Can you impact your soil microbiology?

BY **ROCH GAUSSOIN, PHD**

Turfgrass managers, especially sports turf managers, are inundated with products that are marketed to improve turf and increase stress tolerance. Often the claims of these products are based on testimonials from end-users or manufacturers marketing departments. Academic institutions across the US and internationally unfortunately do not have the resources to scientifically test the merits of all products available.

One group of products available are designed and marketed to enhance turf "health" of both the plant and the soil through the addition of beneficial microorganisms. In theory these products are applied and the beneficial microorganisms colonize the rootzone increasing the plants capacity to combat disease, take up nutrients and tolerate stresses like drought, heat etc. Until recently little scientific information was available which provided even a rudimentary understanding of turfgrass soil microbiology and the possibility of introducing microbes into the turfgrass environment to enhance turf health.

Work completed at numerous university turfgrass research programs has resulted in information that is helpful in determining the merits of microbial applications. This research has created new and academically interesting challenges for future research, fundamental questions have been answered and common perceptions been found to be untrue or at least, suspect. This article will attempt to summarize these studies and indicate implications relevant to sports turf operations.

Here are common perceptions about microbial relationships in turfgrass soils: Excessive pesticide applications adversely affect soil microbiology; sand-based rootzones are relatively sterile; soil inoculums/additives can alter soil microbiology; and turfgrass soils are lower in microbial biomass and diversity than other soils.

From 1996-1998, sand-based rootzones located on 16 golf courses in eastern Nebraska were sampled for microbial properties in a project funded by the USGA and the O.J. Noer Turfgrass research program. The courses were separated into three distinctly different management groups based on pesticide and fertility inputs. Rootzones ranged in age from 1-28 years. Results indicated that age of rootzone was the most significant factor in microbial biomass/diversity. Management level did not influence microbiology, indicating that higher levels of management, including relatively high pesticide inputs, did not adversely affect soil microbiology.

These findings are similar to data reported from Florida and New York. Microbial biomass of sand-based turfgrass soils 18-24 months after establishment was less than native undisturbed soils, but greater than traditional row crop soils. Similar results concerning microbial levels and stability were reported in work conducted in North Carolina. These data indicated that sand-based turfgrass rootzones reached significant microorganism levels and stability relatively quickly (within 12-18 months), and levels were equal to native soils.

They also reported the temporal effects of microbial populations, with the largest populations being associated with the periods of greatest plant growth, i.e., spring and fall, which also agrees with work conducted in Nebraska. It is interesting to note that the period associated with the lowest microbial numbers also coincides with the period of greatest root pathogen activity and other stresses, i.e., summer. Obviously, these other stresses such as heat and drought are contributing to the grass decline during the summer, but the soils microbial "health" should not be overlooked.

In a relatively short time, sand-based turfgrass rootzones reach microbial levels comparable to other "native" soils. This information can be used to develop a theoretical scenario for the use of microbial inoculants. These are products that are packaged and marketed to turfgrass managers to improve the microbiology of the soil. These are often beneficial organisms packaged with other ingredients such as iron or biostimulants, or in some cases packaged as spores of the desired microbe.

These products may contain up to 10^9 organisms per milliliter of product, and application rates range from 1 to 6 ounces per 1000 sq. ft. Soil contains 10^8 bacteria per gram of soil. The relative quantity of actinomycetes is approximately 100 times less than the bacteria and fungi 100 times less than the actinomycetes, but for our theoretical example, we will disregard both.

Realizing that many soil microorganisms are sensitive to UV light and/or heat instable, and survival from purchase to application is decreased when the packaged organisms are exposed to light and/or heat, assume that all applied microorganisms survive and that the maximum use rates of the product are applied - the ratio of applied vs. native bacteria is approximately 6000 native: 1 applied, or the applied represent 0.02 percent of the total bacterial population.

When one considers the total microbial population (i.e. actinimycetes and fungi), this ratio is even more unbalanced. The applied microbes are being introduced into a hostile environment at levels considerably lower than the indigenous microbial population. It appears that the applied microorganisms have little or no chance of effectively competing with the already established population. Further, work at Ohio State showed that at approximately 2 years post-construction in a soil/sand/compost vs. sand/peat rootzone, microbial diversity was not different, even though the former rootzone was significantly higher at establishment. While the compost increased microbial taxa initially, a natural equilibrium ultimately occurred in 1-3 years.

