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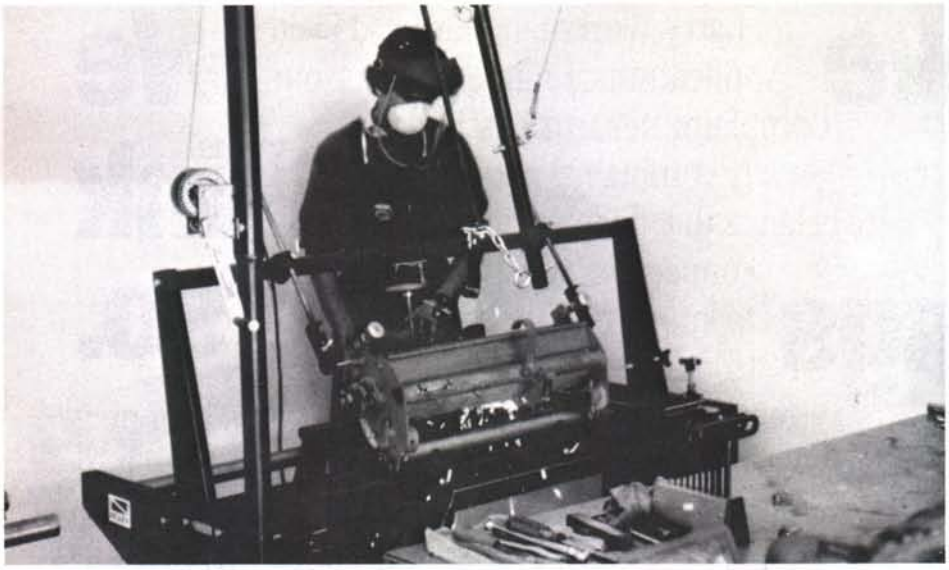


All greensmower blades are sharpened before the first cut of the overseeded ryegrass at Gulf Shores Golf Club.

Ryegrass

continued from page 20

ryegrass can get established in time for the peak tourist season which starts in November. Cal Hardin, superintendent at the private Club at Morningside in Palm Desert, CA, applies maleic hydrazide once every week for three weeks starting in September to slow the Tifgreen bermudagrass on the tees and the common bermudagrass on the Club's fairways and roughs down. Irrigation is also cut way back to stress the bermudagrass. Appearance is generally not a concern since most courses close for the month of October.

Competition among golf courses is intense in this resort community so many superintendents overseed "wall-to-wall" and use improved perennial ryegrasses. Hardin has purchased 65,000 pounds of Citation II perennial ryegrass for this fall. In October, Hardin cuts back on water, scalps, verticuts and vacuums the tees and fairways. The Morningside crew broadcasts 450 pounds of seed per acre to the fairways and up to 25 pounds per 1,000 square feet on the tees. The roughs are scalped and seeded at a rate of 350 pounds per acre.

Hardin contemplated buying seed treated with fungicide at an additional six cents per pound, but felt he could handle disease problems with spraying if an outbreak of *Pythium* occurs. The greens at The Club at Morningside are Penncross bentgrass. Bentgrass greens are becoming the rule at many of the prestige courses in the area. The extra maintenance needed to get the greens through the summer is apparently worth the effort. Hardin will overseed the greens lightly in the fall with coated Penncross to repair any losses during the summer. A few superintendents in the Southeast are trying bentgrass on their greens despite favorable disease conditions. Some call it a fad; others believe it's worth the extra effort and expense.

For two to three weeks after overseeding Hardin sets the irrigation for four two-minute cycles during the day. For the remainder of the winter the turf is irrigated with a six- to ten-minute cycle every other night. The heads at the Club apply 30 gallons of water per minute. During the summer, the bermudagrass is irrigated in nightly 12-minute cycles. This is nearly four times the amount of water used during the winter.

In the Phoenix, AZ, area overseeding is similar to Palm Desert. Westbrook Village Golf Course in Peoria, AZ, closes nine holes at a time for five days at the end of September. Superintendent Paul Merton overseeds greens, tees, fairways and roughs on the 18-hole course which serves as the centerpiece for a housing development. The greens are Tifgreen while the rest of the course is common bermudagrass.

During the fall, Merton will sow more than 40,000 pounds of Pennant perennial ryegrass on the course. He buys the Apron-treated seed for the greens and nontreated seed for the rest of the course. Merton is a strong proponent of perennial ryegrass over annual. "Perennials are better all the way around," he states. "The annual ryegrass grows an inch every day and is always heavy and wet when you cut it. The perennial has better color, grows slower, and needs less water and fertilizer than annual."

