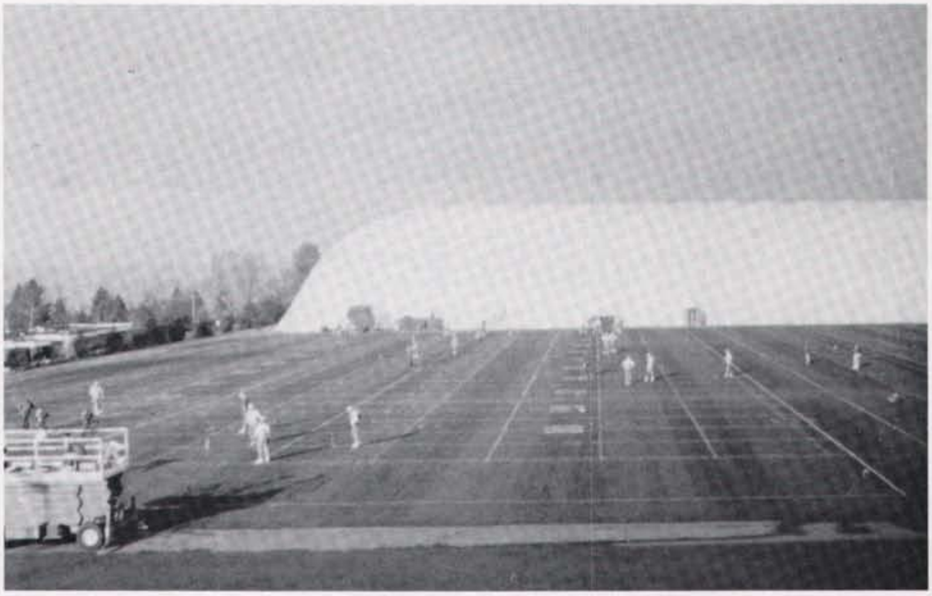
Fertilization of Sand-Based Rootzones



Seattle Seahawks training center features a four-acre sand-based field maintained with a precise fertilization program.

Sand has become a remedy for many of the modern pressures placed upon natural turf. By replacing or amending native soils with sand, turf specialists have largely solved problems with drainage, compaction, hardness, traction, and shallow rooting. As the value of golf greens, race tracks, and athletic fields rises, more turf managers find themselves dealing with sand-based rootzones. It isn't long before they discover that fertilization of these rootzones is considerably different from feeding standard, soil-based rootzones.

The very characteristics that make sand drain well and resist compaction also make it relatively poor as a reservoir for water and nutrients. Compared to clay, sand has a smaller surface area by weight, which limits its ability to react chemically with nutrients. A significant portion of soluble fertilizers will leach through sand following rainfall or irrigation, rather than clinging to it. Roots growing in sand are not protected from chemicals by the buffering action of clay and organic materials. As a result, there is less margin for error and a greater necessity for close management of chemicals applied to sand-based rootzones.

The size and type of sand affects the way it holds water and nutrients. Finer sands hold more water than coarse ones. Minerals and impurities in some sands may increase water retention. Unfortunately, turf managers have limited control over the sands available to them. For practical reasons, builders of golf greens and sports fields must specify sands that are available locally. This puts the job of determining appropriate maintenance and irrigation levels on the superintendent or groundskeeper.

Fortunately, the United States Golf Association Green Section has reduced the margin of error for superintendents by developing specifications for sand-based greens. The USGA guidelines state that the ideal particle size range for sand used in the rootzone mix is between .25 mm to .75 mm, with the majority being between .25 mm and .50 mm (medium). In most instances, fine and very fine sands (less than .25 mm) should comprise no more than ten percent of the total volume of the mix.

Furthermore, the mix should contain less than five-percent silt and three-percent clay. The organization stresses that the components and the final rootzone mix must be tested by a laboratory for accuracy before installation. According to the specifications, the rootzone should retain 12 to 18 percent water by weight at a tension of 40 cm. Water should be able to pass through the compacted rootzone at a rate of approximately five inches per hour.

Particle size is not the only factor in sand's influence on fertilization. "There is a lot of variability in sands from one location to another," remarks Dr. Ed McCoy, assistant professor of agronomy at Ohio State University in Wooster. Silica sands are pretty inert. Calcareous sands contain some contaminants, including silts, clays, shales, feldspars, and calcium carbonate. The contaminants provide some additional absorption."

