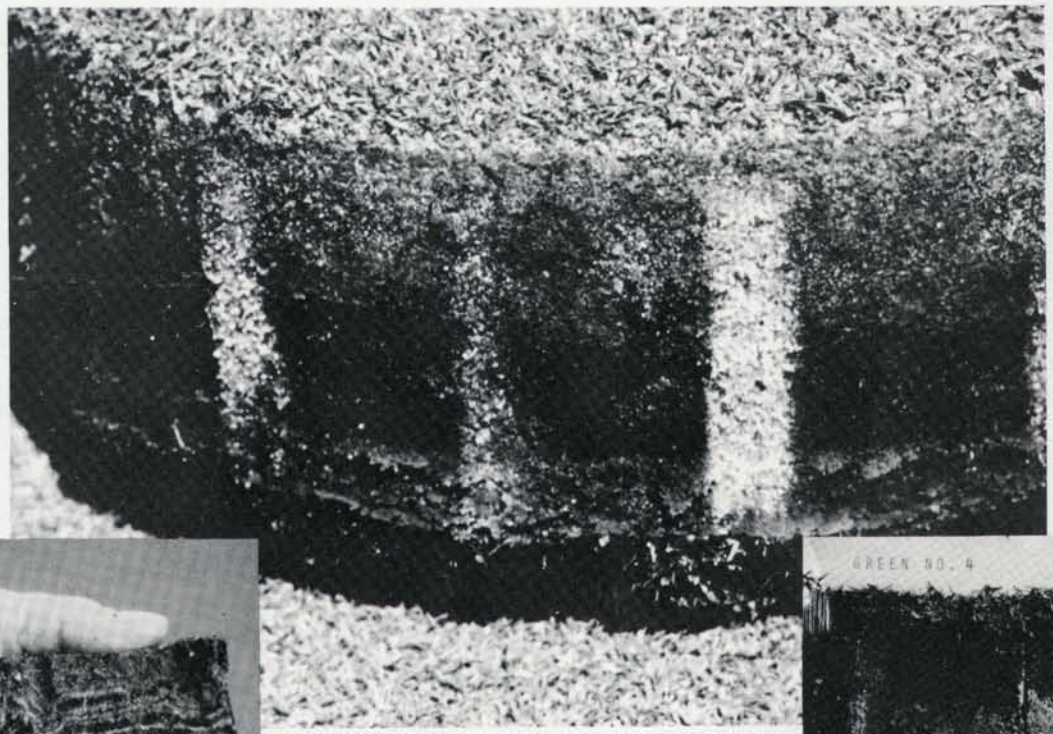
Aeration and Cultivation

Making Sure the Cure Is Better Than the Disease



Soil modification resulting from aeration and topdressing.

Layers like these can block drainage and impact root growth.

Wind-blown silt caused this surface layer to build up on greens.

"Sports turf managers have been guessing for too long about why or how to aerify." These are the words of Tom Mascaro, who invented of one of the first aerifiers (aerators) for turf in 1946. He has no doubt about the value of aeration, he just can't understand why it took the turf industry so long to adopt it as a key maintenance tool.

"The original idea was simply to cultivate or disturb the soil beneath the turf surface," he states 41 years later. "Anything you do to disturb grass causes it to grow faster." That factor alone justifies aeration to Mascaro. When you add relief of compaction, deeper penetration of chemicals, speeding up decomposition of thatch, greater infiltration of water, breaking up subsurface layers, amending heavy soils or creating a better seedbed for overseeding, it becomes impossible to select one machine that will accomplish all these tasks in all soil conditions.

"Before using a particular aerator, you really should identify the problem you are trying to solve," points out Dr. Bob Carrow, associate professor of grasses and turf management at the University of Georgia in Experiment. "Aeration, or cultivation as I prefer to call it, isn't as straight forward as people think. There is no one piece of equipment for all problems." Carrow is half way through a two-year study on cultivation supported by a grant from the United States Golf Association Green Section. He has collected as much of the existing research on aeration as he could find to help guide him through his project.

"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. "The important thing is to look at the net benefit—in other words, making sure that the amount of compaction relieved is greater than the amount of compaction caused by the machine."

