Troubleshooting Irrigation Valves

Valves are Vital to Your Irrigation System...
Knowing How They Work Provides You With Fast Solutions to Problems

By LAURIE BERRY
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"An ounce of prevention is worth a pound of cure."

Nowhere is this truer than with irrigation valves. They are highly reliable and will last for years if you properly care for them. But valves can be difficult to troubleshoot because many of the parts that could be causing the problems are hidden. By learning how irrigation valves work, you can troubleshoot almost any problem.

Proper valve troubleshooting starts with a few basic questions:

* Is the irrigation controller plugged in and properly programmed?
* Is the master water supply turned on?
* Is water present to the valve?
* Is the flow-control handle open?
* Is sufficient water pressure and flow available?
* Is the pump working?

Valves 101

Before troubleshooting begins, you must understand how irrigation valves work. Valves control the flow of water to sprinklers and can be mechanical, hydraulic, electric or a hybrid-know what kind you're dealing with.

A valve stays closed because the surface area above the diaphragm is about two-and-half times larger than the pressurized surface area below the diaphragm. The difference causes a greater force above the diaphragm than below it. The valve traps the water, which fills the upper chamber. The valve will open only when the force above the diaphragm has been relieved. This will happen electrically when the controller energizes the solenoid or manually when you use the manual bleed.

The solenoid is a coil of electrical wire that, when charged with an electrical current from the controller, creates a magnetic force and pulls up a small, metal plunger inside the valve. As the plunger rises, it dumps water from the chamber above the diaphragm to a lower (downstream) pressure area. This reduces the force above the diaphragm and the valve opens.

To close a valve, the irrigation controller stops sending an electrical current to the solenoid. As the current terminates, the solenoid drops the plunger and stops the flow of water from above the diaphragm. The pressure above the diaphragm builds to a force greater than the pressure below the diaphragm, and the valve closes.

This also occurs when you operate the valve manually. When you open the manual bleed screw, you relieve the force above the diaphragm either to the atmosphere or to the downstream side of the valve.

Electricity and Water

A variety of conditions can cause an irrigation valve to malfunction. But don't overlook the obvious. If the valve will not open, make sure you have turned on the water supply. You can check to make sure you have a water supply by manually opening or "bleeding" the valve.

There are two types of manual-bleed devices. The most common is an external manual bleed. It usually consists of a small knob on top of the valve bonnet that bleeds-or relieves-the water above the diaphragm. The second type of manual-bleed device is an internal manual bleed. It is usually a lever on the solenoid or the solenoid itself. When you turn on the lever or activate the solenoid, water pressure above the diaphragm bleeds to the downstream side of the

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valve. Turn the external manual-bleed screw or operate the internal manual bleed and check for water flow. Be aware that some valves incorporate both external and internal manual-bleed systems. If there is still no water flow to the valve, check the PVC line for breaks.

Another common problem is lack of electrical signal (voltage) to the valve. To determine if the valve is receiving power, use a volt-ohm meter. From the irrigation controller, manually turn on the station you are troubleshooting. With the volt-ohm meter, check the voltage between the ground and the controller-station terminal. Your reading should be 24 volts AC (VAC). If it is not 24 VAC, you need to determine the cause-which is usually a blown fuse in the controller or in the controller's transformer.

While you are at the controller, check the entire irrigation program. In many cases, a valve will not operate properly because of faulty controller programming.

If your meter reads 24 VAC at the controller station wires, check the zone in question to make sure it's operating. Make sure that the controller has a programmed start time and run time and that the "days-to-run" setting is programmed. Though this may seem elementary, an improperly programmed controller is one of the most common causes of valve malfunction-and usually the largest source of customer complaints.

If the controller is working properly, check the voltage to the solenoid. With the controller turned off, skin the insulation off the two wires running from the valve solenoid to the splice. Make these cuts as close to the splice as possible. Attach a voltmeter to the wire running from the splice-the voltage should read zero.

Manually operate the irrigation controller, and check that you are receiving 24 VAC. It is normal to experience some voltage loss at the valve, but if the volt-ohm meter reads less than 20 VAC, the field wires have a problem. You need to find the source of this problem or replace the wires.

After completing this test, cut out the original splice, and reconnect the wires. It's important to leave enough wire to make the splice.

Contamination

Because of its direct connection to piping from the main water line, a valve is susceptible to contamination from dirt and debris, especially if you use non-potable or effluent water. To reduce the risk of contamination, most irrigation valves have a filter or screen to keep dirt out of the area above the diaphragm and the solenoid area.

