Water Currents

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Dear Reader:

Water conservation encompasses any method for efficiently using water. Specifically, it concerns avoiding any unnecessary or wasteful use of water.

In the urban areas of Texas, water conservation methods can be applied to industrial, municipal, and urban-agricultural water uses.

A current research focus of the Texas Agricultural Experiment Station (TAES) is specifically directed toward water conservation in urban agriculture.

This research includes several projects dealing with the efficient use of water for sustaining landscapes in and around residences, as well as on commercial, industrial, institutional, and recreational sites.

Many commonly used landscape plants require liberal amounts of water during prolonged droughts to sustain acceptable quality and growth. Certain native plant species from semiarid and arid climates survive on far less water and, thus, offer the possibility for use as water-efficient substitutes in landscape plantings. Included in the group of native plants currently under study by TAES scientists are buffalo grass, purple sage, and evergreen sumac.

Even plants from humid climates can be sustained at relatively low levels of irrigation if planted in a suitable medium with adequate drainage, aeration, and moisture-retention capabilities. These plants can be even more water-efficient if cultural operations such as irrigation, fertilization, mowing or pruning maintain them properly.

Irrigation systems can be designed and operated to minimize loss of water from evaporation runoff and excess drainage. Water then is directed toward its intended purposes of sustaining the plants' moisture requirements.

Another water conservation measure is the use of nonliving ground covers such as gravel or bark. By placing polyethylene or other materials under nonliving ground covers, rainfall can be directed to concentrated plantings of trees, shrubs, or grass. This has the effect of multiplying the amount of precipitation received at the planting sites and, therefore, reduces the amount of irrigation water necessary to sustain these plants.

Detailed investigations of these and other water conservation measures are now under study by TAES scientists located at research centers across the state. Researchers representing a broad range of scientific disciplines hope to reduce urban landscape water use through research on plant materials, cultural systems, and environmental modification .

A. J. Turgeon
Resident Director
TAES Dallas Center

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Editor: Lou Ellen Ruesink

Designer: Karen Glenn

Cover photographer: Griff Smith

For further information on research presented in this issue, contact **Water Currents,** Texas Water Resources Institute, College Station, TX 77843; send subscription requests and mailing changes to the same address.

Urban Studies

Lush, green lawns do not grow naturally in most areas of Texas. They must be pampered with water, nurtured with fertilizers, and protected with pesticides. They behave very badly most summers if they do not receive constant and loving care.

Nevertheless, broad expanses of smooth green turf and thick tropical foliage grace homes and buildings even in the semi-arid areas of the state.

Trees, shrubs, groundcovers, and turfgrasses not only add beauty to Texas, they also improve the quality of urban life by stabilizing soil, controlling dust, reducing heat and glare, screening eye-sores, and establishing recreational areas.

Texas ranks third in the nation in the amount of money spent on ornamentals and turfgrass. Wholesale plants in the state total $270 million each year while another whopping $600 million goes just to maintain the 3.1 million acres of turf in the state.

Urban lawns are very demanding in terms of water consumption. Texas lawns consume almost as much water during the summer months as Texans use inside houses and buildings. City supply and distribution systems are often unable to meet the summertime demand of residential lawns, city parks, and institutional landscapes. Cities quite commonly restrict lawn watering at the first sign of a water shortage.

Because of work currently underway by researchers with The Texas Agricultural Experiment Station (TAES), future Texas lawns should demand far less water and better survive periods of limited water. Examples of this research, described on the following pages, include:

1. Identification of the water requirements of common landscape plants and of native Texas plants.
2. Comparison of the water use characteristics of various turfgrasses.
3. Evaluation of the efficiency of commercially available lawn sprinklers.

Grass Facts

"We have so much to learn," says James Beard, a scientist with The Texas Agricultural Experiment Station who specializes in turfgrass research.

"We don't even know," he says, "which common grasses use the least amount of water or which varieties can best withstand drought."