In his own state of Ohio, McCoy has noticed that the amount of calcium carbonate in sands increases from north to south. "In southern Ohio, local sands contain quite a large amount of calcium carbonate and have a pH ranging from 7.5 to 8.5," he states. "Groundskeepers who add sulfur to correct the pH may end up dissolving the calcium carbonate, allowing it to migrate down in the soil profile. The result can be a lower, caliche layer with a high pH. It's almost like cement. That's why it is so important to have a laboratory test any sand before it is installed."

Once you know the particle sizes of sand, you can fairly accurately predict its water-retention ability, McCoy points out. However, water and nutrient retention levels change after turf has become established. "The older sand-based fields become, the more organic matter enters the rootzone," explains Dr. Roy Goss, who recently retired as professor of agronomy at

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Washington State University in Puyallup. As the organic matter increases, so does the cation exchange capacity (CEC) of the soil. This improves the water and nutrient retention ability.

"Soil should be tested at least once a year," Goss suggests, "to gauge the cation exchange capacity and to get a handle on nutrient deficiencies before they impact the turf. Once you see symptoms of nutrient deficiency, the turf has been in deficit growth for a week to ten days. Then it takes fertilizer or micronutrients a few days to bring the turf back up to speed. During this period of time, the turfgrass is not performing up to its ability. When a green, tee, or field is heavily used, you can't afford to lose this time."

Goss has consulted for many golf courses and athletic facilities during his career. Working with civil engineer Carl Kuhn, Goss designed and established a maintenance program for the Seattle Seahawks training center in Kirkland, WA. The four-acre, sand-based field has provided a consistent, playable surface for the Seahawks for five seasons. The training center is considered a model by many other National Football League franchises.

John Monson is responsible for the Kentucky bluegrass and perennial ryegrass growing in 18 inches of medium-sized sand. Monson changes the lines and goals for two full-sized fields regularly to distribute the wear evenly over the area. Minicamps start in April and extend through mid-July. Practices take place on the fields into December. The facility also has one Omni-Turf, sand-filled artificial field which can be covered by an air-inflated plastic bubble.

"In this climate you need to have a sand rootzone," the former golf course superintendent says. "The native, heavy-clay soil can't take the rain or abuse. Water never puddles on the [sand-based] fields and the roots extend all the way to the bottom. It's easier to manage than other fields in some respects, but you have to stay on top of maintenance all the time."

Monson watches fertilization and irrigation very closely. "The sand becomes loose if it gets too dry," he reveals. "It has to be kept uniformly moist without overirrigation. We don't want anything leaching through the rootzone and into the storm sewers. Wetting agents help us with uniformity and slow-release fertilizers control the leaching."

Goss and Charles Lilly Co. of Portland, OR, developed a fertilizer containing 11 basic nutrients called Royal Green. One-half pound of the 18-3-16 blend of sulfur-coated urea with macro- and micronutrients is applied every two to three weeks beginning in April. Monson supplements the nitrogen in the spring and fall with light rates of ammonium sulphate, which has a lower leaching potential than ammonium nitrate or calcium nitrate. "There is a problem with the predictability of release of slow-release products in cold weather," Goss explains. "For this reason, we have to use some soluble sources." The total amount of nitrogen applied during the season ranges between six and eight pounds per 1,000 square feet.

Additional phosphorus is applied only in the spring, during renovation. After a soil test, the field is aerified, dethatched, reseeded, and topdressed with the exact same sand as the rootzone. "Phosphorus is not prone to leaching," states Goss. "Once turf has established, high levels of phosphorus only encourage *Poa annua*." Monson has also applied Endothall to knock the Poa back.

Potassium is the nutrient Goss and Monson watch closely at the training center. "Potassium can leach readily with heavy rainfall and irrigation," says Goss. "It can become deficient rapidly, within a matter of days. We try to keep it at medium to medium-high levels, around 200 parts per million. The one-to-one ratio of nitrogen to potassium in the fertilizer accomplishes this."

Other nutrients contained in the Royal Green are sulfur, iron, calcium, copper, boron, manganese, magnesium, and molybdenum. "It's important to keep all nutrients in balance with regular feeding," says Goss.

