Seeding Rate: It's Effect On Disease and Weed Encroachment

By A. Douglas Brede

Difference in broadleaf weed encroachment. Turf on right of stake was seeded with Kentucky bluegrass at three pounds per 1,000 square feet. The area to the left was seeded at less than one pound.

Seeding rate recommendations—the figures listed in most turfgrass textbooks—have been developed over the years by "seat of the pants" observation by turfgrass experts and authors. Until the late 1970s, little was known as to why these rates were best.

New research from several United States universities has shown that, under certain circumstances, deviations from these recommended rates are not only allowable, but oftentimes advisable. By knowing when to deviate from these rates, the educated turfgrass manager can make better decisions on a case-by-case basis of when and where to use higher or lower rates than are published.

I began a study in 1976 at Pennsylvania State University to scientifically investigate the effects of the seeding rate on the maturation of a turf stand and development of weeds and diseases.

Specifically, we wanted to answer several questions: How long are the effects of seeding rate felt on the turfgrass stand? Is seeding rate of a transitory nature, exerting effects on the stand during only the first six months? Can higher seeding rates be used to effectively compete against annual bluegrass? Do certain cutting heights "prefer" certain seeding rates? And, What effect does turfgrass variety have on seeding rate? Kentucky bluegrass was chosen for this study.

I evaluated the progress of this experiment for five years after planting. On regular intervals we sampled the shoot density of the plots. We found that even 41 months after planting (nearly four years later), we were able to detect statistically significant differences among the four seeding rates in shoot density. It wasn't until nearly five years after the trial was established that we were no longer able to detect seeding rate effects on shoot density.

We also found that it is desirable to use higher seeding rates with lower cutting heights. This is because lower cutting heights require more plants per square foot to maintain 100 percent ground cover than does a higher cut stand.

The one pound of bluegrass seed per thousand square feet listed in many older turfgrass textbooks may have been appropriate when we were mowing Kentucky bluegrass at three inches height. Our research indicated that seeding rate should be doubled for every halving of the cutting height.

For instance, while one pound might be acceptable for a three-inch cut, a two-pound rate might be better for an inch and a half, and a four-pound rate for a three-quarter-inch intended mowing height. This provides the desired shoot density of the stand without the usual "equilibration" peroid.

The effect of Kentucky bluegrass seeding rate on encroachment of annual bluegrass is quite profound. Using a low seeding rate or a weak cultivar will "open the door" for invasion of annual bluegrass. This invasion can occur simultaneously with emergence of the Kentucky bluegrass or may happen within the first six months or a year after planting, due to a thin stand. Any time we do not have complete ground coverage of a turf stand, annual bluegrass being an opportunistic weed can take over.

Seeding rates of three to four pounds of Kentucky bluegrass per 1,000 square feet were desirable where annual bluegrass seed was prevalent in the soil. Vigorous cultivars were also more desirable for use in competing with annual bluegrass.

But you *can* get too much of a good thing. Going too far on the other extreme (seeding too heavily) may bring about added disease problems. We found that incidence of leafspot and Fusarium blight complex was directly related to seeding rate.

Seeding rates above 3.5 pounds Kentucky bluegrass seed per thousand square feet increased the risk of disease during the establishment phase. Once a dense stand was hit with disease, however, the shoot density was lowered by the disease, and the stand subsequently had fewer disease problems.

Where we prolonged the high-shoot density by means of fungicides, the stand was at a greater risk of disease damage during times when fungicides were skipped or withheld.

Ideal rates for seeding Kentucky bluegrass are two to three pounds of seed per thousand square feet. One pound or less would be considered too light, and greater than five pounds, excessive. Perennial ryegrass is best used at four to eight pounds per thousand square feet, with two pounds or less being too light, and greater than ten being excessive (except for overseeding).

Tall fescue benefits from a stouter seeding rate of six to ten pounds of seed per thousand square feet. Skimping on tall fescue seed is undesirable since tall fescue has no runners. Seeding at less than six pounds per thousand square feet is considered too light, whereas seeding at greater than 15 pounds of seed per thousand square feet would be excessive.

