previously or weather conditions are hot and humid, fungicide treatments are advised. This disease can develop rapidly so preventative treatment or immediate curative treatment are necessary. Fungicides labelled for this use include Aliette, Banol, Koban, Subdue and Terraneb SP. Retreatment every seven days to three weeks may be needed. As mentioned previously, seed coated with fungicides (Koban or Apron) is available.

Brown patch can also kill seedlings. If circular brown patches of dead turf are discovered, an application of Banner, Bayleton, Chipco 26019, Daconil 2787, Dyrene or Fore may be needed.

Uniformity of irrigation is important to both germination and prevention of disease. Malfunctioning heads or valves can flood one area while shorting another. Seed will float and move if water is allowed to puddle or run off.

Ryegrass is not as forgiving to inconsistencies in watering as bermudagrass. Irrigation zones within the turf area should be corrected to match application rates and times. Allowances may be necessary for areas in shade or exposed to the wind. A properly designed irrigation system will have these areas on separate zones.

Programs set for deep, infrequent watering will need to be changed to light, frequent irrigation. This should not be done arbitrarily. Test moisture depth with a soil probe after various cycle times and note how rapidly the surface soil dries under different weather conditions. Cycles may need to be repeated four or more times each day in hot, dry weather. On the other hand, one or two cycles may be adequate on cloudy or cool autumn days.

Seed will float and move if water is allowed to puddle or run off.

Once the seedlings are established, usually three to four weeks for perennial ryegrass, gradually cut back the frequency and increase the duration of irrigation. The emphasis is switching from germination to root growth. You eventually want the roots to extend down six or more inches to obtain moisture. Overwatering discourages deep rooting and encourages disease.

Since typical overseeded areas are on a fertilization program, additional fertilization for overseeding is discouraged because it may prolong the aggressiveness of the bermudagrass. If you don't feel comfortable with this, have the soil tested first. Supplemental phosphorus, potassium or micronutrients such as iron can be applied with little to no nitrogen. This will improve rooting without stimulating foliar growth of the bermudagrass.

This is where timing comes in. The goal is to overseed two to three weeks before the first expected frost or when the temperature of the soil at a depth of four inches is less than 75 degrees F. The specialists at North Carolina State University say if you hit this time frame, the bermudagrass will be far enough into dormancy by the time the ryegrass starts needing nitrogen, that is about three weeks after overseeding.

From then until the season is over, the ryegrass needs between one-half to one pound of nitrogen every month. This can be applied as two applications of quick release N per month or one application of slow-release. Continue to watch phosphorus and potassium levels. Recent advances in fertigation and soluble fertilizers permit very small amounts of nitrogen and micronutrients to be applied to the soil on a weekly basis.

Traffic and damage on the turf may require a recovery rate greater than temperature-dependent slow-release fertilizers can support during cold weather. Even quick-release materials vary in their delivery of nitrogen to turf during cold weather. Don't assume that because the nitrogen is there that it is working.

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Overseeding

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Furthermore, additional seed should be broadcast during the fall to be worked into thin spots by players. Divots must be repaired with a seed/soil mix since ryegrass does not spread. The overseeding process is one of constant renewal at a time when even cool-season turfgrass is slow to recover.

Turf managers are as concerned about spring transition as they are winter performance. Even desert resorts and golf courses are increasingly concerned about recovery of bermudagrass for late spring and summer play. Southern athletic fields barely wrap up football before spring soccer begins. Baseball practice seems to start a week earlier every spring.

the mowing height of the winter turf should be reduced to stress the ryegrass and expose the soil to light and warm air. On greens and tees that are already mowed fairly low, the turf can be spiked every two weeks during cool weather, aerified or verticut lightly and frequently.

Do not fertilize or cut back irrigation to the point that the soil becomes dry. Bermudagrass devotes much of its energy in the spring to root development. Stimulating foliar growth with nitrogen not only diverts the energy of the bermudagrass away from root growth, it stimulates the ryegrass to compete more strongly. Bermudagrass also requires adequate soil moisture at this sensitive point in its biological cycle. Cutting back on water hurts the bermuda as much as the ryegrass.

