The Evolution of a Putting Green

Learn more about what happens as a putting green ages.

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Golf courses are living, breathing entities that, once built, take on a life of their own. A golf course, or any of its many components, can eventually evolve into something very different from what was originally designed or envisioned. In some cases, the course or component may become much better than what was originally designed; in other cases, the evolutionary process may take the course or component in the opposite direction. It may deteriorate structurally, aesthetically, and/or architecturally. This is especially true of putting greens.

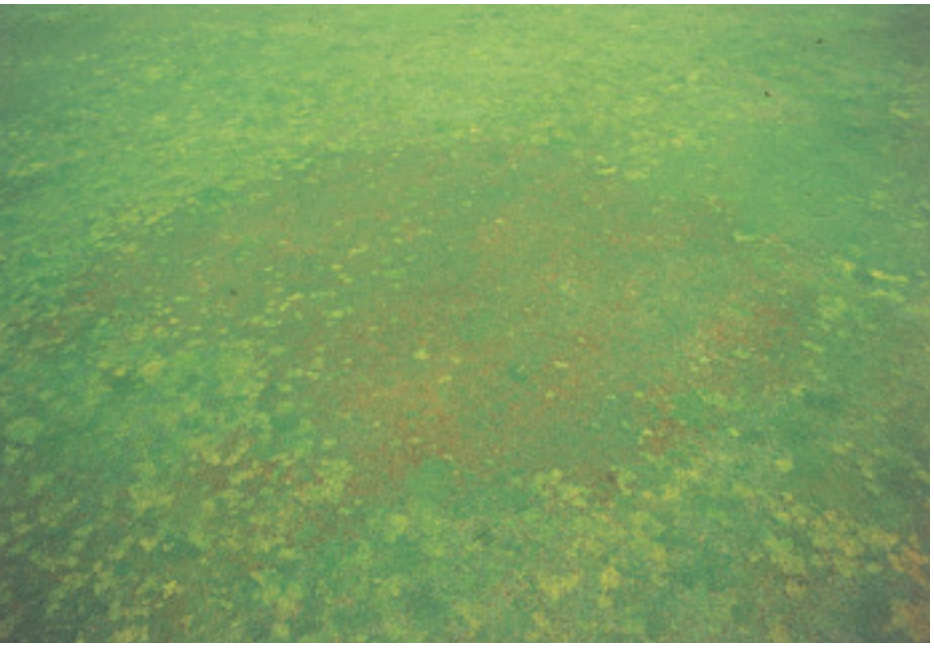
So why is this significant? Building a golf course, or even just a putting green, really just starts the process of evolution. In many respects, the golf course superintendent's primary job is to try to manage or steward the evolutionary process, hopefully ensuring that the changes are desirable in the long run. Understanding these evolutionary processes is especially important today, given the high demands being placed on our putting green turf.

Given the complexity of golf courses and the many changes that can occur to the different parts of a course, this article will concentrate only on the more common changes that occur to putting greens as a result of play, management practices, the passage of time, and the effects of natural selection. Be assured that the changes occurring to bunkers, tees, fairways, and tree plantings, etc. may be even more drastic.

An improperly built or managed putting green often will require extensive and involved management practices to help it perform adequately. In this case, a poorly drained mix was utilized, and deep soil modification was necessary to improve internal drainage.

SHORT- AND LONG-TERM GOALS

The number-one short-term goal for most golf courses usually is to produce good playability, but aesthetics and reliability also play a role. Without a reliable stand of turf, achieving good playability is not of much value. A green that performs well during mild weather, but fails when stress levels increase, is little more than a house of cards. In most areas of the country, weather extremes occur periodically to threaten turf, and new and different turf-threatening pests and diseases arise. Having a reliable stand of turf to go along with the good playability is of paramount importance. Thus, the short-term value of providing good playability today must be measured against the value of maintaining reliability through long-term change.



New bentgrass plantings look very uniform initially. Over time, the individual clones will segregate, creating a patchy appearance that is most evident in the fall, winter, and spring.

COMPLETION OF CONSTRUCTION

So, you just carefully built a brand-new putting green using the best materials and procedures, and you seeded it to the best new creeping bentgrass cultivar currently available. Now all you have to do is play golf, right? The greens should just stay like that forever, right? Nothing could be further from the truth. The process of evolution has just begun.

