



SHINE

SOIL HEALTH INSTITUTE
OF NUTRIENT EFFICIENCY

SOILLIFE™

Health Care for the Soil



How to Build Turf Quality From the Bottom Up

When it comes to turf, professionals understand that there's always more to it than meets the eye. Although turf is ultimately judged by its appearance, professionals know that healthy color, consistency and density all depend on factors below the surface: the health of the plant's roots and the condition of the surrounding soil. Until recently, however, turfgrass professionals didn't have a truly effective tool for managing soil condition and promoting root growth.

Today, turfgrass professionals can reach for a unique soil amendment that has been proven effective even in problem spots. University studies have shown that SoilLife helps improve soil structure and water utilization, and improves root growth and nutrient uptake. The bottom line: healthier soil for healthier turf.

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Welcome to

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This brief but informative curriculum is designed to give you an overview of the latest developments in soil conditioning technology. Review the reading material at your own pace. When you have finished, please turn to the Knowledge Assessment Questionnaire.

SOILLIFE™

Health Care for the Soil

LESSON 1: Why some grass is always greener...

Turfgrass 101: The basics of soil microbiology

As you know, plants require nitrogen (N) and other nutrients to support growth. The plant uses these elements to generate the amino acids necessary for protein synthesis and many other metabolic functions. Grass obtains the nitrogen it needs from the soil; however, over time, levels of available nitrogen in the soil can be depleted and must be replaced. Soil microorganisms—microbes such as nematodes, protozoa, bacteria and other forms—cycle nitrogen and other nutrients in such a way that makes the nutrients more readily available for plant uptake. Unfortunately, just adding more microbes to the soil does not necessarily have a significant impact on the factors that ultimately impact turf quality, such as root growth, nutrient availability, soil structure, water utilization or soil salinity.

Metabolic function matters more than microbe counts

Research has shown that a product's metabolic functioning, and not microbial counts, is the critical variable that sets one soil amendment apart from others. In other words, what the microbes can do is more important than just how many organisms are present. (See Figure 1.) Products containing a very broad range of food sources that the microbes can metabolize will also make a wider range of nutrients more available in the soil and, ultimately, to the plant. As a result, there is greater nutrient uptake and the plant builds greater biomass—roots and shoots.

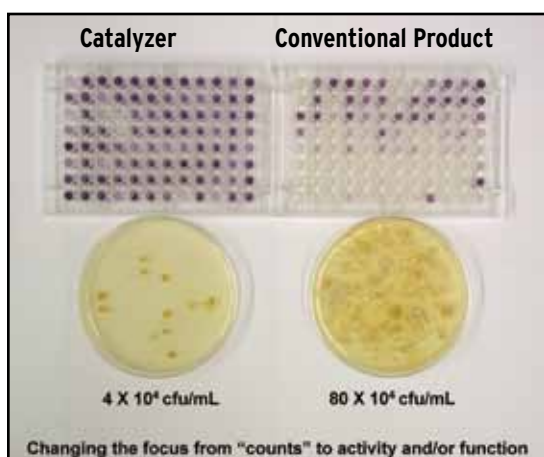


FIGURE 1: The broad metabolic capability of the microbes that go into the making of SoilLife help make the product unique. Note that the round Petri plate on the right (the conventional product) holds a larger number of organisms than the plate on the left (the bacteria from SoilLife). On the rectangular plates above, each purple spot represents a different food source that the organisms in the round Petri plates can use. The rectangular plate on the right has fewer purple spots, even though there are more organisms. The SoilLife organisms have greater metabolic function—so fewer bacteria can use a wider range of food sources.

Introducing a new generation of soil amendments

Microbial functioning goes beyond just cycling nutrients. It also involves the way that the microorganisms interact in the soil, which is influenced by the many different biochemicals these organisms produce. What makes SoilLife so unique is that it is derived from a proprietary fermentation process that harvests naturally occurring, beneficial microbes along with their fermentation medium. This fermentation medium also contains important biochemical by-products produced by many different organisms. Thus, SoilLife brings together a unique combination of bacterial metabolic functioning and a biochemical support system—which is why it works so well in the soil.