Annual ryegrass appears much lighter than perennial ryegrass.

"Many of the improved perennial ryegrasses are extremely durable," says Cockerham based upon test plots in Riverside. "They are going strong when it's time for the bermuda to come back. But what's worse is when the ryegrass does finally give up, some of the bermuda is dead. We don't know if it's winterkill, traffic or the ryegrass that's harming the bermuda." For this reason Cockerham believes superintendents in certain parts of the country will start selecting ryegrasses that are less aggressive in the spring.

Technically, bermudagrass growth resumes when soil temperatures reach 60 degrees F. in the spring. While the bermuda is still dormant, the ryegrass can be stressed in various ways to encourage its decline. If use of the turf area can be restricted for a few weeks, glyphosate (Roundup) can be applied to the ryegrass in some states to wipe it out. As long as the bermuda is dormant, it will not be harmed.

North Carolina State recommends that several weeks before green-up is expected,

As temperatures rise, heat and humidity are ryegrass' worst enemies. Therefore cool weather or shade can slow transition. A last resort to remove ryegrass from established bermudagrass is pronamide (kerb). Consult your local extension turf specialist and your local chemical supplier about safe rates and time of application.

Overseeding has a definite role to play in sports turf management today. Perennial ryegrass has grown from a simple nurse crop with limited production in the Northwest to a multipurpose turfgrass with production greater than any other turfgrass. The sports turf industry is responsible for this tremendous shift in less than 20 years.

But overseeding has its challenges. "We need to look more closely at seeding rates and their effect on bermudagrass during transition," states Cockerham. "We also need to research the effect of winter maintenance and start to look for perennial ryegrasses that are less competitive in the spring. There is a lot we don't know that we should."

Since RegalStar does not prune roots, treated turf survived the drought better. Many users have said, "thank goodness for RegalStar, we survived the drought!"

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EIGHT STATES APPROVE TRIUMPH ON GOLF COURSES

Golf course superintendents were not happy when Triumph, a fast-acting insecticide for grub control, received a national label from the Environmental Protection Agency for treatment of home lawns without including golf courses. They were irritated further when EPA cancelled diazinon for grub control on golf courses and sod farms. Ciba-Geigy Corp., manufacturer of both products, refused to give up and sought the support of superintendents across the country.

Superintendents have since been vital in helping Ciba-Geigy obtain Special Local Need labels for Triumph application to greens, tees and collars in Alabama, Connecticut, Illinois, Iowa, Mississippi, North Carolina, Pennsylvania and Virginia. They are also helping in 15 other states where SLN labels are pending.

The liquid compound is effective on grubs, mole crickets, sod webworms, armyworms and several other insects found in turf, thatch and soil. It has provided 90 percent control of grubs within three days and maintained the same level of activity for more than eight weeks.

Triumph is a restricted-use insecticide and must be applied in a spray by a certified pesticide applicator. Label restrictions limit application of the product to 1.5 ounces per year. This allows one application for grubs or two applications per year for surface insects at label rates. The insecticide should not be used on sandy soils, however, a pending label will clarify this restriction.

The best time to apply Triumph for grub control, according to the manufacturer, is mid-July through October, when adult beetles have finished laying their eggs.

FLORIDA SEEKS $5 MILLION FOR RESEARCH

The Florida Turfgrass Research Foundation has set a $5 million fund raising goal over the next five years to support turf research in the state.

These funds will be used solely for Florida turf research. New and safe controls for mole-crickets, nematodes, drought stress on turf, heat stress and even cold stress, are needed for Florida grasses, states Robert J. Yount, vice president of development for the group.

According to University of Florida data, mole-crickets cost Floridians $40 million a year. The turf industry produces a great deal of revenue, but federal and state budget cuts for research grants have crippled the industry.

