

Troubleshooting Problem Greens

A number of factors determine the quality of a putting green, but golfer expectations define what makes a desirable green.

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Excessive shade is not good for any turfgrass, but it is especially detrimental on putting greens. Shade often discourages healthy growth of desirable grasses and promotes weed species and moss. Ample sunlight during the active growing season is important, but fall and winter shade also must be considered. Winter shade will subject grass to longer periods of snow and ice cover, increasing the potential for damage. Note the green in the background in full sun with no snow or ice accumulation.

Every golf course has at least one putting green that never seems to perform as well as the others. In other instances, many greens on a golf course may fail to meet the expectations of the golfers. Regardless of the number of greens involved, frustration and even anger boil over when putting green quality does not live up

to golfer expectations. Fortunately, options are available to improve problem greens, and although they will not be perfect overnight, improvements can be made to improve putting green performance over time.

Multiple factors contribute to poor putting green conditions, including shade, poor air movement, concen-

trated traffic, and poor drainage. Furthermore, poor putting quality may be the result of inherent problems on a given putting green that cannot be overcome through daily maintenance. Troubleshooting problem greens starts with identifying the factors that can limit putting green performance. This should be followed by evaluating each

green to determine whether one or more factors are affecting playing conditions. It is then time to determine the changes that are needed to produce greens that consistently meet golfer expectations.

GROWING ENVIRONMENT

The growing environment may have the greatest impact on putting green performance. To maintain healthy turfgrass and smooth, true putting conditions, it is critical that putting greens receive adequate sunlight and air movement. If either component is lacking, putting green quality will be compromised. In fact, many of the factors that affect putting green performance may be overcome on greens with good growing environments. Conversely, a well-constructed putting green with the best new grasses will struggle in a poor growing environment.

SUNLIGHT PENETRATION

Trees limiting sunlight penetration should be removed for the benefit of the grass. Persistent shade leads to weaker grass that is less able to tolerate daily stresses from maintenance and golfers. Shade also favors weaker grasses like *Poa annua* — not because weaker grasses thrive in the shade, but because they tolerate shade better than desirable grasses like creeping

bentgrass and ultradwarf bermudagrass. Shade patterns need to be evaluated throughout the year. Fall and winter shade are often overlooked but can increase the potential for winter damage on greens. In addition to shading, the roots of trees planted too close to greens rob water, fertilizer, and other inputs from turfgrass and are often overlooked as a source of turfgrass problems.

AIR MOVEMENT

Underbrush and other vegetation should be removed where air movement is restricted. Air flow helps cool the turfgrass canopy and is especially important for cool-season grasses during summer heat. Adequate air flow discourages humid, stagnant conditions that favor disease development, thus reducing disease incidence. Keep in mind that a green that receives very good sunlight but poor air movement may perform poorly. Sunlight penetration *and* air movement are critical.

Tree removal is often controversial. However, if there is a general feeling that trees surrounding a green are more important than the health of the grass, expect maintenance challenges and reduced putting quality. When regulatory or property line issues prevent tree and underbrush removal, fans can be installed to improve air

movement. Regardless of grass type, a putting green in a poor growing environment will be inferior to a putting green located in a good growing environment.

DRAINAGE

Drainage (both internal and surface) is a major component of turfgrass performance and putting green playability. Poor drainage promotes soft, wet conditions and increases the likelihood of scalping and other forms of mechanical damage from maintenance practices. Additionally, foot traffic and pitch marks from golfers cause severe damage when greens are soft. Standing water on greens also is problematic for putting green turf at any time of the year. Drainage problems in the winter can lead to increased winter kill; during the summer, grass can suffer from scald, wet wilt, and direct mechanical damage.

Greens designed with excellent surface drainage generally perform well, even when internal drainage is limited or nonexistent. Surface drainage problems are easy to diagnose. Observe a green during a heavy rain event or a heavy irrigation cycle to determine the areas where water accumulates. In some instances, low-lying areas that impound water may be improved over time with sand top-



Water accumulates in this area during rain events because the collar prevents water from flowing off of the green. The resulting wet, soft conditions promote stress and lead to mechanical damage from golfer traffic and maintenance practices.