John Nolan, head groundskeeper at Soldier Field in Chicago, IL, also follows a program of frequent, light rates of nitrogen supplemented with micronutrients. Since the Prescription Athletic Turf (PAT) field is like a bathtub filled with sand, it traps any nitrogen that is not held by the sand. Due to its close proximity to Lake Michigan, soil temperatures coincide with the temperature of the lake, a factor which can hamper the release of ureaformaldehyde nitrogen sources.

Jim Fizzell, turf specialist with the University of Illinois Cooperative Extension Service, advises Nolan on the stadium's fertility program. "John applies 1/4 to 1/2 pound of nitrogen every two weeks," says Fizzell. During spring and fall most of the nitrogen is in quick-release forms. In the summer, when temperature and humidity rises, Milorganite (6-4-2) is applied for a total N of four pounds per 1,000 square feet for the year. Milorganite is an organic, slow-release source of nitrogen which contains a number of micronutrients, including iron, copper, zinc, and sulfur. Soldier Field also maintains potassium levels with 10-10-10 or 15-0-30 formulations of fertilizer.

"There is a consensus today that potassium should be applied on a one-to-one basis with nitrogen," says Dr. William Daniel, coinventor of the PAT system. "The tendency is to overwater sand rootzones. This causes leaching of potassium and other important nutrients.

"We have seen instances of heavy rainfall or overirrigation which caused a 50-percent drop in soluble salts. Slow-release nitrogen sources can reduce this loss significantly. One company [Purcell Industries, Sylacauga, AL] recently came out with a slow-release potassium, sulfur-coated sulphate of potash. This product could help groundskeepers maintain practice fields without having to make frequent applications."

Paul Grosh, regional sales manager for Lebanon's Country Club products, said one of his company's biggest products is its 8-4-24 fertilizer. "Superintendents are using potassium to improve heat, cold, and wear tolerance and help turf resist diseases," Grosh says. "They use the high K product during periods of greatest plant stress."

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Dr. Paul Mosdell, project leader for fertilizer development at O.M. Scott, points out that too much nitrogen or a deficiency of manganese can magnify a potassium shortage. "The jury is still out on high rates of potassium," Mosdell says. "Theoretically, nutrients in the soil compete for uptake by the plant. More research is needed to figure out what the right balance of nutrients is for turf growing in sand-based rootzones."

Grosh is concerned by the number of turf managers cutting back or eliminating phosphorus from their fertilization programs. "They want to discourage *Poa annua* from reseeding, but may find they end up with a phosphorus deficiency," he warns.

Iron is a nutrient that can have a dramatic effect on the color of turfgrass and is often unavailable in sandy, overirrigated soils. Excessive levels of phosphorus, zinc, or manganese can also cause an iron deficiency, known as chlorosis. This condition can be corrected with a foliar spray of iron sulfate or an application of chelated iron. The chelated form will not leach and won't discolor pavement or structures in the area.

Daniel suggests three ways to keep track of turf nutrients. "Tissue analysis is the most sensitive," he begins. "A good tissue sample analysis tells the turf manager if there is a nutrient deficiency within the plant." His second indication is the amount of clippings removed during mowing. The third is to test the soil for levels of available nutrients. "The key is a steady diet, not peaks and valleys," he explains.

The cation exchange capacity of sand rootzones can be improved quickly with the addition of certain amendments, says Daniel. He cautions, however, that some of the amendments can reduce the percolation rate of the rootzone mix. "A silty loam soil has a CEC ranging from 15 to 20, while sand runs about 3," he reveals. The incorporation of calcined clay (CEC 15-20) or peat moss (CEC 80-100) can bring the exchange capacity of the soil mix up depending upon the volume added.

The present trend in fertilization of sand-based rootzones is to build a foundation of slow-release nitrogen and supplement it with frequent light applications of quick-release nutrients. Fertigation could assume a major role in the frequent application of nutrients on golf and sports turf, says Daniel. "Using the irrigation system to apply fertilizers reduces the tedium of reapplying products every two weeks," he claims. "It also lowers the chance of striping or misses with sprayers or spreaders."

As research at Louisiana State University in Baton Rouge revealed nearly ten years ago, not all nitrogen sources work equally well on sand-based golf greens. The best turf quality may result because the nitrogen source affects other nutrients in the rootzone. Since Milorganite contains nutrients beside nitrogen, it was rated highest in the tests. But sulfur-coated urea, IBDU, ureaformaldehyde, methylene ureas, and plastic-coated urea, when balanced with timely rates and applications of other nutrients, do not leach from sand-based rootzones.