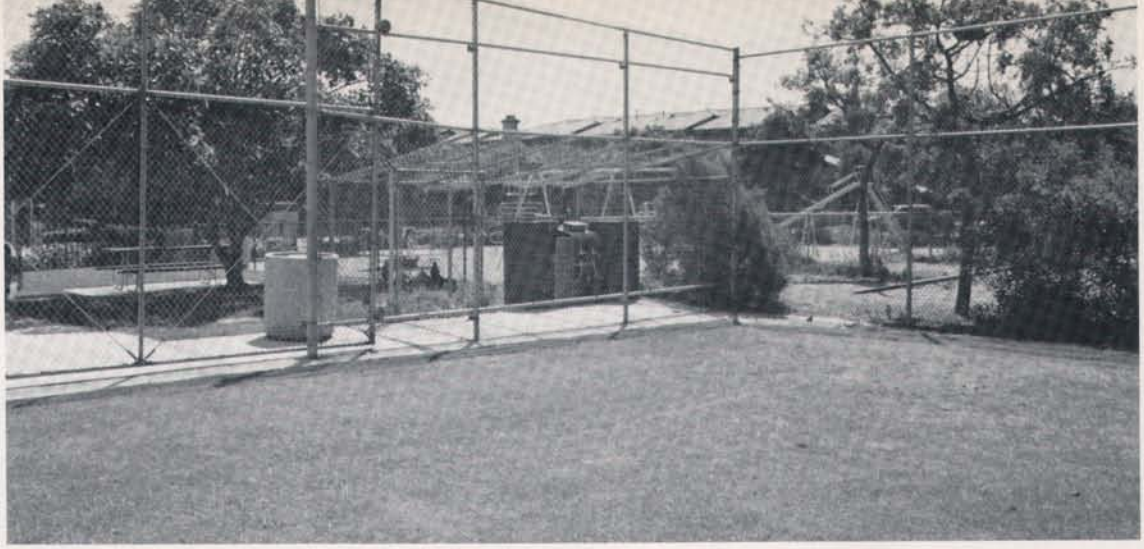
Arnold Palmer, the organization's spokesman, is reinforcing the fact that turf research is an absolute necessity. Palmer said, "Without quality research we will be unable to find controls for the many stresses that affect our grasses. We can no longer count on federal or state funding of turf research, so we must raise our funds from the private sector."

BURTON TO ADDRESS FLORIDA TURF CONFERENCE

Dr. Glenn Burton, the turf breeder who pioneered the development of the "Tif" series of hybrid bermudagrasses, will open the Florida Turfgrass Association's '88 Conference Monday, October 10. The conference and trade show is held each year by FTGA in cooperation with University of Florida, IFAS.

Educational seminars this year include Golf Turf, Principles of Turfgrass Management, Lawn and Commercial Turf, and Turfgrass Production. Also available for those registering in advance are workshops on Identification and Control of Turfgrass Diseases, Basic Soils for Turf Managers, Elements of Turfgrass Nutrition, Managing Your Labor Force, and Nematode Management in Turfgrass.

For more information, contact the Florida Turfgrass Association, 302 S. Graham Ave., Orlando, FL 32803, (407) 898-6721.



Microfertigation control station for school grounds.

MICROFERTIGATION: Greener, Healthier Turf A Drop At A Time

By Tom Lubin

Controlling the growth rate of turf has long been a hope of sports turf managers, chemists, agronomists and turfgrass breeders. They've explored about every angle, from chemical growth regulators to dwarf turfgrasses. However, there is one more angle to consider — fertilization.

There is no question that nitrogen stimulates growth and improves color. The question remains, however, when does turf have enough fertilizer to be healthy and recuperate rapidly? Too frequently, the answer has been, "If a little is good, a lot is better." But that may be changing. In fact, it may have to change, with concern growing over contamination of ground water.

A good place to start rethinking turf fertilization is the application method. One method that has largely been overlooked is fertigation, the process of adding fertilizer and micronutrients with the irrigation water. It is a widely accepted method of fertilization in agriculture, but the concept has not received the same consideration by the turf and landscape industry, primarily because early methods met with marginal success.