Editor's Note: A. Douglas Brede, Ph.D. is a research director. This article is an excerpt from a paper presented at the 1988 annual meeting of the Northwest Turfgrass Association in Spokane, WA.

WATERSCAPES BLEND AESTHETIC OBSTACLES WITH WATER CONSERVATION

Waterscapes, designed to conserve water and built to serve as water hazards—that's precisely what has been created by some of America's top golf-course designers. That is what golf course architect Ted Robinson had in mind as he planned the irrigation system for The Irvine Company's new $10-million, championship-quality Tustin Ranch Golf Course in Tustin, CA.

The 18-hole course's network of lakes, cascading waterfalls and meandering waterscapes will not only serve as scenic and strategically placed water hazards, but will also provide a functional irrigation system that will ultimately conserve millions of gallons of water annually for Orange County.

"The lakes scattered around the course will provide golfers with handicapping yet beautiful obstacles, while they serve the community and the county by helping to save precious water," said Robinson, who has developed more than 120 courses worldwide during the past 25 years.

"By using the lakes as reservoirs instead of continually pumping water into the area, we can help conserve several thousand gallons of water every week," he observed.

Robinson pointed out that using lakes as water-saving elements at golf clubs, a technique first developed in designing desert courses, is becoming more common in water-conscious areas of the country.

Courses typically require a substantial amount of water which can be wasted through improper intake levels, poor drainage, overflows and overwatering. The system in the Tustin Ranch Golf Course helps eliminate water loss by hydraulically monitoring flows of reclaimed water which is stored in lakes that are lined to prevent seepage, he said.

"The system is extremely efficient, because the only way water is lost is through evaporation," explained Robinson.

When fully operational, the golf course irrigation system will intake a continual flow of reclaimed water from two large reservoirs at the Michelson Reclamation Water Plant in Irvine. According to John Economides, senior engineer at the Irvine Water District who helped plan the system, the water will be pumped for nine hours each day. During this period, as much as 1,000 gallons per minute will be piped into the lakes.

Once in the lakes, water will be pumped into the sprinkler system to irrigate grass, trees and natural foliage throughout the area. Though this reclaimed water is purified, regulations prevent it from being used as drinking water, Economides said.

During the 15 hours that the system is not irrigating, water flows back into the lakes, a process which keeps debris such as dust and fallen leaves from stagnating in the water.

According to Economides, this refilling process also helps relieve the strain on the water company.

"The course's reservoirs help alleviate some of our difficulties in serving the public during peak demand periods," said Economides. "Because the course has a large water-storage capacity, we can decrease the strain on the community's waterlines by redirecting the main flow to meet needs in other parts of the local area."

To maintain the purity and luster of the waterscapes, the course's intake system includes hydraulic jets that propel water up to the top of waterfalls, where it cascades slowly down to the lakes and is then recycled back into the jets. This hydraulic system is also used within the lakes to force movement in the water and to provide an ozonization treatment, a process that helps keep the water clear and bacteria- and algae-free.

Although water conservation is of utmost importance, the Tustin Ranch course's water elements have also been developed to reflect the beauty and spirit of the local community and to provide the ambience of an upscale, top-quality golf course, according to Jim Colbert. He is head of Jim Colbert Golf, Inc., Las Vegas, the company which is overseeing construction of the course and will manage it when completed.

"The challenge of the Tustin Ranch project has been to blend a water-saving irrigation system with a well designed, attractive series of water hazards," said Colbert, who has helped formulate several Professional Golf Association clubs along with providing commentary for ESPN's live golf tournaments.

"What we've nearly finished creating is a handsome, manicured lake and water-conservation system that imparts the feeling of a world-class golf course—one that offers area residents a quality club where they can enjoy their leisure time," Colbert said.

Scheduled for completion in the summer of 1989, the 160-acre course will include a clubhouse, driving range, putting green and other related facilities. The Tustin Ranch course is the first of several golf courses planned by the Irvine Company in new residential communities in Laguna Canyon, Orange, and along the Irvine Coast in Southern California.