Research has shown the benefits of biological pest control products, where the goal is pest control as opposed to increasing microorganisms in the soil. Structured research is limited, but work is increasing. Since it appears that new sand-based rootzones take 1-2 years to reach equilibrium, the use of microbial-based products may have merit during establishment. Work in this area continues, and perhaps future research will shed more light on the use of microbial inoculants in turfgrass management. In summary:

* Relatively high pesticide applications do not appear to adversely affect soil microbiology.
* Sand-based greens are not sterile, but in fact, reach levels of native soils in a short time.
* Soil inoculums/additives may alter soil microbiology in the short term, but their use on established turfgrass soils is questionable. ST

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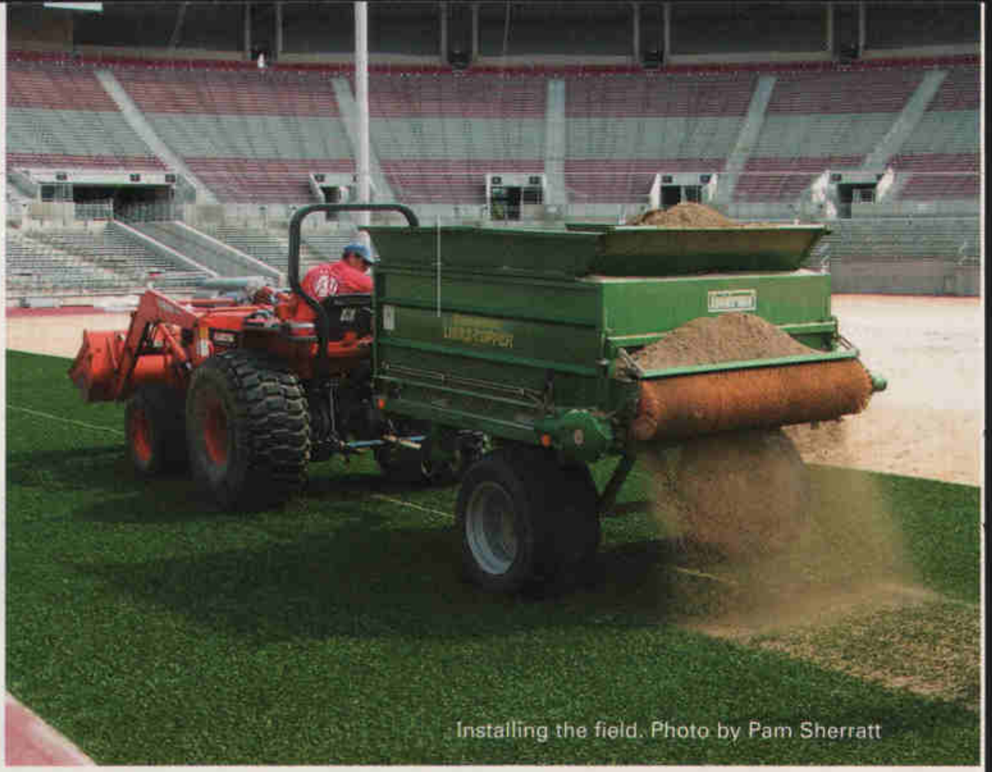

Installing the field. Photo by Pam Sherratt

OSU's stabilized turf a Buckeye exclusive

BY **CHRIS HARRISON**

Being nationally ranked in football is nothing new for the Ohio State Buckeyes. And the field they played on this year justifies national ranking, too. With a brain trust made up of Ohio State alums from the grounds superintendent to the sports turf researchers to the vendors, the Buckeyes got the best possible field they could find.

In summer 2003, Ohio State upgraded its field to a new Prescription Athletic Turf System and TS-II Synthetically Stabilized Turf. The new field is a mixture of perennial ryegrass grown through a synthetic grid and stabilized by a sand base.

"This has worked a lot better than we anticipated. The field has held up great," says Ohio State Athletic Grounds Superintendent Brian Gimbel.

The Buckeyes already were familiar with stabilized turf. For three years they had been using a stabilized Kentucky bluegrass field. "It was working well but there were a lot of challenges," Gimbel says. For one thing, they were watching plots put out by Dr. John Street and Pam Sherratt, extension sports turf specialists at Ohio State. The bluegrass was having problems that the ryegrass plots were not experiencing.

