



Finding Solutions for Poorly Drained Greens

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SEVERAL YEARS AGO the Sports Turf Research Institute in England surveyed all of the golf courses in Britain and found that a full 80% considered that they have at least one poorly drained green. If a survey were done of American golf courses, the results would probably be quite similar.

There is no telling how much time and money are spent dealing with these problem greens on golf courses, but it must be substantial. There is little that is more aggravating or worrisome than a poorly drained green during periods of wet weather, especially when temperatures are high or traffic is heavy. Turf on poorly drained greens is generally more susceptible to disease incidence and stress injury, and the soil on such greens is more prone to compaction than greens that drain well.

For golf course superintendents who have managed poorly drained greens, the symptoms are easy enough to identify. They often include thin turf, shallow roots, compacted surfaces, greater disease, increased traffic injury, mower scalping, algae encroachment, footprinting, and a predominance of *Poa annua*.

Good drainage and poor drainage are relative terms. If all greens could be incorporated into a graph, it would probably show a bell-shaped curve, with a majority of greens in a broad "mediocre" range as far as drainage is concerned. What this means is that many greens could be drainage problems under a certain set of circumstances, even though they drain satisfactorily much of the time. Golf course

Greens subject to poor air circulation and shade do not dry as quickly as greens in more exposed locations. They often exhibit symptoms of poor drainage even though the soil mixture may be equivalent to apparently well-drained greens on other parts of the course.

architects and builders who say they never lose greens to poor drainage even though they don't test their materials through a laboratory are kidding themselves and their clients. What they fail to say, or don't understand, is that many of these "low cost" greens can be a real headache during wet weather even though they may not fail completely. Many of their greens fall into the "mediocre" category.

When a golf course superintendent classifies one of his greens as poorly drained, it doesn't necessarily mean that the soil in that green is of poor quality. What he should say is that under these climatic conditions, in this location on this golf course, and under this particular cultural management program, this green drains poorly. Under a different management program, at a different site on the same course, or in an area that receives less rainfall, for example, this same green might be considered well drained.

The message is this: There are many factors that can contribute to a green being considered poorly drained, and there are many things that can be done to shift a green from the "poor" to the "satisfactory" category. Among the practices that need to be considered are irrigation management, tree effects, dealing with traffic, and drainage installation.

Irrigation Management

The fact is that many greens diagnosed as being poorly drained are actually overwatered. It is telling, for example, when a new superintendent takes over a course, that he is able to eliminate the poor drainage symptoms from certain greens by instituting a different irrigation program or by re-designing or remodeling the irrigation system. After all, overwatering can be due to improper irrigation practices, poor irrigation system design, or both.

Following are symptoms that could indicate poor drainage characteristics, poor irrigation practices, or both. If these symptoms are observed consistently during the season, even during periods of dry weather, then they are more likely an indication of overwatering. If quite a few of these symptoms are commonly identified on your course, then perhaps your irrigation program needs attention.

- Puddling after irrigation (indicates poor irrigation design or coverage).
- Deep-pitted ball marks.

- Spike marks and wear injury around the cup.
- Complaints of wet shoes after walking on greens.
- Triplex ring symptoms (wet, lush turf is prone to traffic injury).
- *Poa annua* encroachment.
- Poor stress tolerance.
- Weak root growth.
- Heavy spring irrigation (when it is often not needed).
- Disease activity (e.g., pythium, brown patch).
- Black layer.
- Manual irrigation system (coverage and control are often poor).
- Lack of cultivation (causing surface runoff or slow infiltration).
- Lack of use of a soil probe (should be used to monitor soil moisture).

- Lack of a hand-watering program (no automatic system can do it all).
- Insufficient daily visual monitoring.
- Insufficient monitoring of the maintenance needs of the irrigation system.
- Isolated dry spots (indicates poor irrigation coverage).
- Black algae.

It is not uncommon for poor irrigation practices or a poorly designed irrigation system to be the actual cause of what many people might consider to be a poorly drained green.

The Effects of Trees

It is more than coincidence that the greens that superintendents identify as being poorly drained on their golf courses are often the ones located in a pocket of trees. On most of these

A sand topdressing program established a compaction-resistant growing medium on this green during a five-year period. The green improved significantly and rebuilding was avoided in this case.





In this instance, poor surface drainage was corrected by removing the sod, regrading the soil, and replacing the sod.

courses, all of the greens were built at the same time and constructed of the same materials and in the same manner. Why, then, should these certain greens exhibit symptoms of poor drainage?

The answer to this question has to do with the environment in which the green is growing. The trees that surround these greens block air circulation through the area and may cast shadows on the turf, preventing the soil in the greens from drying as quickly as other greens on the course. They quite literally stay wet for a longer period of time than the others, and exhibit symptoms of poor drainage such as disease activity, algae and moss encroachment, poor tolerance to traffic, poor root development, etc. This prolonged period of wetness also makes them more subject to soil compaction, a factor that compounds the drainage problem.