Turfgrass research, according to Beard, has been given little attention in the past. "We have a very small pool of fundamental knowledge about turfgrass compared to what we know about traditional agricultural commodities."

Beard likes to point out, however, that the turfgrass research program of The Texas Agricultural Experiment Station is now one of the largest efforts anywhere in the world. Ten TAES scientists located at either College Station, Dallas, or El Paso, currently spend at least part of their research efforts studying the dozen or so low- growing grasses used for Texas lawns.

Turfgrass field plots maintained on the Texas A&M University campus contain all commercially available turfgrass varieties in Texas. Here researchers evaluate effects of cold, heat, shade, traffic, chemicals, cultural practices, and moisture stress on turfgrass. Grass species represented include St. Augustine, bermuda, buffalo, zoysia, bahia, tall fescue, and centipede. The plots are a very important base for all types of turf research, says Beard.

Bermudagrass is the most common turfgrass in Texas and is used extensively for sport and recreational turf. St. Augustinegrass is the second most popular grass in the state and is used widely as a lawn turf. Buffalograss, however, is the only turfgrass native to the state.

Milt Engelke, a TAES plant breeder at the Dallas research center, currently collects information on turfgrasses and then selects promising varieties with low maintenance requirements and high water use efficiency. He hopes to breed turfgrass varieties with the ability to grow slowly and even stop growing entirely during periods of low rainfall. Such grasses could save water and maintenance on low traffic areas along highway rights-of-way, roughs of golf courses, and many urban lawns.

Another TAES scientist, Garald Horst at the El Paso center, conducts research on characteristics of turfgrass which reliably predict tolerance to environmental stresses such as cold, heat, salt, and drought. He is especially interested in how different turfgrasses react to irrigation with salt water.

Beard's major research interest is in understanding water use and drought tolerances of turfgrasses. He hopes that his research can provide answers so that future lawns will demand less water. Two TAES projects which Beard has directed have already filled some gaps in understanding water requirements of turfgrasses. The two projects focus on root growth and water use rates of turfgrasses.

ROOT GROWTH

A study completed in 1980 discovered a root growth pattern called spring root die-back. Researchers found that roots of bermudagrass and St. Augustinegrass tend to "rest" for two or three weeks during the spring while grass is turning green. They also observed that the root growth of these two warm season grasses continues late into the fall season well after grass has ceased to grow.

Beard explains that these findings will definitely affect the scheduling of turfgrass watering, fertilizing, mowing and other maintenance practices in the future. He feels that this research is some of the most important in which he has been involved.

The findings were possible because of a facility in the TAES field lab called a rhizotron. From the outside, the rhizotron resembles a storm cellar_a large mound of dirt with doors on each end. Inside the mound, scientists monitor root growth of various grasses by observing the roots through 48 "windows" which are glass observation boxes 9 inches by 12 inches by 29 inches deep.

Until the installation of the rhizotron - one of only seven such facilities in the world - TAES scientists could not study grass roots without disturbing their growth patterns.

WATER USE

Beard and former Texas A&M University graduate student, Don Johns, discovered an important clue to understanding turfgrass water use rates in another research project completed in 1979.

Their encouraging results came from a 2 feet by 3 feet plot of St. Augustinegrass grown in the sixth floor laboratory of the TAMU Soil and Crop Sciences building.

A sophisticated piece of equipment called an environmental simulation chamber was designed specifically for TAES turfgrass water use studies. The chamber allows researchers to carefully control temperature, light, water vapor, carbon dioxide, wind speed, and wind direction to simulate different Texas climates.

Beard and Johns weighed a profile of grass, roots, and soil each day to determine moisture loss. They found leaf area of the turfgrass to be an important determinant in how much moisture was lost or "used" by the grass. Previous research efforts to identify water loss had concentrated on leaf structure, but this TAES research project identified leaf area as a more important influence on water use rates.

