THE BIOLOGY AND CONTROL OF LOCALIZED DRY SPOTS ON SAND GREENS

Hydrophobic (non-wettable) soils occurring on bentgrass sand greens constructed to USGA specifications have been previously described and partially characterized. These areas, which resist wetting, have been termed localized dry spots (LDS). The LDS syndrome starts with the turf turning a blue-green color followed by a loss of turgor and finally shoot die-back. The symptoms observed are usually in irregularly shaped patches of variable size. Frog-eye type patches, characteristic of some turfgrass patch diseases, have been observed but are not predominant. Symptoms are most severe in hot, dry weather. Lower temperatures and adequate water will result in regrowth of the shoot system of plants that survive. Management practices for the the control of LDS are inconsistent at best, yet the following practices have aided in reducing symptom severity. Top dressing with sand that contains a minimal amount of "fine" particles. As will be discussed later, small particles (especially in the silt-clay size) may tend to aggravate the problem over time. Repeated core cultivation, especially in the spring and fall, has helped reduce the severity of LDS. Wetting agents, which reduce the surface tension of water, have given some degree of control for LDS, but are best used in a preventative program. Syringing of the greens may be used as a stop-gap measure, but primarily serve to lower the canopy temperature and rarely will alleviate symptoms. Frequently, various combinations of the above strategies are necessary, and a trial and error type approach is needed, to achieve adequate control of LDS.

Previous studies have shown an organic coating is present on sand grains associated with LDS and removal of the coating yielded substances with an Infrared (IR) spectra characteristic of fulvic acids. Fulvic acids are a diverse group of large molecules, common in most soils, that are extractable in solutions with a high pH and do not precipitate when the pH is lowered to approximately 1 or below. Previous studies did not include an extraction of wettable soil from bentgrass sand greens, and therefore it could not be determined if the fulvic acid associated with LDS was unique compared to fulvic acids in the wettable areas.

Studies were conducted at the Ohio Sate University from 1989 through 1991 to provide a more complete characterization of the organic matter and soil characteristics associated with LDS, and included samples from wettable areas for comparative purposes. First, several common classes of soil organic matter were extracted from two different sites, using several extraction sequences, were quantified and analyzed structurally using several techniques. Structural analyses of lipids (compounds that are similar to oils) were accomplished by gas chromatography/mass spectroscopy (GC/MS) and the large molecules that were extracted in alkaline solution, i.e. fulvic and humic acids, were analyzed by IR and nuclear magnetic resonance (NMR) spectorsopy. Second, particle size distributions were determined and the extend of non-wettability determined for each size range. While particle size distributions have been determined in previous studies, there were no reports of which fractions were the most hydrophobic, if any. Also, the area in the soil profile that displayed the most hydrphobicity was determined using soil columns collected from greens with LDS, allowed to dry down, re-wetted from the bottom, and the distance that was infiltrated recorded at one and two minutes. Finally, since bentgrass roots have been reported to be colonied by various fungi, both pathogenic and nonpathogenic, roots associated from wettable and non-wettable areas were stained and examined for the extent of fungal colonization present.

Results obtained from the organic matter extraction and analysis indicated that LDS soils had greater amounts of ally organic matter fraction studied that soils that were wettable. The only structural difference observed was from LDS that occurred on greens that were three years old, and this was only detected following an initial extraction with metha[nol]. It appears that there is either a unique struct[ure], or interaction between several structures, occurring in the LDS sample. One possible scenario to explain these results is that a unique structure or structures act to "prime" the LDS areas, and then the syndrome is intensified by subsequent drying cycles, which after several years may mask the unique component that initiated the LDS. The origin of the organic compounds could not be determined in these studies, but it is probably derived from bentgrass roots, soil microflora, or both.

Particle size distribution analysis showed no significant differences between the wettable and non-wettable soils. Hydrophobicity, as determined by how long it took a water drop to penetrate the sample, indicated that particles less than 0.25 mm in size were the most hydrophobic. Since the greens are constructed with 85-90 % sand this size fraction has been largely ignored in previous studies on LDS, but since this is the most chemically reactive fraction, due to the presence of clays, it would not be surprising that this is where organic-inorganic interactions would be the most prevalent. The hydrophobicity was the greatest in the area immediately below the thatch-soil interface. This is the area in the soil profile with the most biological activity, especially in regards to root colonization and thatch degradation. Electron micrographs of soil particles that were approximately 0.1mm in diameter showed that the particles in LDS samples had an extensive organic coating compared to particles from wettable soils.

Roots from both areas n the sand greens were heavily colonized by several fungi including vesicular-arbuscular mycorrhizae (VAM),*Phialophora* spp., *Pythium* spp., and *Ploymyxa graminis*. The VAM appeared to be more extensive in the roots associated with wettable areas, but definitive conclusions should be avoided since the soil was already exhibiting LDS when the samples were collected and so a cause and effect relationship could not be determined. No attempt was made to rate the colonization by the other fungi, they were just observed in roots from both areas.

Results from these studies indicate the role of the bentgrass root system, And associated microflora, on the development of LDS should be investigated in more detail. Previous studies have attempted to characterize the chemical and physical properties of LDS soils, but the impact of biological influences on its development cannot be ignored.
Article seen in Divots, September 1992.

GOLF COURSE WASTEWATER SYMPOSIUM

The United Sates Golf Association, in cooperation with the American Society of Golf Course Architects, Golf Course Builders Association of America, Golf Course Superintendents Association of America, and National Golf Foundation, announces a Golf Course Wastewater Symposium on March 4 and 5, 1993. The Symposium will be held at the Newport Beach Marriott Hotel in Newport Beach, California.

Effluent water from sewage treatment plants and wastewater from other sources has been playing an increasingly important role in golf course irrigation as the use of potable water for irrigation has come under public scrutiny. The Wastewater Symposium will bring together turfgrass managers, engineers, agronomists, golf course architects, equipment manufacturers, and professionals from other disciplines who have a role in planning, designing, and operating wastewater irrigation systems.

The symposium will provide practical answers to questions concerning the use of effluent water for turfgrass irrigation and will encourage greater acceptance of wastewater irrigation as a significant means of conserving our most important natural resource. An indexed, peer-reviewed proceedings with valuable summaries, references, and appendices will be published from the symposium.

For more information on the event, contact Dr. Michael Kenna (405-743-3900) or Dr. Kimberly Erusha (908-234-2300) at the USGA.