This problem is made worse yet by careless irrigation practices on these

greens. Since they stay wet for a longer period of time, greens located in pockets of trees should not be irrigated as often or as heavily as other greens. Superintendents who do not recognize this and who don't make the necessary adjustments often blame the subsequent turf problems on poor soil drainage.

The solution to this drainage problem is sometimes as simple as removing or thinning out a few of the nearby trees to improve sunlight penetration and air circulation. Adjustments to the irrigation program may also have to be made. If trees cannot be removed for some reason, or if these practices do not work, then the traditional methods of drainage or reconstruction may have to be used.

The Effects of Traffic

Many greens that exhibit adequate drainage characteristics under light to

moderate use can develop poor drainage symptoms when subject to heavy traffic. When a municipality takes control of a private club, for example, this scenario is quite common. It also can occur when a switch is made from walk-behind greensmowers to triplex greensmowers.

The cause of the problem in this situation is compaction in the upper part of the root zone. Water infiltration is reduced in compacted soils, causing runoff and puddling symptoms in many instances. Also, compacted soils do not dry as quickly, compounding the problem even more.

When poor drainage symptoms occur due to the effects of heavy traffic, cultivation practices should be increased. Core cultivation, followed by core removal and topdressing with a sandy, compaction-resistant material, should be practiced as often as necessary to improve and maintain good water infiltration. Deep-tine cultivation may

be needed on soils that are being affected at a greater depth.

Green design sometimes impacts the effects of traffic. For example, heavily trafficked greens that lack adequate cupping area can show severe symptoms of surface compaction and poor drainage in the most common hole locations. By redesigning the green to expand hole location areas, these symptoms can sometimes be greatly reduced or eliminated.

When traffic problems occur on walk-on and walk-off areas, redesigning the green or the nearby sand bunkers can sometimes relieve the symptoms. Also, switching to walk-behind mowers for part or all of the time can significantly reduce traffic effects.

Dealing with Poor Drainage

If drainage symptoms persist, even though the problems mentioned previously have been addressed, then a more direct approach to solving the drainage problem will be needed. First, the cause of the drainage problem in the green needs to be determined. It could be one or more of these three possibilities:

- Poor surface drainage.
- Poorly drained soil.
- Layering problems.

Poor surface drainage is often recognizable by the surface puddling that occurs after light to moderate rainfall or irrigation. It stems from poor green design or settling after the green was built.

Poor surface drainage can be overcome in several ways, depending on the extent and severity of the problem. In some cases, low spots can be eliminated by selectively topdressing the area on a light, frequent basis. Where a broader area is involved, sod may have to be removed, the subsurface regraded, and the sod replaced. In some instances, the entire surface may have to be stripped, regraded, and resodded, or be rebuilt completely. Sometimes, nothing at all needs to be done if good surface infiltration can be maintained with a program of regular core cultivation.

When poorly drained soil is the cause of the problem, developing a solution is usually a matter of degree. Where the problem is not too severe, a good pro-

Deep-tine aerification or drilling can improve drainage if there is a layer or compacted zone in the upper 10 inches of the profile.



gram of core cultivation, core removal, and topdressing with a sand or high-sand-content material affords relief over a period of years. Deep-tine aerification also can be incorporated into the program for faster results.

Where the symptoms are severe, the addition of drainage tile to the green may be necessary. The installation of 2" to 4" plastic perforated pipe sometimes works quite well, though the disruption to the putting surface can sometimes take years to eliminate. Various types of sand injection systems and geotextile-covered drainage systems have been tried, but in many instances the results have been insufficient or temporary. If

a green has a long history of drainage problems, the best solution is to rebuild to USGA specifications.

Layering problems caused by poor construction, topdressing inconsistencies, or some other factor, can sometimes be overcome by breaking through the layer and allowing water to reach the well-drained soil below. This is accomplished by regular core cultivation or deep-tine cultivation, depending on the location of the layer. If the coring holes are filled with sand, real progress can be made in overcoming the effects of the layer. In a more severe case, it may be necessary to add drainage tile. Greens that do not respond well to these

techniques should be rebuilt to USGA specifications.

Summary

Green drainage problems aren't necessarily what they appear to be. Poor irrigation practices, tree effects, and traffic effects sometimes mislead golf course superintendents into thinking they have a drainage problem. On greens where poor drainage is identified, the cause of the problem could be 1) poor surface drainage, 2) poorly drained soil, or 3) layering problems. The cause must be determined before a good solution can be developed and implemented.

The installation of drainage tile in an existing green sometimes works very well, but the appearance and playability of the green may suffer for quite some time.