In numerous university studies, SoilLife has been shown to enhance nutrient availability and plant uptake. Figure 2 shows the results of a University of Florida study on nitrogen uptake in perennial rye and hybrid Bermudagrass. Turf grown in soil treated with SoilLife absorbed 50 to 75 percent more nitrogen than the untreated control (all treatments received the same fertilizer). With greater nutrition, grass is able to grow stronger and healthier. In turn, more and deeper roots further enable nutrient uptake—ultimately supporting turf vigor and vitality and improving coverage. (You'll learn more about building a better root system with SoilLife in the next lesson.)

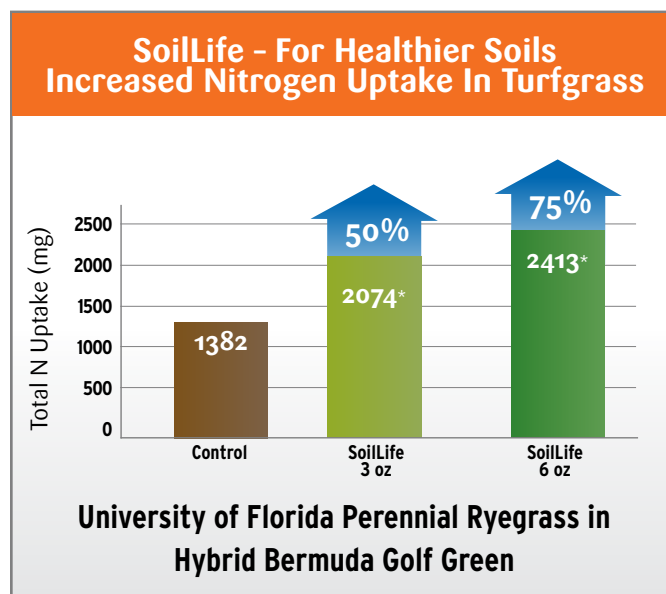


FIGURE 2: The technology in SoilLife can significantly increase nutrient uptake at the standard rate of 3 ounces per 1,000 square feet, and results increase with higher application rates.

*Indicates significantly greater N uptake following SoilLife treatments

SoilLife Shown to Outperform Other Biologicals

Studies at top universities demonstrate that SoilLife can improve turf quality—and its unique formulation significantly outperforms many types of soil amendments that are based on conventional biologicals alone. Cornell University conducted a study comparing 15 fertilizer and soil amendment products, including SoilLife, for the Golf Course Superintendents Association of America. Over the course of five months, turf grown on soils treated with SoilLife combined with a standard fertility program showed consistently higher quality than grass treated with the standard fertilizer program and competitive products — including most of the enhanced fertilizer products. (See Figure 3.) Healthy turf grew even healthier.

Cornell Shows that SoilLife™ Outperformed Biologicals Cornell University - Turfgrass Controlled Experiment

Turf Quality (1 = poor, 9 = exceptional)