Tustin Ranch is a 1,740-acre community along the eastern border of the city of Tustin. Planned for development over the next nine years, it will ultimately include 9,000 homes representing a balanced mix of hillside estates, single-family townhomes, condominiums and apartments.

The community also includes more than 60 acres of neighborhood and community parks, and 160 acres of commercial, office and business centers including the recently completed Tustin Market Place and the Tustin Auto Center.

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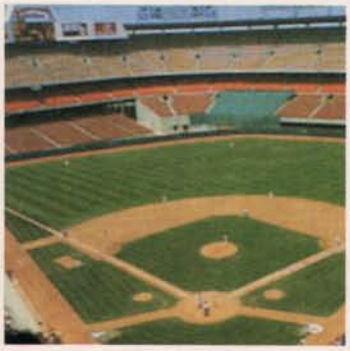

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JACKIE ROBINSON STADIUM UNDERGOES TURF RENOVATION

The infield at Jackie Robinson Stadium on the campus of UCLA in Los Angeles recently underwent complete renovation. The project consisted of two major phases. First, the turf portions of the infield were stripped and regraded, and then the skinned portion of the diamond was replaced and conditioned.

Ten days prior to the arrival of the Sportsfields, Inc., renovation crew the turf was sprayed with Roundup by UCLA Stadium and Grounds Director Laura Adams. The specialists in natural turf athletic field construction and renovation, who are based in Blue Island, IL, stripped the dead turf and removed it from the site.

The areas to be sodded were tilled and soil was added as required. The ground was fine graded and prepared for sodding. The crew installed 12,750 square feet of Tifgreen (Pacific sod) Bermuda, which was watered upon completion of the installation.

Due to the poor condition of the skinned surfaces of the infield, Adams requested that the upper four inches of the existing infield mixture be removed and replaced. Approximately 175 cubic yards of Dodger Baseball Mixture was delivered and graded. In addition, 14 tons of Turface was incorporated into the Dodger mix, tilled once again, fine graded, and rolled.

The entire renovation took just six days to complete and the field was expected to be ready in less than two months. The cooperation between Sportsfields, Inc., and the maintenance staff at UCLA, including Adams and her supervisor, Kyle Hackett, plus the baseball coach, Gary Adams, made the project a success.

PILOT FIELD RECEIVES DESIGN AWARD

Pilot Field, the new AAA baseball stadium for the Buffalo Bisons, Buffalo, NY, has won the "Excellence in Design" award presented by the Kansas City chapter of the American Institute of Architects (AIA).

The ballpark, which is located adjacent to a historical district of downtown Buffalo, was designed by the HOK Sports Facilities Group, Kansas City, MO.

Joseph Spear, the principal designer of the stadium, accepted the award while noting that the chief design challenge involved raising community expectations and perceptions about what a baseball park could become.

"It was necessary to allude to a period when the national pastime was played in ballparks, instead of circular concrete multipurpose complexes," Spear said.

Despite its capacity of 19,500 seats and all the modern features and amenities, the building is considerate of its neighbors and has become a communal place for the entire community.

Pilot Field was designed with expansion capabilities to 40,000 to suit Major League play.

MORRIS NAMED HEAD GROUNDSKEEPER

Gary Morris has been named head groundskeeper of Joe Robbie Stadium and the Miami Dolphins training camp in Miami, FL. by Glenn Mon, general manager of the stadium.

Morris has had 15 years' experience in turfgrass management. After completing the turf management course at Broward Junior College, he trained under Superintendent Larry Weber at Inverary Country Club and the PGA National Golf Club, in Palm Beach, FL.

He served as golf course superintendent for four years at Emerald Hills Country Club in south Florida, before leaving to help organize the sports turf program for Joe Robbie Stadium and the Dolphins practice fields at the training camp located at St. Thomas University.

CHALKBOARD

TIPS FROM THE PROS

THE BLACK LAYER: ONE SYMPTOM OF OXYGEN- DEPLETED SOIL

By Dr. Houston B. Couch

If we are going to deal effectively with the black layer problem that is being reported in various parts of the U.S. and Canada, we should be devoting our energy toward research into the cause. . . anaerobiosis, or life in the absence of air. . . instead of one symptom, the black layer.