Dirt and debris trapped in the valve may cause it to "weep." The telltale sign of a weeping valve is excessive puddling at the lowest sprinkler after the valves have shut off.

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To check for excessive dirt, debris or algae buildup, turn the water off, remove the valve bonnet, and check the screens for contamination. Some valves have filter screens directly below the solenoid, which can be removed with a small screwdriver or coin. Flush the screens with water to remove any debris.

This is also a good time to check the diaphragm and valve seat for debris, wear or deterioration (note that some valves have these two components molded into one piece). The diaphragm, which is a large, rubber-like, flexible disc, is subject to deterioration. It can be nicked or torn by a trapped pebble or a build-up of grit.

The valve seat is the lower sealing surface in the valve body. Inspect it for nicks by running your finger over the lip of the valve seat. Replace the valve body if the valve seat is damaged. Check the diaphragm and the valve seat for cracks and wear. Replace them if they show signs of wear or deterioration. Reassemble the valve, turn on the water, and manually operate the irrigation controller to make sure everything is working properly.

Solenoids

If you have checked the water supply, the power supply and the diaphragm and valve seat, and the valve is still malfunctioning, usually the only possibility left is a faulty solenoid.

With the water turned off, unscrew the solenoid from the bonnet of the valve. Be careful not to lose the plunger or the small spring, which helps force the solenoid plunger downward.

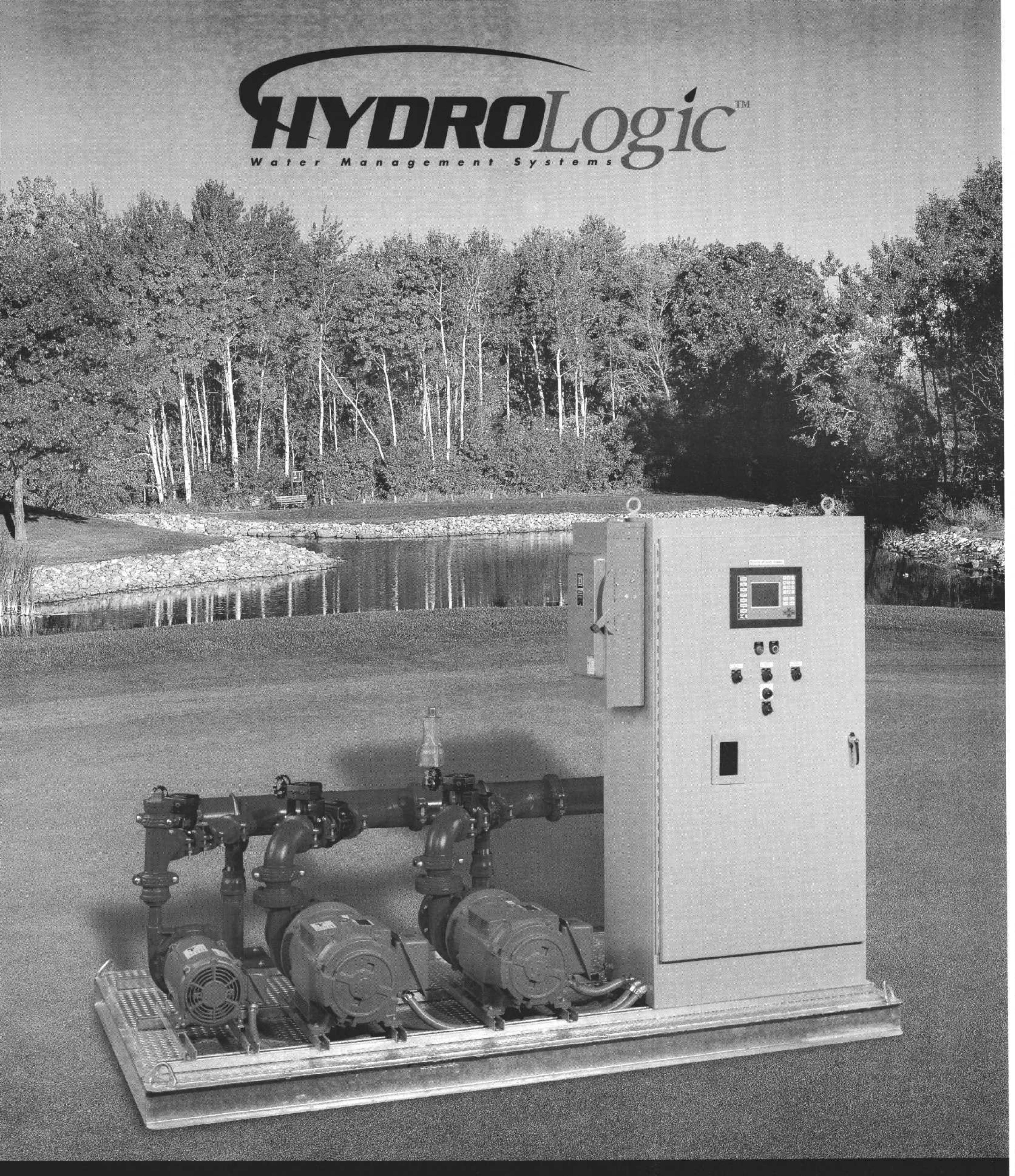
Inspect the solenoid plunger. The plunger is the small, metal piston with a rubber base inside the solenoid housing. The plunger must be clean and free of any debris.

