Fertigation:
Getting the Most Out Of Your Budget And Irrigation System

During the past few years many sports turf managers and golf course superintendents have wisely improved and upgraded their irrigation systems. By retrofitting their systems with better controllers, sprinkler heads, pump stations, and water conservation devices, they have improved the quality of their turf and gained control over water and energy costs. There is however, one more step they can take to get the most from their irrigation systems, adding fertigation.

Stadium at the University of Tampa is used by the Tampa Bay Buccaneers as a training center. The field is fertigated year-round.

Fertigation is the process of injecting minute quantities of nitrogen and other nutrients to the water during irrigation. Whether used as the only means of fertilization or as a supplement to granular or liquid fertilizer applications, fertigation helps eliminate the peaks and valleys in turf nutrition while easing labor, equipment, chemical, and storage costs.

Unlike some aspects of irrigation improvement, fertigation is not an expensive proposition. In fact, many turf managers have found it useful in stretching tight budgets to meet greater amounts of play and higher turf standards. The initial investment in injection equipment, storage tanks, and installation can be less than the cost of one seasonal employee, yet it provides a return for years.

As Lesco's Dr. Bruce Augustin points out, the advantages of fertigation for turf are widely recognized in certain parts of the country and almost a secret in others. One reason for the acceptance of fertigation in Florida, Arizona, and Southern California is the service provided by distributors in these areas. Formulators supplying liquid fertilizers to farms and nurseries have successfully branched into turf. They can custom blend fertilizers to match nutrient needs of turf just as easily as they do for agriculture. Since delivering liquid fertilizers is like shipping water, it is limited to a reasonable distance from the supplier. Some dry, water-soluble fertilizers can be dissolved in water if premixed solutions are not available.

The second roadblock to this useful tool is the illusion that nutrients applied by fertigation are easily lost by leaching and that irrigation coverage has to be perfect to avoid green rings of turf. Neither are true, cites Augustin, a former extension turf specialist in Florida. "Fertigation is the least likely of all nitrogen sources to leach and the best to prevent groundwater contamination," he comments. "A good turf manager may use less nitrogen during the season and have better control over growth with fertigation." That is why he estimates that three quarters of all superintendents south of Orlando have added fertigation systems.

Dr. George Snyder, professor of soil science at the University of Florida Agricultural Research Center in Belle Glade, has evaluated fertigation for more than a decade. He has revealed that fertigation helps stabilize the amount of nitrogen available to turfgrass. It may also have important applications for iron, potassium, manganese and magnesium.

"For best turf quality, nitrogen should be present in the soil in adequate, but not excessive, amounts," Snyder advises. "It is difficult, however, to maintain an ideal level of nitrogen in the soil because of the many changes nitrogen undergoes and because of the speed at which these changes occur. In order to ensure that as much as possible of the applied fertilizer is taken up and used by the turf, it is best to make frequent applications of nitrogen in amounts small enough to be used by the turf in a few days.

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In this way, a minimum amount of nitrogen will undergo unwanted transformations, and excessively lush growth will be prevented."

As Snyder reveals, several methods can be used to achieve this type of regulated nitrogen supply. Slow-release (water-insoluble) fertilizers have been developed so large amounts of nitrogen can be applied to the soil at one time, yet only a small portion enters the soil solution each day. However, once the fertilizer has been applied, the release rate is largely out of the hands of the turf manager.

A second way to regulate nitrogen supply is to make frequent light applications of water-soluble fertilizers. "These forms of nitrogen are less expensive than slow-release forms, but the labor required to make frequent applications by conventional means adds considerably to the total fertilization cost," he adds.

The cost of light, frequent fertilization can be reduced by applying nutrients through the irrigation system. Turf managers can take advantage of low-priced, water-soluble nitrogen sources without the associated costs of conventional sprayers, spreaders, or labor. Furthermore, fertilizer can be applied without disrupting use of the turf. It doesn't have to be watered in and is not subject to skips or overlapping.