Anaerobiosis is a dynamic series of events which take place in an oxygen-depleted environment. When soil becomes anaerobic, there are significant changes in both the form and the solubility of certain nutrient elements. While these nutrients are beneficial in their standard form under normal conditions, they can become toxic under anaerobic conditions. In a reduced state caused by lack of oxygen, these elements may be taken up by the plant more rapidly than they can be metabolized, thereby becoming toxic.

In addition, the root systems of plants do not function properly in anaerobic soils. Their ability to absorb water and nutrients may be reduced significantly.

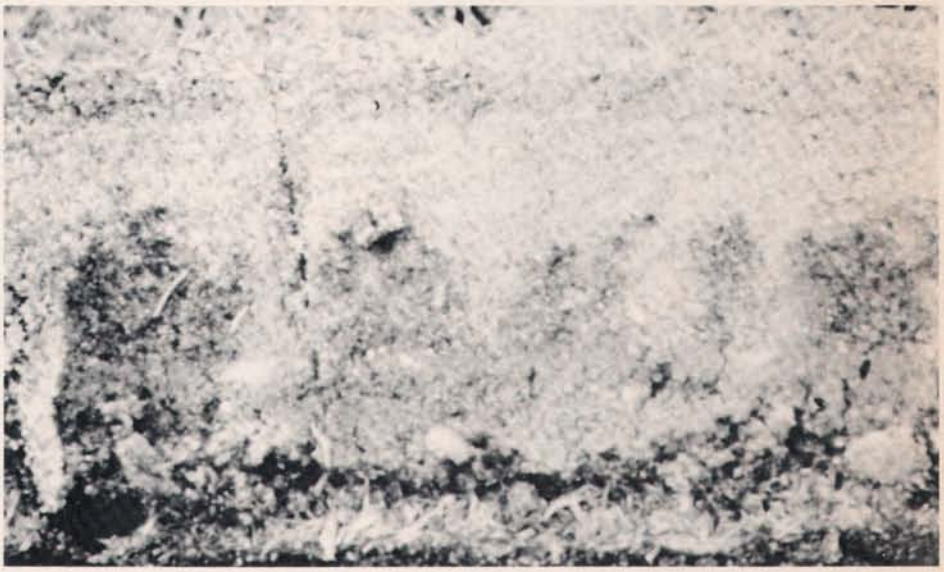
Furthermore, anaerobic micro-organisms in the soil can produce metabolites that are toxic to plants. These can cause either outright death of the roots or an unthrifty growth of the overall plant.

While this problem is receiving more attention than it did in times past, anaerobiosis of bentgrass greens is not new. For some 30 years, I have observed bentgrass putting greens in this condition in various stages of severity at a wide range of locations in this country. During the past year, I have diagnosed cases of acute anaerobiosis in plugs from putting greens with both predominantly sand and predominantly soil construction.

Turf managers should understand that sometimes a black layer accompanies anaerobiosis and sometimes it doesn't. The same is true for a strong odor of hydrogen sulfide or a high population of algae on the surface of the green.

The one thing all of these situations have in common is an anaerobic condition caused by water filling all of the soil's pore spaces. This water accumulation can be the result of prolonged periods of rainfall, or impaired infiltration brought on by either incorrect construction or an aerification program that included topdressing with an improper type of sand.

Anaerobiosis can be accelerated by an accumulation of algae on the surface of the green. Algae proliferate rapidly on greens with a high sand content. This is probably due to a number of facts.



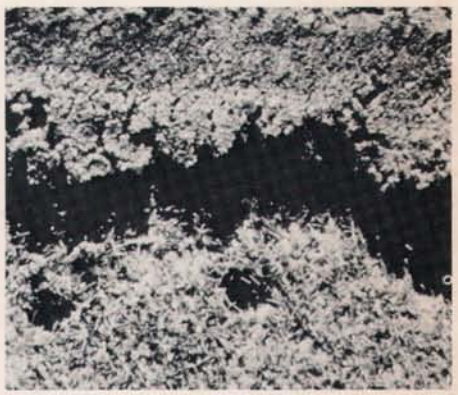
Black layer profile in old green topdressed with sand.