THATCH DEVELOPMENT AND MANAGEMENT

Thatch development is a normal and much-needed process; the key is to manage it. Seeded greens initially have no thatch, and although excessive thatch is a significant and common problem, some thatch is essential to hold soil particles (primarily sand) together to create a smooth, firm, stable, and resilient surface. Without any thatch, traffic from golfers and maintenance equipment would compress the tender turf into the abrasive sandy soil. This would cause the soil to shift and produce surface imperfections (light footprints, ruts, etc.) and significant injury to the turfgrass plants. The turf would thin out (wear away) and the wounds would leave the plants prone to infection from numerous different turfgrass pathogens. Insufficient thatch creates a wear- and disease-prone turf that does not play well.

Once bentgrass greens have been planted and the seeds begin to germinate, topdressing should commence very soon. The goal is to intersperse sand particles in the thatch as it develops. As the green matures and the thatch/mat layer develops, the surface becomes increasingly firm and resilient. This thatch layer, with topdressing incorporated, allows the putting green to handle traffic without excessive injury. It also aids in drainage and moisture and nutrient retention. A thatch layer (with topdressing incorporated in it) must be developed before a green can be subjected to normal play.

On the other hand, excessive accumulation of organic matter (thatch) at the surface of a high-sand green and insufficient dilution of thatch with topdressing are the most common problems of new greens. Other problems also occur:

- Shortened root growth.
- A soft, spongy surface that is prone to footprinting and rutting.
- An excessive thatch layer functions much like a kitchen sponge. It may allow for the transmission of water, but it will retain too much at the surface. A wet surface creates a perfect environment for algae, moss, and annual bluegrass invasion. A wet surface can create a vicious cycle: moss and algae both produce more organic matter that contributes to more water retention at the surface. The problem can spiral out of control.
- Thatchy, wet surfaces result in deep, pitting ball marks.
- If the surface stays wet, gas exchange declines and roots die back.
- Wet surfaces increase disease pressure.

For these reasons and more, developing a sound cultivation and topdressing program is

of critical importance to the long-term health and playability of the putting green. The thatch/mat layer must be developed, then kept open, oxygenated, and adequately diluted to ensure effective drainage, gas exchange, and root growth. There are many ways to manage thatch, and much research has been conducted and numerous articles have been written on this subject. Cultivation and topdressing programs vary widely, but the point is that an effective thatch management program is essential.

Greens established from sod present a different set of problems. They often can be opened sooner than seeded greens, but extra cultivation usually is necessary to alleviate the layering that typically results from establishment with sod. Close-center, hollow-core cultivation followed by core removal and topdressing (to fill the holes) may be needed as many as four to six times or more annually for the first few years of a sodded green's life. Note that the extra cultivation also can increase the potential for weed encroachment. Golfers obviously dislike the cultivation, but it is the long-term downside to establishing greens from sod rather than from seed.

MATURATION

Greens in the Northeast Region usually take several years to mature to a point that they can withstand the same type of wear and tear a mature green can. The maturation process depends on a variety of factors, including weather, length of growing season, species, cultivar, construction methods and materials, irrigation, fertility, growing environment, etc., and three to five years is fairly typical for greens in good growing environments. Greens in poor environments usually take longer (possibly four to seven years) due to their reduced vigor. New greens usually need to be managed conservatively in their first few years, so it is wise to reduce stressful maintenance practices (prolonged low mowing, excessive rolling, etc.) when the weather turns ugly or the green begins to show signs of stress. The health and playing qualities of a new putting green deteriorate quickly when subjected to too much stress, especially when the stress is combined with unfavorable weather (usually high temperatures and rainfall). Closing a young green for 24-48 hours in the event that high temperatures occur in concert with rain and heavy play can obviate damage that otherwise might take weeks or months to recover from.

Annual bluegrass is an opportunistic invader, and once an opening is made in a bentgrass green, it can quickly invade. Openings come from traffic, ball marks, and ill-timed cultivation practices.

SEGREGATION

Some golfers seem to like the uniform color and blemish-free appearance of a brand-new putting green, and these golfers may complain when the grasses begin to segregate. Segregation refers to the "sorting out" of individual clones or biotypes with which the grass cultivar was planted. So why does it happen?

Creeping bentgrass seed is the product of sexual reproduction, so the individual seeds are not identical. New plantings initially have a very uniform appearance (assuming the seed is pure and there are no preexisting weed seeds in the soil) because the various different biotypes are uniformly dispersed. After planting, certain better-adapated and more aggressive biotypes gradually begin to crowd out weaker, less well-adapted ones. As this occurs, different clones/biotypes segregate into patches, gradually becoming visible to golfers. Segregation can be especially noticeable on putting greens, where the variety used is more prone to segregation or where multiple cultivars have been used. It also is especially noticeable in the early spring and fall when temperatures are cool. During cool temperatures, different biotypes of creeping bentgrass change color and grow at somewhat different rates, thereby enhancing the patchwork appearance. Generally speaking, the older the

green, the more noticeable the segregation is. Segregation begins as soon as a green is planted, but it usually is not apparent until the green is at least five to seven years old.