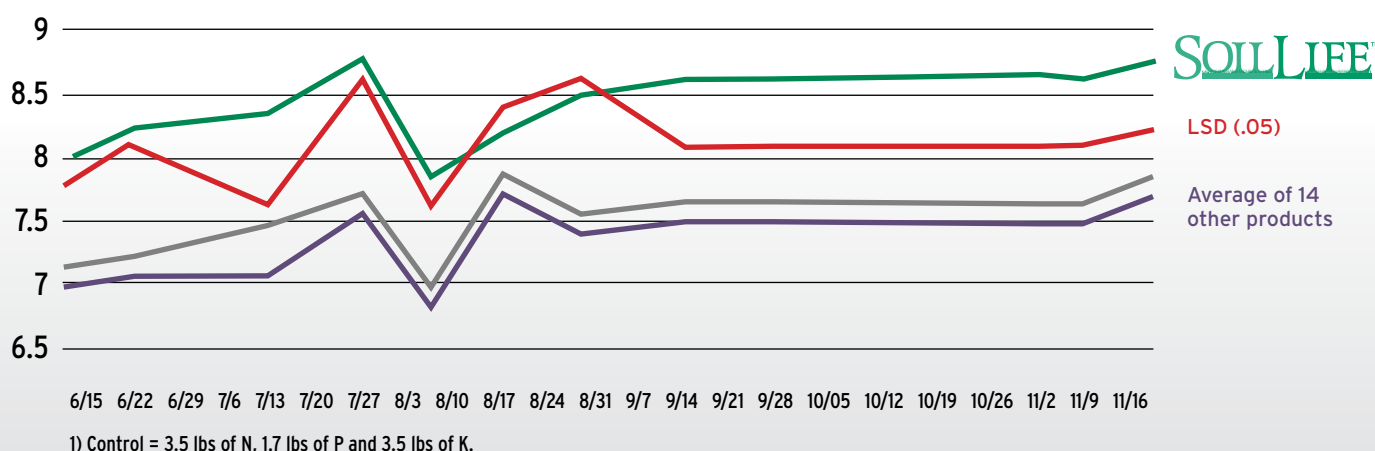


FIGURE 3: In a controlled experiment conducted by Cornell University, turf grown on soil treated with SoilLife consistently received the highest ratings for quality— from 8 to 8.5 and higher on a scale of 1 to 9, where 9 = “exceptional” quality.

LESSON 2: The root of the matter

Great turf starts with a solid foundation

Good turf quality depends on an effective root system for the absorption of nutrients and water. Thus, a good root mass helps turf thrive and resist adverse conditions. SoilLife soil amendment improves root growth and soil functions, which impact turf in a number of ways:

- 1) Increasing nutrient availability: You already learned that treating soil with SoilLife can increase nutrient uptake in turf by 50 percent or more. It does this by making nutrients in the soil more available to the plant and by preventing nutrients from becoming locked up in the soil. As the plant grows more and deeper roots, the increased root mass can absorb even more of the available nutrients from the soil. In turn, the roots release carbohydrates from photosynthesis that feed the soil microbes. The soil microbes then help to cycle nutrients and maintain soil structure.
- 2) Improving soil structure and tilth: Research shows that soil treated with SoilLife tends to be less compacted and have better structure than untreated soil. As a result, roots can grow deeper, and the soil can hold water more efficiently.

In summary, SoilLife improves root growth and nutrient uptake while also reducing soil compaction. These functions encourage expansion of the root system, which feeds the plant and the soil microbes. Together, the roots and microbes further improve soil structure—so SoilLife is the key to integrating the functions of roots, soil microbes and good soil structure. You'll learn more about soil compaction and structure in the next lesson.



FIGURE 4: Researchers at Auburn University showed that SoilLife can improve root mass and increase shoot density. The photos show a harvest of blue grass in August, 60 days after seeding. All plants received an application of the same complete fertilizer. The grass on the left was grown in soil treated with SoilLife.



FIGURE 5: The photo shows bentgrass grown in Winnipeg, Canada. The grass on the left was grown in soil treated with SoilLife, and its roots are significantly longer than the untreated grass in the control plot.

LESSON 3: Breaking up isn't so hard to do

SoilLife reduces compaction and improves soil structure

Getting nutrients to the roots only solves half the problem. Healthy grass needs deep roots, especially under stressful conditions like drought or heavy traffic. If the soil is too compacted for the roots to go anywhere, the roots grow shallow, thin and horizontal to the surface, and the turf suffers. Soil compaction is the result of both chemical and physical stresses on the soil. These include the use of high salt index fertilizers, broad-spectrum fungicides and heavy equipment. These ever-present stresses also have an adverse effect on the soil's microbiological functioning, and the combination of all these factors can severely restrict plant growth.

SoilLife helps to rebuild soil structure by balancing some of the soil's chemistry. It reduces salinity, promotes the development of soil aggregation and loosens up the soil. This permits better movement of air and water, further stimulates microbiological activity, and allows plant roots to grow deeper into the soil.

See improved soil structure and tilth in as little as six weeks

Plant growth response and rooting depth are the best indicators of soil improvement. It's possible to determine soil improvement by measuring how deep a penetrometer can penetrate into the soil before reaching a resistance of 300 pounds per square inch (psi). Roots can't push through the soil if it takes a penetrating force greater than 300 psi. The penetrometer can be pushed deeper into soils treated with SoilLife before reaching this 300 psi limit than it can into untreated soils—and in many cases, the difference can be detected within just six weeks of the SoilLife application.