To check the operation of the solenoid, manually turn on the valve or zone from the irrigation controller. If it's working, the solenoid plunger will be pulled into the solenoid body.

Some irrigation-equipment manufacturers have designed "captive" solenoid plungers. A small piece of plastic holds these types of plungers in the solenoid housing. If the valve has a captured solenoid, you will hear a sharp clicking sound when the solenoid energizes. If the solenoid is not working properly or if the solenoid plunger does not move freely in the solenoid housing, clean and retest it. If it is still not working, replace the solenoid.

Also, with the solenoid removed, check the small hole in the bonnet that allows water to pass from above the diaphragm to the downstream side of the valve. Check the opening with a paper clip or small piece of wire. It is important not to enlarge this hole because it controls the opening and closing speed of the valve.

By following these suggestions, you'll be able to save time and quickly get to the root of the problem when valve troubles occur.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Mark your calendars now to attend the MTGF Educational Conference and Trade Show, December 6-8, 2000 at the Minneapolis Convention Center. This year's program will feature more than 45 educational sessions during the three days plus special sessions designed specifically for mechanics and Affiliate Members.

" We are again hoping to have some form of an all industry reception on Wednesday afternoon or early evening," said Bob Mugaas, MTGF executive director.

"In addition to our regularly planned educational sessions, we are cooperating with the University of Minnesota Water Resources Center to provide a 'Current Topics Symposium' on Friday morning," Mugaas said. "That session will be focused on phosphorus sources in the urban landscape and their potential to impact water quality. We anticipate both local and national presenters to be part of that session."

The conference will also provide an opportunity to meet the MTGF's new Communications Director, Greg Crawford, who also will provide some training on marketing and public relations for our industry.

Watch for more information in the Spring, 2000 Clippings newsletter.

MTGF Golf Outing On July 18th Highlights MTGF Awareness Week

On the heels of its best attended summer golf outing ever in 1999, the MTGF will return to the U of MN Les Bolstad Golf Course on July 18 to host this year's benefit golf outing and tournament.

Eighty-nine people took part in last year's event. The MTGF hopes to reach 120 participants this year. The event will be a scramble with a shotgun start at 8:00 a.m.

During this same time, an MTGF Awareness Week is being planned as part of the foundation's heightened public relations efforts. It is intended to highlight the people and their professions among all of the Allied associations. "We will be working with Greg Crawford in helping plan this event, said Bob Mugaas, MTGF executive director.

"For now, be sure to reserve your participation in the MTGF Benefit Golf Outing and Tournament on Tuesday, July 18th," Mugaas said. "All funds generated over expenses go toward supporting turf and grounds research and education activities of the Foundation. Watch your mailbox later this spring regarding this event."

National Golf Foundation Reports Record Number of Course Openings

509 Golf Courses Opened in 1999 Across the U.S.

SECOND PLACE TEAM AT RIVER FALLS GOLF CLUB, from left to right, Brandon Schurtz, St. Croix National, Tim Berquam, Bergerson Caswell, Inc., and Dean Wojtczak, River Falls Golf Club.

The National Golf Foundation says last year's total of 509 golf course openings was a record, and the fifth consecutive year the U.S. golf industry christened more than 400 new courses. The total included 13 reconstructions.

"Based on what's currently in the development pipeline, we expect another big year in 2000," said Jim Kass, NGF research manager. There were 936 courses in some stage of construction as of Dec. 31. That's second only to the record 1,069 under way at the end of 1998 and the sixth consecutive year it has exceeded 700.

