Fall Renovation

Turfgrasses, like any other part of nature, operate on their own biological clock. They instinctively respond to their environment, changing their growth according to sunlight, temperature, moisture, nutrition and season.

Controlled by this biological clock, cool-season grasses enter the fall driven by nature to repair damage they sustained during the growing season and to replenish their reserves before the onset of winter. When you consider that turf has devoted its energy before this time to recovering from winter damage, producing seed in the spring, and surviving the heat and drought of summer, you can appreciate that fall is tremendously important to its recovery and survival.

If all we did was fertilize and mow turf in the fall, it would easily fulfill its mission of recovery and renewal. But ours is working turf—it must withstand tremendous traffic and use long into the fall. Even though growing conditions are at their best, sports turf requires more attention in the fall than at any other time of the year.

Research has shown that the fall is the best time for establishing, fertilizing, and encouraging root development of cool-season turfgrasses. Triggered by decreasing temperatures and sunlight, these plants divert their energies from foliar growth to root growth and nutrient storage.

Timing becomes critical in providing adequate shoot growth during this busy sports season without severely disrupting the plant's ability to prepare for winter. Each week is important to the establishment of newly-seeded or overseeded turfgrass. Furthermore, established cool- or warm-season grasses must be allowed to "harden off" to avoid problems with winterkill or spring transition.

Nearly every cultural practice comes into play in late summer and fall. Use-related stresses such as compaction, excessive thatch, poor drainage, inadequate irrigation, and soil chemistry should be corrected *prior* to the onset of fall. The purpose is to provide as close to ideal growing conditions as possible for renovation and seeding.

The renovation process should always begin with a soil test. An analysis of pH, nutrients (major and micronutrients), soil type, and bulk density is important in planning maintenance. Now is also an excellent time to check thatch/mat depth and take a soil profile to uncover any disruptive subsurface layers.

The goal is to have important nutrients *available* during the fall growing season for established and seedling turf. Acidity or alkalinity of soil can significantly reduce the availability of these nutrients. Based upon soil test recommendations, you may need to adjust pH levels with calcium carbonate (agricultural limestone) or dolomite limestone on acid soils, or sulfur on alkaline soils. The optimum pH range for most turfgrasses is from six to seven.

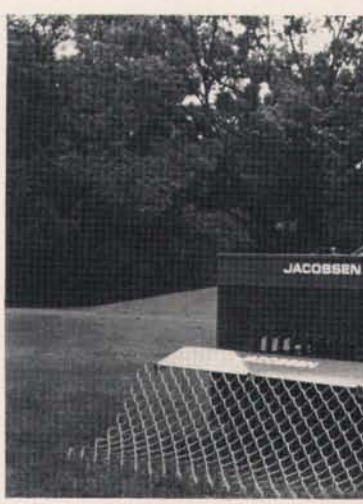
Nitrogen increases the growth of both turfgrass roots and shoots. It is essential for maintaining shoot density and gives turf the ability to recover from injury quickly. However, when too much nitrogen becomes available, root growth is restricted because shoot growth is favored over root growth. This can cause serious problems in the fall since it is a critical period for root growth and storage of food reserves. Lush, overfertilized turf is also prone to winter injury. Therefore, only moderate levels of quick-release nitrogen should be applied in the fall.

Phosphorus is perhaps the most important nutrient for renovated or seeded turfgrass in the fall. Unlike nitrogen and potassium, phosphorus does not leach into the soil. It has to be placed where it is needed. During the fall, that is on the surface for seedlings and in the root zone for established turf. Core aeration prior to applying phosphorus can assist in placing the nutrient where it is needed.

Phosphorus stimulates root growth and branching. It speeds up maturation of seedling turf and improves winter hardiness. The need for phosphorus in seedling turf is greatest in the first four to six weeks after planting. Turf can tolerate high levels of phosphorus without damage. However, such levels can reduce the availability of iron and hamper the effectiveness of the inorganic arsenical herbicides, such as DSMA and MSMA.

Turf utilizes more potassium than any other nutrient except nitrogen. It is subject to leaching, so regular applications are necessary to maintain adequate levels. Potassium plays a pivotal role in turf growth and development. Seedling turf has an especially great demand for the nutrient, and stores extra potassium for use later. Overall, potassium improves winter hardiness, wear tolerance, rooting, and disease resistance.