Often a full pound of nitrogen was applied in a single night of irrigation. If sprinkler coverage was not perfect because of a stuck head, or adverse wind conditions, the application was inconsistent. That might be sufficient on crops, but not on turf, and so many systems that were installed have since been abandoned in total frustration.

In 1980, a new concept, microfertigation, was introduced. The process is simple. Nutrients are added in small quantities, 0.005 to 0.01 pounds per treatment, during regular irrigation. When nitrogen levels reach 0.25 pound, the process is complete. It's an important alteration of previous fertilization methods because it allows the groundskeeper to have control of the growth rate.

Nitrogen levels are adjustable to as low as 0.005 pounds per treatment during irrigation.

To determine the quantity of nitrogen needed to provide the proper growth and color desired for the particular turf it is necessary to make a light application over a month or so and observe the response. Only after this observation will it be possible to determine the proper application rate. The ideal level should be approached from the low side. You can always add more, it is hard to take it off.

By injecting two or three nights in succession each week, the process should take two to four weeks to complete. Areas where more growth is desired can be dressed up with light spot watering on the days following fertigation.

Applied in this fashion, the nitrogen acts as a growth regulator. The superintendent or sports turf manager can control growth while still providing color to both turf and ornamentals.

The biggest advantage in using nitrogen as a growth regulator is, that if the growth rate drops, that rate can be increased again by the flip of a switch and the addition of another application of fertilizer. Said one golf course superintendent of microfertigation, "It can be used like a paint brush. If a little more color or growth is needed, all I have to do is turn on the system."

Microfertigation also prevents wide nitrogen swings which are caused by occasional, large granular applications. Light, consistent nitrogen feeding can help soils that are not buffered with high concentrations of bicarbonate ion, which control the soil pH to near 7.0 and make phosphorous and micronutrients more available.

For the first time, the turf manager can make the very small application rates necessary to control growth rate.

But the turf must be allowed to respond to the applications. Excessive fertigation defeats the purpose. With this concept, the application of ¼ pound of fertilizer should take

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Components of microfertigation system for a park with athletic fields.

Microfertigation

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an extended period of time. Application at very low concentrations allows for deeper placement of the fertilizer in the soil, and more even distribution than ever before possible, even in soils that vary greatly in clay content.

When the nitrogen is placed in deeper, cooler soil, the conversion of ammonium ion to nitrate takes place at a more controlled rate. This is because the rate of conversion is slower at the lower temperature.

The proportional fertigation system offers the most efficient method of fertilizer application, but a nonproportional system can yield excellent results. The level of sophistication in the system, from running the fertilizer directly into a wet well, to the most complex proportional system with mixing capabilities in the storage tanks, depends on specific needs and budgetary constraints. The only restriction to the results will be dictated by soil pH and the salt content of the irrigation water. However, with the technology available today, even these problems are not insurmountable.

A critical aspect of fertigation is water coverage. No amount of fertilizer will sustain turf that is inadequately irrigated. If uniform turf is to be grown, water must be placed as evenly as possible. It is the combined application of fertilizer with the irrigation water that produces the outstanding results in the field. If coverage doesn't exist, then it must be improved.

On most golf facilities where fertigation is utilized, the water use drops 15 to 25 percent because of improved fertilizer application, and because of more efficient water use.

The reason for the improved results is twofold. First, when both water and fertilizer are simultaneously applied, a turf manager is more inclined to ensure that all the heads are working properly with as little run-off as possible. Second, the microfertigation process will allow the grass to grow more evenly. As the turf spreads and covers the soil, the evaporation rate decreases and less water is required. The improved look of the turf will convince the manager that progress is being made as a direct result of the microfertigation.

Fertigation not only saves turf, but also saves money — money spent on labor, materials, and water.

Labor: Fertigation eliminates the labor involved in granular fertilizer applications, and post-application watering. Fertilizers can be applied at the touch of a button.

