Project Narrative

Name of Project: Efficient irrigation and fertilization practices for urban landscapes
Is this a new project or request for continuation?: New
Geographic Area of Project: North Texas
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Amount of Funding Requested: $14,262

Project Need, Description, and Expected Outcomes

A major portion of the urban population in Texas resides in the Blackland Prairies Resource Area, including three of the largest metropolitan areas in Texas (Dallas, Austin, and San Antonio). Soils in the Blackland Prairies are typically fine-textured, containing very high amounts of clay. A large portion of the soils are classified as vertisols, which means they have a high shrink/swell capacity depending on their water content. High-clay soils are difficult to manage due to very slow water infiltration and percolation rates as well as high water holding capacity. However, they tend to be fertile soils due to their ability to retain nutrients. Irrigation and fertilization practices recommended for coarser-textures soils, such as silty and sandy loams, are not appropriate for high clay soils because they result in excessive runoff. The conventional wisdom for proper irrigation is to apply water infrequently, but to add enough to wet the entire rooting zone. This is not appropriate for high-clay soils because the water application rate quickly exceeds the infiltration rate into the soil, resulting in water runoff from the landscape into streets where it quickly enters the stormwater sewer system. Surface runoff from urban landscapes commonly contains high levels of soluble fertilizer nutrients and pesticides. The overall result is a waste of potable city water and increased contamination of surface waters which supply a major portion of municipal water supplies in the Blackland Prairies Resource Area. Clearly, irrigation practices need to be developed that are appropriate for the high-clay textured soils that are common to major metropolitan areas in Texas.

Turfgrass is by far the most common plant in the urban landscape. It is very important to the quality of urban life. Benefits of turfgrass include its aesthetic appeal, the provision of safe surfaces for recreational activities, control of soil erosion, and enhancement of air quality by reducing the absorption and storage of solar radiation. The majority of irrigation used in urban landscapes is applied to turfgrass. Therefore, in addition to developing irrigation practices that improve water use efficiency and surface water quality, it is important that turfgrass growth and vigor be maintained.

The research proposed for this project will utilize an existing 2.2 acre irrigation facility at the Texas A&M University Research and Extension Center in Dallas. A linear gradient irrigation system (LGIS) applies water quantities ranging from 0 to 120% evapotranspiration (ET). Irrigation is applied from late spring to early fall when warm-season grasses are actively growing. Up to this point, the LGIS study has been conducted to evaluate the relative drought tolerance of 20 commercially available warm season turfgrass varieties representing the following four species: bermudagrass, buffalograss, St. Augustinegrass, and zoysiagrass. While this data is important, the information is specific to certain species and varieties and does not explain how irrigation levels affect the infiltration and storage of water in the soil profile. The LGIS area provides an opportunity to study how water application rates affect soil moisture trends. The primary objective of our study is to determine how the frequency and quantity of water application affects the infiltration and storage of water in the soil profile. The information will enable us to develop appropriate irrigation recommendations for urban landscapes in the highly populated Blackland Prairies region.

Soil moisture will be closely monitored in 10 cm increments to a depth of 1 meter throughout the year using existing technology. Soil moisture data will be correlated to weather data at the Dallas site in

order to determine at what point irrigation should begin so that soil moisture reserves are not severely depleted. Once the large cracks typical of vertisol soils are formed, it is difficult to maintain adequate moisture in the subsoil during the hot summer months. Our goal is to identify the appropriate timing, frequency, and duration of irrigation that will maintain adequate levels of available moisture in the turfgrass rooting zone.