Snyder stresses that fertigation is not foliar fertilization. Very little of the applied water remains on the foliage. He also has found that considerably less nitrogen is leached out of the rootzone with fertigation as compared to bimonthly applications of dry ammonium sulphate applied to Tifgreen bermudagrass. During one study, an average of 44 percent of nitrogen from dry ammonium sulphate leached beyond the rootzone while only eight percent of the nitrogen from fertigation with ammonium nitrate leached.

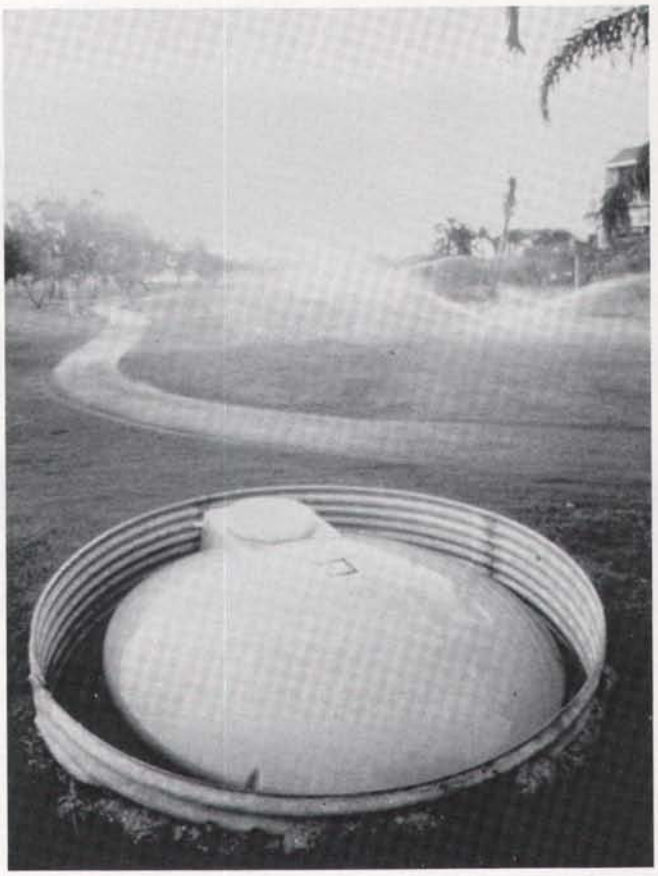
In the same study, Snyder found that the amount of nitrogen in the rootzone from fertigation remained relatively constant while the nitrogen level from bimonthly dry treatments dropped rapidly within ten days. Nitrogen levels in the bermudagrass tissue and the amount of clippings removed during mowing were constant for fertigated plots and dropped over an eight-week period for the dry fertilizer.

Snyder concludes that fertigation helps stabilize nitrogen nutrition within the rootzone and reduces leaching under heavy rainfall or frequent irrigation cycles. More controlled growth of turfgrass results, as well as a reduction in the potential for groundwater contamination. Secondary benefits may include a more manageable amount of clippings, reduced thatch accumulation, and hardier, more disease-resistant turf.

This type of technical evidence provides a strong case for fertigation, yet most superintendents and groundskeepers utilize the technique for economy and convenience. Every night, while the maintenance crew is asleep, your irrigation system can apply a few hundreths of a pound of nitrogen per 1,000 square feet. Over a month, this will spoon feed the turf with more than one pound of nitrogen per 1,000 square feet. Furthermore, a greater portion of the applied nitrogen is utilized by the plant.

By adjusting the amount of nutrients injected, fertigation systems can also be set to apply nitrogen, iron, or potassium every seven to ten days. This light, frequent feeding is helpful to turf growing in sand rootzones or in soils that have a poor pH or low cation exchange capacity.

Fertigation is also useful when a course or field is scheduled for a special event. Small amounts of nutrients can be applied to prepare the turf for the event or help it recover afterwards. These rates avoid lush growing conditions, give the turf greater stress tolerance, and do not disrupt the use of the facility during the day. They also greatly reduce the potential to burn the turf during the summer and enable you to restore nutrient levels following heavy rain storms.



Fertilizer tank at Isla Del Sol.