Since all three of these nutrients are vital during the fall, turf managers should either use complete fertilizers, nitrogen carriers that contain phosphate (monoammonium phosphate or diammonium phosphate) and



Jacobsen slicer/seeder for renovati

Major work such as drainage improvement is best performed in the fall. Photo courtesy: Cambridge Sportsturf Systems-West.

potassium (potassium nitrate), or supplement nitrogen applications with superphosphate and potassium sulphate.

The nutrient applied most frequently to sports turf besides the three mentioned above is iron. This metallic micronutrient plays an important role in photosynthesis and can have a dramatic effect on turf color. It can be used as a color enhancer to avoid the effects of using high rates of nitrogen.

Iron may be present in the soil but unavailable to the plant. Correcting soil alkalinity, improving drainage, and removing heavy thatch layers help to improve iron's availability. When these problems can't be resolved, foliar applications of iron can provide a short-term improvement in color. For long-term results, chelated forms of iron should be incorporated into the root zone when possible.

Soil tests will also reveal deficiencies in other nutrients. These include calcium, sulfur, magnesium, manganese, zinc, copper, boron and molybdenum. Many of these problems can be solved by correcting alkaline soil conditions. Fertilizers containing these nutrients are available. However, it is wise to contact your extension turf specialist for his or her recommendations.

An increasing amount of attention is being paid to the biological activity of soils. Recently, a number of universities initiated research on the effects of environmental and management stresses on soil microbes, bacteria, nematodes, insects, and earthworms in the soil. Scientists are evaluating the impact of soil moisture, pesticide applications, sand root zones, and other turf management practices on these organisms. "We need more information on the role these things play in our turf environment," states Keith Karnock, associate professor of agronomy at the University of Georgia in Athens.

One purpose of this research is to study the effectiveness of a number of "biostimulants" or "non-fertility growth enhancers" currently on the market. They include products such as PBI Gordon's Bovamura, Emerald Isle's Sand-Aid, Ringer's Restore, and Soil Technologies' Turftech. Testimonials of improved color, root growth, thatch reduction and even disease prevention have turf managers asking university specialists how these products perform. Some experts believe that organic fertilizers, especially activated sewage sludge products, also contribute to the biological activity of soils. To date, university researchers do not have definitive answers.

A lot of research is needed to get a clear picture of the effectiveness of non-fertility growth enhancers on various turf species, moisture conditions, soil temperatures, and time of year, adds Karnock. He suggests that turf managers conduct their own tests on small areas first. His results from a three-year test on bentgrasses will be ready next year. Dr. Dick Schmidt at Virginia Polytechnic Institute in Blacksburg, has also been conducting a number of tests in this area.

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Excessive thatch, compaction, subsurface layers, hydrophobic soils and the coverage of irrigation systems are all items that should be corrected in late summer or early fall. They can disrupt or reduce the effectiveness of renovation procedures.

Since cool-season turfgrasses are in a recuperative state during the fall, the more severe operations are safest at this time. Practices such as verticutting, deep cultivation (fracturing subsurface soils), heavy aeration, amending soils, installing supplementary drainage, seeding and sodding can be accomplished with the greatest success. This is the time to spend your budget where it will have the most impact.

Due to the growth of the industry, a wealth of new technology is improving the effectiveness of renovation.

By utilizing these renovation methods safely in the fall, the higher cost of reconstruction can be avoided. Due to the growth of the golf and sports turf industries, a wealth of new technology today is improving the effectiveness of renovation as opposed to reconstruction. These procedures also reduce the amount of time a turf area is out of play.

Reconstruction is usually called for because original specifications and construction were inadequate. Barring complete replacement of the root zone, most deficiencies can be corrected today without reconstruction. However, the cost of the equipment necessary to perform things such as sand injection, deep cultivation, extensive trenching, pipe pulling and regrading is typically beyond the resources of any one sports complex. Fortunately, contractors in many areas are buying this equipment to perform these services for you.

A few examples of contract renovation devices are the units utilized to install the Cambridge System of sand slits and perforated drain lines, the Verti-Drain deep shatter aerator, the Green Care Drillmaster and Vibramaster, and the Yeager-Twose Turf Conditioner. These machines allow deeper cultivation of the root zone to improve drainage and aeration. They break through subsurface layers and encourage deep root growth.

Hydro Resources of Mesa, AZ, has just introduced a "no-till" subsurface injector for fertilizer and water-absorbent polymers. Vibrating blades cut beneath the surface and lift the soil so nozzles can inject granular material within the root zone instead of on the surface. The polymers store water and fertilizer in the root zone where they release them to roots upon demand. They swell and contract with moisture for a period of three years or longer before breaking down.

