Overview of a New Environmental Issues Project

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Over a 15 year period culminating in 1997, the United States Golf Association (USGA) Turfgrass and Environmental Research Program allocated nearly $15 million to fund research projects involving environmental problems and issues and golf course maintenance. USGA-sponsored projects have generated over 100 related scientific and technical articles. While the rate and quality of these publications is impressive, of particular interest to Cooperative Extension is the actual adoption of recommended practices and principles by golf course superintendents and greenskeepers. In recognition of this need, the author received funding from the USGA in 1998 to develop an educational program specifically oriented to golf course superintendents in Southern California based on results of USGA funded research. This three-year project focuses on increasing the adoption of USGA-sponsored research concerning water quantity and quality, pesticide and nutrient fate and alternative pest management systems by golf course superintendents and greenskeepers.

The initial phase of the project entails consolidating research results and authoring new publications stressing applications of the results to golf course superintendents, while the focus of the second and third phases include conducting a series of workshops to facilitate dissemination of the results in an audio-visual format. A brief review of information included in each major publication category follows:

Water Quantity

Background. Large amounts of irrigation water are often wasted due to poor sprinkler distribution uniformity and lack of scheduling irrigations based on evapotranspiration. Properly scheduling turfgrass irrigations can reduce water waste, increase the performance of golf course turfgrass, and reduce pest problems. Irrigation scheduling entails applying the correct amount of water in a timely way, based on turfgrass evapotanspiration (ET) and soil conditions.

Maintaining high sprinkler distribution uniformity is crucial for optimum turfgrass performance and reducing water waste. While a modern, multi-valve system with numerous controllers can fine-tune an irrigation schedule, large amounts of water may still be lost due to mechanical and/or physical problems with the system. Common irrigation system problems leading to poor water distribution include: broken sprinkler heads; non-vertical sprinkler heads; mismatched heads and nozzles; clogged nozzles; broken valves and piping; improper sprinkler head spacing; and, incorrect pumping station and operational pressure. Often, remedying these problems can improve distribution uniformity by 20 percent or more.

Relevant Information Included in New Educational Program. Two methods of scheduling turfgrass irrigation based on turfgrass evapotranspiration, using either real-time or historical reference ET (ETo), are discussed. *Method One* involves conducting a catchment test to determine the precipitation rate of the sprinkler system, and matching this output with the length of irrigation listed in an accompanying table, based on historical reference ET (ETo) for three climatic zones in Southern California.

Method Two offers a more precise method of calculating irrigation needs than *Method One,* and offers accuracy under unusual weather patterns, but requires the golf course superintendent to mathematically determine the on-site distribution uniformity (DU), application rate, net amount of water to apply, and sprinkler run time. It offers the option of utilizing the California Irrigation Management Information System (CIMIS) and incorporates the use of tensiometers.

Information on conducting catchment can tests to determine precipitation rates and distribution uniformities and walk-through evaluations to identify and rectify irrigation hardware problems are discussed in detail.

Water Quality

Background. The quality of water used to irrigate golf course turfgrass is directly related to its growth, development, and performance. Components of water quality include salt concentration, sodium hazard, bicarbonate content, toxic ion concentration and water pH. Research has shown that, while almost all irrigation water contains dissolved salts and other chemicals, detrimental effects occur beyond certain levels, which vary among chemicals and species of turfgrass.

Most problems resulting in salt accumulation in turfgrasses relate to their transport in irrigation water. Irrigating turfgrass with effluent water has gained popularity in many areas of Southern California; while this practice offers many dividends such as recycling a valuable resource and adding nutrients to the soil, it may increase salinity and should be monitored closely.

Relevant Information Included in New Education Program. Due to increased interest and emphasis on use of effluent water as a source of irrigation water for golf courses, a discussion of sampling procedures, specific analyses to request, and a comprehensive listing of laboratories with the capacity to perform analytical water quality tests in Southern California is included. Information regarding the interpretation of test results and critical levels of specific ions and related implications on golf course turfgrasses is included, along with conversion charts. Because a common result of effluent water tests is the detection of high levels of dissolved salts, management options including various irrigation scheduling regimes emphasizing leaching are highlighted.

Pesticide and Nutrient Fate

Background. Understanding and quantifying the fate of pesticides and fertilizers in runoff and groundwater aids in determining the extent of current and predicted environmental impacts of golf courses. Protecting groundwater and surface water from chemical pollutants is a priority of golf course superintendents. Although over 70 percent of the pesticides applied in agricultural operations are for the production of food and fiber, there has been increased public concern in recent years about the ramifications of chemical use in all settings, including those requiring intense maintenance, such as golf courses. In 1991, the USGA initiated a three year study to: investigate the fate of pesticides and fertilizers applied to golf course turfgrasses; develop alternative non-chemical methods of pest control; and, determine the impact of golf courses on people and wildlife. Eleven university research projects were funded in these areas. In general, the measured nitrogen and pesticide leaching in the simulated golf course turfgrass plantings was minimal and within federal clean water guidelines. However, heavy irrigation or rainfall

subsequent to pesticide applications can result in leaching of some chemicals, particularly in sandy soils, emphasizing the importance of employing recommended cultural management practices.

Relevant Information Included in New Publication. Results and implications of these university research projects involving pesticide and nutrient fate relevant to Southern California golf course superintendents are reported. Included are studies conducted at the University of California-Riverside under the direction of Dr. Marylynn Yates.

The relative importance of processes influencing chemical fates and related optimum cultural management practices are discussed. Irrigation management is a key factor in pesticide movement, since soil moisture content that is equal to or in excess of field capacity at the time of pesticide application increases runoff potential. Practices such as irrigation sequencing before and just after pesticide applications, selecting low toxicity pesticides when feasible, correctly timing pesticide and fertilizer applications, and, reducing chemical losses in surface runoff by maintaining buffers downslope from treated areas are discussed.

Alternative Pest Management Systems.

Background: Alternative pest management (APM) methods potentially reduce the amount of pesticide necessary to maintain viable golf course turfgrass. Several USGA-sponsored APM projects developed and evaluated various scenarios of disease and insect control including use of cultural and mechanical practices, allelopathy, selective breeding for pest resistance, ecological balance of plant species in turfgass swards, and biological control. Examples include studies aimed at: improving creeping bentgass through genetic transformation: identifying parasitic bacteria as potential biological control agents against Summer Patch Disease (*Magnaporthe poae*): cultural control of white grubs and cutworms; allelopathic control of crabgrass by perennial ryegrasses; and, biological control of Sting Nematode (*Belonalaimus longicaudatus*).

Relevant Information Included in New Publication: Applicable information from USGA-sponsored APM studies was coupled with updated University of California Turfgrass Pest Management Guidelines to produce comprehensive guidelines for controlling major diseases, insects, and weeds that impact Southern California golf course turfgrasses.