Various types of injection techniques have been utilized over the past 20 years. It's important to recognize that any chemical injection system must follow a backflow prevention device to avoid contamination of the water source. For further control, fertigation devices are installed on a bypass with valves to separate the injection equipment when not in use. All types of fertigation installations should be designed by a trained expert.

The first modern fertigation device was a venturi system. In this method, a small tube leading from a nutrient supply tank is inserted into the water line. The flow of the water in the pipe sucks fertilizer into the irrigation water for distribution by the sprinkler heads. If the flow changes, the amount of suction changes. A small valve is used to adjust the amount of solution injected. By keeping track of the level of fertilizer in the supply tank, the turf manager can determine the amount applied during a given irrigation cycle.

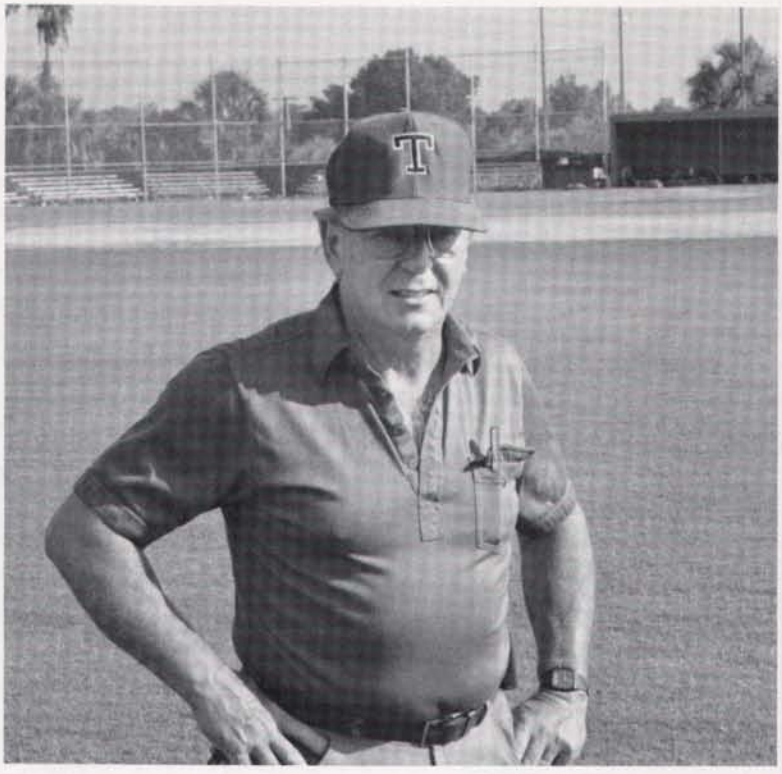
In an effort to gain greater control over injection amounts, engineers incorporated small proportioner pumps which deliver precise quantities of solution into irrigation lines. These pumps can be adjusted to inject parts per million of a chemical if necessary. Since one irrigation station may require a different flow rate than the next, and therefore a different quantity of fertilizer, flow sensors were added to change the injection rate of the pumps. Then, as the controller switches from one station to the next, the level of fertilizer remains the same.

In some cases, the turf manager may not want to fertigate all stations on his control-

ler. One option is to run individual stations with the fertigation system on. A second is to install injection devices only for the lines leading to the fertigated zones. A third, more advanced option is to utilize the irrigation controller to instruct the bypass valve on the fertigation system to open and close.

The one limitation of electric pumps is they require a power source to operate. Some manufacturers offer water-driven piston pumps that compensate for water pressure and flow. These can be used for remote turf areas. Like all pumps, they must be selected to fit the flow rate of the irrigation system.

In all cases, storage tanks must be protected from vandals and located in areas accessible to delivery trucks. All applicable state and local laws regarding storage facilities must be followed.



Bill Andrews, head groundskeeper at the University of Tampa.

Whether the facility is a single baseball field or an entire island resort, fertigation is being utilized for turf fertilization. Every square foot of Isla Del Sol, a small island across the bay from St. Petersburg, FL, receives fertigation during the winter. Superintendent Marvin Russell turns to spoon feeding to keep the 18-hole golf course and resort grounds green and thriving during the busy season when the island is filled to capacity with retirees and their guests.