Materials: Because the material will be applied only when needed, the cost of fertilizer can decrease as much as 50 to 75 percent. Before, large quantities would be used in order to minimize the number of applications. Now, that is no longer necessary. This also eliminates the need for the more expensive stabilized nitrogen fertilizers. An additional advantage with conventional nitrogen sources is that the rate of conversion is more predictable, and uncontrolled growth spurts during hot weather are virtually eliminated.

Water Savings: The savings in water can be realized mainly because of the deeper placement of all nutrients. When nitrogen and ammonium ion are placed at a greater depth, they provide an acidification that allows increased nutrient availability. Use of a quality, organic, ionic penetrant at extremely low rates during fertigation carries water and fertilizer further into the soil. The deep placement of the ammonical nitrogen helps build a deeper root system.

In soils with high pH, and especially in soils that have high concentrations of calcium, phosphorous is much less available. The pH level must be controlled to make the phosphorous accessible. When the soil pH is under control (6.8-7.0) and a strong root system is built, then less irrigation is needed. This also decreases the salt buildup, again relieving stress on the turf.

Providing a separate pump for penetrant application also decreases the need for excess watering. In areas where evaporation is a problem, nonionic penetrant can help provide better penetration and lower the evaporation rate, giving the turf a chance to survive. Very low application rates of penetrant can decrease the amount of water normally applied to keep shallow roots moist.

In cases where a regimen of light day and night waterings were used, problems arose from localized salt buildups. To combat this, turf managers tried hand watering, which is usually insufficient to carry the salts past the root system. In areas where the soil temperature reaches well over 100 degrees (California, Arizona, Nevada, and Texas), light hand waterings can cause more harm than good. Under these extreme conditions the penetrant is most effective. However, best results are obtained when low application rates are used.

The process also encourages a minimum of runoff which is always desirable, whether fertilizer is applied or not. This is especially important during a drought. Short, repeated irrigation cycles in the early morning hours while soil temperature is still low allows the fertilizer, etc., to be applied even in very steep slope areas without runoff problems.

Microfertigation is a simple, efficient method of placing fertilizer, micronutrients, and penetrant on turf. It decreases the material used by 50 to 75 percent, thus lessening the chance of nitrate contamination of the ground water. In the future, the government will monitor the quantity of fertilizer applied, so converting to a microfertigation system now keeps your facility one step ahead of Uncle Sam.

The microfertigation system has been tested in widely varying soils, temperatures, and wind conditions, with great success. However, each set of circumstances are unique, and require inventiveness on the part of the turf manager. Shared experience of this new concept will maximize the usefulness of this very effective tool in the turf industry.

Editor's Note: Tom Lubin is professor of chemistry at Cypress College, Cypress, CA. He has also consulted with golf course superintendents and sports turf managers regarding fertilization for ten years as president of Lubin Microfertigation Equipment, Products, and Consulting.

CHALKBOARD

TIPS FROM THE PROS

PRACTICE TEES

By Douglas T. Hawes, Ph.D.

Few golf courses have a 17-acre, circular practice tee and range like the Muirfield Village Golf Club outside of Columbus, OH. Most courses have trouble coming up with a range 320 yards long, let alone one 320 yards in diameter with a tee surface completely around the circumference. However, with careful planning, good construction and wise and use, better practice tees (driving ranges) are possible even within the small framework of most golf courses.

First, keep the entire practice tee surface on one level if possible. Whenever a level is added, valuable space is lost on slopes between the levels. Such slopes are also a maintenance problem. Exceptions are the bi-level tees found at Industry Hills, CA, and similar ones in Japan.