Beard hopes to verify in outside experiments this year the finding that leaf area, or what the scientist calls leaf canopy, influences water use rates. The research finding should encourage turf breeders to breed for broad, horizontal leaves which provide a good canopy or leaf cover. The finding could also influence cultural practices such as mowing heights and fertilizing.

He also hopes to fill some other information voids concerning turfgrass water use with a current project comparing water use of twelve varieties of turfgrasses commercially available in Texas.

Each variety is grown in test plots at the TAES field lab on the Texas A&M University campus. Ten-inch pots buried in the middle of each plot, their tops flush with the ground surface, are also planted with the same variety of grass and the same type of soil as the plot. The pots, called mini Iysimeters, are lifted and weighed each day to compare how much moisture each type of grass has "used."

RESEARCH OBJECTIVES

TAES researchers list three major objectives they hope to accomplish with their current projects and other research they plan to initiate in the near future.

They hope to make information on water use rates of commercial turfgrasses available to Texans establishing lawns so that their choice of a particular grass can be based on the water demand.

They plan to identify plant characteristics such as leaf angle and root growth suspected to influence water use rates and then to breed grass varieties especially adapted to Texas summers.

They hope to develop varieties of grasses better able to withstand heat, cold and salt stress.

They hope to find turfgrass varieties and cultural practices which will give lawns a better chance of survival in a dry year, or during an emergency ban on lawn watering.

"I am confident," says Beard, "that our research can reduce by at least half the amount of water now required to maintain lawns in Texas."

Less Thirsty Landscapes

Most plants now gracing Texas homes, parks, and institutions demand water far in excess of the state's limited rainfall. The vast majority of landscape plants commercially available in Texas, in fact, originated in more water abundant areas of the world.

Plants native to Texas have not gained wide acceptance in urban landscapes, but two scientists at the TAES research center in Dallas hope their research will encourage future use of native plants in urban settings. They study trees, shrubs, and groundcovers to find particular plants and varieties with low water requirements. They also look for plants which can survive and remain attractive in yards and parks, around buildings, and along highways during those inevitable Texas droughts.

Soils scientist Billy Hipp studies water use of plants commonly used in urban landscapes and compares this water use with that of native plants. He works closely with research scientist Benny Simpson who for more than 30 years has collected plants native to Texas.

Simpson has propagated close to 300 species of trees, bushes, and groundcovers from seeds or cuttings from their native habitat. He has incorporated many of these plants into the attractive landscape around the Dallas research center. Simpson hopes that some day many of the plants found in areas throughout Texas will be commercially available for urban landscaping.

"There is little doubt," says Simpson, "that certain native plants in Texas could be quite desirable in urban landscapes and quite instrumental in conserving water." He says that it is safe to assume any plant which survives and proliferates in native areas of Texas with less than 20 inches of average annual rainfall (excluding those plants growing at high elevations or near water) is reasonably drought tolerant.

Some of the characteristics Simpson has observed in native plants able to survive periods of extremely low water are:

- root systems that are finely branched and wide-spreading.
- leaves that are small, leathery, and gray.
- leaves that have a waxy coating or have dense, fine hairs.
- leaves and branches that shed during dry periods.
- flowering stage that is postponed until rain falls.

Simpson is quick to point out that native plants offer many more alternatives than just cactus or yucca. He has identified all sorts of flowering shrubs, groundcovers, and even shade trees which are native to Texas and could replace traditional plants for screen, shade, and color.

As Simpson identifies native plants with landscape potential, he tests their ability to maintain an acceptable appearance. Many plants able to withstand drought in their original setting do so by shedding leaves and limbs - undesirable characteristics for urban landscapes. Simpson also warns that native plants may lose some of their ability to tolerate drought when established in urban settings.

While both Simpson and Hipp agree that some plants require less water than others, they point out that very little information is available on water requirements of even popular landscape plants, much less water requirements of plants not yet commercially available.