He starts the overseeding process in August by aerifying and cutting back on irrigation. When the course is closed, Merton verticuts the greens and tees in four different directions. He applies a light coat of sand, overseeds at 25 pounds per 1,000 square feet, fertilizes, and then applies a second light coat of sand and an application of wetting agent. For one week, the irrigation is set to repeat three-minute cycles five times a day. When that particular nine is reopened, the irrigation is reset for four six-minute cycles during the night.

The common bermudagrass tees, fairways and roughs are scalped before overseeding with 350 pounds of seed per acre. A similar irrigation plan is followed for these portions of the course. Just before Christmas, Merton applies Betasan to control annual bluegrass. In May, Merton shuts the water off for four days to knock the ryegrass back. "This wipes out 50 percent of the ryegrass right away," he says. "The summer temperatures take care of the rest except for a few patches in shady spots."

"When you consider that some superintendents still paint their fairways in the winter, you can see that overseeding still has a long way to go," says Merton. "We all learn a little more every year."

Overseeded winter turf is actually more important than the native warm-season turf for resort areas. "The primary tourist season for Arizona is October through April," explains David Snyder of Snyder Turf Supply in Phoenix, AZ. "For nearly eight months of the year the primary turf here is ryegrass. By the time the bermudagrass gets back on its feet, there are few tourists to enjoy it. If water restrictions force us to decide between irrigating the bermudagrass in the summer or the ryegrass in the winter, the answer has got to be the ryegrass. That's how important it is to this community."

A new concept in overseeding is coating seed with different materials to insure high germination and survival rates. By covering the seed with the nutrients it needs to get established and a fungicide to prevent pythium from attacking the germinated seedlings, seed quantities can be cut in half in some cases. The process has been tried successfully on perennial ryegrass and common bermudagrass seed. The coated seed plants are more vigorous than seedlings from uncoated seed following germination. The seed is basically self-sufficient except for water for the first few critical weeks.

While coating seed does not necessarily save the sports turf manager money, it can improve results. Celpril Industries, Inc., in Manteca, CA, coats seed for various suppliers. The supplier, not Celpril, markets the coated seed with a statement on the label, "contains Nutri-Kote or Nutri-Kote Plus Apron (the fungicide).

At the same time, seed companies are breeding perennial ryegrasses that will not compete with bermudagrasses during spring transition. "We are looking for new perennial ryegrasses that are susceptible to spring heat because the take longer to mature," explains Frederick Ledeboer, who works with Turf Merchants of Albany, OR. The less mature the ryegrass is in the spring, the more susceptible it is to heat and water stress at that time of year."

Dr. Richard Duble of Texas A&M Univeristy, College Station, has shown that high rates of seed tend to produce very dense, less mature stands of ryegrass in the spring. By lowering the seed rate, the ryegrass appear to mature more quickly and becomes more persistent in the spring.

Dr. Robert Mazer, professor of horticulure at Clemson University, Clemason, SC, has recently shown that light vertical mowing in the spring, once a recommended practice to speed up transition, actually slows

The greens at Gulf Shores Golf Club are spiked in the spring when the ground temperature reaches 58 degrees F.

it down (at least in South Carolina). He has also shown that two growth regulators (Embark and maleic hydrazide) will selectively slow the growth of the ryegrass in the spring to give the advantage to the bermudagrass. Kerb (pronamide) is a herbicide that selectively damages the ryegrass. Mazer says the growth regulators do not cause the turf to turn yellow to the degree Kerb does. The net effect, says Mazer, is that the growth regulators can speed up transition by as much as two months.

In other studies Mazer has shown that topdressing has no effect on the success of overseeded ryegrass, neither does aerification. Fertilizing and irrigation in the spring tend to push the ryegrass more than the bermudagrass. Reducing either may help the bermudagrass during transition. Low fertility and low mowing height have also been associated with speeding up transition to bermudagrass.

While advances in perennial ryegrasses are moving along rapidly, advances in bermudagrasses are taking much longer. Dr. Alden Baltensperger of the University of New Mexico, Las Cruces, recently announced that seed to an improved bermudagrass will be available from a Farmers Marketing of Phoenix in about two years. The new bermuda has many superior characteristics to common bermudagrass. Unlike hybrid bermudagrasses, it can be seeded instead of sprigged. Work is also underway to develop bermudagrasses with better winter hardiness.

One thing that threatens the expanding practce of overseeding is water. The limited supply of water in many parts of the country is must be faced. Most overseeded areas have already experienced water restrictions at some time. Choices will have to be made in the future. Judicious use of water today through highly controllable irrigation systems can protect sports turf from the cutbacks of water agencies in the future. When an economy depends upon sports turf for its livelihood, every step should be taken to assure responsible water use.