From May to November, Russell has plenty of time to get on the course with spreaders to establish a base of slow-release fertilizers. But when the winter residents arrive on the island, he must squeeze maintenance into the first few minutes of daylight. For the past eight years, Russell has solved this problem with fertigation.

Two nights a week, Russell turns on the fertigation system to apply ammonium sulphate through his Rain Bird

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impact rotors. His seven-ton tank is refilled every six weeks by Koos-Shore, a fertilizer supplier. Dave Bouck, president of Golf Course Services, Inc., helps Russell put together a fertilization program based on soil tests.

"The liquid fertilizer is a good supplement for cool weather," says Russell. "The ryegrass stays healthy without growing too fast. It's easier and cheaper for us to apply with all the winter traffic we get. The sandy soil here also doesn't hold nutrients well. We can add potassium to improve traffic tolerance if necessary."

In nearby Tampa, Bill Andrews has a busy winter and summer schedule for the athletic facilities at the University of Tampa. Fertigation was a big switch for Andrews after 40 years as a college groundskeeper. "The people at Mantek/Opti-Gro had to twist my arm to get me to try fertigation the first time," he admits. "Now, I call them regularly for advice."

In addition to fielding strong baseball, softball, track, and soccer teams, the university is the site of the Tampa Bay Buccaneers training facility. The Tifway 419 has to be perfect for the Buccaneers when camp starts in July. Andrews overseeds the athletic fields in November to withstand the winter practice and game schedule on campus. He can't allow either the ryegrass or the bermuda to lose its aggressiveness.

"Not only do we have to keep the turf growing year-round," says Andrews, "we face a constant battle with fire ants and mole crickets. Every moment of staff time we save by fertigation is needed to perform other types of turf maintenance. Our ten-person crew must stay on top of 100 acres of campus grounds without a break.

Marvin Russell, superintendent of Isla Del Sol.

"We can green up the baseball stadium for a major tournament in 12 hours by using the fertigation system to apply nitrogen and iron," he adds. "It's tough to predetermine our needs. We may only get a few day's notice for a special event. I can also adjust the fertigation to fit rainy or dry weather. You really need to manage stress well in this climate."

Across the country in drought-stressed Southern California, Phil Baker has adapted monthly fertigation to the campus at Westmont College. Located on 135 acres in the Montecito Hills above Santa Barbara, Westmont's campus and athletic facilities are a stark contrast to the chaparral of the surrounding mountains.

Baker, like other groundskeepers in the region, has been forced to save every drop of water possible without sacrificing his valuable landscape. Westmont is fortunate because it has an excellent well and a former swimming pool in which to store 210,000 gallons of water. Most campus plants and trees are on drip.

Cut into the mountains are the athletic

fields for the college's 1,200 students. Carr Field serves as a baseball and soccer field. Lovik Field was added in 1988 as a multi-purpose field. Carr Field is kikuyugrass in the summer and overseeded ryegrass in the fall. Lovik is turf-type tall fescue. Nine gardeners do all the work on campus.

Carr Field had a venturi-type fertigation system for 10 years before Baker joined the staff. "Fertigation is not new here," he states. "But when Lovik Field was built we had a chance to reevaluate different types of injection systems. The Dosatron unit was a good fit due to the hillside location of the fields and the way our controllers are set up. Since they don't require electricity, we could have one system for each field. With the old system someone has to be there to adjust the injection rate when the controller switched to the next station. The new unit adjusts automatically."

Since the school only fertigates once a month, Baker is using approximately a half pound of nitrogen each application. "We just set the dial on the unit and go home," Baker adds. "The next morning the teams are out practicing without any limitation on field use. It saves us a lot of time over spreading fertilizer, we don't have to water it in, and we've never had a problem with fertilizer burn."

Baker has been upgrading heads and controllers and checking soil moisture levels frequently the past five years. "In some areas we found we could get by with half the amount of water we were using. By using the water budgeting feature on the Irri-Trol controllers we have reduced campus irrigation by 25 percent."