The question of whether or not to change turf was made by the fans after the Michigan game a year ago. Excited fans swarmed onto the field and pulled up great chunks of turf, right through the stabilizer. They tore through the thatch and the grass. Gimbel could understand their excitement; he earned his BS in agronomy at Ohio State 10 years ago and now is in charge of all Ohio State outdoor varsity sport facilities, including the field inside the Horseshoe.

The biggest change was the decision to install a seeded ryegrass field, instead of bluegrass. One of the prime concerns was keeping moisture off the surface.

"We grew the field in from seed," Gimbel continues. The ryegrass is a mixture of six cultivars from three breeding groups and suppliers. One of the turf's main features is high resistance to gray leaf spot and pythium.

On synthetically stabilized turf, fertilization, mowing, and irrigation are about the same as any other sand-based field, says Sherratt. She recommends careful monitoring of the fertility levels through soil and tissue testing etc. "Because we used perennial ryegrass this year, we did have a preventative fungicide program developed with our pathologist, Dr. Mike Boehm," she adds.

The three main management differences are verticutting (more verticutting to keep biomass accumulation down); tining (they have done none yet as they know from experience that it ruins the integrity of the stabilizer); and little-or-no topdressing, which would also create a biomass build up and move the stabilizer away from the surface.

Since they grew the field in from seed, they were able to lay the stabilizer in long, full strips. They run about 15 feet wide by 40 yards long. "We were able to lay enormous sections flat and then sow them together," Gimbel says. Then they put the sand on top.

Keeping organic material off the field is a prime concern of Gimbel's. During the season the crew mows every day at fifteen-sixteenths to one-inch height. In the off-season, they may mow every other day.

Topdressing strategy is another ticklish area. "I know one field manager who does topdress his field but plans to take all live matter off with the Koro and re-seed onto the stabilizer surface," Sherratt says. "That might be an option for us, but we literally play it week-to-week." In fact, Street and Sherratt meet once a week during the season with the stadium crew (Don Patko, superintendent of athletic facilities; Gimbel; and athletic grounds specialists Brian Blount and Brent Packer) to make plans for the week ahead.

The rye grows more quickly and is sturdier than the Kentucky bluegrass that used to cover the field. Joe Motz of The Motz Group, Cincinnati (www.themotzgroup.com), installed the new system. Keeping it in the family, Motz is also an Ohio State graduate, with a 1977 degree in Horticulture.

The old system, also installed by The Motz Group, was replaced with the TS-II product, a combination of real grass and a synthetic base to hold it in place. It combines sand-filled, fibrillated synthetic tufts and a backing of biodegradable fibers and plastic mesh. The unique matrix shelters the vegetative parts of the grass plant that are essential for vigorous growth and rapid recuperation.

"I personally feel that sand-based fields (those with over 90% sand) have to have some kind of synthetic reinforcement, whether it be Motz TS-II, GrassMaster, Loksand, or Fibresand, etc.," Sherratt says. She adds that these systems usually are too expensive for most high schools but should not be a problem for high-profile facilities.

A plastic grass field costs $800,000; if a stadium manager replaces the stabilized natural grass field every three years, that would still give 15 years for the same money.

Ohio State seeded the field during the first week of May and felt that it was playable several weeks after seeding date. "Note we used 100% perennial ryegrass," Sherratt says. "Establishing soil sod is a whole different ball game. If it rains a lot (like it did last year), then the imported sod layer remains saturated for long periods of time and it's difficult to core until is it drier and knitted down a bit."

Research shows that the amount of time it takes to root depends upon the turf thickness, with thicker cut sod, like that used in sports, taking a lot longer than washed or regular cut.

Gimbel was pleasantly surprised that the system required less overseeding than he expected. "I thought we'd be sending out tons of rye seed through the year," he says. "But the stabilizer held the crown of the plant intact."

In 2003, they had no serious divots all season long. There was some leaf tearing from cleats, but Gimbel points out that is exactly what they want to happen. The player's foot is released immediately and the leaf, not the whole plant, gives. "The crown shoots out a new leaf and the divots heal back quickly," Gimbel says.

Ohio State did overseed the field by the fourth game. "It was thinning a bit," Gimbel recalls. But overall, he is quite happy with the new field. ST

Chris Harrison, like everyone else involved in this article, is a graduate of The Ohio State University.

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