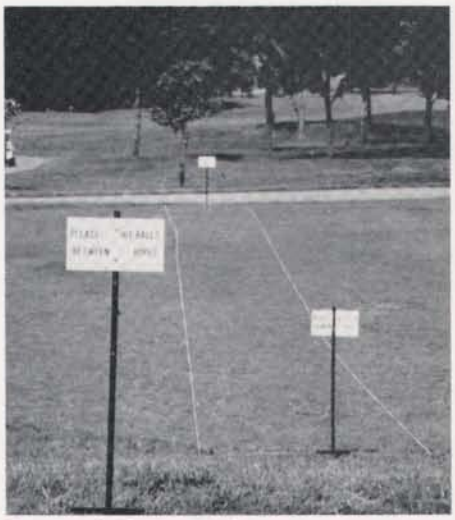
Controlling the use of the tee surface is critical to turf maintenance. Play needs to be mixed each day so the whole practice area is used. Roped off areas and movable bag racks appear to work best in moving play around the tee surface. Ropes are laid on the ground in a long thin rectangle to mark the area to hit from each day. In some cases heavy use and restricted space make grass survival impossible.

Proper construction is very important. In addition to having the teeing surface on one level, constructing the tee with little or no elevation gives the maximum usable surface. The more elevated the tee, the more area is lost along the edges. The turf must be smooth. An elevated tee is also subject to greater settling as time passes.

I've seen some tees built at, or near, USGA specifications for greens. Whether this is an improvement or not is uncertain, but the important factor is building a tee with good surface drainage. If the range slopes downhill away from the player, then slope the tee downhill (or the opposite if the slope is uphill). A grade of two to four percent appears level to most golfers providing it slopes the same way as the surrounding land.

A tee must have a well-planned irrigation system to keep part of the surface in use while the rest is under repair. The tee should be zoned into front, middle and back irrigated areas. Four zones are better yet. While the zone being used that week is dry and firm, another zone can be aerified, seeded, fertilized and topdressed, while the third zone can be kept moist to encourage seed germination and growth. A fourth zone allows more time in the rotation for recovery.

Practice tee at Souris Valley Golf Course in Minot, ND.



Tee roped off to control wear.

Once the practice tee is zoned, it is possible to put it on a weekly maintenance schedule. Each week, one zone receives aerification or topdressing, overseeding or sodding, or fertilization and lots of water if needed. The key to success is adhering to the weekly maintenance schedule. The exact maintenance needs depend on the grass species, on the tee, and on the time of year.

The sprinklers used for the zones should be small and triangulated. The smallest practical head should be used; nothing larger than the Toro 634 at a 60-foot triangular spacing. Each zone would thus be 52 feet deep. The heads within each zone need to occupy separate locations on the time clock.

Three such zones 300 feet long and 50 plus feet deep should be more than adequate for most 18 hole golf courses. Some heavily played municipal courses with lighted driving ranges need more teeing surface.

Another trick to increase the amount of usable practice tee is to construct another tee at the far end of the range. Golfers end up hitting golf balls at each other, but if the practice area is long enough there is no problem. In case of a strong wind from behind, players at one end may be restricted to teeing with short irons. Where ranges are short, country clubs can restrict forward portions of the tee to irons.

The grass species will vary between the northern and southern parts of the U.S., but not as much as one might imagine. Perennial ryegrass, the standard on northern tees, is used for winter play on southern courses. Perennial ryegrass's ability to germinate quickly and take abuse even as a seedling make it an obvious first choice for overseeding tees.

Some northern golf courses do have Kentucky bluegrass and bentgrass practice tees, more of the former than the latter. Kentucky bluegrass sod is very economical in certain areas making resodding feasible. In the South, bermudagrass cultivars surface 99 percent of practice tees in the summer.

Weed control is a problem due to constant divots and the desire to reseed. On northern tees the use of Tupersan (siduron) at low rates allows reasonable control of crabgrass, while still allowing overseeding to perennial ryegrass. On bermudagrass, early spring applications of most preemergents will allow perennial ryegrass overseeding in the fall.

Editor's Note: Douglas Hawes is a certified professional agronomist specializing in golf course maintenance consulting. He is based in Plano, TX.