Collar dams are often overlooked as a significant impediment to surface drainage. Regrading affected areas to promote positive surface drainage can eliminate a problem that affects playability and turfgrass quality.

dressing, but in more severe cases regrading may be required. Collar dams are a common cause of surface drainage problems. Collar dams can develop over time as topdressing sand used during aeration accumulates around the edges of the greens. Collar dams can be fixed by removing sod from the collar and immediate green surrounds then carefully regrading the affected area to provide positive surface drainage. Where bermudagrass is grown, sod replacement following regrading may not be necessary. If regrading is done during the active growing season and the area of interest is healthy, bermudagrass will recover from stolons and rhizomes in 3-4 weeks. Even when collar dams do not lead to direct turfgrass decline, they contribute to soft conditions that affect playability around green perimeters. Collar dams are often overlooked as a barrier to surface drainage and ultimately contribute to poor playing conditions.

The first concern related to internal drainage is whether or not a putting green has an internal drainage system. The majority of greens constructed during the past 30 years have some form of internal drainage installed; however, it is important to be sure that internal drainage is properly functioning. On older greens, internal drainage may be limited or nonexistent. In the absence of internal drainage, frequent rainfall will saturate greens, and they can remain wet for extended periods of time. Severe drainage problems can force temporary course closure.

Retrofitting older greens with sand-channel drains can benefit overall performance. Sand-channel drains can be installed in-house, but most utilize outside contractors. Fiberglass rope drainage also has been installed in greens to improve drainage in recent years, with reports of success. Surface drainage and internal drainage both contribute to successful putting green management. Remember, if either is less than ideal, problems can develop.

SIZE, AVAILABLE HOLE LOCATIONS, AND TRAFFIC

Putting green size affects putting green performance. An average-sized



Limited entrance and exit points can affect putting green conditions. Golfers are forced to walk around this bunker to and from the cart path, leading to increased traffic on the back left of this green.