Overseeding has changed the way sports turf is managed in a large part of the country. What was once an unusual practice has now become commonplace. The growing importance of events played on turf in the South during the winter is too great to depend upon dormant grasses. Only the skill of the sports turf manager and golf course superintendent keeps fields, stadiums and golf courses safe and in play during this important time of year.

RAIDERS ANNOUNCE MOVE FROM COLISEUM

Al Davis, the owner of the Los Angeles Raiders, has never been afraid to fight the National Football League or local governments when it comes to the success of his team. He beat the NFL and he beat the city of Oakland and he is about to beat the Los Angeles Coliseum Commission.

When his team completes its ten-year contract with the Coliseum in 1991, Davis is moving the Raiders to their own stadium to be constructed in Irwindale, a city 25 miles northeast of central Los Angeles. For more than a year, Davis has been battling with the Coliseum Commission over details that are important to the profitability of an NFL franchise. Agreements he thought had made with previous commissioners about seating, sky boxes and stadium conditions when he moved the Raiders from Oakland to Los Angeles weren't being honored to Davis' satisfaction by new commissioners. Davis did not hide his dismay about the situation and other cities started to approach him with attractive options.

The city of Irwindale apparently came up with the right package. Not only is Irwindale willing to help Davis finance the new stadium, it enticed him with a nonrefundable $10 million development fund. The new stadium will be strategically located near the intersection of two major highways on the site of an old gravel quarry. Miller Brewing Company's plant is located directly across the highway causing some reporters to speculate that the brewer is a strong backer of the move.

Irwindale's city council is confident they can help the Raiders clear all hurdles with Los Angeles County supervisors and neighboring land owners regarding zoning, parking and traffic. If for any reason the project is blocked, Davis keeps the $10 million.

When Davis moved to the Coliseum he understood that the city would add sky boxes to the old stadium that seats nearly 100,000. The 2,000-plus seats eliminated by construction of the sky boxes were to be relocated. When work was to begin, the Coliseum Commission hedged on replacing the seats and Davis cried foul. After months of debate, it appeared in August that Davis and the Commission were close to an agreement. At the same time other cities approached Davis about other stadiums for the Raiders to call home. Before the Coliseum could close its amended deal with Davis, he announced the future switch to Irwindale.

Davis has been a strong proponent of natural turf. He insisted on sand-based Hi-Play fields for the Coliseum and the Raider's practice facility in El Segundo, CA. Ken Irons, grounds manager at the practice facility, believes Davis will install a state-of-the-art natural field in Irwindale if the stadium is built. "It makes a big difference whether you are a tennant or the owner of a stadium," Irons said.

The Raider's contract with El Segundo expires the same year as the Coliseum contract does opening up the possibility that Davis will move the practice facility and headquarters to Irwindale. The team also holds practice camps in Oxnard, CA.

SPORTS TURF ASSOCIATION LAUNCHED IN CANADA

After numerous organizational meetings at the University of Guelph, Ontario, the Sports Turf Association (of Canada) became reality this summer. Michael Bladon of the University of Guelph has been elected president. The organization is busy planning its first annual educational conference and putting together its first newsletter.

The primary objective of the new group, says Bladon, is to improve the safety and quality of turf athletic facilities by collecting and disseminating scientific, educational and practical knowledge. Cooperative educational and research projects will be developed to find solutions to turf problems specific to Canada.

Membership in STA is open to anyone with an interest in safe sports turf. "We invite members from the turf industry in its entirety," explained Bladon, "including schools, parks, professional sports, golf course superintendents, community colleges, contractors and sod producers." STA intends to represent the sports of field hockey, lawn bowling, soccer, rugby, softball, baseball, cricket and golf.

The association will have its first conference in March 1988. Bladon invites interested sports turf managers to contact him, 185 Edinburgh Road South, Guelph, Ontario N1G 2H8, (519) 824-4120.

OMAHA RENOVATES STADIUM FOR COLLEGE WORLD SERIES

Due to the increasing popularity and sponsorship of college sports the National Collegiate Athletic Association (NCAA) and the city of Omaha, NE, have taken steps to improve the College World Series by renovating city-owned Rosenblatt Stadium.

The College World Series has been held in Rosenblatt Stadium since 1950. It is estimated that more than two million fans have attended the series over the past 38 seasons. A large portion of the stadium's 15,000 seats are bleachers with limited reserved seating. NCAA officials believe the event will attract more fans and attention by increasing the number of reserved seats. James Wright, NCAA media coordinator for the Series, said people buying season tickets don't want to sit in bleachers, so the NCAA felt there was a need to expand the stadium.

