Jeanne Cantu, national specification sales manager for Toro Irrigation.

Adds Pagano of VIT/Strongbox, "Without louvers, the box will set up its own little environment and sort of 'rain' or 'mist' inside, getting moisture all over the things you're trying to protect."

• *A strong locking mechanism.* An enclosure's weakest link is its locking mechanism. Many manufacturer recommend no less than a three-point locking system. Both key lock and padlock set up are available. When considering an enclosure, ask the manufacture to carefully explain the lock involved.

On a related note, hinges and all "extra" hardware should be manufactured from the same material as the enclosure itself, as should all welds. It makes little sense to select an expensive stainless-steel enclosure that doesn't employ the same material in crucial areas. "Not only do we have a stainless-steel pin for our hinges, but the hinges are 'staked' so that thieves or vandals can't take the pin out," says Pellerin.

• *Ample capacity.* The enclosure should have enough space to hold the required components. It seems like an obvious requirement, but inadequately sized enclosures *have* been specified all too frequently. Although enclosure manufacturers strive to make their products accommodate the various high-end controllers, some controller products may require controller-manufactured enclosures. Always check with the controller manufacturer. Specific places inside to store irrigation plans and controller manuals are also a plus.

• *Ease of access.* Maintenance personnel shouldn't have to contort to unlock or open an enclosure — they have enough

Cold-rolled painted steel pedestal-mount controller enclosures are frequently used in golf course applications. Photo courtesy: Toro Irrigation.

hard work to do. Granted, locks can and often should be "hidden" from the view of passersby, but they shouldn't be so hidden that they are a nightmare for those who need access. Most enclosures have swinging doors in front or back of the unit, which function well. There are, however, variations on this theme. The Turfman enclosure from Rainman, for example, is designed with its door in the top of the enclosure.

Design Situations and Considerations

The choice between stainless-steel, cold-rolled steel, fiberglass and even plastic enclosures goes beyond structural integrity. How the enclosure will "look" in the environment, an environment generally composed of soft plant materials, can be equally important. In the past, says Karen Moore, national sales manager for VIT Products/Strongbox, there was a belief that brown or green-colored enclosures would "blend in" better. That's changed, she asserts.

"I see people going in the direction of stainless steel," says Moore. "Years ago there was this perception that stainless steel would be reflective and stand out. What we're discovering is the 'chameleon effect' of stainless steel — it actually blends in much better than a colored enclosure trying to replicate nature. Stainless steel provides a subtle reflection of the colors around it."

The key word, more observes, is subtle. To that end, VIT Products/Strongbox and a few other manufacturers give their stainless-steel enclosures a brushed finished to make it less "mirror-like."

Although the majority of enclosure manufacturers who make both stainless-steel and cold-rolled steel enclosures lean toward stainless, they emphasize that cold-rolled steel products can do an excellent job if properly maintained. The primary job of any enclosure is to protect the sensitive contents within.

"In a situation where you have a computer system controlling satellite controllers, the satellites and their necessary components would definitely need to be enclosed," says Malkin of Rain Bird. "And I would certainly recommend an enclosure in any situation where you're using moisture sensors, rain sensors or any other sensors with circuitry back at the controller."

Moore believes the balance between aesthetics and armor is achievable.

"From an exterior point of view you don't want something obtrusive," she concludes, "but you do want to select an enclosure that says, 'You really don't want to get into this, and if you try, you're going to have a very hard time.'" ❑