The developers of SoilLife and a leading lawn care company tested soil compaction and root growth in treated and untreated soil. Six weeks after application, they measured the 300 psi limit with a penetrometer. Root depth in the untreated soil actually *decreased* as the stress of summer weather reduced soil permeability. The root depth was 119 percent deeper with SoilLife, due to decreased soil compaction. (See Figure 6.)

Effective Compaction Reduction and Increased Root Growth

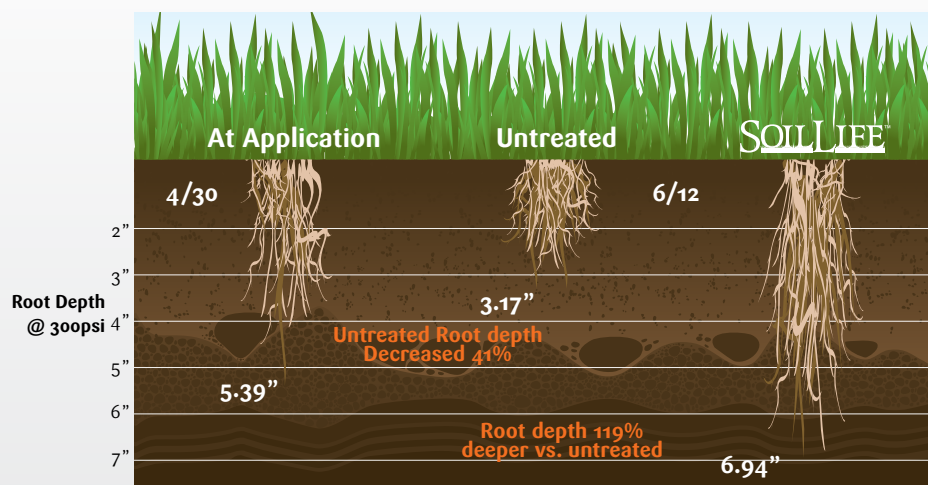


FIGURE 6: Root depth was 119 percent deeper with SoilLife vs. untreated, due to decreased soil compaction

Source: AMS and a leading lawn care company - Maryland

LESSON 4: Water, water everywhere... even when it hasn't rained

Water balance is critical—to the plant and to the soil

Soil moisture content must be maintained within an optimal range. Soil moisture substantially below or above 50 percent of the soil's maximum water-holding capacity is costly—both in terms of long-term harm to the soil's productivity and in wasted energy costs.

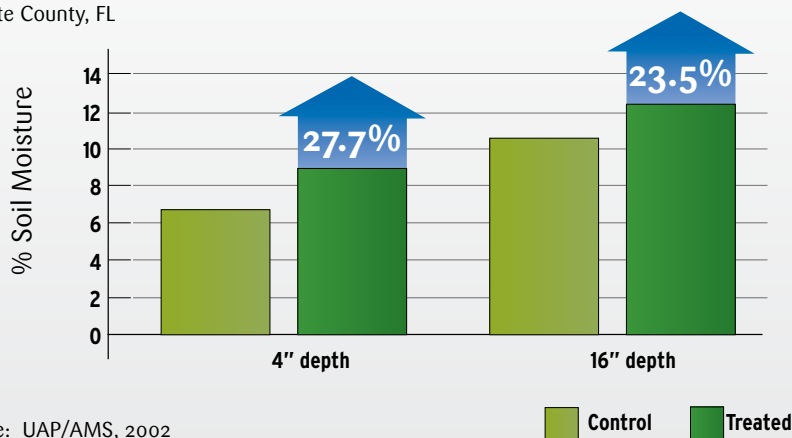
You know what a dry spell can do to turf. Not only do grass plants not get enough water, but insufficient moisture promotes the build-up of salts in the soil, which destroys soil structure and further lessens the roots' ability to take up water. On the other hand, overwatering can lead to excessive moisture, which reduces soil aeration, wastes water and creates unnecessary additional financial burdens related to pumping and labor costs. Therefore, water management can be a challenge.