High-quality turf can grow in a compaction-resistant, well drained rootzone without wasting water or chemicals, contaminating groundwater, or restricting use. It takes more effort, but that effort is justified by the increased value and productivity of the facility. You can't build a sand-based rootzone and then expect to maintain it with old, soil-based technology.

SCOTT AND SANDOZ TO DEVELOP BIOLOGICAL PESTICIDES

Sandoz Crop Protection, a producer of biological insecticides for agricultural uses, and the O.M. Scott & Sons Company, a marketer of products for home lawns and gardens, have agreed to develop and market a natural line of products for home gardens and lawn care in the United States and Canada. The first products from this alliance are expected to be introduced in 1991.

Under the agreement, Sandoz research and development will provide biological products to Scott for inclusion in a newly developed natural product line. This line will initially include biological insecticides, and may eventually include products based on naturally occurring insect viruses, bacteria, protozoa, and natural plant extracts to control lawn and garden pests.

Sandoz presently sells a number of biological products to farmers to control caterpillars and Colorado potato beetles in fruit and vegetable crops. Another product is widely used to combat gypsy moth infestations across North America.

"Increasing public awareness about the environment has created a demand for such a natural line of products for home gardeners," says Tadd C. Seitz, Scott president and CEO.

"Some of our ongoing advanced-technology development and many of our existing products can be readily applied to home lawn care and garden use," says Dale A. Miller, president and CEO of Sandoz Crop Protection. "This alliance also gives us an opportunity to seek out other natural materials that can be used to control garden pests."

HELP MAKE CHILD'S LAST WISH COME TRUE

A seven-year-old boy with a brain tumor in Surrey, England, would like everyone to help him set a record before he dies. Craig Sherbold's final wish is to be entered in the Guinness Book of Records for the largest number of "Get Well Cards" ever received by an individual.

You can help by sending a card as soon as possible to Craig Sherbold, 36 Shelby Road, Carshalton, Surrey, England. Postage for a card weighing one half ounce or less is 45 cents.

Those touched by Craig's last wish are urged to send a letter to ten of their friends on his behalf so that they may also send him a get well card.

SHARP TO DISTRIBUTE BUFFALOGRASS CULTIVARS

Sharp Bros. Seed Co. of Healy, KS, and the University of Nebraska have reached an agreement on the worldwide production and marketing rights of the new generations of Buffalograss. Under the agreement, the seed company will distribute new generation cultivars its extremely drought-tolerant and low-maintenance Buffalograss into all areas, especially those concerned with environment and water conservation.

"The first challenge is to utilize these varieties not only as vegetative, but also as seeded varieties," said Gail Sharp, president of Sharp Bros. Seed Co. "Evaluations will be instigated immediately within our production facilities. We hope to supply seed from these varieties within the next few years."

CHALKBOARD

TIPS FROM THE PROS

Wetting Agents: First Aid For Localized Dry Spots

Summer has arrived. You are beginning to increase irrigation run times to compensate for the dry heat of the season, ever mindful of your water budget. You have instructed the crew to be on the alert for symptoms of wilt. Overall, the turf looks terrific.

One day the golf professional or coach enters your office and asks, "What are those small patches of off-color turf?" A number of small, irregular patches of limp, dark blue-green turf have begun to die.

Because you've kept a tight rein on water, thatch, diseases, and insects, you are fairly certain you have things under control. You send soil and tissue samples to a lab for a second opinion. The results indicate no problems with fertility, pests, or diseases. Through a process of elimination, you reach the conclusion that the problem is localized dry spots (LDS).

Does this sound familiar? Extension turf specialists from across the country are reporting widespread incidence of LDS, especially on greens and fields constructed of sand. Bentgrass seems to be more prone to the problem than other grasses. However, as the specialists have revealed, the problem is not the turf, it is the soil in which the turf is growing.

Research at the University of Georgia in Athens, Michigan State University in East Lansing, and Ohio State University in Columbus has narrowed the problem in sand rootzones down to organic material that repels water when it becomes dry. This material coats sand particles in localized spots and deprives the turf of soil moisture. To date, they have not identified the source of the material, but they have discovered that repeated applications of wetting agents will correct the situation.

Wetting agents are a type of surface active agent (surfactant) that decreases the surface tension of water. By reducing the forces that hold water molecules together or make them cling to soil particles, more moisture is available for uptake by plant roots.