Fertigation Lowers the Boom on Inefficient Nutrient Distribution

By Luke Frank, Irrigation Editor

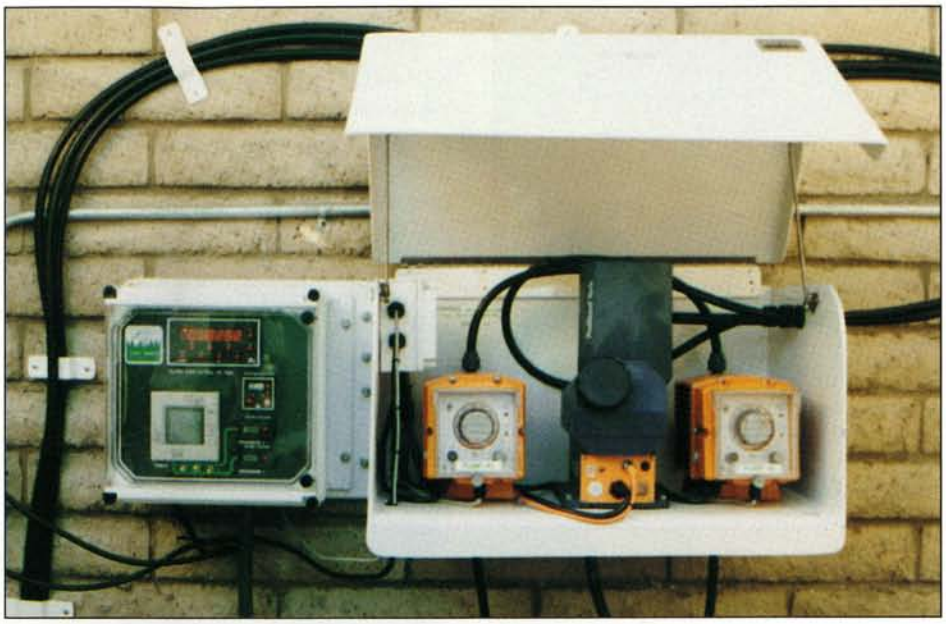
Control is the name of the game. Mastering a golf swing or dominating a fastball ultimately produces successful results. Similarly, controlled application of turf nutrients, soil amendments and some chemicals will ultimately result in a dense, durable playing surface.

Your irrigation system *can* be an effective vehicle for distributing fertilizers, wetting agents, herbicides and fungicides in addition to controlling water and soil pH levels. However, effectively dispersing these compounds largely pivots on the coverage uniformity of the irrigation system through which everything must pass.

There are clear advantages to "spoon-feeding" turf and earth in small doses at short, regular intervals. The compounds applied are more readily absorbed and utilized by the plant material while chemical leaching is minimized. "A turf manager who fertigates may use the same amount of fertilizer annually, but the plant material will use more," relates Bob Walker with the Irrigation and Training Research Center at Cal Poly, San Luis Obispo.

Perhaps the greatest advantage to fertigation is the savings on labor and material. Funds consumed purchasing and maintaining walk-behind spreaders and tractor-tugging hoppers throwing granular fertilizers may be channeled to cover the expense of installing or retrofitting an irrigation system with an injector system. Once the system is in, fertigation costs no more in labor than maintaining your irrigation system.

Time used mixing chemicals in a tank mounted on a utility vehicle, driving across greens while another crew member pulls pins, then cleaning the tank, the boom and the nozzles, may be diverted to other areas of maintenance like cleaning fairway bunkers, pulling crabgrass from greens or pruning trees. Athletic field maintenance crews can spend more time spraying or chalking lines, resurfacing baselines, or rebuilding pitcher's mounds. Fertigation also eliminates heavy equipment compacting turf and soil, possibly damaging plant material or sprinkler heads and laterals.



An injector system secured in a building applies fertilizers and other amendments through the irrigation system. The controller gives the power and flexibility to dial a percentage of chemicals to water, or to override the fertigation program altogether. ***Photo courtesy: Karsten.***

Velvet Green Turf

Shooting concentrated granular nutrients heavily in the spring and fall invites "turf torch" where human and mechanical errors are likely. By applying substantially diluted solutions with each irrigation schedule (generally for turf, 1-to-1,000 gallon or higher ratio of fertilizer to water in peak water periods), lush growth is eliminated, taking with it fluctuating turf maintenance schedules, relates Harold Goldsmith with Auto Grow in Las Vegas, NV. Nor will your turf enter stress periods of feast and famine, adds Frank Maggio of Long Island-based Ecoturf.

A light, consistent application of iron and/or nitrogen can help maintain a consistently healthy green luster. Less expensive fertigation systems simply inject these and other nutrients into the main irrigation line, which distributes a diluted solution evenly across the entire turf area, explains Dr. George Snyder with the Everglades Research and Education Center in Belle Glade, FL. Some prefer to use fertigation in this manner, applying a background level of turf and soil nutrients which can be supplemented with more conventional distribution methods, if needed. Snyder encourages turf managers to combine fertigation and conventional fertilization, incorporating the best features of each method for optimal control of application. Snyder adds that fertigation may help with sandy soils which won't readily retain such nutrients as nitrogen, sulphur, potassium and other micronutrients. Metering fertilizer in frequent, light doses will maintain these nutrients at adequate levels of plant availability while reducing leaching.

Quick recovery for waning or damaged high-traffic turf areas is achievable. Plant material can consume a fertilizer/water solution much faster than water soluble granules tossed out, awaiting meltdown and absorption, emphasizes Goldsmith. A consistently healthier playing surface reduces the level of turf damage.