SoilLife improves water management

Water management is the skill of efficiently applying water to the soil to meet plant requirements and stimulate aerobic microbiological functioning. SoilLife works within the soil to reduce salinity and improve soil structure. Good soil structure results from the combination of small and large soil aggregates, which creates small and large pore spaces for improved drainage and aeration. This leads directly to improved water management, because the soil is better able to hold moisture for plant growth, while allowing excess moisture to drain. As a result, turf professionals can better judge water requirements and avoid over- or underwatering.

SoilLife - For Healthier Soils Improves Soil Water Efficiency

Charlotte County, FL



Source: UAP/AMS, 2002

FIGURE 7: SoilLife improves soil water efficiency. In a study in Florida, soil treated with SoilLife held 27.7 percent more moisture at a depth of 4 inches than untreated soil, and 23.5 percent more moisture at a depth of 16 inches—giving plants an advantage during dry spells.

LESSON 5: What you need to know about the salt of the earth

Salt build-up breaks down soil and stresses turf

Soil salts include sodium chloride, carbonates, phosphates, sulfates and other compounds. These salts build up in soil due to long-term use of some fertilizers, use of high-salt irrigation water, alkaline soil materials and lack of rainwater, which is necessary to flush out the salts. As the salts accumulate, they cause the soil structure to breakdown, which leads to soil compaction. Salts also cause an osmotic stress on plants, making it difficult for the roots to access and take up water.

SoilLife reduces sodium and total salts in treated soils

SoilLife has been shown to reduce the soil's electrical conductivity, which is a measure of the soil's total salts, and reduce sodium levels, improving plant growth in salt-affected soils. Figure 8 shows the results of soil analysis conducted by the Texas A&M extension service. In this case, the application of SoilLife helped reduce the level of total salt in the soil by more than 60 percent in the first year.

Several interacting mechanisms may be involved in SoilLife's ability to remediate soil salinity. One of these is an improvement in the base saturation percentages, i.e., the relationship between concentrations of four key soil elements: manganese, calcium, potassium and sodium. These elements are not created or destroyed, but they may be unevenly distributed within the soil in plant-available and unavailable (insoluble) forms. In the case of sodium, where lower water-soluble concentrations are desired, SoilLife helps to increase the ability of water to leach sodium away from roots. This improvement in soil chemistry leads to improved soil structure and turf quality.

Soil analysis results on extremely salt-contaminated soil by Texas A&M University:

	Calcium	Magnesium	Potassium	Sodium	Total Salinity	Soluble Salts
SoilLife™	154 ppm	83 ppm	44 ppm	178 ppm	815 ppm	2.06 mmhos/cm
Alternate Treatment	493 ppm	284 ppm	94 ppm	494 ppm	2138 ppm	5.37 mmhos/cm

FIGURE 8: The technology in SoilLife soil amendment has been shown to reduce total salinity and soluble salts, freeing up nutrients such as potassium and magnesium for plant use.

LESSON 6: Get to the bottom of better turf

SoilLife is ideal for a variety of applications

As you've learned, optimal soil growing conditions—soil structure, soil chemistry, moisture content and other factors—are critical to turf quality. SoilLife soil amendment helps improve turf quality from the bottom up, whether you're planning a new course or addressing trouble spots.

Grow-ins:

The most critical part of any new construction or renovation project is the grow-in and establishment of a new stand of turfgrass on greens, tees, fairways and rough. When applied just prior to planting as a pre-plant soil amendment, SoilLife's unique blend of beneficial microorganisms, microbial by-products and nutrient package has been shown to "jump start" grow-ins. The result is faster and better grow-ins—a healthy and playable stand of turfgrass that can let a new course open sooner and in better condition without the need for more fertilizer.

Overseeding:

Getting a golf course overseeding ready for play more quickly depends directly on the ability to get seed to germinate and turf to grow and cover. University studies and field trials have shown the benefits of including SoilLife soil amendment in an overseeding program. SoilLife can help improve germination and stimulate a stronger and healthier root system, providing improved cover and vigor.

In fact, in a study on Bermudagrass at Texas A&M, SoilLife yielded impressive results: higher germination rates, greater coverage and more roots. (See Figure 9.)