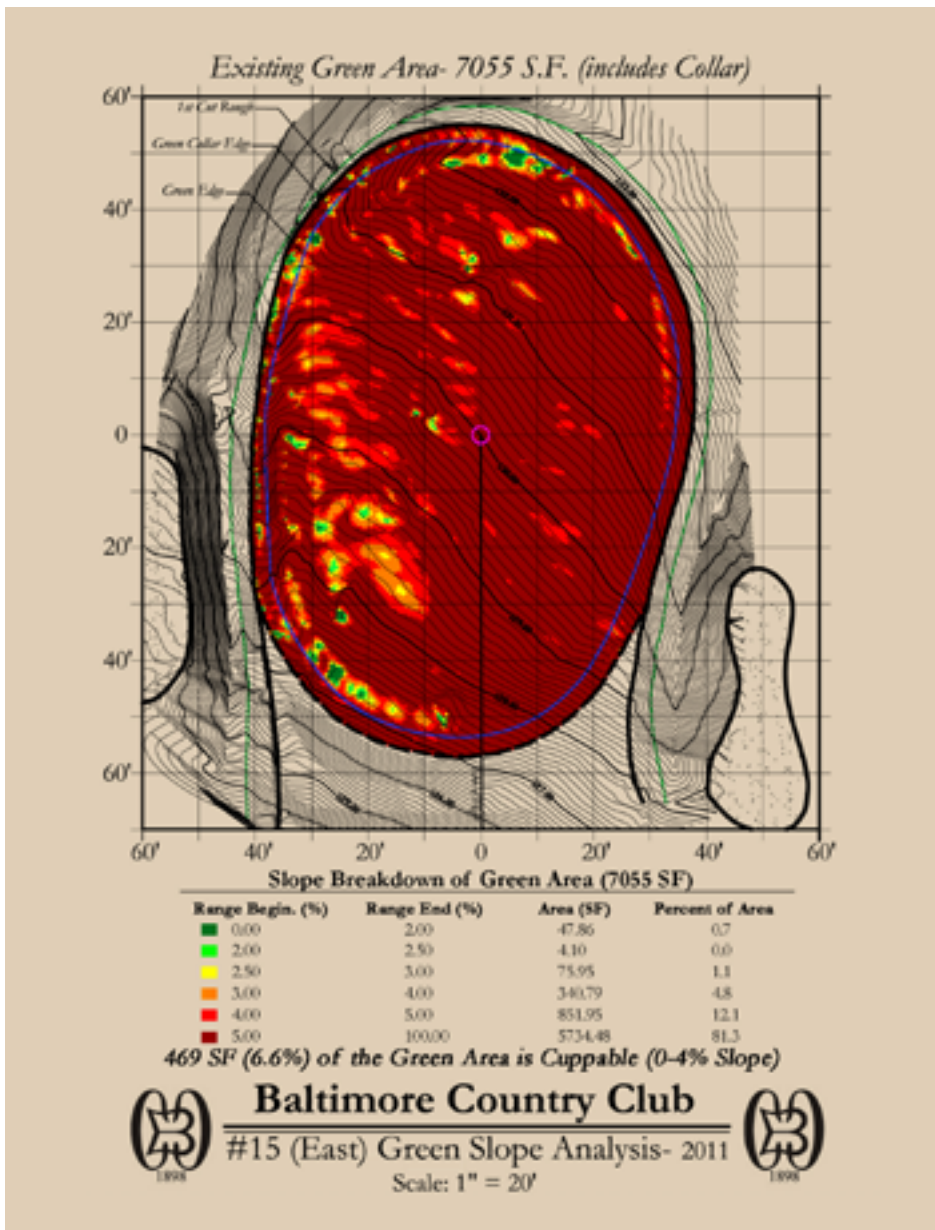
putting green is around 6,000 square feet. However, many older golf courses, and some new ones, have much smaller putting greens that can have significant problems depending upon the number of rounds played. Small greens can be difficult to manage because golfer traffic is more concentrated. Damage from foot traffic can be problematic on any green when conditions are soft, but small greens can be especially susceptible to traffic damage because of limited options for moving hole locations away from wet or damaged areas. Larger greens provide more room to disperse golfer traffic, which generally means healthier turf and better playability. Putting green size is not the only factor to consider regarding traffic distribution. Available hole locations and the number of available entrance/exit points also affect putting green conditions.

Hole locations may be limited at modern green speeds if greens have severe contours and significant surface area with greater than 4-percent slope. Fewer available areas for hole locations means the same areas must frequently be used, leading to increased wear and reduced playability. Furthermore, areas that are suitable for hole

locations are often flatter areas with reduced surface drainage; they tend to be wetter, which makes them more susceptible to damage from golfer and maintenance traffic. Reduced surface drainage has a compounding effect, and the areas that are most important to playability on a green with limited hole locations are most likely susceptible to turf problems.

3-D green scans are helpful to identify the areas of a putting green that are suitable for hole locations at modern putting green speeds. Sloped putting greens that have excellent surface drainage often have fewer hole locations. While a sloped green may perform well with respect to turf health, the small, localized areas suitable for hole locations may suffer because of concentrated traffic. Ultimately, excessively sloped greens may be perceived to be in bad condition because there simply are not enough distinct hole locations to disperse daily traffic.

The number of putting green entrance and exit points also affects traffic patterns and turfgrass health. Architectural features like bunkers, water features, and even steep slopes constantly force golfers to use the same areas to enter and exit greens.



Putting green scans accurately depict total square footage within a variety of slope ranges. Generally, hole locations should be placed on slopes below 4 percent at modern green speeds. On this green, less than 7 percent of the total surface area is below 4 percent slope. (Used with permission from Baltimore Country Club and McDonald & Sons Design Group, Inc.)

Limited entrance and exit points concentrate traffic and can contribute to poor putting green performance.

GRASS SELECTION

Many different turfgrasses are managed on putting greens. In many instances, golf course superintendents are not managing the best type of grass on their putting greens; rather, they are “playing the hand they have been dealt” and managing a grass, or combination of grasses, that has been

in place for many years. In other cases, cool-season grasses, like creeping bentgrass, may have been established where climatic conditions clearly favor warm-season grasses because it is often presumed that cool-season grasses have enhanced performance when compared to warm-season grasses like bermudagrass.