Fertigation may be used to adjust water and soil pH, add penetrators and utilize wetting agents. Golf course superintendent Chris Mock uses a relatively inexpensive injector system to apply wetting agents with each irrigation,

enabling more efficient use of the water and soil at Hallbrook Farms Country Club in Kansas.

Newly seeded and reseeded areas are also receptive to fertigation practices due to the ease of foliar and root absorption from frequent, light applications and the elimination of foot or other traffic on the seeded surface, adds Michael Chaplinsky of Turf Feeding Systems in Houston. The traditional method of new turf grow-in using dry fertilizer requires applying fertilizer before planting, planting and watering, then interrupting irrigation to apply more granule fertilizer regularly for the next eight to 12 weeks during grassing, according to Chaplinsky. Fertigation shortens grow-in times while minimizing fertilizer leaching and damage to turf and the irrigation system.

When laying sod, Maggio suggests using conventional fertilization methods to stimulate root growth, then following with fertigation to maintain even and consistent growth for the life of the turf.

Custom Blending Your Solution

A big bonus of fertigation is the ability to custom blend fertilizer. Managers can serve as turf dieticians by submitting soil and plant tissues and irrigation water samples for evaluation. Testing such samples identifies what's in the soil and what the turf needs and is getting, stresses Goldsmith. Site-specific elements not required for healthy turf are excluded, saving money and possibly avoiding other problems, while distinct deficiencies may be identified and supplemented. This is the only way to formulate a truly tailored, logical blend for your turf, he emphasizes.

Most prepackaged fertilizers are meant to be general formulas. Historically, matching nutrients to needs meant choosing packaged materials that came closest to meeting a turf manager's requirements, he continues. Custom blending tramples the hit-and-miss turf feeding of prepackaged, dry fertilizers.

Controlling Concentration

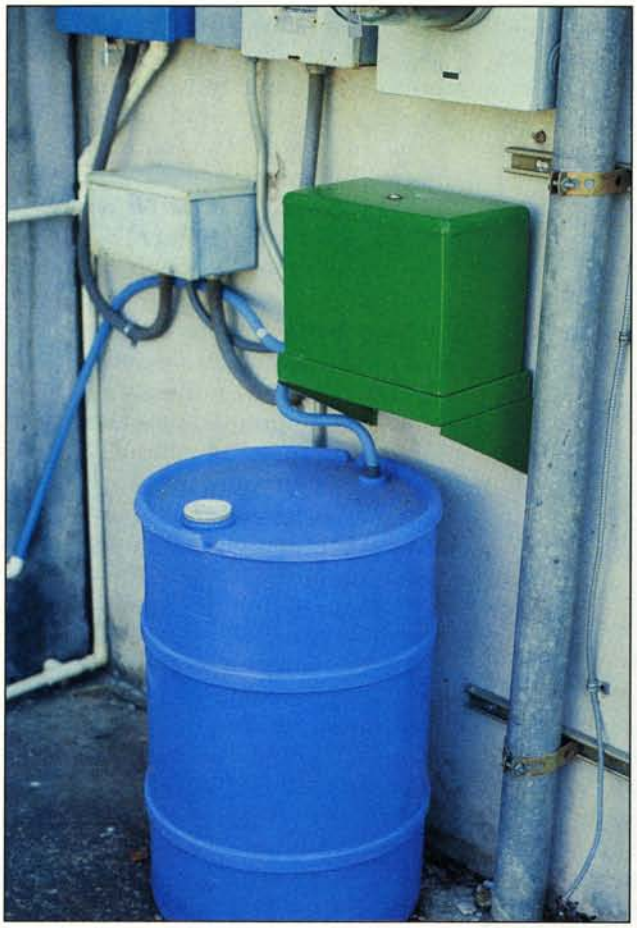
There are several ways to mix fertilizer solutions and control which elements are presented to the turf at specific doses and frequencies.

Goldsmith describes the design of injection systems as crucial to the success of a fertigation program. Minimum and maximum flow rates for the irrigation system must be considered as well as total water usage for peak and low periods. With this information, fertilizer concentrate tank and blending tank sizes may be determined as well as fertilizer and water ratios for the various flows. The manager must also calculate the amount of fertilizer needed in pounds per thousand square feet or per acre unit of time — usually one month, adds Snyder.

An adjustable injection flow rate which controls volume proportioning is also important to the effectiveness of a fertigation program, claims Goldsmith. A fertilizer to water ratio of 1-to-500 may be appropriate in the winter where warm-season grasses fall dormant or rainfall precedes irrigation. But in the summer, when schedules are dialed up with more and longer cycles, the ratio must be adjusted accordingly. The capability of dialing your solution ratio up or down is invaluable.