The school plans to expand fertigation to the dormitory areas of the campus and add moisture sensors in the coming year. Baker has been adding wetting agents and soil penetrants to heavy wear areas through the fertigation system. Minor elements are added to the solution based upon yearly soil tests. For the hard-to-reach fields, Baker transports the solution in a 50-gallon tank on the back of a Cushman truckster. He then tranfers the mix into a 150-gallon storage tank on site.

Baker, Russell, and Andrews have their special reasons for fertigation, but those reasons are not unlike those of thousands of other professional turf managers. Getting the most out of an irrigation system and limited maintenance budget is the important thing. By doing this in an environmentally responsible way, they have insured the use and reputation of their facilities for the future.

GOLF COURSE EUROPE TO DOUBLE IN SIZE

In response to a heavy demand for booth space, Golf Course Europe (GCE) '90, to be held November 28-30 in Paris, France, will be twice the size of GCE '89. The Second International Conference on the Design, Construction, and Maintenance of Golf Courses and Golf Club Management will be held in Parc des Expositions du Bourget.

The conference and show is expected to attract thousands of golf course industry personnel from Europe and many other countries to Paris. The first GCE was held last fall in Wiesbaden, West Germany. Seminars and workshops will presented in addition to the exhibition.

LIGHTNING DETECTION USED AT U.S. OPEN

Airborne Research Associates (ARA) recently assisted the USGA at the U.S. Open at Medinah, IL, by providing lightning detection and equipment for the tournament. The move is the latest in a series of cooperative efforts between the company and several professional golf associations.

For the past few months, M-01 optical lightning detectors have been loaned by ARA to the USGA, PGA Tour, PGA Senior Tour, LPGA, PGA of America, and numerous other golf organizations and clubs for evaluation. The device detects intracloud lightning, which is invisible to the naked eye. Intracloud lightning occurs during the initial stages of a thunderstorm, and therefore is the precursor to cloud-to-ground lightning strikes, which are hazardous to golfers.

An ARA P-1 Atmospheric Potential Probe was also installed at Medinah. This instrument measures the earth's electric fields and interfaces with an IBM personal computer. If a thunderstorm is within five miles, the unit will detect its presence, since it is impossible to have lightning without high electric fields. The device was used earlier this year at the TPC Championship.

AMGA ELECTS OFFICERS

Troy Puckett was elected president of the American Modified Golf Association (AMGA) during a recent meeting of its board of directors. He will be taking over for outgoing president Bill Amick, who will continue as a director of the organization. In addition, Charley Stine was reelected as vice president and John Nichols was reelected as secretary. Puckett will also continue as treasurer.

Puckett, who holds a degree in engineering from Georgia Tech University, is currently president of the Cayman Golf Company in Albany, GA. Cayman manufactures the Mactec ball for MacGregor Golf Company. Prior to that, he was in charge of golf ball production for MacGregor. He is credited as being the key person in developing and improving the modified golf ball, and holds a degree in engineering from Georgia Tech University.

Gil Barfield and Bob Weber have been named AMGA board members. Barfield is president of the Hye Precision Products Company in Perry, GA, a division of Wilson Sporting Goods Company that produces molds for making most golf balls, including Mactec. Weber is director of product marketing for MacGregor.

BASEBALL EXPANSION TIMETABLE SET

Major League Baseball owners met recently in Cleveland, OH, to set a timetable for National League expansion franchises.

According to Douglas Danforth, expansion committee chairman, six to 14 cities may apply for two franchises that will be added to the league in 1993.

The committee has sent out questionnaires to interested parties and has begun selecting leading candidates, who will make presentations in New York by the end of September. Three to five finalists will be selected before the end of the year, and committee members will visit those cites by early 1991. The committee will recommend franchise candidates to owners next June. Winners will be selected by September 30, 1991.

The new franchises will be allowed to field minor league teams in 1992 and will participate in the June 1992 amateur draft.

WATER SUPPLY PROMISING IN PALM SPRINGS AREA

Despite California's fourth consecutive year of drought, water users in the Palm Springs-Cathedral City area will not face mandatory water restrictions this year.