When Omaha corporations, including Mutual of Omaha, Conagra and Union Pacific heard about the NCAA's criticism, they contributed more than $3 million to renovate the stadium to keep the event in the city. Construction is scheduled to begin in November. The city wants to have most of the renovation completed by the 1988 series. CBS Sports will broadcast the event for the first time next year which will increase the national exposure of the event.

City officials estimate the event contributes more than $12 million to the local economy each year. The Kansas City Royals AAA farm club also plays its home games at the stadium.

LANDMARK PURCHASES PALM BEACH POLO CLUB

Landmark Land Company, Inc., developer of PGA West and La Quinta Golf and Tennis Resort in La Quinta, CA, has purchased the Palm Beach Polo & Country Club in Wellington, FL. The posh polo club includes 11 polo fields, two 18-hole golf courses, 17 tennis courts and a championship croquet field.

In the past, Landmark has built its own golf course/real estate developments. The only other established property Landmark has purchased is Mission Hills in Rancho Mirage, CA. The company is already planning improvements to Palm Beach Polo & Country Club. "The first thing they did when they completed the purchase," says golf course superintendent James Branstrom, "was increase my budget by 20 percent." Gould Inc., the previous owner, had been trying to sell the club for almost two years. "We had been putting off buying some equipment," admits Branstrom. "Now we can get back to business."

Landmark's courses are famous for major tour events, both PGA and LPGA. The two courses at Palm Beach, one deisgned by professional golfer Jerry Pate and the other by golf course architect George Fazio, will probably follow the Landmark tournament tradition.

ST. LOUIS SOCCER PARK HOSTS OLYMPIC MATCH

The United States National Soccer Team will play an Olympic Qualification Match against Trinidad/Tobago at St. Louis Soccer Park in suburban St. Louis this month. The U.S. Soccer Federation arranged the match for the multi-field soccer complex owned by Anheuser Busch, Inc. The match will be played on the Kentucky bluegrass main field.

The U.S. National Team qualified for the match by beating the Canadian National Team last May. If the U.S. team wins, they will play El Salvador. The winner of the El Salvador match will then be part of the 16-team Olympic Soccer Finals in Seoul, South Korea in 1988.

More than 5,200 soccer fans are expected to pay to see the two teams play.

ANGELS ALMOST BLOCK RAM'S HOME OPENER WITH 36-HOUR CLAUSE

Gene Autry, owner of the California Angels, concerned over the playing condition of Anaheim Stadium, decided in August to invoke a 36-hour clause contained in his contract with the city of Anaheim to prevent the Rams from playing its season opener against the Minnesota Vikings on September 20. It took the persuasiveness of National Football League Commissioner Pete Rozelle to change Autry's mind by promising to be more careful about scheduling games in Anaheim Stadium in the future.

The clause states that the Angels have the right to cancel any event that takes place within 36 hours prior to a scheduled game. The Angels, who still have a chance at a pennant, have a game on Monday, September 21. Autry based his decision on recent problems with the field after the Angels opened an August home stand three days following a Rams exhibition game and six days after two David Bowie concerts. Autry did not blame the grounds crew for the rough, compacted condition of the outfield.

The National Football League scheduled the Rams/Vikings game knowing that it was within 36 hours of the Angels game. As the primary tennant, the Angels have the 36-hour clause for protection. The Rams are under contract with the city of Anaheim to play its 11 home games at the stadium which makes it virtually impossible for the game to be played at another Los Angeles area stadium. The city would have lost more than $100,000 in parking and concession revenues if the game is not played at the stadium. CBS has also sold advertising for its telecast of the game.

Nearly 60,000 Bob Dylan and Grateful Dead fans packed Anaheim Stadium last July 26.

The field has been considered one of the best in professional baseball. Both the Angels and Rams have shared the field for years without major problems. The bermudagrass outfield was covered with geotextile four times in July and August for rock concerts.

"There's no question the outfield is compacted," admits Don Marshall, the individual in charge of the stadium turf and two city golf courses. "We aerified and topdressed to relieve some of the compaction and to fill in the chair holes. The field really needs deep aerification, something we can't do with the current schedule." Marshall is concerned about the condition of the bermudagrass as it enters dormancy and the success of overseeding with ryegrass in the coming month.

The Living Soil-Absorbing Shock The Natural Way

By Eliot C. Roberts and Fred V. Grau

Sports turf, more than any other type of turf, needs to be managed with consideration of the condition of the soil and the roots growing in that soil.