The second major factor is surface disturbance. "You don't want to tear up the turf

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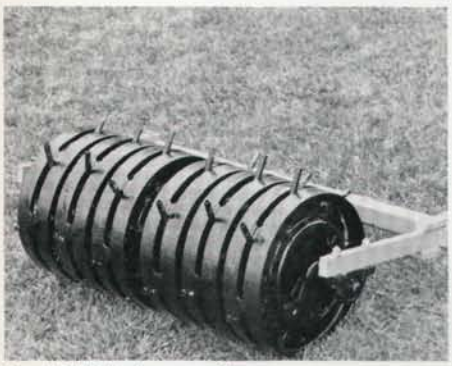
during the playing season or before a major golf tournament," he remarks. "Certain types of aerators should be used at certain times based upon the use of the turf, soil conditions and weather. Sometimes you have to settle for light or moderate cultivation with a small amount of improvement instead of severe cultivation and an unplayable surface. Each type of machine has its place and time."

Relieving compaction is the most widely



Land Pride's drum aerifier.

known use for aeration equipment. "You can get compaction in a flower pot," says Mascaro. As the silts and fines filter down into the pore spaces around soil particles, the soil becomes harder and drainage is slowed. Pressure exerted on the surface compounds natural compaction to reduce the amount of space between soil particles. Where a well-textured soil would contain 50 percent solids, 25 percent air and 25 percent water, a compacted soil contains more solids and less space for air and water.

"A good example is prairie soil," Mascaro points out. Prarie grasses sent their roots into the dead mineral matter that was there originally to open up pore spaces. As the roots died, air and water took their place. The result was a naturally textured soil that served as a good root zone. Without disturbance, this soil ecosystem remained in balance. But when man moved to the prairies to farm and ranch, he upset the balance and today must cultivate to relieve soil compaction.

To say that sports are the equivalent of a herd of cattle on soil is not farfetched. The pounds per square inch placed upon soil by golfers, football, baseball and soccer players, turf vehicles and maintenance equipment is not that much different. By intensively using turf for sports, we create compaction that must be periodically remedied if the turf is to recover quickly.

The majority of aeration or cultivation equipment is designed to relieve compaction in the top three inches of soil. The units drive tines or blades into the topsoil using various methods.

The original concept utilized star-shaped blades mounted on an axle or drum. As a tractor rolled the aerator over the turf, the weight of the unit forced the blades into and out of the soil. The openings left behind allowed improved penetration of air, water and fertilizers. Since soil was forced down and to the side when the spike entered the soil, little direct relief of compaction was provided. By creating pathways in the soil, natural processes that improve soil texture, such as root penetration and freezing and thawing, could indirectly benefit the turf. This method of cultivation is referred to today as pin spiking.

Inventors, such as Mascaro, took the concept a step further by replacing the blades with open spoons or hollow cylindrical tines that pulled a plug or core of soil out of the ground. They also developed other methods of driving these tines into the ground, ranging from drills to sets of arms on a crankshaft. By removing cores of soil, the density or hardness of the soil around the holes was reduced. It has since been confirmed at Michigan State University that these tines initially compact the soil on the walls and bottom of the holes. As the hole walls collapse, the net result is reduced compaction down to the depth of the tine.

Repeated aeration at the same depth, however, can create a compacted layer in

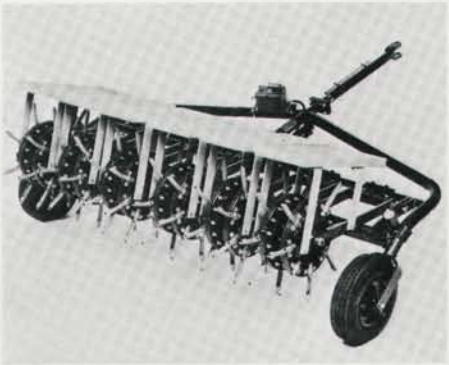
Terracare pull-behind aerator.

some soils at the bottom of the holes, usually between two and three inches. This has led to development of cultivation technology that breaks up this subsurface layer. How frequently "deep cultivation" is required can be based on the soil type, the frequency of shallow cultivation, the closeness of the tine pattern and whether or not the tine depth is altered between aerations.

Another type of aeration, called "shattercore," has been developed to cultivate a larger volume of soil around holes made by tines or blades. The action of the tine or blade in the soil shatters or disturbs the soil beyond the hole wall. Instead of bringing a core of soil to the surface that must be removed or broken up, this technique relies on solid tines or specially designed blades to disturb the soil below the surface. Manufacturers of shattercore equipment recommend that soil moisture levels should be lower than they would be for conventional core aeration.