The Desert Water Agency (DWA), which co-manages the area's water supply with the Coachella Valley Water District, credits good water conservation practices and a large groundwater basin for the area's adequate water supply. According to a DWA newsletter, the basin will provide an ample supply to the area for many years without adding imported water.

However, imported water from the Colorado River is allowed to percolate into the basin, substantially improving the area's supply. During wet weather cycles, large quantities of water are banked for use during dry years.

Each acre-foot of water that is reclaimed will provide the same amount of groundwater for domestic use. An acre-foot can meet the needs of an average family for a year.

Reducing water demand in the Palm Springs-Cathedral City area through landscape water conservation has been ongoing for many years. Water-use reductions at certain condominium projects have been as high as 35 percent. In addition, a joint City of Palm Springs-DWA evaluation project of moisture probes has resulted in a water savings of 56 percent at a city park. Palm Springs has recently installed similar devices in traffic islands along one of its major thoroughfares.

Ryan 48-inch Lawnaire for three-point hitch tractors.

Aeration and Topdressing:

Applying Technology To Reduce Disruption

Aeration and topdressing are two of the most disruptive cultural practices in turf management. The fact that rebuilding, the alternative to aeration and topdressing, is considerably more expensive and disruptive is often overlooked or simply not understood by athletes and golfers. Since these practices take some extra explanation to turf users, it is important to maximize their benefit.

Meanwhile, manufacturers are working on ways to speed up or reduce the disruption caused by aeration and topdressing. More attention is being paid to the depth and pattern of aerators in order to get the most out of each aerification. Machines to collect or pulverize aeration cores have been introduced. New and existing methods of aerating without producing cores are being examined more closely. Solid tines, colter blades, vibratory plows, and even jets of water may all have a role in aeration in the future.

HydroJect 3000 Aerator by Toro uses jets of water to cultivate rootzones.

Topdressers have also been refined to increase their speed and cause less disruption in play. Rotating brushes have been incorporated to force material into the turf stand where it won't disrupt use of the surface. In addition, many machines feature brushes or drags to work the material down to the soil surface. Effort has been taken to reduce the footprint and wear of topdresser tires. Emphasis is being placed on making the machines easy to load and of sizes appropriate for specific sites, such as greens, fairways, and sports fields. By keeping the center of gravity of topdressers low, manufacturers provide machines with greater stability on slopes and mounds.

To make aeration, and especially topdressing, available to a greater number of athletic facilities, contractors have begun to specialize in these services. In eight hours, a contractor can recondition all greens and tees on an 18-hole golf course using the latest equipment and trained crews. Larger areas, such as fairways, stadiums, practice fields, and parks can be brought back to top condition by a contractor with a minimal amount of disruption to play or other scheduled maintenance. Golf courses, parks, or schools which either can't justify the cost of equipment used only a few times a year or don't have the necessary staff can now benefit from aeration and topdressing.

The need for reconditioning can also be quantified today. Universities are now utilizing diagnostic equipment for measuring surface hardness, water infiltration, root depth and density, and other soil characteristics to study the effectiveness of aeration and topdressing. They are beginning to provide some valuable information regarding different methods and the frequency required to maintain healthy turf under heavy use.

Furthermore, some of the diagnostic equipment is now available to turf managers. By testing these areas every few weeks and maintaining records of soil conditions, turf managers can accurately

gauge the frequency needed to keep these areas in shape. By comparing their records to use levels, such as rounds or games played, they can stay a step ahead of compaction. They can also track the effects of weather conditions, irrigation, and different sports on turf rootzones. Finally, they can pinpoint problem areas and adjust maintenance levels accordingly.

A certain amount of background is necessary to fully grasp aeration and topdressing. Aeration is widely recognized as a way to relieve soil compaction and improve soil texture from the surface. By creating channels for air, water, and nutrients in the rootzone, turf managers realize a long list of benefits. Among them are greater depth and density of roots, improved infiltration of water and fertilizer solutions, a small yet helpful reduction in thatch, and a softer, more resilient surface for footing or ball bounce.