Multiple pumphead capability may also be desired for additional control of chemical distribution — if your budget can float it. Goldsmith has previously utilized a three-head pump station: one to supply acid, either sulfuric, phosphoric or a combination of both to adjust water pH;

continued on page 20



The ability to supplement irrigation with iron, wetting agents or micronutrients through an injector system, can tremendously boost the control a manager has over growth and maintenance of turf. ***Photo courtesy: Amiad U.S.A., Inc.***

Fertigation

continued from page 19

the second to supply a desirable balance of nitrogen and potassium; and the third to supply soil penetrators or surfactants which help leach undesirable salts and to alleviate parching and dispersion problems during very hot weather.

Rain of Terror

No system is foolproof however, and there are certain inherent risks to fertigating. Foremost, the quality of the fertigation program rides on the uniformity and dependability of an irrigation system. "If you don't have good uniformity of irrigation, you won't have good uniformity of fertilization," reasons Walker. Logically, some turf managers schedule irrigations to ensure the driest area receives adequate amounts of water, leaving other areas overwatered, thus overfertilized. "Even with an 80-percent efficiency on an irrigation system, you may be looking at a 2-to-1 coverage ratio from the spot getting the least amount of water to the spot getting the most," he explains. For systems with large sprinklers, Walker recommends an efficiency rating no lower than 70 percent for retrofitting with an injector system. "The irrigation should be more than acceptable, it should be outstanding."

It is notable that if dry fertilizer is being applied to turf, an inefficient irrigation system may also cause burns or damage. Chaplinsky points out if your irrigation system is missing coverage when fertigating, at least the fertilizer is already liquified. Maggio adds there is a capillary effect in surrounding turf to absorb nutrients peripherally, aiding in distribution uniformity. Snyder stresses fertigation may be used with very simple irrigation systems which don't necessarily require superlative uniformity. "Just differences in the wind conditions from one irrigation to the next, will vary the distribution sufficiently that distinct fertilization patterns do not occur," he claims.

Although these master blend solutions should be highly diluted, the risk of mechanical failure to the system is always a concern of fertigators. Spewing excessive amounts of fertilizers and/or acids can damage turf and contaminate soil or water, just as overfertilizing with a spreader can. A situation where valves are sticking open, irrigation pumps are failing while injector pumps are operating, and fittings and hoses are leaking, may trash turf and defile groundwater. Because turf is irrigated at night, essentially unsupervised, these mechanical failures often aren't realized until grounds degradation slaps you in the face. Secondary containment for tanks, an interlocking system for the irrigation and injector pumps, which prevents one from running without the other, and regular inspection of equipment are all recommended by David Zoldosky of the Center for Irrigation Technology in Fresno, CA.

Proper backflow prevention is a must for anyone considering fertigation. "If everyone follows the procedure of pulling permits and installing the prescribed backflow prevention device with their fertigation system, then all's well," Walker says. "But for projects using well water, that may not be the case." Improper backflow prevention can create serious problems and consequences.

Managers should use caution when blending fertilizers. "You really need to understand the chemistry involved," Walker stresses. He adds, they should never mix their own chemicals. First, the packaging should indicate whether it is legal or not to disperse through an irrigation system. If fertigation is permissable, blending should be left to the professional manufacturer or distributor of fertilizer or chemical products. That way potentially dangerous chemical reactions or resultant turf damage liability lies with them. They are the experts.

Fertigation may not be appropriate for distributing nutrients in areas of consistent or seasonal heavy rainfall, since you're locked into running your irrigation system to fertilize, even if irrigation is not needed. Snyder suggests fertigation may be adaptable to soil and climatic conditions that require four or more irrigations per month.

Learn Not to Burn

Fertigation, like many new technologies available to the turf manager, requires extensive education to be a seriously effective tool in creating and maintaining a sturdy, resilient, verdant playing surface. A willingness to spend the money on a system should be partnered with a willingness to spend the time to learn about the systems available and the specific needs of the turf. Understanding how much fertilizer, wetting agent, acid or chemical a system should be feeding the turf at any given time of year is vital to the success of the fertigation program. Calculating how time with each cycle should be dedicated to passing nourishment through the line, then purging the system without leaching the chemical through the root zone, is as vital a responsibility. The dividends of an easily managed, low-maintenance carpet of turf requiring less manpower and long-term equipment and maintenance costs may be well worth the investment. ❑