Proactive vs. passive transition Part I. Pay now or pay later

Understanding bermudagrass physiology gives superintendents an edge in managing spring transition.

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EDITOR'S note:

This is the first installment of a two-part series describing a more effective way of overseeding bermudagrass turf with perennial ryegrass.

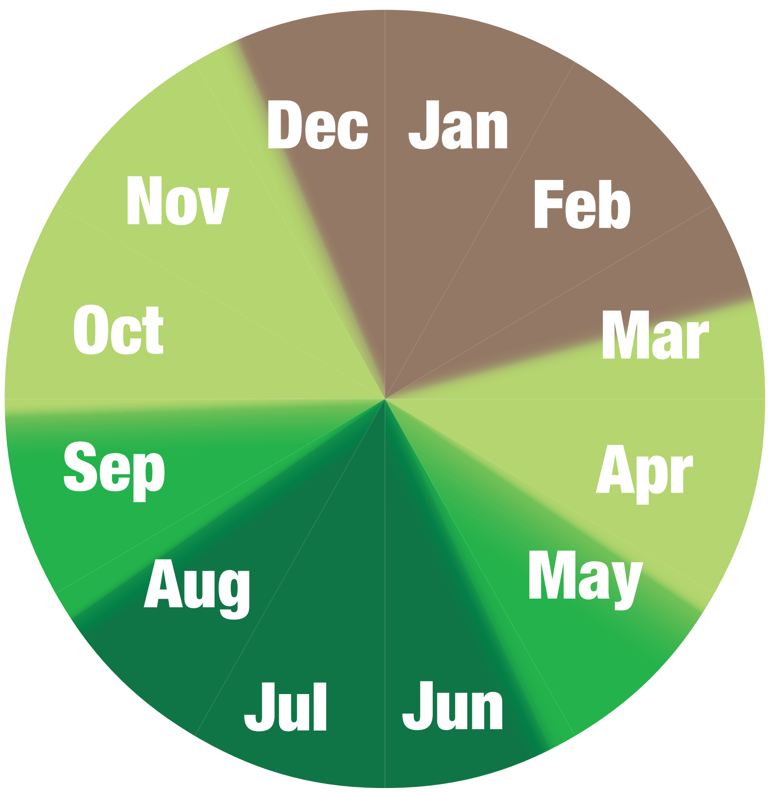
Superintendents in the South understand that transition from winter perennial ryegrass (*Lolium perenne*) to summer bermudagrass (*Cynodon dactylon*) is a lot like the old television commercial for motor oil. The message: Pay a few bucks early on for an oil change, or pay a few thousand for a new engine later on. With the tools available in the turf industry today, superintendents can initiate transition in late spring rather than waiting for it to occur later on nature's schedule. Though a smooth transition may be a fantasy, those who address transition proactively are able to minimize the pain, but those who wait for nature are often in for some ugly experiences.

Bermudagrass physiology

A primary goal of superintendents in the South is to minimize the transition pain and develop a mature bermudagrass crop that goes into the next overseeding in strong health. To best accomplish this goal, superintendents need to learn about the physiological mechanisms and responses that have allowed bermudagrass to persist.

Bermudagrass changes its growth patterns at different times of the year depending on temperature, light intensity and day length. As with other tropical species, its metabolism is designed to operate very efficiently and productively in high temperature and high light intensity, so it thrives in summer. In spring and fall, its metabolic efficiency is mediocre and the plants grow, but not aggressively. However, in winter when temperatures are cool and light intensity is low, its metabolic machinery is inefficient. The plant's strategy for dealing with that period of inefficiency is to cut its losses and close shop by going into

BERMUDAGRASS GROWTH CYCLE



Illustrations by Kelly Neis

Figure 1. The growth rate of bermudagrass that has not been overseeded depends primarily on temperature.

dormancy. In this way, the bermudagrass can drastically lower its metabolic consumption of stored carbohydrate reserves and conserve them for regrowth in the spring when conditions are more favorable.

Bermudagrass in the wild

Now imagine a bermudagrass plant growing in a meadow under natural conditions without interference from man (Figure 1). In summer, the bermudagrass grows very aggressively and covers the entire surface of the meadow, denying other species an opportunity to invade. In fall, the rate of photosynthesis decreases and will soon become metabolically unfavorable. As a result, the plant's growth slows and it begins storing extra carbohydrate in preparation for dormancy. As the temperature drops in November, the plant withdraws nutrients from the leaves and enters dormancy. After the first freeze in late November, the leaf cells are essentially dead, and only the dormant crowns and belowground structures remain alive.