"If your goal is to control compaction," says Carrow, "the best thing you can do is develop a schedule of assorted cultivation techniques timed to consider surface disturbance, weather conditions and use of each turf site at different times of the year. If a green is showing signs of stress a week before a tournament, you might consider pin spiking to gain maybe five percent improvement, instead of core cultivating." Another option is to switch to a smaller tine, possibly even a small solid tine, to keep surface disturbance to a minimum. More effective methods of cultivation should be scheduled and carried out after the tournament and periodically throughout the growing season.

One scale of the severity of core cultivation is the percentage of soil removed by the aerator. The size and pattern of tines



Ryan Tracaire rolling aerator.

on aerators can vary this percentage from one to more than ten. A figure between two and three percent is common for standard turf aerators while some greens aerators can remove more than ten percent.

Tines range in size from 1/4-inch to 3/4-inch in diameter. Larger tines remove more soil. Patterns, or the spacing between tines, generally range from four by seven inches for some rolling-type aerators down to one by two inches for some crankshaft models. Making more than one pass with an aerator can create a tighter pattern. In addition to the tine size and pattern, tine depth is also an important consideration when it comes to the volume of soil being removed. A large tine on a tight pattern can remove up to 15 percent of the soil.

Carrow's point is that the sports turf

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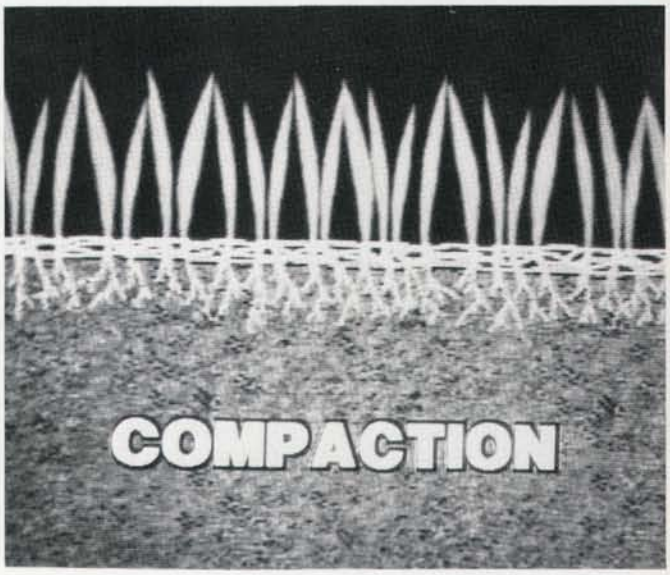
Holland Aerway deep cultivator.

HARD PLAYING FIELDS CAUSE INJURIES!

Problem: COMPACTION

The primary cause of soil compaction is heavy foot or vehicular traffic. That's why it's such a common problem on playing fields. Because compaction drastically alters the physical structure of the soil, it becomes a poor medium for the growth of turfgrass roots, wastes valuable water and nutrients, and results in higher maintenance costs. Compacted soil stunts root growth, rendering turfgrass more vulnerable to periods of stress. You don't just have a rock-hard surface in which turfgrass has great difficulty growing . . . you also have an accident waiting to happen!



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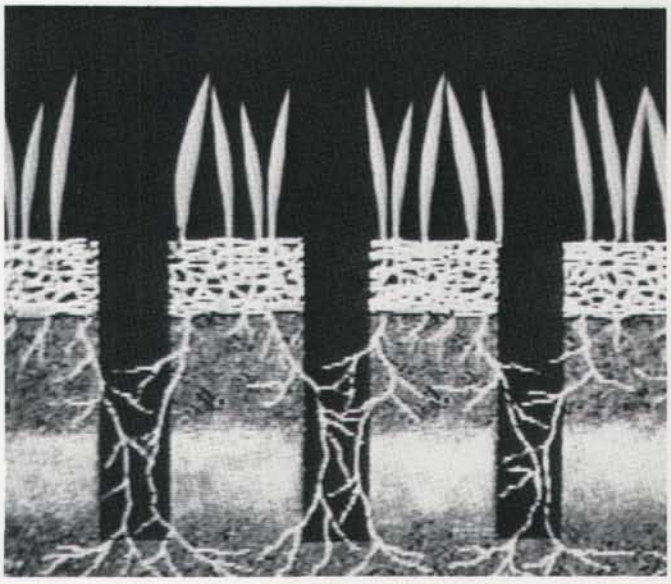

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Toro crankshaft greens aerator.