Previous research at the LGIS site showed that soil fertility has a significant effect on the ability of turfgrass to tolerate and recover from drought conditions. A component of our study will be the establishment of ^{15}N microplots within the LGIS area. By using ^{15}N labeled fertilizer, we will be able to study the interaction between soil fertility and soil moisture levels. We will install three microplots in each of the four turfgrass species commonly used in Texas (Bermuda, St. Augustine, zoysia, and buffalo). Microplots will be located at positions that receive irrigation equivalent to 0, 50, and 120% ET losses. Our goal is to identify the optimum combination of nitrogen fertilization and irrigation that maintains healthy turf growth, yet minimizes environmental risks from nutrient-laden runoff. We will apply ^{15}N fertilizer to the microplots in the spring. Grass clippings will be collected throughout the growing season as well as visual and electronic data related to turf quality and density. We will extract soil cores from each microplot near the end of the growing season and measure ^{15}N content to a depth of 50 cm in order to determine the interaction between N fertilizer use and irrigation levels.

Conservation of water supplies and quality is an important issue for municipalities. They often include information in their water utility bills explaining to the homeowner how to properly irrigate their landscapes. Unfortunately the recommendations are not appropriate for the high-clay soils of the Blackland Prairies. Also, the economic benefits of water conservation are often ignored by affluent urbanites who can afford to apply excess water to their landscapes. As part of this study, we plan evaluate the current amounts of municipal water supplies that are used to irrigate urban landscapes and then estimate the economic benefits of reducing that amount by using appropriate irrigation practices. Municipalities will be able to use the information from this study to convince homeowners of the environmental and economic benefits of proper landscape irrigation.

We expect this project to continue for two to three growing seasons in order evaluate irrigation practices for different weather cycles. Although this is a research project, we will begin to organize our data and results into forms that will be useful to municipalities and landscape managers. By virtue of its location in a large metropolitan area, the TAMU-Dallas Center is recognized as a knowledge and training resource for the Dallas area. At the Dallas Center, TAES and TCE scientists work together to offer classes to regional urban landscape planners and managers, including parks and recreation personnel, private landscaping companies, and various gardeners groups.

Specific Issues Addressed

This research project will directly address urban irrigation practices and their effects on water conservation and water quality in the highly populated Blackland Prairies Resource Area of Texas. Municipalities in this region are highly dependent on surface waters. The quantity and quality of those sources can be quite variable depending on weather cycles. Therefore, it is important to adopt urban irrigation practices that reduce our consumption of potable municipal water and also protect the quality of the water source.

Collaboration

John Sloan, Soil Scientist at with the Texas Agricultural Experiment Station in Dallas is the primary investigator for the project. In addition to overall project management, his specific involvement will focus on soil moisture and ^{15}N fertilizer activities. He will work most closely with Dr. Milt Engelke, Turfgrass Breeding Genetics and Management, TAES-Dallas, who will focus on the effects of irrigation practices on turfgrass growth and vigor. Dr. Blake Bennet, Extension Economist, TCE-Dallas will coordinate activities related to assessing the potential economic impact of irrigation practices on

municipal water supplies. As we collect, analyze, and summarize data, Dr. James McAfee, Extension Turfgrass Specialist, TCE-Dallas, will help combine the various components of the project into education materials for target audiences. In the future, we plan to expand the project to include a companion Extension component, that will consist of educational literature and training classes.

TAES/TWRI
Water Conservation and Soil Management
Project Budget Form

Expenditure Description	Amount Requested	Other Sources	Total
Staffing Requirements:			
1.) Student Summer Employee	2,000		2,000
2.) Technician I	3,600		3,600
3.)			
4.)			
5.)			
Fringe	462		462
Total Staff Costs	**6,062**		**6,062**
Travel -Professional meetings	1,000		1,000
Materials and Supplies • ^{15}N fertilizer • Laboratory and field supplies	 1,200 500		 1,200 500
Capital Equipment • Soil Moisture Equipment	4,000		4,000
Printing and Publications			
Services • ^{15}N laboratory analysis	1,500		1,500
Evaluation			
Other Direct Costs (describe in detail)			
Total Project Costs	**14,262**		**14,262**

Submitted by: _____
(P.I. Signature)

Approved for Submission: _____
(Unit Head Signature)