Although some golfers dislike the patchwork appearance, others argue that segregation is desirable. It is a natural attribute that almost all older greens have, and some claim that it makes putting easier because the different patches make great aiming points to align putts. What is the downside? During the spring and fall, when growth is initiating or slowing down, the growth rates of the different patches will be slightly different, and this can contribute to slight unevenness in the putting surfaces. However, segregation cannot be prevented, and any resulting unevenness would be more than matched by the overall lack of growth. In a nutshell, segregation is not worth worrying about!

WEED INVASION

In the Northeast, annual bluegrass (AB) or *Poa annua* is the most common weed to invade putting greens, and there are thousands of different biotypes of annual bluegrass. Newer courses often struggle valiantly to keep annual bluegrass out of their putting green turf, and currently a variety of materials and strategies can aid in "*Poa* control." Nonetheless, AB almost always invades and usually becomes a significant component of the putting green turf population. Given the fact that annual bluegrass is a significant component in the greens at most older courses, it's a wonder why anyone would want to keep it out in the first place. Plenty of golfers like to play on *Poa annua* greens (some wax on about the putting quality of *Poa* putting surfaces), so what is all the fuss about?

When *Poa annua* greens are good, they are great, but when they are bad, they are producing seedheads or they are dead. Annual bluegrass is very susceptible to many turfgrass diseases and to winter injury (common in the Northeast). AB can be kept alive during many years, but there are weather patterns that virtually guarantee widespread loss of AB. Anthracnose and summer patch are two of the most damaging and most common diseases of AB, and the annual bluegrass weevil is an insect pest that is nearly exclusive to AB.

Annual bluegrass has many disadvantages when compared to creeping bentgrass (CB), but it has two distinct advantages: annual bluegrass is more wear tolerant and is a more efficient user of light. Thus, in low-light and high-wear situations, annual bluegrass may actually be the better-adapted species when compared to CB.

There literally are thousands of different biotypes of AB, and some are very desirable because they have fine texture, excellent wear tolerance, and are tolerant of the stresses associated with prolonged low mowing. There also are many undesirable biotypes. These typically produce the most seedheads, are the least tolerant of stress and disease, and may be true annuals. These are the types that fail most often and are the types that typically invade putting greens first.

Annual bluegrass encroachment into a new bentgrass putting green has significant consequences. Initially, it may go unnoticed because at first just individual plants become established. These form small, dime-sized patches, but they become increasingly obvious and disruptive as they expand. AB patches are most noticeable in spring due to their prolific seedhead production, and this is when the effect on putting quality is greatest. AB also is more visible in fall when CB is more off color. During the prime playing months, AB usually blends in better with CB, and putting quality can be perfectly acceptable.

Natural selection works for courses that can keep AB alive. Over time, the weaker, less desirable biotypes are gradually replaced with finer-textured, more stress-tolerant biotypes that are more hardy and attractive. The appearance of a new green suffers when AB begins to colonize it, as the ever-increasing number and size of the AB patches cause them to become more obvious in the bentgrass background. The AB and CB eventually coalesce into a homogeneous blend of the two grasses, but this may take eight to ten years or more from the initial planting. Some courses, particularly older courses that are rebuilding one or two greens, purposely plant new greens to a mixture of CB and AB to maintain consistency with the older greens, and doing so eliminates the troublesome colonization phase. For some, AB is a noxious weed, but for others it is the species of choice.

It should be noted that a green is comprised of millions of individual plants, and when two species (or more) are present, there can be significant fluctuations in their populations. For instance, AB out-competes CB in the spring and fall, and CB out-competes AB during the sum-

Annual bluegrass first colonizes a putting green as individual plants that can be nearly invisible. The plants expand into small patches that can become very obvious and unattractive, and they can disrupt surface smoothness.

mer months. The vast majority of greens in the Northeast Region are two-grass systems.

ENVIRONMENT

The environment a putting green occupies has a greater impact on its performance than any other factor, bar none. Simply put: a perfectly built green with the best grasses will perform poorly in a poor grass-growing environment. Conversely, a marginally built green may perform adequately in a very good growing environment. So what constitutes a good or bad environment? Simple: sunlight and air circulation. There are products and practices that can help improve the performance of turf that is grown in a poor environment, but none can overcome the effects completely.