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manager should have the ability to adjust the severity of cultivation to match turf use and weather conditions. For example, a football field constructed of heavy soil should be severely cultivated in the spring by removing up to ten percent of the soil through core aeration. During the playing season, when surface disturbance needs to be kept to a minimum, the sports turf manager could switch to pin spiking or small solid tines. After the last game, moderate core aerating can then remove between three to five percent of the compacted soil.

Carrow cautions that severe core aeration should be avoided during excessively hot, cold or dry periods. In fact, if a turf area does not have an irrigation system, severe cultivation could do more harm than good.

Heavily-used, severely compacted sports turf may periodically require deep cultivation in addition to frequent aeration of the topsoil. Deep cultivators operate on a number of different principles to cultivate and shatter the soil to a depth of four to ten inches. Carrow's preliminary results have shown that deep cultivation increases root depth, an important factor in drought and wear tolerance. "We've discovered that compaction can stimulate surface rooting," states Carrow. While the turf may actually increase its root structure, these roots are nearer to the surface where they are exposed to traffic and the elements.

"One very important thing to remember," says Carrow, "is turf under stress does not recover as quickly as healthy turf. Cultivation also adds to the stress placed on the turf at first. It's critical to fertilize before or immediately after cultivating to give the turf the ability to heal up rapidly."

The value of cultivation in controlling thatch is also gaining recognition. The organisms which break down dead plant material are sensitive to soil conditions. Excessive wetness or dryness caused by surface compaction can disrupt their role in breaking down thatch. Cultivation that breaks through compacted soil layers improves the environment for these beneficial organisms. Furthermore, by relieving compaction, turfgrass rooting should shift in favor of deeper rooting as opposed to surface rooting. As surface roots age and die, they add to the amount of material in the thatch layer that organisms must break down.

Ryan Greensaire II.

Core aeration can remove up to 15 percent of the thatch on the surface. Dr. Martin Petrovic at Cornell Univeristy in Ithaca, NY, says core aeration can actually remove more thatch than some verticutters or dethatching units. Furthermore, if core soil containing beneficial organisms is mixed into the thatch layer, decomposition is improved. By breaking the cores up with a drag or vertical mower and brushing them

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Closeup of quadratines on Green Care CoreMaster 12.

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into the thatch, the layer of dead vegetation is recharged with fungi, bacteria and other organisms which feed on it. Many sports turf managers find aeration and recycling the cores back into the soil more practical than removing thatch by power raking and disposing of the debris.

Some superintendents utilize core aeration with topdressing to gradually amend heavy soils. By brushing sand or sand mixed with humus into core holes after each aeration, heavy soil is replaced with a growing medium that resists compaction and drains better. The improvement is small, but it may provide some relief when reconstruction is impractical. One type of deep cultivation consists of a vibratory plow that injects sand into narrow channels in the soil.

Manufacturers have developed machinery to reduce the amount of labor required to handle large volumes of soil and amendments. They have designed core collectors to simplify removal of cores on greens. They have also developed topdressers that distribute material evenly over large areas. Combined with cultivation methods, these machines allow turf managers to control the texture of playing surfaces more effectively.

One obstacle to managing soil texture has been the inability of the sports turf manager to reliably measure soil hardness. He can send soil samples to a laboratory for analysis, but that doesn't provide a quick way of judging hardness or compaction in the field. An athletic field manager needs to know if certain fields or portions of fields are becoming too compacted for player safety and turf health. A superintendent needs to know if his greens are approximately the same firmness. Small raised greens may get hard faster than larger shaded greens. Separate cultivation techniques and schedules may need to be developed for each green.

Compaction meters range from simple spring-loaded rods to complex impact testers. These devices not only allow the turf manager to compare the firmness of

different sites, they can alert him if the soil is too wet or dry for cultivation. "Water is a good lubricant," explains Mascaro. "You need a certain amount of moisture for tines to penetrate the soil to a desired depth." Diagnostic tools, such as compaction gauges, give the sports turf manager the control he needs to plan and implement cultivation programs more effectively than before.