When the environment warms up in late March, the plant uses most of its stored carbohydrate to produce a spurt of leaf growth in an attempt to begin photosynthesis. Those leaves produce carbohydrate by photosynthesis at a slow rate because early spring is not particularly favorable for metabolism. If these first leaves are eaten by a deer or killed by a late frost, the plants may have enough carbohydrate reserves to fuel a second spurt. If there are no carbohydrate reserves or if the replacement leaves have been eaten, then the plant might die or lose the competition for space to another plant. Later in the spring as conditions become more favorable and photosynthesis produces more carbohydrate, the carbohydrate is used to fuel more-aggressive growth, which, in turn, regenerates the plant's canopy. The faster the plant regenerates its canopy, the more successful it is in competing with neighboring plants for space. In summer, the plants again grow quickly to maturity so that they will be strong and competitive going into the next winter.

This is the life cycle of bermudagrass without human intervention. When humans intervene, they may expect bermudagrass to perform in a situation that it is not equipped for. For example, on golf courses in fall, bermudagrass is buried under perennial ryegrass and then expected to break through the perennial ryegrass canopy and thrive in the spring. These expectations come with a price: the well-being of the bermudagrass.

Fall overseeding

In fall, perennial ryegrass seed is planted over the bermudagrass (Figure 2). Good seed-to-soil contact is necessary to successfully establish the perennial ryegrass from seed, but mature bermudagrass has a substantial layer of thatch above the soil surface, making overseeding preparation a necessity. This preparation usually involves physically removing the thatch, a practice that is destructive to bermudagrass. After the preparation, perennial ryegrass is seeded at rates of 400 to 1,000 pounds per acre and the water is turned back on. From this point on, all efforts are designed to rapidly develop perennial ryegrass turf.

The bermudagrass, however, has been dealt a serious blow.

- Shredding the bermudagrass turf and removing the plant parts physically removes much of the plant tissues that contain the stored carbohydrate and are potential points for regrowth.
- If the perennial ryegrass rapidly germinates and grows a leaf canopy, the shade from that canopy will thwart any efforts of the bermudagrass to capture light. However, because of the warm early-fall temperatures, the bermudagrass plants will continue expending stored carbohydrate to produce leaf growth and compete with the perennial ryegrass.
- In preparation for dormancy, bermudagrass develops vast underground rhizomes and packs those storage organs with carbohydrate reserves. Artificially ending the growing season two months before those tasks are completed prevents the plants from preparing for winter.
- Until about 20 years ago, superintendents in the Southwest overseeded their bermudagrass on Oct. 15, but management learned that overseeding a month earlier would generate an extra month of revenue-