ROOKIES

PRODUCT UPDATE

PART-CIRCLE SPRINKLERS

Sports turf managers with quick coupler irrigation systems can select from a new line of part-circle impact sprinklers and valves from Walla Walla Sprinkler Co., a newly created subsidiary of Nelson Irrigation Corp.

The sprinkler line includes 1/2-, 3/4- and one-inch models. All models are constructed of heavy-duty brass and stainless steel with heavy-duty bearings. Easy-to-set stops and a new design trip mechanism provide part-circle arcs.

The quick-coupling valves range in size from 3/4-inch to 1½ inch. A locking valve lid with key is optional. The company also offers swivel hose ells from 3/4-inch to one inch.

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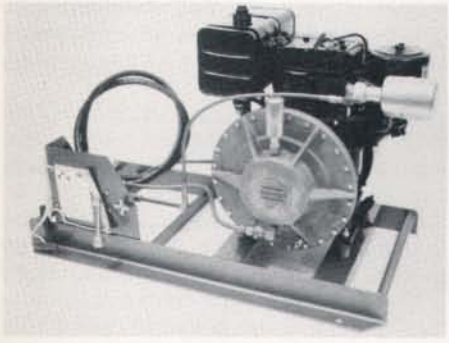
THERMO-FOGGER



Capable of laying down a ten-foot-wide blanket of insecticide fog, the Thermo Fogger Model F-3901 high-output fogger is designed for controlling insect pests in large areas.

The unit utilizes a two-stage fogging system which preheats and pumps insecticide into a chamber mixing it with hot exhaust. The fog is spread at a rate of 175,000 cubic feet per minute.

Power is supplied by a ten hp, four-cycle Briggs & Stratton engine with a factory settling of 3000 rpm. Fuel capacity is one-and-a-half gallons with a running time of more than one hour.

The formulation output is ten to 25 gallons per hour, or dry fog at 16 gallons per hour. The unit weighs 147 pounds and is 35 inches long and 20 inches wide. The fog particle size is controllable from 0.5 to over 50 microns.

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QUARTER TON HAULER

The convenience of a quarter-ton hauler is available to the sports turf industry in either assembled or easy-to-build kits from CHI Industries. There is a choice of three- or four-wheel models.

The haulers feature a sturdy, tubular steel frame, large flotation tires, automatic clutch with belt-drive torque converter for variable speed, forward and reverse transmission and tilting dump bed. Both ten- and 16-hp engines are available with electric start and hand-operated throttle. The three-wheel hauler has handlebar steering, while the four-wheel model has a steering wheel.

Accessories include a steel cab, off-road tires, lights and front wheel brakes. Assembled units are available from dealers or partly assembled kits can be purchased directly from the factory.

CHI INDUSTRIES, INC.
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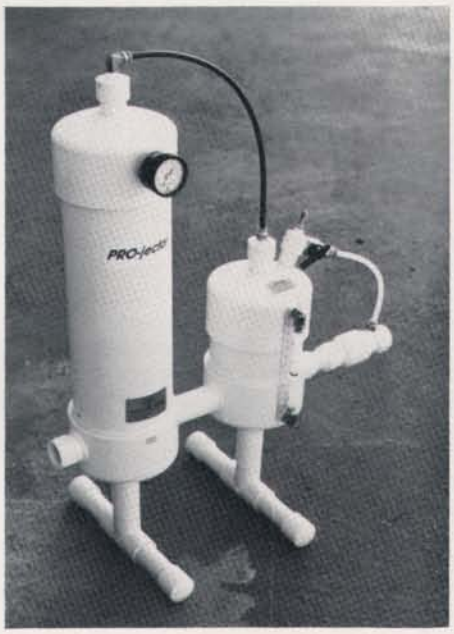
FERTILIZER INJECTOR

The PRO-jector is an automatic proportioning fertilizer injector developed by TFS Systems for use with conventional drip irrigation systems.

The injector allows users to decide how much fertilizer or other liquid additives will



be distributed throughout the irrigation system, in the exact proportions they choose. Because the fertilizer is injected in consistent, pre-determined amounts, the problem of uneven distribution is greatly reduced.