The best plays in sports—like a leaping catch in baseball or football or a diving header in soccer—depend upon the skill of the player and the turf under his feet. Amateur and professional athletes soon learn to judge the hardness of fields they play on. One unforgiving collision with poor turf and promising careers can abruptly come to an end.

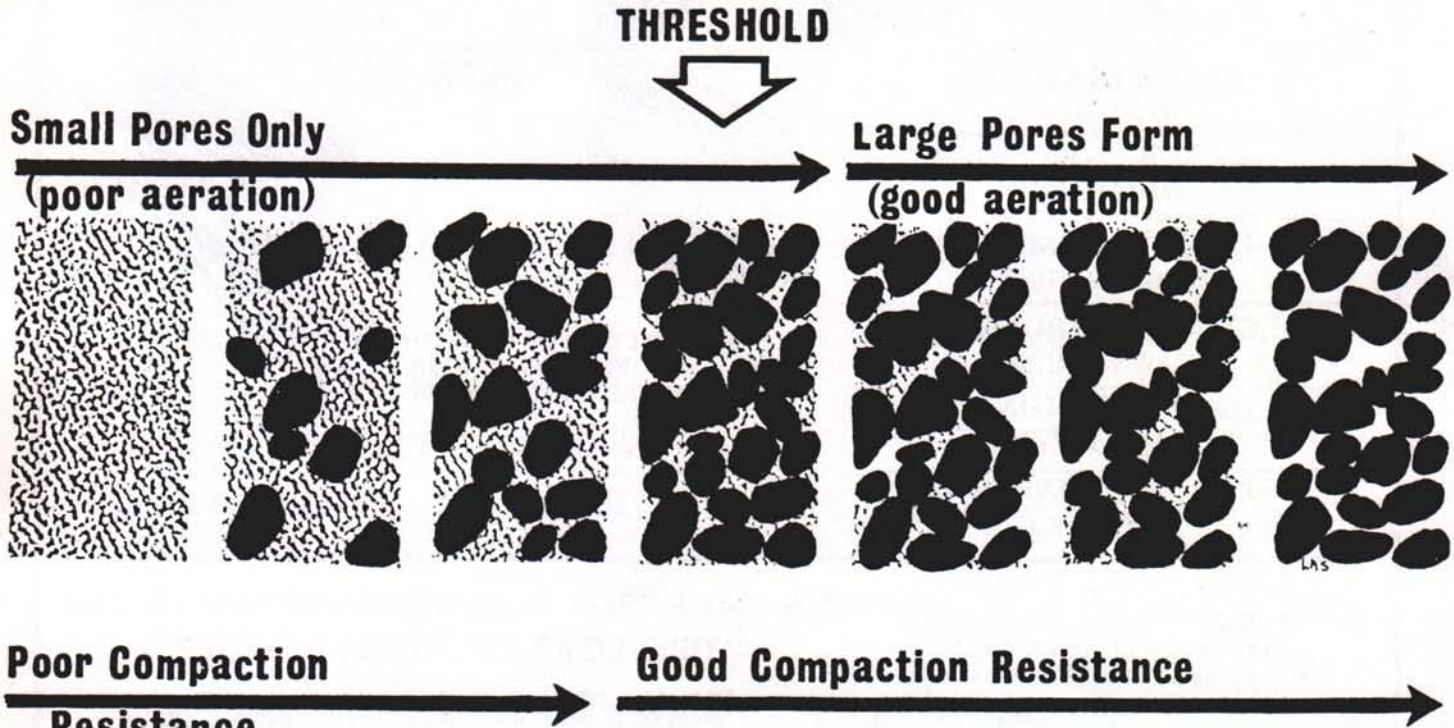
The athlete who is likely to come in contact with the ground should be able to expect a good dense turf to serve as a shock absorber. It's important for everyone who manages sports turf to understand what makes turf and soil absorb shock well.

Sports turf soils need to be firm to provide stable footing. Soft and spongy soils may be great to fall on, but they are dangerous when an athlete is required to change directions quickly.

Let's not forget that the turf takes a beating too. Turfgrasses used for sports surfaces are subjected to the harshest of growing conditions. The physical wear of the sport on the turf is damaging and limits the persistence of the turfgrass plant. Seldom is there adequate time between practices and games to allow for recovery of the turf.

Furthermore, athletic activity compacts soils even under the most favorable conditions. With field use, the soil structure begins to collapse and the healthy relationship among soil, air and moisture is disrupted. Poorer soil restricts root growth and plants are weakened as a result.