Shaded, pocketed environments produce weaker turf with reduced vigor and recuperative potential; also, disease pressure is greater as a result of the higher relative humidity. Poor environments produce weaker, more disease-prone turf that is more susceptible to stress, wear injury, and disease. Furthermore, when problems do occur, recovery is slower due to the lack of vigor. The growing environment also has a huge impact on natural selection. The advantages AB has over bentgrass already have been mentioned, but they are especially significant in a poor growing environment. CB has a high light requirement and does not perform as well in moist, low-light environments. AB is much better adapted to this type of environment and generally outperforms CB in shady, pocketed environments. It is virtually impossible to prevent AB encroachment in a bentgrass green that is located in a poor growing environment.

The comments regarding the significance of the growing environment are not made to discount the importance of proper construction; they are made to emphasize the importance of providing a good grass growing environment for the turf.

CONTOURS

The surface contours of a putting green, when initially constructed, sometimes are a bit too sharp, and this can make it difficult to mow without scalping the turf at the typical low heights of cut. Surface imperfections often limit how low a new green can be cut, and it may not be possible to lower cutting heights to the eventual target height until the green has been rolled, topdressed, and/or aerated repeatedly. Fortunately, the surfaces soften slightly by way of settling, combined with these practices.

On the other hand, sand blasted out of a heavily used bunker can build up the grade of a greenside bank. Initially, this may create more definition and interest, but a number of problems can occur if the buildup becomes extreme:

- The soil on the bunker bank becomes extremely droughty due to the sand buildup and is incapable of supporting healthy turf. This may eventually lead to turf failure and even to a structural breakdown of the bank.
- The buildup occurs primarily on the bunker banks, but when the bunker is close to the

Environmental conditions determine which grass will thrive. In this situation, *Poa annua* is more dominant on the lower portions of the green, which have inadequate drainage and greater traffic. The bentgrass is thriving around the perimeter areas of the green.

putting surface, the buildup can extend into the green, altering the surface contours on the putting green. The change can be minor or so severe that hole locations are lost. The buildup also may block surface drainage, increasing the potential for turf problems due to disease, winter injury, etc.

Some change in the contours of greens likely happens over time as a result of cultivation and topdressing practices, but the changes are so subtle that the human eye could not possibly notice it. Given the number of 100-year-old courses that still have severely contoured putting greens, the change must be very minor, indeed.

THE SHAPE OF THE GREEN

Greens often get smaller over time, and irregularly shaped greens frequently become more rounded. The amount of putting surface that can be lost over a long period of time can be tremendous. Unless extreme care is taken, greens on courses more than 10 to 20 years in age usually experience significant changes in their shape. It is rare to find an older course (50 years plus) that does not have significant loss of hole locations.

Loss of cupping area can have an enormous impact on a putting green from both the playability and turf management points of view. Smaller putting surfaces mean that more traffic is being concentrated on less area, and obviously that can cause wear problems. Shrunken greens also may play very differently than they were intended to play. Smaller putting surfaces mean they are farther from the hazards that were designed to guard them. Smaller greens also may not be as receptive to the type of shot called for in the original design of the hole. Perhaps most important of all, golfers are cheated out of playing to challenging hole locations envisioned by the architect in the original design, and this reduces options, strategy, and challenge. Most older courses can be improved significantly by expanding greens back to their original shape, and while this type of project may require plenty of labor and planning, it does not have to cost a lot of money.

DRAINAGE

Rigorous testing should be performed on the components a green is to be built from before

construction begins in order to ensure the green will function properly. It is not enough just to make sure that the rootzone mix meets the USGA Putting Green Construction Guidelines. They also must be appropriate for your specific geographic area and project. The infiltration test is one of many that provide guidance in rootzone mix selection. According to the USGA Guidelines, a rootzone mix for a putting green should drain at least 6 inches per hour, but some mixes may drain in the range of 10 or 20 inches per hour or more. Regardless of what the initial infiltration number is, this number will drop by as much as 70% or 80% in the top few inches of the green, where the majority of the organic matter develops. While this may be surprising, it is not necessarily cause for concern. However, it does illustrate the importance of proper management of the thatch layer. If thatch is not managed properly, the infiltration rate at the surface of the green may drop dangerously low, thereby contributing to all of the problems previously described under thatch management.

Assuming the initial rootzone mix selected was appropriate and it is properly managed, its drainage properties should remain adequate indefinitely.

CONCLUSION

This article may spur many questions regarding the different subjects covered. A number of related articles are listed in the bibliography, and these will be appropriate reading for anyone interested in delving deeper into some of the topics touched on here.

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Although few sand greens still exist in the United States, they were much more prevalent in the early years of golf (Sag Harbor Golf Club, New York).