A vibratory plow is the same technology used to install the small drainpipe of the Cambridge System and fill the cut to the surface with sand. Sometimes referred to as sand injection, this process has been used to improve drainage on golf greens, fairways, and stadium fields with minimal surface disturbance.

An option to sand injection has been the use of prefabricated drain channels which are inserted into narrow trenches. This technology is available to anyone with access to a trencher. Disc-tooth trenchers are an economical alternative to conventional models and cut a narrower slit for the drain channels.

These drain channnels are usually placed in a herringbone pattern, similar to the branches extending out from the trunk of a tree. The spacing between the channels depends upon the type of soil and the amount of water you need to remove in a given period of time. The heavier the soil is, the closer the channels need to be to each other.

Back on the surface, sports turf managers can solve problems with depressions near goal mouths and worn out crowns of fields by topdressing, a technique used for years by golf course superintendents to keep greens smooth and firm. Topdressers are now available that can spread layers of material as thick as 1/4-inch evenly and quickly.

Regular topdressing of heavy play areas can avoid the expense of periodic regrading and reestablishment. The topdressing should be compatible with the root zone mix and the same material should be used each time to avoid layering. Core aeration prior to topdressing can help mix the material into the existing soil to improve drainage.

Water infiltration and percolation can also be improved by surface-applied wetting agents. They can be applied as granules or injected as liquids through the irrigation system. They are also effective for temporarily correcting localized dry spots and water-repellent thatch layers.

Of course, nothing will help moisture problems if the irrigation system does not provide uniform coverage. Check all heads and nozzles prior to renovation to assure an even distribution of water. For optimum fall root growth you want to provide moisture deep into the root zone. Repeat irrigation cycles and check moisture depth with a soil probe until you are certain that water has percolated down eight or more inches into the soil profile. This is your reservoir.

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The trick is to maintain this reservoir without creating a waterlogged condition. That is why adequate drainage, a good irrigation system, and wetting agents are so important. Seeding will require surface moisture at all times. However, overwatering to keep the seed moist will waterlog the root zone and hamper root development. Frequent, light syringing will keep the seed moist without overwetting the soil below. The reservoir can be replenished if necessary by infrequent, longer cycles.

One factor that contributes to waterlogged soils is the extended germination period of most cool-season grasses. While perennial ryegrasses typically germinate within seven to ten days, Kentucky bluegrasses and tall fescues can take a month or longer. That means frequent irrigation must take place for a large portion of the busy fall playing season. This can encourage surface compaction and turf damage.

Three techniques can shorten this critical wet period. The first and most entailed is pregermination. This involves soaking the seed in water-filled containers to force it to germinate before it is sown.

Significant advances have been made in pregermination recently. California Polytechnic Institute in Pomona; Liquid Sod Inc. in Brighton, MI; and Northrup King in Minneapolis, MN, have been working to perfect this process. High germination rates for ryegrass, bentgrass, Kentucky bluegrass and even wildflowers have been achieved.

Pregermination was first tried by stadium groundskeepers to repair damaged football fields with perennial ryegrass between games. Harry Gill at Milwaukee County Stadium, Barney Barron at Candlestick Park, and George Toma at Arrowhead Stadium each developed methods to germinate seed before it was applied. Barron mixed seed with sand and calcined clay. This mix was wet down, placed in mounds, and rewet daily. Gill mixed seed with Milorganite in much the same way. Toma chose to soak the seed alone in drums, changing the water daily. Following germination offsite, the seed, sometimes mixed with a spreading agent, was sown on the field. Within two weeks, the seedlings were rooted and filling in thin spots.

Cal Poly, Northrup King, and most recently, Liquid Sod have improved pregermination methods. By experimenting, they found that by changing the water, adding air during the soaking process, and controlling the temperature of the seed, germination rates could be increased.

Dr. William Levengood, a retired University of Michigan biophysicist consulting for Liquid Sod, has been able to clarify a number of problems with pregermination. "The important thing to understand is what goes on inside the seed during germination," he explains.

"By measuring the physiological response of the seed to temperature, oxygen and other factors over time, the pregermination process can be adjusted to reduce stress and increase germination. Seed generates heat as it germinates, especially when the seed is gathered together in in a bag, tank or pile. That heat, if not controlled, stresses the seed and reduces it potential to germinate."