Although 790 of the 936 are scheduled to open in 2000, Kass said experience indicates 60 percent will actually make it, bringing the number to about 450. Further down the road, development remains just as strong, with a record 903 course projects in planning.

Not all of last year's activity was 18-hole facilities. There were 241 nine-hole openings, most expansions to existing facilities. The number of 18-hole equivalents is actually 375.5, compared to 327.5 in 1998, 316 in 1997 and 319.5 in 1996.

Florida and California topped the rankings by state with 36 new courses each. Texas, which ranked a distant 11th in 1998, pulled up to the number three spot with 31 new courses. And Michigan, which ushered in the most new courses in 1998, fell to fourth in 1999 with 28. According to the NGF's under-development indicators, two states to watch in 2000 will be New York with 46 new courses now under construction and Wisconsin with 40.

Daily-fee and municipal courses continue to dominate development. Of 1999 openings, 84 percent were daily fee or municipal facilities.

The source of this information, Golf Facilities in the U.S.: 2000 Edition, is available on line or from NGF Information Services at 1-800-733-6006.

Golf Course Developments	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Course Openings	289	351	354	358	381	468	442	429	448	509
Courses Under Construction	560	583	616	671	769	820	850	932	1,069	936
Courses in Planning	781	681	580	543	541	562	808	720	708	903

Source: Golf Facilities in the U.S. (Figures are as of December 31 of each year.)

With the Grain or Against It

The Continuing Challenge of Sand in Bunkers

By JAMES SNOW

National Director of the USGA Green Section

What do you think golfers complain about most on the golf course? Green speed? Hole locations in unfair spots? Fairways too wet? Not enough water in the ball washers? Based upon the travels of the 16 USGA agronomists who consult at more than 1,600 courses annually, the answer probably would be the sand in bunkers.

Many golfers assume bunkers are among the easiest parts of a course to maintain, requiring little more than a quick daily run-through with a raking machine. That's why they feel compelled to complain about sand color, depth and hardness or softness. Yet bunkers can cause just as many headaches for superintendents as for players.

It is far easier to keep a set of 18 greens playing to uniform speed and firmness than to ensure dozens of bunkers have the same characteristics. A green can be mowed, rolled, verticut with blades and punched with holes by an aerifier. There are few preventative maintenance practices for bunkers. That said, under the right circumstances a bunker can remain playable for up to 10 years but the wrong factors can cause problems from the start.

Three characteristics dictate how a bunker will play: the physical attributes of the grains, maintenance practices and weather. Some sands placed in a bunker at the top of a windy ridge will perform poorly, just as they would in an area with inadequate drainage.

The best possible sand is like Goldilocks's favorite porridge: not too smooth or rugged, not too big or small, not too round or angular. If sand grains fit in a medium range of size, shape and texture, the overall surface benefits. Rounded, smooth sands can be too soft and unstable, like a bag full of marbles, and will produce "fried-egg" lies; grains with many sharp edges and irregular shapes can pack too tightly and produce something closer to concrete.

Weather affects sand more than most golfers realize. From the day it is put in place, bunker sand is subject to contamination. The tiniest wind gusts deposit dust and debris, and heavy rainfall or irrigation runoff causes washouts that introduce soil from bunker faces. Each time this happens the sand becomes polluted with tiny silt, clay and other particles. Over time the open spaces between the sand grains become plugged, resulting in a firmer surface. When golfers complain long enough about its hardness and dark color, the contaminated sand is removed and replaced with new sand.

Course superintendents can take steps to keep sand at its proper surface texture. Soft sand can be made to seem firmer by compacting it with a tamper or vehicle, wetting it to make it more stable, reducing its depth and using shallow-toothed rakes to avoid loosening the sand. Hard sand can be made to seem softer through frequent attention with long-toothed rakes, keeping it dry, increasing the depth of the sand or periodically adding small amounts to dilute the impact of the silt, clay and organic contaminants.

Superintendents face continual battles with sand. Each bunker takes on individual characteristics, just as a green that is in shade most of the day will play differently from one in direct sunlight. Cost and logistics make it practically impossible to renovate all bunkers at once, so many courses juggle their programs, replacing the worst bunkers as the need arises. The largest cost of a renovation program is not the sand, but trucking it to the site.