Over time, golfer expectations for putting green conditions have increased, especially with respect to green speed. Meeting golfer expecta-

tions with older varieties of grass can be very challenging, especially with a limited maintenance budget. *Poa annua* encroachment can compromise putting quality because of prolific seedhead production and differences in life cycle and growth rate. Older creeping bentgrass varieties also may develop a patchy appearance that can impact putting quality at certain times of the year. Although newer creeping bentgrass varieties currently seem less inclined to develop patchy growth, time will tell as these greens age. Off-type bermudagrasses in warm-season putting greens also can negatively affect playability. Off-type bermudagrasses can respond negatively to aggressive cultivation or changes in weather, causing turf to thin out at certain times of the year. Off-type grasses in putting greens often result in using increased resources to meet golfer expectations (e.g., labor, fertilizer, plant protectants, and plant growth regulators). Producing and maintaining high-quality playing conditions often is more difficult on older greens with Tifgreen 328 and Tifdwarf bermudagrass than on greens with newer varieties of ultradwarf bermudagrasses. Furthermore, because of enhanced characteristics like traffic tolerance, ultradwarf bermudagrasses are becoming more popular as the golf industry continues to adopt more sustainable maintenance practices such as eliminating overseeding.

Maintenance practices that are used to achieve golfer-desired green speeds, such as low mowing heights, double cutting, and repeated rolling, are stressful for all grasses, but they are especially stressful for older grasses. Fortunately, plant breeders have developed grasses for use on putting greens that more consistently meet golfer expectations. The first high-density creeping bentgrasses were released in the mid-90s and have created a new standard for cool-season putting greens. Similarly, the first ultradwarf bermudagrasses were introduced in the mid-90s, establishing a new standard for putting green quality in hotter climates. Since their release, ultradwarf bermudagrasses have replaced creeping bentgrasses on greens in areas where creeping bentgrasses required



The development of ultradwarf bermudagrass has prompted many golf courses in search of better playing conditions to regrass older bermudagrass greens and many creeping bentgrass greens as far north as Richmond, Virginia. Replacing older varieties of grass with new ones can be a dramatic, long-term upgrade that can also reduce the resources used to achieve acceptable playing quality.

substantial resources to maintain but older bermudagrasses failed to produce acceptable playing quality. Turfgrass breeders continue to improve the characteristics of grasses used on golf courses. The USGA has provided funding for turfgrass breeding projects at several universities in the U.S., resulting in improved turfgrasses that produce excellent playing quality while more efficiently using resources and better tolerating stresses than earlier grass types.

Growing the ideal grass is not a requirement for good greens, but more resources will be required or expectations must be lowered to maintain older grasses. Genetic limitations of older, existing grasses may prevent

expectations from being met, regardless of available maintenance resources. Regrassing to a newer grass can allow better conditions to be maintained on a daily basis while reducing the use of resources like labor, fertilizer, water, and plant protectants, potentially allowing operating dollars to be allocated elsewhere. When expectations cannot consistently be met and turfgrass decline on putting greens regularly occurs, regrassing should be considered.

IRRIGATION AND WATER QUALITY

The irrigation system plays a huge role in putting green quality. Applying water when and where it is needed is critical.

Ideally, putting green complexes have two sets of irrigation heads: one set of heads dedicated to watering the putting greens while a second set of heads applies water to only green surrounds. Generally, putting green surrounds require more water than putting greens, and water management on greens should not be compromised in the interest of the surrounds. Having dedicated heads allows water to be applied only where it is needed.

Also, individual-head control for putting greens is desirable. Control of individual irrigation heads allows specific areas of a green to be irrigated separately from areas that do not need additional water. An irrigation system that only provides the ability to activate

multiple putting green heads at one time limits the superintendent's ability to target specific areas with overhead irrigation, further increasing reliance on hand watering.

Water quality plays a critical role in successful putting green management,

water infiltration rate and internal drainage become very important when regular leaching is required. Managing a combination of factors, including water quality, grass selection, and drainage, is critical to maintain acceptable putting green quality.