Jesse Johnson, vice president of the company, has uncovered other factors which contribute to the success of pregermination. "For one thing, you can use less seed," he states. "Once seed has germinated, there is no reason to apply extra seed. It also costs less to treat seed with fungicides (Apron) during pregermination than to apply the same fungicide to the ground afterwards." Johnson noted that the company has seen positive results from staining the seed with Bovamura. Finally, he states that wetting agents are helpful if used only during the first soaking.

Pregermination bags by Liquid Sod aerate and control the temperature of the seed as it germinates.

The second method of cutting down the time it takes to establish turf is "seed priming." The advantage of seed priming is that the treated seed can be marketed or shipped like untreated seed. Priming begins the germination process and then stops it just before emergence of shoots. When the seed is sown, it has a head start, allowing tall fescues and Kentucky bluegrasses to complete germination in seven to ten days, just like perennial ryegrass.

Jacklin Seed plans to have treated seed available within two years, says Gayle Jacklin Ward. "We will be using primed seed first to plant some of our production fields," she states. "The crop comes up faster, lengthens our planting time, and gives us cleaner fields. Because Kentucky bluegrass spreads, it has an important advantage in golf and sports turf over non-spreading turfgrasses. By cutting germination down to a week, turf managers can use it more effectively for overseeding and reseeding."

Turf Merchants has announced it will have primed seed of Bonzai dwarf tall fes-

cue this fall. The company is using the same priming process as Chemlawn Corporation, one of the nation's largest lawn service companies. "We've found that by using primed seed in our production fields, tall fescue is more mature by winter," reports Steve Tubbs with Turf Merchants. "As a result, we get full seed production the first spring, instead of the second year."

The third time-saving technology is seed coating. By coating seed with nutrients, moisture control agents, and/or fungicides, a higher and faster rate of germination is obtained. Celpril, a company which offers the coating process to seed companies, says turf managers can use half as much coated seed as uncoated. The company also claims time savings of nearly 50 percent with some turfgrasses. Furthermore, the seed can be bagged, shipped, and stored like uncoated seed.

Mechanical methods of improving seed germination are also useful to the manager of a busy sports complex. Shallow aeration, with either hollow or solid tines, provides a protected environment for seed and developing seedlings. Roots flourish in these core holes. Obviously, a tight pattern will provide the most protection. Light topdressing after aeration also offers important traffic and moisture protection for seedlings.

Application of activated charcoal, dark-colored organic fertilizers, or dyes can speed germination by warming the soil surface. These dark materials absorb and retain heat from sunlight during the day. This may be important later in the fall, when nighttime temperatures drop below 50 degrees F.

Covers are also useful for keeping soil temperatures up during the fall. Some turf managers cover fields or greens at night to trap daytime heat and insulate the turf from cold nights. A number of manufacturers make tarps with one dark side and one light or reflective side. The light side is intended for rain protection during the growing season, while the dark side can be used to warm the turf in the fall and winter. The value of these covers has increased as football extends further into the fall and baseball starts earlier each spring.

Translucent covers have the advantage that they can be left on turf areas both day and night. They allow sunlight to reach the turf and trap heat when temperatures fall. Dr. John Roberts, associate professor of plant science at the University of New Hampshire, has found that these covers can increase soil temperatures by as much as 15 degrees F. Reemay, Hinsperger Poly Industries, DuPont, and Warren's Specialty Products manufacture covers of this type. They are not solid. They are spun-bonded, needle-punched, or woven to allow movement of moisture and air through the cover.

Some northern golf course superintendents have left the covers on greens all winter to achieve spring greenup of bentgrasses up to three weeks early. The extra protection can also reduce winterkill and desiccation.

Any method of extending the growing season in the fall enables cool-season turfgrasses to mature more rapidly. The more mature they are in the spring, the more resilient they will be. Every week gained in the fall adds to root development and food storage. These are vital to turfgrass hardiness and resilience the following year.

Sports turf managers and golf course superintendents are learning to make every second count during the fall, when the biological clock of turfgrasses favors renovation. By assisting natural processes with new management techniques, you can gain as much as a month in the fall and two or more weeks in the spring. This not only allows longer and safer use of natural turf surfaces, it gives turfgrass more time to recover from wear, regenerate its natural defenses, and achieve its full potential.

Just as in medicine, you can apply intensive care to keep a sick patient alive. . .or you can implement a program of preventive medicine to let the patient's natural defenses avoid a critical situation. You are the doctor. You can spend the year in the emergency ward, or you can invest in techniques which avoid disaster. Renovation in the fall is the best medicine for golf and sports turf.