A core sampler, a simple hollow rod or shaft that opens after a core is pulled, is diagnostic tool that every sports turf manager should use regularly, says Mascaro. It not only reveals subsurface layers, it can provide important information on soil texture and moisture at various depths. "You can see how deep roots are growing in a certain area," says Mascaro. "Shallow roots are a sure sign of a compaction problem."

Salsco crankshaft greens aerator.

Selecting an aerator or aerators can be surprisingly complicated. Rolling-type units have fewer parts that require service than crankshaft types. However, a rolling-type aerator may have 30 to more than 300 tines that will need to be replaced at some point. Crankshaft models typically have between eight and 12 tines.

Rolling-type tines enter and leave the soil at an angle, whereas crankshaft-driven tines enter and leave the soil in a near-vertical motion. As a result, the surface opening made by the vertical tine is cleaner. You may not want to use a rolling-type aerator on a green, but its speed makes it faster on fairways and fields. Some manufacturers have recently increased the speed of their crankshaft models to cultivate up to 30,000 square feet per hour. One manufacturer has more than doubled that speed by doubling the width of its crankshaft-type aerator. A rolling-type aerator pulled by a tractor in the same period of time might do one to two acres. "You have to look at the core pattern and depth for a true comparison," says Sal Rizzo, president of Salsco, Inc.

With the exception of the Holland Aerway, deep cultivators are more complicated machines than rolling-type aerators. They too require regular maintenance for reliable, long-term performance. For this reason, most deep cultivators are owned and operated by specialized contractors.

One thing is very clear—you have to maintain aerators regularly if you expect them to work properly when you need them. "You should spend 30 minutes on maintenance every day you use an aerator," says Rizzo. "That small degree of prevention can save you hours of downtime. After all, you should be doing the same thing for your mowing equipment."

The other key to longevity of aeration equipment is evaluating the site and soil conditions prior to aerating. "Once you get off a green and onto a sports field or fairway, the hardness and uniformity of the soil changes drastically," warns Clarke Staples with Cushman-Ryan. "The machine and the tines must work harder and for a longer period of time. The operator needs to be on the alert for roots, rocks and other hard objects in the soil at all times. You may need to vary the depth of the aerator due to soil conditions."

One reason Carrow thinks cultivation has been accepted as an important part of sports turf maintenance is golfers and players are beginning to understand that a small amount of inconvenience caused by holes or soil cores is a small price to pay for overall improvement in the turf throughout the year. In fact, if they don't see some signs of cultivation during the year, they may wonder if the superintendent or sports turf manager knows what he is doing.

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STMA ANNUAL MEETING PLANNED FOR DODGERTOWN

The Board of Directors of the Sports Turf Managers Association (STMA) has voted to launch its own independent annual meeting January 13-15, 1989 at Dodgertown, the Los Angeles Dodgers spring training facility in Vero Beach, FL. For three years STMA held its annual meeting in conjunction with the Golf Course Superintendents Association of America Show. Last year, STMA's meeting was part of the Pro Show in Dallas, TX.

"We felt that STMA now has the size, strength and resources to step out on its own with a show," said Mark Hodnick president of the 700-member organization. "The board is grateful to GCSAA for its help in the past, but it's time to move on."

The Dodgertown event will feature two half-days of seminars and two half-days of trade show. Demonstrations of athletic field equipment and supplies will be presented in addition to an awards banquet. Showgoers will also be able to see the Dodgertown crew prepare for spring training.

The event was scheduled to fit between football and baseball seasons, said Dr. Kent Kurtz, executive director. "We hope members and other sports turf managers will also take advantage of our one-day institutes to be held this summer at Du Page College in Glenn Ellyn, IL, and at the College of Holy Cross in Worcester, MA." The oldest institute is held every March at California Polytechnic University in Pomona. STMA is in the process of developing a new institute in Seattle, WA, or Portland, OR. Since the annual meeting will be held in Florida, the Daytona Beach institute normally held in September will be delayed until the fall of 1989. "We plan to move the show each year so members from across the country have a chance to attend," said Hodnick

Interested sports turf managers and exhibitors should contact Melissa Merritt, STMA, 400 N. Mountain Ave., Suite 301, Upland, CA 91786, (714) 981-9199.