PERENNIAL RYEGRASS OVERSEED

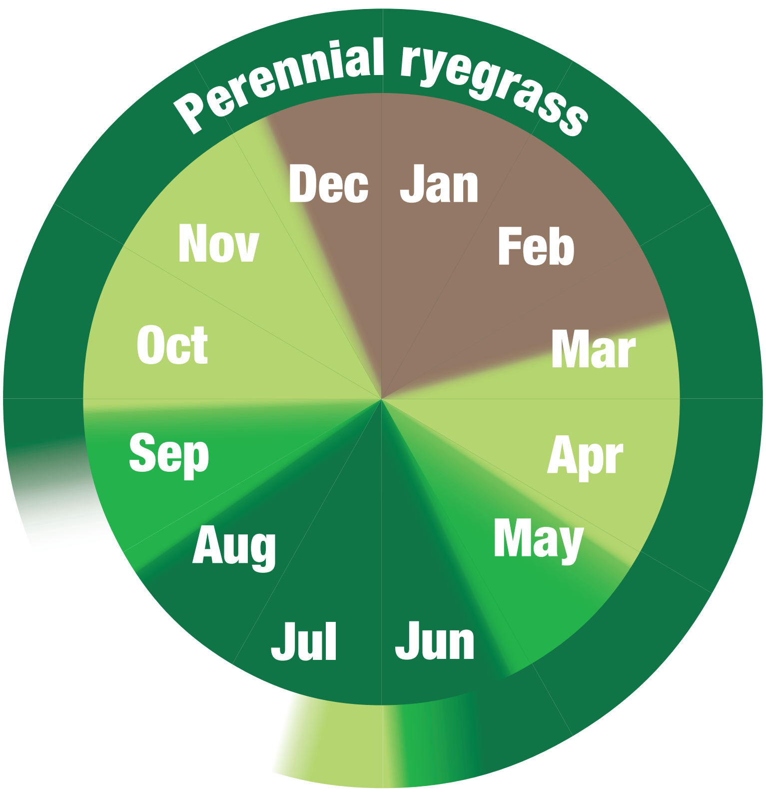


Figure 2. Typical growth cycles of perennial ryegrass overseed (outside ring) and bermudagrass (inner ring) that has not been overseeded. White areas (outer circle) indicate times when perennial ryegrass is absent.

producing golf. This decision may be good for business, but it is certainly bad for the bermudagrass, which loses its productive growing time and must rely on carbohydrate reserves for a longer period. The reserves, however, cannot supply the grass indefinitely. To further worsen the situation of early overseeding, respiration is temperature-dependent. The higher the temperature, the more rapidly the carbohydrate reserves are burned to fuel survival. Hence, the exposure to high temperatures in September is much more destructive to overseeded bermudagrass than are the cooler months later on.

The end result of these fall overseeding factors is that when the plants do become dormant, they will enter dormancy with a low fuel tank.

Photo courtesy of H. Howard

Figure 3. In this case of transition trauma, perennial ryegrass persisted until most of the underlying bermudagrass had died. When the perennial ryegrass inevitably died, the remains were rather grim.

Spring emergence

Even though the bermudagrass may be low on carbohydrate at the end of the dormancy period, it may survive if it can begin manufacturing carbohydrate by photosynthesis as soon as it awakens in mid-March. However, this is not the case with overseeding. Rather, the bermudagrass finds itself buried underneath a mature perennial ryegrass canopy that is thriving at ideal temperatures. The bermudagrass will use its stored carbohydrate to extend leaf tissue up into the perennial ryegrass canopy in an attempt to capture light for photosynthesis, but this early in the season, the effort will likely be futile as the perennial ryegrass is more competitive. The bermudagrass will continue attempting to reach light until it is either successful or until it depletes its stored carbohydrates and dies.

The longer the bermudagrass is forced to endure this losing situation, the less likely it is to survive. In theory, the superintendent could solve this problem by killing the perennial ryegrass in mid-March as the bermudagrass awakens from dormancy. However, such a proposal would not be acceptable as the perennial ryegrass would be at its peak condition with two to three months of prime golfing season ahead. Rather, business pressures require the superintendent to maintain excellent perennial ryegrass well into the bermudagrass season. At best, the superintendent can manage for an increasing bermudagrass turf population among the perennial ryegrass. At worst, the perennial ryegrass wins the competition and successfully excludes the bermudagrass throughout the spring.

Just as warm temperatures make burying the bermudagrass in September more injurious than burying it in cooler months, warm temperatures make keeping the bermudagrass buried in May and June especially harmful. To further complicate the issue, weather patterns vary dramatically in the South. Unlike the Gulf states where the springtime humidity is high, the desert Southwest has exceptionally low humidity through mid-July. In the desert, water evaporates rapidly from the turf surface, causing an evaporative cooling effect. For example, in June when the humidity is low and the ambient temperature is 110 F (43.3 C), the temperature of the turf surface may be 80 F (26.6 C). In essence, the turf is fooled into sensing spring conditions until mid-July, thus allowing the perennial ryegrass to persist and impeding bermudagrass development (carbohydrate reserves continue to be depleted, however).

When the monsoon season begins in mid-July and the humidity rises, the temperature of the turf canopy may rise to 130 F (54.4 C) as the ability for evaporative cooling is lost. When that happens, the superintendent can literally watch his perennial ryegrass melt away in a day. Unfortunately, if the bermudagrass has not aggressively invaded at that point, all that was buried under perennial ryegrass has probably expired, leaving bare soil and sparse bermudagrass with little recovery potential. I call this worst-case scenario "transition trauma" (Figure 3). The situation may be artificially worsened in a resort environment where business pressures require excellent turf conditions through June. In the low-humidity desert region, keeping the turf damp will keep the perennial ryegrass alive through June, but the bermudagrass will suffer.