We make matters worse at times by close clipping. Such mowing practices may give fields a well-groomed appearance, but they



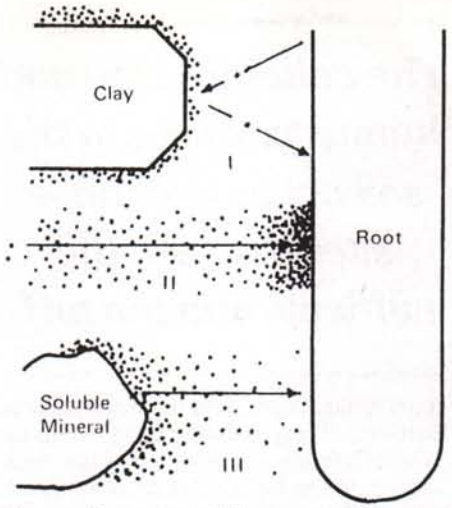
Soil organisms help particles in the soil combine with other particles to improve drainage and relieve compaction.

restrict root penetration into the soil and place the turf in a highly vulnerable position where recovery from injury is most difficult.

Sports turf, more than any other type of turf, needs to be managed with constant consideration to the condition of the soil and the roots growing in that soil. Any practice that amends the soil for optimum root growth should be employed. Failure to manage the turf below the surface is frequently the cause for turf failure above the surface.

A variety of mechanical and chemical techniques are commonly-used to improve the condition of sports turf root zones. But there is one major factor in soil management that is frequently overlooked by sports turf managers—those organisms living in the soil. These micro- (very small) and macro- (small) organisms contribute to the shock absorbing characteristics of sports turf. Since they are so small and hidden within the soil, we seldom remember they are there. In fact, they are so important, we should make a major effort to promote their general welfare.

These organisms were here on earth long before man. Billions of years ago, three and a half billion according to experts, micro-organisms like these played a major role in the development of our oceans, the atmosphere around the earth and the eventual formation of our soil. Working in conjunction with physical, chemical and other



Clay and humus particles are a vital part of nutrient exchange and help buffer chemical reactions between the roots and nutrients.

biological processes, micro-organisms helped break down native rock into soil. Since they were working with different types of rock and in different climates, not all soils are alike. Some soils are much older than others. One observation on soil formation is very clear: those soils that are most productive agriculturally were formed under grassland conditions and are high in organic matter and very active biologically.

These native soils can support sports fields under restricted use. Since restricting field use is frequently not practical, there is a trend in athletic field construction to increase the sand content of soils to a point that resists compaction and increases internal drainage. This, in turn, improves root penetration.

These amended, or artificial root zones, are especially favorable for sports turf. However, changing the soil disrupts many natural soil functions and processes. For example, replacing a portion of the soil with sand also changes the content of colloidal clay and humus of the root zone. These very small, surface-active particles are important sites for chemical and biological reactions. They also store water and chemicals needed for plant growth. By reducing their number, you effectively reduce the exchange capacity (cation and anion) of the soil.

Up-To-Date Root Zones. Realistically, we don't even need soil to grow turfgrasses. They can be cultured in solution or sand so that all essential nutrients along with oxygen can be supplied in dissolved form through the roots. Some sports fields have such a high sand content that they come close to qualifying as a hydroponics system.

However, these root zones also change over time. As roots develop and enter continuous cycles of growth and decomposition, organic matter accumulates within the root zone encouraging the establishment of populations of micro-organisms and

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macro-organisms. These populations may be quite different from those found in natural soils with much lower sand content.

The value of these organisms as shock absorbers may well be much less in this instance since the hydroponic systems are dominated by chemical reactions. In addition, they are not well buffered and may change rapidly over time.

Striking evidence of this lies in the fact that turf fertilization in hydroponic systems requires direct application of nutrients in amounts required to meet plant needs. In natural soils, we indirectly fertilize the turf by fertilizing the soil. The colloidal clay and humus particles in the soil act as exchange sites between the nutrients and the turf. These particles also act as buffers between the fertilizer and the turf.

Sports turf grown on natural soil is rooted into a medium that is usually highly buffered. Plant nutrients and all sorts of compounds within the soil system (both beneficial and harmful) are made more or less available to grass roots by the soil colloids. The colloids and the micro-organisms act as chemical shock absorbers to the turfgrass plant.

It's sometimes difficult to think of soil as a combination of small particles. We can easily see and understand soil components such as stone, gravel, and coarse sand. It's more difficult to picture the much smaller particles of clay, silt, and sand contained in soil. Clays are so small that they are measured in minute units called microns. Sands and silt are slightly larger and measured in tiny units called millimeters (one millimeter is one thousanth of a meter). Coarse sands are nearly 40 times larger than fine sands. Silts range in size between fine sands and clay particles.