MAJOR LEAGUES GET FEEL OF OMNITURF

Considering that artificial turf has been a major factor in recent World Series, Major League Baseball managers take notice when new types of artificial turf enter the market. This spring 11 teams got their first look at Omniturf at the Kansas City Royals spring training center at Boardwalk and Baseball near Orlando, FL.

The sand-filled artificial turf surface was installed on the infield of the new stadium last fall. The outfield is Tifway bermudagrass overseeded with perennial ryegrass. This spring ten teams visited the facility to play the Royals in 17 exhibition games. It was their first exposure to the artificial surface. Many of the teams play their home games on AstroTurf.

Omniturf consists of a one-inch-high carpet of polypropylene fiber blades, filled to within 1/4-inch of the top with sand. This layer is laid atop rubber pads and a rock sub-base. A drain pipe system runs through the sub-base.

The five other practice fields at Boardwalk and Baseball are bermudagrass. The Class A Baseball City Royals have begun their schedule of 70 home games at the stadium. College and high school games will round out the schedule for this year.

A Guide to Irrigation Repairs

Irrigation system repairs can usually be kept to a manageable level if you follow a few simple but orderly steps. The first is to do what John Wayne did in his low-budget cowboy movies of the early 1930s—head them off at the pass.

We spoke to some experts on the subject—*real* experts, in that they either spend their days repairing systems or have gone on to become consultants based on their years of experience in the field. They agree that a regular maintenance schedule to *avoid* repairs should be first on anyone's list of things to do.

In order to make such a schedule most effective, however, you first need to know which components in a system are most likely to need periodic maintenance—and, should the varmints still get through that pass, which are most likely to need repairs.

You also have to know how to detect problems when they occur—hopefully before they become serious, though this isn't always possible.

These three stratagems have been applied by each of our experts to some or all of the following elements, depending on their particular expertise and interests: electrical, hydraulics, pressure, flow, controls, sensors, valves, and pump systems.

Bill Derryberry spoke to us from his office in Scottsdale, AZ, where he has a thriving practice as an irrigation consultant and has written and published a book, "Troubleshooting Irrigation Control Systems," which he sells by mail.

Derryberry began very modestly by saying, "People often ask me what kind of maintenance I recommend for avoiding problems in irrigation systems. And, frankly, I don't see a lot that you can do! It's not like changing the oil regularly in an automobile engine." Then he proceeded to tell us *plenty* that you can do. . . .

"Check to spot solenoids that are about to fail. Make sure your splices are correct. Keep your clocks clean, dry, and bug-free. Adjust and set all heads to their correct height to avoid their being broken off by a mower. Seek out broken heads frequently and repair them promptly. When you do repair them, install flexible swing joints in order to head off future damage. And, of course, use swing joints on all new heads.

"Most problems involve breakage caused by incorrect installation. Ninety percent of that involves failure to use swing joints, or failure to use them properly, plus setting the heads improperly. Few people appreciate how critical it is to set a head within a half-inch of level, and flush with the finished grade."

Getting down to details, Derryberry had this to say about the various elements of an irrigation system and what can go wrong with them:

"Electrically, probably the biggest and least-understood failing is deteriorating solenoids. Most of the time you can anticipate early failure of solenoids by a simple ohmmeter test at the clock, instead of walking

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Technician checks resistance for each valve at controller.

Sprinkler heads should be flush with the surface to avoid damage by maintenance equipment.

Irrigation System Repairs

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all over to check the whole system personally. Ohmmeters directly measure electrical resistance in ohms, so you can see at a glance if something's wrong."

Simply comparing the resistance in various stations will disclose which solenoids are shorted or partially shorted, Derryberry explained. When you do find a solenoid in either condition, "Change it *now,*" he urged, "to avoid a future service call. Don't try to talk yourself out of it. Don't let it go!"

Turning his attention to components most likely to fail, he said, "Aside from ordinary pipe breakage and vandalism, the single greatest cause of service calls—perhaps 90 percent of the remainder—is for remote-control valves, or RCVs."

His maintenance advice in this regard: "Ohmmeter readings every six months would probably be the most important thing you could do. Inspect all valve pigtail splices, and replace those which are not properly waterproofed. If you have just inherited a large project, don't fail to go through and check all those RCV pigtail splices—because electrical shorts cause confusing symptoms and misdirect repair efforts. Therefore you should at least eliminate such symptom confusion by seeing to it that you have good splices first.

"On the ohmmeters, you'll get different

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