Core aeration and topdressing provide short-term surface disruption, but these programs are very important to season-long putting green health. Golf courses considered to have the best greens generally implement aggressive aeration and topdressing strategies on a consistent basis.

and it is important to test the quality of irrigation water. As the quality of water available to golf courses decreases and golf courses throughout the country use more reclaimed water, the increased salt load associated with the water source must be accounted for in grass selection and management practices. For example, in a climate like southern Nevada, turf managers can successfully grow cool- or warm-season grasses, but warm-season grasses like bermudagrass or seashore paspalum are better adapted if the irrigation water contains high concentrations of salts.

Leaching is an important practice when irrigation water contains elevated salinity and sodium levels. An effective leaching event typically involves applying 3 inches or more of water to a putting green over the span of 8 to 12 hours. During flushing, water must not be applied at a rate exceeding the infiltration rate of the green. Thus,

MAINTENANCE PROGRAMS

Ongoing maintenance programs have the greatest impact on daily and long-term putting green conditions. However, maintenance cannot overcome inherent limitations of putting greens, especially if expectations are not in line with limitations and available resources. However, if proper maintenance is not employed, even a green with no limitations will underperform. Maintenance programs that minimize surface thatch accumulation while yielding adequate oxygen exchange and water infiltration are critical to putting green performance.

Inadequate aeration and topdressing lead to surface organic matter accumulation that can dramatically slow water infiltration. If not properly managed, organic layers will hold water and lead to soft conditions. Oftentimes drainage problems in putting greens are caused by layers of organic matter in the upper portion of the soil profile that prevent

water infiltration. The best internal drainage is ineffective if water infiltration is limited.

Deep aeration programs like deep-tine, drill-and-fill, and deep sand injection are among the most disruptive programs used to manage putting greens. However, when implemented repeatedly over time, deep aeration programs can improve water infiltration, allowing water to move more rapidly into internal drainage systems. Deep aeration can both improve older, poorly draining greens and help maintain infiltration rates on newer greens.

Although budget heavily impacts daily maintenance, long-term programs like core aeration, topdressing, and deep aeration help provide a foundation for healthy turfgrass and should be used to some degree on golf courses regardless of budgets. Aggressive aeration may be all that is needed to improve putting green performance. Greens will perform better when proper soil profile management practices are implemented as needed.

CONCLUSION

Rarely do the factors mentioned in this article independently affect putting greens. Generally, several factors combine to make a good green or a problem green. However, one exception to this rule may be growing environment. Even a putting green with suitable drainage, adequate size, and multiple hole locations will struggle in a poor growing environment. There is no substitute for adequate sunlight penetration and air movement. The interaction of the factors discussed in this article will dictate whether small changes can be made to improve putting green conditions or whether complete renovation is required. Golfer expectations also play an important role in determining the appropriate path to improving putting green performance. How often are golfers satisfied by putting green playing conditions?

A putting green with several problems may be perfectly fine at a facility where golfers are simply satisfied to have good turf cover and accept slower green speeds that allow the turf to stay healthy. The same putting green could be considered completely

inadequate at a facility where fast green speeds are expected or demanded on a daily basis.

Golfer expectations play a huge role in defining what is, and is not, a problem green. Golfer expectations also make it very difficult to compare one golf course to another. If greens consistently fail to meet golfer expectations, changes should be made. The extent of changes — from adjusting management practices to complete renovation — will vary and should be

determined by carefully evaluating the factors affecting putting green performance at your facility.

If your golf course has problem greens, the factors discussed above most definitely play a part. The USGA Green Section offers a specialized Course Consulting Service visit, the Putting Green Evaluation visit, to help golf facilities assess the factors affecting putting green performance and determine which options should be considered to improve problem

greens. If changes are not made to mitigate limiting factors, problem greens will continue to underperform and fail to meet golfer expectations.

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Total renovation of putting greens is an expensive proposition, but it offers the opportunity to address factors that limit putting green performance from the ground up and can provide dramatic long-term improvement.

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