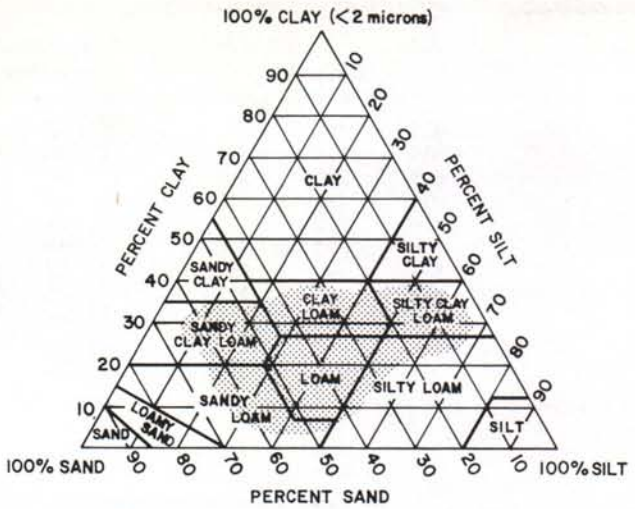
The colloidal clay and humus particles in the soil act as exchange sites between the nutrients and the turf.

Since we seldom deal with particles this small, it is necessary to compare sand, silt, and clay sizes with some things we are familiar with in order to picture their size. If we could enlarge a particle of medium sand to the size of the White House in Washington, DC, then a silt particle would be about the size of the President's limousine and a clay particle would be about the size of an orange the President is eating while riding to the Capital.

With particles this small, there are very many of them in the soil. For example, a pound of medium sand contains about 2.5 million particles, while a pound of silt will contain more than 2.5 billion particles and a pound of clay will contain over 40 trillion particles. Despite their small size, the surface area of the particles is large. A pound of sand has a total surface area of 20 square feet. A pound of silt has 220 square feet of surface area and a pound of clay would have 5,500 square feet.

Now, if you think a clay particle is small compared to a particle of sand, consider how small a molecule of water is compared to a clay particle. If you emptied the contents from a two liter bottle and filled it with sea water, and if you could tag each molecule of water in the bottle and then pour the water back into the ocean, once that water was equally distributed the world over, two liters of water from any sea would contain about 30,000 tagged water molecules.

Despite the small size of many soil particles and water molecules, there are huge numbers of them in the soil and they have a very large surface area. The greater the surface area, the more activity can take place on these surfaces. It is this high surface activity combined with living organisms in the soil that make soil a living, dynamic system than can serve as a shock absorber for sports turf.



Soils are classified by the amount of sand, silt and clay they contain. The shaded area represents soil preferred for sports turf.

Large numbers are not limited to soil particles, micro-organisms and molecules. There are some 35 million grass plants per acre. One single grass plant can produce 375 miles of roots that have a surface area of roughly 2,500 square feet.

Putting it all together, sports turf culture involves large numbers of plants with the potential for extensive root contact with soil particles, nutrients and organisms that are all part of the most amazing system ever created or devised.

Soil Organism Benefits. Natural processes in the soil convert organic matter (dead leaves, roots, insects, manure, etc.) into humus. Humus is colloidal in nature, meaning it tends to form and stabilize clumps or aggregates of soil. These aggregates are essential to holding and exchanging nutrients for plant growth.

As organic matter decomposes, a variety of products and by-products result, including cellulose, starches, sugars, oils and fats. In addition to undecomposed residues, there may also be proteins, amino acids and lignin. These are attacked by the micro-organisms living in the soil. The micro-organisms utilize what they can and release carbon dioxide, water, some alcohols and organic acids. They may also release unutilized ammonia for conversion to nitrate, a source of nitrogen used by turfgrasses.

Nitrogen is required for decomposition of organic matter to occur. For this reason, some forms of organic matter decompose more rapidly than others. If sufficient nitrogen is lacking, a supplemental application of nitrogen must be made for decomposition to continue. This is the reason fertilizer is added to compost piles. Without enough nitrogen, organic matter may remain undecomposed or it may rob nitrogen from soil reserves needed for turfgrass growth.

Populations of micro-organisms vary considerably in the soil. High populations are favored by adequate moisture, warm temperatures and the presence of organic matter. Localized dry spots, cool temperatures and low organic matter levels discourage these organisms. Population changes can take place quickly as conditions become more or less favorable.

