Why Bother Learning About Turf Microbiology?

IPM Corner

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The life of a turfgrass manager is much easier when the soil contains a balanced array of microscopic organisms, because they increase plant health. The benefits of fostering this natural ecosystem include adaptability and resiliency of the turf. High microbial activity in the soil leads to increased root growth over time, due to effects on soil quality and improved nutrient availability. There are beneficial bacteria and fungi in soils, sludge and composts, and new biological control formulations to prevent turfgrass diseases. With an improved root system, the turf will show less damage from the stress of low mowing height, seasonal changes, dry, hot weather, heavy rainfall, insects, or diseases.

Nutrient cycling depends on the activity of microorganisms. Many species of bacteria and fungi are decomposers, organisms that feed on grass clippings, thatch, and other dead plant and animal materials. These microbes release soluble substances into the soil that are excellent nutrient sources and stimulators of plant growth. Most decomposers need temperatures above freezing, some moisture, and a good supply of oxygen. They also need nitrogen, and will compete successfully with plant roots for nitrogen if necessary. There must be sufficient nitrogen to keep decomposition going and prevent the plants from yellowing.

Other groups of bacteria in the soil live on simple elements in the air and soil, converting these elements into molecules that plants can absorb and use. One example is the nitrogen fixing bacteria that use gaseous nitrogen from the atmosphere, releasing complex nitrogen compounds to the soil.

Occasionally the benefit of bacterial activity is not appreciated until it is gone. For example, when a fungicide drench was applied to Easter lilies in a central New York greenhouse to suppress root disease, it killed the beneficial bacteria, and very severe root damage was observed. The bacteria were critical in converting urea in constant-feed fertilizer into a form of nitrogen that roots can take up. Without the bacteria, the soluble salts accumulated to toxic levels, and the roots died. Chemicals applied to outdoor soil can also result in major shifts in the microbial activities observed, with drastic results at times.

Soil quality is very closely linked to the biological properties of soil. Many physical and chemical properties of soil are influenced by microbiological processes. Some of the properties affected by the size and composition of the microbial biomass are water holding capacity, aggregate stability, and susceptibility to compaction.

Decomposers are present in enormous quantities in soil, estimated in tons per acre. Not only do they release substances taken up by roots, but they also secrete complex carbohydrates that have beneficial effects on the physical aggregation of the soil. When they die, their mass increases the organic matter content of the soil and becomes part of the mysterious material called humus. This material is highly valued as a soil constituent because it has a very high exchange capacity for charged mineral ions and it also retains water.

Biological control of turfgrass diseases relies on addition of specific beneficial organisms and topdressing with compost. Inoculation with microbes and supplying rich organic matter to boost microbial activity increase the diversity and activity of soil organisms in the soil. Disease suppression and deeper rooting are the long term goals.

Nearly all turfgrass diseases are caused by common pathogens, fungi that can infect, colonize and reproduce on many types of plants. There are natural microbial enemies of the disease-causing fungi. They may compete with pathogens for food, secrete antibiotics that antagonize the pathogen, or use the pathogen as a food source. A standard farming practice for controlling diseases is to till infected plant residues into the soil, where decomposers will degrade the plant material and fungi together. In turf, topdressing with good compost can achieve the same purpose, supplying organic matter to native microbes, and increasing the moisture and nitrogen levels in the top inch or two of the soil. Active microbes will reduce the inoculum potential for disease, as well as digesting the thatch.

Many beneficial bacteria and fungi have been isolated that can successfully compete with pathogens in laboratories. It is more difficult to predict what formulated products containing these live organisms will do in the field than in the lab, where conditions can be controlled. Positive reports have come in from golf course superintendents who are injecting live suspensions of bacteria into turf. They are noticing both increased rooting depth and reduced incidence of disease. The turfgrass ecosystem will benefit from increased diversity and greater microbial activity, whether it is from applying organic fertilizer, a topdressing of processed municipal sludge, or a generous application of live benefi

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Snow Mold Diseases

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Preventive fungicide applications are quite helpful in minimizing snow mold damage. However, oftentimes the fungicides effective against Typhula blight are not always effective against pink snow mold. Among the better choices for fungicide applications are iprodione (e.g., Chipco 26019 2F) applied at 4-8 oz./1000 ft^2, azoxystrobin (Heritage 50WG) applied at 0.4 oz./1000 ft^2, or PCNB (e.g., Terrachlor 75W) applied at 8 oz./1000 ft^2. These fungicides are usually applied in mid to late October up until mid November prior to turf dormancy and snow cover.

In the spring, be sure to rake out any diseased areas to facilitate drying and fertilize to promote turfgrass growth. Snow molds are generally not devastating. But, if left untreated, could destroy vast areas of turf. So take some time now to prepare your turf for next spring!

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Turfgrass soils should be well drained and free of significant levels of compaction. Thatch accumulation should also be kept to a minimum to avoid high levels of water retention.

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cial microbes to the root zone. Chemical pesticides should be used as sparingly as possible. The goal: a balanced and active microbial population, and heathy green grass.

In future reports on this subject we will examine other questions: For example, how do cultural practices (mowing height, leaving clippings on the turf, watering, fertilizing, cultivating or removing cores of the turf, de-thatching, topdressing, applying fungicides, applying insecticides, liming) affect turfgrass microbiology?

What can we do to improve microbial activity and soil health? While cultivation plus topdressing relieves soil compaction, manages thatch, improves drainage by breaking through soil layers, and aerifies the soil; what is the effect of short term inoculation for biological control? Is there a gradual increase in rooting depth by adding compost?

What are the roles of organic matter and humus in turfgrass microbiology? Adding organic matter increases activity until nitrogen is limiting. What about the release of complex and simple nutrients that can be absorbed by roots, or changes in the population profile. Humus — organic matter at the endpoint, no longer degradable by bacteria — results from the cycling of bacterial products. What are the special roles of actinomycetes, saprophytic fungi and nematodes?

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