The injector features a dual tank design. Existing water pressure forces air into the larger tank to be compressed. This compressed air forces fertilizer in the smaller tank to be injected into the irrigation system. The unit is simple to install, easy to use and requires no outside power source to operate.

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SLICER SEEDER

The SS-35-20S all-terrain slicer seeder from SALSCO, Inc., is controlled by a single lever, which activates the cutters, lowers them, sets the cutter depth, and turns the seed applicator on.

At a speed of two mph, it covers 18,000 square feet hourly, using a large-capacity hopper (with sight gauge). It can turn to plant seeds in a 25-inch radius, planting rows on two-inch centers.

Depth is infinitely adjustable down to two-and-a-half inches. The seeder can travel up inclines of up to 40 degrees, powered by a ten-hp Briggs & Stratton engine. Eleven-gauge blades are standard, while 14-gauge blades are optional. The tires are 11 X 400 X 5 Pneumatic Turf Savers.

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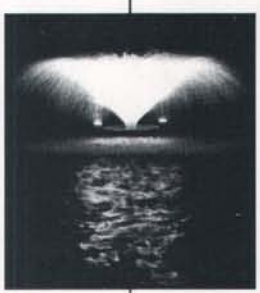

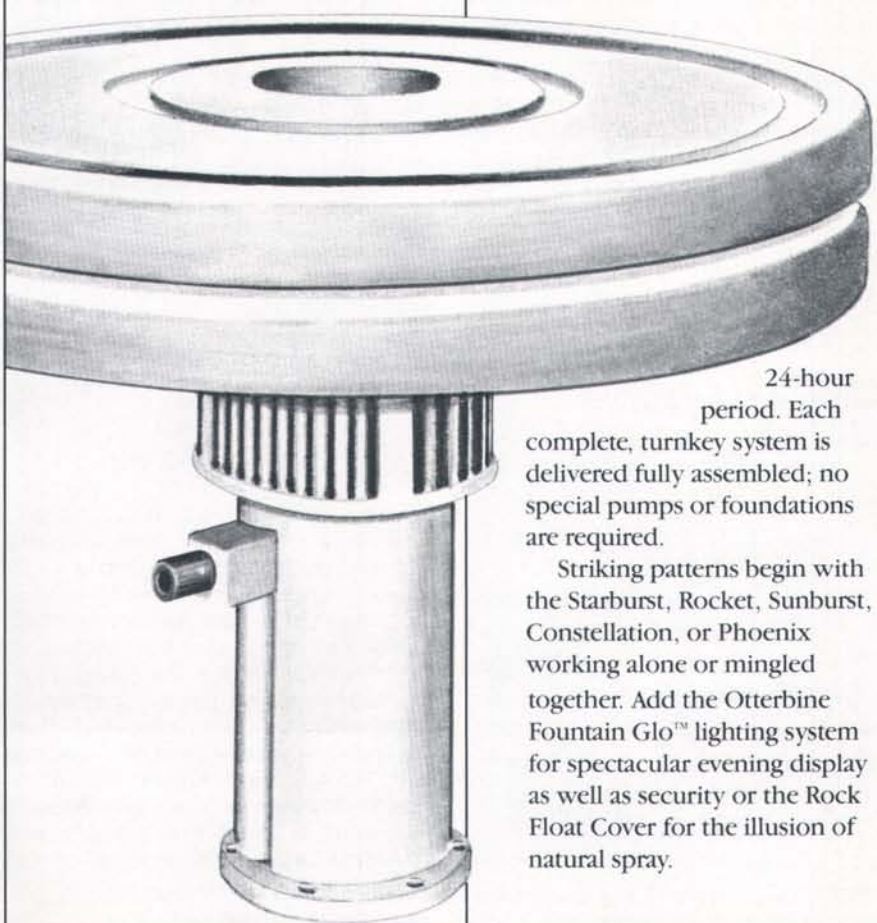

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