A good sports field soil should contain billions of micro-organisms per pound. Even high sand fields contain beneficial micro-organisms, although not as many as organic soils. Beside their value to soil health while living, they also release nutrients back to the soil as they die. These nutrients include significant quantities of nitrogen, phosphorus, and potassium, in addition to small quantities of calcium, magnesium and sulfur.

Macro-Organisms. Many small animals occupy the root zones of sports turf and contribute to the living nature of the soil. Each acre of turf contains millions of insects, spiders, mites, nematodes and other creatures. Earthworms are perhaps the best known of all soil macro-organisms. Depending upon how favorable soil conditions are, there may be as many as 70,000 earthworms per 1,000 square feet.

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Average Contents and Moisture Retention Values for Various Soil Types

Soil Type	*Sand*	*Silt*	*Clay*	*Available Moisture*
		% by weight		*% by volume*
Sand	92.5	5.4	2.1	4.0
Loamy sand	80.5	15.4	4.1	7.5
Sandy loam	61.1	28.0	10.9	13.1
Loam	40.0	41.2	18.8	13.4
Silt loam	19.6	61.3	19.1	17.9
Silt	3.4	89.3	7.3	21.1
Sandy clay loam	57.1	19.6	23.3	10.4
Clay loam	26.8	41.9	31.3	11.5
Silty clay loam	11.3	56.5	32.2	14.5
Silty clay	6.5	47.3	46.2	12.1
Clay	10.2	31.0	58.8	11.0

The Living Soil

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In a year's time, earthworms may deposit as much as 40 pounds of soil in their casts on the surface for each 1,000 square feet of root zone. These casts are greatly enriched in comparison with the surrounding soil. For example, the nitrate content of casts can be three times greater than the surrounding soil. The phosphorus content is frequently six times greater and the potassium content ten times greater. These increases in plant nutrients are a result of the digestion processes of the worm.

Shock Absorption. Sports turfgrasses are living plants subjected to harsh growing conditions most of the time. Without the assistance of the organisms living in the soil, the physical and chemical processes taking place there can change little to accomodate the stress of unfavorable conditions imposed on the grass, particularly its roots. It is the living organisms in the soil that share the good times with the bad with turfgrass roots. They work together to make things better for each other.

Basically, the turf generates roots. These live a short time and die off only to form more roots. The dead roots serve as a source of food for soil organisms which, in turn, release nutrients and improve the physical condition of the soil by producing humus and related products.

Since both roots and soil organisms are alive, they compete with one another for space, moisture and nutrients. This struggle can be harmful when population imbalances occur. But most of the time, they cooexist extremely well. The net result is a buffering of soil reactions so that there is less damage from the extremes of too much or too little anything.

Excessive fertilizer in the root zone can be utilized by soil organisms protecting the roots from fertilizer shock. Soil organisms also break down pesticide residues to cancel out their pesticidal properties when they are no longer needed.

By their activity, soil organisms help in the formation of granules and improve soil structure. They cannot substitute for mechanical soil cultivation, aeration and coring. But they do help stabilize improved soil structure following these mechanical operations.

Soil Component Characteristics Defined by the USDA

Soil Separate	*Particle Diameter mm*	*Number of Particles/Gm*
Very coarse sand	2.00-1.00	90
Coarse sand	1.00-0.50	722
Medium sand	0.50-0.25	5,777
Fine sand	0.25-0.10	46,213
Very fine sand	0.10-0.05	722,074
Silt	0.05-0.002	5,776,674
Clay	under 0.002	90,260,853,860

Soil moisture relationships can also be improved by soil organisms. By decomposing organic matter they create substances that increase the moisture holding capacity of the soil as well as improve aeration. They are not likely, however, to improve moisture conditions in hydrophobic (hard to wet) soils since this problem is caused by fungi rather than the physical condition of the soil.

These benefits to sports turf come about as positive means for lessening the stress of the game on the grasses involved. The shock of physical injury to the grass is reduced. The shock of soil compaction on air and moisture requirements of roots is lessened. And the shock of misapplication of chemicals (either too much or too little) is cut.

Taking Care of Organisms. Sports turf management has come a long way in the past 20 years—perhaps out of necessity. The tremendous use on athletic fields and golf courses has forced the turf manager to apply all available technology to help turf withstand wear-related injuries. In our rush to find solutions to field problems we must make certain that we meet the needs not only of the turfgrass, but also the needs of soil organisms associated with grass roots.

We suggest that sports turf managers consider a number of adjustments to their current maintenance program to improve the health of the organisms living in the root zone of their turf. Incorporating these changes will provide the shock absorption needed by today's sports turf.

Soil Mixtures. Root zones for sport turf should be constructed to contain sufficient clay and organic matter to create a favorable cation and anion exchange capacity for