Compost Amendments for Turfgrass Disease Control

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Intensively managed turfgrasses, such as those on golf course putting greens, athletic fields, and other high-traffic areas, have traditionally been grown on soils modified through the addition of both organic and inorganic amendments. This is done to minimize compaction and other plant stresses, and to improve plant-soil relationships for the enhancement of turf growth. Today, turf on golf course putting greens is commonly grown on completely artificial growth media similar to those used in the floriculture and nursery industries.

Newly constructed or renovated golf course putting greens are typically built according to specifications outlined by the United States Golf Association. These specifications call for root zone mixes that consist largely of sand mixed with some form of organic matter, usually peat. Similarly, topdressing mixes, which are used to smooth putting surfaces, manage thatch, and, over time, modify underlying soil conditions, consist of similarly-combined components. Under these manufactured growing conditions, a key element to optimum turfgrass culture is high quality organic amendments. These amendments serve to increase water and nutrient retention, decrease bulk density, increase microbial activity, and increase soil strength in root zone profiles that otherwise consist largely of sand.

Peats have been the most common types of amendments used in turfgrass management. However, in recent years, turfgrass managers have increasingly turned to composts for use as amendments on high maintenance turf. Composts are prepared from a variety of organic wastes such as leaves, grass clippings, animal manures, industrial by-products such as municipal biosolids, food residuals, and mixed solid waste (MSW). These materials are gaining greater use and acceptance as widely available and high quality amendments.

Composts are much more readily decomposable than most highly decomposed peats. As a result, these types of amendments support greater microbial populations and microbial activities important to turfgrass health. Benefits of using composts include reduced thatch buildup, reduced soil compaction, reduced nitrate and pesticide movement, increased levels of soil organic matter, and reductions in the incidence and severity of certain turfgrass diseases. It is the latter attribute that offers the greatest potential impact on turfgrass management, providing a cost-effective alternative to traditional fungicide disease control programs.

Results of studies conducted over the past 10-15 years have clearly shown the potential for compost amendments to reduce the severity and incidence of a wide variety of turfgrass diseases, particularly when applied either as a topdressing, a dormant turf cover, or a root zone amendment.

TOPDRESSING AMENDMENTS

Golf course superintendents routinely topdress putting greens with a thin layer of sand, sand/organic matter, or sand/organic matter/soil mixtures. The purpose of topdressing is primarily to smooth putting surfaces and to manage thatch, but also to gradually modify underlying soil properties. Among the goals of amending topdressing mixes with composts are to increase the nutrient and water holding capacities of sand-based growth media and also to convert a relatively biologically-inert material into a biologically-active soil amendment. Yet, most typically, the organic component of a topdressing mix consists of sphagnum peat. Many sphagnum-based mixes contain little or no disease suppressive activity. Numerous studies with container media have verified this property.

Studies have shown that monthly applications of topdressings composed of as little as 20% compost by volume applied at rates of 10 lbs compost/ 1000 ft2 are effective in suppressing foliar as well as root diseases of turfgrasses. For example diseases such as dollar spot, brown patch, Pythium root rot, Typhula blight, and red thread have been effectively reduced following topdressing applications of various composted materials. Reductions in severity of Pythium blight, summer patch and necrotic ringspot have also been observed in sites receiving periodic applications of composts. The levels of disease control vary widely, but can be as great as 94% , depending on the target disease, the compost feedstock, and the manner and degree to which the material is composted.

Whereas the short-term magnitude of turfgrass disease control using compost-amended topdressings may not match that typically achieved with fungicide applications, the longer-term level of control often equals or exceeds that attainable with fungicide applications. This is, in part, related to the ability of composted topdressing amendments to gradually reduce populations of some pathogens in turfgrass soils, an effect not realized with fungicide applications. The level of turfgrass quality is also greatly enhanced over what one would typically achieve with fungicide applications. The reasons for this are undoubtedly due to many undescribed mechanisms of growth enhancement and pest suppression. In some cases, the improved quality following compost applications can be evident years after compost applications cease.