Proactive transition

In a perfect world, transition would be seamless and the bermudagrass would phase in as the perennial ryegrass phases out. In the real world, prolonged high temperatures will eventually kill the perennial ryegrass. If the bermudagrass has not been allowed to develop, only bermudagrass patches and barren soil will remain. The superintendent must either replant the bermudagrass or wait for the patches to spread across the bare areas.

A newer option is gaining popularity: Superintendents may end the competition from perennial ryegrass in late spring, perhaps mid-May, by physically or chemically removing the perennial ryegrass. I call this strategy "proactive transition" because the superintendent, not nature, chooses the time and terms of transition. Conversely, the natural transition would be termed "passive transition."

The advantage of proactive transition is that the bermudagrass is relieved of competition from perennial ryegrass and allowed to grow unimpeded earlier in the spring. At this earlier date, the bermudagrass has more surviving growing points and more stored carbohydrate reserves so that it can reestablish its canopy more quickly. The disadvantage of proactive transition is the same as with passive transition: The playing surface will still be ugly until the bermudagrass has recovered. However, the recovery period will be brief.

In passive transition, assuming that the perennial ryegrass dies in mid-July and the facility is overseeded in mid-September, the bermudagrass growing season is limited to about nine weeks per year. Allowing only nine weeks for weakened bermudagrass with sporadic density to become fully mature is simply asking for more than the species can deliver, and the bermudagrass does not endure. On the other hand, when transition occurs earlier, perhaps in mid-May when the bermudagrass has a much greater recuperative potential, the growing season is extended to about 16 weeks (Figure 4). The bermudagrass can fully mature in 16 weeks of good growing weather and go into the next overseeding in good health, thereby enhancing its chances for survival and allowing faster transition the following spring.

Back to the "pay me now, or pay me later" commercial. Whether transition is initiated early by the superintendent or allowed to proceed on nature's timetable, an ugly period is going to occur. However, initiating an early transition means the ugly period will not be as ugly and won't last as long. Often, when superintendents are proactive and initiate an early transition, their bermudagrass has fully recovered by the time other facilities are just beginning their ugly period.

THE RESEARCH says . . .

- **Understanding bermudagrass physiology** will help superintendents make the spring transition from perennial ryegrass to bermudagrass less ugly.
- **By being proactive** and initiating transition earlier in the spring, the superintendent allows the bermudagrass more time to mature before fall overseeding begins.
- **A healthier, more** mature plant is better able to withstand the overseeding process and will come back stronger the following spring.

Public relations

We now know that the later one overseeds in the fall, the better the bermudagrass transition will be the following summer. However, given the business pressures, that is a battle that most superintendents will not win. We also know that being proactive and initiating an early transition will produce benefits. First, the length of the ugly period will be shorter and less severe. Second, the bermudagrass growing period will be long enough for the bermudagrass to be fully recharged, providing better late-summer playing conditions and enhancing transition the following year. However, it is still a little heart-wrenching to start out the morning with superb perennial ryegrass turf and have self-induced Armageddon a short time later.

When I first introduced proactive transition on the USGA conference circuit in the mid-1990s, the response was lukewarm. However, some superintendents adopted the practice of proactive transition and promoted it to golfers. I worked with one superintendent who seized the concept, embarking on a public relations campaign and communicating the virtues of proactive transition. The members not only enthusiastically bought into the concept, but were even known to brag to their peers about it. Today, proactive transition is becoming a mainstream practice.

After a 15-year trend of earlier overseeding and year-round conditioning, the negative aspects of overseeding have become increasingly traumatic for the bermudagrass during transition time. Recently, there has been a general recognition that initiating transition at an early date is a less painful alternative. Though superintendents push the envelope by overseeding bermudagrass, perhaps understanding the physiology of the species will help them stop before the grass reaches its breaking point.

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Figure 4. With proactive transition (plot A), the perennial ryegrass was physically removed on May 31; 10 days later, the bermudagrass has begun to spread across the plot. At the same time, with passive transition (plot B), the bermudagrass remains buried by the perennial ryegrass.

Leo Feser Award candidate

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