First, algae grow better on wet, light, sandy soils. Microbial competition is not as great as that found in mixes where soil is predominant. Irrigation practices on high-sand-content greens are often excessive. And finally, there is a wide "swing" in the availability of various nutrient elements in sand greens.

Algae produce complex carbohydrates (polysaccharides) that have the consistency of gelatin. This material can move downward into the soil profile, plugging the pores and impeding the infiltration of water. Not only do these polysaccharides contribute to the development of an anaerobic condition of the soil, but they also serve as a growth medium for anaerobic microorganisms. Algae, then, can be an important factor in the development of anaerobically induced decline of turfgrass.

An article in the June 1987 issue of *Golf Course Management* theorized that sulfur is the primary cause of anaerobiosis. The authors of these articles proposed that sulfur, not excess water, initiates an anaerobic state in the soil, and that sulfur (in the form of hydrogen sulfide) is the cause of plant death. Their premise centers primarily around the fact that sulfur does have the potential for developing a blackened condition in the soil. They were also able to produce black layers with very high rates of sulfur in their tests.

Their hypothesis assumed that sulfur at presently used rates will induce an anaerobic condition in the soil and produce black layers, and that all conditions of anaerobiosis in soils lead to the formation of black layers. None of these assumptions is correct. In fact, the results of their tests showed that sulfur applications within the normal range do not produce black layers.



Black layer profile in new green with sandy root zone mix.

The experimental design for this research consisted of applying sulfur at two separate rates, one pound and five pounds per 1,000 square feet. None of the experimental units treated with one pound of sulfur developed black layers, while 75 percent of those treated with five pounds did.

Where sulfur and products containing sulfur are concerned, there is no published scientific evidence that either elemental sulfur or sulfur contained in currently used turf fertilizers at recommended rates will cause

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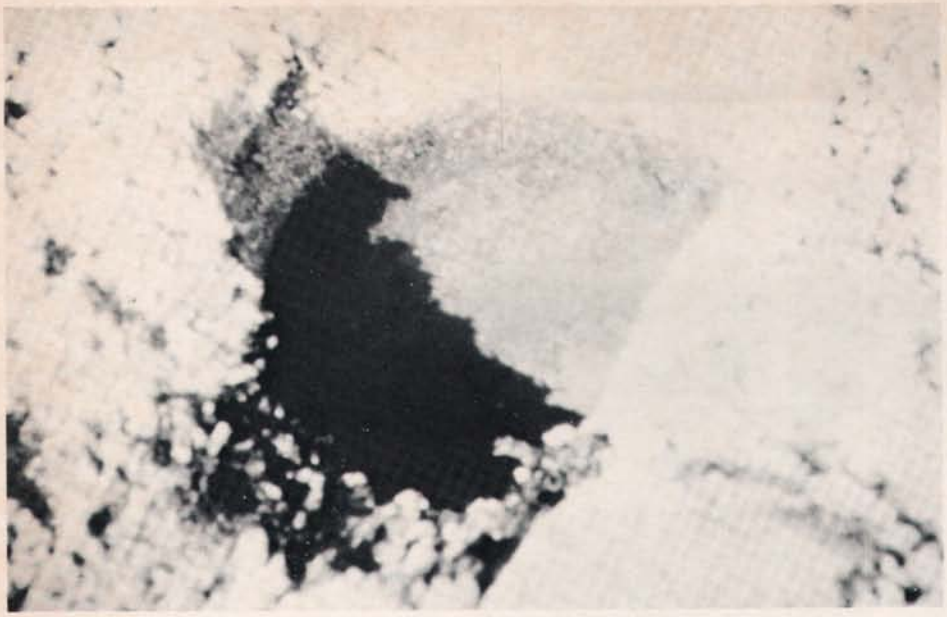

Black layer in sand bunker.

producing black layers.