TURF COVERS

Typically in the late autumn across the northern tier of the United States and across Canada, once cool-season turfgrasses become dormant, golf course superintendents routinely apply fungicides for control of snow mold diseases caused by *Typhula* spp. (Typhula blight) *and Microdochium nivale* (pink snow mold). In addition to fungicide applications, some golf course superintendents cover greens with protective tarping to prevent desiccation and ice damage to the putting surface. Covering greens also alleviates some early season disease problems such as Pythium root rot, cool-season brown patch, and anthracnose basal rot since protected turf comes out of dormancy in a less-stressed condition and is not as predisposed to diseases as uncovered turf. Results of preliminary studies have indicated that a dormant application of certain composts to golf course putting greens in the late autumn appears to be a promising substitute for artificial turf covers, allowing golf course superintendents to not only protect greens from winter damage, but also from snow mold damage.

The insulating properties of the compost, combined with its dark heat-absorbing properties, will help to retain soil heat and at the same time, absorb additional heat on sunny winter days. Additionally, the compost will harbor many different microbes and also stimulate the activity of native soil microbes. The activity of each group can potentially provide a significant level of disease control. The elevated temperatures under a compost cover should provide conditions for microbial activity, even during the winter months. Collectively, these conditions should discourage the development of snow mold diseases and reduce the risk of winter turfgrass damage.

This type of application strategy has promise in providing long-term disease control at least through spring and early summer when turf is susceptible to a number of disease problems. It may also provide a means of maintaining elevated levels of microbial activity and potentially reducing populations of pathogens in golf course putting greens.

ROOT-ZONE AMENDMENTS

Composted root-zone amendments have the potential to induce much higher levels of disease suppression, particularly for root-infecting pathogens, than topdressing amendments since greater quantities of material can be placed in the root zone. Additionally, preplant organic amendments to root zones such as those in sand-based golf course putting greens may have dramatic long-term disease control efficacy. In studies conducted here at Cornell University, we have found that amending sand-based greens with either a municipal biosolids compost, a brewery sludge compost, or a reed sedge peat induces a high level of suppression of Pythium root rot disease. In our studies, these amendments provided complete control 6 months after incorporation and retained their suppressive properties for up to 4 years.

One of the concerns of using compost amendments in this way, particularly on USGA specification sand-based greens having a perched water table, is that over time as the organic materials decompose, the smaller particles may clog pores, interfering with the drainage properties of the root zone profile. Also, there has been a perceived phytotoxicity hazard from the byproducts of anaerobic decomposition of organic materials in the perched water table zone of USGA-type golf greens. To date, however, there has been no long-term research to address these issues. However, as a general guideline, organic materials and incorporation rates should be chosen such that the organic matter content does not exceed 3.5%. This will help to maintain more ideal physical properties so that many of the problems mentioned above may be avoided.

THE FUTURE OF COMPOSTS ON TURF

One of the greatest obstacles to the widespread use of organic amendments for turfgrass disease control has been the inconsistent performance from site to site, batch to batch, and year to year. Much of the unpredictable nature of organic amendments can be attributed to our overall lack of understanding of the microbiology of these materials. This understanding is critical for determining the suppressive properties of and microbial responses to amendments when incorporated into turfgrass soils or when applied as topdressings. Increased research efforts in this area will eventually make organic amendment use more predictable and manipulable.

As sources of peat continue to diminish, the use of alternative organic components of topdressings and construction mixes will continue to grow. In particular, composted industrial and municipal wastes are being viewed as potentially important sources of organic amendments. The management and recycling of municipal and industrial wastes is one of the greatest challenges facing the U.S. and the global community. Composting is emerging as one of the more desirable biotechnologies for managing these types of wastes and converting them into a valuable resource that can be used effectively as a biological alternative for the control of turfgrass diseases.