Dr. Keith Karnock at the University of Georgia has performed the most recent research on wetting agents. All 15 products he tested improved the water-holding capacity of LDS soils. The main differences he discovered between them were their recommended rates of application and the number of treatments necessary to achieve equal results.

Karnock reports that the soil in all treated plots returned to its previous dry state once applications of wetting agent were discontinued. This indicates that use of the products for less than one year did not provide a permanent cure for LDS.

The standard treatment program for golf greens is to make thefirst two applications two weeks apart in the spring, once irrigation has begun. Some manufacturers recommend higher rates for initial treatments than for subsequent ones. From that point on, the wetting agent is reapplied once a month. Programs for athletic fields may require lower rates and longer retreatment intervals.

As a general rule, wetting agents need to be watered in immediately after application. Turf managers have found it helpful to apply the products during rainfall or by injecting them into the irrigation system.

Most manufacturers offer both liquid and granular formulations. Granular products are convenient for spot treatment or application by spreaders. Liquid versions can be applied with sprayers or injected into irrigation water. Recently, hose-end adaptors that use dissolving pellets or liquid proportioners have gained popularity, especially for follow-up treatments.

Rates vary considerably between products. In Karnock's study they ranged from two to 64 ounces per 1,000 square feet per application. During the three-month project, the total amount applied ranged from eight to 128 ounces, depending upon the product. These rates provided a statistically equal amount of improvement in the water-holding capacity of the soil. Rates and price per weight or volume need to be determined when figuring the overall cost of a wetting agent program.

Karnock did find a difference in the speed of water penetration between products. This might be important when using wetting agents on slopes or undulating greens. All products in the trials reduced water penetration time by 50 percent or more.

Danneberger points out that certain management practices can reduce the incidence of LDS. Because soil becomes more water repellent as it gets drier, don't allow problem areas to dry out during irrigation intervals. A method known as "double bumping" can help. This involves moistening the soil first with a short cycle, waiting a few hours, and then applying the bulk of the irrigation.

Mechanical aeration prior to hot, dry weather can improve water infiltration. Heavy thatch layers can also prevent water from reaching the soil. Thatch is found in close association with localized dry spots, but it is not always needed for them to occur, says Danneberger.

He reminds turf managers that wetting agents must be watered into the rootzone to be effective. Do not allow wetting agents to remain on the foliage of turf, especially if applied at high rates. Rinse the material off the plant and into the soil immediately after it is applied.

Once in the soil, wetting agents assist the movement of water into the rootzone for a period of weeks. The uniformity of the turf area is restored and water is utilized with greater efficiency. The temptation to overapply water to an entire area to correct dry spots is gone.

Localized dry spots are a tradeoff. If we want turf to withstand intense use, we need sand rootzones. If we want to discourage annual bluegrass from greens, tees, fairways, and athletic fields, tight control over water is necessary. If we are to satisfy golfers who prefer bentgrass to other turfgrasses, we must accept higher maintenance levels. And if we are to provide the highest-quality turf with the least amount of water, we must explore every possible way to conserve. Wetting agents allow us to do all these things while meeting professional standards of turf care.

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PRODUCT UPDATE

WETTING AGENT APPLICATOR

The Pro-Ap, a hose-end applicator for applying Hydro-Wet Turf Wetting Agent, has been introduced by Kalo, Inc. It is designed especially for use on golf courses.

The sprayer will accurately apply the wetting agent to tees and greens, and can be used to apply micronutrients and other additives. The Pro-Ap metering system mixes small quantities of chemical with large volumes of water, and offers a variety of chemical dilution rates.

Molded from chemical-resistant Celcon, the Pro-Ap connects to one-inch water service and adapts to 3/4-inch. Its pistol-grip design and light weight reduce operator fatigue. A shower-type nozzle ensures gentle application to turf.

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Operating solely on water pressure with, no need for external energy, the Amiad Fertilizer-Chemical Injector requires only two 3/4-inch outlets from the main water line. The 11-pound injector can be connected to the main or sub-main line and the fertilizer or chemical tank with union couplings in minutes, permitting application of fertilizer or chemicals to specific areas.

The operating injector does not break line pressure. Its linear hydraulic motor provides an efficient and accurate injection rate of two to 80 gph which is easily controlled through a ball valve or a flow regulator. The unit is equipped with an automatic cutoff that shuts down the injector when materials have been expended.

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