Microbial technology offers advantages around the course

The microbial technology behind the SoilLife soil amendment is highly versatile. In addition to turf management benefits, the technology also provides a green approach to eliminating wash pit odors and solids. Based on the same microbiological technology as SoilLife soil amendment, PitBoss™ treatment breaks down suspended solids and eliminates odors from wash pits and drainage areas. Its stable microbial blend effectively digests grass clippings, petroleum products and other organic and inorganic solids.

Texas A & M Research SoilLife Yields Impressive Results

Bermudagrass
Victorian silt clay soil

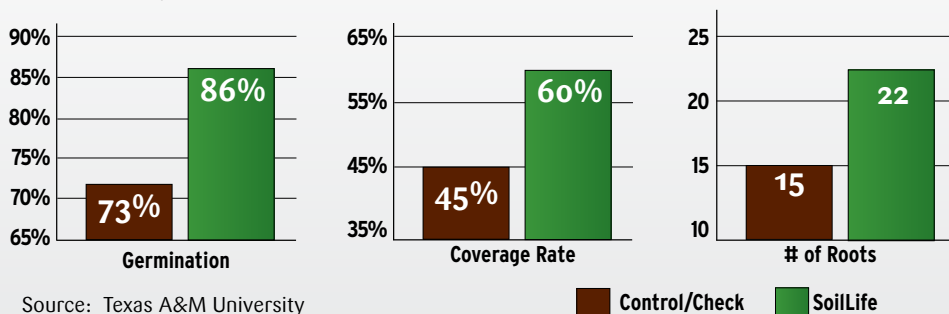


FIGURE 9: Texas A&M University conducted a study of SoilLife for Bermudagrass grown in Victorian silt clay soil. Grasses grown on the soil treated with SoilLife had a 13 percent higher germination rate than untreated soil, a 15 percent higher coverage rate and a greater number of roots.

Be on the forefront of turf technology

To learn more about the advantages of using SoilLife soil amendment, or for application protocol information, call Nutrient Technology Partners at 610-594-9950 or log onto www.nutrienttechnologypartners.com

SoilLife™ Knowledge Assessment Questionnaire

Your name _____

Company name _____

Address _____

City _____

State _____ ZIP _____

Phone _____

Fax _____

E-mail _____

Profile

 Turfgrass Professional Distributor Lawn care

Approximate acreage _____

Please complete the questionnaire below and return it to:

Nutrient Technology Partners
404 Newcomen Road, Suite 200
Exton, PA 19341**1. What is the greatest determiner of turf quality?**

- a) Seed quality
- b) Soil quality
- c) Fertilizer quality
- d) All of the above

2. What is the role of soil microorganisms?

- a) They enable plants to generate amino acids for protein synthesis.
- b) They replace depleted nutrients in the soil.
- c) They cycle nutrients to make them more available for plant uptake.
- d) None of the above.

3. What is the primary driver of soil microbial amendment efficacy?

- a) Metabolic function
- b) Microbial count
- c) Nitrogen
- d) Photosynthesis

4. SoilLife soil amendment is different from other biological amendments because it...

- a) Costs less
- b) Combines microbial functioning and microbial by-products
- c) Contains no microbes
- d) Contains more microbes

5. SoilLife soil amendment improves plant vigor because it...

- a) Is better for the environment
- b) Includes a stabilizer for consistent performance
- c) Improves plant nutrient uptake
- d) Contains microbes

6. SoilLife makes turf management easier because it...

- a) Enhances soil structure
- b) Enhances nutrient efficiency
- c) Supports better plant quality
- d) All of the above

7. It is important to reduce soil compaction because doing so...

- a) Improves root penetration in the soil
- b) Improves soil moisture content
- c) Improves soil aeration
- d) All of the above

8. Improved root growth...

- a) Reduces soil salinity
- b) Increases a plant's access to water and other nutrients
- c) Directly stimulates microbial functioning
- d) b and c but not a

9. Why is water management challenging?

- a) Underwatering can create problems.
- b) Overwatering can create problems.
- c) Using recycled water can create problems due to high salt content.
- d) All of the above

10. Applications of SoilLife soil amendment are recommended for...

- a) Grow-in
- b) Overseeding
- c) Turf maintenance
- d) All of the above