Prevention of the problem is accomplished by close monitoring of the infiltration rates of the greens. When the rate begins to drop, even though it may not appear to be significant, direct measures should be taken to correct the matter.

When it has been determined that anaerobiosis has developed, steps should be taken to increase the oxygen levels in the root zone. This means following a watering program that allows the soil moisture to be extracted well below field capacity between irrigations. It means aerification—including deep aerification if drainage barriers exist. It may also call for installing supplementary drainage for the greens.

Another important aspect of preventing anaerobiosis from developing to the acute stage is the control of surface algae. At the present time, the only pesticide that can be used on putting greens for algae control is mancozeb (Manzate, Fore, Tersan LSR). This material is effective in the control of Helminthosporium-incited diseases, and is also effective in reducing the impact of Pythium blight. Its inclusion in the spray schedule can then serve more than one purpose.

Editor's Note: Dr. Houston B. Couch is professor of plant pathology at Virginia Polytechnic Institute and State University in Blacksburg, VA.

Chalkboard

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or contribute to the development of anaerobiosis. This means that sulfur at the rates currently recommended will not *induce* anaerobiosis. . .and refraining from using sulfur will not *reduce* anaerobiosis.

The impact of anaerobiosis on plant growth can be either chronic (of long duration) or acute (sudden onset). It can exist in soil long before there is strong evidence of affected plant growth. It can exist without

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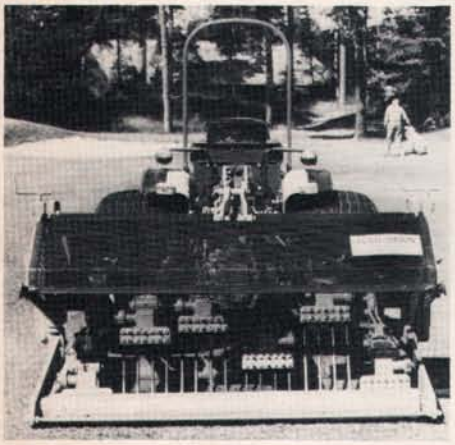

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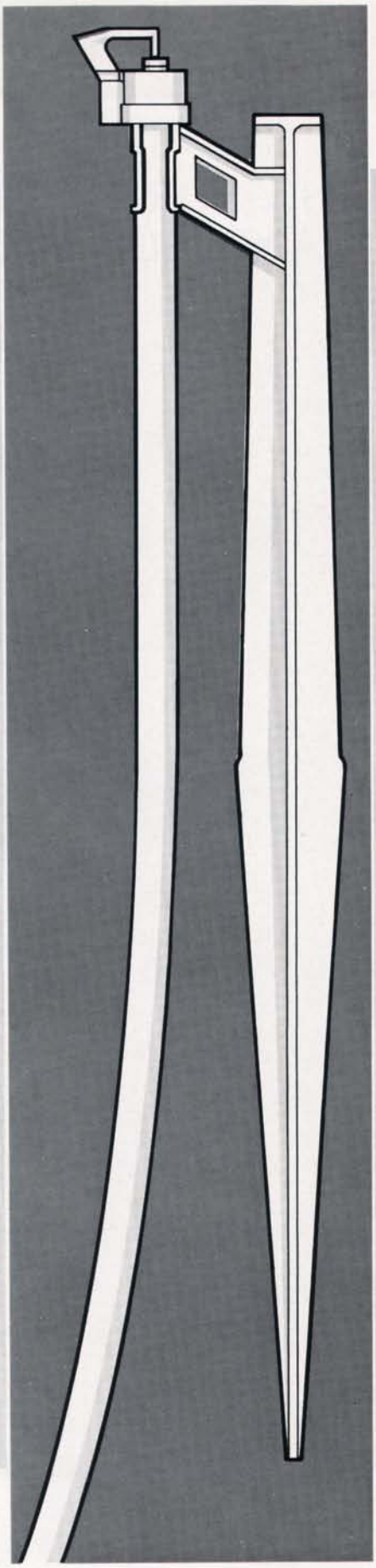

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