"We know that shoot growth is reduced 50 to 75 percent in compacted, oxygen-deficient soils," says Dr. Mike Agnew of Iowa State University in Ames. Turf growing in compacted soil doesn't begin to approach its potential for root and shoot development. Aeration more than doubles the plant's ability to recover from traffic and other related stresses. Few cultural practices can provide this degree of improvement.

Agnew adds that the benefit of shallow cultivation (less than four inches) is limited if the soil below this level is poor. "The core holes provide a port or entry for air, water, and nutrients, but only to the depth of the tines," he points out. For this reason, Agnew sees increased interest in aerators that reach depths of ten inches or more.

On the other hand, he does not want to draw attention away from conventional aeration. "Superintendents and sports turf managers should aerify at least once a year," Agnew states. "Five or six times a year may be needed for heavily used sites. Practice fields generally require more aeration than game fields. Since most of the players' time is spent on practice fields, that is where the turf manager needs to focus maintenance."

Concern over creating a hardpan layer at the depth of tines after frequent aeration is currently being addressed by researchers at various universities across the country. Research by Dr. Martin Petrovic at Cornell University in Ithaca, NY, and Dr. Paul Reike at Michigan State University in East Lansing has established that tines create certain types of compaction after repeated use.

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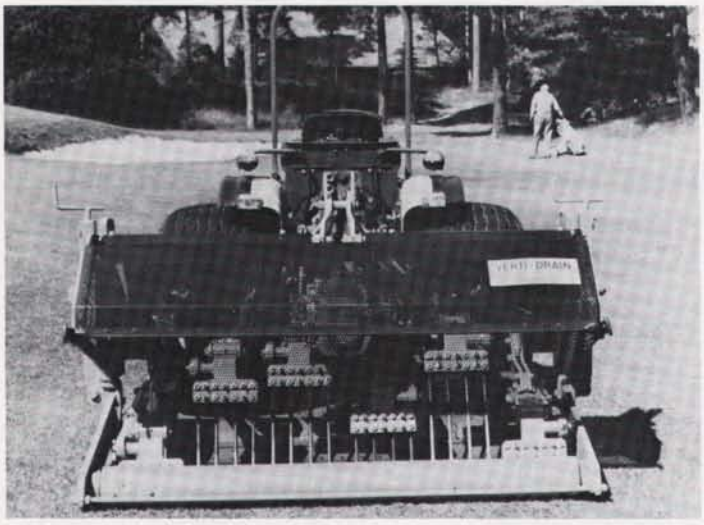

Verti-Drain by Emrex penetrates 12 inches into the soil.

Aeration and Topdressing
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Studies to clarify the effects of different types of aeration devices are now being conducted by Dr. Robert Carrow at the University of Georgia in Experiment, GA. "One of the biggest hurdles we have to overcome is realizing that all types of cultivation create some degree of compaction in the soil," states Carrow. "We need to look at the net benefit to make sure that the amount of compaction relieved is greater than the amount of compaction caused by the machine."

Until Carrow's results are published later this year, he advises turf managers to alter the depth of tines between aerations. Preliminary observation indicates that the benefits of conventional aeration can be increased by periodic deep aeration. This suggests that more than one type of aerator may be needed for a comprehensive cultivation program and that tine depth adjustment is an important feature of aeration equipment.

Topdressing improves and strengthens some of the benefits of aeration while smoothing the surface and amending poor soils. Broken-up aerator cores are essentially a type of topdressing. By mixing core material with thatch, conditions for soil microorganisms improve within the thatch layer. This leads to more rapid decomposition of thatch and may eliminate the need for clipping removal after mowing.

Sand Tote by Star City Fabrication improves handling and transportation of topdressing materials.

Agnew advises that any topdressing should closely match the soil on site. Topdressing with a different soil mix will create layers in the rootzone that can hamper drainage, irrigation, and rooting.

"Both the soil and topdressing should be tested beforehand," he warns. "Once you find the right topdressing, stick with it. When you buy topdressing, make sure you order enough for the entire year and store it on site. Don't get in a position where you have to change topdressing in the middle of the growing season."

To give you an idea of how much