Hipp and Simpson believe that ornamentals in landscapes quite often receive much more water than they need. Substantial water savings could be made, according to the TAES researchers, by determining the water requirements of specific plants and then passing this information along to landscape managers. In the Eastern half of Texas, for instance, many plants can survive on natural rainfall alone after they have been established.

Hipp has research underway to determine water requirements of boxwood, a common ornamental plant in Texas lawns. He is comparing boxwood with Texas Barberry and cenizo, better known as sage.

To determine each plant's water use, he established four plants of each species in twelve containers measuring two feet in diameter and three feet deep. He placed each container, called a Iysimeter, in a metal-lined hole so that its top was flush with the ground surface.

Hipp weighed the containers weekly during the growing season, and daily during August, to determine the amount of water consumed by each plant. He calculates the moisture remaining in the soil, the amount of water applied to each plant, and the amount of water drained from the bottom of each container. Hipp weighes the Iysimeters with an electronic scale that he installed on a metal tower and hoist. He moves the tower from one container to another on wooden tracks.

In the future, Hipp hopes to provide homeowners and landscape managers information on the amount of water needed to maintain established plants. He feels this information can prevent overwatering in future Texas landscapes.

Hipp and Simpson plan to continue their research efforts on the water requirements and the drought tolerance of native and adapted landscape plants. They hope their results will soon give Texans a choice of ornamental plant material based on the amount of water a plant will consume and how well a plant will react to limited moisture.

Sprinkler Study

More than half of the water applied to lawns in Lubbock is lost to evaporation and inefficient sprinklers, according to Charles Wendt, soil scientist at the TAES Lubbock research center. Much of the water applied to lawns never even hits the ground, but is lost to the atmosphere instead.

Wendt tested six models of commercially available lawn sprinklers including impact, oscillating, traveling, stationary ring, rotating, and buried head models. He found each one lacking in efficiency when he evaluated their flow rate, evenness of distribution, evaporation loss, and wind susceptibility.

The most efficient sprinklers, according to Wendt's study, were the stationary ring sprinkler and the traveling sprinkler. For a small area, the ring sprinkler is most efficient, but inconvenient for a large area because it must be moved so often. The traveling sprinkler model tested more efficient than others, but it required traveling over the same area two or three times to apply the recommended amount of water.

Every sprinkler tested, according to Wendt, lost much more water to evaporation than the normal evaporative rate. The one factor which had the most effect on efficiencies was the rate at which the sprinkler applied water. The lower the flow rate, the higher the evaporation and the poorer the distribution.

Wendt warns, however, that if flow rate is higher than the soil can absorb, water will be lost as runoff. He emphasizes that any sprinkler application must be evaluated according to climate, soil, and plant requirements.

"Much of the equipment we are using to irrigate lawns was designed 50 years ago," says Wendt, who feels water applied to lawns could be significantly reduced with better distribution equipment.

Ripples & Waves

URBAN WATER CONSERVATION TASK FORCE

The importance placed on research to reduce water demand of urban lawns is reflected in a task force established by the Texas Water Resources Institute and The Texas Agricultural Experiment Station.

Task force responsibilities include compiling reports on completed and current research on turfgrasses, ornamental plants, soils, water distribution systems, and landscape design and construction. Research dealing with legal and economic constraints and public acceptance of new landscape strategies are also part of the task force charge.

Task force chairman Al Turgeon, director of the TAES Dallas research center, has challenged members to also identify achievable research goals for future TAES research and to report these by the end of 1982. The following TAES scientists serve on the task force:

Jack Runkles, director of the Texas Water Resources Institute
Charles Wendt, Lubbock research center
Milton Engelke, Billy Hipp, and Benny Simpson, Dallas research center
Garald Horst and Jimmy Tipton, El Paso research center
Corneiius van Bavel, James Beard, John Nieber, Joanne Westphal, and Ron Kaiser, scientists on the TAMU campus

Also on the task force are Ralph Wurbs, TAMU civil engineer, Mick Hynes, water systems distributor, and Bill Knoop, Texas Agricultural Extension Service turfgrass specialist.