A successful sand-maintenance program is built on selecting quality sand grains, adjusting maintenance practices according to the inherent properties of the sand and weather, and gaining the understanding of those who play the course. Many times that takes just a simple reminder to a golfer that a bunker, after all, is a hazard meant to impede the player from reaching the hole.

Help Bentgrass Beat the Heat

Bentgrass' Tolerance of Summer Heat Stress Depends On Your Year-Round Maintenance Practices

By JACK FRY and BINGRU HUANG
Kansas State University

Bentgrass is not well-adapted to high summer temperatures. However, you can help bentgrass through this stressful time by using fans to increase transpiration and cool the turf.

Creeping bentgrass prefers the cool, moist European climate from which it originated. How, then, can you maintain creeping bentgrass through the scorching mid-summer heat common to the Transition Zone and Upper South? Actually, the challenge is not keeping bentgrass alive in temperatures above 100øF; it's keeping it alive at these temperatures while you mow it at 1/8 inch and subject it to constant traffic. It isn't natural, it isn't easy, and it requires special knowledge and talent.

Creeping bentgrass is a cool-season grass that prefers air temperatures between 60 and 75øF and soil temperatures between 50 and 65øF. Nighttime temperatures are particularly important. Even if daytime highs are in the 90s, nights in the low- to mid-60s significantly ease heat stress. In the Transition Zone and Upper South, however, mid-summer temperatures commonly exceed 90øF during the day and 70øF at night.

Research we've conducted at Kansas State University shows that bentgrass-root-zone temperature plays an important role in turf performance regardless of air temperature. If the root-zone temperature is 100øF and air temperature is 68øF, shoot quality will decline rapidly. Conversely, when we exposed shoots to 100øF, it did not affect shoot quality when the root-zone temperature stayed at 68øF (see photo, page G 16). Roots play an important role in regulating shoot response to high temperatures. This information suggests that the development of some type of refrigeration for root zones in greens could help maintain summer turfgrass quality.

Nursing Bentgrass Through the Heat

Bentgrass plants stay cool by evaporating water through microscopic pores called stomata, which are present on the upper and lower surfaces of leaf blades. This evaporation process is called transpiration. The plant experiences a response not unlike the one you might feel immediately after stepping out of a pool in mid-summer. You are cooler because water is evaporating from the surface of your skin. For this cooling process to work effectively (in plants), a gradient must exist between the layer of humidity surrounding the leaf (the boundary layer) and the atmosphere. Of course, the relative humidity at the leaf surface is almost always 100 percent. Atmospheric relative humidity, on the other hand, varies greatly. Lower atmospheric relative humidity results in a "steeper" gradient, and more water evaporates to cool the plant more effectively. This explains why you can grow bentgrass in Arizona, where mid-summer humidity is low, but not in southern Florida where the relative humidity is always high. Bentgrass growing in the humid South is unable to transpire water effectively. This results in heat buildup within the plants' tissues and leads to heat stress.

Creeping bentgrass usually doesn't exhibit symptoms of heat stress overnight. Indirect high-temperature stress appears days or weeks after exposure to temperatures above the optimum range. Our research results provide clues to understanding how a prolonged period of exposure to high temperatures results in bentgrass decline.

Photosynthesis is the process by which plants use sunlight, carbon dioxide and water to produce food (carbohydrates). Bentgrass prefers cooler temperatures because it photosynthesizes more efficiently than during warmer temperatures. In other words, photosynthesis operates at an optimum level when bentgrass is growing within its preferred temperature range and becomes less efficient as temperatures increase above the desired range.

Conversely, the process whereby the plant expends energy-respiration-increases with temperature. Food consumption is, therefore, much faster in mid-summer than it is in spring or fall. When food consumption consistently outweighs food production, as in summer, plant health falters. The plant is literally starving. This probably is the primary contributor to bentgrass decline (see graph, at right).

You cannot prevent high summer temperatures, but you can develop a plan to reduce the starvation of bentgrass during the mid-summer heat. The first tactic is to manipulate the plant's environment. You can accomplish this by using proper greens-construction methods, encouraging air movement and syringing.

* Construct proper greens. You'll first notice heat-stressed bentgrass on push-up greens constructed with heavy soil. These soils often are compacted, poorly drained and generally unfavorable for root growth. Our research demonstrates that a bentgrass plant whose roots are growing under saturated conditions is more susceptible to heat stress than one growing in well-drained soil. Superintendents often blame turf decline under these conditions on root-infecting diseases or other pathogens. Although pathogens may be present, they usually appear

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